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M.O. 248.

AIR MINISTRY—METEOROLOGICAL OFFICE.

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INTERNATIONAL METEOROLOGICAL COMMITTEE.

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REPORT  
OF THE  
ELEVENTH ORDINARY MEETING  
LONDON, 1921.

And of Meetings of the Commissions for Weather  
Telegraphy, Maritime Meteorology, Aerial Navigation,  
Réseau Mondial, and Polar Meteorology.

With Appendices and Lists of Members of the  
International Committee, and of the Commissions  
associated therewith.

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*Published by the Authority of the Meteorological Committee.*

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# LIST OF INTERNATIONAL METEOROLOGICAL MEETINGS.

- Congresses of Official Delegates.** Vienna 1873, Rome 1879.
- Conferences.** Leipzig 1872, Munich 1891, Paris 1896, Innsbruck 1905, Paris 1919.
- Permanent Meteorological Committee.** Utrecht 1874, London 1876, Utrecht 1878.
- International Meteorological Committee.** Berne 1880, Copenhagen 1882, Paris 1885, Zürich 1888, Upsala 1894, St. Petersburg 1899, [Paris 1900], Southport 1903, Paris 1907, Berlin 1910, Rome 1913 [London 1919], London 1921.
- Commissions.**
- Terrestrial Magnetism and Atmospheric Electricity.** *Appointed* 1891. Munich 1891, Paris 1896, Bristol 1898, Paris 1900, Innsbruck 1905, Berlin 1910.
- Scientific Aeronautics [or Upper Air].** *Appointed* 1896. Paris 1900, Berlin 1902, St. Petersburg 1904, Milan 1906, Monaco 1909, Vienna 1912, Bergen 1921.
- Radiation.** *Appointed* 1896, *reconstituted* 1910. Rapperswyl 1912.
- Solar.** *Appointed* 1903. Cambridge 1904, Innsbruck 1905, London 1909 (not re-appointed at Paris).
- Weather Telegraphy.** *Appointed* 1907. London 1909 and 1912. London 1920 and 1921.
- Maritime Meteorology and Storm Warnings.** *Appointed* 1907. London 1909, 1912, and 1921.
- Réseau Mondial.** *Appointed* 1907. Monaco 1909, London 1921.
- Polar.** *Appointed* Rome 1913, Copenhagen, 1914, *reconstituted* 1919, Bergen and London 1921, united with the Commission du Réseau Mondial.
- Meteorology and Agriculture.** *Appointed* 1913, *reconstituted* 1919. Has not yet met.
- Investigation of the Sound of Explosions.** *Appointed* 1921.
- Application of Meteorology to Aerial Navigation.** *Appointed* 1919. London 1921.
- The Study of Clouds and their Stratification.** *Appointed* 1921.

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*Circular No. 1.*

## Comité Météorologique International, 1919.

### Meeting in London in September, 1921.

#### CIRCULAR OF INVITATION TO MEMBERS OF THE COMMITTEE.

Meteorological Office, London, S.W.7. Paris,  
Bureau Central Météorologique,  
Rue de l'Université, 176.  
De Bilt,  
Koninklijk Nederlandsch Meteorologisch Instituut.

*Septembre, 1920.*

Cher Monsieur et très honoré Collègue,

Selon le règlement de l'organisation météorologique internationale qui a été adopté à Paris en 1919 "le comité se réunit tous les trois ans, au moins, en séance plénière. Le bureau du Comité informe par circulaire une année d'avance les membres du Comité et les présidents des Commissions de la réunion du Comité et leur fait désigner par un vote l'époque exacte et le lieu de la réunion."

Vue la situation météorologique internationale le Bureau est d'avis qu'il est désirable de convoquer le Comité dès l'année prochaine.

D'abord il est bien entendu que le président a donné sa démission de sa position comme Director of the Meteorological Office, London.

La Commission de la Télégraphie Météorologique se propose de se réunir en Novembre de cette année pour discuter les questions, aussi difficiles qu'importantes, des codes télégraphiques pour les services de la terre et de la mer. Il est probable que la commission transmettra au Comité des questions pressantes.

Quelques membres de la conférence de Paris ont émis l'opinion que la conférence devrait se réunir à bref délai; le Comité aurait alors à préparer les questions à soumettre à la conférence.

Le Bureau propose donc que le Comité se réunisse l'année prochaine. Dans le passé on a trouvé que la deuxième semaine de Septembre convenait le mieux à la plupart des membres du Comité.

La conférence de l'année passée s'est tenue à Paris et il est entendu que la conférence prochaine se tiendra en Hollande. M. Shaw propose, donc, que la réunion du Comité en 1921 se tienne en Angleterre, très probablement à Londres, le lundi 12 Septembre, 1921.



Le Bureau demande respectueusement aux membres du Comité et aux présidents des commissions d'approuver par leurs votes la proposition ainsi faite et aussi de signifier au bureau s'ils ont des propositions qui doivent être mises à l'ordre du jour.

"Les personnes qui veulent proposer une question à la délibération du Comité devront préalablement demander au président que cette question soit mise à l'ordre du jour et distribuer aux membres respectifs deux mois avant la réunion un court rapport sur cette question."

Agrérez, Monsieur, notre considération très distinguée.

Le Bureau du Comité Météorologique International,

Le président NAPIER SHAW,

Le vice-président A. ANGOT,

Le secrétaire E. VAN EVERDINGEN.

Circular No. 1(a).

### Réunions du Comité météorologique international et de ses Commissions en 1920-1921.

#### NOTE DU PRÉSIDENT.

Meteorological Office,  
South Kensington,  
London, S.W.7.

A la suite de la circulaire n° 1 proposant qu'une réunion du Comité météorologique international ait lieu dans la seconde semaine de septembre de cette année, le Bureau a reçu des réponses favorables des membres suivants—

Dr. Eginitis,  
Dr. Hesselberg,  
M. Hunt,  
Commandant Jaumotte,  
Professeur Maurer,  
Professeur Nakamura,  
Professeur Palazzo,  
Capitaine Ryder,  
Dr. G. T. Walker.

En approuvant la proposition, M. Walker exprime le regret de ne pouvoir assister cette année à la réunion.

Le Professeur Nakamura annonce sa retraite du poste de directeur de l'Observatoire central du Japon et la nomination, pour son successeur, du Professeur Okada. J'ai prié le Professeur Nakamura d'assurer le Professeur Okada que nous serons heureux de le voir assister aux réunions des Commissions et du Comité et de profiter de ses avis.

On est convenu que la Commission pour l'étude de la haute atmosphère se réunirait à Bergen le 25 juillet, où aurait lieu probablement aussi à la même époque une réunion de la Commission polaire.

On est convenu également que, dans la semaine précédant la réunion du Comité, il y aurait une réunion conjointe des Commissions de télégraphie météorologique, de navigation aérienne et de météorologie nautique et qu'il faudrait trouver, en septembre, une époque pour réunir, avant la session du Comité, la Commission du réseau mondial et la Commission de météorologie maritime. Le Professeur van Everdingen demande que la réunion de cette dernière Commission commence le 7 septembre.

Les propositions arrêtées pour la réunion des diverses commissions seront comprises dans l'ordre du jour de la réunion du Comité.

En répondant à la circulaire N° 1, le Dr. Hesselberg exprime le désir que la réunion ait lieu en Hollande, le Capitaine Ryder estime qu'une plus petite ville, comme Cambridge, serait préférable à Londres. Bien que cela ne paraisse pas impossible à réaliser, la conduite des réunions dépend tellement de documents qui ne sont accessibles qu'à Londres, ou partiellement à Edimbourg, qu'il ne paraît pas opportun d'envisager une réunion d'affaires en dehors de l'un de ces deux centres. Autant que je sache, Londres est le seul endroit possible pour les réunions du Comité à la date du 12 septembre et des jours suivants. La réunion conjointe des Commissions de télégraphie météorologique, de météorologie maritime et de navigation aérienne, la semaine précédente, doit être associée à celle du Comité et les réunions séparées de ces Commissions doivent naturellement se tenir au même endroit. La Commission du réseau mondial pourrait se réunir dans les premiers jours de la semaine commençant le 5 septembre, et la Commission polaire dans les derniers jours de la semaine précédente, si la réunion à Bergen est reconnue impraticable. Il serait possible à l'une de ces Commissions, ou à toutes deux, de se réunir à Edimbourg; mais cela serait incommode avec si peu d'intervalle pour les réunions suivantes à Londres.

En conséquence le programme arrêté pour la réunion du Comité et des Commissions en 1921 est le suivant :—

A Bergen—

25 juillet.—Commission de la haute atmosphère et, si possible, Commission polaire.

A Londres—

1-3 septembre.—Commission polaire (si la réunion ne peut avoir lieu à Bergen).

5-6 septembre.—Commission du réseau mondial.

7-10 septembre.—Commission de météorologie maritime et réunion conjointe des Commissions de télégraphie météorologique, de météorologie maritime et des applications de la météorologie à la navigation aérienne.

12 septembre.—Comité météorologique international.



Les questions particulières qui m'ont été envoyées pour figurer à l'ordre du jour sont :—

1° Pour le Comité météorologique international—

Professeur Nakamura.—“Que tous les Bureaux ou Observatoires météorologiques centraux publient et distribuent chaque mois les moyennes des éléments météorologiques pendant le mois précédent en des endroits choisis de leur réseau.”

2° Pour la Commission du réseau mondial—

M. Eredia.—Météorologie de l'Afrique; état présent de nos connaissances, nécessité de multiplier les stations d'observations.

M. Hunt promet que les résolutions qu'il désirera proposer seront envoyées en temps utile.

Le 24 mai 1921.

NAPIER SHAW.

LIST OF DOCUMENTS CIRCULATED TO THE MEMBERS  
OF THE INTERNATIONAL METEOROLOGICAL  
COMMITTEE.\*

1. Preliminary Circular. (p. 5.)
  - 1.—(a) Preliminary Programme: “Réunions du Comité météorologique international et de ses Commissions en 1920–1921. Note du Président.” (p. 6.)
  2. Provisional detailed programme of meetings in London.
  3. Calendar of meetings of Commissions in London, September 5–10, 1921.
  4. Report of the Commission for the Study of the Upper Air.†
  - 5.—(a) Report of the informal meeting of the Polar Commission held at Bergen, July, 1921. (See below, Appendix I., p. 55.)
  - (b) Minutes of the meeting of the Polar Commission in London, September 6, 1921. (Appendix I., p. 57.)
  6. Letter from M. Eynac, Sous-Secrétaire d'Etat de l'Aéronautique et des Transports Aériens, to the President of the International Meteorological Committee.
  7. Reply sent by the President of the International Meteorological Committee to M. Eynac's letter.
  8. Memorandum by Sir Napier Shaw on Weather Reports from Ships at Sea.
  9. List of members attending the meeting of the International Meteorological Committee, September 12–17, 1921.
  10. Agenda of meetings, September 12–17. (Corrected copy of Circular 2.) (See p. 14.)

\* These documents are referred to in the text thus—I.M.C. 1, &c.

† Published by the President: Bergen, 1921.

11. Minutes of three meetings of the Commission of the Réseau Mondial held in London, September 5–6, 1921. (Appendix III., p. 59.)

12. Note on Projection and Scale of Charts, by Professor V. Bjerknes.\*

13. Summary of the Report of the International Commission for the Study of the Upper Air. (Appendix II., p. 58.)

14. Memorandum by Dr. G. Melander on the Measurement of the Depth of Snow. (See p. 35.)

15. Memorandum by Sir Napier Shaw on the Financial Aspects of the proposed international publication of *La Haute Atmosphère*. (Appendix IX., p. 113.)

16. Minutes of the Meetings of the International Meteorological Committee.

17. Report of the Commission for the Application of Meteorology to Aerial Navigation. (Appendix V., p. 74.)

Minutes of Meetings of the Commission held in London, September, 1921. (Appendix V., p. 73.)

18. Report of the Commission for Maritime Meteorology. Minutes of Meetings of the Commission held in London, September, 1921. (Appendix IV., p. 65.)

19. Memorandum by Professor E. van Everdingen on Funds for Aerological Publications. (Appendix XI., p. 116.)

20. Report of the Sub-Committee on Agricultural Meteorology. (Appendix VIII., p. 112.)

21. Report of a Joint Meeting of the Commissions for Maritime Meteorology, Aerial Navigation and Weather Telegraphy. (Appendix VII., p. 110.)

22. List of Members of the Commissions appointed by the International Meteorological Committee. (Appendix XI., p. 116.)

23. Report of the Commission for Weather Telegraphy. Proceedings at Meetings held in London in November, 1920. (Printed separately, M.O. 242.)

Minutes of meetings held in London in September 1921, with Annexes. (Appendix VI., p. 75.)

24. Memorandum by Lieut.-Colonel E. Gold on Units of Wind-Velocity. (Appendix VIA., p. 108.)

\* *Geografiska Annaler*, Vol. I., p. 1, 1920.



# REPORT OF THE MEETINGS OF THE INTERNATIONAL METEOROLOGICAL COMMITTEE IN LONDON,

SEPTEMBER 12 TO 17, 1921.

## MINUTES OF PROCEEDINGS.

### First Meeting, Monday, September 12, 1921.

The following gentlemen were present:—

*Members and Presidents of Commissions:* Sir Napier Shaw (President), M. A. Angot (Vice-President), Professor E. van Everdingen (Secretary), Colonel F. A. Chaves, Director Th. Hesselberg, Commandant J. Jaumotte, Professor Dr. Maurer, Captain C. Ryder, Professor V. Bjerknes (President of the Commission for the Study of the Upper Air), Colonel J. Th. Saconney (President of the Commission for the Application of Meteorology to Aerial Navigation).

*By Invitation:* Colonel E. Delcambre (Directeur de l'Office National Météorologique de France), Dr. L. Gorczynski (Director of the Meteorological Service of Poland), Colonel Matteuzzi (Director of the Aerological Service of Italy), Dr. G. Melander (Director of the Meteorological Institute, Helsingfors), Professor T. Okada (Director-Designate of the Meteorological Service of Japan), Dr. G. C. Simpson (Director of the Meteorological Office, London), Dr. A. Wallén (Director of the Meteorological and Hydrographical Service of Sweden), Dr. S. Fujiwhara (Meteorologist of the Imperial Observatory of Tokyo), Mr. L. F. Richardson (one of the Secretaries of the Royal Meteorological Society).

**I. Place of Meeting.**—The Committee assembled at 10 a.m. in the Library of the Meteorological Office, South Kensington.

**II. President's Address.**—The President addressed the meeting as follows:—

“Messieurs,

“Le Comité Météorologique International était nommé par la Conférence des directeurs des Instituts et des Observatoires Météorologiques qui a eu lieu à Paris en 1919. La Conférence a adopté un règlement de l'Organisation Météorologique Internationale qui se trouve imprimé dans les Procès-verbaux de la réunion. Je dois lire un extrait du règlement qui concerne le Comité.

[Procès-verbaux des Séances de la Conférence Météorologique, Réunion de Paris, 1919, p. 13. II. Comité Météorologique International and M.O. 239 (English Edition), p. 12.]

“Voilà nos devoirs et nos privilèges.

“Le règlement fut dressé d'abord par M. Mascart, ancien président du Comité, à Paris en 1907. Il fut adopté par le Comité Météorologique International de cette époque. On avait l'intention de le présenter à une conférence des directeurs qui aurait dû se tenir à Utrecht en 1915; mais la guerre l'interdit.

“La Conférence de Paris convoquée par le Gouvernement de la République Française en 1919 a discuté le projet du règlement et a fait des changements peu importants. Les principaux sont premièrement que les réunions de la conférence générale auraient lieu tous les six ans au lieu de tous les dix ans, et deuxièmement que le nombre des membres du Comité serait vingt au lieu de dix-sept. La conférence a élu quinze membres seulement et a laissé au Comité le privilège de compléter le nombre des membres à sa discrétion. Alors nous sommes quinze, avec le pouvoir d'élire cinq membres de plus quand nous jugerons l'occasion à propos. Et par conséquent, notre Comité est le successeur en ligne droite du Comité Météorologique International historique. Il y a eu à Paris en 1919 même une réunion formelle du Comité pour nommer un Bureau du Comité et le Comité a élu M. Angot, Vice-Président, M. van Everdingen, Secrétaire, et moi-même, Président.

“Trois années n'ont pas “échappé” depuis la réunion de Paris, mais il n'y a pas eu une réunion plénière du Comité depuis celle de Rome en 1913. Les circonstances ont demandé, à l'avis du bureau, que l'on convoque la réunion d'aujourd'hui. D'abord le progrès de l'aviation pendant la guerre a démontré la nécessité de changements bien importants dans les données qu'on demande des réseaux météorologiques et par conséquent dans les dépêches et dans les codes télégraphiques. Il faut aussi organiser encore la coopération internationale pour l'étude de la haute atmosphère et puis par laps de temps je ne me trouve pas directeur du Meteorological Office et par conséquent ma place dans le Comité devient à disposer et l'on doit, une fois encore, considérer le bureau.

“Voilà les causes principales qui ont déterminé une réunion à Londres à ce moment. Nous avons beaucoup d'affaires à discuter. Nous passons tout de suite au programme.

“Je fais encore le bon accueil que Sir Frederick Sykes a déjà fait au nom du Gouvernement Britannique. Messieurs soyez les bienvenus.”

**III. Reports from Jan Mayen.**—The President reported that he was informed by Professor Bjerknes that a meteorological expedition under the leadership of M. Ekerold had started from Norway at the end of July to erect a W/T station at Jan Mayen in order to send weather messages during the coming winter, and that he had received the following telegram yesterday from Bergen:

“Roest,\* Saturday evening heard the first signals from Jan Mayen. Radio-signals clear without intensifier.”

\* Roest is a radio-station in Northern Norway.



**IV. List of Gentlemen Present.**—The President read the list of gentlemen who would attend the meetings of the Committee. He welcomed the addition of the names of Dr. Melander and Dr. Gorczynski to the list already circulated (I.M.C. 9.).

**V. Correspondence.**—(i) **Apologies for Absence.**—The President reported that he had received letters of apology for absence from Professor Palazzo (Rome), Mr. H. A. Hunt (Australia), Professor Eginitis (Athens), Sir Frederic Stupart (Toronto), Dr. G. T. Walker (Simla).

Professor Nakamura had written explaining that he was retiring from the Directorship of the Observatory in Tokyo in December 1921, and asking the International Meteorological Committee to accept Professor Okada in his place. The President had since been informed that Professor Nakamura had been persuaded to continue his directorship for another year, but that his resignation from the Committee should take effect.

(ii) **Election of Members.**—The President proposed Dr. T. Okada as a member of the Committee in place of Professor Nakamura, and also Director Wallén, the Director of the Meteorological and Hydrographical Service of Sweden as a member. Both proposals were unanimously approved.

(iii) **Information as to Absent Colleagues.**—*Russia.*—Regarding the Meteorological Service of Russia, the President reported that he had been informed that the work of the Central Physical Observatory at Petrograd and of the Observatory at Pavlovsk was still being continued, and that both were under the management of the Academy of Science at Petrograd. General Rykatheff died in 1917. The present Director of the Central Physical Observatory at Petrograd, Professor Obolenski, was desirous of being informed of the course of meteorological work so that he might co-operate and the President stated that he had addressed a letter to him.

*Italy.*—It was reported that Professor Palazzo had written sending his good wishes to the members of the Committee but that scientific meetings at Trieste and an expedition to Sicily prevented his attending.

(iv) **League of Nations.**—The President referred to correspondence with Professor Nitobe of the League of Nations and reported that he had forwarded to the League copies of the publications of the Meteorological Office, London, which contained reports of proceedings of the International Meteorological Committee.

**VI. Times of Meeting.**—It was agreed that meetings should be held during the week from 10.30–1.0 and from 3.0–5.0 p.m.

**VII. Arrangements for the Election of a New President of the Committee.**—The President reported the necessity for the appointment of two new members in place of

the President and Vice-President, and also stated that there were still four vacancies on the Committee; he suggested that the afternoon of Friday, September 16, should be reserved for the consideration of the completion of the membership of the Committee, and that the new Committee should then meet to elect the new Bureau.

**VIII. Programme of Meetings.**—The programme of subjects for discussion during the week (Circular I.M.C. 10) was read.

(i) **The Commission de la Météorologie Agricole.**—The President stated that arrangements should be made for a sub-committee\* of members interested in agricultural meteorology to meet, during the week, before the proposals were considered by the general Committee. He stated that a limited number of copies of the report of M. Louis Dop's proposals were available.

M. Angot asked whether the credit for the International Bureau for Agriculture had been voted by the Italian Parliament. Colonel Matteuzzi undertook to make inquiry.

Professor E. van Everdingen said that he had suggested that in addition to the main Committee proposed by M. Louis Dop a small Committee should also be appointed by the International Meteorological Committee to provide a link between the two Committees.

(ii) **List of Directors of Independent Institutes and Observatories.**—It was reported that Professor E. van Everdingen had already forwarded a list, and the President suggested that the list might be amplified to form a meteorological "Who's Who" containing a list of the professional meteorologists in all parts of the world.

Dr. Okada suggested that a short sketch of the organization of the meteorological services of each country should be included in the list of Directors.

(iii) **Additions to Programme.**—The following additions were made to the programme:—

(a) Report of the Commission for the Application of Meteorology to Aerial Navigation.

(b) *International Research Council.*—The President stated that the Council would hold a meeting in Rome in April, 1922, and that it was desirable to consider the proposals for co-operation between the two Committees.

(c) A proposal by Dr. Melander on the measurement of the depth of snow.

(d) Colonel Delcambre also stated that he would make a communication about telegraphic Reports of the Atlantic cruise of the "Jacques Cartier."

\* The Sub-Committee was elected at third Meeting, see p. 23.



(iv) **Final Programme.**—The programme was agreed to as follows —

1. *Arrangements for the election of a new President of the Committee.*

2. *International Glossary of Meteorological Terms.*

Professor E. van Everdingen.—Dutch equivalents of the technical words in the Meteorological Glossary. (M.O. 225 (ii).)

Captain C. Ryder.—Danish equivalents of the same.

Director A. Wallén.—Swedish equivalents of same.

3. *Commission de la Télégraphie Météorologique.*

Report of proceedings of meetings of the Commission held in London, November 22–27, 1920 (M.O. 242) and on September 7–9, 1921.

Report of a joint meeting of the Commissions for Weather Telegraphy, Maritime Meteorology, and Aerial Navigation held in London, September 10, 1921.

4. *Commission de la Météorologie Maritime.*

Report of proceedings of meetings of the Commission held in London, September 6–9.

5. *Commission pour l'Exploration de la Haute Atmosphère.*

Report of a meeting held in Bergen, July 25–30, 1921.

Proposal by Colonel Matteuzzi for the publication of daily charts of the wind velocities in the upper air.

6. *Commission du Réseau Mondial.*

Report of a meeting held in London, September 5–6, 1921.

Appointment of a new Chairman.

Letter from the Director of the Brazilian Meteorological Service.

7A. *Commission Polaire.*

Note of informal meeting at Bergen during the session of the Commission de la Haute Atmosphère, and of a meeting in London on September 6, 1921.

Proposal for the combination of the two Commissions.

7B. *Commission de la Navigation Aérienne.*

8. *Commission de la Météorologie Agricole.*

Report of proposals for Agricultural Meteorology presented to the General Assembly, 1920, of the International Agricultural Institute, Rome, by the Vice-President of the Institute, M. Louis Dop.

Proposals for new members of the Commission.

9. *Notices of Motions.*

(a) *Monthly Bulletins.*

Professor Nakamura:—"Que tous les Bureaux ou Observatoires météorologiques centraux publient et distribuent chaque mois les moyennes des éléments météorologiques pendant le mois précédent en des endroits choisis de leur réseau."

(b) *Units of measurement.*

Lieut.-Colonel Gold:—Proposal to adopt the "kilometre per hour" as the unit of wind-velocity in place of the "metre per second."

(c) *Projection and scale of charts.*

Professor V. Bjerknes:—Proposal respecting the projection and scale of charts. (Set out in *Geografiska Annaler*, 1920, Vol. I. Copies circulated.)

(d) *Sunshine Recorder.*

Dr. J. Maurer:—"The Committee recalls the conclusion arrived at in Rome, 1913, and repeats the wish to obtain certain normals for the glass-sphere-heliograph concerning the constitution and dimension of the glass-sphere and the cards.

To make easier the comparison of the results it is necessary to communicate in the Reports and Tables of mean values which type of instrument has been used (original or recent Hicks or Negretti model, Fuess, Usteri, &c.). The determination of the duration of the burn of the apparatus used to that of the new Negretti model as the most fully defined glass sphere we have may be recommended for the different climatic regions."

(e) *Cloud Study.*

A proposal for a Commission to make recommendations with regard to the republication of the International Cloud Atlas and to prepare a supplement with a view to international co-operation in a more detailed study.

Colonel Saconney:—Proposal for a prize for the best collection of cloud photographs.

f) *Measurement of depth of snow.*

Proposal by Dr. Melander.

(g) *Meteorological Observations from a mobile station on the Atlantic.*

Communication by Colonel Delcambre.

10. *List of Directors of Independent Institutes and Observatories.*

11. *Arrangements for the next Conference.*

12. *Appointment of Members of Commissions.* Terrestrial Magnetism, Réseau Mondial, &c.

13. *Election of members of Committee in place of those who retire at the close of the Meeting.*

14. *International Research Council.*—Form of co-operation in view of the meeting at Rome in April, 1922.



### IX. International Glossary of Meteorological Terms.

— The President reported that in pursuance of the resolution at Paris\* asking for equivalents in different languages of the terms in the Meteorological Glossary he had received copies of the equivalents of the terms in Dutch, Swedish and Danish.

The President drew attention to the fact that a Committee was sitting in London—the Aircraft Sub-Committee of the British Engineering Standards Association—to define the technical terms used in aviation, and that the Committee contemplated including meteorological terms in their investigation and proposed to adopt the definitions in the Glossary as standard definitions for Aeronautics. He pointed out that in this case the proposal for equivalents in foreign languages of the terms in the Glossary would be of special importance. He added that a member of the Sub-Committee had also made certain suggestions with regard to the Glossary and asked that an Index might replace the Table of Contents.

The following resolution† was unanimously approved:—

1. "That the Director of the Meteorological Office, London, be requested to consider the incorporation of the equivalents in various foreign languages of the words of which the equivalents are given in these lists, in any new edition of the Meteorological Glossary."

The Director of the Meteorological Office reserved liberty to arrange the details.

Dr. Okada stated that in 1893 Professor Nakamura had published in the Meteorological Journal of Japan a Glossary of Meteorological terms in Japanese with the English equivalents, and that he was now completing the Glossary to conform with the resolution of the Paris Conference. M. Moidrey of Zikawei had also published in Chinese a Treatise on Meteorology based on M. Angot's text book and in an appendix had added a Glossary of the French equivalents of meteorological terms.

**X. Polar Commission.** (I.M.C. 5 (a) and 5 (b), Appendix I., p. 55).—The report of an informal meeting of the Polar Commission in Bergen in July 1921, together with the minutes of a meeting of the Commission held in London on 6th September 1921, were submitted to the Committee.

(i) **Co-operation with Amundsen's Expedition.**—Captain Ryder asked if the stations equipped by Canada, Finland, Great Britain and Sweden in connection with Amundsen's expedition were likely to be permanent; and it was stated that in all cases it was probable that the stations would be continued.

\* M.O. 273, p. 28.

† The resolutions of the Committee are printed in heavy type and are numbered consecutively from 1 to 88.

Captain Ryder's report on Rasmussen's expedition was read as follows:—

"After having completed the equipping (at Thule) the expedition starts on the 22nd of August from Holsteinborg to the territory north of the Hudson Bay, where it takes headquarters at Lyon Inlet. It is the intention the first autumn and winter to visit the Igdlulek-tribe at Fury and Hecla Strait and possibly different parts of the Baffins Land.

"In the spring or autumn, 1922, the expedition will work itself down to Chesterfield Inlet in order, in the autumn, together with the interesting and little known Esquimo-tribe 'the Kinipetu-inlandstribes' to go over the Barren-grounds, where the winter is to be spent.

"Later on it will go westward to the tribes along the North-West-Passage, and on the last ice-cover, in the spring 1923, drive back to the headquarters at Lyon Inlet, from where the ethnographic material, which the expedition has collected, is to be carried home by 'Sokongen.'

"Two of the members, Magister Thorkel Mathiasen and Magister Birket-Smith, are going home with 'Sokongen,' but during the winter, 1923-24, Knud Rasmussen, together with Peter Freuchen and the Cape-York-esquimos of the expedition goes down the old wandringsroad of the esquimos over Baffin Land, Lancaster Sound, Jones Sound, Ellesmere land and eventually Heiberg Land, back to Greenland, expecting to reach Thule in the spring, 1924..

"From there they then are travelling back with 'Sokongen'."

The following resolution was approved:—

2. "The Committee approves resolution 1 of the Polar Commission,

"The meeting expressed its gratification at the responses which had been made to the proposals for co-operation in the geophysical investigations of the North Polar Regions, and resolved to recommend that the work which had already commenced in the stations in high latitudes should continue, and it expressed the hope that the Governments will provide funds for the continuation of their co-operation during the whole period of the Amundsen Expedition, 1921 to 1925, and, if possible, permanently."

and adds that in the interests of general meteorology the continuation of the stations after 1925 would be of great value."

(ii) **Daily Maps of the Northern Hemisphere.**—Resolution 2 of the Polar Commission was confirmed.

3. "That the Commission desires to see established as soon as possible a series of daily charts of the Northern



Hemisphere similar to that published in 1914 by the Weather Bureau of the United States, supplemented by Reports from additional stations and from ships traversing the Atlantic and Pacific oceans."

(iii) **Hours of Observation at Stations in High Latitudes.**—The President reported that Capt. Ryder had brought a copy of the report of the meeting in Copenhagen in 1914, and that the resolution of that Committee as to the hours of observation had been incorporated in the procès-verbaux of the meeting of the Polar Commission.

It was reported that the following representatives had been present at the meeting at Copenhagen:—

Gen. Rykatcheff (President), Director Golicyn, Prof. Hergesell, M. Birkeland (representing Amundsen), M. de Quervain, Capt. Ryder, Prof. Wegener.

After discussion as to whether the resolution referred to future expeditions or only to Amundsen's expedition the following resolution was approved:—

4. "In reply to Dr. Devik's question local time should be used for ordinary observations, observations at other times should be by special arrangement."

Dr. Hesselberg further proposed—

5. "That in co-operation with Amundsen's expedition it is desirable to have observations at 7h. G.M.T., especially on the international term days."

The resolution was approved.

(iv) **Publication of Meteorological Results of Polar Expeditions and Polar Observer's Handbook.**—The question of the desirability of international control on questions of polar work was discussed, and the President pointed out that the International Meteorological Committee could only offer advice, and that even if it were to publish a handbook for the use of Polar Observers, such a book would only contain recommendations for observers based on the accumulated experience of the past.

After further discussion the Committee agreed—

6. "That Dr. Simpson and Lieut. Rouch be invited to confer together with a view to the preparation of such a guide-book."

(v) **Combination with the Commission du Réseau Mondial.**—The Committee also approved of the resolution:—

7. "That the Commission Polaire be united with the Commission du Réseau Mondial."

The meeting adjourned at 12.40.

(Signed) NAPIER SHAW.

## Second Meeting, Monday, September 12, 1921.

Present:—Sir Napier Shaw (President), M. Angot (Vice-President), Professor E. van Everdingen (Secretary), Colonel F. A. Chaves, Director Hesselberg, Commandant Jaumotte, Professor Dr. Maurer, Professor T. Okada, Captain Ryder, Dr. A. Wallén, Professor V. Bjerknes. Colonel Delcambre, Dr. Gorczynski, Colonel Matteuzzi, Dr. Melander, Dr. G. C. Simpson, Dr. Fujiwhara, Mr. L. F. Richardson.

The meeting assembled at 3.0 p.m.

I. **Minutes.**—The minutes of the first meeting were read and passed for circulation.

II. **Proposal for the Study of Clouds.**—Colonel Delcambre proposed that a new Commission should be appointed for the further study of clouds and their stratification. He emphasised the importance of the study from the point of view of aviation, and desired that it should be systematised by the appointment of a Commission.

The President said that the proposal made by Colonel Delcambre should be very welcome to the Committee. The classification adopted in the International Cloud Atlas was only the first step in the study of clouds. It was necessary to extend the classification in order to provide for (1) the analysis of a complicated sky, and (2) the inclusion of certain types of clouds, such as (a) *Pallio-nimbus*—a sheet of alto-stratus covering the whole sky and raining, (b) *Lenticular Clouds* and (c) the *Contessa del Vento* included in Professor Taffara's Atlas.

Professor Okada said that the forms of clouds observed in Japan, including Formosa, Korea and Saghalien show more numerous varieties than those given in the 1st and 2nd editions of the International Cloud Atlas.

He stated that Mr. Abercromby, when he visited Nagasaki some years ago to study the cloud forms of the far East, had stated that the cloud forms of Japan were the same as those in Europe. Though this remark was true in general, Professor Okada suggested that before compiling a new Cloud Atlas, the photographs taken of clouds in the Far East should be consulted.

Professor E. van Everdingen stated that a sub-committee of the Commission on Weather Telegraphy had made a report on Cloud Study and that a recommendation would be forwarded to the Committee. He suggested that it would be desirable to consider the subject further when the Commission submitted its report.\*

He also pointed out that in the International Cloud Atlas, *Nimbus* is defined as a cloud from which rain is falling, but this definition might apply to all clouds, the distinction being whether the rain did or did not reach the ground. He then drew the

\* See page 27 and Appendix VI., p. 92.



attention of the Committee to the important work on clouds of the German meteorologists, in particular that of Wegener and Süring.

Colonel Chaves said that he had a collection of photographs of clouds of lenticular form which had been taken in the Azores.

The Committee adopted the resolution:—

**8. "That a Commission for the study of Clouds be formed."**

—The following names were suggested and approved as members of the Commission:—**Monsieur J. Bjerknes, Colonel Chaves, Mr. G. A. Clarke, Colonel Delcambre, Dr. S. Fujiwhara, Professor Dr. Maurer, M. de Quervain, Signor Taffara**; with the understanding that the Commission should have power to add to its number.\*

It was agreed that the final vote on the subject should be taken after the consideration of the recommendation of the Commission for Weather Telegraphy.

**III. Meteorological Observations from the Atlantic.**

—Colonel Delcambre reported to the Committee that the National Meteorological Office of France had had under consideration a proposal to establish a mobile meteorological station in the Atlantic Ocean between longitude 25° and 35° W. and latitude 47° and 49° N., and that to give the proposal a trial two French meteorologists were making a thirty days' cruise in December next on board the "Jacques Cartier"—a training-ship of the French Trans-Atlantic Company.

Colonel Delcambre remarked that he placed himself at the disposal of the Meteorological Institutes in case they should desire experiments to be made on board the "Jacques Cartier" having in view the researches in which they are especially interested.

Prof. E. van Everdingen suggested that the proposed observations could be made more economically by using the personnel of liners on the route between Europe and the United States.

Colonel Delcambre said that the idea of using only transatlantic ships had been considered by the French services and that they had had recourse to it during the war, but that that solution of the problem was not practicable for three reasons:—

(a) Because meteorological observations on the sea must be obtained and controlled by meteorologists.

(b) Because the transmission of observations from ship to ship across the Atlantic to reach the Continents would necessitate an organisation which it would not be possible to obtain.

\* At the 4th Meeting the following names were added: Sir Napier Shaw, Captain Douglas, Commandant Jaumotte and Colonel Matteuzzi, and at the ninth meeting, M. Bergeron.

(c) Because it was necessary to have regard from the present time (in order to be ready when the aeronautical equipment permits) to the steps which would have to be taken to give to Aerial Navigation all the observations necessary for making the transatlantic flight, and that it did not seem that any other steps were adequate than the establishment of a mobile station.

He added that the financial question would not present any difficulty when long distance air-routes were established.

The President agreed that it was very desirable to aim at obtaining regular daily observations from the Atlantic, and that the meteorological services would take all possible steps to further the proposal; though the cost in the immediate future would be great, yet he felt sure that the Directors of the various Institutes would take advantage of any opportunities that offered.

He said that the Committee appreciated the aspiration which Colonel Delcambre had put forward, and shared the hope that would be realised in the immediate or near future.

**IV. Report of the Commission for the Upper Air.**

—The following summary of the report submitted by Prof. Bjerknes was read (*see* Appendix II., p. 58).

Professor Bjerknes emphasised the difference in the situation before and after the war, and pointed out that before the war Professor Hergesell had edited the international publication of the results of upper air observations and had put into it much of his life's work and the work of his Institute and that it was difficult to find a Director who could take up the work on similar terms at the present time.

Copies of the publication up to 1912 were laid on the table and the President stated that in his opinion though the value of the publication was not to be under-estimated the possibilities of improvement were also great. It was not simply a case of reproducing what had been produced before, but of reconstructing the publication in the light of the knowledge and experience of the past years.

The President then read a memorandum on the financial aspects of the proposal (Appendix IX., p. 113, and Circular I.M.C. 15).

The members of the Committee were asked to submit to the Committee an estimate of the number of copies which it would be likely that their respective Governments would take if the proposals outlined in the memorandum were approved.\*

Professor Bjerknes said that the proposals set out therein were acceptable to him (i) if there were a guarantee of there being a good choice of personnel at the start; (ii) if there were a guarantee of continuity in the future.

\* *See* Minutes of 3rd Meeting, p. 26.



Dr. Okada reported that up to the present time no observations of the upper air had been made in Japan. The Government had, however, now granted the money for the establishment of an observatory 20 miles from Tokyo, the equipment was almost complete and it was hoped to begin observations in January. He said that the Japanese Service would be willing to contribute the observations required by the proposal and would, he thought, agree to approach the Government for the necessary financial support.

The Committee proceeded to the consideration of the resolutions set out in the report of the meeting of the Commission of the Upper Air held at Bergen in July, 1921.

Resolutions (I)-(IX.) as set out below, were unanimously approved.

9. "That there should be an international aerological publication" (I.).

10. "That this publication should contain at least all the ascents, giving both pressure and temperatures on chosen days" (II.).

11. "That the normal number of ascents should be 24 per annum" (III.).

12. "That the dates for 18 ascents should be chosen in advance and that six ascents should be left to the President to arrange" (IV.).

13. "That six ascents should be concentrated in one period of three days at intervals of 12 hours" (V.).

14. "That in addition to the period of three days mentioned in resolution (V.) there should be two periods of six days each, during which six ascents should be made at intervals of 24 hours" (VI.).

15. "That in the international publication the results of ascents giving both pressure and temperature should be published in graphic form and this should be supplemented by a bulletin of data in an agreed form for exchange between the Institutes through the intermediary of the Bureau" (VII.).

16. "That the international publication contain a summary of the observations with pilot balloons made on the chosen international days and possibly some days before and after : and for the purpose of this summary the Institutes should report to the Bureau a suitable selection of observations of pilot balloons for the respective countries and should enumerate the whole number of available soundings" (VIII.).

17. "That pilot balloon observations should be taken on the chosen days as a rule with an interval of 24 hours, but with intervals of 12 hours on days when two ascents with registering balloons are made" (IX.).

Resolutions (X.), (XI.), and (XII.) were deferred for further consideration.

Resolutions (XIII.) and (XIV.) as set out below were approved.

18. "That a Commission consisting of Messrs. E. van Everdingen, Fujiwhara, Jaumotte, Maurain, Oddone, and de Quervain should prepare a programme of systematic investigations on the sound of explosions" (XIII.).

19. "That Directors of Institutes be requested to take such steps as may be possible to secure aerological results from the sea by registering balloons" (XIV.).

With reference to Resolution XV., Dr. Maurer stated that he was desirous that the establishment of the Observatory should be supported as a useful meteorological enterprise, and it was therefore agreed—

20. "That this Committee concurs in the Resolution XV. of the Commission for the Investigation of the Upper Air." "That the International Commission for the Investigation of the Upper Air, assembled in Bergen, concurs in the desire expressed in 1920 by the International Commission on Meteorological Telegraphy that a station for making observations for synoptic purposes should be established in the Alps at as high a point as possible, and gives its moral support to the schemes worked out for this purpose for a geophysical station on the Jungfrauoch" (XV.).

(Signed) NAPIER SHAW.

Note added October 28, 1921 :—

Sir Napier Shaw suggested that an additional resolution should be inserted—Resolution XXV.—"that the Committee should take over the duty of conducting negotiations for providing staff and obtaining the money necessary for the International Publication."

The consideration of the question was deferred.

N. S.

### Third Meeting, September 13, 1921.

Present :—Sir Napier Shaw (President), M. Angot (Vice-President), Professor E. van Everdingen (Secretary), Colonel Chaves, Director Hesselberg, Commandant Jaumotte, Professor Dr. Maurer, Dr. Okada, Captain Ryder, Dr. Wallén, Professor Bjerknes, Dr. Gorczynski, Colonel Matteuzzi, Dr. Melander, Dr. Simpson, Dr. Fujiwhara, Mr. L. F. Richardson.

The meeting assembled at 10.30 a.m.

I. *Minutes*.—The minutes of the second meeting were read and passed for circulation.

II. *Appointment of Sub-Committee to consider M. Louis Dop's Proposals on Meteorology applied to Agriculture*.—The President reported the receipt of a memorandum by Dr. Wallén on M. Louis Dop's proposals, and suggested that a sub-committee



should be appointed to consider the matter and report to the Committee.

M. Angot, Prof. van Everdingen, Capt. Ryder and Dr. Wallén were nominated as members, and the nominations were unanimously approved.\* The sub-committee was invited to submit a report for the consideration of the Committee on Thursday.

III. **Correspondence.**—The President reported the receipt of a letter from Prof. Bigelow, and asked Mr. Richardson to make a report on the questions contained therein.

IV. **Report of the Commission for the Investigation of the Upper Air** (continued).

Resolutions (XVI.), (XVII.), (XX.), and (XXI.) as set out below were approved:—

21. “With reference to a proposal made by M. Dongier in connection with his communication concerning the observations on the Eiffel Tower:—

“The International Commission for the Investigation of the Upper Air, assembled in Bergen, calls attention to the great interest presented by the meteorological observations obtained by means of recording instruments placed in elevated positions such as those realised in the Eiffel Tower at Paris, and expresses the wish that, following the example already set by various countries, such installations may become of widespread occurrence by making use of the tall masts which are constructed for large wireless telegraph stations” (XVI.).

22. “That the form of publication of the data for wind derived from pilot-balloons be left to the discretion of the organisation, which it is proposed to create, when the first set of data has been received, and it is recommended that before a final decision is taken, the organisation should circulate to the participating Institutes specimens for comment” (XVII.).

23. “That the days for international aerological researches should lie in the middle weeks of the months given in the following scheme in which the years which are printed in black type refer to the three-day periods” (XX.).†

J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.
1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933
1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933

\* The name of Mr. F. J. W. Whipple, of the Meteorological Office, London, was added at the meeting in the afternoon.

† See also M.O. 237, p. 27.

24. “That it is desirable, when sites for upper-air stations are being selected, that the dynamics of the atmosphere, and the accumulation of mass, should be taken into consideration as far as practical necessities permit” (XXI.).

Resolution XVIII. was deferred for consideration with Resolutions X.—XII., and it was agreed that no action by the Committee was necessary with regard to Resolutions XIX., XXII.—XXIV.

The Committee then returned to the consideration of Resolutions X.—XII.

“X. That the cost of the international publications should be met by the contribution of the necessary funds from the countries which are interested therein, the contribution being assessed, for example, according to a scale based upon population. The Commission therefore authorises the President to request the International Meteorological Committee to take the necessary steps for bringing before the respective governments a proposal for re-establishing the principle of a subvention to a central bureau for the publication of the results of the investigation of the upper air, which was adopted at Petrograd in 1904.

“XI. That, in view of the experience since 1904, the cost of editing and compiling the international publication should no longer be left as hitherto to the good offices of the Director who occupies, for the time being, the position of President of the Commission, and that the funds should include the sum necessary to pay for the preparation, printing and distribution of the publication.

“XII. That on this understanding the President of the Commission be invited to undertake the care of the international publications.

“XVIII. It is estimated that the cost of printing and distribution would not amount to more than fifty thousand (50,000) gold francs, and, assuming that accommodation would be available without charge, it is further estimated that the preparation and compilation of the observations could be carried out for a similar sum. It is therefore resolved that the President be authorised to incorporate an estimate on that basis in the presentation of the report to the International Meteorological Committee.”

Professor Bjerknes asked that the opinion of the individual Directors and members of the Committee might be invited on the proposals set out in Resolution X. and in Sir Napier Shaw's Memorandum, Appendix IX., p. 113.

The President said that the alternative suggestions were that the money should be raised by the Institutes concerned, asking their Governments either for definite contributions or for money to purchase a definite number of copies at a certain fixed price per copy, and pointed out that the difficulty of asking for a definite



contribution lay in the statutory directions operative in some countries against voting money to foreign countries.

Prof. van Everdingen said that in his opinion the time had come to face the problem of international funds. He referred to the international Bureau which had been formed for hydrographic work, where the assessment for each country was based on tonnage; and suggested that in the case of the meteorological Bureau the nations might be classified according to their total budget, and the scale of contributions adjusted between a fixed maximum and minimum.

He agreed to work out the details of the proposition and to circulate a memorandum to the Committee.\*

The opinion of the Directors present was taken as to the form the contributions should take and M. Angot (France), Dr. Hesselberg (Norway), Commandant Jaumotte (Belgium), Col. Chaves (Azores), Prof. Dr. Maurer (Switzerland), Col. Matteuzzi (Italy), Dr. Okada (Japan), Dr. Melander (Finland), Dr. Gorczynski (Poland), were all of the opinion that in the case of their respective Governments the money would be more easily obtained by arranging for the purchase of copies than by asking for a definite contribution. An estimate of the copies required was obtained from the following members:—

Dr. Hesselberg (Norway), 15; Prof. E. van Everdingen (Holland), 20; Dr. Okada (Japan), 80; Dr. Wallén (Sweden), 20; Capt. Ryder (Denmark), 10; Dr. Simpson (Great Britain), 75.

The difficulties caused by the adverse rates of exchange in certain countries were emphasised.

The general opinion of the representatives of Norway, Denmark, and Japan was that at the present time it would not be possible for their respective Institutes to lend members of the staff to work in the Bureau as suggested in Sir Napier's memorandum.

Dr. Simpson suggested that the Committee should revert to the pre-war practice of asking the various countries simply to contribute to the cost of printing and distributing the observations without employing an international bureau, and said that in his opinion the cheapest method of obtaining the data was the one to be adopted.

After further discussion the President said that in his opinion the form of the publication required revision and that the proposal for an efficient editor was a proposal for economy in the long run.

The Committee agreed:—

25. †“that as a preliminary step a communication be addressed to the principal Institutes setting out the three

\* See Minutes of 9th Meeting, p. 48, and Appendix X., p. 116.

† See Resolution of 9th Meeting, p. 49.

The resolution as amended is as follows:—

“That as a preliminary step a communication be addressed to the principal Institutes setting out the three proposals and asking for an opinion on the points raised, inviting suggestions of definite sums in case of the further development of the proposal.”

proposals and asking for the opinion of the respective Governments on the points raised, inviting promises of definite sums in case of the further development of the proposal.”

The President drew attention to Resolution XII. of the Commission for the study of the Upper Air, and pointed out that the President of the Commission had only undertaken the care of the publication on the understanding that the proposals outlined in the former resolutions were approved.

The further discussion of the question was adjourned.

Commandant Jaumotte proposed the following resolutions which were approved:—

26. “Que les Instituts et Observatoires météorologiques nationaux s'entendent avec les autorités compétentes de l'Armée ou de la Marine, pour réaliser une fois par jour au moins, autant que possible, à une des heures d'observations internationales, un sondage aérien avion complété par un sondage simultané par ballon-pilote.”

27. “Que les résultats de ces sondages soient publiés mensuellement par chaque pays, dans la forme préconçue par la Commission pour l'investigation de la haute Atmosphère.” (Bergen, July, 1921.)

A resolution\* proposed by Col. Matteuzzi was approved as follows:—

28. “Que les résultats des sondages, faits tous les jours et intensifiés si possible soient publiés de préférence sous forme de cartes journalières ainsi qu'il est fait actuellement pour les autres données météorologiques.”

(Signed) NAPIER SHAW.

#### Fourth Meeting, September 13, 1921, Afternoon.

Present: Sir Napier Shaw (President), M. Angot (Vice-President), Prof. E. van Everdingen (Secretary), Colonel Chaves, Director Hesselberg, Commandant Jaumotte, Professor Dr. Maurer, Dr. Okada, Captain Ryder, Dr. Wallén, Professor Bjerknes, Lieut.-Col. Gold, Colonel Delcambre, Dr. Gorczynski, Colonel Matteuzzi, Professor Melander, Dr. G. C. Simpson, Dr. Fujiwhara, Mr. L. F. Richardson.

The meeting assembled at 3.0 p.m.

I. **Minutes.**—The minutes of the third meeting were read and passed for circulation.

II. **Commission on Cloud Observations.**—The Vice-President translated the report, previously circulated (Appendix VI., p. 92), of the Sub-Committee appointed by the Commission on Weather

\* See also Minutes of 5th Meeting, p. 32.



Telegraphy to consider (i) the possible modification of the code for cloud observations and (ii) the suggestions to be made to the International Committee in view of a revision of the international classification and of a new Cloud Atlas.

The President directed the attention of the Committee to the wide-base stereoscopic views of clouds by Mr. J. Tennant which were exhibited in the Office at South Kensington.

Colonel Matteuzzi asked that the decision of the Sub-Committee, that the proposed new atlas should include photographs from aeroplanes, should be recorded in the report.\*

The Committee agreed:

29. "That the last paragraph of Section A of the report and the whole of section B should be referred to the newly appointed Commission on Clouds for their consideration."

Additional members of the Commission on Clouds.—The Committee agreed:

30. "That M. Bergeron†, Captain Douglas, Commandant Jaumotte, Colonel Matteuzzi and Sir Napier Shaw be appointed additional members of the Commission for the Study of Clouds,"

and the formation of the Commission as thus constituted was approved. (See Minutes of Second Meeting p. 20.)

III. Report of the Commission for the Réseau Mondial (Appendix III., p. 59).—The Minutes (previously circulated, Circular I.M.C. 11) of the three meetings of the Commission for the Réseau Mondial were submitted for consideration.

Resolutions I. and II. as set out below were unanimously approved.

31. "That the policy of the officer in charge of the Réseau Mondial should be for him to consult Directors of the National Meteorological Services before including new data from their stations in the Réseau Mondial (I)."

32. "That the Commission of the Réseau Mondial expresses its thanks to the Meteorological Office, London, for the publication of the five volumes of the Réseau Mondial and asks that the publication may be continued (II.)."

Resolution III. of the Commission, with a slight addition, was approved as follows:—

33. "That the Committee recognises the importance of observations from Africa and desires that they be maintained as regularly as possible, and that the Committee further agrees that the officer in charge of the publication of the Réseau Mondial should be asked to communicate with Professor Eredia as to his proposals for the meteorology of Africa."

\* See also p. 94.

† Added at 9th Meeting.

IV. Projection and Scale of Charts.—In connection with Resolution IV. (p. 61) of the Commission the Committee proceeded to the consideration of Professor Bjerknes' proposal on the projection and scale of charts. Specimen copies of the charts prepared in the Norwegian Meteorological Office were laid on the table.

The President pointed out that the main differences between the charts proposed by Professor Bjerknes and those at present in use for the Réseau Mondial were:—

(a) For the projection used for the charts of middle latitudes, Professor Bjerknes proposed a conformal projection, while the charts of the Réseau Mondial, as of those of the Bureau Central Météorologique, were based on Albert's equal area projection.

(b) The points at which the sections of the Globe were made in the Réseau Mondial charts were at the Tropics and in the Arctic Circle, and in Professor Bjerknes' charts at  $22\frac{1}{2}^{\circ}$  and  $67\frac{1}{2}^{\circ}$ , a difference of only  $1^{\circ}$ .

(c) The parts of the Réseau Mondial charts were adjusted to enable them to be fitted for a Globe.

He said that on investigation it had been found that Professor Bjerknes' charts could probably be formed into a Globe without difficulty.

A short discussion followed as to the merits of the various projections and the advantages of uniformity were emphasised.

Captain Ryder said that he could not see his way to adopting the proposal for the charts used for Danish purposes, and expressed himself in favour of freedom in the choice of projection, especially in the case of the working charts of the several Institutes.

A resolution was approved as follows\* :—

34. "(i) Principes généraux :—Les projections des cartes météorologiques dynamiques doivent satisfaire aux conditions suivantes :—

A. Avoir des méridiens rectilignes.

B. Être conformes.

C. Avoir des défauts d'échelle aussi petits que possible relativement à l'étendue des régions représentées.

"(ii) Projections spéciales :—Prenant pour base ces principes généraux, on recommande les trois projections spéciales suivantes :—

A. Pour les régions polaires : projection sur un plan qui coupe le long du parallèle de  $75^{\circ}$ .

B. Pour les latitudes moyennes : projection sur un cône qui coupe le long des parallèles de  $30^{\circ}$  et  $60^{\circ}$ .

C. Pour les régions équatoriales : projection sur un cylindre qui coupe le long des parallèles de  $15^{\circ}$ .

\* See Projection and Scale of Charts by V. Bjerknes, *Geografiska Annaler*, vol. I., p. 1. §(1) is amended by the addition of the word "dynamiques."



“(iii) Echelles :—On recommande d'employer autant que possible l'échelle de 1 : 10,000,000.

“Pour des travaux sommaires, on peut appliquer aussi l'échelle de 1 : 20,000,000 pour les travaux détaillés les échelles de 1 : 5,000,000 et de 1 : 2,500,000.

“On recommande aux Instituts météorologiques de prendre en considération ces principes à toute occasion ou l'on introduira de nouveaux arrangements concernant les cartes.”

V. **Monthly Meteorological Bulletin.**—The President read the following report of the Commission on Professor Nakamura's proposal for “Monthly Report for immediate use in the preparation of forecasts à longue échéance, and for the purpose of industry or public health,” and agreed to pass on the recommendation to the Directors :—

“The Commission notes that monthly publications for the general purposes of climatology and general meteorology are already issued by the various Institutes within a period of one year of the time to which the data refer, that a considerable number of Institutes issue monthly or weekly climatological data for their own nationals within a month or a week of the close of the period to which the data refer, and that some Institutes make an issue on the first day of each month. They further note that the prompt issue of meteorological and magnetic data for industrial purposes has been found to be a necessity.

“In reporting these facts to the International Meteorological Committee the Commission is of opinion that further inquiry is necessary before an agreement can be arrived at for the general issue of a monthly report of climatological data suitable for industrial purposes or for forecasts of long period, and that in the meantime the Directors of the Institutes would not find it difficult to supply such information to other Directors by private arrangement on application.

“In expressing this opinion the Commission recognises that prompt information concerning the weather in different parts of the world may be of great importance for international trade, and a suitable summary in a form which could easily be telegraphed might find a place in trade journals.

“The Commission therefore suggests to the Committee that the Directors of the Institutes concerned might confer as to a form for the information which could be made available for trade journals as well as for the immediate purposes contemplated by Professor Nakamura.”

Dr. Okada pointed out that Professor Nakamura's proposal was made with a view to accelerating the mutual exchange of monthly bulletins already published, and that he would not

urge unnecessary duplication by asking the Bureaux to start new monthly bulletins. He emphasised the fact that the Bulletin was not intended to supersede the Réseau Mondial.

The Committee agreed :

35. “That the recommendation of the Commission du Réseau Mondial regarding the publication of monthly bulletins should be forwarded to the Directors of the Meteorological Institutes concerned.”

VI. **Monthly means for 5° squares of the Oceans.**—Resolution VI of the Commission, as set out below, was approved.

36. “The Commission invites the International Meteorological Committee to address a letter to the Directors of Institutes which collect observations from the ocean inviting them to forward observations for 5° squares for the month of any of the years 1910–14, and regularly for the months of the year 1922 onward. The Commission also desires that the attention of the Commission for Maritime Meteorology be drawn to the subject.”

Professor E. van Everdingen drew the attention of the Committee to Resolution V of the Commission of Maritime Meteorology, which was approved as follows :

37. “In addition to the monthly values for 10° squares selected to be sent to the Dutch Meteorological Office (Resolution 8 of the Commission on Maritime Meteorology, Rome, p. 57) monthly values for other 5° squares might be inserted in the Réseau Mondial Publication : the care and selection of squares in the N. Atlantic being left to the British Meteorological Office and the Scandinavian Institutes and in the N. Pacific to the United States and Japanese Office.”

The Committee approved the draft letter (*see* p. 64) proposed by the Commission du Réseau Mondial for despatch to the Directors of Institutes which collect observations from the Ocean, subject to the incorporation of the resolution of the Commission on Maritime Meteorology.

VII. **Letter from M. Sempaio Ferraz.**—The President read a letter from M. Sempaio Ferraz, Director of Meteorological Service of the United States of Brazil, Rio de Janeiro; which he had received since the meeting of the Commission.

The letter suggests that in order that the several Institutes may have before their notice what is occurring abnormally all over the world, the chief meteorological institutions should be asked either—

“(1) To send regularly to some chosen universally read meteorological periodical the abnormal weather experienced in each respective piece of the earth which the institution serves; or



"(2) To exchange such information directly, by means of circulars, which could be sent out by ordinary office means."

The Committee agreed :

"That M. Sempao Ferraz be appointed a member of the Commission du Réseau Mondial."

The Committee adjourned at 5 p.m.

(Signed) NAPIER SHAW.

### Fifth Meeting, September 14, 1921, Forenoon.

Present: Sir Napier Shaw (President), M. Angot (Vice-President), Professor E. van Everdingen (Secretary), Colonel Chaves, Director Hesselberg, Commandant Jaumotte, Professor Dr. Maurer, Dr. Okada, Captain Ryder, Dr. Wallén, Colonel Sacoinney, Dr. Gorczynski, Colonel Matteuzzi, Dr. Melander, Dr. Simpson, Dr. Fujiwhara, Mr. L. F. Richardson.

The meeting assembled at 10.30 a.m.

I. **Minutes.**—The minutes of the fourth meeting were read and passed for circulation.

II. **New Member.**—The President presented copies of the Codex of Resolutions of International Meetings to Dr. Okada and Director Wallén, the newly-appointed members of the Committee.\*

III. **Reports of Upper Air Observations.**—Colonel Matteuzzi asked permission to add to the resolution which had been passed on the previous day.† He submitted a copy of the Bulletin published by the Italian Meteorological Service, and emphasised the desirability of increasing the publication of upper air data so that it might be possible to draw a chart of upper air observations for the whole of Europe, if possible, on the day following the observations.

The President made inquiry to ascertain how many data were already published; and the representatives of the various countries reported as follows:—

*Denmark* makes no publication at present.

*Finland* publishes data from 4 stations in a Monthly Bulletin.

*France* publishes data for 3 or 4 stations and collects, but does not publish, data from 12 or 14 stations.

*Great Britain* publishes day by day an upper air supplement to the Daily Weather Report.

\* Minutes of 1st Meeting, para. V. (ii), p. 12.

† Resolution 28 (p. 27).

*Holland* obtains data from 3 or 4 stations for the daily weather service, but the results are only published yearly.

*Italy* publishes day by day the "Bolletino Aerologico."

*Japan* publishes data from 4 stations, some weekly and some monthly.

*Norway* obtains data from 2 stations which are included in the daily weather telegram but are not published.

*Poland* obtains data from 5 stations, which are published daily, but only "pour le service de l'intérieure"; there is no issue to foreign countries.

*Portugal.*—No upper air data are obtained at present, but it is hoped to establish a station in the Azores in the near future.

*Sweden* publishes data from 3 stations in the weather telegram and in a daily Bulletin.

*Switzerland* has one aerological station at Zürich.

Colonel Matteuzzi's resolution was again approved by the Committee, and the President said he hoped that the resolution might make possible the construction of maps of stream-function for the upper air.

IV. **Report of the Commission for Maritime Meteorology** (Appendix IV., p. 72).—The report of the Commission for Maritime Meteorology (Circular I.M.C. 18) was read.

Resolutions I. and II. of the Commission were approved as follows:

38. "To recommend to the Committee two kinds of weather reports from ships at sea for universal use\*:

"(a) PQLLL ILLGG BBDDF wwVKd without check figures.

"(b) QLLLx<sub>1</sub> Plllx<sub>2</sub> BBDDx<sub>3</sub> FVKdx<sub>4</sub> WWGGx<sub>5</sub> y<sub>1</sub>y<sub>2</sub>y<sub>3</sub>y<sub>4</sub>z with check figures.

"P indicates the day of the week.

[1 = Sunday, 2 = Monday, 3 = Tuesday, 4 = Wednesday, 5 = Thursday, 6 = Friday, 7 = Saturday. (The day refers to Greenwich time, and not to local time, i.e., Sunday means the 24 hours from 0h. G.M.T. to 24h. G.M.T. on Sunday at Greenwich.)

"Q indicates the quarter of the globe and the barometric scale.

"Any message of four groups should have the form (a).

"Any message of six groups should have the form (b)."

39. "The Commission recommended the following forms for additional groups to the message (a):

"Continental CNTTT Wrttt

"British CNTTd WrttK'."

\* A list of the various symbols employed for the representation of the elements of the groups of a telegraphic report, with their interpretation, is given in Appendix XII., p. 122.



In the consideration of § 1, p. 72, Dr. Simpson said that in his opinion it was essential that the check figures should be included; and said that in a trial made recently it had been found that of the observations received from ships 20 per cent. contained errors, 19.5 of which were corrected by the check figures. He said that it was proposed that the code set out above which contained only data which were required by all countries should be adopted as a universal code, and that further groups should be added by individual nations to meet their special requirements.

Professor E. van Everdingen said that he thought he represented Professor Bjerknes' point of view when he said that the increase in the number of observations was more important to Norwegian meteorologists than the insurance of absolute accuracy, especially as 20 per cent. errors in the whole message involved an error of only 1 or 2 per cent. in the observations of any one element.

He suggested that both forms might be used on the understanding that no six group code should be used without the check figures.

He pointed out that it was a step in advance to agree that the contents of the message should be universally the same, and that in his opinion it would be inadvisable at the moment to press for further uniformity.

After further discussion the Committee adopted Resolution 3 of the Commission:

40. "To circulate the four and six group codes to the various Directors who arrange or who are going to arrange for weather reports from ships at sea and get their opinion as to the desirability of check figures (with a view to selecting one of the two alternatives for universal use)."

Resolutions IV. (a) and (b) of the Commission were discussed, and the Committee agreed:

41. "That it is desirable that in Resolution IV. (a) the area over which oceanographic data are required should be extended to include the West as well as the North-west shores of Europe."

The Resolutions IV. (a) and (b) were then approved as follows:—

42. "that oceanographic data (values of the temperature and the salinity of the sea water at the surface and at different depths below it such as have for several years been collected by the International Council for the Study of the Sea) bearing on the surface area and the capacity of the warm masses of water off the North-West and West coasts of Europe, especially in the autumn, should be collected by international co-operation." (a)

43. "That the material thus collected should be worked up for climatological purposes, especially with the object

\* The words in brackets ( ) were added at the seventh meeting, when the Committee considered the report of the Commission for Weather Telegraphy.

of obtaining the data required for studying the possibility of drawing up long range forecasts for the winter temperatures over N.W. and W. Europe." (b)

"It is understood that the Meteorological Institutes might ask observers on board ship to take water samples and arrange for these being sent to some fishery institute for titration."

Resolution V. of the Commission had already been confirmed (see Resolution 36b) in considering the report of the Commission du Réseau Mondial; it was agreed to place on record Resolution VI. of the Commission that:

44. "With regard to the communication of Dr. Wallén on the control of storm warnings, the Commission recommends the study of the proposed method in different countries."

V. *Equivalents for the Numbers of the Beaufort Scale.*—Signor Marini's proposal, which had been referred to the Committee by the Commission as beyond its terms of reference, was discussed by Professor van Everdingen, Dr. Simpson, and the President. Professor van Everdingen referred to experiments which had been made on a Dutch steamer to ascertain whether there had been any marked difference between the estimates of observers on steamers and on sailing ships. The inquiry had shown that the estimates were unchanged.

The Committee agreed:

45. "That Dr. Simpson should be asked to look into the matter of proposing a definite scale of equivalents between the Beaufort numbers and wind velocity in m.p.h. and m/s."

Resolution VII. was approved:

46. "That this meeting recognises the importance of the subject of Colonel Delcambre's memorandum on the proposed organisation of international meteorology in the N. Atlantic and looks forward with much interest to the results of the next cruise of the "Jacques Cartier."

A resolution submitted by Commandant Jaumotte was postponed for consideration with the report of the Commission on Weather Telegraphy.

VI. *Proposal by Dr. Melander on the Measurement of Depth of Snow.*—The following proposal by Dr. Melander (Circular I.M.C. 14) was read:

"At the meeting of the Meteorological Committee at Rome in April 1913\* the following rules for the evaluation of the monthly mean depth of the snow, were fixed:—

"With reference to the evaluation of a monthly mean of "snow-thickness" it appeared that this was seldom

\* Report of the Tenth Meeting, Rome, 1913. M.O. No. 216, p. 16.



made. In case, however, this evaluation is made, the monthly mean of snow thickness should be defined as the sum of all the measured depths of snow divided by the number of days of snow lying.'

"This mode of evaluation seems to be inappropriate, as the sub-Director Korhonen at our Meteorological Office has many times remarked :

"(1) Because a station which all through the month has been covered by snow can obtain a lower monthly mean than another station where the snow has fallen only on the last days of the month, though the depth of snow on the former station at the time was greater than on the latter station. This is always the case when the depth of snow on the former station has been lesser at the beginning but on both stations greater at the end of the month.

"For the same reason it may happen that at the same station a month on which much snow has fallen can yield a lower mean value than another month on which less snow has fallen.

"(2) In uncertain cases when the snow has covered only about half of the country some observers would judge the day to be a snow-lying day (Code ☒), though other observers would note it as a snowless day. The evaluation of the monthly mean of snow thickness would then very much depend on the individual judgment of the observer.

"The evaluation of the means should therefore be so altered that the sum of the depths of snow measured on several days would be divided by the number of all the days of the month, because the above-mentioned inconveniences do not then occur, and this mode of evaluation is also more suitable to the other modes of computing meteorological means; by using the proposed rule it will be scarcely possible to compute the mean of the depth of snow for the snow season, but this can very well be compensated for by giving the greatest depth of snow and the number of winter days on which snow has lain.

"The fixed mode of evaluation of the Meteorological Committee would correspond to an evaluation of the monthly means of cloudy days, where only the cloudy days would be counted, but the cloudless days not taken into consideration."

Dr. Hesselberg reported that the Norwegian Service had adopted the same method of measurement suggested at Rome for some years, but had found it preferable to change to that suggested by Dr. Melander. Dr. Wallén and Dr. Maurer also expressed themselves in favour of the proposal.

After discussion, in which the President, Dr. Wallén, Dr. Hesselberg, Dr. Maurer, Professor E. van Everdingen and Dr. Simpson took part it was agreed :—

47. "That the Committee had no objection to the specification of the depth of snow as proposed by Dr. Melander."

The Committee adjourned at 1.10 p.m.

(Signed) NAPIER SHAW.

### Sixth Meeting, Wednesday, September 14, 1921, Afternoon.

Present: Sir Napier Shaw (President), M. Angot (Vice-President), Professor E. van Everdingen, (Secretary), Colonel Chaves, Dr. Hesselberg, Commandant Jaumotte, Professor Dr. Maurer, Dr. Okada, Captain Ryder, Dr. Wallén, Lieut.-Colonel Gold, Colonel Saconney, Dr. Gorczynski, Dr. Melander, Dr. Simpson, Mr. L. F. Richardson.

The Committee assembled at 3.0 p.m.

I. On the invitation of the President, M. Angot (Vice-President), took the chair.

II. **Sunshine Recorder.**—Dr. Maurer submitted the following resolution :—

"The Committee recalls the conclusion arrived at in Rome, 1913, and repeats the wish to obtain certain normals for the glass-sphere heliograph concerning the constitution and dimension of the glass-sphere and the cards.

"To make easier the comparison of the results it is necessary to communicate in the reports the Tables of mean values which type of instrument has been used (Original or recent Hicks or Negretti model Fuess, Usteri, etc.). The determination of the duration of the burn of the apparatus used to that of the new Negretti model as the most fully defined glass-sphere we have, may be recommended for the different climatic regions."

and added the following note as to his reasons for selecting the new Negretti model as the standard.

"Depuis assez longtemps personne de nous n'ignore les défauts adhérent aux héliographes à boule de verre. Le rapporteur lui-même, lors de ses comparaisons faites entre les divers types d'héliographes a dû constater des différences assez graves, qu'il n'a pas manqué de publier dans les journaux météorologiques. Mais pour vérifier jusqu'au fond les données de l'héliographe à boule de



verre j'ai fait construire, à titre de comparaison, un appareil spécial, le chronohéliographe, dont j'ai exposé les résultats dans les séances du Comité Météorologique à Rome en 1913. Ce chronographe, ayant une ligne focale considérablement allongée—environ 120 mm. l'heure—permet d'enregistrer le temps de l'insolation jusqu'aux moindres détails de ces interruptions.

“ Nous donnons ci-après, une brève comparaison des enregistrements de ce chronographe avec ceux d'un Sunshine-Recorder, Campbell-Stokes, modèle Negretti & Zambra. Ces résultats datent des années 1917 et 1918.

*Résultats obtenus :*

	Sonnenschein- Chronograph.		Heliograph Negretti-Zambra		Différence en	
	Std.	Min.	Std.	Min.	Std.	Min.
1917.						
April—Juli	237	3	236	58	+ 0	5
Aug.—Okt.	302	1	300	19	+ 1	42
1918.						
Jan.—Febr.	223	1	220	57	+ 2	4
Mars.—Apr.	274	10	253	1	+ 21	9
Mai—Juni	469	41	477	12	— 7	31
	1505	56	1488	27	+ 17	29

“ La différence entière pour l'année 1917/18—17h. 29m.—est extrêmement petite; les différences pour tous les autres appareils sont plus grandes; il serait donc très désirable de porter le modèle Negretti & Zambra comme appareil normal.”

The President pointed out that the name of Negretti and Zambra was not a sufficient specification of a sunshine recorder. In order to insure instruments which were comparable, and which every instrument maker could make, it would be necessary to specify both the size and nature of the glass-sphere, including particulars of the specific gravity, refractive index, transparency and durability of the glass, and the size of the bowl.

He proposed the following resolution which was unanimously adopted :—

48. “ That the British Meteorological Office be requested to compare the specification of Negretti and Zambra's instrument with the Hicks instrument used in the Meteorological Office and with any other instruments to which they may have access, and to submit the results to the Committee with a view to a detailed specification of the instrument which Dr. Maurer has found to give so reliable a record.”

Dr. Maurer agreed to lend his instrument to the London Meteorological Office as a secondary standard.

III. **Meteorological Glossary.\***—The President drew the attention of the Committee to the Glossary of terms used in Forecasting with their equivalents in foreign languages, and the Directors present were asked to complete and correct the list with a view to its incorporation in *Instructions to Telegraphic Observers* or similar publications.

Professor van Everdingen proposed the addition of certain terms to the *Meteorological Glossary*, and Dr. Simpson said that he would welcome any such suggestions.

Professor Okada drew the attention of the Committee to two phenomena not referred to in the Glossary.

1. Oceanic Noise. The sound of the sea at a distance.

2. The existence of ice-needles just below the surface of the ground.

IV. **Report of the Commission for the Application of Meteorology to Aerial Navigation.**—The following resolutions were approved :—

49. “ La Commission réitère le vœu émis à Paris en 1919 et insiste sur son importance et sur son urgence :—

“ Que chaque pays édite un “ Guide Météorologique pour la Navigation Aérienne.” La forme doit être laissée provisoirement à l'initiative de chacun.”

50. “ La Commission recommande que chaque pays crée des récompenses destinées aux Navigateurs aériens qui auront fourni des documents intéressants sur les phénomènes météorologiques observés au cours de voyages aériens. (Notes, Photographies de nuages, etc.) ”

51. “ En vue de faciliter aux pilotes des lignes internationales la lecture des renseignements météorologiques horaires la Commission propose l'adoption par les pays intéressés du type ci-dessous de tableau d'affichage.”

Heure.	Station.	Temps Présent.	Visibilité.	Altitude des nuages bas.	Quantité de nuages bas.	Quantité totale de nuages.	Colonnes complé- mentaires (faculta- tives).

52. “ La Commission propose pour la transmission des messages horaires les deux groupes suivants :

“ wwVhL NDDFW suivis de renseignements en clair en cas de nécessité. Sous réserve des possibilités de services de T.S.F. appartenant au réseau de navigation



aérienne des pays intéressés, elle propose s'il en est besoin l'émission d'un message tri-horaire de la forme suivante :

"BBBDD FwwTT cbWVH ALaNh C<sub>a</sub>ddF<sub>1</sub>S"

53. "Elle propose une nouvelle échelle de visibilité, échelle proposée par M. van Everdingen (voir rapport de la Commission de télégraphie météorologique) qui permet de définir les visibilités dépassant 50 km."

After discussion as to the desirability of specifying the three heights referred to in Resolution VI.,

"(6) Elle propose que les sondages destinés à la navigation aérienne donnent trois fois par jour, la vitesse et la direction du vent au moins à trois hauteurs convenablement choisies. La vitesse sera exprimée en km/h (ou m.p.h.),"

it was agreed that the resolution be postponed.

It was noted by the Committee that—

"Les propositions relatives aux codes et à la forme des messages subiront peut-être des modifications dès que l'usage de la téléphonie sans fil aura facilité la multiplication et la précision des renseignements."

V. **Units of Measurement.**—Lieut.-Col. Gold: "Proposal to adopt the 'kilometre per hour' as the unit of wind velocity in place of the 'metre per second.'"\*

Colonel Gold enumerated the variety of units used in the year books of the various meteorological Institutes and suggested that the decision of the Committee:—†

"That it is desirable to give in the tables wind velocities in metres per second,"

be reversed.

Mr. Richardson suggested that the most scientific unit might be the 100 kilometres per day which was of the same order as the metre per second.

The Committee recognised the advantage of adopting the kilometre per hour as the unit in certain cases, but was of the opinion that the metre per second must be retained for scientific purposes.

The following resolution was approved (one Director opposing):—

54. "That for the expression of the speed of the wind in publications intended for use in aerial navigation the unit used should be the kilometre per hour."

The Committee adjourned at 5.15 p.m.

(Signed) NAPIER SHAW.

\* See Appendix VI.A, p. 108.

† See Report of the Proceedings of the Meteorological Congress at Vienna (M.O. No. 21), pp. 27 and 51. Report of the International Meteorological Conference at Munich, 1891 (M.O. No. 102), p. 24.

## Seventh Meeting, September 15, 1921, Forenoon.

Present: Sir Napier Shaw (President), M. Angot (Vice-President), Professor E. van Everdingen (Secretary), Colonel Chaves, Director Hesselberg, Commandant Jaumotte, Professor Dr. Maurer, Dr. Okada, Captain Ryder, Dr. Wallén, Colonel Sacconey, Lt.-Col. Gold, Colonel Delcambre, Dr. Gorczynski, Colonel Matteuzzi, Professor Melander, Dr. G. C. Simpson, Mr. L. F. Richardson.

The Committee assembled at 10.30 a.m.

I. **Minutes.**—The Minutes of the 5th and 6th Meetings were read and passed for circulation.

The President reported some corrections to the Minutes of the first, second, and third Meetings which were approved; and asked permission to reconsider at a later meeting the resolution taken at the third meeting as to the steps to be taken in arranging for an international publication of upper air data. (See p. 48.)

II. **Prof. Bigelow's letter.**—The President read a report by Mr. Richardson on Professor Bigelow's communication (see p. 24), and it was agreed to refer the matter to the Commission for the Study of the Upper Air for consideration.

III. **Decorations conferred by the Portuguese Government.**—Colonel Chaves announced that the Portuguese Government had expressed their appreciation of the work of the International Meteorological Committee by conferring upon Sir Napier Shaw (President), M. Angot (Vice-President), and Prof. van Everdingen (Secretary), the Order of S. Tiago da Espada.

The President on his own behalf, and on behalf of the Vice-President and Secretary, expressed their pleasure at the honour which had been conferred upon them and thanked Colonel Chaves and the Portuguese Government for this expression of their good-will.

IV. **Report of the Commission for Weather Telegraphy.**—The Committee proceeded to the discussion of the report of the President of the Commission on Weather Telegraphy, and Colonel Chaves asked that the list of stations given in the Minutes of the 2nd Meeting of the Commission might be modified to include Portugal and the Azores. Colonel Gold undertook to make the necessary alteration before the printing of the report.

**Code for reports from land stations.**—The Committee approved the following resolution:—

55. "That this meeting approves of the code for land stations suggested in paragraph 6(a)\* of the report as follows:—

\* See p. 81.



'That the standard form of messages for reports from the individual station be represented symbolically by the following letters :—

BBBDD FwwTT cbWVH ALaNh

and that to these four groups be added twice daily as follows :—

Inland stations { RRMmr for reports at 0700 G.M.T.  
RRMMr for reports at 1800 G.M.T.

Coast stations — RRSV<sub>r</sub> for reports at 0700 and 1800 G.M.T.'

with additional groups of the form C<sub>1</sub>ddVV for certain selected stations reporting the direction of motion and relative speed of clouds."

The meaning of the various symbols is given in Appendix XII.

The President suggested that steps should be taken to bring the code into general use and the following resolutions were adopted :—

56. "That the Directors of Services be requested to bring the code specified above into use on the 1st January 1922, or as soon thereafter as possible."

57. "That the Committee recognises the importance of the telegrams from the Azores and desires to express the grateful thanks of the Committee and of the Directors of European Institutes to the Portuguese Government for the observations that have been received during the past 20 years and desires to ask Colonel Chaves to represent to the Portuguese Government the desirability of continuing the assistance from the Azores and the Portuguese Continent in the code which has now been adopted, and expresses the hope that the observations from the Azores and Portuguese Continent may, in the near future, be sent by Wireless Telegraphy.

"The Committee notes that messages containing observations at the hours chosen for synoptic observations in Europe would be specially acceptable."

The following resolution of the 1st Meeting of the Commission (Minutes, paragraph 5, p. 85) was also approved :—

58. "The Commission recognises the difficulty of making observations in Iceland at so early an hour in the morning as 0700 G.M.T. and expresses its appreciation of the manner in which Director Thorkelsson is meeting the needs of European meteorologists in regard to the reports from Iceland. In view, however, of the importance of those observations in International Meteorology, the Commission considers that it is undesirable either to reduce the number of stations or to change the morning hour of observation from 0700 to 0900 G.M.T."

With regard to paragraph 6 (c) (p. 81), Professor E. van Everdingen suggested the addition of a supplementary group and Colonel Gold, Professor E. van Everdingen and Dr. Hesselberg were requested to consult as to the form and to circulate a proposal for the Committee's consideration at a later meeting.

The Sub-Committee submitted its proposal at the Ninth Meeting and the Committee approved the code as follows :—

59. "That the symbolic form of the reports of upper wind be : h<sub>1</sub>ddvv, and the symbolic form of reports of upper air temperature and humidity be : BBTTH, and that for both wind and temperature in the upper air the reports should be for definite heights given on pages 33 and 34 of M.O. 242.

"That when inversions are present they may be indicated by adding at the end of the groups for fixed heights a group 00000 followed by a group or groups of the form B<sub>1</sub>B<sub>1</sub>B<sub>1</sub>t<sub>1</sub>t<sub>1</sub> where B<sub>1</sub>B<sub>1</sub>B<sub>1</sub> is the pressure in whole millibars or whole millimetres and t<sub>1</sub>t<sub>1</sub> the increase of temperature in degrees C or F according to the units used in the remainder of the report."

The Committee then adopted the resolution—

60. "that the form of message set out in 6 (d) (p. 81) for giving a synopsis of the meteorological situation for a whole continent be approved, viz. :

BBDDF w<sub>1</sub>TTK'R for the observations at 0700 G.M.T.

BBDDF w<sub>1</sub>TTK'W for the observations at other hours."

The Committee approved the following resolutions :—

61. Specification of scales.\*—"That the specification of scales set out below be adopted with the addition of a code for F<sub>1</sub> (Speed of clouds) in kilometres per hour" :—

(a) For the form of cloud (M.O. 242, page 27) with one modification.

(b) For the visibility on land and at sea (M.O. 242, pp. 26 and 27) modified in 1921, *see* Appendix VI., p. 89.

(c) For the height of the base of cloud (M.O. 242, p. 28.)

(d) For the relative humidity (M.O. 242, p. 28).

(e) For the revised specification for barometric tendency (M.O. 242, p. 29). An abbreviated specification of the barometric tendency where no figure is available for the characteristic is given in the minutes of the 1st meeting, held in September 1921 (paragraph 14, p. 87).

(f) Upon two specifications for the state of the sea and swell for use at coast stations and in the open sea respectively (M.O. 242, pp. 29 and 36).

\* The complete specifications of the scales are collected and published in M.O. publication 253 under the title *The (New) International Code*.



(g) For the amount of rainfall (M.O. 242, p. 30). An abbreviated specification of the amount of rainfall when only one figure is available, is given in the minutes of the 2nd meeting, held in September 1921 (paragraph 6, p. 88).

(h) For the time of commencement of rain (M.O. 242, p. 31).

(i) For the height to be used in reports of upper winds (M.O. 242, p. 33).

(j) For the heights to be used in reports of upper air temperature and humidity (M.O. 242, p. 34).

(k) For reports of weather at the time of observation (M.O. 242, p. 39) (modified in 1921, see Appendix VI., p. 86).

(l) For reports of past weather (M.O. 242, p. 42)."

#### Scale for Wind Direction :

62. "That the scale 0-32 should be retained for reports of surface wind direction, but that the scale of 0-36 should be used for reports of direction of upper wind and of cloud motion."

#### Issue of Collective Messages by Radiotelegraphy :

63. "That the table set out in paragraph 14 of the minutes of the 2nd meeting of September 1921 (p. 90) be approved with the modifications introduced at the present meeting."

#### Transmission of Reports from Iceland :

64. "The Commission considers that the arrangements with the Great Northern Telegraph Company, negotiated by Captain Ryder, offer a satisfactory solution of the problem of the distribution to European Meteorological services of the reports from Iceland, and recommends that the arrangements be put into operation as early as possible."

65. "That an arrangement by which the agreement with the Great Northern Telegraph Company was terminable at 6 months' notice would best meet the requirements of the Meteorological Services."

66. "That the forms of code approved for transmission of telegrams from Iceland be recommended to M. Thorkelsson and Captain Ryder."

Establishment of radiotelegraphic stations in Greenland.—The Committee endorsed the recommendation of the Commission :

67. "That the establishment at the earliest possible date of a high power radiotelegraphic station in Greenland is of the utmost importance to the meteorology of Western Europe, and is of such importance as to warrant the international provision of funds for maintaining it."

"The Committee notes that the Commission has ascertained that a small-power radiotelegraphic station in Greenland would be sufficient to transmit reports from

Greenland to Iceland and is of opinion that the establishment of such a small-power station ought not to be delayed by their desire to see a high-power station established."

Code for International Exchange of Forecasts.—The Report of the Sub-Committee on the Code for Forecasts (previously circulated, Appendix VI., p. 91) was read, and the Committee adopted the resolution :

68. "That the British Meteorological Office be requested to prepare a code on the basis of that set out in the report."

Cloud Atlas. It was agreed :—

69. "That the conclusions of the Sub-Committee and of the Commission should be referred to the Commission on Clouds for their consideration."

The following resolution proposed by Colonel Gold was approved :—

70. "That the International Meteorological Committee desires to express its appreciation of the services rendered by Captain Ryder in conducting the negotiations for the revision of the arrangements for the distribution, to the European Meteorological Services, of the reports from Iceland."

The following resolution was approved—

71. "The Committee, at the suggestion of Captain Ryder, desires to express its thanks to the Meteorological Office, London, for contributing to the satisfactory solution of the question by undertaking to distribute by wireless telegraphy the reports received from Iceland."

The President said that he would like to place on record the appreciation of the International Meteorological Committee of the work of the Commission on Weather Telegraphy.

The Committee unanimously adopted the following resolution proposed by M. Jaumotte :—

72. "Que les pays qui reçoivent les observations de bateaux veuillent bien faire un effort pour faire bénéficier aussitôt que possible les pays voisins des renseignements reçus.

"En particulier il serait désirable que les pays qui réalisent des émissions destinées à l'aviation examinent avec bienveillance la possibilité de joindre des dépêches de bateaux au premier météo-horaire émis après la réception."

The Committee adjourned at 12.55 p.m.

(Signed) NAPIER SHAW.



**Eighth Meeting, September 15, 1921, Afternoon.**

Present:—Sir Napier Shaw (President), M. Angot (Vice-President), Prof. E. van Everdingen (Secretary), Colonel Chaves, Director Hesselberg, Commandant Jaumotte, Prof. Dr. Maurer, Dr. Okada, Capt. Ryder, Director Wallén, Professor Bjerknes, Dr. Gorczynski, Col. Matteuzzi, Dr. Melander, Dr. Simpson, Mr. L. F. Richardson.

The meeting assembled at 3.30 p.m.

**I. Minutes.**—The minutes of the seventh meeting were read and passed for circulation.

**II. Commission for Agricultural Meteorology.**—M. Angot expressed his regret that he had been unable to summon a meeting of the Commission, and that he had therefore no report to submit to the Committee. He added that it was his intention to resign the Presidency of the Commission, but many of his colleagues had urged him to retain it. As he was no longer Director of the French Meteorological Service he had no facilities for carrying out the secretarial work of the Commission, but his friend and colleague, Director Wallén, had offered to act as Secretary and in these circumstances he would be willing to retain his position as President.

Director Wallén was accordingly elected Secretary of the Commission.

**Report on Agricultural Meteorology by M. Louis Dop.**—M. Angot referred to the proposals of M. Louis Dop, and said that they were now simply of historical interest as at the general meeting of the International Institute for Agriculture at Rome the proposals made by M. Dabat had been accepted.

**Report of the Sub-Committee on Agricultural Meteorology.**—The report of the Sub-Committee appointed at the third meeting of the Committee was submitted. (Appendix VIII., p. 112.)

M. Wallén said that he considered that a Commission for agricultural meteorology must be composed not only of meteorologists, but also of representatives of the agricultural services; and that if the new Commission for agricultural meteorology at Rome were not realised the International Meteorological Committee would have to consider the question of appointing additional members representing agricultural sciences to the Commission. He also drew attention to the demand of the Agricultural Institutes for reports on the organisation of agricultural meteorology in the different countries and presented copies of the Swedish report, and asked the Directors of the Meteorological Institutes to send copies of the reports upon the provision for agricultural meteorology asked for by the Institute of Agriculture also to the President of the Commission for Agricultural Meteorology.

The Committee unanimously adopted the following resolutions of the Sub-Committee:—

**73. Resolution I.**—“Le comité considère que la Commission de la Météorologie Agricole rattachée à l'Organisation météorologique internationale est nécessaire, même si la nouvelle Commission de Météorologie Agricole rattachée à l'Institut International d'Agriculture est établie.”

**74. Resolution II.**—“Le Comité considère qu'il doit être entendu que les questions de la météorologie forestière appartient aussi aux tâches de la météorologie agricole.”

**75. Resolution III.**—“Le Comité considère qu'il est désirable d'avoir une séance de la Commission de Météorologie Agricole avant la prochaine conférence des Directeurs.”

The President suggested the addition of the following note, which was unanimously approved:—

**76.** “It is understood that the Commission is empowered to co-opt, as members, experts in the various branches of agricultural science in which questions of the influence of weather arise.”

**Appointment of Additional Members to the Commission.**—M. Angot reported that the following additional members had been appointed to the Commission:—

M. M. Azevedo Gomes, Professor of the Institute of Agriculture, Lisbon.

Dr. Okada, Director-designate of the Meteorological Service of Japan.

The following additional members were nominated as representatives of the agricultural sciences:—

Mons. A. Åkerman, Institute for Selection of Plants, Svalof.  
M. Louis Dop, Vice-President of the International Agricultural Institute, Rome.

M. Engler, Professor of Forest-meteorology, and Director of the Central Institute for Forestry, Zurich.

Mr. R. A. Fisher, Statistical Department, Rothamsted Experimental Station, Harpenden.

Prof. O. Hagem, Professor of Botany, Bergen.

Mr. R. H. Hooker (President of the Royal Meteorological Society), Ministry of Agriculture and Fisheries, London.

Mr. Warren Smith, Weather Bureau, Washington.

M. Wéry, Directeur de l'Institut National d'Agronomie, Paris.

Mlle. J. Westerdyk, Professor of Phytopathology, Utrecht.  
and the nominations were approved.

**III. Commission for Terrestrial Magnetism and Atmospheric Electricity.**—M. Angot reported that at the request of Professor van Everdingen he had agreed to continue as President of the Commission.



The Committee approved of the co-option of the following additional members:—

M. Banachiewicz, Astronomical Observatory, Cracow, Poland.

M. de Carvalho, Director of the Meteorological Observatory, Coimbra.

Prof. S. Chapman, The University, Manchester.

Dr. C. Chree, Superintendent, Kew Observatory, Richmond, Surrey.

Dr. Crichton Mitchell, Superintendent of the Meteorological Office, Edinburgh, and of the Observatory, Eskdalemuir.

Dr. G. C. Simpson, Director, Meteorological Office, London.

Prof. Dr. Wolfer, Director of the Federal Astronomical Observatory, Zurich.

**IV. Commission for Solar Radiation.**—Dr. Maurer expressed his regret that it had not been possible up to the present to hold a meeting of the Commission; he announced that he hoped to call a meeting of the Commission in Switzerland during 1922.

The Committee adjourned at 5.0 p.m.

(Signed) NAPIER SHAW.

### Ninth Meeting, September 16, 1921, Forenoon.

Present:—Sir Napier Shaw (President), M. Angot (Vice-President), Prof. E. van Everdingen (Secretary), Colonel Chaves, Director Hesselberg, Commandant Jaumotte, Prof. Dr. Maurer, Dr. Okada, Capt. Ryder, Dr. Wallén, Prof. Bjerknes, Colonel Delcambre, Dr. Gorczynski, Colonel Matteuzzi, Dr. Melander, Dr. Simpson, Mr. L. F. Richardson.

The Meeting assembled at 10.40 a.m.

**I. Minutes.**—The minutes of the 8th meeting were read and passed for circulation.

The minutes of the 4th, 5th and 6th meetings were corrected and confirmed.

**II. Financial Proposal for the International Publication of Upper Air Data.**—The question of the publication of the upper air data, which had been considered at the third meeting, was further discussed and a memorandum (previously circulated, Appendix X., p. 116) was submitted by Professor van Everdingen, containing his proposal that the amounts contributed by each country should be assessed according to the total budget of ordinary expenditure.

The President pointed out that two alternative courses of action were open:—

(i) To circulate the proposals to the Directors of the various Meteorological Institutes and to ascertain their opinion as to the best way of approaching their respective Governments.

(ii) To authorise Prof. Bjerknes to request the Norwegian Foreign Office to approach the Governments of Foreign countries with a view to obtaining their support to the proposals.

After discussion in which the President, M. Angot, Prof. Bjerknes, Colonel Delcambre, Prof. E. van Everdingen, Colonel Matteuzzi, Capt. Ryder and Dr. Wallén took part, the Committee adopted the resolution—

**77. "That this Committee is unanimous in desiring to see the proposal put forward by Prof. Bjerknes carried into execution as soon as possible."**

Prof. Bjerknes said that as the problem was becoming political rather than scientific, he did not feel himself suited for carrying it through to a successful conclusion, and would prefer that the responsibility should be transferred to other hands; he accordingly offered his resignation of the Presidency of the Commission for the Upper Air and asked Colonel Delcambre if he would be willing to undertake the publication.

The President said he thought it desirable to make further inquiry before deciding on a course of action, and agreed to undertake any correspondence that might be necessary.

The Committee unanimously adopted a resolution:—

**78. "That Professor Bjerknes should continue as President of the Commission of the Upper Air if he be willing to do so."**

**79. "It was agreed that it was desirable to take the opinion of the Directors before approaching the question through diplomatic channels and that the resolution of the third meeting be altered accordingly."\***

**III. International Research Council and Geodetic and Geophysical Union.**—The President said he understood that a meeting of the Union was to be held in Rome in 1922, and as President of the Meteorological Section he would be glad to receive any proposals which Directors might wish to make.

**IV. List of Directors of Independent Institutes and Observatories.**—The President reported the receipt of a provisional list which had been drawn up by the Secretary based on—

(i) The Institutes with which the Dutch Service was in relation.

(ii) The list of delegates to the Paris Conference.

(iii) The list printed in the English edition of the Report of the Paris Meeting, of the Institutes with which the British Meteorological Office exchanges publications.

The Committee approved of Dr. Okada's proposal:—

**80. "That a short sketch of the various Meteorological Institutes be added, with the names of the Directors and Assistant-Directors and, if possible, the Scientific Staff."**

\* See also page 26.



The Committee further agreed :—

81. "That Professor van Everdingen be asked to complete the list and to circulate it, in typed form, to the Directors for their approval."

It was agreed—

82. "That the decision of the respective Directors should be accepted as to the significance of the term 'independent' in any special case."

V. **Correspondence.**—The President reported the receipt of a letter from Professor Rudolf Schneider of the Meteorological Institute of the Czechoslovak Republic, explaining his absence from the Paris Conference and expressing his desire to take part in international meteorological work.

VI. **Arrangements for the next Conference.**—The President referred to the decision that a meeting of the Conference should be held every six years, at least, and emphasised the desirability of holding a meeting in the near future. He added that as the Conference which had been suggested for Utrecht in 1915 had not been held, Professor van Everdingen now invited the next Conference to meet there.

The question as to the most suitable date for the Conference was discussed, and by a majority of five votes to four the Committee was in favour of 1923 in place of 1922; a considerable majority was in favour of May, as compared with September. It was agreed :—

83. "That a Conference be summoned for the Spring of 1923 if that date should prove possible to Professor van Everdingen, and if not in September of that year."

VII. **Commission for the Study of the Upper Air.**—Professor Bjerknes repeated his wish not to undertake the responsibility of the publication of the international upper air data. He said that after consulting Colonel Delcambre they found that the best solution of the matter was contained in a letter which he had addressed to the President and requested that the letter be read.

The President accordingly read the letter which suggested that Sir Napier Shaw should undertake the duties of President of the Commission.

It was pointed out that according to the Règlement the duty of electing a new President of the Commission rested with the Commission itself and not with the Committee.

The Committee adjourned at 1.15 p.m.

(Signed) NAPIER SHAW.

[NOTE.—The recommendation of the sub-committee appointed to consider a code for "inversions" was considered at this meeting and approved. The recommendation is incorporated in Resolution 59 (p. 43).—N. S.]

### Tenth Meeting, September 16, 1921, Afternoon.

Present :—Sir Napier Shaw (President), M. Angot (Vice-President), Professor E. van Everdingen (Secretary), Colonel Chaves, Director Hesselberg, Commandant Jaumotte, Prof. Dr. Maurer, Dr. Okada, Captain Ryder, Director Wallén.

The members of the Committee assembled at 3.10 p.m.

I. **Appointment of Members of Commissions.**—The list of members of Commissions previously circulated was amended. The corrected list is set out in Appendix XI, p. 116.

II. Dr. Simpson was elected President of the Commission du Réseau Mondial and de la Météorologie Polaire and Sir Napier Shaw President of the Commission for the Study of Clouds.

III. **Resignation of President and Vice-President.**—Sir Napier Shaw in resigning his position as President of the Committee thanked the members for their kindness to him since his election to the Committee in 1900, and to the Presidency in 1907.

M. Angot resigned his position as Vice-President. After cordial reference to those with whom he had served on the Committee since 1907, he took leave of his colleagues and withdrew from the meeting.

IV. **Election of Members of the Committee.**—The Committee unanimously adopted the resolution :—

84. "That Dr. G. C. Simpson and Colonel Delcambre be appointed members of the Committee in place of Sir Napier Shaw and M. Angot."

Sir Napier Shaw welcomed the newly-elected members and handed to each a copy of the Codex of Resolutions of International Meteorological Meetings.

Captain Ryder expressed the thanks of the Committee to Sir Napier Shaw for his work during the past years and congratulated him on having directed the actions of the Committee to such satisfactory conclusions.

The meeting adjourned at 3.50 p.m.

(Signed) NAPIER SHAW.

### Eleventh Meeting of the Session, First Meeting of the new Committee.

#### Friday, September 16, 1921, Afternoon.

Present :—Professor E. van Everdingen (Secretary), Colonel Chaves, Colonel Delcambre, Director Hesselberg, Commandant Jaumotte, Prof. Dr. Maurer, Dr. Okada, Captain Ryder, Dr. Simpson, Director Wallén.



The Committee assembled at 4.0 p.m.

**I. Election of new Members.**—The Committee were of the opinion that the time had not yet come to fill the four places left vacant by the Conference in Paris, 1919, and agreed:—

85. "That no new members should be elected at present."

**II. Arrangements for the next Conference.**—The Secretary asked the opinion of the Committee as to whether it was their wish that the next Conference should be summoned in accordance with the *Règlement* which stated that:—

"The Officers of the Committee shall invite to the Conferences all heads of Réseaux of stations in each country and the Directors of Meteorological Observatories which are official and independent of one another."

The Committee were of the opinion that if the Conference were fixed for 1923 instead of 1922 there was not likely to be any difficulty about extending the invitation to all nations.

**III. Election of Officers.**—(a) *President.*—The Secretary referred to the loss which the Committee had suffered by the resignation of the President and Vice-President and asked for nominations for a new President.

Captain Ryder suggested that Sir Napier Shaw should be asked to continue as President of the Committee though without a vote, and pointed out that the *Règlement*\* stated that:—

(1) "Each member of the Committee must belong to a separate country and must be the Director of an independent meteorological establishment."

(2) The Committee nominates its own officers consisting of a President, a Vice-President and a Secretary,

and that therefore the Committee would technically be within its rights in making the re-appointment.

The Committee were unanimously of the opinion that even if the appointment were a departure from the meaning of the *Règlement*, it was warranted by the exceptional circumstances and the following resolution was unanimously adopted:—

86. "That Sir Napier Shaw be appointed President of the Committee."

(b) *Vice-President and Secretary.*—The Committee proceeded to the election of a Vice-President and Secretary and the following resolutions were unanimously approved:—

87. "That Professor E. van. Everdingen be appointed Vice-President."

88. "That Director Hesselberg be appointed Secretary."

\* Report of Proceedings of the Fourth International Conference at Paris, 1919 (M.O. 239), p. 12.

Having ascertained that Sir Napier Shaw was willing to accept the appointment as President, the Committee adjourned at 5.10 p.m.

(Signed) NAPIER SHAW.

## Twelfth Meeting, Saturday, September 17, 1921, Forenoon.

**Present:**—Sir Napier Shaw (President), Professor E. van Everdingen (Vice-President), Director Hesselberg (Secretary), Colonel Chaves, Commandant Jaumotte, Professor Dr. Maurer, Dr. Okada, Captain Ryder, Dr. Simpson, Professor Bjerknes, Dr. Gorczynski, Colonel Matteuzzi, Professor Melander, Mr. L. F. Richardson.

The meeting assembled at 10.45 a.m.

**I.** Sir Napier Shaw thanked the Committee for the confidence which they had shown by re-electing him as President of the Committee, and said that he hoped he would not disappoint them in their lofty conception of his capacity for carrying on the work.

**II. Minutes.**—The minutes of the 7th and 8th meetings (previously circulated) were corrected and confirmed.

The minutes of the 9th, 10th and 11th meetings were read, corrected and confirmed.

**III. Proposal for Funds for Aerological Publications.\***—Professor van Everdingen referred to the difficulties of formulating a satisfactory scheme for assessing the contribution to be paid by the respective countries owing to the variation in the rate of exchange, and suggested that his proposal set out in Circular I.M.C. 19 and Appendix X., p. 116, might be modified so that the contribution paid by each country might be taken as a percentage of the budget of ordinary expenditure and be payable therefore in the currency of the nation concerned.

It was agreed that the question be taken into consideration when the proposals were circulated.

**IV. Minutes of the Joint Meeting** (Circular I.M.C. 21 and Appendix VII., p. 110).—The President referred to the fact that the corrected minutes of the Joint Meeting of the Commissions for Aerial Navigation, Maritime Meteorology, and Weather Telegraphy had been circulated, but had not been subjected to detailed consideration. He reported that all the questions raised in the report had been treated in the discussions of the reports of the several Commissions.

**V. Commission for Weather Telegraphy.**—The corrected text of the Report of the President of the Commission for Weather Telegraphy was submitted. (Appendix VI., p. 80.)

\* See Minutes of Third and Ninth Meetings, pp. 26 and 48.



VI.—In closing the meeting the President referred to the important conclusions which had been arrived at during the past fortnight and said that he hoped they might justify the work which had been devoted to them. He was personally most anxious to find a solution of the problem of co-operation in the investigation of the upper air, and though it was difficult to get the political side of Government to sympathise with scientific aspirations, he hoped that the line of action agreed upon would be productive of the results which they all desired.

He expressed the thanks of the British meteorologists to those who had come from so great a distance to take part in the deliberations.

At the invitation of the President, the Committee then passed an unanimous vote of thanks to Dr. Simpson for making arrangements for accommodation for the meetings; to Sir Napier Shaw's personal assistant, Miss E. E. Austin; and to the clerical staff of the Meteorological Office for the speed and efficiency with which they had carried out the clerical work in connection with the meetings.

The Committee closed at 11.20 p.m.

(Signed) NAPIER SHAW.

## APPENDICES.

### APPENDIX I.

#### POLAR COMMISSION.

##### Report of Informal Meeting at Bergen.

An informal meeting was held at Bergen on Thursday, July 28th, during the session of the Commission for the investigation of the Upper Air. There were present, Sir Napier Shaw, President, Directors Hesselberg and Wallén and M. de Quervain, also Olaf Devik (Chief of Forecast Service, Tromsø), B. Helland-Hansen, Director of the Geophysical Institute, Bergen, Martin Knudsen, who were invited to become members of the Commission.

The President reported that the Commission was appointed originally at Rome in 1913 to promote the investigation of the upper air of the Arctic regions, and was re-appointed at the Conference in Paris in 1919 in order to promote a general geophysical investigation of the North Polar regions in connection with the expedition of Roald Amundsen, 1919-23. A proposal by Professor Bjerknes to make a systematic investigation of the Polar front by the establishment of a number of stations surrounding the North Pole, which would provide material for a daily map, is closely associated with the business of the Commission, and also with that of the Commission du Réseau Mondial.

He also reported communications from Director Melander, who hoped to be present in Bergen, from Lieut. de Vaisseau Rouch, who was unable to be present, Captain Ryder, who was unable to attend and expressed a preference for a meeting in London at the beginning of September, and from Sir Frederic Stupart, who was unable to come to Europe this year.

From the communications which he had received he reported the following arrangements, in connection with the general geophysical investigation of the circum-polar regions:—

(1) *Canada* is providing for stations in the neighbourhood of Hudson's Strait, and will carry out this year the inspection of stations in the North-West.

(2) *Denmark*.—The project of a station at Godthaab or Godhavn on the West Coast of Greenland was changed on account of its isolation in the absence of neighbouring stations into one for a station at Thorshavn, and that had been temporarily suspended owing to the changes in Amundsen's plans.

(3) *Finland* has secured the continuation of the registering and observing of terrestrial magnetism at Sodankyla. Attempts are to be made at photographing the "Northern Lights" with Norwegian apparatus. Soundings with Pilot Balloons on international days are provided for at four stations, and observations at meteorological stations at 7 a.m. G.M.T., and at the same time as the aerological observations.

(4) *Great Britain*.—A geophysical observatory has been brought into operation at Lerwick, Shetland, and provision for observations by wireless from ships in the Atlantic is being developed.

(5) *Norway*.—The government has established observatories at Quade Hook in Spitsbergen and Baeren Island, both of which are planned as permanent stations. A hunting expedition proceeding to Jan Mayen for the winter of 1920 has been equipped with meteorological instruments, and will make observations there. Wireless messages have been received from Norwegian ships since the summer of 1919.



(6) *Sweden*.—The Government has arranged for developing the Arctic station Abisko in Northern Sweden, which will be equipped sufficiently to make the proposed Aerological, Magnetic and Auroral observations. The funds granted for the purpose amount to 38,000 Swedish crowns.

With regard to the preparation of a daily map of the circum-polar regions, which would naturally extend to the whole northern hemisphere and form a continuation of the series of maps published in 1914 by the Weather Bureau of the United States, Sir Frederic Stupart has explained a proposal for co-operation with the United States, in which he raises again the question of code, because a figure code is not suited to the conditions of the American telegraphic service. Professor Marvin has written: "I hope it may be possible at some future date to consider more seriously than now what measures can be taken to accomplish the objects so clearly represented in Professor Bjerknes' proposals."

#### Co-operation in connection with Amundsen's Expedition.

It was reported that a subvention of 500,000 crown had been granted by the Norwegian Government for the furthering of Amundsen's expedition, and that Amundsen would leave Nome in 1922, so that co-operation was still necessary, and the assistance which was originally designed for 1920 would be required for 1922.

Professor Helland Hansen reported that an expedition under the leadership of Civil-Engineer Hagbard Ekerold left Bergen on 26th July for Jan Mayen, where three or four men will spend the winter, 1921-22, in order to make meteorological observations (temperature, pressure, wind, clouds, humidity). A wireless station will be equipped in the island and will despatch the observations made at 1h., 7h., 13h. and 19h. G.M.T. The telegrams will be sent as nearly as possible at those hours.

*Iceland*.—Director Hesselberg reported that the Icelandic Government had promised a geophysical station at Reykjavik, equipped for soundings with pilot-balloons, magnetic registration and auroral photographs.

*Greenland*.—Mention was also made of an expedition under the leadership of Knud Rasmussen to the West Coast of Greenland, with the intention of wintering north of Hudson's Bay. It was suggested that Captain Ryder would be able to report upon the prospects of its co-operation in meteorological inquiry.

Resolution I. (see p. 17).

#### Daily Maps of the Northern Hemisphere.

Resolution 2.—After consideration of the reports on the present position of the question of the provision of daily observations from a series of circum-polar stations, Resolution 2 (see p. 17) was approved.

#### Hours of Observation at Stations in High Latitudes.

Dr. Devik asked whether there was any international agreement respecting the hours of observation at Arctic Stations. He pointed out that the use of local time in high latitudes would give material of a very un-homogeneous character, but on the other hand strictly simultaneous observations would involve considerable practical difficulties for the observers.

Director Hesselberg reported that the question had already been settled at the meeting of the Commission held at Copenhagen in 1914. The report had been published at Petrograd during the war, but had not yet been distributed. A copy was, however, probably in the possession of the Danish Institute.

Resolution 3.—It was agreed to refer the question to the International Committee, and to ask Captain Ryder, if possible, to bring a copy of the report of the meeting at Copenhagen to the meeting of the Committee in London. (See p. 18.)

Two questions raised by letters to the President from Lieut. de Vaisseau Rouch, dated 9th July 1921, were considered:—

#### Publication of the Meteorological Results of Polar Expeditions.

"Afin de faciliter les comparaisons ultérieures chaque Expédition Polaire publie un minimum de documents autant que possible, sous une forme identique et avec les mêmes unités. Ce minimum, comprendra non seulement les observations détaillées d'heure en heure ou de 2h. en 2h. ou 4h. en 4h, mais aussi certaines statistiques (variations diurnes moyennes diverses, variabilité d'un jour à l'autre, etc.). Ce minimum devrait être fixé par la Commission de la Météorologie Polaire."

Resolution 4.—It was in this case also agreed to refer to the report of proceedings of the Conference at Copenhagen of 1914 and to bring the matter to the notice of the Meteorological Committee in September.

#### Polar Observer's Handbook or Manual of Instructions for Meteorological Observers on Polar Expeditions.

"Il serait très utile de leur indiquer (aux météorologistes des expéditions polaires) sous une forme très succincte les instruments qui ont jusqu'ici donné de bons résultats dans les climats polaires et la manière de s'en servir . . . . Il me semble que la Commission pourrait édicter un certain nombre de conseils (sous forme de guide pour les observateurs) qui seraient les bienvenus."

Resolution 5.—It was agreed that Dr. Simpson be requested to take up the question of a suitable manual of instructions for meteorological observers of polar expeditions which would meet the requirements indicated by Lieut. Rouch.

#### Meeting on Tuesday, September 6, 1921. Forenoon.

Members present: Sir Napier Shaw (President), Professor Th. Hesselberg, Professor A. de Quervain, Captain C. Ryder, Dr. A. Wallén.

There were also present by invitation: Dr. S. Fujiwhara, Mr. R. G. K. Lempfert, Colonel Matteuzzi, Dr. T. Okada, Dr. G. C. Simpson, Mr. C. E. P. Brooks.

The Commission met in the Council Room of the Air Ministry, Kingsway, W.C.2., on Tuesday, 6th September, 1921, at 11.50 a.m. following the meeting of the Commission du Réseau Mondial.

The President presented the report of the informal meeting held in Bergen in July 1921, which was approved by the Commission. He then invited Captain Ryder to give an account of the plans of the expedition to Greenland referred to in the report (p. 56). Captain Ryder's report is incorporated in the Minutes of the Committee, p. 17.

Captain Ryder also remarked that the expedition would probably keep a regular meteorological journal, but that, on account of the many expeditions, there was little possibility of obtaining a long series of observations at a definite place at fixed hours. He added that there would probably be no difficulty about the publication of the observations if they were likely to be of value.

#### Hours of Observation at Stations in High Latitudes.

With reference to Resolution 3, printed in the report of the Commission, Captain Ryder stated that a preliminary report and subsequently the procès-verbaux of the meeting in Copenhagen in 1914 had been printed by General Rykatcheff in St. Petersburg, but that he was uncertain how widely the copies had been distributed.

The following extract from the Procès-verbaux was read:—

"Resolution 10.—The stations shall take their meteorological observations three times daily at the usual hours, local time. Further, the values for pressure and temperature at 7 a.m. G.M.T.



are to be taken from registering instruments and published with the three direct observations.

"As far as possible all the hourly values registered for pressure and temperature are also to be published.

"On the international term days of every month direct observations of all meteorological elements are to be taken at 7 a.m. G.M.T."

The Commission agreed to ascertain whether copies of the procès-verbaux had been distributed and resolved:—

"That if copies of the 'Procès-verbaux des Séances de la Commission Internationale Polaire d'Aérostation Scientifique, Réunion de Copenhague, 1914,' are not available, it is desirable that certain extracts should be reprinted.

Dr. Hesselberg was invited to make the selection of the extracts.

#### Polar Observer's Handbook.

With regard to Resolution 5, Dr. Simpson was asked to make suggestions for obtaining a manual of instructions for meteorological observers of polar expeditions.

Dr. Simpson pointed out that the greater part of polar work consisted in devising new methods of observation, and stated that in his opinion it would be more desirable to have simply a record of the methods employed by previous explorers than a definite handbook of instructions.

Captain Ryder suggested that a book setting out the difficulties of principle involved would be of value.

#### Proposed Unification of the Commission du Réseau Mondial and the Commission de la Météorologie Polaire.

The Commission agreed to the President's proposal to submit a recommendation to the International Meteorological Committee:—

"That the Commissions du Réseau Mondial and de la Météorologie Polaire should unite to form one Commission."

#### Aerological Work in the Faeroe Islands.

Dr. Hesselberg reported that he had recently received a letter stating that the aerological station in the Faeroe Islands had been given up and asked Captain Ryder if there were any possibility of its being re-established.

The following resolution, proposed by Dr. Hesselberg, was approved:—

"That it is desirable that a permanent aerological station should be established in the Faeroe Islands."

The meeting adjourned at 12.30 p.m.

(Signed) NAPIER SHAW.

## APPENDIX II.

### COMMISSION FOR THE INVESTIGATION OF THE UPPER AIR.

REPORT BY THE PRESIDENT, PROF. V. BJERKNES, TO THE INTERNATIONAL METEOROLOGICAL COMMITTEE.

I have the honour to present to the Committee the printed report of the Proceedings of the meeting held at Bergen, on July 25th to 29th of this year, by the International Commission for the investigation of the upper air.\*

\* Report circulated to Institutes in August 1921 (I.M.C. 4).

As it will be seen, the practical result of the meeting has taken the form of 24 resolutions. I have to draw the attention of the Committee to the most important among them.

The duty of our Commission in the present situation is obvious.

Before the war the investigation of the upper air was placed upon an international basis and contributed thereby much to the general development of meteorology and to the knowledge wanted for the increasing human activity in the air.

The war has destroyed this international organisation, but has at the same time shown its importance more strongly than ever. Therefore the Commission must do what it can for restoring the international basis of these investigations.

The practical steps which, according to the opinion of the Commission, must be taken for this work of restoration, are given by Resolutions I. (p. 22), X. (p. 25), and XVIII. (p. 25).

The estimate which the President is authorised by these resolutions to present has been based upon information which will be found in the printed Report, p. 39-40, where the particulars of the international contributions and the performance of the work before the war are set out.

The cost of the printing of the International Meteorological Publication was met by contributions from 18 countries, ranging from about 500 to 1,250 francs, and giving the total sum of 15,626 francs. As the cost of printing is much greater than before the war, and as certain extensions have been foreseen, we have arrived at an estimate of 50,000 gold francs for the printing.

Before the war the work of compiling and preparing the observations for publication was performed, along with other more extensive labours, at an Institute whose Director was the President of the Commission; and for performing this additional international work, this Institute received from its own Government an extra contribution amounting to 8,000 francs.

It is thought that the aforesaid Institute gave freely the services of its Director and staff, so that the true value of the work put in was much in excess of this sum.

No existing Institute has expressed the wish to take the responsibility of the work on these terms. It is therefore estimated that a sum of 50,000 gold francs a year would be necessary to defray the expenses. Of this sum, 33,000 francs would be used for the acting-Superintendent of the work, and his scientific assistants, while 17,000 francs would be for clerical assistance, the latter sum roughly corresponding to the already-mentioned 8,000 francs before the war.

(Signed) V. BJERKNES.

## APPENDIX III.

### COMMISSION DU RÉSEAU MONDIAL.

#### 1st Meeting, Monday, September 5th, 1921. Forenoon.

The Commission assembled at 11 a.m. in the Air Council Room, Air Ministry, Kingsway, W.C.2.

Members present:—Sir Napier Shaw, President; Prof. E. van Everdingen (Holland), Mr. R. G. K. Lempfert (Great Britain), Capt. C. Ryder (Denmark), Dr. A. Wallén (Sweden).

There were also present by invitation:—Dr. T. Okada and Dr. S. Fujiwhara (Japan), Prof. Bjerknes (Norway), Dr. G. C. Simpson, Mr. C. E. P. Brooks and Mr. Corless (of the Meteorological Office, London).



The President welcomed the delegates and reported that he had received letters from the following members: Prof. Palazzo (Italy), Mr. H. A. Hunt (Australia), Prof. Marvin (United States), Mr. Knox Shaw (Egypt), Mr. Stewart (South Africa), Sir Frederic Stupart (Canada), and Dr. G. T. Walker (India), who were unable to be present; and from Prof. Nakamura explaining that he had asked Prof. T. Okada, Director-designate of the Meteorological Service of Japan, to attend in his place.

The President then called to mind the conspicuous services which Prof. H. H. Hildebrandsson had rendered to the important science of the meteorology of the globe, and the Commission agreed to send a telegram of salutation to Prof. Hildebrandsson expressing their good wishes for his continued life and activity.

**1. Election of additional Members.**—Dr. van Bemmelen (Batavia), Dr. Fujiwhara (Japan), Director Hesselberg (Norway), Dr. T. Okada (Japan), were nominated as additional members of the Commission and unanimously elected.

#### PUBLICATION OF THE RÉSEAU MONDIAL

**2. Monthly Reports for the Globe.**—The President gave a short account of the work of the Commission since its appointment in Paris in 1907 to consider the proposal of M. Teisserenc de Bort for the construction of daily maps of the Globe. He reported that the Commission had met in Monaco, with Prof. Hildebrandsson as Secretary, and that its activities had then been extended to include the collection and publication of reports from meteorological centres of action to give a conspectus of the mean monthly values for the world.

He explained that the duty of carrying out the proposal had devolved on the Meteorological Office, London, because that Office had inherited the responsibilities of the Solar Physics Observatory, and said that his first duty was to ask the attention of the Commission to the publication of the Réseau Mondial for the four years 1910–13 and to enquire whether the publication satisfied the desire of meteorologists for a conspectus of the meteorology of the Globe.

The President then drew attention to the details of the publication, the selection of stations and the form of data published, and pointed out that it included daily observations of wind in the tropics and also data as to the state of ice in the Arctic Seas, which for many years had been a subject of enquiry by the Danish Meteorological Office.

Capt. Ryder explained the increasing difficulty of obtaining ice-observations owing to the absence of whalers, and expressed the wish that the various countries would co-operate in obtaining any additional observations that were possible.

The President reported that a collection of normals used for the Réseau Mondial was available, but had not been published. He also drew attention to the units employed, viz.: the millibar as the unit of pressure, the degree absolute on the centigrade scale as the unit of temperature, the millimetre as the unit of rainfall.

(i) *Dr. Walker—Note respecting Stations in India.*—An extract from a letter from Dr. G. T. Walker, suggesting some alterations and additions to the *réseau* of stations in India, was read. The President reported that the suggestions would be incorporated in the new issues.

(ii) *Selection of Stations.*—Dr. Simpson asked for information as to the original selection of the stations, and suggested closer co-operation with the Directors of the local services.

A resolution proposed by Dr Simpson and seconded by Prof. E. van Everdingen, was carried:—

Resolution I. (see p. 28).

(iii) *Additional Observations.*—Prof. van Everdingen reported that the daily values of wind could be given for Paramaribo and Curaçao; he drew attention to the proposal at the meeting in Paris, 1919\* :—

“that Meteorological Institutes and Hydrographic Departments be invited to supply to the Director of the British Meteorological Office monthly means for 5° squares of the oceans, giving pressure (corrected for temperature and height above sea level), temperature of the air and temperature of the sea surface from 1914,”

and asked whether any such values had been received.

It was agreed that the question should be considered at a later meeting.†

Prof. Okada suggested that observations from the Bonin Island and from the Kurile Islands, which were available, should be included in the Report, both stations being telegraphic stations.

The Commission passed the following resolution :—

Resolution II., see p. 28.

(iv) *Prof. Eredia's proposal to call attention to the Météorologie de l'Afrique “état présent de nos connaissances, nécessité de multiplier les stations d'observation.”*—The President reported that he had received no details as to Prof. Eredia's proposal. It was therefore agreed—

III. “That the officer in charge of the publication of the Réseau Mondial be asked to communicate with Prof. Eredia as to his proposals.”

**3. Scale and Projection of Charts.**—A proposal by Prof. Bjerknes as to the scale and projection of meteorological charts was submitted for the consideration of the Commission, and a comparison was made between the new charts and those already in use for the Réseau Mondial, which were constructed on three projections and which were convenient in that they were easily formed into a globe.

Prof. Bjerknes pointed out that his proposal only involved that, if an office were changing its chart, it should change to the new scale so as to make for uniformity; an extract from the resolutions of the Paris Conference was read.‡ The Chairman drew attention to the slight difference which existed between the British and German D.W.R., though the charts were on the same scale and projection.

The following resolution was passed :—

IV. “That if Prof. Bjerknes' proposals be approved by the International Meteorological Committee, the Commission for the Réseau Mondial recommends that the charts of the Réseau Mondial should be on conformal projection.”

The Commission adjourned at 1 p.m.

(Signed) NAPIER SHAW.

5th September 1921.

#### Second Meeting, Monday, September 5th, 1921. Afternoon.

*Present.*—Sir Napier Shaw (President), Professor E. van Everdingen, Dr. S. Fujiwhara, Mr. R. G. K. Lempfert, Dr. T. Okada, Captain C. Ryder, Dr. A. Wallén, Professor Bjerknes, Lt.-Col. Matteuzzi, Dr. G. C. Simpson, Mr. F. J. W. Whipple, Mr. C. E. P. Brooks.

\* Report of Proceedings of Fourth International Conference, Paris, 1919, p. 45.

† See p. 64.

‡ Appendix I. of the Report of the Conference in Paris, 1919.



The Commission assembled at 3 p.m.

The Minutes of the first meeting were read and confirmed.

1. **Monthly Meteorological Bulletin.**—The following proposal by Dr. Okada, on behalf of Dr. Nakamura, was read :—

“All the Central Meteorological Bureaux or Observatories should publish and distribute every month the means of the meteorological elements of the preceding month at the selected stations of their réseau.

“This is to make easier and quicker the collection of the climatic data of foreign countries, which are necessary for business and industry, and to make accessible to specialists in the field of the world-meteorology the data indispensable for their investigations of seasonal forecasts and other things.

“The climatic elements to be published in the Monthly Bulletin should include at least the mean barometric reading (reduced to the freezing point and to sea-level and corrected for gravity), mean air-temperature, total amount of precipitation, the mean direction of wind or direction of prevailing winds.

“In collecting the required data, postal reports will be sufficient for the purpose of most of the stations, but for some stations having difficulty of communication it is necessary to get the reports by wire or cable.

“A rough estimate of the total annual expenditure for communication and for printing of the Monthly Bulletin will be some ten pounds, one thousand sheets of it being supposed to be printed.

“It is contemplated that each Central Bureau will have a provisional Bulletin ready for publication within (five) days of the close of the month, and that the various countries interested would make their own arrangements as to the transmission of the information.”

Professor Okada explained that the Monthly Bulletin was intended, not to supersede, but to be complementary to the publication of the Réseau Mondial—the units employed would be different for different nationalities.

In reply to inquiry by Sir Napier Shaw, he explained that the number of stations required from Great Britain would be from 10 to 15, chosen from among the principal cities in the industrial centres; the distribution of stations in the various countries would depend upon the population.

Instances were given by several members of the influence of weather on industry.

Sir Napier Shaw said that the expense of the telegraphic reports would rest with the country that received the reports. He then made inquiry to ascertain how many countries already made a practice of supplying the information which Professor Nakamura wished should be made public within a few days, and the following information was forthcoming :—

*Denmark* publishes one month after date a Monthly Weather Report based on climatological reports, chiefly for agricultural purposes. In summer data of precipitation are also published weekly.

*Great Britain* publishes on the first day of each month a supplement to the Daily Weather Report, containing a summary of the climatic conditions of the previous month based on the data from telegraphic stations. It publishes also a Weekly Weather Report within a week, and a Monthly Weather Report within a month, containing data for climatological stations.

*Holland* published in the press a small bulletin on the 1st of each month, but as this was thought to be insufficient for climatological purposes, it was replaced by a bulletin of which part 1,

containing rainfall data and data for De Bilt only, is published in the press on the 1st of the month; part 2 is published after 20 days, though earlier publication of some of the data might be arranged.

*India* publishes within seven days a short review of the weather of the previous month, giving data based on the telegraphic stations.

*Italy* publishes after 10 days the bulletin of the previous 10 days.

*Sweden* publishes on about the 20th of each month a report containing data for about 45 stations for climatological work.

Dr. Simpson explained that, for the forecasts of the monsoon, arrangements had been made with the various countries for data of the meteorological elements up to the end of May to be supplied, so that a forecast based on correlation coefficients could be issued by 15th June.

Mr. Brooks stated that the monthly data for the Northern Hemisphere were usually available after a period of about three months.

The question as to whether the present form of the Réseau Mondial should be superseded by the Monthly Bulletin was discussed. Professor van Everdingen expressed the opinion that data published within so short a time would be too incomplete to be of much value, and that the publication of a separate *resumé* would involve great expenditure.

Dr. Wallén suggested that something might be done to accelerate the publication of the Monthly Bulletins already issued by the several services, and said that if Professor Nakamura's proposal were adopted, it could best be effected by telegraphic distribution through a Central Information Bureau.

Professor Bjerknes suggested that the problem would be solved if wireless messages from the several countries were sent from sufficiently powerful stations so that they could be picked up by the other countries.

Dr. Simpson stated that if only a few countries required the data within so short a time, it would be possible to prepare mean values for a limited number of stations and forward them in manuscript.

Sir Napier Shaw suggested that the climatic information might be published week by week, or month by month, in a specially selected foreign trade journal, and the information would then be transmitted by telegraph to the different countries of the Globe if the agents of the several countries deemed it desirable.

The Commission agreed that the decision as to the publication of the Monthly Bulletin would not affect the publication of the Réseau Mondial, and decided to summarise the proposals and submit a resolution to the International Meteorological Committee for their consideration (p. 64).

2. **Monthly Maps of average Cloud Amount, and Pressure in the Upper Air.**—The President submitted a series of thirteen maps prepared in the London Meteorological Office showing the average cloudiness for each month of the year and for the year on the scale 0 to 10. He also submitted two maps showing the pressure of the layer from 0 to 8 km., and the pressure at 8 km., and remarked on the similarity of the run of the lines in the two maps though the gradient of the second map was reversed.

3. **Daily Reports : Professor Bjerknes' proposal for a circumpolar series of Stations.**—A proposal by Professor Bjerknes for constructing daily maps of the Globe, especially of the Northern Hemisphere, in order to facilitate the drawing of the polar front, was submitted.

It was reported that daily maps, extending over the whole of the circumpolar region of the Northern Hemisphere with the exception of Russia, were now being constructed by the Canadian Office, and that steps were also being taken to extend the observations obtained by W/T from ships in the Atlantic.

Professor Okada reported that a wireless receiving and transmitting station was in course of construction at Kobe with a view to obtaining data from ships in the Pacific, and also for transmitting meteorological data to the ships.



Captain Ryder reported that efforts were being made to establish a wireless station in the South of Greenland.

The President expressed the wish that co-operation in the Southern Hemisphere might lead to the construction of similar circumpolar charts for that area, and it was remarked that a wireless station was already in existence at Macquarie Is.

Letters were read from Professor C. F. Marvin and Sir Frederic Stupart.

The suggestion of the extension of the daily charts of the North Atlantic prepared by the Danish Institute, to include the whole circumpolar region was commended to Capt. Ryder for his consideration. The meeting adjourned at 5 p.m.

(Signed) NAPIER SHAW.

6th September 1921.

### Third Meeting, Tuesday, September 6th, 1921.

*Present*—Sir Napier Shaw (President), Professor E. van Everdingen, Dr. S. Fujiwhara, Mr. R. G. K. Lempfert, Dr. T. Okada, Captain C. Ryder, Director Hesselberg, Dr. A. Wallén, Professor V. Bjerknes, Colonel Matteuzzi, Professor A. de Quervain, Dr. G. C. Simpson, Mr. C. E. P. Brooks.

The minutes of the second meeting, previously circulated, were read and confirmed.

The President reported the receipt of a telegram from Professor H. H. Hildebrandsson thanking the Commission for their good wishes.

1. **Monthly Meteorological Bulletin.**—The Commission proceeded to the further consideration of Professor Nakamura's proposal for a Monthly Meteorological Bulletin, and a report, submitted by the President, was approved for transmission to the International Meteorological Committee.

2. **Monthly Means for 5° Squares of the Oceans.**—The Commission reconsidered the suggestion made at the Paris Conference as to the collection of monthly means for 5° squares of the Oceans (*see* Minutes of the 1st Meeting, p. 61), and Resolution VI. was passed (*see* p. 31).

The following draft letter, submitted by the President, was approved for despatch to the Directors of Institutes which collect observations from the Oceans (*see* p. 31):—

SIR,

At the Conference in Paris, 1919, in considering the collection of data for the Globe, it was noted that the publication Réseau Mondial included information only from land stations, and therefore left vast regions covered by ocean unrepresented. It was therefore agreed to invite contributions of data of mean values for the month from those Institutes which make a practice of collecting observations from the sea.

At a meeting of the International Meteorological Committee, held in London on 12th–17th September 1921, attention was called to the resolution of the Paris Conference, and it was desired that, on behalf of the Committee, I should ask for the co-operation of the Directors of Institutes concerned with Marine Meteorology in this enterprise.

It is understood that satisfactory information can only be obtained for a limited number of squares which are traversed by frequented trade routes, but the Committee are impressed with the possible value of the incorporation of that information with what is already collected from land stations.

The Committee will be greatly obliged if you are able to promote the realisation of this request.

I have the honour to be,  
etc.

3. **Charts of Monthly Values for April, May, June, 1921.**—A set of three charts prepared in the Meteorological Office in the middle of August, from data available for April, May and June, in connection with an investigation on the drought of the summer of 1921, were exhibited.

4. **Professor Eredia's Proposal on the Météorologie de l'Afrique.**—The attention of the Committee was drawn to a paper by Mons. C. Negro, containing a list of stations in Tripoli and Cyrenaica which were in action in 1913. Colonel Matteuzzi reported that only a very small number of stations were in operation at the present time. It was agreed to notify to the Committee the importance of the collection of information from Africa.

The Committee adjourned at 11.50 a.m.

(Signed) NAPIER SHAW

### APPENDIX IV.

#### INTERNATIONAL COMMISSION FOR MARITIME METEOROLOGY.

##### Preliminary Meeting, September 6th, 1921.

The meetings were held in the Council Room of the Air Ministry.

*Present*:—Professor E. van Everdingen (President), Professor V. Bjerknes, Dr. Petterson, Captain Ryder, Commander Brooke-Smith, R.N.R., Dr. Fujiwhara, Dr. Hesselberg, Professor Okada, Dr. Simpson, Dr. Wallén, Commander Garbett, R.N. (acting Secretary).

The President, in opening, said he had arranged the present informal meeting to discuss some preliminary points in order to save time at the official meeting to be held at 3 p.m. on the following day, 7th September. He thanked those gentlemen who were not yet members of the Commission for consenting to be present at this meeting.

He then said he had several papers before him dealing with "Weather Reports from Ships at Sea," namely (1) a letter from Mr. Claxton, Hong Kong, enclosing a circular from the Marconi Company; (2) a Memorandum from Prof. Bjerknes; (3) a Memorandum from Dr. Simpson, and (4) a Memorandum from Sir Napier Shaw.

It was left to him to decide whether the latter should be brought forward at the meeting or not; he considered it should be read if the Committee failed to agree on a universal code.

He proceeded to give a brief historical review of the four proposed Weather Codes, namely: the Paris Code (1919), London Code (1920), and those proposed by Dr. Hesselberg and Professor Marini.

He said the principal difference was the introduction of check figures, which necessitated more groups and emphasised the desirability of keeping as much resemblance in international messages for various purposes as possible.

He said that Dr. Simpson's Memorandum explained what had been done during the experiments which had been carried out by Great Britain. He then asked those present to express their views.

2. Dr. Simpson said that his ideal of a Meteorological Code was one which could be used throughout the whole world, common to all nations. He was prepared to make great sacrifices to obtain a universal code; if this was not possible it might be necessary to form our own codes and let time prove which is the best.

He said reports from ships were now being arranged in all parts of the world. Up to the present, Japan had not been consulted, but she had more ships reporting than Europe. India and Australia were arranging reports, and Mauritius was ready to do the same thing and only waiting for an international code.



3. The President then read a letter from Mr. Claxton regretting that it was unlikely that the Hong Kong Weather Bureau would come into line with an international code, mainly owing to expense; he attached a copy of the code at present in use.

The President, continuing, said he thought it should be possible to get some groups in common, as the needs were the same throughout the world; he advised the meeting to concentrate on that for the present.

4. Prof. Bjerknes did not think we had as yet sufficient knowledge to construct a code common to all. Norway had already had two years' experience, and could hardly be expected to take a step backward. He considered it dangerous to try and construct a universal code without more experience.

5. Captain Ryder said he had had no experience with the code, as the Danish ships did not send weather messages; he did not agree with Professor Bjerknes that the difference of temperature of air and sea could be taken accurately enough to be very essential for forecasts.

He thought barometer, direction and force of wind, and temperature in full degrees were the first things to consider in the construction of a new code.

6. Professor Okada said that Japanese ships running between Yokohama and London had made experiments in testing accuracy of temperatures and found errors amounting to a full degree centigrade. The code used by them was made up as follows:—

Date, 2 figures. Latitude, 2 figures. Longitude, 2 figures.  
Barometer, 4 figures. Wind direction, 2 figures. Wind force,  
2 figures. Weather, 1 figure. State of swell, 1 figure. (16 figures.)

7. Commander Brooke-Smith said that he had compared the logs of several British ships meeting at sea and a difference of three or four degrees Fahrenheit was sometimes observed in the values of the temperature.

He urged the need for simplicity in the construction of a code for seamen.

8. Dr. Wallén considered that there should be as little difference as possible between the land and sea codes and the most important groups should come first—he knew their forecasters would like to have the temperatures in three figures. He could not realise that the difficulty of obtaining accurate temperatures on board ship was so great.

9. Dr. Hesselberg did not think it possible to get one code to suit all, but advocated agreeing on four or five groups and permitting a certain liberty for other groups. Each country would then gain more experience and in a few years time a uniform code could be made. He was not in favour of check figures.

10. The President said that Holland had had 50 years' experience of observing. Humidity observations with wet bulb had been stopped on board ship as they were not considered accurate enough. Trained observers should be able to observe with a thermometer to 1/10th of a degree and the humidity with a psychrometer accurately, but the average observer does not possess that training.

He was in favour of promoting accuracy of readings on board ship and referred to Pamphlet No. 102 of the K. Ned. Met. Inst., No. 25, where the accuracy of barometer readings on board moving ships is tested.

11. Dr. Simpson stated that steps had been taken to teach officers to draw synoptic charts which meant interchange of messages; a short paper on this subject has been published for seamen,\* the messages are at present made "en clair" but he hoped soon to have a suitable code in use.

\* M.O. 246.

He urged the necessity of coming to an agreement on four or five groups and making them universal, and then further information could be given at the end of the code if desired.

It had been suggested that the first four groups be taken and additional groups added for check figures. He feared by putting the check figures as additional groups would lead to these figures being considered optional which he could not agree to. He realised the additional expense in having the check groups which formed 50 per cent. of the message, but thought it was worth it.

12. The President said he would like to see check figures optional, as it would diminish cost and probably be the means of getting more observations.

After some further discussion it was unanimously agreed to leave the question of check figure groups until the next meeting.

The President asked the Committee to decide on the elements in the first four groups which would be agreeable to all and the following were agreed upon:—

2 groups for position and time and 2 groups for the elements,  
as follows:—

BDDDF

wwVKd

He then read the conclusion of Sir Napier Shaw's Memorandum, "Weather Reports from Ships at Sea."

13. Dr. Wallén distributed his pamphlet on "Control of Storm Warnings," and explained the tables and diagrams.

The President congratulated Dr. Wallén on his work, but regretted it was too late to discuss it at the present meeting; he asked if other countries were carrying out methods of control of storm warnings, and in reply Dr. Hesselberg, Captain Ryder, and Professor Okada said that such investigations had been made in their countries several years ago, but not in recent years.

Dr. Simpson said that reports were received by the London Meteorological Office from lighthouses round Great Britain and a percentage taken of failures and successes during the year; he was interested in similar methods for weather forecasts.

The President said that Storm Warning Signals in Holland were being criticised by using observations from lighthouses and readings of anemometers, and referred to Pamphlet No. 102 of K. Ned. Met. Inst., No. 14, where exact methods of criticising ordinary forecasts were described.

The Meeting adjourned at 5 p.m.

### First Meeting, September 7th, 1921. Afternoon.

Present: Professor E. van Everdingen, Professor V. Bjerknes (for latter part of meeting only), Commander Brooke-Smith, R.N.R., M. Gallé, Commander Garbett, R.N., Dr. Hesselberg, Capitaine Frégate Ladonne, Professor Okada, Dr. Petterson, Captain Ryder, Dr. Simpson, Mr. Sekigouchi, Dr. Wallén.

The President in opening the meeting regretted that the following members had notified him that they would be unable to attend: Captain Rouch, Mr. Hunt, Professor Marini, Sir Frederic Stupart and Dr. van de Stok\*.

He had invited to be present this afternoon: Commander Brooke-Smith R.N.R., Colonel Chaves, Dr. Fujiwhara, Commander Garbett, R.N., and Dr. Wallén. Colonel Chaves and Dr. Fujiwhara were not present but

\* Letters were received later from Lieut.-Col. D. C. Bates and Signor Marini expressing regret at being unable to be present.



hoped to attend to-morrow, September 8. He proposed to elect as members all these gentlemen, and to re-elect Mr. Claxton, Father Froc, Dr. Marvin (to replace Mr. Willis Moore), and Dr. Okada.

Commander Garbett was elected as Secretary.

2. The minutes of the informal meeting were read and amended.

3. It was decided that if possible there should be a universal message containing the essential information required from ships. It would then be open to the various weather services to arrange for ships to add national groups to the universal message. The consideration of the groups in the universal message was then taken up, the first and second groups being first considered. It was agreed without discussion:

**I. "that the last three letters of the first group should be LLL and the second group III GG."**

4. After a short discussion it was agreed that the second letter should be Q, the code for Q being changed into the following:—

Code No.	Latitude.	Longitude.	
1	N	W	} Barometer in millibars.
2	N	E	
3	S	W	
4	S	E	
5	N	W	} Barometer in millimetres.
6	N	E	
7	S	W	
8	S	E	

For the first letter P three solutions were proposed:

- (a) To indicate the character of the Code.
- (b) " " " day of the week.
- (c) " " " course of the ship.

The first was dismissed because it was thought if a universal code was agreed upon no indication of supplementary groups was necessary; discussion took place on the possibilities of the other two, and it was decided by a vote of 4 to 3 that the first figure should indicate the day of the week.\*

Hence the form of the first two groups will be PQLLL III GG.

5. The next point raised was the form of the next two groups, and the following was proposed: BBVDD, FwwKd and BBDDF wwVKd.

The latter form was adopted on a vote of 6 to 1.

The question arose as to whether it was necessary to fix the form of any additional groups; it was agreed that these should be left free.

6. After a lengthy discussion it was decided **II. that for a universal code a four-group code without check figures should be recommended to the International Committee together with a six-group code including the check figures, as adopted in London in 1920.** It was to be understood that any message of four groups should be without check figures, and any message of six groups should include check figures in the groups. On this understanding also the number of additional groups might be left free.

7. Dr. Simpson proposed that the International Meteorological Committee should be asked to circulate the four, and six-group codes to the various Directors arranging for weather reports from ships at sea, and get their opinion on the desirability of check figures. He said that if the general opinion of the other Directors was in favour of the four-group code he would do the same, and do away with checks altogether in the universal message.

\* 1 = Sunday, 2 = Monday, 3 = Tuesday, 4 = Wednesday, 5 = Thursday, 6 = Friday, 7 = Saturday. The day refers to G.M.T. and not to local time, i.e., Sunday means the period from 0 h. to 24 h. on Sunday at Greenwich.

The President asked for the views of the members on the desirability of check figures, but no definite conclusions were reached.

9. The President brought forward the next item on the programme for discussion, namely, the co-operation with the Commission for the Réseau Mondial, and asked for opinions as to the best methods of carrying it out. Dr. Simpson pointed to the fact that various nations would have observations available for the same squares, and asked what course ought to be taken in such a case.

The President suggested that all nations should agree as to the squares in which a sufficient number of observations would be available, and for these squares all observations should be compiled before sending them to the Réseau Mondial.

Dr. Simpson suggested that each nation might be allotted a portion of the globe, and collect the data for that particular portion; he was ready to assist, but was not prepared to undertake to compile the data for all over the world.

10. A pamphlet on the Atlantic cruise by the Danish Research Vessel "Dana" was distributed and explained by the President, who asked the meeting to consider the possibilities of co-operating by sending observations for salinity, surface temperatures, and currents to the Hydrographic Bureau at Copenhagen.

The question of resuming the publication of monthly charts of salinity for the Atlantic Ocean was raised, but the discussion was left to the next meeting.

The Meeting adjourned at 5.35 p.m.

## Second Meeting, September 8th, 1921. Afternoon.

Present: Professor E. van Everdingen, Professor V. Bjerknes, Commander Brooke-Smith, R.N.R., M. Gallé, Dr. Hesselberg (for, commencement of meeting only), Capitaine de Frégate Ladonne, Professor Okada, Dr. Petterson, Captain Ryder, Dr. Wallén, Commander Garbett, R.N., Secretary; Dr. Simpson and Mr. Sekigouchi.

1. The Minutes of the first meeting were read and amended.

2. The President said that before proceeding with the Agenda for this meeting he would ask the members to decide by vote whether obligatory check figures should be included in a universal code or not; after a brief discussion the vote was taken and resulted as follows:—

For: Great Britain, Japan.

Against: France, Holland, Norway, Sweden.

The Danish representative did not vote.

3. Dr. Wallén's pamphlet on the "Method of Control of Storm Warnings" was next considered, and the following proposal was made by the President:—

**III. "With regard to the communication of Dr. Wallén on the Control of Storm Warnings, the Commission recommends the study of the proposed method in different countries."**

This was unanimously agreed to.

4. The President then said he had tried to arrange for a small sub-Committee consisting of Commander Brooke-Smith, Capitaine Ladonne, and M. Gallé to confer on the distribution of marine observations over the oceans but no meeting had taken place as yet; he suggested that the proposed discussion should be postponed until the next meeting. It was accordingly postponed.



5. The following proposal by Dr. Petterson was then read:—

The International Commission for Maritime Meteorology considers it to be highly desirable:

IV. (a) That oceanographic data (values of the temperature and the salinity of the sea-water at the surface and at different depths below it such as have for several years been collected by the International Council for the Study of the Sea) bearing on the surface area and the capacity of the warm masses of water off the N.W. coasts of Europe, especially in the autumn, should be collected by international co-operation.

IV. (b) That the material thus collected should be worked up for climatological purposes, especially with the object of obtaining the data required for studying the possibility of drawing up long-range forecasts for the winter temperatures over N.W. Europe.

The President asked Dr. Petterson to tell the Commission something about the work which had already been done in this direction.

6. Dr. Petterson gave a short résumé of the work done by oceanographers in order to collect data of value for climatological studies.

He said the "International Council for the Study of the Sea" was trying to arrange regular cruises off the N.W. coasts of Europe to be made in the late autumn for finding the capacity of the heat storage represented by the branches of the Gulf Stream. Reference was made to similar investigations made by Dr. H. Dickson and Professor O. Petterson in 1893-1894, and to the "Bulletin Hydrographique" for the Atlantic Ocean, which gives monthly values for sea temperatures for the years 1900-1913.

M. Gallé said he had had some experience in seeking a relation between the N.E. trade in the Atlantic and the winter temperatures in Europe. He stated that from material covering 17 winters it appears that in 14 winters the deviation from the normal winter temperature bore the same relation to the deviation for the normal force of the Trade Winds, stronger winds corresponding to higher temperatures.

He considered that observations of Trade winds would be of much value.

8. In reply to a query as to what concrete steps were to be taken Dr. Petterson said it would materially assist the oceanographers working on these problems if the interest taken by meteorologists in this kind of research was adequately expressed by the Commission, and hoped that co-operation between the two organisations would ultimately be established.

The President added that if Meteorological Institutes asked the observers on board ship to take water samples and arranged for these being sent to some Fishery Institute for titration, valuable help would be obtained.

Dr. Petterson's resolution was then passed unanimously.

9. The President asked the Commission to consider the advisability of making the form of the contents of the first two optional groups universal; he suggested a temperature group, and a cloud and weather group.

The meeting was of the opinion that there would be much difficulty in attaining this end at present, and after some discussion it was agreed to ask Colonel Gold and Dr. Hesselberg to try and come to some agreement on the matter.

The meeting adjourned at 6.15 p.m.

### Third Meeting, September 9th, 1921. Afternoon.

Present: Professor E. van Everdingen (President), Professor V. Bjerknes, Commander Brooke-Smith, R.N.R., Dr. Fujiwhara, M. Gallé, Capitaine de Frégate Ladonne, Dr. Petterson, Captain Ryder, Dr. Wallén, Commander Garbett, R.N. (Secretary), Mr. Sekigouchi.

1. A letter was read from Mr. Grant saying that in view of the change in his career he resigned the membership of the Commission.

2. The Minutes of the Preliminary Meeting were confirmed as amended and circulated to the members present.

3. The Minutes of the second meeting were read and confirmed and circulated to the members present.

4. The President asked if the sub-Committee (Commander Brooke-Smith, M. Gallé, and Captain Ladonne) had arrived at any agreement on the manner of distribution of marine observations over the ocean.

In reply M. Gallé said that they had agreed as follows:—

(1) That the squares selected for the requirements of the Dutch Meteorological Office were considered the most convenient for the purposes of the Réseau Mondial; they had been chosen originally because (a) they were not affected by the land and therefore true oceanographical observations could be obtained; (b) they were on the trade routes.

(2) That it was advisable to continue the manner of publication, each country calculating its own mean values and sending them with the number of observations to the Réseau Mondial and Holland.

5. The President asked whether these squares included any Island Stations appearing already in the Réseau Mondial, as he presumed they would prefer the Island Stations—there appeared, however, to be only a few such stations in existence. He suggested that the other plan should be somewhat extended, the centres of action near the Equator not being thought sufficient for the Réseau Mondial.

The Dutch Meteorological Office was prepared to receive and compile all the observations for the squares selected in 1912, and to resume the publication of the results in Pamphlet K. Ned. Met. Inst., No. 107, and he suggested that other countries should take the care of 5° squares in temperate latitudes.

After a lengthy discussion Resolution V. was unanimously passed. (See Minutes of Committee, Fourth Meeting, Section VI., p. 31.)

6. At the previous meeting it was decided to ask Colonel Gold and Dr. Hesselberg to come to some agreement with regard to making the form of the contents of the first two optional groups universal, and they had now agreed upon the following:—

For England	CNTTd.	WrttK'.
Continent	CNTTT	Wrttt

7. The President referred to Professor Marini's proposal about choosing definite equivalents for the numbers of the Beaufort Scale, but it was agreed that this was a matter which should be left to the Committee.

8. A short discussion took place on the "proposed Organisation of International Meteorology in the N. Atlantic," by Colonel Delcambre, and the resolution printed on p. 35 was unanimously passed.

The meeting was concluded at 4.55 p.m.

### Fourth Meeting on September 10th, 1921. 1.15 p.m.

Present: Professor E. van Everdingen (President), Professor V. Bjerknes, Director Gallé, Captain Ryder, Dr. Wallén.

The Minutes of the First Meeting were confirmed as amended, and those of the Third Meeting were read and amended. A vote of thanks was proposed to Commander Garbett who had been acting as secretary at the previous meetings.

The Meeting was concluded at 1.30 p.m.



## REPORT TO THE INTERNATIONAL METEOROLOGICAL COMMITTEE.

*Election of New Members and Resignations.*

After the conference at Paris was closed the Commission held a short meeting at Paris, where two new members were elected, Sir Frederic Stupart, Director of the Canadian Service, and Mr. C. Stewart, Chief Meteorologist of the South African Union. In the time between this meeting and that in London, September 6-10th, 1921, the Commission had to regret the loss by death of its member, General Azcarate, but was honoured by H.H. the Prince of Monaco accepting his nomination as honorary member by correspondence. Lieutenant Grant resigned his membership during this meeting.

The following were elected members at the first meeting: Commander Brooke-Smith, R.N.R. (Marine Superintendent, Meteorological Office, London); Mr. T. F. Claxton (Hong Kong); Colonel F. A. Chaves (Azores); Father L. Froc (Zi-Ka-Wei); Dr. S. Fujiwhara (Tokyo); Dr. C. F. Marvin (United States Weather Bureau); Professor T. Okada (Tokyo); Dr. A. Wallén (Stockholm).

Commander Garbett, Superintendent for Naval Services, Meteorological Office, London, was appointed Secretary.

*Meetings of the Commission.*

The Commission held an informal meeting on September 6th and four meetings on September 7th to 10th. Minutes of these meetings have been or are going to be distributed: the principal results obtained are as follows:—

1. **Code for Wireless Messages from Ships at Sea.**—The Commission considered the various codes adopted at Paris in 1919 and in London in 1920, and the proposals for modification by Dr. Hesselberg and Professor Marini.

Opinions appeared to differ very considerably as to the desirability of check figures being obligatory and as to the possibility of obtaining observations of air and sea temperature accurately to a tenth of a degree. The Commission therefore agreed to Resolutions I. and II. (see page 33).

Dr. Simpson wanted to ask the International Committee:—

(3) To circulate the four and six-group codes for universal use to the various Directors who arrange or who are going to arrange for weather reports from ships at sea and get the opinion as to the desirability of check figures.

2. **Co-operation with other Commissions.**—The Commission considered co-operation with:—

- (a) The Réseau Mondial Commission;
- (b) The International Council for the investigation of the sea;
- (c) The International Hydrographic Bureau.

As a result, two resolutions (IV.(a) and IV.(b)) were proposed (see page 34).

The President added that valuable help would be obtained if Meteorological Institutes asked the observers on board ship to take water samples and arrange for these being sent to some Fishing Institute for titration.

(5) The Commission approved Resolution V. (see page 31).

3. **Control of Storm Warnings.**—After discussion of Dr. Wallén's paper on the Method of Control of Storm Warnings, the Commission expressed the opinion set out in Resolution VI. (see page 35).

4. **Equivalents for the Numbers of the Beaufort Scale.**—Professor Marini's proposal about choosing definite equivalents for the numbers of the Beaufort Scale was referred to the Committee for consideration.

5. **Proposal to Establish a Mobile Station in North Atlantic.**—After reading Colonel Delcambre's memorandum on the proposed organisation of international meteorology in the N. Atlantic the Commission approved Resolution VII. (see page 35).

E. VAN EVERDINGEN,  
President.

## APPENDIX V.

## COMMISSION FOR THE APPLICATION OF METEOROLOGY TO AERIAL NAVIGATION.

Wednesday, September 7th, 1921. 3 p.m.

Present: Prof. V. Bjerknes, Dr. Cannegieter, Lieut.-Col. E. Gold, Commandant Jaumotte, Col. Matteuzzi.

1. In the unavoidable absence of the President, Commandant Jaumotte was elected chairman.

2. It was decided that there should be an international form for the presentation of the information contained in the hourly meteorological reports at the terminal aerodromes in each country.

3. The Commission proposed the following form (set out in Resolution 51, page 39), in which the information is arranged on the general principle that the most important elements come in the first columns.

In the optional part of the form may be included such information as the direction and speed of the lower cloud, the state of the sea and the visibility towards the sea.

4. It was agreed that the results of pilot balloon ascents should be added three times daily and should include (see Resolution 6, page 40) information as to the direction and speed of the wind at three different heights at least. The heights selected should be those considered to give the best information of the results of the ascent. The velocity should be given in kilometres per hour or in miles per hour.

5. The Commission discussed the form of the hourly and three-hourly messages and examined the proposition of Dr. Cannegieter (Annex I.), but the further consideration of this was postponed until the next meeting.

September 7th, 1921.

## ANNEX I.

## NOTE ON AVIATION REPORTS.

By DR. H. CANNEGIER.

(September 2nd, 1921.)

I have the honour to give you, in the following, some remarks about the standpoint of the Dutch meteorological service about weather reports for aviation. Thrice daily, at 6.45, 9.45 and 12.45 G.M.T., the radio-station Soesterberg issues a weather report for the air route Amsterdam-London, Amsterdam-Brussels-Paris, and Amsterdam-Hamburg, in the code proposed by the Commission for Weather Telegraphy for the route reports for the London-Paris route

DDFD<sub>1</sub>F<sub>1</sub> ALAnh wwWVV. BBBSB hddvv  
with pilot balloons if De Bilt and sometimes Helder. The aerodromes Schiphol and Rotterdam give information about the local weather in the abbreviated form wwNVh.

After an experience of some months in this year and the summer of 1920, we came to the conclusion:—

- (1) That the system of hourly route reports gives too many difficulties when there is not a large number of well trained observers as there are in England and France to make the observations and to send them over to the radio-station, which has to transmit them every hour.
- (2) That three-hourly messages with barometer readings are sufficient for the meteorological service to give information about the weather prospects in the next six hours in the form of "route forecasts."

It seems to us specially desirable that the difference between the code of the three-hourly route reports with barometer readings—

DDFD<sub>1</sub>F<sub>1</sub> ALAnh wwWVV. BBBSB hddvv







EXAMPLE OF A TELEGRAPHIC REPORT OF OBSERVATIONS AT 0700 G.M.T.  
AT AN INLAND STATION.

Element.	Abbreviation used.	Reading.	Figures for Telegram.	Remarks.
Barometer - - -	(BBB)	1012.9 mb.	129	Corrected and reduced to mean sea-level.
Wind direction - -	(DD)	South	49	<i>i.e.</i> , 33 + 16 Barometric tendency greater than 9 and less than 20.
Wind force (Beaufort)	(F)	5	5	Fresh wind.
Present weather -	(ww)	o/r	16	Overcast, after rain.
Temperature, dry bulb	(TT)	39.2° F.	39	
Temperature, wet bulb		37.6° F.		Not telegraphed.
Characteristic of barometric tendency -	(c)	Falling	5	
Barometric tendency -	(b)	12	2	Fall of twelve half millibars since 0400 G.M.T.
Weather since last report - - -	(W)	r	6	
Visibility - - -	(V)	4	4	Objects visible at 1,000 metres but not at 2,000 metres.
Relative humidity -	(H)	87 per cent.	8	
Form of low cloud -	(A)	St.	0	
Amount of low cloud -	(L)	6/10	6	Six-tenths of sky covered by stratus.
Form of high cloud -	(a)	Ci. St.	2	
Total amount of cloud	(N)	9/10	9	Nine-tenths of sky covered by cloud.
Height of low cloud -	(h)	1400 m.	6	Measured by pilot-balloon.
Rainfall during night	(RR)	4 mm.	04	
Minimum temperature during night - -	(mm)	35° F.	35	
Time of commencement of precipitation	(r)	0330 G.M.T.	4	

The observations given in detail above are put into five-figure groups according to the scheme below. The *letters* are given merely to assist the observer in realising the actual position in the message where the figures are to be inserted, *e.g.*, TT are the last two *letters* of the second group, so that the observer realises immediately that the temperature (for which TT is an abbreviation) is reported by the last two *figures* of the second group.

After some time, an observer will know by heart the order of the letters, and the clerk at Headquarters will do the same, so that both coding and decoding are done without books or cards of instructions.

Letters: BBBDD FwwTT cbWVH ALaNH RRmmr (not telegraphed).

Figures: 12949 51639 52648 06296 04354 (telegraphed).

EXAMPLE OF A TELEGRAPHIC REPORT OF OBSERVATIONS AT 0700 G.M.T.  
AT A COAST STATION.

Element.	Abbreviation used.	Reading.	Figures for Telegram.	Remarks.
Barometer - - -	(BBB)	1002.6 mb.	026	Corrected and reduced to mean sea level.
Wind direction - -	(DD)	NW	28	
Wind force (Beaufort)	(F)	6	6	Strong wind.
Present weather -	(ww)	c	10	Cloudy, cloud decreasing.
Temperature, dry bulb	(TT)	46.7° F.	47	
Temperature, wet bulb		43.4° F.		Not telegraphed.
Characteristic of barometric tendency -	(c)	Steady, now rising	3	
Barometric tendency -	(b)	6	6	Rise of six half millibars since 0400 G.M.T.
Weather since last report - - -	(W)	p	5	Passing showers.
Visibility - - -	(V)	8	8	Objects visible at 20,000 m. but not 50,000 m.
Relative humidity -	(H)	77 per cent.	7	
Form of low cloud -	(A)	Cu.	8	
Amount of low cloud -	(L)	8/10	8	Eight-tenths of sky covered with cumulus.
Form of high cloud -	(a)	None visible	8	Cumulus cloud (no higher cloud visible).
Total amount of cloud	(N)	8/10	8	Eight-tenths of sky covered.
Height of low cloud -	(h)	800 m	5	Estimated.
Rainfall during night	(RR)	4 mm.	04	
Sea disturbance - -	(S)	4	4	Moderate swell with moderate sea.
Sea visibility - -	(V <sub>s</sub> )	6	6	Objects visible at 4,000 m. but not at 10,000 m.
Time of commencement of precipitation -	(r)	0515 G.M.T.	2	Showers began 1½ hours before 0700 G.M.T.

The following is the coded report (*see* note of explanation on page 76):—

Letter: BBBDD FwwTT cbWVH ALaNH RRSV<sub>r</sub>

02628 61047 36587 88885 04462



## 78 Commission for Weather Telegraphy.

SPECIMEN PAGE OF A FORM OF OBSERVER'S REGISTER USED IN GREAT

Tuesday,  
28th February 1922.Raingauge { 7h. 3.4 mm.  
18h. 0.8 mm.

Earth Temp.\* (1 ft.) at 9h. 40.2° F.

Hour. G.M.T. (1)	BAROMETER.		WIND.		THERMOMETERS.		CLOUD.	
	Attd. Ther.	As read.	Direction.	Anemo-meter	Dry, °F.	Relative Humidity.	First Form.	Amount
	Tendency.†	Corrd. to M.S.L. nib.	Beaufort Force.	m.p.h.	Wet, °F.	%	Second Form.	First Type. Total Amount
0100	277 514	987.1 1001.6	S.W. 4	16	40.7 40.5	98	Nb ...	10 10
0700	279 302	989.7 1003.9	W. by S. 5	23	41.2 40.7	96	Fr-St ...	7 7
0900	281 002	990.6 1004.5	W. by N. 5	23	43.3 41.9	89	Fr-Nb ...	7 7
1100	282 003	992.0 1005.6	W.N.W. 6	26	43.9 42.0	85	Fr-St Ci	3 5
1300	285 004	994.0 1007.1	N.W. by W. 6	25	46.2 43.3	80	Cu Ci-St	3 6
1500	286 200	994.1 1007.0	W.N.W. 5	22	46.1 43.0	78	Cu Ci-St	4 7
1800	284 501	993.5 1006.8	W. by N. 4	16	44.7 42.7	85	... Ci-St	... 3
2100	283 501	992.6 1006.2	W.S.W. 3	10	40.9 39.5	89	St-Cu ...	4 4
	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—

\* These are national entries and are not essential to the International Scheme.

† Half-millibars.

Space reserved for telegrams

BRITAIN AT STATIONS REPORTING IN THE INTERNATIONAL CODE OF 1920-1921.

Max. { read at 7h.\* 45° F.  
Temp. { „ 18h. 47° F.Min. { read at 7h. 39° F.  
Temp. { „ 18h.\* 41° F.

Grass Min.\* read at 7h. 38° F.

Sunshine\* 4.8 hrs.

Height of Lowest Cloud. feet. (10)	VISIB.		WEATHER.		NEPHOSCOPE.		REMARKS.
	Land.	Sea.	Since last Observation.	At Time.	Character of Swell and Sea Disturbance.	Type observed. — Direction.	
	(11)	(12)	(13)	(14)	(15)	(16)	
1500 (E)†	5 5	rr	or	1	...	—	Rain ceased at 0230 and sky began to clear slightly, wind became gusty.
2000 (M)	7 8	orepq	cq	1	...	—	
2500 (E)	7 7	cpqbec	croq	5	Fr-Nb 294	84	
2500 (M)	7 8	cpqbc	bcq	5	Ci 250	16	Wind squally.
3500 (M)	6 8	bcqz	bcqz	5	Ci-St 248	18	
3500 (E)	6 8	bcz	cz	5	Ci-St 260	21	
—	7 8	cbcb <sub>1</sub> z	b <sub>1</sub>	1	Ci-St 258	24	
4000 (E)	7 8	b <sub>1</sub> bc	bc	0	St-Cu 272	40	
—	—	—	—	—	—	—	
—	—	—	—	—	—	—	

† E=Estimated. M=Measured.

transmitted to Central Office.



# REPORT OF THE PRESIDENT OF THE COMMISSION FOR WEATHER TELEGRAPHY, SEPTEMBER, 1921, TO THE INTERNATIONAL METEOROLOGICAL COMMITTEE.

1. A special Commission on Weather Telegraphy was appointed during the Conference at Paris in 1919, and three meetings of this special Commission were held during the meeting of the Conference at Paris. An account of the proceedings is given in Appendix III. to the Report of the Proceedings of the Fourth International Conference. The conclusions of this special Commission were, briefly, as follows:—

(a) That greater use should be made of radiotelegraphy in the collection and distribution of meteorological reports.

(b) That the code for the International exchange of meteorological observations should be modified.

(c) That the existing hours of observation—1h, 7h, 13h, and 18h. G.M.T.—should not be changed.

2. At the eighth meeting of the Conference at Paris, a permanent Commission for Weather Telegraphy was nominated. This Commission met in London in November 1920, and a report of the proceedings of that meeting has been printed and circulated (M.O. 242—Report of the Proceedings of the Third Meeting of the Commission for Weather Telegraphy). The code for the International exchange of reports from land stations, recommended at this meeting, has been put into operation by the following countries from the dates shown:—

Belgium (July 1, 1921).

Great Britain (March 1, 1921).

Norway (July 1, 1921).

Roumania (July 15, 1921).

Sweden (July 1, 1921).

Czecho-Slovakia will adopt it either from September 1, 1921, or from June 1, 1922.

Italy, as soon as modification of observing instructions can be completed.

Spain, as soon as modification of observing instructions can be completed.

It will be put into operation by the following countries after approval by the International Meteorological Committee:—

Holland.

Poland.

Finland.

Iceland (with modifications).

The code for reports from ships at sea has been put into operation by—

Great Britain.

Spain.

3. The Commission met again in September 1921, and the minutes of this meeting have been circulated.

4. The members of the Commission appointed at Paris were:—

Lieut.-Colonel E. Gold (President).

Professor A. Angot.

Colonel L. F. Blandy.

Professor E. van Everdingen.

General Ferrié.

Captain P. Franck.

Señor J. Galbis.

M. C. Goutereau.

Lieutenant H. D. Grant.

Professor T. Hesselberg.

Lieut.-Colonel L. Matteuzzi.

Professor C. F. Marvin.

Professor A. de Quervain.

Captain C. Ryder.

Dr. G. T. Walker.

M. A. Wallén.

5. Professor F. Eredia, nominated by Professor Palazzo, was co-opted a member in 1920. Colonel E. Delcambre, M. C. Gain, Dr. W. van Bemmelén and M. Rey, were co-opted members at the meeting in London in November 1920. Lieutenant Kerguistel, Commandant Jaumotte and Colonel F. A. Chaves were co-opted members at the meeting held in London in September 1921. Captain Franck, Señor Galbis and Lieutenant Grant have resigned.

6. **Code for Reports from Land Stations.**—At the meeting in London in November 1920, a form of message was agreed upon for reports from individual stations, and the form was unchanged after the meeting of the Commission in 1921, though some minor alterations were made in the specification of scales as explained in paragraph 9 below.

(a) The standard form of messages is represented symbolically by the following letters:—

BBBDD FwwTT cbWVH ALaNh

To these four groups, an additional group is added twice daily, as follows:—

Inland stations —RRmmr for reports at 0700 G.M.T.

—RRMMr for reports at 1800 G.M.T.

Coast stations —RRSV,r for reports at 0700 and 1800 G.M.T.

(b) Further, from certain selected stations, groups reporting the direction of motion and relative speed of the clouds are added in the following symbolic form:—

C<sub>1</sub>ddVV

This form of message was unchanged after the meeting of the Commission in 1921.

(c) Forms were also agreed upon at the meeting in 1920 for reports of upper air observations. The symbolic form of the reports of upper wind is:—

h<sub>1</sub>ddvv,

and the symbolic form of the reports of upper air temperature and humidity is\*:—

BBTTH.

For both wind and temperature in the upper air, the Commission agreed that the reports should be for definite heights given on pages 33 and 34 of M.O. 242.

(d) In September 1921, the Commission agreed upon an abbreviated form for use in the issue of collective messages, giving a synopsis of the meteorological situation over a whole continent by means of the data for selected stations. This form of message is given in the minutes of the second meeting (paragraph 6), and is as follows:—

BBDDF w<sub>1</sub>TTK'R for the observations at 0700 G.M.T.

BBDDF w<sub>1</sub>TTK'W for the observations at other hours.†

\* It was agreed that inversions should be reported at the end of the message by the addition of the groups 00000 B<sub>1</sub>B<sub>1</sub>B<sub>1</sub>t<sub>1</sub>t<sub>1</sub>, where B<sub>1</sub>B<sub>1</sub>B<sub>1</sub> is the pressure in millibars at the level of the inversion, and t<sub>1</sub>t<sub>1</sub> is the increase of temperature at the inversion in degrees.

† For specification of w<sub>1</sub>, K', R, see Minutes of Meetings, pp. 87 and 88.



7. **Code for Reports from Ships at Sea.**—(a) The Commission agreed, in 1920, upon a form of code for reports from ships at sea. The fundamental message is represented symbolically by the following figures:—

QLLLx<sub>1</sub> llllx<sub>2</sub> BBDDx<sub>3</sub> FVKdx<sub>4</sub> wwGGx<sub>5</sub> Y<sub>1</sub>Y<sub>2</sub>Y<sub>3</sub>Y<sub>4</sub>Z.

This applies to ships from which temperature and cloud are not reported. If these elements are reported the type of message is symbolically:—

QLLLx<sub>1</sub> llllx<sub>2</sub> BBDDx<sub>3</sub> FVKdx<sub>4</sub> wwGGx<sub>5</sub> TTttx<sub>6</sub> CNWrx<sub>7</sub>.  
Y<sub>1</sub>Y<sub>2</sub>Y<sub>3</sub>Y<sub>4</sub>Z.

This code was referred to the Commission for Maritime Meteorology for its consideration. That Commission has recommended slight modifications which the Weather Telegraphy Commission accepts. The modified form is represented symbolically by:—

QLLLx<sub>1</sub> Plllx<sub>2</sub> BBDDx<sub>3</sub> FVKdx<sub>4</sub> wwGGx<sub>5</sub> Y<sub>1</sub>Y<sub>2</sub>Y<sub>3</sub>Y<sub>4</sub>Z  
CNTTd, WrttK' (Fahrenheit)  
or CNTTT Wrttt (Centigrade).

An alternative form of message for use without check figures is:—

PQLLL lllGG BBDDF wwVKd CNTTd, WrttK' (Fahrenheit).  
CNTTT Wrttt (Centigrade).

The Commission agrees with the recommendation of the Commission for Maritime Meteorology that the two forms of message should be circulated to Directors of Institutes who arrange for reports from ships at sea by wireless telegraphy, with a view to the adoption of a single code for these reports.

8. **Code for Reports for Aviation.**—At the meeting in November 1920, the Commission adopted the following forms for hourly reports for aviation, on the understanding that the forms would be further considered by the Commission for the Application of Meteorology to Aerial Navigation:—

(a) DDFD<sub>1</sub>F<sub>1</sub> ALaNh wwWVV, BBBS—

for reports at 0100, 0400, 0700, 1300, 1600, 1800, 2100 G.M.T.

(b) DDFD<sub>1</sub>F<sub>1</sub> ALaNh wwWVV,—

for reports at all other hours than those specified in (a).

The latter Commission considered the form at the meeting in September 1921, and recommended the following forms, which the Weather Telegraphy Commission accepts:—

(a) Hourly reports.

I<sub>n</sub>I<sub>n</sub>(V<sub>s</sub>\*) wwVhL NDDFW (†C<sub>s</sub>ddF<sub>1</sub>S)

I<sub>n</sub>I<sub>n</sub> = index figures of stations.

C<sub>s</sub> = form of cloud to which ddF<sub>1</sub> refer.

This form of message, with the addition of the last group, also applies to 3-hourly reports from observation posts not fully equipped with instruments.

(b) 3-hourly or 6-hourly reports from fully-equipped synoptic stations.

I<sub>n</sub>I<sub>n</sub>(V<sub>s</sub>) BBBDD FwvTT cbWVH ALaNh C<sub>s</sub>ddF<sub>1</sub>S.

9. **Specification of Scales.**—The Commission agreed in November 1920 upon the specifications of the code figures:—

(a) For the form of cloud (M.O. 242, page 27).

(b) For the visibility on land and at sea (M.O. 242, pages 26 and 27).

\* For sea stations only.

† Every three hours only.

(c) For the height of the base of cloud (M.O. 242, page 28).

(d) For the relative humidity (M.O. 242, page 28).

(e) For the revised specification for barometric tendency (M.O. 242, page 29). An abbreviated specification of the barometric tendency where no figure is available for the characteristic is given in the minutes of the first meeting, held in September 1921 (paragraph 14).

(f) Upon two specifications for the state of the sea and swell for use at coast stations and on the open sea respectively (M.O. 242, pages 29 and 36).

(g) For the amount of rainfall (M.O. 242, page 30). An abbreviated specification of the amount of rainfall when only one figure is available, is given in the minutes of the second meeting held in September 1921 (paragraph 6).

(h) For the time of commencement of rain (M.O. 242, page 30).

(i) For the heights to be used in reports of upper wind (M.O. 242, page 33).

(j) For the heights to be used in reports of upper air temperature and humidity (M.O. 242, page 34).

(k) For reports of weather at the time of observation (M.O. 242, page 39).

(l) For reports of past weather (M.O. 242, page 42).

No alteration has been made in these specifications except in the code for visibility, for which the new specification is given in the minutes of the second meeting, held in September 1921 (paragraph 8), one alteration in the specification of cloud by the deletion of the words "mammato-cumulus" for figure 6, and two minor alterations in the code for present weather which are also specified in the minutes of the meetings held in September 1921 (1st meeting, paragraph 7; 2nd meeting, paragraph 9). The specification of F<sub>1</sub> (speed of low cloud) requires to be added in the following form:—

Code Number.	Corresponding mean speed in kilometres per hour.	Limits of speed in kilometres per hour.
0	less than 5	0-7
1	15	8-22
2	30	23-37
3	45	38-52
4	60	53-67
5	75	68-82
6	90	83-97
7	105	98-112
8	120	113-127
9	135	128-142

10. The Commission further agreed that the scale of 0-32 should be retained for reports of surface wind direction, but that the scale of 0-36 should be used for reports of direction of upper wind and of cloud motion.

11. The Commission had also under consideration the National issue of collective messages by radiotelegraphy for International purposes. A table indicating the times at which the issues in different European countries should commence was drawn up in November 1920 (M.O. 242, page 44). The table was revised in September 1921, and the revised table is given in paragraph 14 of the minutes of the second meeting of September 1921. With the exception of the alteration of this table and



the modification of paragraph (h), page 44, of M.O. 242, by the substitution of continuous wave instead of spark, the report of the sub-committee on the Organisation of the Transmission of Reports by Radiotelegraphy is unchanged. It is, however, noted that the list of stations for inclusion in the European collective message has not yet been completed, as the Directors of the Institutes in some countries have not yet furnished the information.

12. The Commission invited Captain Ryder, the Director of the Danish Meteorological Institute, to negotiate a new agreement with the Great Northern Telegraphy Company, for the transmission of the Icelandic reports to London, whence the British Meteorological Office undertook to have them transmitted by radiotelegraphy at the end of the British synoptic messages issued one hour after the standard times of observation. The resolutions of the Commission on this subject are given in paragraph 6 of the minutes of the first meeting, held in September 1921.

13. The Commission has had under consideration the necessary modification of the code for use in the transmission of the reports from Iceland, and recommends the modification represented in detail in paragraph 10 of the minutes of the second meeting, September 1921.

14. The Commission has had under consideration the question of reports from Greenland and decided that the establishment, at the earliest possible date, of a high-power radiotelegraphic station in Greenland is of the utmost importance to the meteorology of Western Europe, and, further, it is of such importance as to warrant the International provision of funds for maintaining it. It has since been ascertained that a small-power radiotelegraphic station in Greenland would be sufficient to transmit reports from Greenland to Iceland and the Commission was of opinion that the establishment of such a small-power station ought not to be delayed by their desire to see a high-power station established.

15. The Commission appointed a sub-committee to consider the question of a code for the International exchange of forecasts for which the use of plain language messages has obvious disadvantages. The report of the sub-committee was adopted.

16. The Commission appointed a sub-committee to consider the preparation of an International cloud atlas for the use of observers at telegraphic reporting stations. The report of the sub-committee has been circulated. The Commission adopted paragraph A.1, with the modification shown by the slip attached to the copies circulated. It also recommends circulation of the report to those interested in cloud classification, but the Commission could not adopt the report without modification owing to the divergence of opinion on some of the recommendations included in it.

September 16, 1921.

# MINUTES OF MEETINGS.

## FIRST MEETING, THURSDAY, SEPTEMBER 8, 1921,

in the Council Chamber of the Air Ministry, Kingsway, London, W.C.2.

Members present: Lt.-Col. Gold (President); Col. Delcambre, Prof. van Everdingen, Lieut. Grant, Dr. Hesselberg, Col. Matteuzzi, Prof. de Quervain, Capt. Ryder, M. Wallén.

There were also present: Commandant Jaumotte, Lieut. Kerguistel, Capt. Mackenzie (Acting Secretary), Dr. Simpson, Mr. Rikichi Sekigouchi.

1. The opening speech of the President (Appendix to the Minutes of the first meeting) was circulated later.

2. The resignation of Captain Franck was accepted, and the following were co-opted members of the Commission:—

Lieut. Kerguistel.  
Commandant Jaumotte.  
Col. Chaves.

3. It was decided to appoint sub-committees to consider the details relating to items 6 (transmission of reports by radiotelegraphy) and 7 (codes for international exchange of forecasts) and for the consideration of a cloud atlas for the use of observers. The committees were appointed as follows:—

## Cloud Atlas.

Sir Napier Shaw.  
Dr. Cannegieter.  
Capt. Douglas.  
Commandant Jaumotte.  
Col. Matteuzzi.  
Prof. de Quervain.

## Radio-telegraphy.

Col. Gold.  
Col. Blandy.  
Col. Delcambre.  
Dr. Dellinger.  
Lieut. Kerguistel.  
Capt. Ryder.  
M. Wallén.

## Code for Forecasts.

Col. Gold.  
Dr. Hesselberg.  
Commandant Jaumotte.  
Prof. de Quervain.

4. Some discussion took place on the procedure for giving effect to the tenth paragraph of the minutes of the 6th meeting, page 37 of M.O. 242. Further consideration of this question was postponed until a later meeting, the President having reported that he had distributed copies of M.O. 242 and circulated the papers relating to the present meeting to the following Directors of Institutes:—

Zentralanstalt für Meteorologie und Geodynamik, Vienna.  
Osten Gesellschaft für Meteorologie, Vienna.  
Central Meteorological Institute, Sofia.  
Bayerische Landeswetterwarte, Munich.  
Deutsche Seewarte, Hamburg.  
Meteorologisches Institut, Berlin.  
Sächs Landeswetterwarte, Dresden.  
Meteorologisches Observatorium, Aachen.  
Central Bureau für Meteorologie und Hydrographie, Karlsruhe.  
Meteorologische Geophysikalisches Institut, Frankfurt a/m.  
Meteorological and Magnetic Institute, Budapest.

5. The President reported that he had had correspondence with Capt. Ryder with regard to a note from Mr. Thorkelsson indicating that it might be necessary to make the morning hour of observation in Iceland 9 a.m. instead of 7 a.m. He stated that he had asked Mr. Thorkelsson to postpone any change of this kind until there had been an opportunity of discussing the situation at the meeting in London. Mr. Thorkelsson had expressed his intention of maintaining the observations at 7 a.m. unless the expenses of doing so should eventually prove too great. The following resolution was then passed unanimously:—

“The Commission recognises the difficulty of making observations in Iceland at so early an hour in the morning as 0700 G.M.T., and expresses its appreciation of the manner in which Director



Thorkelsson is meeting the needs of European meteorologists in regard to the reports from Iceland. In view, however, of the importance of those observations in International Meteorology, the Commission considers that it is undesirable either to reduce the number of stations or to change the morning hour of observation from 0700 to 0900 G.M.T."

6. Captain Ryder then reported the result of his negotiations relating to the proposed new agreement with the Great Northern Telegraph Company for the despatch of the Iceland reports to England, and their issue from England with the collective British synoptic reports. He gave an account of the replies which had been received from the countries participating in the present reports and from countries likely to be interested in the reports if they were distributed by radiotelegraphy. The following resolution was passed unanimously:—

"The Commission considers that the arrangements with the Great Northern Telegraph Company, negotiated by Captain Ryder, offer a satisfactory solution of the problem of the distribution to European Meteorological Services of the reports from Iceland, and recommends that the arrangements be put into operation as early as possible."

It was also unanimously agreed:—

"That an arrangement by which the agreement with the Great Northern Telegraph Company was terminable at six months' notice would best meet the requirements of the Meteorological Services."

Captain Ryder undertook to continue the negotiations, with a view to beginning the new plan by about April 1922, and to negotiate with countries which are not at present participating.

7. It was agreed unanimously:—

"That the present weather scale, M.O. 242, page 39, should be amended so that the figures 07 and 17 should have the following meaning:—

07 — after snow, sleet or hail.

17 — after snow, sleet or hail."

8. It was agreed unanimously:—

"That the characteristic of barometric tendency, M.O. 242, page 29, should be amended by deleting the words 'or the same as' in the sentence 'the barometer is now lower than or the same as 3 hours ago.' The words 'or the same as' in the sentence 'the barometer is now higher than or the same as 3 hours ago' stand unaltered."

9. A long discussion ensued upon the proposal to add the figure 10 to the scale of visibility, to indicate that objects were visible at a distance of more than 50 kilometres, and to substitute for figures 03 and 13 in the scale of present weather, the meaning "with or after precipitation within sight."

The meeting adjourned at 1 p.m.

10. The afternoon session opened at 2.45 p.m.

The discussion of the proposed modification of the visibility scale was resumed. On a vote being taken, the proposal to add the figure 10 to the visibility scale was lost by 5 votes against 3.

11. A further proposal to substitute "precipitation within sight" instead of the words "with solar or lunar halo" for the numbers 04 and 14 of the present weather code, was lost by 7 votes against 2.

12. Colonel Delcambre then explained the memoranda which he had circulated to members of the Commission. He expressed the opinion that considerable freedom ought to be left to National Services to

develop codes for National purposes based on the new principles which were gradually being introduced into meteorology by Bjerknes in Norway and by the National Meteorological Office in France. It was not his intention to propose that the International code should undergo complete modification, but he considered that a rigid insistence upon the application of the codes to the exclusion of National developments, would not be in the best interests of meteorological progress.

Director Hesselberg explained that he had similar views in Norway and he had found it necessary to supplement the International code by special groups giving additional information which they required for National purposes. He added that, in a few years' time, it might be possible—he hoped it would be possible—to make such alterations in the International code as would permit of the inclusion of the additional information which the National Meteorological Services of different countries found necessary, and that he and Colonel Delcambre might then unite in securing the necessary reforms.

\* 13. The suggestion to include information about the time of beginning and ending of rainfall as supplementary figures to the index groups to stations was then discussed. The Commission considered\* :—

"That it was undesirable to include in the index groups any information beyond that necessary for the specification of the station."

14. The code for the messages to be included in the collective issue of European reports, M.O. 242, page 44, paragraph (h), was then considered, and it was suggested that two groups for each station might be of the form:—

BBDFF w<sub>1</sub>TTK'W

where w<sub>1</sub> is the initial figure of the present weather code and so indicates the general state of the weather;  
and K' is a single figure indicating the manner in which the barometer is changing.

*Suggested Code for K'.*

		Change in last three hours in half-millibars.
0	Barometer steady	- - - - 0 or 1
1	" rising slowly	- - - - 2 or 3
2	" rising	- - - - 4 to 7
3	" rising quickly	- - - - 8 to 12
4	" rising very rapidly	- - - - more than 12
5	" falling slowly	- - - - 2 or 3
6	" falling	- - - - 4 to 7
7	" falling quickly	- - - - 8 to 12
8	" falling very rapidly	- - - - more than 12

15. The meeting adjourned at 5 p.m.

(Signed) E. GOLD.

September 8th, 1921.

SECOND MEETING, FRIDAY, 9TH SEPTEMBER, 1921,

in the Council Chamber of the Air Ministry, Kingsway, London, W.C.2.

Members present: Lt.-Col. Gold (President), Col. Delcambre, Prof. van Everdingen, Dr. Hesselberg, Commandant Jaumotte, Col. Matteuzzi, Prof. de Quervain, Capt. Ryder, M. Wallén.

There were also present: Capt. Mackenzie (Acting Secretary), Dr. Simpson, Mr. Rikiehi Sekigouchi.

1. The minutes of the first meeting were circulated and read, and the President outlined the programme for the day.

\* Col. Delcambre notified the President after the meeting that he dissented from this resolution.



2. After a lengthy discussion the proposal of Professor de Quervain that messages by ordinary telegraphy should not be discontinued until after the complete service by wireless telegraphy has been introduced was withdrawn on the understanding that messages would be sent by ordinary telegraphy on request on occasions of atmospheric disturbance which prevent the reception of the radiotelegraphic signals.

3. The meeting then proceeded to a discussion of Mr. Wallén's proposal for an alternative method of reporting barometric tendency. It was pointed out that an examination of the reports from observers in Great Britain showed that the system of adding 33 or 67 to the wind direction number, in accordance with the decision on page 29 of M.O. 242, has been successful; in all cases of tendencies of 10 or more, the necessary addition to the number reporting wind direction had been made by the observers. In view of this the proposal was withdrawn.

4. In connection with paragraph 3, the question of comparing the radiotelegraphic messages received by different Institutes with the corresponding messages issued, was considered and the following resolution was passed unanimously:—

"That the Commission requests the British Meteorological Office to arrange for a return for selected days of the messages received by radiotelegraphy by the different Institutes and for their comparison with the corresponding messages issued and for their return after examination with a note of the discrepancies revealed."

5. A proposal for a new code for visibility to permit of the reporting of visibility greater than 50 kilometres was discussed. It was decided to leave the decision until the opinion of the Commission for Aerial Navigation had been ascertained.

6. The discussion of the form of the proposed code for the European issue (M.O. 242, page 44, paragraph (h)) was resumed. It was eventually decided unanimously that the form of the code should be as follows:—

BBDDF w<sub>1</sub>TTK'R for the observations at 0700 G.M.T.

BBDDF w<sub>1</sub>TTK'W for the observations at other hours

where w<sub>1</sub> and K' have the meaning given in paragraph 14 of the minutes of the first meeting, and R denotes the amount of rainfall for the preceding 24 hours according to the following code:—

Code Number.	Amount of Rainfall (24 hours).
0	0
1	Trace or 0.1 mm.
2	0.2 to 2 mm.
3	3 to 5 mm.
4	6 to 10 mm.
5	11 to 15 mm.
6	16 to 20 mm.
7	21 to 30 mm.
8	31 to 50 mm.
9	above 50 mm.

7. After a discussion of the unit to be adopted in reporting the speed of the cloud in the group C<sub>1</sub>ddVV, it was decided, *nemine contradicente*, that:—

The relative speed of the cloud should be expressed in the units used on page 12 of M.O. 242, i.e., VV is expressed by a number such that the actual speed of the cloud will be given in kilometres per hour by the equation:—

$$vv = \frac{h}{1000} \times VV$$

if "h," the height of the cloud, is expressed in metres. This unit is the "radian per hour."

The meeting adjourned at 11.45 a.m. in order to allow the Radiotelegraphic Sub-Committee to meet.

8. The afternoon session commenced at 5.45 p.m. The discussion of a change in the code for visibility to permit of reports of visibility greater than 50 kilometres, was resumed. It was reported that the Commission for the Application of Meteorology to Aerial Navigation saw no objection to the proposed change. On a vote being taken it was decided by 6 votes against 1, that:—

The visibility code should be as follows:—\*

Code Number.	Objects.	Previous Distances.
0	Not visible at 50 metres	50 m.
1	" 200 "	200 m.
2	" 500 "	500 m.
3	" 1,000 "	1,000 m.
4	" 2,000 "	2,000 m.
5	" 4,000 "	4,000 m.
6	" 10,000 "	7,000 m.
7	" 20,000 "	12,000 m.
8	" 50,000 "	30,000 m.
9	Visible at 50,000 " or more	30,000 m. or more.

9. In view of the resolution of paragraph 8, it was decided unanimously that:—

"the figures 03 and 13 of the code for present weather M.O. 242, page 39, should have the meaning 'precipitation within sight.'"

10. The Committee then proceeded to consider the proposal for a code for the reports from Iceland. It was decided unanimously to recommend:—

that the following should be the forms of the messages in the telegrams from Iceland:—

(a) For all stations except Reykjavik and Thorshavn.

Reports at 7 a.m.

B<sub>2</sub>B<sub>2</sub>cb'b' BBBDD FwwTT cbWAN

where B<sub>2</sub>B<sub>2</sub> gives the barometer reading at 1 a.m. in whole millimetres or whole millibars.

cb'b' gives the barometric characteristic and barometric tendency for the three hours preceding 1 a.m. The barometric tendency is to be expressed in half-millimetres or half-millibars.

The remaining figures have the same significance as in M.O. 242.

For reports from these stations at hours other than 7 a.m. the same form should be adopted with the omission of the first group.

(b) For Reykjavik and Thorshavn.

B<sub>2</sub>B<sub>2</sub>cb'b' BBBDD FwwTT cbWVH ALAnh RRSV<sub>r</sub>

For reports at 1 p.m. the messages from these two stations should be in the form:—

BBBDD FwwTT cbWVH ALAnh.

For reports at 6 p.m. the messages should be in the form:—

BBBDD FwwTT cbWVH ALAnh RRSV<sub>r</sub>

\* The distance for figure 7 was given originally as 30,000 m. but 20,000 m. was agreed subsequently to be preferable by those members of the Commission who were present at the meeting and this value has therefore been inserted.



It was further considered that the group for direction and speed of upper cloud, viz., C<sub>1</sub>ddVV, should be added to the messages from Reykjavik and Thorshavn twice daily when the observations could be made.

11. The Commission sees no objection to the observations in Iceland for the European messages being made half an hour before the usual hours of synoptic reports if that is necessary to secure their arrival in London in time for inclusion in the British synoptic messages.

12. The report of the sub-committee on the cloud atlas was received and section A, paragraph 1, was adopted after amendment. The Commission recommends :—

**the circulation of this report of the sub-committee to all interested in the classification of cloud forms.**

13. The report of the sub-committee on the code for the transmission of forecasts was received and adopted.

14. Colonel Delcambre made a statement on the proceedings of the sub-committee appointed to consider the transmission of reports by radiotelegraphy, and the following table for the times of transmission for the reports of the different countries was adopted unanimously to replace the table on page 44 of M.O. 242 :—

Time after Standard Hour of Observation.	Country.	Time after Standard Hour of Observation.	Country.
Transmission* begins.		Transmission* begins.	
0h. 30m.	Holland (de Bilt only).	5 mins. before	Bulgaria.†
0h. 35m.	Denmark.	0h. 20m.	Serbia.
0h. 40m.	Sweden.	0h. 30m.	Azores.
0h. 50m.	Norway.	0h. 40m.	Malta (ships observations from Mediterranean).
1h. 00m.	Great Britain.		
1h. 20m.	France.	0h. 50m.	Roumania.
	Belgium.	1h. 00m.	North Africa.
	Switzerland.	1h. 20m.	Esthonia.
1h. 40m.	Germany.	1h. 30m.	Greece.
	Holland additional stations.	1h. 40m.	Italy.
		2h. 00m.	Spain.
1h. 55m.	Finland.	2h. 10m.	Portugal.
2h. 00m.	Poland.	2h. 20m.	Constantinople.
2h. 10m.	Hungary.		
2h. 20m.	Austria.		
2h. 25m.	Czecho-Slovakia.		

15. The Commission received a letter from Colonel Blandy forwarding a note of certain decisions of the Technical Committee on International Radio Communications, Paris, June, July and August, 1921. The Commission noted that :—

The Technical Committee considered the proposals of M.O. 242, pages 42-54, quite feasible so far as radiotelegraphy is concerned, with the exception of recommendation (h), page 44.

\* The transmission from each country should cease at or before the time given for the commencement of the transmission by the next country in the column.

† Observations made at 0527 and 1227 G.M.T.

Colonel Delcambre informed the Commission that he would take up the question of arranging for the transmission of these collective messages on continuous wave instead of on spark. The President undertook to communicate to the Technical Committee that arrangements would be made to ensure the issue of the collective message in accordance with the International Radiotelegraphic requirements.

16. The suggestion that an official list of the meteorological reports issued by radiotelegraphy should be prepared by the Commission was considered to have been met for the present by the lists published by the various national offices.

17. The President of the Commission for Maritime Meteorology described briefly the conclusions of his Commission with reference to the code for reports from ships at sea. It had been agreed that the fundamental messages should contain information expressed symbolically by the following groups :—

PQLLL III GG BBDDF wwVKd

where P refers to the day of the week.

If further groups were added to these fundamental groups, which would consist either of four groups without check figures or six groups with check figures, it was recommended that the first two of these further groups should be of the following form :—

Countries using Fahrenheit degrees : CNTTd, WrttK'  
Countries using Centigrade degrees : CNTTT Wrttt

where K' represents the barometric tendency in the same code as that used for the European Collective Issue, paragraph 14 of the Minutes of the first meeting (p. 87), and d. represents the direction of motion of the ship.

18. In accordance with the resolution of paragraph 10, page 37 of M.O. 242, it was proposed :—

**That, as Austria had now been admitted to the League of Nations, Professor F. M. Exner of Vienna, should be co-opted a member of the Commission.**

This proposal was carried unanimously.

(Signed) E. GOLD.

September 9th, 1921.

THIRD MEETING, SATURDAY MORNING, SEPTEMBER 10th, 1921.

1. The minutes of the second meeting were read, corrected and confirmed.

2. The President reported the receipt of a letter of resignation from Lieutenant H. D. Grant, which was accepted.

(Signed) E. GOLD.

September 10th, 1921.

REPORT OF THE SUB-COMMITTEE ON FORECAST CODE.

*Addendum to the Minutes of the First Meeting, Thursday, September 8th, 1921.*

1. The sub-committee, consisting of :—  
Colonel Gold,  
Dr. Hesselberg,  
Commandant Jaumotte,

met at 5 p.m. on September 8th, 1921.

2. M.O. 244 is based on a good principle but it contains elements of purely national importance which render it unsuitable in its present form for international use; and the code will gain in simplicity by the separation of the national details from the international part.



3. The time at the disposal of the sub-committee was insufficient to make the necessary modifications in the details of M.O. 244.

4. The sub-committee considered that the British Meteorological Office should be asked to prepare a code on the following basis for circulation to the members of the Commission for consideration before the next meeting:—

(a) An index group of three figures should indicate the day of the week and time of the reports on which the forecast is based.

(b) The first figure of each five-figure group should indicate the nature of the information according to the following scheme:—

First Figure of Group.	Information in Group.
0	Position (latitude and longitude of centre of degree square).*
1	Pressure Distribution.
2	Wind Direction.
3	Wind Velocity.
4	Upper Wind.
5	Temperature.
6	Visibility.
7	Clouds.
8	Precipitation.
9	Group reserved for national purposes.

September 8th, 1921.

#### REPORT OF SUB-COMMITTEE FOR CLOUD OBSERVATIONS.

The sub-committee, consisting of Professor de Quervain (President), Captain Douglas, Commandant Jaumotte, and Colonel Matteuzzi, met on Thursday from 4.30 to 6.30 p.m., and on Friday at 9.30 a.m.

Two questions were dealt with: the possible modification of the cloud observation code proposed in November 1920 (see M.O. 242, page 27), and the suggestions to be made to the International Committee in view of a revision of the international classification and of a new cloud atlas.

##### A. 1920 Code.

Colonel Delcambre's very incisive proposals, as their author himself states, are not intended for immediate application.

1. With regard to certain other suggestions already submitted to the President of the Commission, the sub-committee agrees that the addition "or *mammato-cumulus*" to figure 6 should be *deleted* as not defining a type of cloud, but only a detail found with several types, and which, as such, is not more important for the object in view than many others which cannot all be represented in this code. "Mammato-cumulus" cloud should be reported by the figure for the type with which the mammato form corresponds." †

2. The sub-committee would have preferred not to follow the more or less fortuitous enumeration of the classification in the figures of the code, but for the purposes of forecast here involved, to have united certain forms under one figure, to admit of more detailed representation of other forms. In particular, it would have preferred, in these weather telegrams, to have put cirro-cumulus and alto-cumulus together in order to give more detail in the case of cloud "with ascending current," distinguishing fine weather cumulus from the dynamic cumulus which is the forerunner of cumulus-nimbus.

\* West longitude to be indicated by adding 50 to the hour of report in the index group.

† Amendment added in accordance with decision of Commission.

If the Commission does not consider it possible to accept this modification, the sub-committee suggests that at least competent observers should be allowed in their reports to imply certain forms of special interest for forecasting without in any way prejudicing the *general* signification of the figure. Thus, for example, figure 3 in these observations might stand for alto-cumulus castellatus, heralding storm, and similarly figure 8 might be reserved for heavy cumulus, while fine weather cumulus could be reported by the same figure as the strato-cumulus, which has a similar favourable significance for forecasts.

The sub-committee recommends that the designation cumulo-nimbus be reserved for the cloud with a *certain* tendency to the formation of storm cirro-stratus (anvil), and that the forms reported be selected in such a way that Cu-Nb, if present, shall always be included. If the direction of cumulo-nimbus is indicated, it should refer to the highest part of this cloud: if the Cu-Nb figure is repeated with different speeds and directions the first indication should refer to the base and the second to the summit.

##### B. Revision of the Classification Atlas.

The sub-committee finds that there is universal need for revision of the classification and a new cloud atlas. It believes itself to be acting in accordance with the wishes of the Commission in merely forwarding to the International Committee a certain number of suggestions emanating from our Commission itself, leaving to the Committee the task of forming a special committee of a few competent persons to go into the matter more carefully.

1. The sub-committee considers that a complete revision of the classification and of the atlas is necessary in view of the important progress made since the first edition, and starting from the international year for cloud measurements. It does not, however, suggest a complete change of the present system of classification which is the fruit of wide experience. It would be necessary to retain the principle of connecting certain forms with certain relative altitudes as the basis of all cloud observation and classification which is to be utilised in the study of the general circulation. On the other hand, in as far as the conditions of formation are known, it will be necessary in the nomenclature to emphasise the fact of this *genesis* rather than a detail of form which may be fortuitous and passing.

2. The *new atlas* should include not only one or two, but several different varieties of each type of cloud, which would give about 40 to 50 figures in all.

We should also like to insist that observers should be trained in such a way as to be independent of the figures and to draw their conclusions especially from the principles of the relative altitude of the cloud forms, the method of formation and the natural relation between them.

We must arrange for *collaboration* between all the meteorological services which should be in a position to supply the future Commission with all the material and characteristic observations for their region. Indeed, in spite of the relative identity of cloud forms all over the globe observed by Abercromby, it is also necessary to take into consideration certain varieties which depend on the latitude and on other conditions varying from one region to another. The Commission must make a careful study of the numerous atlases published during the last few years and should benefit by these examples.

From the technical point of view, and after examination of some specimens of these, the sub-committee recommends the style of reproduction in which the sky is shown in blue and where the cloud, if necessary, is shown brownish-grey on the blue background. These are the indispensable conditions as regards colour. The question of zinc-cut quite sufficient conditions as regards colour. The size of the graphic or lithographic reproduction must be left till later. The size should not be less than 9 × 12 cm.: an even larger size would be very desirable in order to obtain a nearer approach to actual angular conditions



at the usual distance: these angular conditions must be added together with all the indications necessary to characterise the situation (direction of lighting, time, general date). The atlas should also include photographs of clouds taken from aeroplanes.\*

The sub-committee recommends that the atlas be completed by the addition of wide-base stereoscopic views, such as those in the Meteorological Office, London, or those which have been prepared lately at the Institutes of Brussels, Paris and Zurich.

The sub-committee is of opinion that the publication in question should consist of two more or less distinct parts; a first part acting as an immediate introduction to the atlas, and a supplement for use in more thorough investigation, including different detail classification: this latter part should contain as well as other points of view, the idea of classification by families, and everything already known about the genesis of clouds.

The sub-committee is aware that these suggestions are incomplete. It will be for the future Commission to lay more sound foundation for this long and delicate work.

September 8th, 1921.

#### ANNEX I.

Letter from Captain C. RYDER, Director of the Meteorological Institute, Copenhagen, Denmark.

DEAR SIR,

THE three Scandinavian Meteorological Institutes are of the opinion that reports from Iceland after the new international code will not give so good information as the code used for these reports now.

The night observations of the barometer in the morning report now for 10 p.m., 1 a.m., 4 a.m., and 7 a.m. Grw. time, are for us of so great an importance, that we should consider it as a step backwards if these observations in future should not be included in the reports, the intervals between the evening and the morning observation being too large by rapid weather changes.

At a meeting in Stockholm in May this year, we have discussed the matter and agreed to propose that a special code should be used for the Icelandic reports, in which night observations of the barometer should be included.

On the behalf of Directors Wallén, Hesselberg and myself, I therefore ask you to put on the programme for the meeting, in September, of the Commission for Weather Telegraphy the discussion of a special code for Icelandic reports, and we propose the following:—

Morning report	-	BBB BB	B BBBW	BBBDD	FwwTT
		10 p.m.	1 a.m.	4 a.m.	7 a.m. (Grw. time.)
Afternoon and evening reports	-	...	BBBW	BBBDD	FwwTT
			3 hours		
			before observation.		

As regards the morning reports, our proposed code will be very near the same as the code used now. The only alterations are that on the vacant place in the second group is put W (past weather), and in the fourth group we take two figures for ww (present weather) and give the temperature in full degrees only.

Regarding the afternoon and evening reports, there is the same alteration in the last group, and there is placed a first new group with the barometer 3 hours before observation and "past weather."

\* See also p. 28.

The total amount of groups after this code from five stations in Iceland and from Thorshavn will then be:—

Morning	-	4 groups from 6 stations	-	24 groups.
Afternoon	-	3 " " 6 "	-	18 "
Evening	-	3 " " 6 "	-	18 "
sum				60 groups.

As the draft of agreement with the Telegraph Company allows us up to 74 groups a day, there will be plenty of room for extra groups.

We think that the proposed code will give all information necessary and gives us more than the International Code, and we hope it will meet the demands of all the Institutes interested.

I have sent Mr. Thorkelsson the proposed code, but cannot await his answer before writing you. I am therefore not acquainted with his opinion.

I am, dear Sir, &c.,

Meteorological Institute,  
Copenhagen.

June 20th, 1921.

(Signed) CARL RYDER.

#### ANNEX 2.

#### NOTE ON PROPOSALS FOR MODIFICATION IN THE CODE FOR ICELAND REPORTS.

By Lt.-Col. E. GOLD.

1. If the Iceland reports come in the International Code, then the tendency in the reports at 7 a.m. will give effectively the height of the barometer at 4 a.m. If, therefore, it is possible to arrange for the inclusion in the 7 a.m. message of a single five-figure group, giving the barometer and tendency at 1 a.m., the whole of the information asked for by the Scandinavian Meteorological Institutes would be provided. When this question of the modification of the code for reports from Iceland was raised at the meeting of the Commission in November, Mr. Thorkelsson, the Director of the Meteorological Service of Iceland, stated that it was essential that the new International Code should be brought into use there. It is therefore extremely desirable that no steps should be taken which would discourage the important advance in the meteorology of Iceland which the adoption of a new code would effect.

2. Provision of an extra group could perhaps be made by omitting the cloud group from the reports from Iceland stations other than Reykjavik.

3. If, however, any appreciable modification is to be made in the code for the reports from Iceland, then it would seem to be better to reduce the reading of the barometer to 2 figures only; to report only one form of cloud and the total amount; and to omit the cloud height. This would save 4 figures, which are all that are required to give the barometer at 1 a.m. and the tendency. In evening reports, the figures might be utilised for reporting the amount of rainfall.

London,

June 29th, 1921.

#### ANNEX 3.

#### NOTE ON PROPOSALS FOR MODIFICATION IN THE CODE FOR ICELAND REPORTS.

By Mr. T. THORKELSSON, Director of the Meteorological Office, Iceland

I am now arranging for double observations in the morning, viz., at 7 a.m., G.M.T., for external reports, and 9 a.m. for national reports.



If I, as I hope, succeed in getting satisfactory arrangements in this way, I have, from Icelandic point of view, no objection to Captain Ryder's proposal regarding the code for the morning reports. On the other hand, it is essential for avoiding belated or confused reports, that the afternoon and evening reports are common, but the code proposed by Captain Ryder does not meet the national demands; therefore, some modifications in this code will be desirable.

The barometer 3 hours before observation is of less value than the characteristic and amount of barometric tendency during these three hours, and information about clouds is also required.

For national purposes the following code would be acceptable:—

Morning report, 7 a.m. -  $B_1B_1B_1B_2B_2B_2B_3B_3B_3W$  BBBDD FwwTT

Afternoon (1 p.m.) and evening (6 p.m.) report - BBBDD FwwTT cbWaN.

Lieut.-Col. E. Gold, in his note on Captain Ryder's proposals (annex 2, art. 3), suggests some modifications that, from my point of view, are preferable, excepting the reduction of the reading of the barometer to two figures only. At least for national purposes, the tenths of mm. in the barometer readings are indispensable. The place lost in this way may be gained by omitting the humidity. At present the Icelandic stations are not equipped with hygrometers; therefore, they will be unable to report the humidity at least next year. The omission of humidity is, consequently, no serious loss.

Perhaps the following code might serve the purposes:—

Morning Reports:  $B_2B_2c_2b_2V$  BBBDD FwwTT cbWaN.

The suffix 2 refers to barometer readings at 1 a.m. G.M.T. The afternoon and evening reports would be composed of the three last groups of the morning report. In my opinion, it is an advantage to use the same code in the morning and evening reports.

The above-mentioned codes are based upon the assumption that the code for present weather, as given in M.O. 242, pages 39-41, will be used; but I should prefer the following modifications in the code for present weather for the Icelandic reports.

Instead of readings 00-19, I suggest the following:—

No precipitation at the station nor visible in its neighbourhood.	Cloudiness 10 or 0	-	-	-	00
	" 1	-	-	-	01
	" 2	-	-	-	02
	" 3	-	-	-	03
	" 4	-	-	-	04
	" 5	-	-	-	05
	" 6	-	-	-	06
	" 7	-	-	-	07
	" 8	-	-	-	08
No precipitation at the station but visible in its neighbourhood.	" 9	-	-	-	09
	Cloudiness 10	-	-	-	10
	" 1	-	-	-	11
	" 2	-	-	-	12
	" 3	-	-	-	13
	" 4	-	-	-	14
	" 5	-	-	-	15
	" 6	-	-	-	16
	" 7	-	-	-	17
	" 8	-	-	-	18
	" 9	-	-	-	19

In this code, 00 signifies sky covered with cloud as well as absolutely cloudless, but the latter case is easily discernible in that no cloud is observed, which is reported as a hyphen (-) in the place of "a." When the sky is covered with cloud, the form of cloud is always reported. When cloud is observed, the cloudiness being below 1, either 01 or 11 should be reported.

If this modification of the code for present weather could be introduced into the Iceland reports, I could dispense with N in the reports, the normal Iceland report might then be composed of the following three groups:—

BBBDD FwwTT cbWVa

ww being the modified code for present weather. The extra group in the morning reports might then either be

$B_2B_2B_2c_2b_2$  or  $B_2B_2c_2b_2H$

the suffix 2 referring to the barometer and tendency at 1 a.m. G.M.T.

Reykjavik,  
August 12th, 1921.

#### ANNEX 4.

### MEMORANDUM ON WIRELESS WEATHER REPORTS FROM SHIPS.

By Professor V. BJERKNES, Director of the Geophysical Institute, Bergen, Norway.

April, 1921.

A/S John Griegs,  
Boktsykkeri  
M. Nilssen & Son,  
Bergen.

[This Memorandum has already been circulated by the Bergen Institute.]

#### ANNEX 5.

### NOTE ON PROFESSOR BJERKNES' MEMORANDUM ON WIRELESS REPORTS FROM SHIPS AT SEA.

By Lieut.-Colonel E. GOLD.

1.—(a) A uniform system of meteorological reports is even more desirable in the case of ships at sea than in the case of stations on land. The reports from land stations are collected at a central office and transmitted to other central offices, and although variations in the codes are certainly inconvenient, it is relatively simple at a central office to keep a note of such variations and to interpret the reports which are received regularly every day. In the case of ships at sea, however, the reports may be sent from one ship to another or from any ship to any local meteorological office. The development of meteorology at sea depends very largely upon the application of the synoptic method on board ship. It will greatly facilitate this application if all reports from ships of all nationalities are made according to a uniform international code.

(b) Limitations in the number of ships at sea and in the funds available for transmitting meteorological reports, make a ship practically an isolated meteorological station in a way in which very few fixed stations are isolated. Comparison with neighbouring reports is not usually possible in the case of ships at sea, especially in regions far distant from land and where the density of shipping is very much less than it is on certain routes in the North Atlantic. It is, therefore, essential to the best use of ships' reports, that the meteorologist should be able to assure himself that errors of transmission do not exist. It is true, as Professor Bjerknes remarks, that telegraphic errors are not more numerous in wireless messages from ships than in wireless messages ashore, but (1) telegraphic errors are more numerous in wireless messages ashore than they are in land-line messages, and (2) if there were no check by means of neighbouring stations, it would be essential, even in wireless messages on land, to have some method of correcting errors of transmission.



2. It is true that a ship at sea is in a particularly favourable situation for meteorological observations; but in the case of a moving steamship, there remain serious difficulties to be surmounted before the precise accuracy, which Professor Bjerknes demands, can be achieved. The movement of the ship introduces a difficulty in the exact measurement of the direction and speed of the wind. This difficulty is largely overcome by observation of the effect of the wind upon the surface of the sea. Further, a steamship, even more than a sailing ship, affects the temperature of the air surrounding it, and the exact measurement of the air temperature, when a ship is almost at rest relative to the air, is a matter of considerable difficulty. Appreciable errors certainly exist in all cases where the thermometers are placed in a screen in a fixed position on the ship.

It is much easier to get an accurate measurement of the temperature of the surface water of the sea than to get an accurate measurement of the temperature of the air. I would, therefore, suggest if any modification appears desirable in the code for reports from ships at sea, the practice of leaving the temperature of the air in whole degrees should be maintained and provision should be taken for obtaining the temperature of the sea to the nearest tenth of a degree. (It may be added that reports from ships at so small a distance apart as 100 kilometres will occur very infrequently, even in the North Atlantic. In other parts of the world they will be still less frequent.) The requisite figure for giving the temperature of the sea to the nearest tenth of a degree might be provided for in the code by the omission of "r"—time of beginning of rainfall.

3. Professor Bjerknes' principal objection is to the use of check figures in these reports. The code, with check figures, has been in operation for some time in reports from ships in the Atlantic to the British Meteorological Office. The check figures proved most valuable. Errors in transmission occur in about one message out of every four, and in practically every case the check figures enable the error to be corrected. An individual case may be quoted of a wireless message received on May 2, in which a whole group of five figures was lost in the reception. The check figures enabled the missing group (which contained the height of the barometer and the direction of the wind) to be replaced, and the message utilised with confidence in its accuracy. One of the principal advantages derived from the check figures depends upon the importance of *unexpected variations* in the weather map. When only one report comes from a large area and the report indicates conditions very different from those which would be anticipated from the synoptic charts based on the reports from land stations, the ship's report can be used with confidence and the forecast made in accordance with it, if the report includes check figures; otherwise the forecaster does not know whether or not he should reject the report. Without the check figures, the report can only be accepted with confidence when it agrees with the preconceived idea of the forecaster as to the distribution at sea, *i.e.*, when it has little or no influence in modifying a forecast based upon the land reports. This advantage of check figures is one on which too great stress cannot be laid. It would be a definitely retrograde step to give up accuracy and confidence in the simple reports of the principal elements, for the hypothetical advantage of obtaining the temperature of the air to a tenth of a degree and of securing the non-meteorological information about the course of the ship.

Progress in forecasting is not achieved by throwing upon the forecaster the onus of discarding observations which appear to be doubtful owing to the risk of telegraphic errors. The fundamental information required from ships at sea is the height of the barometer, the direction and force of the wind, temperature of the air, and the state of the weather. It would be better to sacrifice everything else to secure accuracy in these five, if that accuracy could not otherwise be achieved. Actually,

by Dr. Simpson's code, this accuracy is achieved and a considerable amount of extremely useful additional information is also provided.

London,

June 29th, 1921.

#### ANNEX 6.

#### SUMMARY OF W/T WEATHER REPORTS FROM SHIPS.

From W/T Registers received up to August 25th, 1921.

Ship.	No. of messages sent.	No. relayed through other ships.	Number correctly transmitted.	Errors found by check.	Not corrected by check.
Adriatic -	45	4	37	7	1
Aquitania -	25	3	19	6	—
Berengaria -	16	1	14	1	1
Cedric -	77	1	61	14	2
Celtic -	64	1	56	7	1
Lapland -	18	1	16	2	—
Mauretania -	62	4	51	11	—
Olympic -	68	4	60	7	1
Orbita -	23	2	15	8	—
Orduna -	28	4	19	7	2
Saturnia -	29	4	25	3	1
Totals -	455	29	373	73	9

London,

August 25th, 1921.

#### ANNEX 7.

#### NOTES ON THE PROPOSED CODES OF M.O. 242.

By Dr. HESSELBERG, Director of the Meteorological Institute, Norway.

#### 1. On the Use of Check Figures in the Code for Reports from Ships at Sea.

As Colonel Gold states in his memorandum, a uniform system of meteorological reports is even more desirable in the case of ships at sea than in the case of stations on land. It is, therefore, necessary to come to a compromise as to the check figures. I therefore propose:—

- (a) that check figures are given only for the obligatory part of the reports from ships at sea.
- (b) That the check figures are given in two special groups.
- (c) That these groups of check figures might be omitted.

To take concrete example:—

If the ship code be

GGLLL 1111Q BBDDF wwVSd ANTTT tttWr

the first four groups contain all the obligatory reports. Writing these groups in vertical order, we have

GGLLL  
1111Q  
BBDDF  
wwVSd

Vertical addition gives  $y_1y_2y_3y_4y_5$ .

Horizontal addition gives the second groups of check figures:  $x_1x_2x_3x_4x_5$



2. *About the Code proposed by V. Bjerknes for Ships at Sea.*

(a) It might be advantageous to change the order of the observation in the following way:—

GGLLL 1111Q BBVDD FwwSd ANTTT ttWw

We have then the wind direction, wind force and weather, in the places where we are accustomed to find them in the land code.

(b) If it is desirable to save a figure, it can be done in the following way:—

Instead of Q, we introduce O, the octant of the globe according to the code:

1	0-90 W.	} Northern Hemisphere.
2	90-180 W.	
3	180-90 E.	
4	90-0 E.	} Southern Hemisphere.
5	0-90 W.	
6	90-180 W.	
7	180-90 E.	
8	90-0 W.	

At the same time, 50 is added to GG for ships giving temperatures in degrees Celsius.

We then can spare a figure and have the code:—

GGLLL 111Op BBVDD FwwSd ANTTT ttWw

where p is that observation which it is desirable to introduce, *i.e.*, the humidity H.

3. *On the Code for Land Reports.*

(a) In the proposed code for the visibility, there are not sufficient numbers for the great visibilities. In the code for the weather, therefore, the numbers 03 and 13 give "visibility over 50 kilometres." This is not convenient. I therefore propose that visibility is given in a scale 0-10, where the numbers 0-8 have the same meaning as in the present code, and,

9 Objects not visible at 30,000 metres (20 miles).

10 Objects visible at above 50,000 metres (35 miles).

The number 10 can be telegraphed as 0, as we, by means of ww and h can see if the number 0 in the telegram means 0 or 10.

In the code for the weather, the numbers 03 and 13 might give "precipitation within sight," that it is most desirable to have in the code for present weather.

(b) As several countries have introduced the new code, it might seem inconvenient to make greater changes of it. I will, however, mention that it is possible to put two figures into the group giving the number nn of the station. That should presumably be figures, the use of which is not generally acknowledged, so that countries which will not give these might omit them without difficulty.

Without proposing anything, I will mention the following code:—

nnrs BBBDD FwwTT cbbWH ALaNH RRSV,V  
mm  
MM

Here not only the hour of the beginning, but also the hours of the cessation of the precipitation is given. Further, we have two figures for the amount of barometric tendency. A disadvantage is that the visibility only is given in the morning and the evening reports.

4. *On the Code for Reports from Iceland and the Faero Islands.*

In addition to the memorandum of Director Ryder, I propose that the following additional groups are given from Thorshavn and one Icelandic station:—

In the morning report - - ALaNH RRSV,r C<sub>1</sub>ddVV  
In the afternoon report - - ALaNH C<sub>1</sub>ddVV  
In the evening report - - ALaNH RRSV,r

The total amount of groups in the proposal of Director Ryder is 60. The groups given above from two stations give 14 groups more, or in all 74 groups.

Bergen,

August 6th, 1921.

## ANNEX 8.

MEMORANDUM BY HEAD OF BRITISH DELEGATION TO THE  
TECHNICAL COMMITTEE ON INTERNATIONAL RADIO-  
COMMUNICATIONS.—Paris, June, July and August, 1921.

6th September 1921.

To the President,

International Commission for Weather Telegraphy.

The Technical Committee, consisting of representatives from the United States, France, Great Britain, Italy and Japan, was convened by the French Government, at the request of the Conference on Electrical Communications held at Washington in October 1920, in order to consider certain technical Radio questions for which the latter conference had been unable to find satisfactory solutions.

The result of the work of the Committee is contained in a document, the final edition of which will be circulated to all nations by the French Government. Certain portions of the document deal with the transmission and reception of meteorological radio-telegrams, and, as head of the British delegation, I have been requested by the Committee to communicate to you these particular portions for the information of the forthcoming meeting of the International Committee for Weather Telegraphy.

Accordingly the particular portions of the document which concern meteorological telegrams are given as enclosures to this memorandum.

I am further to inform you that the French Government will communicate the above information to you officially in due course.

(Signed) I. F. BLANDY,

Group Capt. R.A.F.

Head of British Delegation.

## QUESTION No. 4.

*Time-Signals, Meteorological, &c.*

To ascertain whether time-signals, meteorological telegrams, &c., should be transmitted on specified standard wave lengths, or whether they should be transmitted on any wave between definite limits.

*Answer to Question No. 4.*

1. In principle, stations shall transmit time-signals, meteorological bulletins and warnings to navigators, on those frequencies and classes of waves on which they are allowed, by Appendix II. of the draft regulations, to transmit their regular traffic.

2. Stations which at present transmit the signals indicated above on damped waves, shall be allowed to continue transmission on their present waves, until a date to be fixed by the next International Conference on Electrical Communications.

3. After the date so fixed the 500 kc/s (600 m.) wave shall not be employed for such signals, except that it may be used by mobile and land stations for telegrams of an urgent character involving the safety of navigation.

4. In addition to the frequencies and classes of waves indicated in paragraph 1, above, the damped wave of 113 kc/s (2,650 m.) is specially allotted for the signals therein mentioned.

5. Messages giving the observations made by the stations of the meteorological network, or by maritime meteorological stations, which do



not include either storm warnings, or information of interest to navigators, shall be transmitted on frequencies and classes of waves ordinarily permitted to the stations for handling their regular traffic.

6. The exact times of transmission for each station should be decided upon by international agreement.

#### QUESTION No. 14 (c).

##### *Meteorological Service.*

1. The Technical Committee on International Radio-communication desires to notify the International Commission of Weather Telegraphy, that their proposals have been considered and have been found quite feasible so far as Radio-Telegraphy is concerned, except as regards the recommendation (h) concerning the issue of collective reports by the Eiffel Tower (spark). The Committee is of opinion that this service should be conducted in accordance with art. CX\* of the Washington Draft, also paragraphs 1 and 5 of the Committee's answer to Question No. 4 in this document.

#### \* Art. CX. :

1. The Administrations of neighbouring countries will arrange to organize a sufficiently complete service of routine transmissions, giving to mobile stations time, meteorological bulletins, and warnings to mariners.

2. The times of transmissions of these three categories of signals shall be fixed in such a manner as to enable them to be received by ships at sea having only one certificated telegraphist.

As a general rule time signals should terminate at an exact hour or half hour, Greenwich time; meteorological bulletins and warnings to mariners should commence at an exact hour, Greenwich, and the total duration transmission must not exceed 12 minutes. The daily number of transmissions from each station shall not exceed two for time signals and four for meteorological bulletins and warnings to mariners.

3. As a general rule, during this transmission all radio-telegraph stations whose transmission might disturb the reception of these signals and telegrams shall keep silence, so as to allow all stations which desire to do so to receive these telegrams and signals. An exception shall be made in the case of distress messages and state telegrams.

4. Radio-telegraph stations which have to transmit to mobile stations information involving safety of navigation and being of an urgent character (icebergs, derelicts, cyclones, typhoons, sudden changes in the position or form of fixed obstructions or of land marks) shall transmit such information on 600 metres.

5. The Governments of the contracting states will select the stations which are to send out to mariners safety information of an urgent character. When the information in question has been sent out by stations performing the time service, it shall be again sent out after the transmission of the time signal, and the meteorological bulletin.

6. In addition to the routine transmission mentioned in paragraph 1, the administrations may make, in agreement with the meteorological services, and with the services of maritime information, such arrangements as are necessary to furnish meteorological bulletins and warnings to mariners to certain specified fixed stations, such messages containing information affecting the region of these stations. These telegrams, the text of which shall be as short as possible, shall be sent to such mobile stations as ask for them.

#### *Meteorological Data Messages from Mobile Stations.*

7. The Meteorological data messages made by certain mobile stations appointed for that purpose by the country to which they belong, may be sent to the fixed stations authorised by the administrations concerned to receive them, who shall also appoint the meteorological offices to which these observations shall be addressed by the fixed stations.

#### *Time Signals, Meteorological Bulletins and Messages for the service other than that of ships.*

8. In addition to the signals specified in paragraphs 1 and 6 above, the administrations shall be at liberty to organize national or international services of time signals and of meteorological bulletins or synoptic messages for the benefit of services other than that of ships.

2. The wave lengths used by the Meteorological Service should be those which the Radio-Telegraph stations normally employ. It is recommended that a copy of the restrictions on this subject, passed by the Technical Committee on International Radio-communication, should be forwarded to the International Commission of Weather Telegraphy, for information.

3. An extract\* from the report of the International Commission on Weather Telegraphy has been drawn up for the information of those interested in Radio-communication, and is appended hereto.

4. It is recommended that this subject be given special consideration at the next International Conference on Electrical Communications, and that the Meteorological Bureaux of the various Administrations be represented during the discussion on this subject.

#### ANNEX 9.

#### NOTE BY COL. E. DELCAMBRE SUR LE MAINTIEN DES TELEGRAMMES METEOROLOGIQUES PAR FIL

(Proposition de Monsieur de Quervain—Circulaire No. 5),†

5th September 1921.

#### A.—*Propositions Générales de l'Office National Météorologique de France.*

I.—L'échange de certains télégrammes par fil doit être maintenu—Mais il faut l'organiser.

II.—Il faut déterminer *quels télégrammes sont utiles*. L'échange actuel repose sur des conventions très anciennes. Il est désirable que chaque pays dresse la liste de ce qu'il reçoit et de ce qu'il envoie, et qu'il fasse éventuellement des propositions de modifications.

III.—Il faut que ces télégrammes arrivent *en temps voulu*. Ce n'est que très rarement le cas actuellement. Les différents Offices doivent échanger les heures de dépôt des télégrammes envoyés et les heures de réception des télégrammes reçus. Connaissant les retards, ils doivent se mettre en relation avec leurs services télégraphiques respectifs pour les diminuer (Exemple du résultat remarquable obtenu entre Zurich et Paris. Les observations suisses ne manquent pour ainsi dire jamais dans le radiogramme de la Tour Eiffel)—(Moyens : éviter adresses multiples, employer fil direct—Envoi des télégrammes à heures à peu près fixes).

IV.—Il faut baser l'organisation télégraphique sur l'organisation radio, c'est-à-dire concentrer par fil près de postes T.S.F. très puissants et diffuser à partir de postes recevant facilement.

#### B.—*Propositions particulières de l'Office National Météorologique de France.*

I.—L'Espagne peut-elle envoyer aussitôt après 18 heures des télégrammes d'observations de 18 h. (pour 4 ou 5 stations au moins) (et non plus le lendemain avec les télégrammes d'observations de 7 heures)?

II.—L'Espagne peut-elle envoyer des télégrammes d'observations de 18 heures à Météo. Rabat?

III.—Mêmes demandes pour le Portugal.

IV.—Mêmes demandes pour l'Italie.

V.—Les télégrammes des Iles de l'Atlantique (Açores, Canaries, Madère) peuvent-ils être acheminés plus rapidement (en employant au besoin la transmission mixte T.S.F. et télégraphe comme il est prévu pour l'Islande—M. O. 242, page 36)?

Des télégrammes de ces Iles peuvent-ils être envoyés rapidement à Météo. Rabat?

\* Extract—Page 37 para. 14 and pages 42, 43, 44 and 45 (para. 2 (a) to (k))—Report of Sub-Committee on the organization of the transmission of Reports by Radio-Telegraphy.

† "The messages by ordinary telegraphy should not be discontinued until after the complete service by wireless telegraphy has been introduced."



## ANNEX 10.

## MEMORANDUM BY COL. E. DELCAMBRE.

## PROJET D'ORGANISATION MÉTÉOROLOGIQUE INTERNATIONALE DANS L'ATLANTIQUE NORD.

3rd September, 1921.

## I.—La Solution est Urgente.

A.—La réception en Europe d'un réseau suffisant d'observations atlantiques ferait passer la portée des prévisions du temps sur le continent de 1 jour à 3 jours. Nous n'insisterons pas sur cet avantage capital, qui est, croyons-nous, universellement reconnu.

B.—Une autre nécessité a été moins bien mise en évidence : celle d'établir une prévision pour l'Atlantique même, et de la communiquer aux bateaux en cours de traversée.

Cette nécessité s'impose pourtant au premier examen :

1°.—Les statistiques indiquent la présence simultanée, sur les routes de l'Atlantique entre l'Amérique du Nord et l'Europe Occidentale, d'une moyenne de 300 navires de plus de 5,000 tonnes de déplacement. Les prévisions météorologiques intéresseraient évidemment tous les marins, surtout ceux qui font route sur l'Ouest†, et détermineraient très fréquemment, pour ceux qui pratiquent la navigation à voile, d'opportuns changements de route.

2°.—Le trafic transatlantique aérien sera sans doute réalisé dans un avenir prochain. Mais un service de prévision pour l'Atlantique en est évidemment une condition de possibilité essentielle. Nous rappellerons simplement que lorsque le dirigeable R 34 accomplit cette traversée, la Grande-Bretagne a établi un service météorologique à l'aide de navires échelonnés sur la route et communiquant avec l'Aéronef. C'est grâce à cette organisation que le R 34 évita dans le voisinage de l'Amérique un orage violent qui aurait pu lui être fatal.

## II.—Elle ne peut consister en une simple liaison entre les Navires et le Continent. La Solution qui s'impose.

A.—Il est impossible de prendre d'Europe les radiogrammes de navires à une distance suffisante parce que :

1°.—La portée d'émission du poste radio d'un navire ne dépasse pas actuellement 300 à 500 kilomètres, et l'expérience a montré que la retransmission de navire à navire est extrêmement pénible, au moins dans le voisinage du continent, où le trafic radio devient considérable. Quand bien même les navires seraient dotés de poste émetteur à arc (2,000 kilomètres environ), les renseignements qui pourraient être ainsi rassemblés en Europe s'étendraient jusque sur le 30° W. de Greenwich. Cette amélioration serait à la rigueur suffisante pour la prévision sur le continent, elle ne résoudrait pas le problème de la prévision pour les routes atlantiques.

2°.—La communication entre de multiples navires et les postes d'écoute continentaux serait difficile et très lente, à cause de l'encombrement du trafic radio qui, dans la zone comprise entre le 15° W. de Greenwich et le continent, s'établit quand les navires arrivent à portée des postes côtiers. Notons de plus qu'il est très difficile d'assurer l'écoute en Europe des météo américains nécessaires à l'établissement des prévisions pour l'Atlantique. Cette écoute sera beaucoup plus facile sur l'Atlantique (Distance moins grande; postes brouilleurs plus éloignés).

† En effet; 1°.—les phénomènes météorologiques progressant très généralement vers l'est, un navire qui va d'Europe en Amérique marche vers l'inconnu, il croiera un beaucoup plus grand nombre de phénomènes que celui qui fait route vers l'Est et qui accompagne le mouvement général de l'atmosphère.

2°.—les mauvais temps, sont généralement de S.W. ou de N.W., le vent et la houle d'avant sont plus mauvais que d'arrière.

3°.—les navires de commerce sont toujours moins chargés dans le sens Europe-Amérique que dans l'autre, donc plus sensibles au gros temps.

B.—Une station collectrice située sur l'Atlantique même (nous en discuterons plus loin le mode de réalisation) s'impose donc d'autant plus que la rarefaction relative du trafic radio en plein Atlantique permettra à cette station de faire elle-même sa discipline radio, de choisir les observations à écouter pour une bonne répartition dans l'espace, d'utiliser enfin des navires comme relais pour étendre son rayon d'action. Ajoutons tout de suite que la Station Atlantique ne devra pas seulement jouer le rôle de central collecteur et réexpéditeur, mais même élaborer elle-même la prévision pour les routes atlantiques. Cette opération ne doit pas en effet être réalisée sur le continent parce que :

1°.—L'envoi des renseignements à la station de prévision du continent et le retour à la Station Atlantique, pour y être diffusée, de la prévision élaborée sur le continent constituent une perte de temps importante;

2°.—Surtout l'élaboration de la prévision pour l'Atlantique par la Station Atlantique elle-même présente tous les avantages de la prévision régionale sur la prévision à grande distance. La Station Atlantique pourra converser avec les navires observateurs. Elle pourra enquêter, le cas échéant, en les attaquant; inversement elle pourra être attaquée par eux et leur fournir des renseignements complémentaires. Elle pourra enfin, beaucoup mieux qu'une station éloignée, sélectionner les observations, filtrer celles qui sont douteuses.

3°.—Le point de vue spécial des possibilités radio, montre que l'émission amortie puissante nécessaire pour communiquer la prévision aux navires en mer, serait très difficile à caser sur le continent où elle troublerait tout le trafic radio. Sur l'Atlantique le trafic étant bien moins dense, elle sera beaucoup moins gênante, du reste la Station Atlantique étant plus à portée des intéressés, cette émission amortie n'aura pas besoin d'être aussi puissante que si elle était faite à terre; de ce fait le trouble apporté à l'ensemble du trafic sera encore diminué.

Enfin s'il était nécessaire de réduire le trafic radio-météo. entre l'Atlantique et le continent, il serait possible, si la Station Atlantique est équipée en station de prévision, de lui faire envoyer en Europe non pas le relevé brut et complet des observations recueillies, mais une première élaboration synthétique de ces observations, une direction de prévision en quelque sorte.

4°.—L'élévation de la Station Atlantique au rang de station "intelligente," c'est-à-dire sa dotation en outillage au complet et en personnel véritablement compétent, permettra d'en faire un merveilleux laboratoire de recherches météorologiques d'autant que les phénomènes météorologiques se présentent constamment sur l'Océan avec une régularité et une pureté tout autre que sur le continent où ils viennent se briser.

## III.—Comment réaliser la Station Atlantique.

Les Açores sont trop au sud des routes directes à gros trafic. Il n'y a pas de fonds suffisamment élevés pour ancrer un navire. Il existe bien un projet de "l'île flottante," sorte de ponton doté de moteur pour se maintenir dans une zone fixe, et destinée à servir d'escale dans le trafic aérien futur. Sans vouloir décider de la possibilité technique de cette entreprise colossale, il est évident que les difficultés et son prix très élevé en reportent l'application à une échéance assez éloignée. Une autre solution doit donc être envisagée au moins à titre provisoire. On pourrait évidemment imaginer plusieurs stations installées sur des bateaux-navettes et entrant en action dans une zone déterminée (ces bateaux étant assez nombreux (au moins 4) pour que l'utilisation de la zone ainsi choisie soit continue). Cette solution définitive présenterait peut-être un avantage au point de vue financier, la dépense étant réduite du fait que les navires pourraient être utilisés commercialement. Mais la complication présente de multiples inconvénients : immobilisation d'un personnel technique de multiples inconvénients : immobilisation des navires, &c. . . Il ne reste qu'une solution, la seule logique : l'équipement d'un stationnaire ou plutôt d'un navire croisant sur place, ou du moins dans une zone de faible diamètre,



Le diamètre minimum est déterminé par la condition que le navire puisse se maintenir, le cap au vent, pendant tout le passage d'un gros temps; à raison d'une vitesse de quelques nœuds à l'heure, cette condition donne un diamètre de 200 milles environ.

Quant aux caractéristiques du navire elles devront, semble-t-il, s'approcher des suivantes :

Tonnage : 2,500 tonnes de déplacement pour présenter une résistance suffisante au gros temps.

Type : Voilier à moteur auxiliaire pour réduire au minimum la dépense de charbon.\*

Bien entendu, il faudrait deux navires de ce type se relayant tous les cinquante jours par exemple.

La dépense totale résultante peut être évaluée, au grand maximum, à 7,500 francs papier par jour, soit : 2,700,000 francs papier par an—se décomposant ainsi : (amortissement des navires, assurances, intérêts du capital, charges obligatoires, frais généraux, équipage de 30 hommes), 6,000 francs ; Personnel technique (20 météorologistes et radios), 1,200 francs ; Matériel radio (amortissement et fonctionnement) 300 francs.—(Poste émetteur puissant, 2 récepteurs).

Les observations simultanées des navires pouvant être recueillies par la Station Atlantique, pourront d'autre part être évaluées à 40, et à raison de 4 heures fixées par jour. On voit que l'observation reviendrait au total à un peu plus de 60 francs papier† ce qui n'est pas cher si l'on songe que toutes les puissances européennes (et même les Etats-Unis d'Amérique, non pour la prévision sur leur continent, le mouvement général de l'atmosphère étant d'Ouest, mais pour la prévision à destination de leur marine marchande) étant intéressées au fonctionnement de la Station Atlantique, une coopération doit pouvoir être réalisée et la dépense répartie.

Nous avons réservé jusqu'ici le choix de la zone de stationnement. Elle nous paraît s'imposer entre le 25 et le 35° W. Greenwich, et 47-49° Nord parce que :—

- (a) elle est située sur la route du trafic maximum ;
- (b) les trajectoires de baisses américaines qui traversent l'Atlantique suivent généralement deux routes qui abordent l'Europe, l'une sur l'Irlande, l'autre vers l'Islande (cas où les hautes pressions des Açores remontent vers le Nord et y rejettent les variations). La divergence de ces routes est suffisamment nette vers le 30° W. pour qu'elles puissent y être distinguées.
- (c) elle est au voisinage de régions de formation des baisses océaniques.
- (d) Cette position est suffisamment centrale pour que la communication radio soit faite avec les deux continents et suffisamment éloignée de la zone tropicale pour que les réceptions ne soient pas gênées par les parasites atmosphériques.

#### IV.—La Leçon des Essais du "Jacques Cartier."

Sur le "Jacques Cartier," navire école de la marine marchande de la Compagnie Générale Transatlantique de France, il a été procédé cette année par les soins de MM. Adeline et Coyecque, professeurs sur ce navire-école, à des essais du plus haut intérêt.

Le "Jacques Cartier" prenait le météo. américain et les météo. Europe émis par la Tour Eiffel; d'autre part il attaquait les navires, passant à sa portée, pour leur demander un message d'observations de 7 heures du matin. Une prévision était élaborée chaque jour à bord suivant les méthodes de l'Office National Météorologique (étude de l'évolution de

noyaux de variation de pression et étude directe de l'évolution des systèmes nuageux); cette prévision qui a donné de très bons résultats était diffusée par radio, en Français et en Anglais, à destination des navires en route. En outre quand le "Jacques Cartier" était suffisamment près de l'Europe il transmettait ses observations en France.

En somme le "Jacques Cartier" a réalisé une première ébauche de la Station Atlantique de centralisation, de prévision et de diffusion—Station qui n'était malheureusement pas maintenue dans une zone fixe.

Malgré la faible portée de son poste émetteur, qui ne lui permettait pas d'interroger les navires au delà de 150 milles, le "Jacques Cartier" arrivait à recueillir en moyenne 5 à 6 observations pour une heure donnée. Ce résultat est remarquable quand on songe que les navires n'étaient pas prévenus, qu'aucune entente préalable n'avait été établie avec les compagnies, ni même aucun avis donné. L'initiative du "Jacques Cartier" a rencontré le meilleur accueil: les navires interrogés ont répondu avec beaucoup de bonne volonté, se pliant d'eux-mêmes à la discipline radio., servant bénévolement de relai avec des navires plus éloignés (cette opération pratiquement impossible au voisinage du continent où le trafic radio. est trop considérable est par contre facile en plein Océan) et ils se sont intéressés à la prévision fournie, demandant même parfois des renseignements complémentaires. On peut donc conclure de cette expérience :

1° qu'un service de centralisation de renseignements et de diffusion de prévision vraiment organisé réussirait d'emblée, et jouirait très vite d'une "popularité" considérable sur l'Atlantique.

2° qu'en plein Océan où le trafic est relativement faible, la centralisation des renseignements, même avec relai, ne présente pas de difficulté, s'organisant pour ainsi dire automatiquement par l'entente des opérateurs.

Les études pour la prévision faites par le "Jacques Cartier" ouvrent d'autre part des perspectives très intéressantes sur la météorologie dynamique de l'Atlantique. Ce n'est pas ici le lieu de développer ce côté de la question; nous tenons néanmoins à signaler que l'application aux noyaux américains et océaniques de la méthode des variations semble montrer :

1°/que presque tous les noyaux américains traversent l'Atlantique, soit qu'ils viennent aborder l'Europe vers l'Irlande, soit que, rejetés par les hautes pressions des Açores, remontées vers le Nord, ils passent à hauteur de l'Islande. Ce phénomène de la traversée complète de l'Atlantique par les mouvements atmosphériques a été contesté jadis parce qu'on a fait porter l'examen sur les dépressions dont on perd la trace quand le champ isobarique est un peu accidenté; mais il apparaît clairement si on isole le phénomène actif, c'est-à-dire le noyau de variation.

2° que vers le 30 ou 35° W. Greenwich se trouve un nid de formation de baisses océaniques.

3° que sur l'Océan les noyaux de variation de pression et les systèmes nuageux se déplacent plus régulièrement que sur le continent où ils viennent en quelque sorte se briser. Ce dernier résultat, s'il est confirmé, est fort intéressant, car il permet d'espérer que la prévision sur le continent, portée de 1 jour à 3 jours grâce à la Station Atlantique, ne sera pas moins précise qu'à un jour parce que les phénomènes dont le passage aura été signalé par la Station Atlantique se conserveront suffisamment pendant les deux premiers jours.

Terminons en disant que le Chef du Service des Avertissements de l'Office National Météorologique embarquera en décembre sur le "Jacques Cartier"; au cours de cette traversée, la question de la prévision sur l'Atlantique pourra être définitivement mise au point.

Il sera fait part aux divers Services Météorologiques Européens des résultats obtenus par une note qui leur sera adressée au cours du premier semestre de 1922.

\* Types bien définis qui pourront être utilisés : garde-pêche, navire scientifique (modèle "Princesse Alice" ou "Pourquoi-Pas") Bateau câble, bateau de la flotte d'Etat français ou schooner américain qui seraient cédés à bon compte.

† Encore convient-il de remarquer que les frais à payer pourront être allégés au titre des budgets météorologiques, du fait que la Station Atlantique servirait sans doute à d'autres travaux, par exemple océanographiques.



## APPENDIX VI. A.

## UNIT OF WIND VELOCITY.

Note by Lt.-Col. E. Gold.

DEAR SIR NAPIER SHAW,

1. The International Commission for Weather Telegraphy recommended at the Third Meeting (M.O. 242, p. 33, Minute 7) that the horizontal speed of the wind in reports of the upper air should be expressed in kilometres per hour, the Beaufort scale being retained in telegraphic reports and surface observations. The Commission made no recommendation with regard to the tabulation of wind speed from anemometers at the surface, but it would clearly be desirable to use the same units for the speed of the wind to whatever level the value refers.

2. The question of the unit to be used for the velocity of the wind appears to have been considered by the International Conference at Leipzig in 1872, when the recommendation of the sub-committee that "the velocity should be given in metres per second in agreement with the unit which is taken in all physical works" was adopted. It is not at all clear that any discussion took place as to the relative advantages of metres per second and kilometres per hour. In the appendix to the report of the Leipzig Conference opinions are expressed practically invariably for kilometres per hour. Portugal (Appendix III., paragraph 10) uses kilometres. Fritsch, Salzburg, (Appendix IV., paragraph 10) recommends metres per second. Mohn, Christiania (Appendix VIII., paragraph 10) recommends kilometres per hour. Professor Ragona, Modena, (Appendix XI., paragraph 10) recommends kilometres per hour.

3. The decision to use metres per second was indirectly reaffirmed at Munich in 1891, but on that occasion the conference appears to have been more concerned with the correction factors of anemometers than with the actual unit in which the velocities should be expressed. The decision to use metres per second was merely subsidiary to the decision to give the values obtained from the instrumental indications by means of a formula of reduction of which the constants have been determined either directly or indirectly.

4. It appears therefore desirable that this matter should be more fully discussed, especially in view of the fact that the decision of the Leipzig Conference has not been put into practice in the majority of countries using the metric units. From the published volumes for different countries using metric units, the enclosed table has been prepared and illustrates how widespread already is the practice of using the kilometre per hour. It does not claim to be complete, but it illustrates the necessity for a common agreement.

5. The recommendation of the kilometre *per hour* as the unit is based on practical considerations. The speed of aeroplanes is reckoned in kilometres *per hour*; the speed of trains is reckoned in kilometres *per hour*, or in miles *per hour* in countries using the British units; the speed of ships is reckoned in knots or nautical miles *per hour*. In fact, practically all speeds comparable with the speed of the wind are reckoned with the hour as the unit of time. When greater speeds occur, as in gunnery, the second is used as the unit of time; when lesser speeds occur, the day is often used.

6. It appears desirable that an international agreement should be made with regard to the units to be used in tabulations of wind, and I should like to ask if this question can be placed upon the agenda for discussion at the forthcoming meeting of the International Meteorological Committee.

7. The usual practice in the publication of upper winds, has hitherto been to use the metre per second as the unit, and I am asking Professor Bjerknes to include the question of the future unit on the agenda of the meeting of the Upper Air Commission at Bergen in July, with a view to arriving at a recommendation from that Commission to the International Meteorological Committee.

Yours sincerely,  
(Signed) E. GOLD.

27.4.21.

*Units used for Tabulations of Velocity of Wind in certain Countries using the Metric System.*

Country.	Place.	Unit.
Russia	Ekaterinburg	Metres per second.
	St. Petersburg	
	(Pavlovsk)	Kilometres per hour.
	Moscow	Apparently kilometres per hour ( <i>i.e.</i> , values of 40 show it cannot be metres per second).
Germany	Bavaria	Metres per second.
	Potsdam	Metres per second.
France	Paris	Metres per second.
	Nantes	Metres per second.
	Marseilles	Kilometres per hour.
	Algiers	Kilometres per hour.
	Langres	Kilometres per hour.
	Dunkirk	Kilometres per hour.
	Perpignan	Metres per second.
	Toulouse	Metres per second.
	Nice	Metres per second.
	Bordeaux	Kilometres per hour.
Italy	Lyons	Metres per second.
	Puy de Dome	Metres per second.
	Venice	Kilometres per hour.
	Genoa	Kilometres per hour.
	Pola	Kilometres per hour (but averages also in metres per second).
Austria	Vienna	Kilometres per hour (but average hourly values are also given in metres per second).
	Sonnblick	Kilometres per hour.
Japan	-	Metres per second.
Egypt	Cairo	Kilometres per hour.
Switzerland	-	Kilometres per hour.
China	Zi-ka-wei	Kilometres per hour.

(Signed) E. GOLD.

27.4.21.



## APPENDIX VII.

REPORT OF  
JOINT MEETING  
of theCOMMISSIONS FOR MARITIME METEOROLOGY, WEATHER  
TELEGRAPHY, AND THE APPLICATION OF METEOROLOGY TO  
AERIAL NAVIGATION.

September 10th, 1921.

Present: Sir Napier Shaw, in the Chair. Professor E. van Everdingen (President of the Commission for Maritime Meteorology), Lieut.-Colonel Gold (President of the Commission for Weather Telegraphy), Colonel Saconney (President of the Commission for the Application of Meteorology to Aerial Navigation), Professor V. Bjerknes, Colonel L. F. Blandy, Commander L. A. Brooke-Smith, Colonel Delcambre, Mons. P. H. Gallé, Lieut. H. D. Grant, Director Hesselberg, Commandant Jaumotte, Lieut. Kerguistel, Commander Ladonne, Colonel Matteuzzi, Dr. Okada, Dr. H. Pettersson, Professor A. de Quervain, Captain Ryder, Dr. G. C. Simpson, Director Wallén, Commander Garbett (Secretary).

1. The Chairman of the meeting (Sir Napier Shaw) stated that there was no precedent for a meeting such as that which was being held, and he proposed to ask the Presidents of the different Commissions to give brief accounts of the results of the meetings of their Commissions during the preceding week.

2. Colonel Saconney, President of the Commission for the Application of Meteorology to Aerial Navigation, said that his Commission had agreed:—

(a) Upon the form in which the meteorological information contained in hourly reports should be exhibited at aerodromes. This form ought to be adopted at all terminal aerodromes so that an aviator would be able to see at once the meteorological information so important for him, even if he had but an imperfect knowledge of the language of the country in which the aerodrome was situated.

(b) Upon the form of hourly messages which could be represented symbolically as follows:—

$$I_n I_n (V_s^*) \text{ wwVhL } \text{NDDFW } (\dagger C_{ddF_1S}).$$

$I_n I_n$  = Index figures of station.

$C_s$  = Form of cloud to which  $ddF_1$  refer.

(c) Upon the need for a meteorological guide which ought to be prepared by each country and which should give an account of meteorological conditions and especially of those meteorological peculiarities affecting aviation.

(d) Further it was considered that pilots on regular air routes would be able to give information of value for meteorological purposes and in particular it was hoped to arrange for photographs of clouds to be taken when exceptional forms were observed.

3. Some discussion took place in the joint meeting on the form of the messages for radiotelegraphy. The need for reduction in the length of messages which had to be sent by radiotelegraphy, was emphasised. It was pointed out that the new form for hourly messages meant a reduction of 30-50 per cent. in the messages sent at present at the hours

\* For sea stations only.

† Every three hours only.

intermediate between the hours of synoptic messages. It was eventually agreed, *nemine contradicente*, that:—

if additional information beyond that conveyed in the ordinary hourly reports were required every three hours or every six hours, the form of the three-hourly or six-hourly report should be the same as the form of the reports for synoptic messages with the addition of a group for motion of low cloud and state of sea, viz. —

BBBDD FwwTT cbWVH ALaNh C<sub>ddF<sub>1</sub></sub>S.

4. Professor van Everdingen gave an account of the proceedings of the Commission for Maritime Meteorology. The Commission had considered the proposals of the Commission for Weather Telegraphy for a code for reports from ships at sea, M.O. 242, pages 22-23, and the modifications proposed. The Commission recommended:—

(a) That the question of the retention of the check figures in the messages should be considered by the International Meteorological Committee after reference to the Directors of those Institutes who were making arrangements for reports by radio-telegraphy from ships at sea.

(b) That the fundamental messages should contain the information indicated symbolically by the following letters:—

PQLLL 11GG BBDDF wwVKd

which have the same meaning as the letters given in M.O. 242 with the addition of "P" which represents the day of the week. These four groups contain precisely the same information as the fundamental messages of six groups with check figures adopted in M.O. 242.

(c) If check figures are adopted, they should be incorporated in the messages in the manner recommended in M.O. 242.

(d) If further groups are added to give information additional to that contained in the groups specified, paragraph b, the form of these groups should be as follows:—

For countries using Fahrenheit degrees - CNTTd, WrttK'.  
For countries using Centigrade degrees - CNTTT Wrttt.

5. The Commission had also considered the question of the utilisation of the oceanographic information regarding temperature and salinity in the study of long range forecasting and they recommended that:—

Observations of temperature, current, and salinity should be taken and sent to a central oceanographic Bureau (Salinity by taking water samples and sending them for titration to a Fishery Institute).

6. The Commission had also considered the proposal of M. Wallén for the control of storm warnings and a proposal by Colonel Delcambre for a weather service of the Atlantic. They have been specially interested in the account which Colonel Delcambre had given of the experiment which had already been made on the "Jacques Cartier."

7. They had also considered the question of the selection of squares for the Réseau Mondial. In addition to the squares selected by the Dutch Meteorological Office, they recommended other squares to be chosen in the North Atlantic and North Pacific.

8. Colonel Gold stated that the Weather Telegraphy Commission had considered—

(a) The proposal for a new agreement with the Great Northern Telegraphy Company which had been drafted by Captain Ryder in accordance with the decisions at their last meeting and they considered that the arrangements offered a satisfactory solution for the distribution of the Icelandic reports.



(b) The Commission had also agreed upon an abbreviated general code to meet the special case of Iceland from which all the details given in the general code were not so essential for European meteorology as the more fundamental information from a greater number of stations. The code adopted agreed very closely with one proposed by the Director of the Icelandic Meteorological Service.

(c) The Commission had agreed upon a code for the collective continental issue by radiotelegraphy envisaged in paragraph (h), page 44 of M.O. 242. The form of the code adopted is as follows —

BBDDF  $w_1$ TTK'R for the observations at 0700 G.M.T.

BBDDF  $w_1$ TTK'W for the observations at other hours;

where  $w_1$  is the initial figure of the present weather code.\*

K' is a single figure for the barometric change.\*

R is the rainfall for the preceding 24 hours.\*

(d) The Commission had agreed further upon a revised table for the times of transmission of reports by radiotelegraphy to replace the table given on page 44 of M.O. 242. In this revised table account had been taken of the replies of the Directors of the different Meteorological Institutes indicating the arrangements which could be made in each country. It was a matter of great importance to ensure that reports should be available with the least possible delay and at the same time to avoid the overlapping of reports from neighbouring countries.

(e) The Commission had also agreed upon a revision of the code for visibility after having ascertained that the Commission for the Application of Meteorology to Aerial Navigation had no objection to the proposed change.

(f) The Commission had also learned of the proposals of the Commission for Maritime Meteorology with regard to the code for reports from ships at sea and accepted the proposals as satisfying the fundamental requirements of reports for forecasting purposes.

9. The President congratulated the Commissions on the work which had been achieved, and especially on their solution of the problem of the code for reports from ships at sea.

10. The meeting adjourned at 12.30 p.m.

#### APPENDIX VIII.

##### RAPPORT DE LA SOUS-COMMISSION POUR LA MÉTÉOROLOGIE AGRICOLE.

La sous-commission consistait de MM. Angot (président), van Everdingen, Ryder et Wallén.† Elle s'est réunie le 13 et le 14 Septembre, 1921.

La sous-commission rappela d'abord les notes historiques suivantes. Dans le rapport présenté au nom du Comité permanent à l'Assemblée Générale de l'Institut International d'Agriculture de 1920 le vice-président de l'Institut, M. Louis Dop, a proposé :—

"3. Vu l'article 111 des décisions prises par l'Assemblée Générale de 1913, l'Assemblée Générale est d'avis de compléter la Commission Permanente de Météorologie Agricole telle qu'elle résulte de la lettre du Président du Comité Météorologique International, Sir Napier, par la désignation de membres nommés par le Ministère de l'Agriculture de chacun des pays et choisis parmi les agronomes, les botanistes, les phytopathologues et les agrogéologues."

\* For specification see Appendix VI. Minutes of meetings of the Commission for Weather Telegraphy, pp. 87, 88.

† Mr. F. J. W. Whipple was unable to be present.

M. Dabat, au nom du Gouvernement Français, a présenté la contre-proposition, qu'au lieu de compléter avec des biologistes l'ancienne Commission de Météorologie Agricole rattachée à l'organisation météorologique internationale, on établisse une nouvelle Commission de Météorologie Agricole rattachée à l'Institut International d'Agriculture.

Dans la séance de la Commission chargée de ces questions M. Wallén a estimé désirable d'éviter d'avoir plus d'une commission de météorologie agricole et a proposé dans ce but que l'Assemblée Générale propose au Comité Météorologique International de compléter sa commission de météorologie agricole avec certains membres conformément à la proposition de M. Louis Dop. Mais, pour éviter de faire intervenir les gouvernements, l'Assemblée Générale de l'Institut d'Agriculture donnera elle-même la liste des membres qu'elle proposerait. (Voir les Comptes-Rendus de la 3<sup>me</sup> Commission de l'Assemblée Générale à Rome en 1920.) La proposition de M. Dabat a été adoptée par la dite Commission. Dans l'Assemblée Générale M. Wallén a lu une réserve exprimant la nécessité d'une co-opération très intime entre la météorologie agricole et les instituts météorologiques ainsi que l'organisation météorologique internationale, afin de réaliser tous les vœux importants au point de vue non seulement des observations météorologiques mais aussi des études d'écologie agricole. (Voir les Comptes Rendus de l'Assemblée Générale à Rome en 1920.)

La proposition de M. Dabat a été approuvée ensuite par l'Assemblée Générale.

Il ressort de cet historique que l'Institut International d'Agriculture a résolu de créer une nouvelle commission de météorologie agricole rattachée à l'Institut International d'Agriculture et composée de météorologistes, d'agronomes, de botanistes, de phytopathologues, d'agrogéologues et de malariologues. La sous-commission présente les résolutions suivantes.

Resolutions I., II. and III., see page 47.

#### APPENDIX IX.

##### THE FINANCIAL ASPECTS OF THE PROPOSED INTERNATIONAL PUBLICATION:—LA HAUTE ATMOSPHERE.

Memorandum by Sir Napier Shaw.

Professor Bjerknes in presenting the report of the Commission pour l'étude de la haute Atmosphère, has suggested that an annual sum of 100,000 gold francs will be required to secure the preparation and publication of the results obtained by international co-operation in the study of the upper air. The report suggests that this sum should be contributed by the Governments of the countries interested in the study, "the contributions being assessed, for example, according to a scale based upon population."

The whole sum of 100,000 frs. is made up of 50,000 frs. for the professional and clerical staff necessary to prepare and compile the material and 50,000 frs. for printing and distribution.

The International Committee will naturally be interested in formulating some specific plan by which these amounts could be raised. It will be apparent that assessment according to population is not specially appropriate to the case of a publication designed to furnish material for study by professional meteorologists and other students of the science. The idea which lies at the base of the proposal is that a copy of the collected material should be fully available for students and should therefore find a place in every library which may be called meteorological in the technical sense and in every general scientific library which aspires to include the study of the atmosphere in the widest sense among the subjects represented in its collection.



Meteorological libraries necessarily form part of the equipment of meteorological and aerological Institutes and Observatories, and of Meteorological Societies. Moreover, the meteorological authorities of the countries which maintain such Institutes and Observatories are naturally desirous that their Academies of Science, Universities and Higher Technical Schools should not be destitute of the material for study of aerology and other branches of geophysics. A suitable basis of assessment might therefore be found in the number of copies of the publication which the several countries would desire for distribution to their official meteorological establishments, to their scientific Academies and Societies and to their Universities and Higher Technical Schools.

It is not easy to form an estimate on this basis off-hand; but with a little trouble it might be done. Taking, for example, Great Britain, we have the Libraries of the Meteorological Office (Air Ministry), London and Edinburgh, the Observatories and Aerological stations (Lerwick, Aberdeen, Renfrew, Eskdalemuir, Baldonnell, Holyhead, Liverpool, Manchester, Howden, Cranwell, Pulham, Valencia, Benson, S. Farnborough, Richmond (Kew Observatory), Croydon, Shoeburyness, Grain, Lympne, Falmouth, Plymouth, Calshot, Southport, Stonyhurst, Glasgow); the Royal Societies of London and Edinburgh and Dublin, the Royal Institution, the Royal Meteorological Society, the Universities of Oxford, Cambridge, London, University College, King's College and the Imperial College of Science, Edinburgh, Glasgow, St. Andrews, Aberdeen, Durham, Newcastle, Manchester (and its Technical College), Liverpool, Leeds, Birmingham, Sheffield, Bristol, Reading, Exeter, Cardiff, Aberystwyth, Bangor.

This list, which does not profess to be complete, counts up to 54 institutions and adding, certain libraries with statutory privileges, a few presentation copies to private individuals and a reserve, we might assume that Great Britain could usefully take seventy-five copies for the home countries. And further, it is to be noted that it is the desire of the Commission, as it is doubtless the desire of the countries represented thereon, to obtain material for the study of the upper air not only from their own countries but from all parts of the world. The British Government might, therefore, respond to an appeal to include in its list of libraries to be supplied, in the first instance by presentation, the meteorological establishments such as Malta, Mauritius, Hong Kong, Jamaica and others, leaving for the future the question of a contribution *quid pro quo*. If this suggestion were accepted, we might look to the British Government to take 100 copies of the international publication. It could settle for itself from time to time the terms upon which its libraries should be supplied.

If in like manner the countries now represented at the Committee could form some estimate of the number of copies that each would wish to take for distribution to its libraries, having regard to the fact that the study of the higher regions of the atmosphere is of far-reaching importance, not only for meteorology and aviation but also for radiotelegraphy and various other aspects of geophysics, and that the international publication, if effectively managed, will be an indispensable factor of that study, we might assess the contributions of the several countries according to the number of copies. If the total number asked for amounted to 1,000, the estimated cost of each annual volume works out at 50 frs. for printing and distribution alone. Copies would naturally be on sale and some small addition to the revenue might possibly be derived in that way if the publication were effectively advertised.

It would be desirable, for a reason which will presently be made clear, to include in the cost of the publication the amount necessary for the work of a draughtsman and clerk, perhaps an additional 12,500 frs., because such assistance must be obtained locally, and if the basis of contribution be the cost of the production and the number of copies supplied, the sum should be inclusive. On the hypotheses mentioned, the total cost per copy would be 62·5 frs. If that could be reduced so much the better.

There remains to be provided a superintendent of the work and two scientific or professional assistants. I would suggest that the leading Meteorological Institutes might lend the services of gentlemen or ladies for this purpose. A superintendent might be lent for, say, three years, a scientific or professional assistant for two years, one year, or perhaps for six months.

Such a plan would have many advantages, not only for the country in which the publication was prepared, but also for the countries which provided the staff. In the first place, it would avoid the invidious task of forming an international scale of professional salaries. In the second place, it would promote the exchange of ideas respecting the aspects of the general meteorological problem from the point of view of different countries and in the widely extended responsibilities of the Meteorological Institutes this advantage deserves consideration. It would provide a means of training for members of an office staff which is regarded by some authorities as being of great importance, and may indeed be regarded as essential if Meteorology is to attain the position of a recognised profession. Indeed, it is not too much to say that such an experiment might lead to the organisation of international co-operation on a similar basis in other departments, which would be invaluable. In the third place, by a suitable arrangement of the periods of appointment, continuity would be secured, and the opportunity of fresh initiative would not be neglected. The publication would thus become a living force in the meteorological world. We may suppose that an Institute would not be called upon to lend a superintendent more than once in twenty years, nor to lend a professional assistant oftener than once in ten years, and the arrangement would be foreseen for some years ahead.

For the present it is contemplated that the seat of the organisation would be at Bergen, but for the future, with increasing facilities of communication, one cannot regard the seat of the organisation as limited to one country, to one continent, or to one hemisphere. The possibilities in outlook are not limited by any formula which now applies.

To my mind the possibility of enlisting the co-operation of the Institutes in various parts of the world is of fundamental importance because, with the best intentions in the world, the denizens of one quarter of the globe are more or less subservient to their own environment. No doubt, in the first instance, the possibility of securing the necessary staff would depend upon the good offices of those Institutes which employ a comparatively numerous professional staff, and it would serve little purpose to go into details of a method of selection (which would obviously be necessary) without first ascertaining the disposition of the larger Institutes towards the proposal; but when we consider the organisations which already exist in various countries of Europe, in the United States, Canada, the Argentine and Brazil, in Egypt, India and Japan, and in Australia and the Union of South Africa, there is little doubt that there are resources enough to supply the necessary assistance if we have the common goodwill of the authorities concerned.

A preliminary step would therefore be to address a communication setting out the proposal to the principal Meteorological Institutes, and I propose that the Meteorological Committee should undertake that task. Perhaps, in order to be definite, it would be necessary to ask whether the respective Institutes are willing to lend (1) a superintendent or (2) a professional scientific assistant for two years, or one year, or for six months, and in the first instance if there were, as I hope there may be, a lively competition for the privilege, I propose that Professor Bjerknes, President of the Commission, be authorised to make the selection.

NAPIER SHAW.

12th September 1921.



## APPENDIX X.

## FUNDS FOR AEROLOGICAL PUBLICATIONS.

*Memorandum by Professor E. van Everdingen.*

Most members of the Committee agree upon the desirability of an International Meteorological Bureau which should take care not only of the special wants of Aerology, but of all kinds of international co-operation and information. It is true that such a Bureau has for such a long time been a pious vote that one might doubt the possibility of creating it, but I should like to remark:—

(1) That I do not know of any serious attempt to realise the Bureau by addressing the Governments.

(2) That in spite of the difficulties in the financial way which most Governments have to face now, an International Hydrographic Bureau has been created since the War with an estimated budget of 250,000 francs of which 150,000 francs has been granted or will be shortly.

(3) That the demand for more meteorological information from the War Departments and from Aerial Navigation in many countries has increased the meteorological budgets enormously, and that the contribution asked forms only a small part of subventions granted to aerial navigation even in small countries like Holland.

Of course, it is not necessary now to ask for a more general task of the proposed Bureau, but once the start is made it may grow with the course of time.

I may add that the International Hydrographic Bureau takes the total tonnage of the co-operating countries as a basis for the contributions, but adds to these a contribution equal for all participants which causes a difference in the contributions as compared with tonnage. A similar digression is to be found with the contributions proposed for the aerological publications in Resolution XXVI. According to a rough estimate, an amount of £4,000 might be collected according to this scheme.

## RESOLUTION XXVI.

(a) As an alternative to the suggestion in Resolution X., it is proposed to assess the contributions from the various countries according to a scale based upon the amount of the budget for ordinary expenses, such that a minimum and a maximum contribution are fixed. For instance:

£100 = 2,500 francs for budgets below £50,000,000.

£200 = 5,000 francs for budgets between £50,000,000 and £200,000,000.

£300 = 7,500 francs for budgets between £200,000,000 and £400,000,000.

£400 = 10,000 francs for budgets over £400,000,000.

(b) This contribution might be given either in the form of a subvention or as a subscription for an adequate number of copies of the publication 14th September 1921.

## APPENDIX XI.

## LIST OF MEMBERS OF THE COMMITTEE AND ITS COMMISSIONS.

*September 1921.*

## INTERNATIONAL METEOROLOGICAL COMMITTEE.

Sir Napier Shaw, 1900, Professor of Meteorology, Imperial College of Science and Technology, South Kensington, London (*President*).  
Luigi Palazzo, 1900, Professor, Director of the Italian Meteorological Service.

Francisco S. Chaves, 1901, Colonel, Director of the Meteorological Service of the Azores.  
J. Maurer, 1907, Professor, Director of the Swiss Meteorological Service.  
Sir Frederic Stupart, 1907, Director of the Meteorological Service of Canada.  
E. van Everdingen, 1910, Professor, Director of the Dutch Meteorological Institute (*Vice-President*).  
Th. Hesselberg, 1919, Director of the Meteorological Service of Norway (*Secretary*).  
C. H. Ryder, 1910, Captain, Director of the Danish Meteorological Institute.  
G. T. Walker, 1910, Director-General of Indian Observatories.  
C. F. Marvin, 1919, Professor, Chief of the Meteorological Service of the United States.  
D. Eginitis, 1919, Director of the Meteorological Service of Greece.  
H. A. Hunt, 1919, Director of the Meteorological Service of Australia.  
J. Jaumotte, 1919, Commandant, Director of the Meteorological Service of Belgium.  
T. Okada, 1921, Professor, Director-designate of the Meteorological Service of Japan.  
A. Wallén, 1921, Director of the Meteorological Service of Sweden.  
E. Delcambre, 1921, Colonel, Director of the National Meteorological Service of France.  
G. C. Simpson, 1921, Director of the Meteorological Office, London.

## INTERNATIONAL COMMISSION FOR AGRICULTURAL METEOROLOGY.

Prof. A. Angot, Directeur Honoraire, Central Meteorological Bureau, Paris (*President*).  
M. Wallén, Director, Meteorological and Hydrographical Service, Stockholm (*Secretary*).  
M. G. Azzi, Central Bureau of Meteorology and Geodynamics, Rome.  
Lieut.-Col. D. C. Bates, Director, Dominion Meteorological Office, Wellington, New Zealand.  
M. R. P. Berloty, Director, The Observatory, Ksara, Syria.  
Mr. J. Connor, Climatologist of the Meteorological Service, Toronto.  
M. R. Dongier, Institute for the Physics of the Globe, Paris.  
M. E. Fontseré, Director, Aerological Station, Barcelona.  
J. Galbis, Director, Geographical Service, Madrid.  
M. M. Azevedo Gomes, Professor in the Institute of Agriculture, Lisbon.  
Prof. D. van Gulik, Agricultural College, Wageningen.  
Dr. Hesselberg, Director, Meteorological Institute, Christiania.  
Dr. Okada, Director-designate, Meteorological Service, Japan.  
Prof. Mathias, Director, Puy-de-Dôme Observatory, Clermont-Ferrand.  
Prof. Mercanton, President, Swiss Geophysical Society, Lausanne.  
M. A. Rey, Inspector-General, Agricultural Meteorological Service, Paris.  
Capt. Ryder, Director, Meteorological Institute, Copenhagen.  
Dr. F. T. Shutt, Royal Society, Ottawa.  
Dr. Griffith Taylor, Professor of Geography, University of Sydney.  
Mr. F. J. W. Whipple, Meteorological Office, London.

*Nominated by International Meteorological Committee on September 14th, 1921.*

A. Åkermán, Institute for the Selection of Plants, Svalof.  
M. Louis Dop, Vice-President, International Agricultural Institute, Rome.  
M. Engler, Professor of Forest Meteorology and Director of Central Institute of Forestry, Zurich.  
Mr. R. A. Fisher, Statistical Dept., Rothamsted Experimental Station, Harpenden.  
Prof. O. Hagem, Professor of Botany, Bergen.



Mr. R. H. Hooker (President of the Royal Meteorological Society),  
Ministry of Agriculture and Fisheries, London, S.W.1.  
Mr. Warren-Smith, Weather Bureau, Washington.  
M. Wéry, Director of National Agricultural Institute, Paris.  
Mlle. J. Westerdyk, Professor of Phytopathology, Baarn, Utrecht.

## INTERNATIONAL COMMISSION FOR WEATHER TELEGRAPHY.

Lieut.-Col. E. Gold, Meteorological Office, London (*President*).  
Dr. W. van Bemmelen, Magnetic and Meteorological Observatory  
Batavia.  
Col. Blandy, Controller of Communications, Air Ministry, London.  
Col. Chaves, Director, Meteorological Service, Azores.  
Col. Cruz-Condé, Director of Meteorological Service, Madrid.  
Prof. F. M. Exner, Director, Meteorological Institute, Vienna.  
Col. Delcambre, Director of National Meteorological Service, Paris.  
Prof. F. Eredia, Meteorological and Geodynamical Office, Rome.  
Prof. E. van Everdingen, Director, Meteorological Institute, De Bilt.  
General Ferrié, Inspector of Military Telegraphic Service and Transport,  
51 bis, Boulevard, Latour Meubourg, Paris.  
M. Gain, Meteorological Service for Aerial Navigation, Paris.  
M. C. Goutereau, National Meteorological Office, Paris.  
Dr. Hesselberg, Director, Meteorological Institute, Christiania.  
Commandant Jaumotte, Director of Meteorological Institute, Uccle.  
Lieut. Kerguistel, Meteorological Service, Aerial Navigation, Paris.  
Prof. C. F. Marvin, Chief of Weather Bureau, Washington.  
Lieut.-Col. Matteuzzi, Director Aerological Service, Rome.  
Prof. A. de Quervain, Meteorological Institute, Zurich.  
M. Rey, Inspector-General of Agricultural Meteorological Service, Paris.  
Capt. Ryder, Director, Meteorological Institute, Copenhagen.  
Mr. T. Thorkelsson, Director, Meteorological Institute, Reykjavik.  
Dr. G. T. Walker, Director-General of Observatories, Simla.  
Dr. A. Wallén, Director, Meteorological and Hydrographical Service,  
Stockholm.

## INTERNATIONAL COMMISSION FOR MARITIME METEOROLOGY.

Honorary Member—H.S.H. The Prince of Monaco, Paris.

Prof. E. van Everdingen, Director, Meteorological Institute, De Bilt  
(*President*).  
Commander Garbett, R.N., Superintendent, Navy Services, Meteorological  
Office, London (*Secretary*).  
Lt.-Col. D. C. Bates, Director, Dominion Meteorological Office, Wellington,  
New Zealand.  
Commander Brooke-Smith, R.N.R., Marine Superintendent, Meteorological  
Office, London.  
Prof. V. Bjerknes, Geophysical Institute, Bergen.  
Col. F. A. Chaves, Director, Meteorological Service, Azores.  
Mr. T. F. Claxton, Royal Observatory, Hong Kong.  
Father L. Froc, Meteorological Observatory, Zi-Ka-Wei.  
Dr. S. Fujiwhara, Central Meteorological Observatory Tokyo, Japan.  
Mr. P. H. Gallé, Meteorological Institute, Amsterdam.  
Mr. H. A. Hunt, Director, Commonwealth Meteorological Bureau,  
Melbourne.  
Prof. Marini, Hydrographic Institute, Genoa, Italy.  
Dr. C. F. Marvin, Director, United States Weather Bureau.  
Prof. T. Okada, Director-designate, Meteorological Service, Tokyo.  
Dr. H. Pettersson, Director, Oceanographical Institute, Gotenberg.  
Capitaine de Frégate Rouch, Naval School, Brest.  
Capt. Ryder, Director, Meteorological Institute, Copenhagen.  
Mr. C. Stewart, Chief Meteorologist of the South African Union.

Dr. J. P. van der Stok, Meteorological Institute, De Bilt.  
Sir Frederic Stupart, Director, Canadian Meteorological Service.  
Dr. A. Wallén, Director of Meteorological and Hydrographical Service,  
Stockholm.

## INTERNATIONAL COMMISSION FOR SOLAR RADIATION.

Prof. Dr. Maurer, Director, Federal Meteorological Institute, Zurich  
(*President*).  
Prof. C. G. Abbot, Smithsonian Institute, Washington.  
A. Angström, Meteorological and Hydrographical Service, Stockholm.  
Prof. F. H. Bigelow.  
Prof. C. Chistoni, The University, Naples.  
Mr. W. H. Dines, Meteorological Office, London.  
Dr. J. Evershed, Kodaikanal Solar Physics Observatory, Madras.  
Dr. L. Gorczynski, Director, Meteorological Service, Warsaw.  
Commandant Jaumotte, Director, Meteorological Institute, Uccle.  
Prof. H. H. Kimball, Mount Wilson Solar Observatory, Pasadena, Cal.  
U.S.A.  
Dr. F. Lindholm Meteorological and Hydrographical Service, Sweden.  
Mr. J. Plaskett, Victoria, Canada.  
Mr. H. Knox Shaw, Director, Meteorological Section Physical Service,  
Dawawyn, Cairo.  
Prof. C. Störmer, The University, Christiania.  
Dr. Griffith Taylor, Professor of Geography, University of Sydney.

INTERNATIONAL COMMISSION FOR THE APPLICATION OF METEOROLOGY TO  
AERIAL NAVIGATION.

Lt.-Col. Saconney, Director, Service of Aerial Navigation, Paris (*President*).  
Prof. V. Bjerknes, Geophysical Institute, Bergen.  
Major W. R. Blair, Weather Bureau Dept. of Agriculture, Washington.  
Dr. H. G. Cannegieter, Meteorological Institute, De Bilt.  
Col. Delcambre, Director, National Meteorological Service, Paris.  
M. R. Dongier, Institute for the Physics of the Globe, Paris.  
Señor J. Galbis, formerly Director, Meteorological Service, Madrid.  
Lt.-Col. E. Gold, Meteorological Office, London.  
Dr. Hesselberg, Director, Meteorological Institute, Christiania.  
M. Jacobs, President, Belgian Astronomical Society, Brussels.  
Commandant Jaumotte, Director, Meteorological Institute, Uccle.  
Prof. Mathias, Director, Puy-de-Dôme Observatory, Clermont-Ferrand.  
Lt.-Col. Matteuzzi, Director, Aerological Service, Rome.  
Prof. Mercanton, President, Swiss Geophysical Society, Lausanne.  
Dr. Okada, Director-designate of the Meteorological Service, Japan.  
M. G. Rothé, Director, Meteorological Service, Alsace-Lorraine, Strasbourg.  
Capitaine de Frégate Rouch, Naval School, Brest.  
Sir Napier Shaw, School of Meteorology, South Kensington, London, S.W.  
Dr. Griffith Taylor, Professor of Geography, University of Sydney.  
Dr. G. T. Walker, Director-General of Observatories, Simla.

## COMMISSION DU RÉSEAU MONDIAL ET DE LA MÉTÉOROLOGIE POLAIRE.

Dr. G. C. Simpson, Director, Meteorological Office, London (*President*).  
Dr. W. van Bemmelen, University of Amsterdam.  
Dr. O. Devik, Chief of the Weather Service, Tromsø.  
Prof. F. Eredia, Meteorological and Geodynamical Office, Rome.  
Prof. E. van Everdingen, Director, Meteorological Institute, De Bilt.  
M. Sampaio Ferraz, Director, Meteorological Service, United States of  
Brazil.  
Dr. S. Fujiwhara, Central Meteorological Observatory Tokyo.  
Dr. L. Gorczynski, Director, Meteorological Service, Warsaw.  
Prof. Dr. B. Helland Hansen, Geophysical Institute, Bergen.



Dr. Hesselberg, Director, Meteorological Institute, Christiania.  
 Mr. H. A. Hunt, Director, Commonwealth Meteorological Bureau, Melbourne.  
 Prof. Dr. Martin Knudsen, University, Copenhagen.  
 Dr. O. Krogness, Director Geophysical Institute, Tromsø.  
 Mr. R. G. K. Lempfert, Meteorological Office, London.  
 Prof. C. F. Marvin, Chief of Weather Bureau, Washington.  
 Prof. G. Melander, Director, Meteorological Office, Helsingfors.  
 Prof. T. Okada, Director-designate of Meteorological Service, Japan.  
 Prof. A. de Quervain, Meteorological Institute, Zurich.  
 Capitaine de Frégate Rouch, Naval School, Brest.  
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 M. de Carvalho, Director, Meteorological Observatory, Coimbra.  
 Prof. S. Chapman, The University, Manchester.  
 Dr. C. Chree, Superintendent, Kew Observatory, Richmond, Surrey.  
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## APPENDIX XII.

### MEANINGS OF THE SYMBOLS USED IN THE METEOROLOGICAL CODES.

[The Codes referred to are published in full in *The (New) International Code*, M.O. publication 253, and the numbers quoted below are the numbers given to the codes in M.O. 253.]

A = Form of *predominating cloud lowest* in the scale of cloud forms (see Code VI.).

a = Form of *predominating cloud highest* in the scale of cloud forms when more than one type of cloud exists (see Code VI.).

BBB = Pressure in millibars and tenths (initial 9 or 10 omitted), or millimetres and tenths (initial 7 omitted). The values refer to sea level\* and include all corrections for index error, temperature and gravity.

BB = Pressure in whole millibars or whole millimetres (initial 9, 10 or 7 omitted). (For upper air reports of pressure temperature and humidity, BB is in whole millibars with the hundreds figure omitted, whether this is 9, 8, 7, 6 or 5.)

B<sub>1</sub>B<sub>1</sub>B<sub>1</sub> = Pressure in whole millibars at an "inversion of temperature" in upper air reports.

b = Amount of barometric tendency during the three hours preceding the time of observation expressed in half millibars or half-millimetres. For tendencies, 10-19 the *second* figure only is reported and 33 is added to the wind direction number (DD). For tendencies greater than 29 the *second* figure only is reported and 67 is added to the wind direction number. Tendencies greater than 29 are reported as 29.

C = Form of predominating cloud, according to the scale of cloud forms, when only one form is reported, as from ships at sea (see Code VI.).

C<sub>1</sub> = Form of cloud observed by nephoscope for special cloud reports (see Code VI.).

C<sub>a</sub> = Form of low cloud observed by nephoscope in reports for aviation (see Code VI.).

c = Characteristic of barometric tendency during the period of 3 hours preceding the time of observation (see Code II.).

DD = Direction of the wind near the ground on the scale (01-32) in which 08 = East, 16 = South, &c., 00 = calm.

dd = Direction of wind in the upper air, or of cloud movement, on the scale (01-36), *i.e.*, degrees from North divided by 10 and rounded off to the nearest whole number (00 = calm).

d = Direction from which swell comes on scale (0-8), in which 2 = East, 4 = South, &c., 0 = no swell.

d\* = Direction of movement of ship on scale (0-8), in which 2 = Eastwards, 4 = Southwards, &c.

\* For mountain stations the values refer to the level of the station. In such cases, the initial figure omitted is not that mentioned above, but depends on the height of the station.

F = Force of the wind on the Beaufort Scale. (Forces above 9 are reported as 9 in telegrams with the actual force in a word at the end, *e.g.*, force 10 is reported at the end as "Storm ten," force 11 as "Storm eleven." Ships at sea, however, report "gale ten," "storm eleven," "hurricane twelve.")

F<sub>1</sub> = Approximate speed of low cloud (see p. 83 and Code XIV.).

GG = Greenwich Time of observation (01 = 1 a.m., 12 = noon, 13 = 1 p.m., 24 = midnight).

H = Relative humidity of the air (see Code V.).

h = Height of base of lowest cloud present (see Code VII.).

H<sub>1</sub> = Heights at which upper air temperature and humidity are reported (no code figure telegraphed) (see Code XII.).

h<sub>1</sub> = Height at which upper wind is reported (see XI.).

I<sub>n</sub>I<sub>n</sub> = Index number of station.

jj = Meaning varies according to time of observation and between inland and coastal stations, as follows:—

	Inland Stations.	Coastal Stations.
At 0700 G.M.T.	jj = mm	jj = SV.
At 1800 G.M.T.	jj = MM	jj = SV.

K = The characteristic of the swell in the open sea (see Code IX. (a)).

K' = Amount and characteristic of barometric tendency expressed by a single figure (see p. 87 and Code II. (a)).

L = Amount of sky (scale 0-10) covered by cloud form A and all forms of the same layer (*i.e.*, low, medium or high) as A, if "a" refers to a different layer.

LLL = Latitude in degrees and tenths, the tenths being obtained by dividing the number of minutes by 6 and neglecting the remainder.

lll = Longitude in degrees and tenths, the tenths being obtained as for latitude.

MM = Maximum temperature in the interval of 11 hours ending at 18h. G.M.T. (or at one of the hours 1h., 7h., 13h., 18h. G.M.T., following not less than 4 hours afternoon local time).

mm = Minimum temperature in the interval of 13 hours ending at 7h. G.M.T. (or at the hour 13 hours after the time of reporting the maximum temperature).

N = Total amount of sky covered with cloud (scale 0-10).

P = Day of the week. 1 = Sunday, 2 = Monday, 3 = Tuesday, 4 = Wednesday, 5 = Thursday, 6 = Friday, 7 = Saturday. The day refers to G.M.T. and not to local time, *e.g.*, Sunday means the period from 0 h. to 24 h. on Sunday at Greenwich.

Q = Quarter of globe in which ship is situated (see p. 68 and Code XIII.).

RR = Rainfall in whole millimetres. For specification of certain meanings see Code VIII.

R = Amount of rainfall for the preceding 24 hours (see p. 88 and Code VIII. (a)).

r = Time of commencement of precipitation (see Code X.).

S = State of the sea and swell (coast stations) (see Code IX.).

TT = Temperature of the air in whole degrees Fahrenheit or Centigrade (50 added to negative values).

tt = Temperature of the sea (surface water) in whole degrees.

t<sub>1</sub>t<sub>1</sub> = Increase in temperature in whole degrees at an inversion.

TTT = Temperature of air in degrees and tenths Fahrenheit or Centigrade (500 added to negative values).



ttt = Temperature of the sea (surface water) in degrees and tenths.

V = Visibility or distance at which objects can be seen in daylight (or at which lights can be seen at night) (see p. 89 and Code IV.).

v = Visibility at sea from ships at sea (see Code IV. (a)).

V<sub>s</sub> = Visibility towards the sea (from coast stations) (see Code IV.).

VV = The relative speed of clouds as determined by nephoscope and such that the actual speed of the cloud will be given in kilometres per hour by the equation

$$vv = \frac{h}{1000} \times VV \text{ if "h," the height of the cloud, is expressed in metres. This unit is the "radian per hour."}$$

vv = The speed of the wind in the upper air in kilometres per hour or miles per hour.

W = The weather in the interval since the preceding time of report. This interval is 5, 6 or 7 hours for stations reporting 4 times daily. (For special reports for aviation it is 1 hour or 2 hours.) (See Code III.)

ww = The actual weather at the time of observation with which is combined, whenever possible, the general character of the weather (see Code I.).

w<sub>1</sub> = The initial figure of the code ww, thus indicating the general state of the weather.

x<sub>1</sub> = A check figure obtained by adding the first four figures of the group and taking the units figure in the sum so obtained.

x<sub>2</sub>, x<sub>3</sub>, x<sub>4</sub>, x<sub>5</sub> = Check figures obtained in a similar manner.

y<sub>1</sub> = A check figure obtained by adding together the first figure of each of the preceding groups, thus: Q + P + B + F + w, and taking the units figure of the sum.

y<sub>2</sub>, y<sub>3</sub>, y<sub>4</sub> = Check figures obtained in a similar way from 2nd, 3rd and 4th figures respectively

z = Key figure obtained by adding together all the x's or all the y's.

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