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M.O. No. 216.

# INTERNATIONAL METEOROLOGICAL COMMITTEE.

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## REPORT OF THE TENTH MEETING.

ROME, 1913.

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*With Additional Appendices concerning the Exchange of Publications,  
Lists of Members of the International Committee, &c.*

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Published by Authority of the Meteorological Committee.

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# LIST OF INTERNATIONAL METEOROLOGICAL MEETINGS.

1872.	LEIPZIG, Conference of Meteorologists.
1873.	VIENNA, Congress of Official Delegates.
1874.	UTRECHT, First Meeting of the Permanent Meteorological Committee.
1876.	LONDON, Second Meeting of the Permanent Meteorological Committee.
1878.	UTRECHT, Third Meeting of the Permanent Meteorological Committee.
1879.	ROME, Congress of Official Delegates.
1880.	BERNE, First Meeting of the International Meteorological Committee.
1882.	COPENHAGEN, Second Meeting of the International Meteorological Committee.
1885.	PARIS, Third Meeting of the International Meteorological Committee.
1888.	ZÜRICH, Fourth Meeting of the International Meteorological Committee.
1891.	MUNICH, First Ordinary Conference of Directors of Offices and Observatories.
1894.	UPSALA, Fifth Meeting of the International Meteorological Committee.
1896.	PARIS, Second Ordinary Conference of Directors of Offices and Observatories.
1899.	ST. PETERSBURG, Sixth Meeting of the International Meteorological Committee.
1903.	SOUTHPORT, Seventh Meeting of the International Meteorological Committee.
1905.	INNSBRUCK, Third Ordinary Conference of Directors of Offices and Observatories.
1907.	PARIS, Eighth Meeting of the International Meteorological Committee.
1910.	BERLIN, Ninth Meeting of the International Meteorological Committee.
1913.	ROME, Tenth Meeting of the International Meteorological Committee.

A meeting of the Committee was held in Paris in 1900 for the transaction of formal business, in connexion with an open Congress of Meteorologists.

# TABLE OF CONTENTS.

## INTERNATIONAL METEOROLOGICAL COMMITTEE.

### TENTH MEETING AT ROME, 1913.

#### MINUTES OF PROCEEDINGS.

	PAGE.
First Meeting, April 7	4
Second Meeting, April 8	7
Third Meeting, April 8	12
Fourth Meeting, April 9	14
Fifth Meeting, April 11	16
Sixth Meeting, April 11	17
Seventh Meeting, April 12	18

#### APPENDICES.

I. Address of welcome of M. Palazzo	20
II. Report of the Officers	22
III. Programme of the Meeting	22
IV. Letter of the Deutsche Seewarte with reference to the Synoptic Charts of the Atlantic Ocean	23
V. On Meteorology in relation to Agriculture	23
VI. Commission for Weather Telegraphy	26
VII. Beaufort Scale of Wind Force	33
VIII. Report of the Commission for Scientific Aeronautics	40
IX. Proposal to be considered by the International Meteorological Committee with regard to the wishes expressed by the International Commission for Scientific Aeronautics concerning the study of different layers of the atmosphere in polar regions	42
X. Report of the President of Magnetic Commission of the International Meteorological Committee	44
XI. Letter from Professor Mohn with reference to the Measurement of fallen snow	48
XII. The new status of the Nicholas Central Physical Observatory, Russia	48
XIII. Sleet	50
XIV. Report of the President of the Commission for Maritime Meteorology and Storm Warnings	50
XV. Form for Meteorological Observations in Ships	60
XVI. Report by Captain Ryder on the Charts of Ice of the Polar Sea issued by the Danish Meteorological Institute	61

#### ADDITIONAL APPENDICES.

XVII. Geographical List of Institutions and Persons from whom publications containing meteorological and other geophysical data have been received by the Meteorological Office during the last ten years	63
XVIII. Institutions on the Presentation Lists of the Meteorological Office	81
XIX. List of Members of the International Meteorological Committee and of its Commissions	88
INDEX	95



REPORT OF THE MEETING  
OF THE  
INTERNATIONAL METEOROLOGICAL  
COMMITTEE AT ROME.

APRIL 7TH TO 12TH, 1913.

MINUTES OF PROCEEDINGS.

First Meeting, Monday, April 7th, 1913.

Present: MM. Shaw (President), Hellmann (Secretary), Angot, Chaves, van Everdingen, Hamberg, Maurer, Palazzo, Ryder, Rykatscheff, Stupart, also the President of the Commission for Scientific Aeronautics, M. Hergesell. At the invitation of the President, Professor Bjerknes and Mr. Lempfert were present as guests.

Apologies for absence were received from MM. Mohn, Moore, Nakamura, Trabert, and Walker.

The President, Mr. Shaw, opened the Session at ten o'clock with a brief address. Thereafter M. Palazzo welcomed the members in the name of his chief, the Minister of Agriculture, and expressed his gratification at the fact that thirty-four years after the International Congress of Meteorologists in Rome, which had been so important for the development of Meteorology, meteorologists should assemble once more for deliberation in that city. He proposed to send a telegram of greeting to the members of the Congress of 1879 who were still living, but who no longer took part in the current work of the international organisation, namely, MM. von Hann, Mohn, and Scott (Appendix I.) Mr. Shaw requested M. Palazzo to express to the Minister of Agriculture the thanks of the Committee.

M. Hellmann read the "Report of the Officers." (Appendix II.)

**Programme.**—The programme of the meeting was arranged on the basis of the provisional programme contained in Circular N.S. No. 9, and papers relating to the several items were distributed.

The questions set down for consideration are the following:—

1. Report of the Officers.
2. Questions not disposed of at the last meeting of the Committee in 1910:

- (a) List of Observatories (Report of Berlin Meeting, English Ed., p. 8). See p. 6.
- (b) Extension of the synoptic charts of the North Atlantic Ocean (*loc. cit.* p. 8). See p. 6.
- (c) Commission on Atmospheric Electricity (*loc. cit.* p. 16). See p. 7.
- (d) M. Eiffel's Meteorological Atlas (*loc. cit.* p. 23). See p. 7.

3. Agricultural Meteorology.—A report on this subject drawn up by MM. Angot and Palazzo has been distributed with circular letter N.S. No. 8. See p. 7 and Appendix V.

4. Investigation of the Upper Air.—The report\* of the seventh meeting of the Commission for Scientific Aeronautics held in Vienna in May, 1912, has been printed and circulated by the Austrian Meteorological Office. See p. 7 and Appendix VIII. The sixth resolution of this meeting reads as follows:—

6. The Commission resolve that atmospheric pressure be expressed in the publications of the Commission in bars or in one of their decimal submultiples, decibars, centibars, or millibars instead of in millimetres of mercury; but this resolution is only to become operative after receiving the approval of the International Meteorological Committee.

Mr. Walker, who is unable to attend the meeting at Rome, has communicated his views on this subject in a letter dated January 8th, 1913, which has been circulated to the members of the Committee.

A proposal by M. Rykatcheff dealing with the establishment of upper air stations within the polar circle. See p. 15 and Appendix IX.

5. Solar Radiation.—M. Maurer's report† on the meeting of the Radiation Commission held at Rapperswyl in September, 1913, has been circulated and will serve as the basis for the discussion. See p. 16.

Mr. Hunt, of Melbourne, has submitted the following proposal for consideration, through Mr. Shaw:—

"That it is desirable that the resolution of the International Committee at St. Petersburg recommending the Campbell-Stokes sunshine recorder as the instrument which furnishes the most comparable values, be given effect to by the adoption of a precise specification of the dimensions, weight, permeability of the glass spheres, etc." See p. 17.

6. Meteorological Telegraphy.—A printed report‡ of the last meeting of the Commission on Weather Telegraphy held in London in September, 1912, has been circulated by the President of the Commission, Mr. Shaw. See pp. 8-13 and Appendices VI. and VII.

M. Angot has written to suggest "that it may be desirable for the Committee to discuss some of the questions recently raised by the International Commission on Time Signals, particularly that of the receipt and dispatch by radiotelegraphy, of reports of observations made at sea and on land. The changes in the arrangements for the issue of time signals approved at this Conference will probably come into operation on July 1st, 1913. It seems to me desirable to start a service of meteorological radio-telegrams on the same date." See p. 13.

\* Siebente Versammlung der Internationalen Kommission für wissenschaftliche Luftschiffahrt in Wien, 28 Mai bis 1 Juni, 1912. Sitzungsberichte und Verträge. Published (in German) by the K. K. Zentralanstalt für Meteorologie und Geodynamik, Vienna. Vienna 1912. V, 172 pp. 8vo.

† Schweizerische Meteorologische Centralanstalt. Bericht über die erste Tagung der Strahlungs Kommission des Internationalen Meteorologischen Komitès in Rapperswyl b. Zürich. Sept. 2 and 3, 1912. Zürich-Selnau, Leeman Bros. & Co. 1912. 22 pp. 8vo.

‡ International Meteorological Committee. Report of proceedings at a Meeting of the Commission for Weather Telegraphy, held at the Meteorological Office, London, September 17-20, 1912. London, Wyman and Sons, 1913. M.O. 211. 37 pp. 8vo.



7. Storm Warnings and Maritime Meteorology.—A printed report\* of the last meeting of the Commission on these subjects, held in London in September, 1912, has been distributed by its President, Mr. Shaw. *See p. 18 and Appendix XIV.*

M. Ryder suggests "that a resolution be adopted which asks the different meteorological institutes to assist the Danish Meteorological Institute in gathering information about the state of ice in the Arctic Sea, to be used in the report thereof, which is published each year by this institute." *See p. 19.*

8. Questions by Mr. Shaw, *see p. 17 and Appendix XIII.* :—  
(a) "Is sleet to be reckoned as qualifying for a day of snow?"

(b) "Can a symbol for sleet be added to the international scheme?"

9. Report of the Commission for Terrestrial Magnetism. *See p. 15 and Appendix X.*

10. The next Conference of Directors. *See p. 18.*

11. A letter from M. Hildebrandsson regarding the Commission on the Réseau Mondial. *See p. 19.*

12. A question submitted by M. Mohn regarding the depth of snow. *See p. 16 and Appendix XI.*

13. A proposal made by M. Rykatcheff, relating to comparisons between the English (Stevenson) screen and the aspiration psychrometer. *See p. 17 and Appendix XII.*

[In the following minutes the numbers prefixed to the paragraphs refer to the items of the programme.]

2 (a). List of Meteorological Institutes and Observatories.—On point 2 (a) of the programme M. Hellmann reported that he had had a list prepared in the form of a catalogue; but that it was certainly incomplete because it was scarcely possible for an individual institute to determine which institutes, observatories and stations in the different countries actually published observations regularly. He therefore deprecated the publication of the list. M. Rykatcheff again expressed the wish that the minutes of Proceedings should be liberally distributed.

[A list of Institutions, &c., has been published since 1905 as an appendix to the Annual Report of the Meteorological Office and is now added to this report.]

2 (b). Synoptic Weather Charts of the North Atlantic Ocean.—M. Ryder brought forward a letter from the Deutsche Seewarte (Appendix IV.) upon which a discussion took place; MM. van Everdingen, Hellmann, Hergesell, Rykatschew and Shaw took part. It was resolved:—

That the question be referred to the Commission for Maritime Meteorology, but for the present, the wish should be expressed for an endeavour to extend the observations to the coasts of Africa and South America in order that later on the desired extension of the Synoptic Weather Charts might be made possible.

\* International Meteorological Committee. Report of proceedings at a Meeting of the Commission for Maritime Meteorology and Storm Warnings, held at the Meteorological Office, London, September 17-20, 1912. London, Wyman and Sons, 1912. M.O. 212. 27 pp. 8vo.

2 (c). Commission for Atmospheric Electricity.—M. Hellmann reported a list of investigators in this subject for the whole earth, from which it was seen that continuous observations and records of Atmospheric Electricity were made at very few Observatories. M. Hergesell remarked that the Aeronautical Commission had included observations of atmospheric electricity in its programme. Action with regard to the question of the appointment of the Commission was postponed.

2 (d). Meteorological Atlas for the Globe.—After explanations by MM. Angot and Chaves the item was discharged.

3. Application of Meteorology to Agriculture.—The President gave an account of proceedings which had taken place with reference to this question arising from a communication addressed to him by the Institut International d'Agriculture. After obtaining information on the present position of agricultural meteorology in different countries, the officers of the Committee had formed a special Commission consisting of two of their own members, MM. Angot and Palazzo, together with MM. Börnstein, Brounow and Dop. This Commission had prepared a report which is printed in Appendix V. An exhaustive discussion took place, in which almost all those present took part, with reference especially to the proposal to form a separate permanent Commission for agricultural meteorology. Opinion was divided in this respect: on the one side it was held that such a Commission belonged to the sphere of the International Institute of Agriculture, in so far as the dependence of agricultural products upon weather was concerned, whereas the majority considered it better that the International Meteorological Committee should itself create a Commission for Agricultural Meteorology.

Upon taking a vote, 10 members voted that the Commission for Agricultural Meteorology should be established. M. Angot was named as President, and MM. Börnstein, Brounow, Dop, Hergesell, Palazzo, Ryder and Stupart members of the Commission. M. Chaves expressed the wish that as far as possible the member from Portugal at the International Agricultural Institute in Rome should take part in the Commission.

The session closed at 13 h.

(Signed) W. N. SHAW, President.  
HELLMANN, Secretary.

## Second Meeting, April 8th, 1913.

Present: MM. Angot, Chaves, van Everdingen, Hamberg, Hellmann, Maurer, Palazzo, Ryder, Rykatcheff, Shaw, Stupart, Hergesell, Bjerknes, Lempfert.

The session began at 10h.

Minutes.—The minutes of the previous meeting were read and confirmed.

Telegrams from the Azores.—M. Chaves, who had to leave Rome earlier than he had anticipated, gave detailed information about the weather telegrams which, in future, he will be in a



position to despatch from the Azores. As the stations Flores and Ponta Delgada are only in radiotelegraphic communication with Horta, their morning observations (6h. Local Time = 8h. G.M.T.) cannot be incorporated in a collective report prepared at Horta and transmitted over the cable connecting Horta with Europe without seriously delaying the reports from Horta.\* He therefore proposed to send:—

- (1) the 6h. observations of Horta direct via Horta;
- (2) the 6h. observations of Ponta Delgada via Lisbon;
- (3) the 14h. observations of Horta, Flores, and Ponta Delgada, with repetition of the 6h. observations of Horta, via Horta. This collective message would be despatched from Horta about 15h.

M. Chaves further pointed out that it is frequently difficult to read the radiotelegraphic weather messages sent out each morning from the Eiffel Tower at 10h., and raised the question whether it would not be better to send them at night, when transmission over great ranges is easier than by day.

M. Hergesell asked for pilot-balloon observations at the Azores, and M. Chaves promised to do his best to obtain them; he advised, however, that the Portuguese Government be approached officially through diplomatic channels.

Mr. Shaw expressed the thanks of the Committee to the Portuguese Government and to Colonel Chaves for their great services in regard to the transmission of weather messages from the Azores.

6. Weather Telegraphy.—Mr. Shaw presented a report printed in Appendix VI. upon the position of the subject on the basis of the resolutions of the meeting of the Commission for Weather Telegraphy held in London in 1912, and the comments thereupon of the several institutes.

With reference to the complaint of M. Schmauss as to the belated arrival of French telegrams, M. Angot explained that in winter the telegraph offices in France are only opened at 8h., so that with the difference of an hour between western and middle European time late arrival may easily occur.

\* The arrangements proposed by M. Chaves are now in operation. Since October 15th, 1913, the following messages from the Azores have been received at the Meteorological Office in London:—

(i.) A morning report from Horta, received over the cable from that place, reporting observations taken at 6h. and at 21h. of the previous evening. (Six groups.)

(ii.) A similar report giving observations at the same hours from Ponta Delgada, transmitted *via* Lisbon.

(iii.) A collective report despatched from Horta over the direct cable from that place. (Eighteen groups of figures.)

This collective report is made up as follows:—

Groups 1 and 2; Flores (Santa Cruz) observations at 21 h. of the preceding day.			
" 3 to 6;	"	"	6 h. " day of despatch.
" 7 and 8;	"	"	" " " "
" 9 and 10;	Horta	"	14 h. " " "
" 11 and 12;	Ponta Delgada	"	14 h. " " "
" 13 to 16;	"	"	21 h. " preceding day.
" 17 and 18;	"	"	6 h. " day of despatch.
"	"	"	14 h. " " "

All times are referred to the standard of 30° W.

Only the 11th of the resolutions adopted in London gave rise to any lengthy discussion. Professor van Everdingen wished to obtain more detailed observations of clouds from selected stations, for which space was to be found in the code by leaving out the characteristic of the barometric tendency. MM. Angot and Rykatcheff laid stress upon the danger of errors to which two different forms of weather message might give rise, and deprecated the introduction of a modified form of message for selected stations.

Upon a vote the majority of the members decided in favour of a uniform weather message for all stations. Some of the members suggested that in time to come, as more pilot-balloon observations became available, pilot-balloon and cloud observations might be reported in supplementary groups.

The weather-characteristic V was restricted to the interval between the morning and evening observations as proposed by the Deutsche Seewarte, and the code for temperatures in the neighbourhood of the freezing point of water as set out in the London resolution of the Commission was slightly modified.

As the result of these conclusions the International Code for weather telegraphy takes the following form:—

#### *New International Code for Weather Telegrams.*

##### (1.) THE TELEGRAPHIC CODE.

The telegraphic code for the interchange of meteorological information within the European system consists of six groups, each of five figures, reporting the observations of the morning and the previous evening, and arranged as follows:—

	(1)	(2)	
Observations of the previous evening—	BBBWW	SHTTV	
	(3)	(4)	(5)
Morning observations—	BBBWW	SHTTC	βbbRR MMmm Sea.

BBB = Pressure at Mean Sea Level and latitude 45°, to 0.1 mm. or .01 inch. The hundreds of millimetres and tens of inches are omitted:

763.5 mm. coded as 635

29.93 in. " 993.

WW = Direction of the Wind, true, not magnetic, to 16 points of the compass. Only even numbers are telegraphed.  
N = 32, W = 24, S = 16, E = 08, &c.

S = Force of the wind by Beaufort's scale. If the wind exceeds force 9, the figure 9 is to be inserted in the code, and the actual force reported at the end of the telegram.

H = Hydrometeors—or Weather at the time of observation.—

Amount of cloud.	{ 0 = cloudless.	5 = Rain.
	{ 1 = sky $\frac{1}{4}$ clouded.	6 = Snow.
	{ 2 = " $\frac{1}{2}$ "	7 = Mist, Haze.
	{ 3 = " $\frac{3}{4}$ "	8 = Fog.
	{ 4 = " completely overcast.	9 = Thunderstorm.

The occurrence of hail, lightning, aurora, &c., is reported in words at the end of the message.



TT = The temperature of the dry bulb in whole degrees Centigrade or Fahrenheit. In Continental telegrams temperatures below the freezing point are indicated by adding 50 to the reading, thus:  $-12^{\circ}\text{C.}$  is coded 62.

For temperature within half a degree of the freezing point of water the following code is used\* :—

$^{\circ}\text{C.}$	$^{\circ}\text{C.}$	
— 1.4 to — 0.5	to be telegraphed as	51
— 0.4 to 0.0	"	50
+ 0.1 to + 0.4	"	00
+ 0.5 to + 1.4	"	01.

V† = "Characteristic" of the weather for the interval between the hours of morning and evening observations.—

- 0 = Mainly fine.
- 1 = Fair (Ci. and Ci-St. preponderating).
- 2 = Mainly overcast (low clouds preponderating).
- 3 = Sheet lightning, more than one flash; of importance after periods of heat or drought.
- 4 = Precipitation, mainly during the forenoon (between observations I. and II.), without thunderstorms, or with at most one peal of thunder without lightning.
- 5 = Precipitation, mainly during the afternoon (between observations II. and III.), without thunderstorms, or with at most one peal of thunder without lightning.
- 6 = Mainly foggy.
- 7 = Thunderstorm.
- 8 = Passing showers (squally changeable weather with bright intervals).
- 9 = Persistent precipitation (including falls of snow or soft hail of long duration, sky overcast during the intervals).

When several code figures are applicable to the same day, the one which the observer considers of greatest importance should be selected.

\* The Director of the Deutsche Seewarte has taken exception to this method of reporting temperatures near the freezing point. The following scheme will be adopted throughout the German system :—

$^{\circ}\text{C.}$	$^{\circ}\text{C.}$	
— 2.5 to — 1.6	coded as	52
— 1.5 to — 0.6	"	51
— 0.5 to — 0.1	"	50
0.0 to + 0.4	"	00
+ 0.5 to + 1.4	"	01
+ 1.5 to + 2.4	"	02

† The order of this code differs from that recommended at Rome. Soon after the meeting of the Committee the Director of the Deutsche Seewarte pointed out that the order recommended differed from that already in use at German stations, and requested the institutes to adopt the German order. No objections were raised, and the majority of the institutes signified their intention to adopt the change.

The order adopted at Rome, and printed in the report of the meeting published by the Royal Prussian Meteorological Institute, reads :—

- 6 = Thunderstorm.
- 7 = Passing showers.
- 8 = Persistent precipitation.
- 9 = Mainly foggy.

C = Direction from which upper clouds are moving, according to eight points of the compass —

- 0 = Clouds observed, but no appreciable motion detected.
- 1 = Clouds travelling from N.E.
- 2 = " " " E.
- 3 = " " " S.E.
- 4 = " " " S.
- 5 = " " " S.W.
- 6 = " " " W.
- 7 = " " " N.W.
- 8 = " " " N.
- 9 = No observation.

$\beta$  = The "characteristic" of the barometric tendency.—

- 0 = Steady.
- 1 = Unsteady.
- 2 = Rising continuously.
- 3 = Falling continuously.
- 4 = Falling at first, now rising.
- 5 = Steady at first, now rising.
- 6 = Steady at first, now falling.
- \* 7 = Fall checked, now nearly steady.
- 8 = Rise checked, now steady or falling.
- 9 = Crochet d'orage, Gewitternase, Line-squall.

The characteristic refers to changes taking place within the three hours for which the numerical value of the barometric tendency is estimated. If a station has no barograph, or if the instrument fails to record, the figure 0 is inserted in the code, and the numerical value of the barometric tendency is replaced by the figures 99 (*see below*).

bb = The barometric tendency, *i.e.*, the change of the barometer in the three hours preceding the hour of observation. The specification is to millimetres and decimals in Continental telegrams, and to hundredths of an inch in British telegrams.

Negative tendencies (fall of the barometer) are specified (1) in Continental telegrams by adding 50 to WW, the code figures for wind direction, (2) in British telegrams by adding 50 to bb, the value of the tendency in hundredths of an inch. Changes of the barometer exceeding 4.8 mm. or .48 inch are reported by the code figures 48 or 98, according as the barometer is rising or falling.

If the tendency cannot be given, the figures 99 are inserted in the telegram.

\* In the German edition of this report, published by the Royal Prussian Meteorological Institute soon after the meeting of the Committee, the words "or rising" are added to the definition of the code figure 7. It has been pointed out that their addition renders this case redundant with that defined by code figure 4. The words "or rising" do not appear in the manuscript report of the meeting of the commission in London, and have been added by an oversight in preparing that report for the press. They are accordingly omitted here.



RR = The rainfall in millimetres. The following code figures are used with special significance:—

00 = No precipitation.

99 = Precipitation has occurred, but its amount has not been measured.

98 = Precipitation exceeding 96 millimetres.

97 = "Trace" of precipitation, amount less than 0.5 mm.

Amounts exceeding 96 millimetres are reported in full at the end of the message, the figures 98 being inserted in the code.

MM = Maximum temperature } for the 24 hours ended at the  
mm = Minimum temperature } time of morning observation, in whole degrees. Temperatures below freezing point are specified as in the case of TT (see above).

Sea = Sea disturbance on the scale 0-9.—

0 = Calm.

1 = Very smooth.

2 = Smooth.

3 = Slight.

4 = Moderate.

5 = Rather rough.

6 = Rough.

7 = High.

8 = Very high.

9 = Phenomenal.

The changes from the present system, incidental to the adoption of this resolution, should be made from May 1st, 1914.

## (2.) HOURS OF OBSERVATION FOR TELEGRAPHIC STATIONS.

It was resolved that 7h., 13h., 18h. G.M.T. (Western European civil mean time) be named as approved international hours for weather telegraphy for Central, Northern, and Western Europe (Long. 30 W. to Long. 30 E.), and that 6h., 12h., 18h. G.M.T. be named as approved international hours for longitudes between 30° E. and 180° E.

M. Hamberg asked the members of the Committee for an expression of opinion as to the utility of the characteristic of the barometric tendency in view of the criticisms of M. Ekholm. Several members expressed themselves decidedly in favour of the characteristic.

The session closed at 13h. 10m.

(Signed)

W. N. SHAW, President.  
HELLMANN, Secretary.

## Third Meeting, Tuesday, April 8th, 1913.

Present: MM. Angot, van Everdingen, Hamberg, Hellmann, Maurer, Ryder, Rykatcheff, Shaw, Stupart, Hergesell, Bjerknes, Lempfert; M. Palazzo came later.

The session began at 16h.

Minutes.—The minutes of the second meeting were read and confirmed.

6. Weather Telegraphy.—(continued.)—Weather Reports by Radiotelegraphy.—The question raised at the Time-conference in Paris in October, 1912, as to the application of radiotelegraphy for meteorological purposes was referred to the Commission for Weather Telegraphy for consideration and report.

The consideration of the proposal of Professor Willis L. Moore (Resolution 16 of the Commission) relating to the creation of a weather service for the Atlantic Ocean led to the President being requested to make further inquiry as to whether from the commencement of the new radiotelegraphic convention on 1st July, 1913, there was an improved prospect of receiving weather telegrams by radiotelegraphy from ocean liners in time to be of immediate service.

Velocity-equivalents of the Beaufort Scale.—The question as to the velocity-equivalents of the Beaufort Scale of wind force which was raised by M. Palazzo at the London meeting of the Commission in 1912, and was referred to MM. Köppen, Lempfert, and Palazzo for consideration and report (*see* Appendix VII.), gave rise to a long discussion from which it was apparent that the question was not yet ready for decision.

Mr. Shaw produced for inspection a number of traces from a pressure-tube anemometer in order to show how indefinite the comparison of Beaufort Scale estimates with recorded wind velocity must be. He submitted the following resolution:—

The Committee note that of the scales of equivalents actually in use, two, viz., that given by Professor Köppen and that of the Meteorological Office, London, are based directly upon recent extensive comparisons of estimates of wind-force with the records of anemometers. Differences such as are exhibited between these two scales may be attributed partly to the differences of exposure of the anemometers and partly to the fluctuating nature of ordinary winds which the observer has to estimate.

In the absence of suitable means of forming an opinion as to the effect of these probable causes of difference the Committee deems it inadvisable at present to adopt a single scale of equivalents as applicable for all anemometers and all observers. It expresses the wish that investigations which will throw light upon the subject may be continued, and recommends for the present that any changes made in the hourly equivalents adopted by the several Institutes may be so chosen as to bring the values within the limits specified in the two scales, so that the values adopted should not be outside the aforesaid limits.

The Committee, though agreeing with the views expressed by Mr. Shaw, considered that the time had not yet arrived for the definitive adoption of numerical values for the velocity equivalents of the Beaufort Scale, and requested the sub-Commission to continue its consideration of the subject.

Change of Wind Velocity with Height.—With reference to the investigation advocated by Professor Köppen as to the increase of wind velocity in the lowest strata of the atmosphere over the earth's surface, M. Hellmann made a communication upon the



station for anemometrical experiments which he had organised near Nauen, and M. Hergesell upon similar measurements at different heights made by him in Strassburg.

The session closed at 17h. 45m.

(Signed) W. N. SHAW, President.  
HELLMANN, Secretary.

#### Fourth Meeting, Wednesday, April 9th, 1913.

Present: MM. Angot, van Everdingen, Hamberg, Hellmann, Maurer, Palazzo, Ryder, Rykatcheff, Shaw, Stupart, Hergesell, Bjerknes, Lempfert.

The session began at 10h. 5m.

**Minutes.**—The minutes of the third meeting were read and confirmed.

**4. Report of the Commission for Scientific Aeronautics.**—The President of the Commission, M. Hergesell, gave an account of the meeting of the Commission in Vienna in the spring of 1912 (Appendix VIII.) and drew special attention to various points for which he asked the support of the Committee.

**Death of M. Teisserenc de Bort.**—The following resolution was adopted:—

The International Meteorological Committee shares the regret which the death of M. L. Teisserenc de Bort has called forth, and unanimously expresses the wish that the French Government will take the necessary steps for the continuance of aerological investigations in France.

**Réseau of Pilot-balloon Stations.**—After consideration of the resolution adopted by the Commission for Aeronautics with regard to the creation of a réseau of pilot-balloon stations in Europe, the following resolution was adopted:—

The Committee cordially supports the proposals of the Commission for the establishment of a Réseau of pilot-balloon stations and recommends it to the Directors of Institutes of all countries.

**Expression of atmospheric pressures in millibars.**—With reference to Resolution 6 adopted by the Aeronautical Commission in Vienna (see Appendix III., No. 5) for expressing atmospheric pressure in millibars instead of millimetres in the international publications of the Commission, M. Bjerknes explained his point of view and drew attention to the first section of "Veröffentlichungen des Geophysikalischen Instituts der Universität Leipzig." (Publications of the Geophysical Institute of the University of Leipzig.) An animated discussion took place in which especially MM. Angot, van Everdingen, Hellmann, Hergesell, Rykatcheff, and Shaw took part.

The Committee adopted the following resolution:—

It is desirable in aerological observations to give pressure values in millibars as well as millimetres.

The Committee therefore request the Aeronautical Commission, with reference to its resolution No. 6 of the Vienna meeting, to publish pressure values not only in millibars, as demanded by that resolution, but also in millimetres.

Resolution 8 of the Aeronautical Commission with reference to the steps of height was approved.\*

**"Dynamic Metres."**—After a long and animated discussion upon resolution 7 of the Commission with reference to the adoption of the so-called "dynamic-metre" instead of geometrical metres the President of the Commission expressed a wish for the subject to be further considered by the Commission.

**Aerological research in polar regions.**—The suggestion made by the Aeronautical Commission for aerological observations in the north polar basin during the prospective polar explorations has induced M. Rykatcheff to present the proposal in more extended form and to outline in a printed communication (Appendix IX.) the scheme of operations contemplated by Russia.

It appeared in the course of the discussion that in the next few years several polar expeditions would carry out aerological observations, and there was a possibility of extending the network of stations already in operation in high latitudes. The Committee, therefore, adopted the following resolution:—

In consideration of the probable continuance of the aerological station at Spitzbergen and of the co-operation of the expeditions projected by Amundsen and by the Canadian Government the Committee regards the occasion as an exceptionally favourable opportunity for the establishment of polar stations for the study of the atmospheric conditions of the different atmospheric strata.

The Committee accordingly nominated a special commission for the furtherance of this object, to consist of MM. Rykatcheff (President), Amundsen, Hergesell, Ryder, Stupart. The following resolution was also adopted:—

The Committee has received with the greatest interest the information as to the further project of the St. Petersburg Academy of Sciences to initiate aerological observations in the region of the Siberian pole of cold independently of the international undertaking, and express the wish that the project will soon be realised.

**9. Report of the Commission for Terrestrial Magnetism.**—M. Rykatcheff, President, presented the Report (Appendix X.).

M. Palazzo added a statement as to the progress made with the project for the establishment of a magnetic observatory in Tripoli. The Committee learned with pleasure the steps which M. Palazzo had taken and expressed the wish that the Italian Government would see its way to realise the plans by the establishment of the observatory in a short time.

\* "In publications heights will be shown where the following pressures exist:—

1,000 mb. (= 750 mm.).	500 mb. (= 375 mm.).
900 mb. (= 675 mm.).	400 mb. (= 300 mm.).
800 mb. (= 600 mm.).	300 mb. (= 225 mm.).
700 mb. (= 525 mm.).	200 mb. (= 150 mm.).
600 mb. (= 450 mm.).	100 mb. (= 75 mm.).

This decision will come into force as from January 1st, 1913."



12. **Measurements of Snow and "Snow lying."**—(Professor Mohn, Appendix XI.) Since it had been already resolved in Munich in 1893 (*see* Kodex, German Edition, 1911, p. 15) only to enter the symbol for "snow lying" when more than half the country round the station was under snow, it is clear that only those days can be counted as being days of "snow lying" which are defined by the numbers 3 and 4 on the scale of four degrees adopted by M. Mohn.

With reference to the evaluation of a monthly mean of "snow thickness" it appeared that this was seldom made. In case, however, the 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."

The session closed at 13h.

(Signed) W. N. SHAW, President.  
HELLMANN, Secretary.

#### Fifth Meeting, Friday, April 11th, 1913.

Present: MM. Angot, van Everdingen, Hamberg, Hellman, Maurer, Palazzo, Ryder, Rykatcheff, Shaw, Stupart, Hergesell, Lempfert.

The session commenced at 9h. 40m.

**Minutes.**—After the minutes of the fourth meeting had been read and approved, the President read to the meeting a telegram from Professor Mohn thanking the meeting for its greeting.

5. **Report of the Commission for Solar Radiation.**—M. Maurer, President of the Commission, brought up the report of the meeting held at Rapperswyl in 1913, and put forward the points which required further consideration. The question of the adoption of centres for the comparison of the pyrliometers used at different stations gave rise to an exhaustive discussion, which led to the following resolution:—

The Committee recognizes the desirability of establishing a centre for the comparison of pyrliometers with standard instruments both in Europe and America, and it looks forward to the establishment of similar institutions in the Southern Hemisphere. The Committee requests the President of the Commission to place himself in communication with the Solar Research Union in order that co-operative action may be taken to secure the establishment of centres of comparison.

At the same time the Committee requested the President of the Commission to ascertain from M. Granquist, of Upsala, whether he would be disposed to set up at the Physical Institute there a centre for testing actinometers of all kinds.

With reference to the question of hours most suitable for measuring solar radiation, for which the interval from 11h. to 13h. had been specified at Innsbruck, the Committee resolved to modify the restriction, and to frame the resolution of Innsbruck in relation to Rapperswyl as follows:—

The measurement of the total radiation of the sun should be made regularly at least once a day at a suitable time, and on clear days as frequently as possible.

The second part of M. Maurer's report dealt with the measurements of the duration of sunshine, the comparability of which, in the opinion of the members present, leaves much to be desired, since the instruments supplied by English, German, and French firms differ in respect of the size and composition of the glass sphere and the quality of the paper. Also the diversity of method of evaluating the record leads to want of uniformity. Mr. Shaw pointed out that the apparatus used in the British system fulfilled the conditions of the *Observers' Handbook*, which were based upon the work of Stokes.

The following resolution was therefore adopted:—

Attention having been called to the inadequacy of the methods hitherto employed for registering sunshine by means of the glass ball heliograph, the International Meteorological Committee recommends the Commission for Radiation to initiate experiments for the comparison of the different forms of instrument of this type with each other, and especially with the English Campbell-Stokes instrument which is already made according to a precise specification, in order that, as far as possible, uniformity in the size and composition of the glass of the sphere and also of the paper may be proposed to the makers of the instruments.

The session closed at 13h. 20m.

(Signed) W. N. SHAW, President.  
HELLMANN, Secretary.

#### Sixth Meeting, Friday, April 11th, 1913.

Present: MM. Angot, van Everdingen, Hamberg, Hellmann, Maurer, Palazzo, Ryder, Rykatcheff, Shaw, Stupart, Hergesell, Lempfert.

The session commenced at 16h. 5m.

**Meteorological Service of Russia.**—M. Rykatcheff made a communication on the extension and completion of the Meteorological Service of Russia (Appendix XII.). The President congratulated M. Rykatcheff on the results which he had achieved.

13. **Thermometer Screens.**—M. Rykatcheff, following a suggestion of Professor Köppen's, called the attention of the Committee to the necessity for the comparison of the Stevenson screen (*Englische Hütte*) with the aspiration thermometer in regions of intense radiation, as comparisons of that kind in the summer of 1911 at Bairam-Ali had given the unexpected result that at 13h. the screen and aspiration thermometer gave concordant results, probably on account of the great increase of wind velocity at mid-day.

The Committee accordingly resolved to draw attention to the resolution adopted at Paris in 1896, according to which comparisons should be made in each country between the ordinary thermometer exposure and the aspiration thermometer, and to express the desirableness of such a test of the Stevenson screen in tropical regions.

8. **Sleet and Days of Snow.**—A question put by Mr. Shaw on behalf of Mr. Gold (*see* Appendix XIII.) as to whether on occasions of the occurrence of sleet (rain and snow falling together) the day should be counted as a "day of snow," and whether



a special symbol should be used for sleet, gave rise to a lively discussion, in which all present took part. Though it may sometimes seem desirable to know the number of the days on which snow and rain have fallen together, in addition to the number of days on which snow has fallen, the opinion of several members was that the decision arrived at at Vienna and Utrecht (see *Kodex*, 1911, p. 14) to reckon days of rain and snow as days of snow held good in this case also.

10. **Conference of Directors.**—Finally the question of a conference of directors was considered. It was unanimously decided that it would be desirable to convene one in 1915, that is, ten years after the Innsbruck Conference.

The session closed at 17h. 15m.

(Signed) W. N. SHAW, President.  
HELLMANN, Secretary.

### Seventh Meeting, Saturday, April 12th, 1913.

Present: MM. Angot, van Everdingen, Hamberg, Hellmann, Maurer, Palazzo, Ryder, Rykatcheff, Shaw, Stupart, Hergesell, Lempfert.

The session began at 9h. 45m.

Mr. Shaw read a letter which he had received from M. Hann, thanking the Committee for their telegram.

7. **Storm Warnings and Maritime Meteorology.**—Mr. Shaw, as President of the Commission charged with the consideration of these subjects, presented a report on the meeting of this Commission held in London in 1912, and on the letters he had received from the various meteorological services since the date of the meeting (Appendix XIV.).

No changes were considered desirable in the scheme of day signals approved in Berlin in 1910. In the case of night signals a higher degree of uniformity than that obtained at the meeting of the Commission in London could not be attained. Mr. Stupart wished it to be recorded in the minutes that he could not adopt the proposed signals in Canada as in his service it has been found possible to differentiate effectively between moderate and strong gales. After a few further remarks from MM. Angot, van Everdingen, Rykatcheff, and Shaw, the following resolutions were adopted:—

The Committee is of opinion—

1. That it is not desirable to re-open the question of the scheme of day signals which was approved at the Berlin Meeting in 1910, but it is desirable to place on record that the adoption of a scheme of signals as international does not preclude the adoption by individual organisations of other signals, in addition, which do not form part of the international code.

2. With regard to the code of night signals it appears that the proposal of three red lanterns in a vertical line as a signal for hurricane is open to objection. The Committee, therefore, refer back that proposal for further consideration by the Commission.

3. Objections have also been raised to the use of a single red lamp as a storm signal on the ground that it is liable to be mis-

understood. The Committee are therefore unable to adopt it as an international signal though they see no objection to its use in those cases in which no confusion is likely to arise. With these qualifications the Committee adopt and recommend the proposals of the Commission as set out in Resolutions 1, 11, and 12.

4. With regard to Resolution 13 it is evident that the use of a signal at a storm-warning station to indicate that the signals for storm warning cannot be hoisted on account of the interruption of telegraphic communication, or for some other cause, would be acceptable in many countries, but the objections raised to the use of a single green lamp for the purpose are so numerous that the Committee desire this proposal to be reconsidered by the Commission.

5. With regard to Resolution 7 it appears that the Committee is not yet in a position to approve of any definite proposals of non-local storm signals as an international scheme.

6. The Committee adopts Resolution 8 of the Commission.

With regard to this resolution, which invites the institutes to communicate to the Director of the Netherlands Institute marine observations for specified parts of the tropical oceans, M. van Everdingen reported that, at the request of the Commission, he had drawn up a form for the entry of the observations. This form he submitted to the Committee (Appendix XV.).

11. **Réseau Mondial.**—M. Hellmann reported to the Committee a letter from M. Hildebrandsson announcing his intention to resign from the Commission. After some explanations had been given by the President regarding the position of the work proposed to be undertaken by the Solar Commission, which had been delayed by the resignation of Sir Norman Lockyer from the Directorship of the Solar Physics Observatory, it was decided not to reconstitute the Bureau of the Commission for the Réseau Mondial. Mr. Stupart was requested to publish a report on the synoptic charts of the northern hemisphere, now being constructed day by day by the Canadian Service, as these charts actually realise a part of the work contemplated by the Commission.

7. **Polar Ice.**—M. Ryder reported on the ice charts of the Polar basin which are published by his institute in response to requests formulated at international meetings. He pointed out that the number of observations of this kind sent in by non-Danish ships had decreased steadily year by year (Appendix XVI.).

The Committee requests the Directors of all Institutes to support the enterprise by supplying reports of ice observations as far as they are able to do so.

The business of the meeting being concluded, M. Rykatcheff, who ceases to be a member of the Committee in consequence of his resignation from the Directorship of the Central Physical Observatory of St. Petersburg, took leave of his colleagues. Mr. Shaw thanked him for his valued co-operation.

After the customary concluding speeches and votes of thanks the meeting adjourned at 11h. 50m.

(Signed) W. N. SHAW, President.  
HELLMANN, Secretary.



## APPENDICES.

## APPENDIX I.

(See p. 4.)

## M. PALAZZO'S ADDRESS.

Messieurs et chers Collègues.

Je vous demande la permission de prendre la parole avant qu'on donne commencement à nos travaux.

Bien que notre réunion ne revête pas un caractère officiel, elle a cependant lieu sous les auspices du Ministère d'Agriculture, Industrie et Commerce, duquel dépend le service météorologique en Italie. Or, Son Excellence le Ministre d'Agriculture M. Nitti a bien voulu me charger de vous parler en son nom, pour vous souhaiter la bienvenue à Rome, et pour vous remercier d'avoir voulu vous réunir dans cette glorieuse capitale d'Italie, que vous, illustres savants de l'étranger, honorez maintenant de votre présence. Son Excellence le Ministre espère n'être pas empêché demain soir de présider lui-même le banquet qui vous sera offert; il sera alors bien heureux de faire votre connaissance personnelle.

Mais tandis que je me fais l'interprète des sentiments de bienveillance et de considération du Ministre envers vous, permettez-moi encore, chers collègues, de vous exprimer combien est sincère le plaisir que j'éprouve de vous revoir ici, réunis autour de moi, dans le modeste siège de mon Institut. Je tiens aussi à vous remercier pour avoir accepté la proposition que je fis en septembre dernier à Londres, afin que la réunion du Comité eût lieu à Rome; mon vœu est aujourd'hui exaucé. Après les maintes réunions internationales qui nous ont offert les occasions d'approfondir de plus en plus notre réciproque connaissance personnelle et de resserrer entre nous les liens d'une amitié de plus en plus intime, je me sens maintenant comme dans un cercle de vieux et bons amis, de ces amis qu'on revoit toujours avec joie et sympathie. En effet, je vous assure que ma pensée recourt bien souvent à vous, mes amis et collègues, lorsque dans la solitude de mon cabinet d'étude, je prolonge la veille en m'adonnant à mes travaux particuliers; alors, dans le silence de la nuit avancée, je me sens presque en communion d'esprit avec vous, bien qu'éloignés et parsemés en pays étrangers, car je pense que, vous aussi, vous devez remplir vos devoirs d'hommes de science et vous plier à la loi inéluctable du travail, souvent dur, mais toujours fécond en nobles satisfactions.

Les accueils qui vous attendent ici seront modestes, mais inspirés de la plus grande et vive cordialité; je ferai de mon mieux pour vous rendre agréable ce bref séjour dans notre ville, et je m'enforcerais de me rendre utile à la conférence. Malheureusement, je me sens un peu embarrassé à remplir dignement ma tâche, car à cause de ma dureté d'oreille—vous le savez—je me heurte toujours à des difficultés dans la conversation; j'implore donc votre bienveillante indulgence, si je ne pourrai prendre à vos discussions une part si active comme je le voudrais.

Je souhaite que cette nouvelle réunion internationale de météorologistes à Rome ait une importance et un succès comparables à ceux du mémorable Congrès international météorologique qui eut lieu ici, il y a juste trente-quatre ans, en 1879,

année qui marque aussi la date de la fondation de notre Bureau Central de Météorologie. Le Congrès de Rome a laissé une trace ineffaçable dans l'histoire de la météorologie; ce fut alors qu'on a bien établi les bases de l'organisation internationale des services météorologiques; espérons que la réunion actuelle aboutisse à des résultats aussi féconds!

J'ai obtenu, grâce à la courtoisie de M. le Sénateur Blaserna, la permission d'apporter dans la salle de nos réunions cette vieille, presque jaunie photographie, qui représente les participants au Congrès de Rome de 1879. Le tableau vous intéressera sans doute. Après un si long espace de temps, les survivants de ce Congrès sont malheureusement peu nombreux; mais j'ai le plaisir de saluer ici mon cher ami M. Hellmann, qui très jeune a participé au Congrès de Rome; je lui exprime mes félicitations, car, je pense, il doit être très satisfait de se trouver de nouveau à Rome, en réunion de météorologistes, à la distance de 34 ans, après avoir accompli, depuis lors, une si glorieuse carrière.

Je regrette vivement de ne pas voir aussi, parmi nous, un autre très distingué survivant du Congrès de Rome, M. Mohn, l'illustre vieillard, le doyen de notre Comité. A lui, à M. Hann, à M. Scott, à ces glorieux vétérans de la météorologie, qui, ayant pris part au Congrès de Rome, ont aussi rempli la fonction de membres de notre Comité, va maintenant notre pensée de sympathie et de dévouement le plus respectueux; et je vous propose de faire parvenir à MM. Mohn, Hann et Scott des télégrammes qui, en leur témoignant les sentiments de vénération de nous tous en ce moment réunis ici, leur rappelleront le beau temps de leur venue à Rome à l'occasion de cet ancien Congrès.

Mais cet hommage aux survivants amène notre pensée aussi à ceux qui sont décédés, à ceux qui, représentés dans la photographie du 1879, ne survivent plus; leur mémoire ne nous en est pas moins chère, et elle nous inspire des sentiments plus délicats encore et pathétiques. Je pense surtout à ceux que j'ai connus plus intimement, à mon prédécesseur et bienfaiteur M. Tacchini, à mon illustre et vénéré maître von Bezold, à M. Mascart. Cette pensée de pieuse révérence vers les morts qui ont passé dans notre Comité, comme nous passerons aussi, dans cette perpétuelle succession d'hommes et de choses, ne doit avoir rien d'attristant pour nous; elle ne doit pas non plus attiédir notre enthousiasme pour la vie de travail, et c'est dans le travail que nous trouverons aussi la joie de vivre. Die deutschen Studenten in der Kneipe singen lustig das Carmen amœbaeum:

"Gaudeamus igitur—juvenes dum sumus;  
post jucundam juventutem,—post molestam senectutem,  
nos habebit humus."

Nous sommes animés aussi d'un sentiment pareil; l'idée que notre vie est transitoire, ne nous retient pas de tâcher d'en tirer le meilleur profit; et c'est avec enthousiasme que nous répétons les vers du *carmen amœbaeum* en modifiant le "Gaudeamus" par "Laboremus igitur—videntes dum sumus." C'est par cette invocation à la joie du travail, c'est avec l'invitation "Ergo laboremus" que je cède la place à vos discussions.

L. PALAZZO.



## APPENDIX II.

(See p. 4.)

## REPORT OF THE OFFICERS.

We are happy to be able to report that the constitution of the International Meteorological Committee has suffered no change since its last meeting in Berlin in October, 1910.

The original German edition of the report of that meeting was published and distributed before the end of 1910, while the English edition, supplemented by some additions in Appendix IV., was distributed early in 1912, and the French edition in March, 1913. The French edition of the report of the meeting of the Committee, held in Paris in 1907, was published two months earlier. A second German edition, revised and enlarged, of the International Meteorological Kodex was completed in 1911. It has been distributed widely among meteorological and magnetic institutes and observatories.

The following Commissions constituted by the Committee have held meetings during 1912:—

The Commission for Scientific Aeronautics at Vienna in May.

The Commission on Solar Radiation at Rapperswil (Switzerland) in September.

The Commission on Weather Telegraphy in London in September.

The Commission on Maritime Meteorology and Storm Signals in London in September.

Finally a special Commission, nominated by the officers of the Committee, met in Paris at the end of September to consider the question of Agricultural Meteorology which had been referred to the Committee in 1911 by the International Institute of Agriculture.

The reports of all these meetings have been printed and circulated by the Institutes of Vienna, Zürich, London, and Paris respectively.

The International Meteorological Committee will have to consider at its present meeting several questions raised by the reports of these Commissions.

W. N. SHAW, President.  
G. HELLMANN, Secretary.

## APPENDIX III.

## PROGRAMME.

(Already printed on pp. 4-6.)

## APPENDIX IV.

(See p. 6.)

## EXTENSION OF THE SYNOPTIC CHARTS OF THE NORTH ATLANTIC OCEAN.

*Letter from the Deutsche Seewarte addressed to the President for communication to the Committee.*

In continuation of previous correspondence dated June 20th, 1908, on the subject of the extension of the Deutsche Seewarte's publication "Synoptische Wetter Karten für den Nordatlantischen Ozean" by including in them subsidiary charts for the area between latitudes  $10^{\circ}$  N. and  $10^{\circ}$  S. and longitudes  $10^{\circ}$  W. and  $40^{\circ}$  W., the Deutsche Seewarte begs leave to report that charts of the kind desired have been prepared in manuscript for a period of six months. Ten of these charts, representing the data for the whole month of April, 1911, are forwarded herewith as specimens. It appears from them that the available data for the region under consideration are too scanty to give an adequate representation of the meteorological conditions prevailing therein. This is due to the fact that such observations as are available almost all lie within a very limited area, not to say on a single line, as steamships almost without exception adhere closely to a single track, and sailing vessels which formerly traversed the eastern part of the area, nowadays scarcely ever do so. They all make use of the western route both on the outward and on the return journey to Cape Horn. Moreover, as pressure differences over the area considered are small, small errors of observation or in the instrumental corrections, such as can scarcely be avoided in observations at sea, make it more difficult to represent the pressure distribution satisfactorily.

For these reasons the prosecution of the work appears to the Seewarte to be unremunerative; and it would remain so even with the assistance of other seafaring nations, as their ships sail the same course as the German ones.

In order to prosecute the work satisfactorily a chain of meteorological stations is required on both coasts of the ocean. The observations from these stations could then be used to supplement the ship's observations in a manner similar to that adopted in dealing with the part of the ocean lying between Europe and North America. A few such stations exist on both coasts, but their observations are not accessible to all.

## APPENDIX V.

(See p. 7.)

## AGRICULTURAL METEOROLOGY.

The permanent Committee of the International Institute of Agriculture has received from its Vice-President, M. Louis Dop, a memorandum on the importance of organising the study of agricultural meteorology on a uniform and comprehensive plan in all countries. The Committee transmitted this memorandum to the President of the International Meteorological Committee, with a request that he would bring it before that body.



The President thereupon requested MM. Angot, Börnstein, Brounoff, Dop, and Palazzo to act as a Commission and to formulate proposals for submission to the Committee at its forthcoming meeting in 1913.

This Commission held four meetings in Paris, at the Bureau Central Météorologique on September 26th, 27th and 28th, 1912. After having examined the present state of agricultural meteorology in different countries, and having considered the memorandum of M. Louis Dop, referred to above, the Commission unanimously approved the following proposals which it has the honour to submit to the International Meteorological Committee.

### I. General Proposals.

1. The Commission suggests that the International Meteorological Committee nominate a permanent Commission on Agricultural Meteorology which shall be constituted on a basis similar to that of the Commission on Scientific Aeronautics.

The formation of this Commission is justified by the novelty and complexity of the problems of agricultural meteorology which require for their advancement co-operation between meteorologists, agriculturists and botanists. Moreover, the step will form a suitable acknowledgment of the manifestations of interest in agricultural meteorology which the governments of several countries have recently shown.

### II. Proposals regarding Observations and their Publication.

2. The Commission recommends investigations having for their object the comparison of different types of instruments for measuring the duration of insolation and the intensity of solar radiation both the direct radiation (sun alone), and the total (sun and sky), in order ultimately to be in a position to recommend for general use simple types of instruments which shall give comparable records.

3. The Commission recommends the making of more precise and detailed observations of fog (wet and dry), hoar frost and rime.

4. The Commission recommends the making of comparisons between different methods of exposing minimum thermometers used for determining the temperature at varying heights among plants and above them.

5. The Commission recommends the extension of observations of meteorological optical phenomena (halos, coronæ, colour of the sky, tints, and duration of dawn and dusk, abnormal refraction, mirages, scintillation of stars, &c.). These phenomena are of great importance in foretelling weather locally.

6. The Commission is of opinion that monthly weather reports refer to too long a period to be applicable to many problems connected with agriculture. It recommends the publication of reports for decades. Such reports should appear as soon as possible after the completion of the period to which they refer and should give, as a minimum, observations of temperature, rainfall and the water level of streams. It would be useful to add reports on the level of underground waters.

The publication of reports on these lines should not entail the suppression of monthly reports; the latter should be continued.

7. The Commission recommends the regular publication of statistics of the distribution both in time and space of meteorological phenomena which are specially important in connexion with agricultural operations (temperature, frost, rain, thunderstorms, hail, &c.), and of the relation of these phenomena to the nature of the crops grown and to the orographical and hydrographical features of the country.

It is important that such statistics should be rendered available to the public at small cost.

### III. Proposals connected with Weather Forecasts.

8. Being of opinion that the immediate distribution of weather charts is at least as important as that of forecasts, as such charts enable all interested in them to make local forecasts, and having regard to the fact that the daily weather reports of central offices cannot in many cases be delivered sufficiently early on the day of issue to be of service, the Commission recommends:—

(i) That, following the precedent set in the United States of America and in Germany, a number of local centres be created in each country which shall receive from the central offices sufficient telegraphic reports to enable them to construct and print daily charts showing the general distribution of meteorological phenomena and to issue forecasts. By this means the information would be put at the disposal of all persons interested without delay.

(ii) That these local centres shall be responsible for the issue of forecasts locally, but that they shall be under the scientific direction of the central office, as by that means alone can uniformity be secured throughout the system.

9. Being of opinion that a forecast service which is limited to the construction of charts and the issue of forecasts only once a day, cannot meet all requirements, and in view of the fact that an evening service is already in operation in several countries, the Commission expresses a wish for the organisation of an evening service throughout Europe.

10. The Commission puts on record requests

- (i) that the daily weather reports prepared at the local centres be issued at the cheapest rate possible;
- (ii) that the reports be distributed to all elementary schools and that all teachers be made familiar with the methods of using them.

11. The Commission calls upon the responsible authorities to consider ways and means for the rapid dissemination of weather forecasts in country districts and takes note of the various schemes which are already in operation in different countries, especially in the United States of America.

(Signed)

ANGOT.  
BÖRNSTEIN.  
BROUNOFF.  
DOP.  
PALAZZO.

Paris,

September 28th, 1912.



## APPENDIX VI.

(See p. 8.)

## COMMISSION FOR WEATHER TELEGRAPHY.

*Report of the President.*

The report of the meeting held in London, on September 17th-20th, 1912, has been printed (Meteorological Office publication, No. 211) and circulated to the various Meteorological Institutes. Comments have been received from the Institutes in the following places:—

Munich, Giza (Egypt), Stuttgart, Uccle (Belgium), Vienna, Hamburg (Deutsche Seewarte), Lisbon, Budapest, Trieste, Zürich, de Bilt (Netherlands), Helsingfors, Christiania, Athens, and Madrid.

*General Considerations.*

Upon the general question of the exchange of telegrams, the following remarks have been made:—

M. Defant, writing on behalf of Hofrat Trabert (Vienna):

The Central Meteorological Institute of Vienna feels constrained to point out that its system of observation has been organised on the general meteorological principles elaborated by the International Committee in the course of the second half of the nineteenth century.

The extension of the activities of the institutes and the ever-increasing specialisation involved in the consideration of questions of organisation by special commissions, which naturally pay more attention to their own immediate objects than to considerations of general meteorological importance appears to involve a serious menace to effective international co-operation.

The Deutsche Seewarte requests further consideration of the question of the extremes of temperatures reported by telegraph, raised in Proposition C. (M.O. 211, p. 25). Stations which read and set their maximum and minimum thermometers at the times mentioned in the usual instructions to climatological stations, should be asked to make an additional reading *and setting* of the instruments at the hour of morning observation, in order to be in a position to report extremes of temperature for the 24 hours ended at that epoch. An additional setting as well as an additional reading is essential for this purpose. The Seewarte requests that the report on this subject prepared for the Conference of Directors held in Innsbruck in 1905, which was accidentally omitted from the report of the Proceedings, be printed in the report of the present meeting, as the matter is not completely covered by the resolutions adopted at Innsbruck and Paris. (Kodex, Berlin, 1911, p. 35.)

[The following is the report:—

*Deutsche Seewarte, Hamburg.**A. Uniformity in the Extremes of Temperature published in Daily Weather Reports.*

1. The published extremes of temperature must refer to the same interval.

2. The interval selected should be the 24 hours preceding the morning observation.

The headings "Maximum and Minimum for the past 24 hours," found in many Weather Reports, show that there is a demand for these data, but in very many instances the heading does not describe correctly the information given.

3. The special *climatological* requirements of the various offices in the matter of extreme temperatures must receive consideration. In order to meet the requirements of telegraphic reporting at stations where a duplicate set of instruments is not available, the following procedure must be followed:—

The instruments must be read and set not only at the hour of evening observation as required by the international convention regulating the procedure of normal climatological stations, but also at the hour of morning observation. The readings thus taken should be set out side by side on the monthly returns, as shown in the table given below. The extremes appropriate to the meteorological telegrams are obtained by combining the morning observations with those of the previous evening, while a central office would have no difficulty in selecting from the two sets of values given for each day the appropriate figures for the extremes required for climatological purposes.

	Daily Observations of the Maximum and Minimum thermometers.				Maximum and Minimum for the preceding 24 hours.			
	8 a.m.		9 p.m.		8 a.m.-8 a.m.		9 p.m.-9 p.m.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	7.0	5.4	10.4	7.0	—	—	10.4	5.4
2	10.4	7.8	10.8	7.4	10.4	7.0	10.8	7.4
3	7.4	5.6	9.2	4.1	10.8	5.6	9.2	4.1
4	6.1	4.0	7.4	6.0	9.2	4.0	7.4	4.0
5	6.8	5.7	8.1	5.0	7.4	5.7	8.1	5.0
6	5.0	3.3	7.5	3.3	8.1	3.3	7.5	3.3
7	3.9	0.9	6.5	0.9	7.5	0.9	6.5	0.9
8	8.6	2.7	11.4	7.1	8.6	0.9	11.4	2.7
9	9.1	7.2	10.5	8.3	11.4	7.1	10.5	7.2
10	8.3	5.1	8.5	5.2	10.5	5.1	8.5	5.1
11	8.7	4.4	9.4	4.9	8.7	4.4	9.4	4.4
12	5.7	3.1	7.9	3.2	9.4	3.1	7.9	3.1
13	6.9	4.6	7.3	4.8	7.9	3.2	7.3	4.6
14	5.9	4.3	7.8	5.3	7.3	4.3	7.8	4.3
15	5.4	0.1	5.5	0.1	7.8	0.1	5.5	0.1
16	5.7	4.0	6.2	2.0	5.7	0.1	6.2	2.0
17	2.0	-3.2	-0.2	-3.2	6.2	-3.2	2.0	-3.2
18	-3.2	-6.6	-1.6	-6.4	-0.2	-6.6	-1.6	-6.6
19	-5.4	-8.9	-2.3	-8.9	-1.6	-8.9	-2.3	-8.9
20	-4.5	-6.6	0.2	-6.4	-2.3	-8.9	0.2	-6.6
21	-2.2	-6.3	0.3	-4.6	0.2	-6.4	0.3	-6.3
22	0.0	-0.8	1.0	-2.9	0.3	-4.6	1.0	-2.9
23	-2.9	-6.8	-0.6	-5.7	1.0	-6.8	-0.6	-6.8
24	1.1	-3.7	2.8	1.1	1.1	-5.7	2.8	-3.7
25	2.8	-0.3	1.2	-0.3	2.8	-0.3	2.8	-0.3
26	1.1	0.6	1.3	0.1	1.2	-0.3	1.3	0.1
27	0.4	-1.2	-0.1	-2.1	1.3	-1.2	0.4	-2.1
28	-2.1	-4.2	—	—	-0.1	-4.2	—	—
29	—	—	—	—	For Daily Telegrams.		For Climatology Tables.	
30	—	—	—	—				



The example reproduced shows that the extremes published in daily reports must be far from comparable if the values do not all refer to the same interval. It also shows that the comparable extremes can be obtained without calling for appreciably more work on the part of observers.

It seems desirable for the observers to enter the extremes read off twice a day on special forms, rather than on the regular monthly returns, and to leave the appropriate entries to be made on the climatological return at the central office. The latter can then be certain that the figures of the monthly form, which are used for computing mean temperatures, refer to the interval of 24 hours ending at the time of evening observation.

The interval to which the published extremes of temperature refer should be stated in all Daily Weather Reports. If this suggestion is adopted a note "for the past 24 hours" would give all that is required.

*B. Necessity of stating in all Daily Weather Reports whether the Pressure data have been corrected for the variation of the value of Gravity with Latitude.*

It appears desirable that all pressure values be published after application of the correction for the variation of the value of gravity with latitude, in accordance with a resolution adopted at the International Conference held in Munich in 1891. In order to avoid possible misunderstandings, it should always be stated whether this correction has been applied or not.]

M. Schmauss, Munich, requests that the Committee will consider the question of securing more expeditious transmission of telegrams from France.

*Comments received on individual resolutions.*

The following is a summary of the comments upon the several resolutions submitted by the Commission:—

**Resolutions 1 and 2.** (London Report, pp. 4 and 5.) Hours of observing.

M. Defant, Vienna; M. Róna, Budapest; M. Mazelle, Trieste, point out that their telegraphic services are dependent on the observers at climatological stations where the hours of observing are 7h., 14h., 21h. local time. The adoption of the resolutions would involve additional observations which the observers could not be expected to undertake without remuneration, for which no funds are available or likely to be forthcoming.

M. d'Almeida Lima, Lisbon, prefers the combination 7h., 13h., 19h., to 7h., 13h., 18h.

M. Galbis, Madrid, cannot conform to Resolution 1. The hours of observation are 8h. and 16h. G.M.T.

M. van Everdingen, de Bilt, will try to arrange for observations at 13h. and 18h. at Helder and Vlissingen if complete uniformity is attained.

Mr. Craig, Egypt. The Egyptian service already adopts the hours specified in Resolution 2 (6h., 12h., 18h.) throughout its system, and would prefer to adhere to these in the case of those stations also which lie to the west of 30° E. (including Alexandria).

M. Eginites, Athens, approves the principle of the resolution, but foresees difficulties in carrying it out.

**Resolution 3** (p. 5). Barometric tendency in two figures only.

This is generally approved. No objection is raised.

M. Eginites, Athens, desires a modification of the telegraphic code so that the tendency may be included in the first two groups (3rd and 4th groups of the complete international message), as only two groups are received.

**Resolution 4** (p. 5). Temperature to be given in whole degrees only.

M. Defant, Vienna, can adopt the resolution, but points out that it has been the practice to construct isallotherm charts for the 24-hour interval and that these will be less accurate in future than in the past. An investigation into the future utility of these charts would be desirable before the resolution is adopted internationally.

**Resolution 5** (p. 5). Method of reporting temperature near freezing point.

M. Pilgrim, Stuttgart, would prefer the code suggested by the Deutsche Seewarte. [This proposal was not recommended by the Commission, as M. Rykatcheff pointed out that temperatures below - 40° C. occur in the Russian system and hence the suggested code might lead to ambiguities.]

Mr. Craig, Egypt, concurs, but suggests that the even number in place of the higher number would give a better average when the telegrams are used for weekly or monthly reports.

M. Mazelle, Trieste, prefers:—

+ 0.4° C. to	0.0° C. =	00
- 0.1° C. to	- 0.4° C. =	50
- 0.5° C. to	- 1.4° C. =	51
- 1.5° C. to	- 2.4° C. =	52

to the suggested code—

- 1.5° C. to	- 0.6° C. telegraphed as	51
- 0.5° C. to	00° C. „	50
+ 0.1° C. to	+ 0.4° C. „	00
+ 0.5° C. to	+ 1.4° C. „	01

**Resolution 6** (p. 5). Method of reporting negative tendencies.

No objections are raised.

**Resolutions 7 and 8** (pp. 5, 6). Code for the characteristic of the barometric tendency.

Mr. Craig, Egypt. In the English version the word "steady" is opposed to "unsteady" and also to "rising or falling." We would suggest that "steady" be kept for a barogram with no time change of pressure as opposed to "rising or falling," and that some such words as "uniform" and



"irregular" be employed to designate the character of the trace, and would suggest either of the following codes in place of that recommended:—

- 0 movement uniform
- 1 " " irregular
- 2 rising at first, then steady
- 3 " " " " falling
- 4 steady " " " rising
- 5 " " " " falling
- 6 falling, " " " rising
- 7 " " " " steady
- 8 line squall
- 9 general tendency checked.

The last characteristic, however, is hardly necessary.

Or:—

- 0 General curvature upwards and small, trace uniform
- 1 " " " " " " irregular
- 2 " " " " " " large
- 3 No general curvature, trace uniform
- 4 " " " " " " irregular
- 5 General curvature downwards and small, trace uniform
- 6 " " " " " " irregular
- 7 " " " " " " large
- 8 Line squall.

M. Defant, Vienna, foresees practical difficulties and points out that (i) the barographs must be kept in good order, and that observers must be capable of carrying out small repairs (ii) the three-hour interval is probably too short for the purpose.

Stockholm. A pamphlet has been received from M. Ekholm criticising the suggestion unfavourably. M. Ekholm desires that the tendency should refer to a six-hour interval. [Dr. Hamberg was invited to take part in the proceedings in London, and made no representation of the points raised by M. Ekholm.]

M. Mazelle, Trieste, and M. Galbis, Madrid, concur in the suggestion, but consider the interval of three hours too short.

Mr. Shaw, London. It was the practice in the British system to report the "characteristic" by remarks at the end of the telegrams before the tendency was introduced into the international code. The numerical value of the tendency alone has not been found to give sufficient information and these remarks are still continued.

**Resolution 9 (p. 6).** Code for the characteristic of the weather.

M. Defant, Vienna, M. Mazelle, Trieste, and Hamburg (Deutsche Seewarte) point out that the characteristic for the 24 hours ending in the morning has formed part of their messages for some time past, and do not support the suggestion that the interval be the 24 hours ending with the evening observation, necessitated by the inclusion of the code figure in the evening groups, which are not prefixed to the morning groups by all stations. The Seewarte suggests that if the information must be included in the evening groups, the interval adopted should be that between the morning and evening observations and not a full

24 hour period. This would involve a slight change in the proposed code. It is suggested to give 5 and 6 in place of 4 and 5, and that code figure 6 stand for "Precipitation of approximately equal amount forenoon and afternoon."

The Deutsche Seewarte and M. Mazelle further point out that the last figure of the sixth group (sea disturbance) has been used in German and Austrian telegrams for reporting weather characteristics.

M. Defant, Vienna. In the Austrian system the following code has been used and M. Defant would prefer to retain it, but would conform to an international decision:—

- 0 = vorwiegend heiter;
- 1 = zeitweise bewölkt;
- 2 = zeitweise bewölkt, vorübergehend Niederschläge;
- 3 = zeitweise bewölkt, vorübergehend Gewitter;
- 4 = meist bewölkt;
- 5 = trüb, ohne wesentliche Niederschläge;
- 6 = trüb, zeitweise Niederschläge;
- 7 = Landregen;
- 8 = langdauernde Gewitter, gefolgt von Schlechtwetter;
- 9 = andauernd neblig.

M. Schmauss, Munich, would willingly sacrifice the weather characteristic in order to make space for a 2 figure report of cloud, so as to be able to report form as well as motion and so convey some idea of cloud height.

M. Galbis, Madrid, considers that little value attaches to the weather at the time of observation, as this is transient, and puts forward the suggestion that the second and third figures of the second group, and the second figure of the fourth group be used for reporting respectively the general character of the weather during the intervals (1) 7h. to 14h., (2) 14h. to 21h., and (3) 21h. to 7h. The code suggested for the purpose is as follows:—

- 0 = Generally clear
- 1 = Covered by Ci. or Ci.-St.
- 2 = Overcast
- 3 = Generally covered with low clouds
- 4 = Thunderstorm
- 5 = Squalls, showers, with intervals of clear sky.
- 6 = Rain
- 7 = Snow
- 8 = Fog
- 9 = Gale.

**Resolution 10 (p. 7).** Code for motion of upper cloud.

M. Mohn, Christiania, puts on record that the observers (telegraphists) have not time to undertake this observation.

**Resolution 11 (p. 7).** Extended cloud reports from selected stations.

M. Schmauss, Munich, suggests that the results of pilot balloon ascents should be included in these two groups.

M. Mazelle, Trieste, is not in favour of reporting cloud by means of two figures for any station, if this can only be done at the expense of the characteristic of the tendency.



from the original figures supplied, which are given to whole kilometres per hour. The results are being controlled by comparison with anemometers which have now been erected at several stations in Egypt and the Sudan. So far, the results of the comparison have shown that the observers estimates are in general too high.

(2) *Mean Velocity Equivalents of the Numbers of the Beaufort Scale 0—12.*

	Köppen.	Holland.		Britain.	Russia.
		Telegraphic and Climatological Stations.	Marine Observations.		
0	—	0·0·8	0·1·3	0	1·5
1	1·7	1·7	2·2	0·8	3·5
2	3·1	3·1	3·6	2·4	6·0
3	4·8	4·8	4·9	4·3	8·0
4	6·7	6·7	6·7	6·7	10·0
5	8·8	8·8	8·7	9·4	12·5
6	10·7	10·7	11·0	12·3	15·0
7	12·7	12·7	13·4	15·5	18·0
8	15·4	15·4	16·1	18·9	21·5
9	18·0	18·0	19·7	22·6	25·0
10	21·0	21·0	23·7	26·4	29·0
11	—	—	—	30·5	33·5
12	—	—	—	34·7	40·0

The values given in the column headed "Köppen" are from Professor Köppen's paper published in "Aus dem Archiv der Deutschen Seewarte, 1898." They are generally adopted in Germany and also in Holland for use at telegraphic and climatological stations.

The British values are computed from the relation

$$v = \cdot 836 \sqrt{B^3} \text{ metres/sec.}$$

which is found to give results in close agreement with the comparisons of estimates with anemometer readings made at British stations (see the Beaufort Scale of wind force, M. O. No. 180, and First Report of the Meteorological Committee, 1906).

The values used in Holland when dealing with marine observations are from Table XVII., p. 40 of the report (M.O. No. 180) of the Meteorological Office, London.

The values used in Russia are in accordance with the resolution of the International Meteorological Conference at Utrecht, 1874, in which the telegraphic code is formulated. They are based on old comparisons made by Dr. Scott, in which the factor 3·0 is used for converting the "run of the cups" into "travel of wind." More recent investigations have shown that this factor is too high; the value 2·2 has been adopted in its place.

(3) *Limits of Velocities for the Numbers of the Beaufort Scale 0—12.*

	Köppen.	Norway and Sweden.	France, Spain, and Portugal.	Denmark.	Britain.	Italy.
0	0-1	0-1	0-1	0-1	0-0·29	0-0·3
1	1-2	1-2	1-2	2-3	0·30-1·53	0·3-0·8
2	2-4	2-4	2-4	4-5	1·53-3·30	0·8-1·7
3	4-6	4-6	4-6	6-7	3·31-5·47	1·7-3·0
4	6-8	6-8	6-8	8-9	5·48-7·98	3·0-4·0
5	8-10	8-10	8-10	10-11	7·99-10·78	4·0-7·0
6	10-12	10-12	10-12	12-13	10·79-13·85	7·0-10·0
7	12-14	12-14	12-14	14-15	13·86-17·17	10·0-13·0
8	14-17	14-17	14-16	16-18	17·18-20·71	13·0-17·0
9	17-20	17-20	>16	19-21	20·72-24·47	>17
10	20-23	20-24	—	22-25	24·48-28·44	—
11	23-30	24-30	—	26-30	28·45-32·60	—
12	>30	>30	—	>30	32·61-	—

The values in the column headed "Köppen" are from Professor Köppen's paper published in "Aus dem Archiv der Deutschen Seewarte," 1898. They are generally adopted in Germany.

The values used in Norway, Sweden, France, Spain and Portugal are based on the same results.

The values used in Denmark are based on determinations made at Danish lightvessels.

The values used in Britain are obtained from the formula

$$v = \cdot 836 \sqrt{B^3} \text{ metres/sec.}$$

by substituting 0·5, 1·5, 2·5, &c., for B. The calculation has been carried to two places of decimals in order to fix limits for use in statistical calculations.

M. Palazzo has been unable to trace the origin of the scale used in Italy.

M. Maurer states that no velocity equivalents of estimated wind forces are used in Switzerland. The scale in general use is the half Beaufort Scale of 6 numbers. For the purpose of international weather telegrams the numbers representing the estimates are doubled so that the results may be comparable with those of other countries.

M. Vincent, the Scientific Director of the Meteorological Service of Belgium, reports that the same practice prevails in Belgium.

To the report is added (i) a proposal, which M. Köppen has set down for discussion by the Committee, and (ii) an extract from a letter from Mr. Shaw to M. Köppen.

(i) *Proposal by M. Köppen.*

The equivalents of the Beaufort Scale adopted by the different Institutes are quoted in the report, and remarks of the Institutes upon them are added. The grounds for these assumptions are not



in all cases known. The most important among those hitherto published appear to be the following:—

(1) Norwegian Meteorological Institute.—Mohn in the Year Books for 1874 and 1875, in *Annalen der Hydrographie und maritime Meteorologie*, 1889, p. 365, and in *Meteorologische Zeitschrift*, 1890, p. 50. Comparisons of observations of force values, with estimates according to a scale of six divisions, which is taken by M. Mohn as half Beaufort Scale.

(2) Deutsche Seewarte.—Köppen in *Archiv* 1898, No. 5. The final result is derived from a number of German and English series of observations and from the values from Norway already mentioned. The same numbers, with slight variation, are used in the Instructions for the French Observers (1911, p. 100).

(3) Meteorological Office, London, Official No. 180.—The Beaufort Scale of Wind Force, London, 1906. New investigations by Simpson on exhaustive observational data from England.

All three systems agree very closely for Beaufort numbers 2 to 5, and doubt can no longer exist regarding them. For the higher numbers the Meteorological Office series gives on the other hand considerably greater velocities than the other two. The difference here amounts to a full degree Beaufort. But as equivalents for the Beaufort numbers are still very frequently met with in meteorological publications which show far greater differences from these three experimental series than these show among themselves, I suggest that the Committee passes the following resolution in order to imprint with its authority the considerable measure of agreement attained:—

The International Meteorological Committee recommends the following scale of velocity equivalents\* of the so-called Beaufort Scale of wind for adoption in weather telegrams:—

Beaufort Grade.	M.p.s.	Miles p. h.
0	< $\frac{1}{2}$ †	< 1
1	$\frac{1}{2}$ –2	1–4
2	2–4	4–9
3	4–6	9–13
4	6–8	13–18
5	8–11	18–24
6	10–14	23–31
7	12–17	27–38
8	15–20	34–45
9	18–24	40–50
10	21–28	47–63
11	25–33	56–74
12	> 33	> 74

The Committee considers that values which lie outside these limits are in error, either in estimation, measurement, or method of comparison. The Committee considers that an exact specification of equivalents for the numbers 6 to 12, which in the

\* Measured in the ordinary way by an anemometer 1 to 10 m. above a freely exposed roof.

† Compare Intern. Met. Kodex, p. 10. Resolution of the Vienna Congress,

above table overlap one another, by limits as well-defined as those which can already be given for numbers 2 to 5, should not be attempted at present. They express the wish for (1) the production of further comparisons for these higher forces, which must be based, not on long series of observations, but on the records of as many observers as possible on the ocean, and at coast and inland stations, and (2) further investigations on the variation of wind velocity with height in the first 100 m. above the ground.

Hamburg, 20th March, 1913.

(ii) Letter from Mr. Shaw to M. Köppen.

The information which has been collected shows:—

(1) That your own scale of equivalents forms the basis of the scale of equivalents used in many European countries.

(2) That the scale adopted by the Meteorological Office and based on the formula

$$v = 1.87 \sqrt{B^3} \text{ miles/hour} \\ = .386 \sqrt{B^3} \text{ metres/sec.}$$

gives a scale of equivalents which differs from yours by quantities which are really insignificant in view of the manifold uncertainties of the process of estimation.

(3) That some other countries use scales of equivalents which are not related to either of the two scales above mentioned.

When I set out in 1900 to put together the results of wind measurements in this country, accepting the factor 2.2 for the Standard Robinson anemograph, the situation to be faced was that a practice of estimating existed universally among sailors and generally also at land stations of which no verbal description could be given. The estimation was a matter of unwritten tradition, but every sailor used it and was sure of it.

It seemed to me that we had first to get the established traditions of our respective countries put into words. I did not anticipate that it would even be possible to use one scale of equivalents to express the traditions of all countries. There are so many ways in which differences of tradition might arise that uniformity of practice seemed quite unlikely. My introduction to Dr. Simpson's report gave what I conceived to be my answer for this country to the first question. I had ascertained what hourly velocity a well-exposed anemometer might be expected to give when a sailor estimated the wind at one of the Beaufort numbers.

Dr. Simpson also drew up descriptions of the effects of wind of different Beaufort numbers so that the estimates of land observers might give the same hourly velocity as those of sailors.

It was only when M. Palazzo's proposition came forward that it dawned upon me as being at all practicable to unify the traditional estimations of all the various countries through the specification of the different numbers by limits of mean hourly velocities. Even now this seems to me a proposition of far reaching character which of course has my cordial sympathy, and your suggestions have set me thinking as to how to bring it about.



In connexion with the promotion of aeronautics in the last four years, we have been paying special attention to the details of wind structure, and we have now a large amount of new information as to what the wind which the observer has to estimate really is. In 1905 we regarded wind as completely expressed by the hourly velocity; now we regard it as a sequence of oscillations above and below the hourly velocity, and we know that the range of oscillation depends upon the exposure and upon the average strength of the wind, sometimes also in particular localities upon the direction.

Now it will be clear on reflection that, although the actual wind in the course of an hour will frequently pass through the average velocity, the average velocity will be the most transient of all the stages,\* more transient than the gusts and lulls. For the estimator the average velocity is simply a very transient stage in the progress from lull to gust, or from gust to lull.

If, then, we are attempting to arrive at one scale for all countries and do not ask each country to give its own interpretations of its own estimates, I think we must examine more closely the process of estimating in the light of our new knowledge of wind structure.

Judging by the records of our pressure-tube anemometers, we should infer that an observer on board ship or on a point of land like Spurn Head, with an exposure (for most directions) equal to that of a ship at sea, would be called upon to estimate a wind which, apart from squalls lasting some minutes, would be subject to variations of the order of about 5 per cent. on either side of the hourly velocity as shown by an anemometer. There would, therefore, be little difficulty about using a table of equivalents in terms of the hourly velocity; whereas at a land station like Aberdeen, Alnwick, or Kew, the wind velocity is subject to rapid fluctuations (or gusts) of the order of 15, 20, 30 or even 50 per cent. on either side of the hourly velocity.

We need first of all to decide the question whether the fluctuations of the land exposure represent accelerations as well as retardations of sea wind. With regard to this point, some observations of Mr. J. S. Dines go to show that in the formation of gusts there is no acceleration of the sea wind, and that the effect of imperfect exposure is one of retardation only. Hence the large amplitude of the range of oscillation is more probably represented by alternations between the full or normal velocity of the sea wind and the retardations caused by the eddy motion, than by oscillations above and below the velocity of the sea wind. So we must suppose the fluctuations to be the effect of successive retardations with relapses to the original value. Hence, as the range becomes greater and greater with increasingly restricted

\* In a subsequent letter, Professor Köppen takes exception to this statement on the ground that the average velocity is that which is of most frequent occurrence and therefore has the greatest aggregate duration. I may perhaps explain that in making the statement my idea was that when the velocity passes through the average value it is generally changing rapidly, whereas there is a pause at a gust or lull.

exposure, the "hourly velocity" becomes more and more depressed, while the velocity of the gusts still approximates to that of the original wind.

This question needs further examination; but supposing that the view here taken is verified, then it is clear that for meteorologists the velocity of the gusts is a better criterion than the mean velocity for the hourly velocity of the wind to be selected as the equivalent of the Beaufort number, in the sense that it is more independent of the local circumstances.

Let us next consider what process must be gone through by the observer in making his estimate of wind of gusty character by its effect upon smoke, flags, trees, or buildings, or from personal experience of resistance in walking or driving. We have already pointed out that he cannot be cognisant of the hourly velocity itself because that is the most transient of all the effects within his observation. The effect during lulls is likely to be disregarded compared with the effect of the gusts. There is no alternative but to suppose that he really estimates the effect of the gusts and we, by our anemometers, give an interpretation of his estimate by assigning the corresponding hourly velocity, which to the observer himself is an unrecognised characteristic. Supposing that the same air current passed over a number of stations, some well exposed, some badly exposed, then by the method which we now adopt the same air current will be represented by a lower value if the table of equivalents is taken from the badly exposed stations than if it were taken from the better exposed stations. Whatever mental picture we may make of such an air current, and some mental picture is necessary, we cannot use a single table of equivalents if what we want to express, in interpreting the estimates, is the hourly reading of the local anemometer. Each station ought to have its own table of equivalents.

But do we really want to arrive at the reading of the local anemometer? Is not the peculiarity of the hourly reading of the local anemometer itself a subject for investigation? For practical purposes, *e.g.*, the resistance of wind to locomotion, the effect on trees or houses, it is the velocity of the gusts which count, because they do the damage. In fact a gusty wind giving velocities of say 30 m./sec. two or three times a minute might do more damage than a steady wind of 30 m./sec., and by referring the wind to local anemometers we might be found to give the lower hourly value to the more destructive wind.

If, however, the gust velocity is itself approximately the hourly value which would be indicated in a perfect exposure, then at least we might get a more nearly consistent interpretation of the estimates by referring the effects to the hourly velocity of an ideal exposure. But then each local anemometer of the Robinson type would be subject to a correction to bring its readings into harmony with ideal exposure, whereas an anemometer of the pressure-tube type would give a close approximation to the ideal velocity by the records of gusts.

In this country we are gradually learning to regard the average gradient velocity as the final standard of reference for



wind measurements, and the course which further investigation of this subject will take with us is as follows:—

(1) To obtain for each anemometer, and subsequently for each estimating station, a specification of the relation of the observed wind or estimated wind to the gradient wind for the various directions.

(2) To examine further as to the effect of imperfect exposure (i) upon mean velocity, (ii) upon gust velocity.

(3) To see whether a table of Beaufort equivalents in terms of gust velocity would not give a more effective table of equivalents than those of hourly velocity.

Meanwhile it seems desirable for both scales of equivalents to be officially reported to the Committee, yours as being most suitable for giving the mean hourly velocity for land stations with ordinary exposure, and ours as being more suitable for stations with very free exposure and approximating more nearly to the gust velocity of our and your winds.

Meteorological Office, London, S.W.,  
April 1st, 1913.

## APPENDIX VIII.

(See p. 14.)

### REPORT OF THE INTERNATIONAL COMMISSION FOR SCIENTIFIC AERONAUTICS.

M. HERGESELL.

The International Commission held its seventh meeting last year at Vienna (28th May to 1st June). A detailed report\* of its deliberations has appeared, and has been sent to all the members of the Committee. I can, therefore, refer to this protocol in this report of proceedings and give here only certain supplementary details of subsequent events.

In the first place I must mention here the grievous loss which our Commission has sustained by the death of M. Teisserenc de Bort. It is quite unnecessary for me to mention here his great services to science, but I must emphasize the fact that the Aeronautical Commission has lost in M. Teisserenc de Bort one of its founders and its strongest supporter. We shall have great difficulty in filling the gap which has been caused by his death. I might specially express the wish here that aeronautical activity in France may not suffer through his decease and that his fine dynamical observatory at Trappes, equipped by him at great expense, may remain to science.

All the resolutions, which we passed at Vienna are collected together on pp. 57-70 of our protocol. The Commission adopted one of these resolutions, subject to confirmation by the Committee, and I esteem of great value the fact that various other resolutions may be confirmed here by the Committee and supported by their

\* Seventh Meeting of the International Commission for Scientific Aeronautics at Vienna, 1912.

authority. I will take the liberty of bringing forward these resolutions *seriatim*.

In the next place I have to remark that I fulfilled last summer the desire of several colleagues by circulating these resolutions to their governments through diplomatic channels.

According to a communication of the German Foreign Office the foreign ministers have all been informed of the resolutions which concern them; especially in the case of our resolution concerning an establishment of an international réseau of pilot-balloon stations. It will be of interest to the Committee to learn that, thanks to our resolutions, the Spanish Government has made a large grant for meteorological science. For this year an amount of 250,000 pesetas has been voted by the Spanish Parliament for the foundation of an aerological service in Spain and the maintenance of an aerological observatory at the Canary Islands. The same amount will be set apart by the State for the next three years. M. Galbis, the new and energetic Director of the Spanish Service, will thus be put in the position to take an active part in our work. Above all, the important station on the Canary Isles, which hitherto has been entirely supported by German funds, will become a permanent institution.

The organisation of an international pilot-balloon réseau on systematic lines (Resolution 22) appears to me very important. I should like to ask the Committee warmly to support our resolution by passing a resolution calling on the directors to co-operate in the organisation of these stations. Of still greater importance appears to me the aerological investigation of the Arctic basin, which I also proposed in Vienna. I am much obliged to M. Rykatcheff for bringing definite proposals before the Committee.

I wish now to refer at somewhat greater length to our aerological station in Spitzbergen. This station was established in the summer of 1911 on the Eisfjord, in the neighbourhood of the coal mines of Advent Bay. It has developed out of the aerological summer expeditions, which I carried out in 1906 and 1907 with the Prince of Monaco, and in the year 1910 on board the ship "Mainz" with Prince Henry and Count Zeppelin. MM. Rempp and Wagner who made the observations in the first year, remained until the summer of the next year, and during the arctic winter have investigated the free atmosphere by means of pilot balloons, registering balloons, captive balloons, and kites. The pilot balloon ascents could not be carried out in the dark season, as the experiments with fire balloons led to no result; but I may say that ascents can be made up to a later date in the Arctic twilight. The last pilot balloon was observed on 9th November, 1911, the first on 5th February, 1912. Altogether 144 pilot balloon ascents, 78 captive balloon and kite ascents were made. Several registering balloons were also tried, and two instruments were recovered by sending out several expeditions. The greatest height reached by pilot balloons was 12,600m., that of captive balloons and kites rather more than 4,000m., that of registering balloons 7,000m. As living with the coal miners led to various difficulties I decided to move the station in the summer of 1912. Two station houses were erected in Cross Bay at Ebeltoftshafen, and this station was manned by MM. K. Wegener



and Robitzsch. These gentlemen have also worked assiduously, but only short telegraphic information has come to hand as to the results. The results so far attained make it desirable to continue the station, especially as the Arctic expedition of M. Amundsen begins next year. It will be of quite unusual value if other nations also will take part in this Arctic enterprise. I look forward with interest to the discussion of the Committee on the proposals of M. Rykatcheff.

I attach importance to informing you that on the occasion of his visit to Strassburg I made use of the opportunity to work out all details with M. Amundsen. M. Amundsen may be able to establish an aerological station in North-West America with the help of the Carnegie Institution, so I should like very particularly to direct the attention of our colleague Mr. Stupart to our plan, in the hope that it will be possible for him to help and work with us in his district.

Of new work beyond the seas, an undertaking of Professor Berson, which has already entered upon the first stage of its execution, should be mentioned here. It has for its object the aerological investigation of North-East Brazil, and the study of the trade wind conditions there. M. Berson has already left for South America in order to carry out the preliminaries.

I now come to that resolution, which has produced much commotion, and has encountered much opposition at the hands of certain colleagues. Here I will only state that our resolutions at Vienna relate only to the official publication of the Commission, a fact which has been occasionally lost sight of in the discussion, but nevertheless we passed the resolution with the intention of not proceeding alone in this important matter and change, but to lay the matter before the International Meteorological Committee. I think that we can consider the subject here in all tranquillity, and trust that we may arrive at a conclusion that will meet with general approval.

My desire as President is that there may be in no way any dissatisfaction, and that our resolutions may result in each one co-operating with zeal in the carrying out of the resolutions.

## APPENDIX IX.

(See p. 15.)

PROPOSAL TO BE CONSIDERED BY THE INTERNATIONAL METEOROLOGICAL COMMITTEE WITH REGARD TO THE WISHES EXPRESSED BY THE INTERNATIONAL COMMISSION FOR SCIENTIFIC AERONAUTICS CONCERNING THE STUDY OF DIFFERENT LAYERS OF THE ATMOSPHERE IN POLAR REGIONS.

The International Commission for Scientific Aeronautics at its seventh meeting in Vienna (28th May to 1st June, 1912) expressed the following wishes:—

“That the important station at Spitzbergen be maintained as long as possible.”

“That the aerological work which will be carried out next year in high polar latitudes by the expeditions of Captain Amundsen, by the Swiss expedition, by the Danish expedition for the exploration of Greenland, and by the aerological station at Spitzbergen,

be completed by aerological observations on the shores of the Arctic Ocean and in the Island of Nova Zembla.”

“That on the occasion of the crossing of the Arctic basin contemplated by Captain Amundsen aerological work be carried out according to the programme of the International Commission for Scientific Aeronautics.”

These resolutions were communicated through diplomatic channels to the Russian Government; at the same time the German Embassy transmitted to it the invitation of the President of the Commission to take part in the polar exploration by installing aerological stations in these regions, if possible, before the winter.

As soon as the Minister of Public Instruction communicated these documents to me, Commissions were nominated by the Imperial Academy of Sciences, with the sanction of its august President, to discuss (1) general arrangements for the investigation of the upper layers of the atmosphere, (2) the equipment of the expedition to Spitzbergen, and (3) the equipment of the Russian polar expedition.

At a combined meeting of these Commissions the work of former expeditions to the polar regions of the Russian Empire was reviewed, and the following resolutions were passed:—

(1) With reference to the choice of stations, Nova Zembla and the mouth of the Lena, i.e., the stations of the international polar expeditions of 1881-1882, should be selected.

(2) That it is impossible to equip an expedition to these stations in 1912.

(3) That before taking steps to equip the polar expeditions, it is necessary to come to an agreement with other states in order to ensure that corresponding stations in Europe, Asia, and America may be in operation.

(4) Apart from these international observations it is necessary to organise an expedition to Jakutsk and Werkhoyansk to study the different layers of the atmosphere in this region of extreme winter cold.

As regards this last question it was decided to take the necessary steps as soon as possible; as to the expeditions to Nova Zembla and the mouth of the Lena an international agreement has to be awaited, and I am commissioned to take the opinion of the International Meteorological Committee on the subject. I therefore ask the Committee to be good enough to discuss the following questions:—

(1) Whether it is desirable to organise international polar expeditions for the study of the different layers of the atmosphere.

(2) Whether the present time is opportune for this enterprise.

(3) If so, I propose that a polar commission be appointed to fix the time, to consider the opportunities for combining these experiments with other geophysical studies and to prepare an international programme.

M. RYKATCHEFF,

Director of the Nicolas Central  
Physical Observatory.

St. Petersburg,  
March, 1913.



## APPENDIX X.

(See p. 15.)

REPORT OF THE PRESIDENT OF THE MAGNETIC COMMISSION OF THE  
INTERNATIONAL METEOROLOGICAL COMMITTEE.

The Commission has had no meeting since 1910. The minutes of the meetings held at Berlin on 23rd-24th September were published with appendices by the Royal Meteorological Institute of Prussia and circulated to the members of the Commission and to the different Meteorological Institutes. I take this opportunity to thank, in the name of the Commission, M. Hellmann for this kindness.

Since our meeting we have had the misfortune to lose one of our members, Professor Messerschmitt, who died in 1912. Professor Bildingmaier has been elected in his stead. He is his successor as Director of the Magnetic Observatory at Munich, well known for his magnetic observations carried out during the German expedition in the Antarctic regions and by his theoretical work.

With reference to the form and the contents of publications, Professor A. Schmidt is engaged in preparing a précis of what the different observatories give; his report will serve as a basis of discussion at the next meeting of the Commission.

No comparisons of the normal instruments of the different observatories have been made since 1910. M. Angot proposes to compare the instruments installed at Val-Joyeux with those of Tortosa in 1913, and Professor van Everdingen has also in view the carrying out of similar comparisons.

As regards the establishment of new observatories, we have pleasure in stating that Professor Melander has installed a magnetic observatory in the north of Finland, at Sodankylä. I am also glad to say that the necessary funds were assigned by our Government: (1) to found a new magnetic and aerological observatory at Nikolsk-Oussourijskij, near Vladivostok; (2) to establish a magnetic and aerological section at Soukhaya, 30km. from Irkutsk, to replace the magnetic section at Irkutsk, which will soon be obliged to cease operations on account of trams; and finally (3) for the maintenance of the magnetic observatory at Karsan near Tiflis. The building of the last named observatory is finished; all the instruments are installed and have been in regular operation in conjunction with the instruments at the provisional station since the beginning of this year. The building of the observatory at Soukhaya will be commenced this summer; that of the observatory at Nikolsk-Oussourijskij is allocated to next year.

Continuing the task with which it was charged by the Meteorological Conference held at Innsbruck in 1905, the executive officers as you know have taken steps as occasion allowed to have a magnetic observatory in the middle of Italy, or better still if possible in Tunis or Tripoli. Professor Palazzo in his memoir presented to the Magnetic Commission which met at Berlin in 1910, communicated that he had taken into consideration the

wishes of the Meteorological Conference and that he had had in mind the establishment of a magnetic department at the Meteorological Observatory at Messina, which was demolished by the earthquake in 1908, and had to be rebuilt under the supervision of its director, Professor Rizzo. However, considering that it was probable that very shortly there would be trams at Messina the magnetic observatory ought to be made of wood as lightly as possible, in order that it may be possible to carry it to another place if need be. In fact Professor Rizzo informed me in December, 1910, that he had returned to Messina to rebuild the observatory and direct its work; he has been good enough to ask my opinion on the duties to be fulfilled by the magnetic department. I replied immediately, but since then we have had no information of what has been done in this direction. Now that the Italians are masters in Tripoli it would perhaps be *à propos* to make most earnest requests and recommendations to establish a magnetic observatory there. The importance of this magnetic station from the international point of view has already been set forth at the Berlin meeting of the International Magnetic Commission. I also hope that Professor Palazzo will not give up any longer his plan to establish a National Magnetic Observatory at Sestola or else in some place not far from the capital. As to the other observatories in the direction of the meridian in Africa the executive officers have been in correspondence with Professor J. C. Beattie, F.R.S.E., at Cape Town, who directs the work of the magnetic survey in that district, in order to explain to him of what value from the international point of view the establishment of magnetic observatories in the English colonies of South Africa would be. The letter written by the officers is appended:—

International Commission  
for Terrestrial Magnetism.

St. Petersburg and Potsdam,  
1912, February 2nd.

To Professor J. C. Beattie, F.R.S.E.,  
South African College,  
Cape Town.

Dear Sir,

Having heard of your attempts to secure the erection in British South Africa of one or more Magnetic Observatories, we take this opportunity of indicating our sense of the international importance of the object which you have in view, and of expressing our hopes that success will attend your efforts.

There are several items on the programme approved by the International Magnetic Commission which would greatly benefit by the erection of magnetic observatories in South Africa. Amongst these we may mention the following:

A. General Magnetic Survey of the Earth.

During the important survey work which you have already accomplished in South Africa, you must doubtless have encountered many difficulties, which would have been much lightened by the assistance which local magnetic observatories, if existent, could have supplied. Difficulties of like character, but even more



serious, are likely to present themselves in the future, in the linking together of survey work done at different times and by different observers in Africa and adjacent seas, unless new magnetic observatories are called into being. The work at sea now being carried out by the Carnegie Institution is in itself a powerful argument for pushing forward the erection of observatories at the present time.

#### B. Investigation of the Magnetic Diurnal Variation.

For this investigation it is most important that data should be available from stations adequately representing different magnetic latitudes, and the importance of stations in Africa for this purpose was specially insisted on at the International Meteorological Conference held at Innsbruck in 1905.

#### C. Magnetic Character of Individual Days.

Since 1906 data as to the magnetic character of all days of the year have been collected and published at de Bilt, under the auspices of the International Magnetic Commission. The lists thus published already afford most valuable information, but the Southern hemisphere is very poorly represented, and one station in South Africa would for this purpose be worth at least five in Europe.

#### D. Magnetic Disturbances.

The interchange or publication of disturbed magnetic curves has been on the programme of the Commission for some years. Some forms at least of disturbance seem common to the whole earth, and for the study of the laws they obey, and the discovery of their origin, simultaneous records are desirable from stations in all latitudes. The southern hemisphere is again very poorly represented, and additional stations in it are urgently required.

Magnetographs are at least a very useful auxiliary for all magnetic observational work, and for some of the items on the international programme are essential. For some of these projects, notably B and D, uncertainties as to the estimation of time, or as to scale values of curves, or temperature corrections of magnets, should be reduced to a minimum. It is thus most important that there should be in British South Africa at least one magnetic observatory which, in its equipment and staff, and in the fulness of its publications, should rival the best European and American stations.

The selection of sites for observatories must depend on local considerations, which only those directly concerned can appreciate, and sites otherwise desirable may be rendered unsuitable by their proximity to traction or other artificial electric currents. We thus only venture to add that for the international objects we have mentioned, a station towards the south of Cape Colony would appear the most suitable; and, supposing one observatory erected there, a second at some considerable distance to the north, *e.g.* in Rhodesia, would be a most valuable auxiliary.

M. RYKATCHEFF, The President.

A. SCHMIDT, The Secretary.

I hope that the suggestions set forth in this letter will receive favourable consideration from the Governments of those Colonies to whom Mr. Beattie has communicated the resolution regarding the importance of establishing two magnetic observatories in the regions referred to.

In conformity with the recommendation of the Conference of Innsbruck that all observatories should use data for the same quiet days for the calculation of the normal diurnal range of the magnetic elements, the following observatories have adopted the practice of calculating these means for the five days selected by the Royal Meteorological Institute of the Netherlands: Pavlovsk, Kew, Eskdalemuir, Potsdam, de Bilt, Samoa, Alibag (Bombay), Tortosa, Batavia, and the five observatories of the American Geodetic Survey, Cheltenham, Sitka, Tucson, Honolulu, Porto Rico. Pavlovsk also publishes lists of quiet days on which there has been no appreciable disturbance of any of the elements at Pavlovsk during the twenty-four hours; this system has been in use since 1886.

In accordance with the proposal of M. Abels, Director of the Magnetic and Meteorological Observatory at Katherinburg, which has been adopted by the Executive Bureau, M. van Everdingen has published in the various numbers of "*Caractère magnétique de chaque jour*" lists of days which are particularly interesting for the reproduction of curves.

I have a few words to add regarding the magnetic survey of the Russian Empire. The Magnetic Commission appointed by the Imperial Academy of Sciences of St. Petersburg has had added to it representatives of several other districts interested in the work of the magnetic survey; the Commission is responsible for elaborating the general scheme of the survey and for the administration of the funds assigned to the enterprise. At present it has at its disposal sums of 10,000 roubles a year for ten years, voted by the Academy, and 5,000 roubles a year for three years, voted by the provincial government of Vologda for a more detailed survey of that province. These funds have made it possible for us to order several sets of instruments, both for absolute determinations and for continuous recording. The survey of the province of St. Petersburg was completed in the course of the year 1911; in 1912 magnetic observations were made in the provinces of Novgorod and Vologda; the survey in Finland is being continued under the direction of Professor Melander, a member of the Magnetic Commission of the Imperial Academy of Sciences, while magnetic observations have been carried out under the direction of M. Dubinsky on the coasts of the Baltic Sea and of the Black Sea, at the expense of the Central Hydrographic Office. Beside other work, a magnetic survey of the province of Podolia, partly at the expense of Count Morkoff, is proposed for the year 1913. Two volumes of our report have been issued; they contain the complete data of the survey of the province of St. Petersburg, together with other observations taken in 1910 and 1911, and also a number of magnetic charts.

M. RYKATCHEFF.



## APPENDIX XI.

(See p. 16.)

LETTER FROM PROFESSOR MOHN WITH REFERENCE TO THE  
MEASUREMENT OF FALLEN SNOW.

Det Norske Meteorologiske Institut, Kristiania, 4th March, 1913.

For measuring snow at our stations we have the following rules:—

Snow-covering (*Schneedecke*) is observed at 8 a.m. every day by judgment. It is noted how many fourths (4) of the area, visible from the station and in about the same level there, are covered by snow.

Depth of snow (*Schneetiefe*) is measured at 8 a.m. every day by means of a centimeter-staff; not the new fallen snow but the thickness of the whole layer.

Now the question has arisen how to compute the mean for the month of the depth of the snow.

Either the sum of the noted snow-depths, divided by the whole number of days with snow-covering (1, 2, 3, 4), or the same sum divided only by the number of days with covering 2, 3, 4, or only 3, 4.

We have used the first method, but it seems that in Sweden they use one of the others and get consequently higher numbers for the mean depth.

I think it desirable for the International Meteorological Committee to recommend or fix a precise rule for the computation.

H. MOHN.

## APPENDIX XII.

(See p. 17.)

THE NEW STATUS OF THE NICOLAS CENTRAL PHYSICAL  
OBSERVATORY OF ST. PETERSBURG.

For some time past the moderate funds at the disposal of the Central Physical Observatory, which is charged with the duties of studying the country from a physical point of view and of supporting the meteorological and magnetic services for the immense territory of the Russian Empire, have no longer corresponded with the progress of science and of practical requirements.

An extended programme has been worked out by the observatory, and has been presented to the government by the Imperial Academy of Sciences. In this scheme the recommendations made by the International Meteorological Committee and its Commissions have been taken into consideration as far as possible. The Government and the Legislative Chambers met our requirements in a most liberal spirit. The changes take effect from this year, 1913; financial provision has been made for enabling us in the course of the next five years gradually to carry out our proposed programme, and to extend and improve our réseau of meteorological stations. This programme includes: extension of the Central Observatory buildings, the establishment of a meteorological observatory at Vladivostok with a réseau of

stations attached to it (the director and part of the staff were appointed in 1913); the establishment of the magnetic stations mentioned in the report which I have presented to the Committee in my capacity of president of the Magnetic Commission.

A new aerological observatory is to be established this year near Pavlovsk (to take the place of the former kite station); the staff has already been appointed and building operations will be begun this summer. In 1915 aerological stations will be established in connection with the observatories at Tiflis, Katherinburg and Irkutsk.

At the Central Observatory special posts have been established for scientific work (climatological, magnetic, &c.), and additions have been made to the staff in every department of all the observatories in order that the directors and their assistants may have more time available for research work. Additional inspectors of meteorological stations (two at the Central Observatory, one at each of the other observatories) have been appointed to improve the réseau, and funds have also been allocated for the establishment of 50 stations of the second order (with paid observers and permanent premises) and 100 other permanent stations (with paid observers).

At the same time the salaries of the employés have been raised. The annual grant to the service has been doubled and reaches almost half a million roubles. A sum of nearly a million roubles, distributed over five years, has also been granted for buildings and equipment.

In view of these changes the Academy has found it desirable to modify the status of the observatory. The observatory is placed in direct relation with the Ministry of Public Instruction, but in all scientific matters the Academy remains in close connexion with the observatory; from 1913 the Academy appoints not only the Director of the Central Observatory (which has been the case up to the present) but also the directors of other observatories, the heads of departments, the librarian, and the inspectors.

Under the new regulations a Committee of the Nicolas Central Physical Observatory has been nominated with the president of the Academy of Sciences as president. Four academicians and representatives from various departments are members of this committee, whose relationship to the Physical Observatory is similar to that of the Pulkowa Committee to the Astronomical Observatory.

It will perhaps be of interest to my colleagues to learn that under the new regulations all posts at the Central Observatory and the observatories connected with it may be filled not only by men but also by women, provided they have the necessary qualifications. Women are entitled to the same salaries and pensions as men. The regulations also state that a woman in receipt of a pension does not forfeit the right to receive at the same time half the pension of her husband, in the event of her being left a widow. Until they attain their majority orphans are entitled to the pension reverting to them from their father as well as from their mother.

M. RYKATCHEFF.



## APPENDIX XIII.

(See p. 17.)

## SLEET.

*Memorandum communicated by Mr. Shaw.*

We have from time to time in the British Isles, precipitation in the form of rain and snow falling together to which the name sleet has been given.

There is at present no international symbol for sleet. At the meeting of the International Meteorological Committee at Southport in 1903 it was decided to reckon snow which melts as it falls as snow and therefore as qualifying for a snow-day, but it does not appear certain whether it was intended to include sleet in the expression "snow which melts as it falls."

I beg leave, therefore, to submit the following questions:

- (1) Is sleet to be reckoned as qualifying for a day of snow?
- (2) Can a symbol for sleet be added to the international scheme?

With reference to question (1), it is desirable to make statistics of snow as suitable as possible for application to the practical problems of the agriculturist and the surveyor. From that point of view the inclusion of sleet would complicate the statistics.

With reference to question (2) the symbol  $\ll$  a combination of rain and snow, is suggested.

Meteorological Office, London, S.W.  
January, 1913.

E. GOLD.

## APPENDIX XIV.

(See p. 18.)

## REPORT OF THE PRESIDENT OF THE COMMISSION FOR MARITIME METEOROLOGY AND STORM WARNINGS.

A meeting of the Commission was held in London on September 17th-20th, 1912. A report of the proceedings has been printed for the Meteorological Office, London (Official publication M. O. 212), and in accordance with a resolution of the Commission the report has been circulated to the various meteorological institutes and colonial governments, in order that the opinions of the countries concerned with respect to the various proposals might be ascertained.

In reply to the invitation thus issued comments have been received from the meteorological institutes or from authorities concerned with maritime affairs of the following countries:—Austria, Great Britain, Holland, Italy, Norway, Portugal, Russia, Spain, Sweden, Canada, United States, Trinidad, India, China (Zi-ka-wei), Hong Kong, Philippines, Australia.

I now beg leave to present to the committee a statement of the conclusions arrived at by the Commission, and a summary of the comments made by the representatives of the several countries.

The resolutions are referred to by the numbers which they carry in the published report, but I have thought it desirable to arrange them for presentation to the committee in the order most convenient for the consideration of the subjects treated.

I. *Proposed International System of Signals for Storm Warnings.*

A. **Day Signals.**—A proposal for signals by means of one or two cones to indicate the probability of a gale commencing with wind in the four quadrants and for a hurricane was approved at the meeting of the committee at Berlin in 1910 as follows:—

For a gale commencing with wind in the NW quadrant.—  
Single cone point upward.

For a gale commencing with wind in the SW quadrant.—  
Single cone point downward.

For a gale commencing with wind in the NE quadrant.—  
Two cones point upward.

For a gale commencing with wind in the SE quadrant.—  
Two cones point downward.

For a hurricane.—Two cones with their bases together.

With regard to this scheme the Commission passed the following resolution:—

2. It was also agreed to accept by way of explanation that the distance between two cones hoisted in vertical line for day signals should be the same as the length of the slant side of the cones.

The Commission also considered a letter from the Reverend L. Froc of Zi-ka-wei recommending an 8-point system of day signals, and a letter from Captain W. F. Tyler, Inspector of Coast Stations in China. Both letters are printed as Appendix VI. to the report which has been circulated. On this subject the Commission passed the following resolution:—

10. That as the question of local day signals was decided at the meeting of the International Meteorological Committee at Berlin, 1910, the Commission should not reconsider the matter without fresh instructions from the International Meteorological Committee.

In the replies which have been received no criticism is made with regard to Resolution 2.

With regard to Resolution 10, the representatives of Canada and Portugal concur in the opinion expressed. The representative of Holland thinks it undesirable to alter the international scheme agreed upon.

Mr. Claxton for Hong Kong notes that a system similar to Father Froc's, in which a drum and ball replace the ball and hourglass, is already in use at Hong Kong and deprecates changes except for reasons of visibility, &c.

The Reverend José Algué, S. J., the Director of the Weather Bureau of the Philippine Islands, asks why the Commission have inserted the words "commencing with" in specifying the direction of an anticipated gale and suggests their omission. In the event of a change of direction instructions to change the signal would presumably be sent, and it would then be false that the gale commenced from the direction indicated by the signal.



He further suggests that different countries should be left free to add other signals to the international ones, both in the case of day and night signals. Thus in the Philippines he believes it to be of greater utility that the signals refer to the cardinal points—N., E., S., W.—rather than to the intermediate ones.

M. Galbis, chief of the Central Meteorological Observatory, Madrid, communicates a memorandum from General D. Tomas de Azcarate, director of the observatory of San Fernando, with which the Spanish system of semaphores is connected.

As regards day signals the memorandum expresses agreement with the chief of the Central Observatory in favour of the adoption of the system approved by international agreement, although to them it does not appear to be the best, and proceeds to discuss the extended system of local signals proposed by Captain Tyler and Father Froc, and to suggest combinations of three horizontal lines of light formed by lanterns to represent those signals by night.

**B. Night Signals.**—In continuation of the proposals for day signals which was approved at Berlin in 1910, the following resolutions were adopted by the Commission:—

1. In view of the expressions of opinion of the representatives of various countries as to the difficulty of the manipulation of signals using more than two lanterns on the one hand, and, on the other hand, as to the danger of confusion of weather signals using one lantern, or two, or three lanterns in vertical line, with signals already used for maritime purposes, the Commission find themselves unable to recommend the adoption of a single scheme of night signals for storm warnings applicable to all countries. They are, however, of opinion that any combination of lanterns to form a weather signal should have the same meaning in all countries which adopt a national system of local storm warnings, and they therefore recommend as follows:—

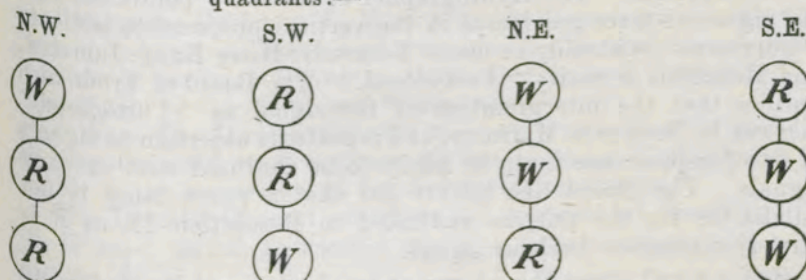
- i. That in countries which use signals consisting of one lantern only for storm warnings, one red lantern shall represent any of the day signals.
- ii. That in countries which use a combination of two lanterns for storm warnings, the two lanterns should be in a vertical line not less than 2 metres apart (generally 4 metres or 15 feet).
- iii. That in countries which use a combination of three lanterns in vertical line for storm warnings, the lanterns should be not less than 2 metres apart, 4 metres covering the whole signal.

11. It was agreed that in order to complete the scheme of night signals three red lanterns in vertical line be recommended as the night signal to correspond with the day signal for a hurricane, but that as the signal for a hurricane would not, as a rule, be hoisted in temperate latitudes, one red lamp may be used as an alternative, signifying the existence of an atmospheric disturbance, which may cause a gale in the locality where the signal is hoisted.

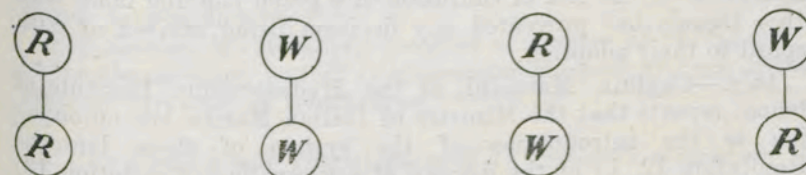
12. It was therefore agreed that the following be recommended as the system of night signals:—

(i) For countries using three lanterns:—

For a gale commencing with wind in the following quadrants:—

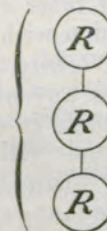


(ii) For countries using two lanterns:—



For use with either of the above:—

Atmospheric disturbance : Hurricane



(iii) For countries using one lantern:—

takes the place of any day signal.

Resolution 9 of the Commission also has reference to this subject and prescribes the form of signals by means of two lanterns for gales in the four quadrants, but as it is comprised within Resolution 12, ii., it is unnecessary to set it out separately. It is, however, convenient to include with these resolutions No. 13 which suggests a signal to indicate that storm signals cannot be hoisted in consequence of the interruption of telegraphic communication or for some other special reason.

On the suggestion of Captain Ryder it was agreed:—

13. That the opinion of the institutes be taken upon the question of exhibiting, where possible at storm signal stations, a green flag by day and a green lamp by night, or some other signal, to indicate that signals cannot be hoisted, either on account of telegraphic communication being interrupted, or for some other cause.

Upon these resolutions a number of comments have been made.



*Austria.*—M. Mazelle writes from Trieste that Austria is contemplating the introduction of storm signals and wind-semaphores and the report of the Commission will be of considerable importance.

*Great Britain.*—The Hydrographer of the Navy points out that the signal of three red lamps in the vertical proposed to indicate "hurricane" is already in use at Bermuda, Hong Kong, Jamaica, and Mauritius to notify "Port-closed." The Board of Trade also notifies that the interpretation of the signal as "Port-closed" is given in Notices to Mariners, and repeats its objection to signals of two lamps or one lamp as likely to be confused with existing signals. The Board also points out that a green lamp is not admissible for the purpose indicated in Resolution 13, as it is already a common harbour signal.

*Holland* will adopt the scheme of two lanterns of Resolution 12 when it has received the approval of the Committee. As regards Resolution 13, the risk of confusion of a green flag and lamp with other signals has prevented any decision being arrived at with regard to their adoption.

*Italy.*—Captain Marchini, of the Hydrographic Institute of Genoa, reports that the Minister of Italian Marine has no objection to the introduction of the system of three lanterns (Resolution 12, i.) or the display of a green flag (Resolution 13) but takes exception to the use of a green lamp as liable to confusion with other maritime signals.

*Norway.*—Professor Mohn writes—"It can scarcely be thought that any of the proposed signals will be confounded with other signals in our harbours and on the coast. In or at a town the signals will probably be hoisted on a hill or high building."

*United States.*—The U.S. Weather Bureau has adopted the two-lantern system and cannot accept three lanterns for the hurricane signal because the method of installation (15 feet between lanterns) does not permit of it. If the resolutions of the Commission are adopted the Bureau will not employ a night hurricane signal at all. In the West Indies one red lamp will probably be used for all disturbances.

The Bureau suggests that no need is felt for the precaution of Resolution 13, and suggests that the signal should be optional.

*Canada.*—The Director of the Canadian Meteorological Service is in favour of a simple system in which two lanterns only are used. The system recommended is not wholly satisfactory because, as the Canadian lights are largely electric, four lanterns in the vertical would be necessary, 15 feet separating the upper pair from the lower pair.

As regards the green light the signal is not regarded as necessary, but the Director will be guided by the decision of the Committee.

*Hong Kong.*—Mr. Claxton, Director of the Observatory, will support the recommendations of the Commission when the question of abolishing the red signals for typhoons more than 300 miles distant comes up for consideration, but no change will be made in the system of warnings until a radio-telegraphic station is erected on the Pratas Shoal.

*Philippines.*—The Director of the Weather Bureau is of opinion that the suggestion of Captain Ryder (Resolution 13) is worthy of careful consideration.

The resolutions do not commend themselves to the following countries:—

*Portugal.*—Professor J. M. d'Almeida-Lima is of opinion that two signals are sufficient, and recommends the continuance of the signals at present adopted by Great Britain and Portugal, viz., the system of the North and South cones.

*India.*—The Director-General of Observatories regrets that the system does not seem appropriate for India, as that country is liable to the occurrence of tropical revolving storms.

The Director-General considers the proposal of Resolution 13 to be most useful, but would prefer a signal made up of cones, drums, &c.

*Trinidad.*—The Governor is of opinion that Trinidad has no use for the signals as it is outside the hurricane zone. Local storms very seldom occur.

For *Sweden* M. Hamberg proposes a revision of the proposals of the Commission, and as an alternative suggests the use of four lanterns arranged in tetrahedron.

## II. *Compilation and Distribution of Information respecting the systems of Storm Warnings adopted by different countries.*

The Commission adopted the following resolutions:—

3. That in order to secure uniformity of practice the representatives of the various countries and the Meteorological Institutes be invited to supply information as to the rules for the hoisting and lowering the signals to be included in the "Provisional Summary of the Maritime Weather Signals at present in use in the various countries of the globe."

4. The Meteorological Institutes are requested to send to the President of the Commission a notification of any changes introduced into the practice in their respective countries.

5. That the London Meteorological Office be requested to issue an edition of the "Summary of Maritime Weather Signals in use in the various countries of the globe" each year, and that the summary be divided into two sections, one for Local and the other for Non-Local signals.

6. That a statement of the scheme for transmission of messages by wireless telegraphy from the Eiffel Tower, Norddeich, and other wireless stations be added to the Summary as indicating the existing provision for Non-Local Signals in North-Western Europe.

It was agreed:—

14. To add a sentence to the circular, "Provisional Summary of the Maritime Weather Signals, &c.," inviting institutes to notify their intention of adopting any special form of signals.

Copies of the rules adopted for hoisting and lowering signals have already been forwarded by Holland, Portugal, Canada, Hong Kong, China (Zi-ka-wei), Philippines, United States of America, and have been incorporated in the provisional summary.

*Russia.*—The director of the Central Nicolas Observatory notified the intention of Russia to adopt the international system of



day signals at the opening of the ports in 1913, and to use provisionally the system of night signals now in use in Norway with red lights instead of white.

*Manila.*—The director of the observatory has notified that Manila Observatory contemplates the adoption of the international local signals as approved thus far, but with some additional signals which, as far as possible, will be based on the international system. There is at present no intention of introducing any non-local signals.

*Australia.*—Mr. Hunt, the Meteorologist of the Commonwealth, reports that he contemplates arrangement for the display of storm warning signals at all lighthouses where the nature of the coast will permit a ship to approach sufficiently close to read them. The arrangement has been carried out in the case of 21 lighthouses.

A new edition of the "Provisional Summary," in accordance with Resolution 5, has been prepared in the Meteorological Office and is now ready for the press.

All the most recent information has been incorporated therein including the information as to the transmission of information by radio-telegraphy, as suggested in Resolution 6.

### III. Non-local Signals.

The Commission resolved as follows:—

7. It was agreed that the proposals of MM. Froc and Hepworth be circulated for the information and comments of the different institutes concerned with warnings for tropical revolving storms.

The proposals are referred to in Appendix VII. and Appendix VIII. of the Report of Proceedings, &c. (M.O. 212), 1912. The replies received are as follows:—

*Portugal.*—M. d'Almeida-Lima agrees with the proposal.

*Hong Kong.*—Mr. Claxton is prepared to recommend to the Hong Kong Government that storm warnings should be issued to semaphore stations if the Chinese Government defrays the cost of erecting the stations and transmitting the messages.

*Canada.*—Mr. Stupart views the proposal with interest. If suitable agents can be found to hoist the signals they will be most useful in countries where typhoons and hurricanes occur.

*United States.*—The Director of the Weather Bureau views the proposal with interest.

*India.*—The Director-General is of opinion that predictions are at present not sufficiently accurate for carrying out Father Froc's proposals which are too complicated for use in India. Captain Hepworth's system does not specify the distance of the disturbance, and is therefore unsuitable.

*Philippines.*—The Director of the Manila Observatory, the Reverend José Algué, S. J., does not see the necessity for a system of non-local signals in the Philippine Islands where vessels very rarely pass along the coast without calling at one or other of the ports, least of all for a system so complicated as that suggested by M. Froc. In proportion as wireless telegraphy

comes into more general use, non-local systems will lose their importance. Within a short time a net-work of wireless stations will be established covering the entire Archipelago, and a law will probably soon be passed making it compulsory for ships carrying a certain number of passengers to be equipped with wireless apparatus. A warning in "plain language" will then be all that is required. The needs of the smaller vessels are fully met by local storm signals.

The Zi-ka-wei system is considered to be not only too intricate but also too indefinite, and any attempt to make it more definite must needs make it also more intricate. The suggestion to give the position of typhoons by means of designated regions, *e.g.*, 3-degree squares, is also not approved. In some cases, where stations are numerous, it is possible to give the position of a typhoon with great accuracy, in others only very approximately. What is wanted is a system which would be very explicit as to regions like the Philippines or Formosa and somewhat vague as to other regions such as the broad expanse of Pacific Ocean between the Ladrões and the Philippines. This idea has been embodied in the "Typhoon Warning Code of Manila Observatory," but it would be difficult to devise a simple system of storm signals on these lines.

With regard to Captain Hepworth's suggestion, the Bureau thinks that it is practically useless whenever there is a question of a typhoon not very far distant for which local signals have been hoisted, while for more distant typhoons such warnings are not required in the Philippines for the reason stated, and for other regions the system is considered too vague.

The adoption of a general "information signal" indicating that the Central Observatory or local meteorological station is in the possession of information likely to prove of use to captains about to sail is suggested.

8. That the Commission invite the several meteorological institutes to send to the Director of the Netherlands Institute extracts from their meteorological logs of ships giving the usual observations of pressure, wind, temperature of the air and sea, and weather, at 8 a.m. and 8 p.m., ship's time, within the following 20-degree squares:—

Lat.	Long.
5° to 25° N.	25° to 45° W.
10° to 30° N.	140° to 160° W.
10° N. to 10° S.	70° to 90° E.
0° to 20° S.	10° W. to 10° E.
10° to 30° S.	90° to 110° W. and 90° to 110° E.

with a view to the publication of a resumé of the observations as a contribution to the meteorology of the globe.

*Portugal.*—M. d'Almeida-Lima thinks the realisation of the project would be very important.

*Canada.*—Mr. Stupart considers the suggestion most valuable.

*Madrid.*—M. Galbis has recommended the proposal to the Minister of Marine.



*United States.*—Professor Willis Moore states that it would be impossible for the Weather Bureau to comply with this resolution as all vessels co-operating with that service take their observations at Greenwich noon, whereas the resolution asks for observations at 8 a.m. and 8 p.m. ship's time. Otherwise the Bureau would be happy to furnish the data desired.

M. van Everdingen, reports that up to the present no extracts from logs have been received by the Meteorological Institute of de Bilt.

Rome, 7th April, 1913.

W. N. SHAW.

P.S.—The following communication from the Royal Alfred Observatory, Mauritius, was received at the Meteorological Office on 5th June, 1913:—

*Remarks on the Recommendations of the Commission for Maritime Meteorology and Storm Warnings.*

No. 3. The following signals are hoisted at the Port Office during cyclonic weather, the first signal when there are indications that a gale of wind may be expected on account of the near approach of the storm centre. The second signal when a hurricane may be expected:—

**First Signal.**—A white flag with three horizontal blue strips and ball above at the Port Office repeated at Fort George and confirmed by a gun.

*Instructions.*—Send down top gallant yards and masts and prepare for bad weather. Ships at the light buoy to go to sea. The masters of all ships and vessels in the Port are required immediately to repair on board their respective vessels.

**Second Signal.**—A red flag at the Port Office with ball above repeated at Fort George and confirmed by a gun.

*Instructions.*—Vessels in the port to strike lower yards and top masts.

**Night Signals.**—One blue light at the Port Office repeated at Fort George and accompanied by a gun.

*Instructions.*—Vessels at the light buoy to proceed to sea and vessels in the Port to make every preparation for bad weather.

The signals remain up until all danger is passed.

No. 8. The Mauritius Meteorological service makes provision for the copying of the meteorological observations from the logs of all vessels calling at Port Louis. Copies of these extracts are then forwarded to the Director-General of Indian Observatories.

The number of vessels calling at Mauritius amounts, on the average, to about 200 and the number of days observations extracted to about 3,000. A more complete scheme is at present being considered for the collection of observations from vessels calling at Mauritius. It appears to be highly desirable that an international system should be adopted, firstly with regard to the

form to be used, and secondly with a view to rendering observations made by vessels not calling at the ports connected with the various services, available for such services if they desire them. If a definite form were decided upon, it could be printed in English, French, and German by the various services in place of those already employed by them at no additional cost, and sufficient forms distributed to vessels calling at the port with which they are connected to carry them to the next station.

On the arrival of any vessel the various meteorological services would collect all the forms filled in, extract such observations as they require and forward the whole batch to the Director of the Netherlands Institute. If the ocean areas were mapped-out into 20-degree squares captains of vessels might be desired to employ a new form when ever they crossed the boundary lines.

After the extraction of such observations as would be required for the formation of a résumé by the Central Netherlands office the forms might be despatched to the services specially interested in the 20-degree squares to which they refer, where they could be stored for reference and special investigations, and possibly incorporated in the various annual volumes of observations. In order to avoid duplicating work the meteorological services through which the forms pass could stamp such as had been copied by them previous to their despatch to the central office. 'Copied at Mauritius' or 'Copied at Bombay' and such forms could be destroyed at the central office when no longer required.

We are specially interested at Mauritius in the four 20-degree squares between latitudes  $0^{\circ}$  and  $40^{\circ}$  S. and  $40^{\circ}$  to  $80^{\circ}$  longitude. We are influenced by cyclones forming between  $0^{\circ}$  and  $20^{\circ}$  S. latitude and by the anticyclonic systems the latter reaches but it is very rare that information concerning the latter reaches us, whereas such observations can probably be collected both at the Cape and in Australia. India is also interested in the conditions from  $0^{\circ}$  to  $20^{\circ}$  S. and, as already stated, we forward them extracts from logs collected here.

The advent of wireless stations and the possibility of a greatly extended system of non-local storm warnings makes it essential that the normal conditions obtaining over the ocean areas should be the subject of a more detailed investigation, but this can only be effected under an international scheme.

No. 9. Only one night signal is required at Mauritius to indicate the near approach of a hurricane. As already mentioned it consists of a blue light and the firing of a gun, but this could be replaced by any other signal decided upon by the International Commission.

No. 13. The day signals required at Mauritius are nine in number and should indicate, in addition to the hurricane signal:—

Cyclonic disturbance N, NE, E, SE, S, SW, W, NW. There would be no difficulty in adopting an international code, Further details are supplied concerning probable weather conditions by the issue of telegrams from the observatory on the approach of dangerous weather.



The following form would meet our requirements:—

INTERNATIONAL FORM FOR SEA OBSERVATIONS.

Name of ship:

Square 0 to 20 South, 40 to 60 East.

Collected and copied Mauritius.

Forwarded to Central Netherlands office through India.

Copied also in India.

Error of barometer as determined at Mauritius .01 too low.

Date.	Hour.	Lat.	Long.	Barometer uncorrected.	Wind, Direction and Force.	Temp.	Sea.	Remarks.
	8 a.m.							
	8 p.m.							
	8 a.m.							
	8 p.m.							

A. WALTER,  
Director.

February 14, 1913.

APPENDIX XV.

(See p. 19.)

FORM FOR MARINE OBSERVATIONS, DRAWN UP BY  
M. VAN EVERDINGEN.

Latitude 5°-25° N.; longitude 25°-45° W.

The position of the ship to be given in whole degrees, so that 6°0' to 6°59' is counted as 6°. The day is reckoned from mid-night local time. The Beaufort scale is recommended for information relating to the weather of the past twelve hours.

b = blue sky	p = passing showers
c = sky three parts clouded	q = squalls
d = drizzling rain	r = rain
f = fog	s = snow
g = gloom	t = thunder
h = hail	u = ugly, threatening sky
l = lightning	v = visibility, unusual trans-
m = mist	parency
o = overcast sky	w = dew

When a different scale is used, it is requested that a definition of it be given.

Day. Month. Year.	Local Time.	Place.		Wind.		Mercury Barometer.		Pressure.	Tempera- ture.		Weather during the past twelve hours.
		Lat. N.	Long. W.	True Direction.	Velocity.	Read- ing.	Attached Thermometer.		Air.	Sea.	

Ship: "Oranje Nassau" Index error and height of the barometer above sea level—0.1 mm, 11 m.

1/1 1913	8 a	23°	41°	ENE	6	770.2	22° 3	768.4	23° 0	22° 5	q r
1/1 1913	8 p	24°	40°	ENE	6	772.1	22° 1	770.4	21° 3	21° 9	e

Ship: "Prins Frederik Hendrik" Index error and height of the barometer above sea level +1.4 mm, 7.5 m.

14/1 1913	8 a	20°	44°	NE	6	768.2	25° 5	767.0	23° 8	23° 2	q
14/1 1913	8 p	22°	43°	NE	4	769.6	23° 2	768.7	21° 8	23° 2	q
15/1 1913	8 a	23°	42°	E	3	769.8	23° 5	768.9	23° 0	23° 4	r
15/1 1913	8 p	24°	41°	ESE	3	769.8	23° 0	768.9	22° 4	22° 8	r

APPENDIX XVI.

(See p. 19.)

REPORT BY CAPTAIN RYDER ON THE CHARTS OF ICE OF THE POLAR  
SEA ISSUED BY THE DANISH METEOROLOGICAL INSTITUTE.

The Danish Meteorological Institute has for several years collected and published information concerning the state of ice in the Arctic regions. To begin with, the information only included the Davis Strait and Baffins Bay and the waters between Iceland, Greenland and Spitzbergen.

At the Meteorological Conference in Paris, 1896, a resolution was adopted which acknowledged the scientific signification of this information, and which expressed the wish that the institutes that had to do with the waters north of 60° lat. would send M. Paulsen the ice observations they had gathered.

Some years later at the International Geographical Congress at Berlin in 1899, a resolution was also adopted asking the different hydrographical and meteorological institutes from all states, who had ships navigating in northern waters where ice occurred, to gather as much information as possible and send it to the Danish Meteorological Institute, which would publish it and supply the captains with the necessary forms, &c.

As a consequence thereof the Danish Meteorological Institute extended the field of investigation to include all the waters round the North Pole, as far as information could be had; and from the year 1901 the information and the maps of ice were published in the form now used.

While in the first years, beside Danish and Norwegian logs, we had information from American, British and Russian ships, I



am sorry to say that these contributions in latter years are only very few, and for 1912 we have only two from America, one Russian and no British.

As you will see on the maps for last year, we have from Danish and Norwegian ships a good number of observations along the west coast of Greenland and the waters between Novaja Zemlja, Spitzbergen, Greenland and Iceland, while the west side of Davis Strait and Baffins Bay, the waters north of Siberia and north of Alaska are marked with the remark: "state of ice unknown."

It is, of course, only a very limited number of ships that navigate in those seas, and the number has in the last years been diminished on account of the ceasing of the whale-fisheries, but still I think that it should be possible to get more observations than we do from these waters.

I do not doubt that the distribution of the Arctic ice has some influence upon the pressure of air, the temperature, &c., of the adjacent lands and oceans, and I have often seen that our publications about the ice have been used in works dealing with these matters. I therefore think it would be desirable if we could diminish the number of waste places on the maps where the remark "state of ice unknown" is now standing.

I think for instance that it ought to be possible to get some Russian information concerning the waters north of Siberia, though we have in the last years tried in vain to get it, and I also think that America, Canada and perhaps England could procure information concerning the waters north of Bering Strait, the western side of Baffins Bay and Davis Strait and along the coast of Labrador and Newfoundland.

I therefore ask the Committee, in continuation of the resolution from Paris in 1896, to adopt a resolution which asks the different meteorological institutions to assist us in collecting such information about the state of ice in the Arctic Seas, in order that our publication may be more complete than it is now.

C. RYDER.

## ADDITIONAL APPENDICES.

### APPENDIX XVII.

GEOGRAPHICAL LIST OF INSTITUTIONS AND PERSONS FROM WHOM PUBLICATIONS CONTAINING METEOROLOGICAL AND OTHER GEOPHYSICAL DATA HAVE BEEN RECEIVED AT THE METEOROLOGICAL OFFICE, LONDON, DURING THE LAST TEN YEARS.

(M.O. Circular 303.)

The list is arranged in accordance with the revised topographical classification adopted in the International Catalogue of Scientific Literature. In each section the names of institutions which collect observations from a network of stations, or which publish observations on an extended scale, have been placed first. In a number of instances, particularly in the case of tropical countries, observations are published by authorities not domiciled in the country. In these instances the names of the places of observation have been given as far as space permits, and the names of the institutions issuing the publications have been printed in *italic type*. If no names of places are quoted, it may be assumed that returns from a number of stations are given.

The character of the information available has been indicated by quoting the numbers in the International Catalogue under which the publications have been classified.

The year quoted is the last complete year for which the information has been received.

The classification numbers employed are as follows:—

- 1710 and 1730. Climatology—Agricultural and Hygienic.
- 1180. Rainfall Tables.
- 1800. Meteorological Observations—General.
- 1810. " " Hourly Values.
- 1820. " " Daily Values.
- 1825. " " Mean Values.
- 1830. Daily Weather Reports.
- 1840. Weather Reports—Weekly, Monthly, &c.
- 3020. Magnetical Observations.

† Indicates publications which give information for the upper air, obtained with balloons or kites.



# GEOGRAPHICAL LIST OF INSTITUTIONS AND PERSONS SUPPLYING PUBLISHED METEOROLOGICAL AND OTHER DATA.

METEOROLOGICAL AND OTHER DATA.										
NAME OF INSTITUTION, &C.	Agricultural and Hygienic. 1710 & 1730	Rainfall Tables. 1180.	Meteorological Observations.				Daily Weather Reports and Charts. 1830.	Weekly or Monthly Weather Reports. 1840.	Magnetical Observations. 302	
			General. 1800.	Hourly Values. 1810.	Daily Values. 1820.	Mean Values. 1825.				
GENERAL.										
International Commission for Scientific Aeronautics, Strassburg.	—	—	1910	—	—	—	—	—	—	
Board of Trade, London—Commercial, Labour, and Statistical Department.	—	—	—	—	—	1907	—	—	—	
Symons's Meteorological Magazine ..	—	—	—	—	—	1912	—	—	—	
d. EUROPE AND MEDITER- RANEAN SEA AND ISLANDS.										
Deutsche Seewarte, Hamburg .. ..	—	—	—	—	—	—	1912	—	—	
da. Scandinavia: Sweden, Norway, Denmark, Iceland, Faeroes:—										
Dansk Meteorologisk Institut (Copenhagen).	—	—	1909	—	1911	1909	1912	1912	1908	
Norsk Meteorologisk Institut (Christiania).	—	1911	1911	1911	1911	1911	1912	—	—	
Svensk Meteorologisk Institut (Stockholm).	—	—	—	—	—	—	—	—	—	
K. Svenska Vetenskaps-Akademie (Stockholm).	—	1910	1911	—	1911	1911	—	1912	—	
Hydrografiska Byrån (Stockholm)	—	1910	—	—	—	—	—	—	—	
Stockholm (H. E. Hamberg) ..	—	—	—	—	—	—	—	—	—	
Upsala, Observatoire Météorolo- gique de l'Université.	—	—	1912	1912	1912	*	—	—	—	
Vassijaure, K. Svenska Ventensks. Akademie, Stockholm.	—	—	—	1907	—	—	—	—	—	
db. Russia in Europe:—										
Observatoire Physique Central Nicolas (St. Petersburg).	—	—	1908	1908	1908	1908	1912†	1911	1908	
Finland, Meteorologisches Zentralanstalt (Helsingfors).	—	—	1910	1910	1910	1910	—	1907	—	
Kaiserliche Livländische Ge- meinnützige u. Ökonomische Sozietät. Dorpat (Jurjev).	—	1905	—	—	—	—	—	—	—	
Dorpat, Meteorologisches Obser- vatorium.	—	—	1911	1911	1911	—	—	—	—	
Dorpat, Station Météorologique de l'Ecole Reale.	—	—	—	—	1906	—	—	—	—	
Kazan, Observatoire Météoro- logique.	—	—	—	—	1911	—	—	—	—	
Kieff, Observatoire Météorolo- gique.	—	—	—	—	—	—	—	—	—	
Moscow (E. Leyst) .. ..	—	—	1908	1908	—	—	—	—	—	
Moscow, Meteorologisches Ob- servatorium der K. Universität	—	—	1909	—	—	—	—	—	—	
Nijni-Oltchedaef, Observatoire Météorologique.	—	—	1911	1911	1911	—	—	—	—	
Odessa, Observatoire Météoro- logique et Magnétique de l'Uni- versité Impériale.	—	—	1912	1912	1912	1909	—	—	—	
St. Petersburg, Observatoire Météorologique de l'Institut Forestier Impériale.	—	1905	1905	—	1910†	1906	—	—	—	
Tiflis, Physical Observatory ..	—	—	—	1909	—	—	—	—	—	
Warsaw, Station Centrale Météoro- logique du Musée de l'Indus- trie et de l'Agriculture.	—	—	1904 1908	1904 —	— 1908	— 1908	— —	1910† —	— —	
* Means of temperature in Stockholm for 1750.										

\* Means of temperature in Stockholm for 1756 to 1905 and in Sweden for 1856 to 1907.

## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTION, &C.	Agricultural Hygienic. 1710 & 1730.	Rainfall Tables. 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts. 1830.	Weekly or Monthly Weather Reports 1840.	Magnetical Observations. 3020.
			General. 1800.	Hourly Values. 1810.	Daily Values. 1820.	Mean Values. 1825.			
d. EUROPE AND MEDITER- RANEAN ISLANDS—cont.									
de. German Empire:—									
Deutsche Seewarte (Hamburg)	—	—	1911	1911	1911	1911	1912	1912	—
Prussia, K. Meteorologisches Institut (Berlin).	—	1910	1909	1909	1909	1912	—	1912	—
Alsace-Lorraine, Meteorolo- gischer Landesdienst (Strass- burg).	—	—	1907	1907	1907	1912	—	—	—
Baden, Central Bureau für Meteorologie und Hydro- graphie (Carlsruhe).	—	1912	1911	—	1911	1911	—	1912	—
Bavaria, K. Meteorologische Central Station (Munich).	—	—	1911†	1911	1911	1911	1912	—	—
Hessen, G. Hydrographisches Bureau (Darmstadt).	—	1912	1911	1911	1911	1911	—	1912	—
Saxony, K. Sächs. Landes- Wetterwarte (Dresden).	—	—	1908	1908	1908	1908	1912	1910	—
Württemberg, K. Statistisches Landesamt und Meteorolo- gische Central Station (Stutt- gart).	—	—	1911	1901	1911	1911	—	1912	—
Aachen, Meteorologisches Obser- vatorium.	—	—	1910	1910	1910	1910	1912	—	—
Berlin, Wetter Bureau .. ..	—	—	—	—	—	—	1912	—	—
Bremen, Meteorologische Station Eberswalde, Meteorologische Station.	—	—	1911	1911	1911	1911	—	1903	—
Emden, Naturforschende Gesell- schaft.	—	—	—	—	—	1907	—	—	—
Frankfurt am Main, Physika- lischer Verein.	—	—	—	—	1908	—	1912	—	—
Lindenberg, K. Preussisches Aeronautisches Observatorium.	—	—	1908†	—	—	—	—	—	—
Potsdam, K. Preuss. Met. Institut	—	—	1911	1911	1911	—	—	—	1911
Wilhelmshaven, Kaiserliches Observatorium.	—	—	—	—	—	—	—	—	1910
dd. Holland; Belgium; Luxem- burg:—									
K. Nederlandsch Meteorolo- gisches Institut (de Bilt).	—	1910	1910	1910	1910	1910	1912	1912	1910
Observatoire Royal, Uccle, Brus- sels.	—	—	1904	1904	1904	1904	1912	—	—
Ghent, Université .. ..	—	—	1911	—	1911	—	—	—	—
Mons (A. Bracke) .. ..	—	—	—	—	1905	—	—	—	—
de. British Islands:—									
Meteorological Office, London	—	—	1912	1912	1912†	1912	1912	1912	1912
British Rainfall Organisation (H. R. Mill).	—	1911	—	—	—	—	—	—	—
R. Meteorological Society, London	—	—	1911	—	1911	1911	—	—	—
Scottish Meteorological Society, Edinburgh.	—	1910	1910	—	—	1910	—	—	—
Board of Agriculture and Fisheries, London.	1910	—	—	—	—	—	—	—	—
General Register Office, Dublin	1912	—	—	—	1912	1912	—	1912	—
General Register Office, London	1913	—	—	—	1912	1912	—	1912	—
Registrar General's Office, Edin- burgh.	1912	—	—	—	—	1912	—	1912	—
Royal Observatory, Greenwich	—	—	1910	1910	1910	—	—	—	1910
Royal Society of Edinburgh [Fort William and Ben Nevis].	—	—	—	1897	—	—	—	—	—
Bath, Medical Officer of Health	1911	—	—	—	—	1911	—	—	—
Birmingham Scientific Society..	—	—	1911	—	1911	—	—	—	—
Blackpool, Public Health Office	1911	—	—	—	—	1911	—	—	—
Bognor, Medical Officer of Health	1909	—	—	—	—	1908	—	—	—



## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTION, &C.	Agricultural and Hygienic. 1710 & 1730.	Rainfall Tables. 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts. 1830.	Weekly or Monthly Weather Reports. 1840	Magnetical Observations. 3020.
			General. 1800.	Hourly Values. 1810.	Daily Values. 1820.	Mean Values. 1825.			
<i>d. EUROPE AND MEDITER- RANEAN ISLANDS—cont.</i>									
<i>de. British Islands—cont.</i>									
Bolton, The Museums and Meteorological Observatory.	—	—	—	—	—	1912	—	1911	—
Borden Wood, Sussex (E. Lamb)	—	—	—	—	—	1912	—	—	—
Bournemouth (C. Dales) ..	—	—	—	—	—	1907	—	—	—
Brighton, Medical Officer of Health.	1911	—	—	—	—	—	—	—	—
Burnley, Medical Officer of Health.	1911	—	1911	—	—	—	—	—	—
Buxton, Devonshire Hospital ..	—	—	—	—	—	—	—	—	—
Canterbury (A. Lander) ..	—	—	—	—	—	1910	—	—	—
Cardiff, Naturalists' Society ..	—	1911	—	—	—	1909	—	—	—
Cardiff, Waterworks Engineer's Office.	—	1905	—	—	—	1911	—	—	—
Chester (J. C. Mitchell) ..	—	—	—	—	—	—	—	—	—
Clongowes Wood College ..	—	—	—	—	—	1905	—	—	—
Cockle Park, Morpeth ..	—	—	—	—	—	1912	—	—	—
Coventry, Medical Officer of Health.	1911	—	—	—	—	1904	—	—	—
Croydon, Natural History and Scientific Society.	—	1911	—	—	—	1911	—	—	—
Devon, North (T. Wainwright) ..	—	—	—	—	—	1912	—	—	—
Dorset (H. Stilwell) ..	—	—	—	—	—	—	—	—	—
Eastbourne, Borough Meteorol- ogist.	—	1911	—	—	—	—	—	—	—
East Ham, Public Health De- partment.	1907	—	—	—	—	—	—	—	—
Falmouth, R. Cornwall Poly- technic Society.	—	—	—	—	—	1909	—	—	—
Great Central Railway ..	—	1912	—	—	—	1911	—	1911	—
Great Yarmouth, Urban Sani- tary Authority.	1910	—	—	—	—	—	—	—	—
Hampstead Scientific Society ..	—	—	—	—	—	1910	—	—	—
Harrogate, Harlow Moor Ob- servatory.	—	—	—	—	—	1910	—	—	—
Hastings, Borough Meteorologist.	—	—	—	—	—	1907	—	—	—
Hertfordshire (J. Hopkinson) ..	—	1906	—	—	—	1911	—	—	—
Hoylake and West Kirby, Urban District Council.	—	—	—	—	—	1906	—	—	—
Isle of Man (late A. W. Moore) ..	—	—	—	—	—	1910	—	—	—
Kew, National Physical Labora- tory.	—	—	—	—	—	1904	—	—	—
Kidderminster, Medical Officer of Health.	1911	—	—	—	—	1910	—	—	—
Kingston-on-Soar, Midland Agricultural and Dairy Col- lege.	—	—	—	—	—	1911	—	—	—
Kingston-on-Thames, Surrey County Council.	1908	—	—	—	—	1908	—	—	—
Liverpool Observatory, Bidston.	—	—	—	—	—	—	—	—	—
Lowestoft, Medical Officer of Health.	1911	—	—	—	—	1911	—	—	—
Manchester, Godlee Observatory	—	—	—	—	—	—	—	—	—
Manchester, Public Health Office	—	—	—	—	—	1911	—	—	—
Margate, Borough Meteorologist	1904	—	—	—	—	—	—	—	—
Netley, Army Medical Depart- ment, London.	1910	—	—	—	—	1904	—	—	—
Northampton, Natural History Society.	—	1910	—	—	—	1910	—	—	—
Norwich (A. W. Preston)	—	—	—	—	—	—	—	—	—
Nottingham (A. Brown and P. Boobyer).	—	1912	1912	—	—	1910	—	—	—
Nottingham, Rural District Council of Basford.	1903	—	—	—	—	—	—	—	—
Oxford, Radcliffe Observatory ..	—	—	—	—	—	1903	—	—	—
Paisley, Coats Observatory ..	—	—	—	—	—	1912	—	—	—
Perth, Natural History Museum	—	—	—	—	—	—	—	—	—
Portsmouth, Medical Officer of Health.	1909	—	1909	—	—	—	—	—	—
Rousdon Observatory ..	—	—	—	—	—	—	—	—	—
Royal Botanic Society, London	—	—	—	—	—	1903	—	—	—

## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTION, &C.	Agricultural and Hygienic. 1710 & 1730.	Rainfall Tables. 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts. 1830.	Weekly or Monthly Weather Reports. 1840.	Magnetical Observations. 3020.
			General. 1800.	Hourly Values. 1810.	Daily Values. 1820.	Mean Values. 1825.			
<i>d. EUROPE AND MEDITER- RANEAN ISLANDS—cont.</i>									
<i>de. British Islands—cont.</i>									
Rugby School Natural History Society.	—	—	—	—	—	1911	—	—	—
Scarborough, Medical Officer of Health.	1909	—	—	—	—	1909	—	—	—
Seaham Harbour, Medical Officer of Health.	1907	—	—	—	—	1907	—	—	—
Sevenoaks (W. W. Wagstaffe) ..	—	—	—	—	—	1905	—	—	—
Shropshire (W. M. D. La Touche)	—	1911	—	—	—	—	—	—	—
Southampton, Medical Officer of Health.	1906	—	—	—	—	1906	—	—	—
Southport, Fernley Observatory	—	—	1911	1911	1912	1911	—	—	—
Stonyhurst College Observatory	—	—	—	—	—	1912	—	—	1912
Teignmouth, Urban District Council.	—	1809	—	—	—	1912	—	—	—
Throcking (C. W. Harvey) ..	—	1909	—	—	—	1909	—	—	—
Totland Bay, Isle of Wight (J. Dover).	—	—	—	—	—	1911	—	—	—
Truro, Cornwall County Council, Sanitary Committee.	1912	—	—	—	—	1910	—	1912	—
Truro (G. Penrose) ..	—	—	—	—	—	1900	—	—	—
Waterford (C. E. Perceval Bolton)	—	—	—	—	—	—	—	1912	—
Weymouth and Melcombe Regis	—	—	—	—	—	1909	—	—	—
Whitechurch (E. E. Glyde) ..	—	1910	—	—	—	—	—	—	—
Workop (H. Mellish) ..	—	—	—	—	—	1912	—	—	—
York, Yorkshire Philosophical Society.	—	—	—	—	—	1911	—	—	—
<i>df. France and Corsica:—</i>									
Bureau Central Météorologique de France (Paris).	—	1909	1910	1910	1910	1910	1912	1912	1907
Avignon, Commission Météoro- logique du Département de Vaucluse.	—	—	1903	—	—	1903	—	—	—
Beaulieu, Sèvres et Vacquey (G. Eiffel).	—	—	1911	—	1905	1911	—	—	—
Bordeaux, Commission Météoro- logique de la Gironde.	—	1910	—	—	1910	—	—	—	—
Chevreuse, Observatoire ..	—	—	—	—	1907	—	—	—	—
Lyons, Commission Départe- mentale de Météorologie du Rhône.	—	1910	1910	—	—	—	—	—	—
Marseilles, Commission de Mé- térlogie du Département des Bouches-du-Rhône.	—	—	1911	—	1911	—	—	—	—
Paris, Observatoire Municipal (Observatoire de Montsouris).	—	—	—	—	1907	—	—	—	—
Paris, Service Hydrométrique du Bassin de la Seine.	—	1910	—	—	—	—	—	—	—
Perpignan, Commission Mé- térlogique.	—	1909	1909	—	1909	1909	—	—	1909
Puy-de-Dôme, Observatoire ..	—	—	—	—	1905	—	—	—	—
Toulouse, Commission Météoro- logique du Département de la Haute-Garonne.	—	—	1908	—	1908	—	—	—	1908
<i>dg. Iberian Peninsula (including Pyrenees): Spain (with Balearic Islands); Portugal:—</i>									
Observatorio Central Meteorol- ógico (Madrid).	—	—	—	—	—	1910	1912	—	—
Observatorio Do Infante D. Luiz (Lisbon).	—	—	—	—	—	1910	1912	—	—
Observatorio, Madrid ..	—	—	—	—	—	1911	1900	—	—
Coimbra, Observatorio Meteor- ológico e Magnético da Uni- versidade.	—	—	1911	1911	1911	—	—	—	1911
Gibraltar, Army Medical Dep., London.	—	—	—	—	—	1906	—	—	—



## GEOGRAPHICAL LIST—continued.

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			General, 1800.	Hourly Values, 1810.	Daily Values, 1820.	Mean Values, 1825.			
<i>d. EUROPE AND MEDITER- RANEAN ISLANDS—cont.</i>									
<i>dg. Iberian Peninsula—cont.</i>									
Gibraltar (Blue Book)	—	—	—	—	—	1912	—	—	—
Granada, Observatorio Meteorológico de Cartuja.	—	—	1910	1908	1911	—	—	—	—
Linas, Observatorio Belloch ..	—	—	—	—	—	—	—	—	—
Madrid, Chamartin de la Rosa, Observatorio Meteorológico.	—	—	1904	—	—	—	—	—	—
Malaga, Sociedad Malagvena de Ciencias.	—	—	—	—	1906	—	—	—	—
Mahon (Minorca), Bureau Central Met., Paris.	—	—	—	—	—	1911	—	—	—
Oña, Observatorio ..	—	—	—	—	—	1910	—	—	—
Oporto, Observatorio Meteorológico da Princeza D. Amelia.	—	—	—	—	1911	—	—	—	—
San Fernando, Instituto y Observatorio de Marina.	—	—	—	—	—	1912	—	—	—
Tortosa, Observatorio del Ebro ..	—	—	1911	1911	1911	—	—	—	1911
<i>dh. Italy: Sicily and Sardinia:—</i>									
Ufficio Centrale Meteorologico e Geodinamico Italiano (Rome).	1912	—	1910	—	—	1910	1912	—	—
Bologna, Osservatorio della R. Università.	—	—	—	—	—	—	—	—	—
Catania, R. Osservatorio ..	—	—	—	—	1911	—	—	—	—
Florence, R. Museo di Fisica e Storia Naturale.	—	—	—	—	—	1909	—	—	—
Florence, Osservatorio Ximeniano	—	—	—	—	—	1910	—	—	—
Genoa, R. Istituto Idrografico	—	—	—	—	—	—	—	—	—
Messina, Osservatorio ..	—	—	—	—	—	1907	—	—	—
Milan, R. Osservatorio Astronomico di Brera.	—	—	1912	—	—	—	—	—	—
Modena, R. Osservatorio Geofisico.	—	—	—	—	—	1909	—	—	—
Moncalieri, Osservatorio del Real Collegio Carlo Alberto.	—	—	—	—	—	—	—	—	—
Naples, Istituto di Fisica Terrestre.	—	—	—	—	—	1911	—	—	—
Naples, R. Osservatorio di Capodimonte.	—	—	—	—	—	1910	—	—	—
Riposto, Osservatorio Meteorologico del R. Istituto Nautico.	—	—	—	—	—	1911	1910	—	—
Rome, Specola Vaticana ..	—	—	—	—	—	1912	—	—	—
Turin, Osservatorio della R. Università.	—	—	—	—	—	—	—	—	—
Venice, Osservatorio Meteorologico del Seminario Patriarcale.	—	—	—	—	—	1905	—	—	—
Venice, Ufficio Idrografico ..	—	—	—	—	—	1911	—	—	—
Venice, Ufficio Idrografico ..	—	—	—	—	—	1908	—	—	—
<i>di. Switzerland:—</i>									
Schweizerische Meteorologische Central Anstalt (Zürich).	—	—	1910	1910	—	—	—	—	—
Berne, Abteilung für Landeshydrographie.	—	—	1907	1911†	1911	1911	1912	—	—
Davos Traffic Association	—	—	—	—	—	—	—	—	—
Genève et le Grand St. Bernard (R. Gautier).	—	—	—	—	—	—	—	—	—
Lausanne, Institut Agricole ..	—	—	—	—	—	1912	—	—	—
St. Moritz (R. Gautier et H. Duaine).	—	—	—	—	—	1910	—	—	—
<i>dk. Austria-Hungary, with Bosnia and Herzegovina:—</i>									
K. K. Central Anstalt für Meteorologie und Erdmagnetismus (Vienna).	—	—	1910	1910	1912†	1910	1912	1912	—

## GEOGRAPHICAL LIST—continued.

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			General, 1800.	Hourly Values, 1810.	Daily Values, 1820.	Mean Values, 1825.			
<i>d. EUROPE AND MEDITER- RANEAN ISLANDS—cont.</i>									
<i>dk. Austria-Hungary, with Bosnia and Herzegovina—cont.</i>									
K. K. Hydrographischer Dienst in Oesterreich (Vienna).	—	1908	—	—	1908	—	—	1912	—
Hydrographisches Amt der K. K. Kriegs-Marine (Pola).	—	—	1911	1911	1911	1908	—	—	1910
K. Ung. Reichs-Anstalt für Meteor. und Erdmagn. (Budapest).	—	1907	1907	1907	1912	1907	1912	1912	1910
Bosnisch-Hercegovinische Landesregierung (Sarajevo)	—	—	1910	1910	1910	1910	—	—	—
Agram, Meteorologisches Observatorium.	—	1910	1910	1904	1904	—	—	—	—
Brünn, Meteorologische Commission des naturforschenden Vereines.	—	—	1907	—	—	1907	—	—	—
Cracow, C. K. Akademii Umiejetnosci u. Krakowie.	—	—	—	—	—	1902	—	—	—
Cracow, K. K. Sternwarte ..	—	—	—	—	—	1912	—	—	—
Cracow, Observatorium ..	—	—	—	—	—	1906	—	—	—
Fiume, K. K. Marine-Akademie	—	1910	1910	—	—	1910	—	—	—
Innsbruck, Meteorologisches Observatorium.	—	—	—	—	—	1907	1907	—	—
Klagenfurt (F. Jäger) ..	—	—	—	—	—	1906	1906	—	—
Kremsmünster, Sternwarte ..	—	—	—	—	—	1911	—	—	1911
Prague, K. K. Sternwarte ..	—	—	1908	1908	1908	1908	1912	—	—
Trieste, I. R. Osservatorio Marittimo.	—	—	—	—	—	1903	—	—	—
Vienna, K. K. Sternwarte ..	—	—	—	—	—	—	—	—	—
<i>dl. Balkan Peninsula:—</i>									
Observatoral Astronomic si Meteorologic (Bucharest).	1911	1911	1902	1902	1902	1902	1912	1912	—
Observatoire National (Athens)	—	—	—	—	—	1908	—	—	1908
Belgrade, Observatoire Central	—	—	—	1903	—	—	—	1903	—
Monastir and Cavalla. Bureau Central Met., Paris.	—	—	—	—	—	1910	—	—	—
Roumania (S.C. Hepites) ..	—	1903	—	—	—	—	—	—	—
Salonika, Gymnase Bulgare ..	—	—	—	—	—	1911	—	—	—
Salonika and Scutari. K. K. Central-Anstalt für Meteorologie, Vienna.	—	—	—	—	—	1910	—	—	—
Salonika, Observatoire Physique Central Nicolas, St. Petersburg.	—	1912	1908	1908	1912	1908	—	1912	—
Sofia, Institut Meteorologique Central de Bulgarie.	—	—	1902	1902	1902	1902	—	—	—
Thera. (F. Frhr. Hiller von Gaertringen.)	—	—	—	—	—	—	—	—	—
<i>dm. Mediterranean and Islands:—</i>									
Cyprus (Blue Book)	—	—	—	—	—	1911	—	—	—
Cyprus Public Works Department (Nicosia).	—	1912	—	—	—	—	—	—	—
Malta Observatory ..	—	—	—	—	—	1911	—	—	—
Malta and Cyprus. Army Medical Dep., London.	—	—	—	—	—	1906	—	—	—
Malta. Bureau Central Met., Paris	—	—	—	—	—	1902	—	—	—
Survey Department, Cairo ..	—	—	—	—	—	1910	—	1911	—
<i>dq. English Channel, including Channel Islands:—</i>									
Guernsey (A. Collette) ..	—	1910	—	—	—	1911	—	—	—
Jersey, Observatoire St. Louis ..	—	—	1912	1912	1912	—	—	—	1908



## GEOGRAPHICAL LIST—continued.

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			General, 1800.	Hourly Values, 1810.	Daily Values, 1820.	Mean Values, 1825.			
<i>e. ASIA AND MALAY ARCHIPELAGO.</i>									
<i>ea. Asiatic Russia:—</i>									
<i>Observatoire Physique Central Nicolas (St. Petersburg).</i>	—	—	1908	1905	1908	1908	—	—	1905
<i>ea. West Siberia:—</i>									
<i>Observatoire Physique Central Nicolas, St. Petersburg.</i>	—	—	—	—	1908	1908	—	—	—
<i>ea. East Siberia:—</i>									
<i>Irkutsk, Observatoire Magnétique et Météorologique.</i>	—	—	1905	1905	1905	1905	—	—	—
<i>Observatoire Physique Central Nicolas, St. Petersburg.</i>	—	—	—	—	1908	1908	—	—	—
<i>ea. Central Asiatic Russia:—</i>									
<i>Observatoire Physique Central Nicolas, St. Petersburg.</i>	—	—	—	—	1908	1908	—	—	—
<i>eb. China and Dependencies: Tibet, Corea:—</i>									
<i>Hong-Kong, Observatory.</i>	—	—	1911	1911	1912	—	1912	—	1911
<i>Chemulpo, Meteorological Observatory.</i>	—	—	1911	—	1911	—	—	—	—
<i>Ouroumshui, Peking, Observatoire Physique Central Nicolas, St. Petersburg.</i>	—	—	—	—	—	1908	—	—	—
<i>Deutsche Seewarte, Hamburg.</i>	—	—	—	—	—	—	—	—	—
<i>Hong-Kong and Weihaiwei, Army Medical Dep., London.</i>	—	—	1910	1901	1910	—	—	—	—
<i>Kashgar, &amp;c. Meteorological Office India (Simla).</i>	—	—	—	—	—	1911	—	—	—
<i>Kharbin (Manchuria), Société du chemin de fer Chinois de l'Est.</i>	—	—	1906	1906	1906	1906	—	—	—
<i>Ou-tchang, K. K. Central-Anstalt für Meteorologie, Vienna.</i>	—	—	—	—	—	1910	—	—	—
<i>Peking, Inspectorate General of Customs.</i>	1904	—	—	—	—	—	—	—	—
<i>Tokio, Central Meteorological Observatory.</i>	—	—	—	—	1906	—	—	—	—
<i>Tchen-Tou, Tien-Tsin, Yunnan-Sen, &amp;c. Bureau Central Mété., Paris.</i>	—	—	—	—	1910	1910	—	—	—
<i>Weihaiwei, Medical Officer .. Zikawei, Observatoire Magnétique et Météorologique.</i>	—	—	1908	1908	1908	1912	—	—	1908
<i>ec. Japanese Islands, Formosa:—</i>									
<i>Central Meteorological Observatory (Tokio).</i>	—	—	1911	1911	1911	1912	—	—	—
<i>Mizusawa, International Latitude Observatory.</i>	—	—	1911	—	1911	1911	—	—	—
<i>Tsukubasan, Observatorium ..</i>	—	—	1909	1909	1909	—	—	—	—
<i>ed. French Indo-China: Tonquin, Annam, &amp;c.:—</i>									
<i>Bureau Central Mété., Paris ..</i>	—	1910	1910	—	1910	1910	—	—	—

## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTE, &c.	Agricultural and Hygienic, 1710 & 1730.	Rainfall Tables, 1180.	Meteorological Observations.				Daily Weather Reports and Charts, 1830.	Weekly or Monthly Weather Reports, 1840.	Magnetic Observations, 3020.
			General, 1800.	Hourly Values, 1810.	Daily Values, 1820.	Mean Values, 1825.			
<i>e. ASIA AND MALAY ARCHIPELAGO—cont.</i>									
<i>ec. Siam:—</i>									
<i>Pnom-Penh, &amp;c. Bureau Central Mété., Paris.</i>	—	—	—	—	—	1910	—	—	—
<i>ef. British India: Himalaya, Burmah, Ceylon:—</i>									
<i>Meteorological Office, India, (Simla).</i>	—	1910	1911	—	1910	1911	1912	1911	—
<i>Agricultural Department, Calcutta.</i>	—	1912	—	—	—	—	—	—	—
<i>Meteorological Office, Bengal, Calcutta.</i>	—	1907	1909	—	—	1909	1912	1909	—
<i>Observatory, Colombo ..</i>	—	—	1910	—	—	1912	—	—	—
<i>Allahabad, Meteorological Office</i>	—	1911	—	—	—	1911	—	—	—
<i>Bangalore, Mysore Government Meteorological Department.</i>	—	1910	1910	—	1910	1910	—	—	—
<i>Bombay, Government Observatory.</i>	—	—	1905	—	1905	—	—	—	—
<i>Ceylon, Royal Botanic Gardens</i>	—	1903	—	—	—	—	1911	—	—
<i>Kodaikanal, Observatory ..</i>	—	—	—	—	—	—	1910	—	1910
<i>Meteorological Reporter to Government, Punjab.</i>	—	—	—	—	—	—	—	—	—
<i>Karikal, Pondichery, &amp;c. Bureau Central Mété., Paris.</i>	—	—	—	—	—	—	1910	—	—
<i>eg. Malay Peninsula and Archipelago, Philippines, &amp;c.:—</i>									
<i>Royal Magnetical and Meteorological Observatory (Batavia).</i>	—	1910	1909	1909	—	1909	—	—	1909
<i>Philippine Weather Bureau, Manila Central Observatory.</i>	—	—	1909	1909	1911	—	—	1911	1909
<i>Principal Civil Medical Officer, Straits Settlements (Singapore).</i>	—	1904	1911	—	1911	1911	—	—	—
<i>British North Borneo (British N. Borneo Herald).</i>	—	—	—	—	1912	—	—	—	—
<i>Buitenzorg, Institut Botanique de l'Etat.</i>	—	—	—	—	1911	—	—	—	—
<i>Federated Malay States (Govt. Gazette).</i>	—	1910	—	—	1910	1912	—	—	—
<i>Penang, Singapore. Meteorological Office, India (Simla).</i>	—	—	—	—	—	1911	—	—	—
<i>Singapore. Army Medical Dep., London.</i>	—	—	—	—	—	1906	—	—	—
<i>eh. Persia, Afghanistan, Baluchistan, Pamirs:—</i>									
<i>Bushire, Ispahan, Jask, Kabul, Quetta, &amp;c. Meteorological Office, India (Simla).</i>	—	—	—	—	—	1911	—	—	—
<i>Bushire. Bureau Central Mété., Paris.</i>	—	—	—	—	—	1905	—	—	—
<i>Enzeli, Kerman. Observatoire Physique Central Nicolas, St. Petersburg.</i>	—	—	—	—	—	1908	—	—	—
<i>ei. Asiatic Turkey, Arabia, Syria:—</i>									
<i>Aden, Baghdad, Bahrein, Busrah, Muscat, Beyrout. Meteorological Office, India (Simla).</i>	—	—	—	—	—	1911	—	—	—
<i>Babylon. Deutsche Seewarte, Hamburg.</i>	—	—	—	—	—	1910	—	—	—



## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTION, &c.	Agricultural Hygienic. 1710 & 1730.	Rainfall Tables. 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts. 1830.	Weekly or Monthly Weather Reports. 1840.	Magnetical Observations. 3020.
			General. 1800.	Hourly Values. 1810.	Daily Values. 1820.	Mean Values. 1825.			
<b>c. ASIA AND MALAY ARCHI- PELAGO—cont.</b>									
<i>ci. Asiatic Turkey, Arabia, Syria —cont.</i>									
Beyrout, Jerusalem, &c. K. K. Central-Anstalt für Meteorologie, Vienna.	—	—	1910	—	1910	1910	—	—	—
Hebron. Scottish Met. Soc., Edin- burgh.	—	—	—	—	—	1910	—	—	—
Ksara (Liban), Observatoire ..	—	—	—	—	—	1910	—	—	—
Bureau Central Met., Paris ..	—	—	—	—	1912	—	—	—	—
Scutari. Army Medical Dep., London.	—	—	—	—	1910	1910	—	—	—
Sinope. Observatoire Physique Central Nicolas, St. Petersburg.	—	—	—	—	—	1906	—	—	—
Smyrna. Survey Department, Cairo.	—	—	—	—	—	1908	—	—	—
						1910	—	—	—
<b>f. AFRICA AND MADAGASCAR.</b>									
<i>fa. Mediterranean States: Moroc- co, Algiers, Tunis, Tripoli:—</i>									
Service Météorologique du Gouvernement Général de l'Algérie.	—	—	—	—	—	—	1912	—	—
Algeria and Tunis, Benghazi (Tripoli), Tangier, Mazagan. Bureau Central Met., Paris.	—	1910	—	1910	1910	—	—	—	—
Casablanca, Marrakesch, Moga- dor, Safi. Deutsche Seewarte, Hamburg.	—	—	—	—	1910	—	—	—	—
Melilla. Observatorio Central Meteorológico, Madrid.	—	—	—	—	1910	—	—	—	—
Tripoli. Ufficio Centrale Met. e Geodinam. Ital., Rome.	—	—	—	—	1905	—	—	—	—
<i>fb. North-east Africa: Egypt, Nile Valley to 5° N., Abyssinia:—</i>									
Survey Department, Cairo ..	—	1910	1910	1908	1910	1909	1912	1911	1911
Department of Public Health, Cairo.	1912	—	—	—	—	—	—	—	—
Egyptian Sudan. Meteorological Office, London.	—	—	—	—	—	1902	—	—	—
Adis-Abeba (Abyssinia). Obser- vatoire Physique Central Nicolas, St. Petersburg.	—	—	—	—	1906	1906	—	—	—
Berbera, Somaliland ..	—	—	—	—	1911	1911	—	—	—
Khartoum. Army Medical Dep., London.	—	1911	—	—	—	—	—	—	—
Ismailia, Port Said, Suez, Adis- Abeba (Abyssinia). Bureau Central Met., Paris.	—	—	—	—	—	1910	1910	—	—
<b>c. Sahara and the Central Sudan:—</b>									
Fort Lamy (Tchad), &c. Bureau Central Met., Paris.	—	—	—	1908	1910	—	—	—	—
<b>fd. West Africa, including French Sudan, from Morocco to the Congo:—</b>									
Mitteilungen aus den Deutschen Schutzgebieten.	—	—	—	—	1909	—	—	—	—

## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTION, &c.	Agricultural Hygienic. 1710 & 1730.	Rainfall Tables. 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts. 1830.	Weekly or Monthly Weather Reports. 1840.	Magnetical Observations. 3020.
			General. 1800.	Hourly Values. 1810.	Daily Values. 1820.	Mean Values. 1825.			
<b>f. AFRICA AND MADAGASCAR —cont.</b>									
<i>fd. West Africa, including French Sudan, from Morocco to the Congo—cont.</i>									
Acera, Observatory ..	—	—	—	—	—	1911	—	—	—
Gambia, Medical Officer ..	—	—	—	—	—	1912	—	—	—
Gambia. (Blue Book) ..	—	—	1911	—	—	1911	—	—	—
Lagos, Survey Department ..	1912	—	—	—	—	1912	—	—	—
Northern Nigeria. (Blue Book)	—	—	1911	—	—	1911	—	—	—
Sierra Leone (Freetown) ..	—	—	1912	—	—	1912	—	—	—
Southern Nigeria Government Gazette.	1909	—	—	—	—	—	—	—	—
Togo (P. Heidke) ..	—	—	—	—	—	1910	—	—	—
Zungeru (Northern Nigeria), Principal Medical Officer.	1909	—	1909	—	—	1909	—	—	—
Sierra Leone, Acera, Cape Coast, Kumasi. Army Medical Dep., London.	—	—	—	—	—	1906	—	—	—
Dahomey, French Guinea, French Sudan, Ivory Coast, Senegal. Bureau Central Met., Paris.	—	—	—	—	—	1908	1910	—	—
Mamfe (Cameroon), Togo. Deutsche Seewarte, Hamburg.	—	—	—	—	1910	1910	—	—	—
<i>fe. Congo State and Angola:—</i>									
Akka (Meteorological Office, Lon- don).	—	—	—	—	—	1902	—	—	—
Ka-Tanga, Mission Scientifique Lambaréné, Libreville and other stations. Bureau Central Met., Paris.	—	—	1899	1899	—	—	—	—	—
	—	—	—	—	1910	1910	—	—	—
<i>ff. East Africa; British (with Uganda); German; Portu- guese (north of the Zam- besi); British Central Africa; Lake Region.</i>									
Mitteilungen aus den Deutschen Schutzgebieten.	—	—	—	—	—	1909	—	—	—
British East Africa ..	—	—	—	—	—	1902	—	—	—
British Central Africa ..	—	—	—	—	—	1902	—	—	—
Rhodesia ..	—	—	—	—	—	1902	—	—	—
Uganda ..	—	—	—	—	—	1902	—	—	—
German East Africa. Deutsche Seewarte, Hamburg.	—	—	—	1910	1910	1910	—	—	—
British East Africa Agricultural Department (Nairobi).	—	—	—	—	—	1910	—	1905	—
Boroma and Zumba. Haynald Observatorium, Kaloca.	—	—	1897	1897	1897	—	—	—	—
Entebbe (Uganda Protectorate Blue Book).	—	—	—	—	—	1911	—	—	—
Mombasa. Army Medical Dep., London.	—	—	—	—	—	1903	—	—	—
Rhodesia. Government Statist and Agricultural Department.	—	—	—	—	—	1911	—	—	—
Rhodesia (Southern), Rhodesia Agric. Journ.	1910	—	—	—	—	1910	—	—	—
Uganda Protectorate, Scientific and Forestry Department (Entebbe).	—	—	—	—	1905	1910	—	—	—
Zanzibar. Meteorological Office, India (Simla).	—	—	—	—	—	1911	—	—	—
Zomba, Forestry and Botanical Department.	—	1903	—	—	1912	1911	—	—	—
<i>fg. South Africa—South of Angola and the Zambesi:—</i>									
Meteorological Commission (Cape Town).	—	1908	1908	1902	—	1908	—	—	—



## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTION, &C.	Agricultural Hygienic. 1710 & 1730.	Rainfall Tables. 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts. 1830.	Weekly or Monthly Weather Reports. 1840.	Magnetical Observations. 3020.
			General. 1800.	Hourly Values. 1810.	Daily Values. 1820.	Mean Values. 1825.			
<b>f. AFRICA AND MADAGASCAR</b> —cont.									
<i>fg.</i> South Africa—South of Angola and the Zambesi—cont.									
Transvaal Meteorological De- partment (Johannesburg).	—	1911	1910	1910	1910	—	1911	1911	—
Beira, Observatorio Meteorolo- gico.	—	—	—	—	1910	—	—	—	—
Bulawayo (E. Goetz) .. ..	—	—	—	—	—	—	—	—	—
Durban, Natal Observatory ..	—	1902	1909	—	—	1904	—	—	—
Damara, <i>Deutsche Seewarte, Ham- burg.</i>	—	—	—	—	1909	1909	—	—	—
Fort Napier (Natal), Pretoria. <i>Army Medical Dep., London.</i>	—	—	—	—	1910	—	—	—	—
German S.W. Africa (E. Ott- weiler).	—	1905	—	—	—	1906	—	—	—
Loanda, Observatorio ..	—	—	—	—	—	—	—	—	—
Southern Rhodesia, Agricultural Journal.	—	1911	—	—	—	1909	—	—	—
Southern Rhodesia, &c. <i>Meteoro- logical Office, London.</i>	—	—	—	—	—	1911	—	—	—
<i>Mitteilungen aus den Deutschen Schutzgebieten.</i>	—	—	—	—	—	1902	—	—	—
	—	—	—	—	—	1909	—	—	—
<i>fh.</i> Madagascar and Comoro Group:—									
Tananarive, Observatoire ..	—	—	1911	1911	1911	1911	—	—	—
Bureau Central M <sup>t</sup> ., Paris ..	—	1908	—	—	1910	1910	—	—	—
<i>fi.</i> Red Sea and Islands:—									
K. Akademie der Wissenschaften, Vienna.	—	—	—	[1903]	[1903]	—	—	—	—
Perim, <i>Meteorological Office, India (Simla).</i>	—	—	—	—	—	1911	—	—	—
<b>g. NORTH AMERICA.</b>									
<i>ga.</i> Alaska:—									
Sitka, <i>U.S. Coast and Geodetic Survey, Washington.</i>	—	—	—	—	—	—	—	1910	—
<i>gb.</i> Canada as a whole:—									
Meteorological Service, Dominion of Canada (Toronto).	—	—	1908	1908	1908	1908	1912	1912	1908
Toronto Observatory ..	—	—	—	—	—	—	—	—	—
<i>U.S. Weather Bureau, Washington.</i>	—	—	—	—	—	1910	—	—	1910
	—	—	—	—	—	1912	—	—	—
<b>c.</b> Canadian Dominion West.									
Alberta (Official Handbook) ..	—	—	—	—	—	—	—	—	—
Edmonton, Department of Agri- culture.	—	—	—	—	—	1906	—	—	—
Regina, Department of Agri- culture.	—	—	—	—	—	1909	—	—	—
	—	—	—	—	—	1905	—	—	—
<b>gd.</b> Canadian Dominion East: New- foundland, Labrador:—									
Toronto, Bureau of Industries ..	—	—	1904	—	—	—	—	—	—
Hebron, Nain, <i>Deutsche Seewarte, Hamburg.</i>	—	—	—	—	—	—	—	—	—
St. Pierre and Miquelon, Bureau Central M <sup>t</sup> ., Paris.	—	1905	—	—	—	1910	—	—	—
St. Croix, <i>Dansk Meteorologisk Institut, Copenhagen.</i>	—	—	—	—	—	1902	—	—	—
	—	—	—	—	—	1909	—	—	—

## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTION, &C.	Agricultural Hygienic, 1710 & 1730.	Rainfall Tables, 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts, 1830.	Weekly or Monthly Weather Reports, 1840.	Magnetical Observations, 3020.	
			General, 1800.	Hourly Values, 1810.	Daily Values, 1820.	Mean Values, 1825.				
g. NORTH AMERICA—cont.										
gf. United States as a whole:—										
U.S. Weather Bureau, Depart- ment of Agriculture, Wash- ington.	—	—	1912	1901	1907	1912	1912	1912	—	
U.S. Coast and Geodetic Survey, Washington.	—	—	—	—	—	—	—	—	1911	
gg. North-Eastern United States, East of Mississippi:—										
Cambridge (Mass.), Astronomical Observatory of Harvard Col- lege.	—	—	—	—	1908	—	—	—	—	
New York, Meteorological Ob- servatory.	—	—	—	1912	—	—	—	—	—	
Washington, United States Naval Observatory.	—	—	—	—	1902	—	—	—	—	
gh. South Eastern United States, East of Mississippi:—										
Cheltenham, Md., <i>U.S. Coast and Geodetic Survey, Washington.</i>	—	—	—	—	—	—	—	—	1910	
gi. Western United States, West of Mississippi:—										
Colorado Springs, Colorado Col- lege, Observatory.	—	—	—	—	1907	1907	—	—	—	
Baldwin, Kansas, <i>U.S. Coast and Geological Survey, Washington.</i>	—	—	—	—	—	—	—	—	1909	
gj. Mexico:—										
Dirección General de Telégrafos Federales (Mexico).	—	—	—	—	—	—	1904	—	—	
Observatorio Meteorológico Central (Mexico).	—	—	1911	1911	1911	—	—	1911	—	
Guadalajara, Observatorio del Seminario Conciliar.	—	—	—	—	1906	—	—	—	—	
Leon, Observatorio Meteorol- ógico.	—	—	—	—	1911	—	—	1911	—	
Morelia, Observatorio Meteorol- ógico.	—	—	1910	—	1910	1910	—	—	—	
Oaxaca (A. M. Dominguez) ..	—	1903	—	—	—	—	—	—	—	
Oaxaca, Observatorio Meteorol- ógico.	—	—	—	—	1908	—	—	1908	—	
Puebla, Boletín de Estadística..	1912	—	—	—	1912	—	—	—	—	
Saltillo, Observatorio Meteorol- ógico del Colegio de San Juan Nepomucino.	—	—	—	—	1905	—	—	—	—	
Tacubaya, Observatorio Astrón- ómico Nacional.	—	—	1897	—	1897	1897	—	—	—	
<i>U.S. Weather Bureau, Washington.</i>	—	—	—	—	—	1910	—	—	—	
Zacatecas, Observatorio ..	—	—	1911	—	1911	1911	—	—	—	
h. CENTRAL AND SOUTH AMER- ICA AND WEST INDIES.										
hb. Central America, &c.:—										
Belize, Colonial Surgeon ..	1911	—	—	—	1911	1912	—	—	—	
Costa Rica, <i>U.S. Weather Bureau, Washington.</i>	—	—	—	1905	—	—	—	—	—	
Panama, <i>U.S. Weather Bureau, Washington.</i>	—	—	—	—	—	1912	—	—	—	
San Salvador, Observatorio Meteorológico y Astronómico.	—	—	—	—	—	1902	—	—	—	
Tegucigalpa, Laboratorio Central	—	—	—	—	1905	—	—	—	—	



## GEOGRAPHICAL LIST—continued.

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			General. 1800.	Hourly Values. 1810.	Daily Values. 1820.	Mean Values. 1825.			
<b>CENTRAL AND SOUTH AMERICA AND WEST INDIES—cont.</b>									
Indian Islands, Caribbean Sea, Gulf of Mexico:—									
Antigua, Government Laboratory.	—	1912	—	—	1912	1912	—	—	—
Bahamas	—	—	—	—	1902	1911	—	—	—
Barbados, Department of Agriculture.	—	—	—	—	—	1911	—	—	—
Barbados, St. Lucia, Jamaica, Bermuda. Army Medical Dep., London.	—	—	—	—	—	—	1906	—	—
Bermuda, Meteorological Service of Canada, Toronto.	—	—	—	—	—	—	—	—	—
Bermuda, Registrar-General ..	1909	—	—	—	—	1908	—	—	—
Bermuda (Prospect) ..	—	—	—	—	—	1909	—	—	—
Cienfuegos, Observatorio ..	—	—	—	—	1912	—	—	—	—
Dominica, Botanic Station ..	—	1911	—	—	1911	1911	—	—	—
Grenada, Carriacou Observatory	—	1907	—	—	—	—	—	—	—
Grenada, Richmond Hill Observatory.	—	1910	1911	—	1910	1911	—	—	—
Guadeloupe, Haiti, Martinique, Bureau Central Mët., Paris.	—	—	—	—	1910	1910	—	—	—
Havana, Observatorio del Colegio de Belen.	—	—	1911	—	1911	1911	—	—	—
Havana, Secretaria de Agricultura, &c.	1910	—	1910	—	1910	1910	—	—	—
Jamaica, Weather Office, Kingston.	—	1912	1912	—	—	1912	—	—	—
Port-au-Prince, (Haiti.) K. K. Central-Anstalt für Meteorologie, Vienna.	—	—	1907	—	1907	1907	—	—	—
Porto Rico (Vieques). U.S. Coast and Geodetic Survey, Washington.	—	—	—	—	—	—	—	—	—
St. Lucia, Agricultural Superintendent.	—	1912	—	—	—	—	—	1910	—
St. Lucia Botanic Gardens ..	—	1911	—	—	—	—	—	—	—
St. Lucia, Harbour Master ..	—	—	—	—	—	—	—	—	—
St. Vincent, Botanic Gardens ..	—	1907	—	—	1912	—	—	—	—
U.S. Weather Bureau, Washington	—	—	—	—	—	1912	—	—	—
British, Dutch, and French; Venezuela; Trinidad:—									
Cayenne, Bureau Central Mët., Paris.	—	—	—	—	1910	1910	—	—	—
Georgetown, Demerara, Botanic Gardens.	—	—	—	—	1912	1911	—	—	—
Paramaribo, K. Nederlandsch Meteorologisch Instituut, de Bilt.	—	—	—	—	1904	—	—	—	—
Trinidad, Royal Botanic Gardens	—	1908	1911	—	1911	1911	—	—	—
<b>Peru:—</b>									
Astronomical Observatory of Harvard College, Cambridge (Mass.).	—	—	1895	1895	—	—	—	—	—
Piura, Deutsche Seewarte, Hamburg.	—	—	—	—	1906	—	—	—	—
<b>Bolivia:—</b>									
Madidi, Bureau Central Mët., Paris.	—	—	—	—	1903	—	—	—	—
Puerto Cobija, Deutsche Seewarte, Hamburg.	—	—	—	—	1910	—	—	—	—
<b>Brazil:—</b>									
Ministerio de Marinha, Directoria de Meteorologia, Rio Janeiro.	—	1904	1904	1906	—	—	—	—	—
Curitiba, Observatorio Meteorologico.	—	—	—	—	1910	—	—	—	—

## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTION, &C.	Agricultural and Hygienic. 1710 & 1730.	Rainfall Tables. 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts. 1830.	Weekly or Monthly Weather Reports. 1840.	Magnetical Observations. 3020.	
			General. 1800.	Hourly Values. 1810.	Daily Values. 1820.	Mean Values. 1825.				
h. CENTRAL AND SOUTH AMERICA AND WEST INDIES—cont.										
hh. Brazil—cont.										
Cuyabá, Observatorio Meteorológico "D. Bosco."	—	—	—	—	1910	—	—	—	—	
Descalvados. <i>Deutsche Seewarte, Hamburg.</i>	—	—	—	1906	—	1906	—	—	—	
Para Prata. <i>K. K. Central-Anstalt für Meteorologie, Vienna.</i>	—	—	—	—	1906	—	—	—	—	
Rio Janeiro, Observatorio Nacional.	—	—	1909	—	1909	1909	—	—	—	
São Paulo, Secretaria da Agricultura, &c.	—	—	—	—	—	1910	—	—	—	
hi. Argentina, Uruguay, and Paraguay:—										
Oficina Meteorológica Argentina (Buenos Aires).	—	—	—	—	—	—	1912	—	—	
Dirección General del Servicio Meteorológico Nacional, Monte Video.	—	1905	—	—	—	1905	—	—	—	
Dirección General de Estadística del Uruguay, Monte Video.	1906	—	—	—	—	1906	—	—	—	
Fray Bentos. <i>Deutsche Seewarte, Hamburg.</i>	—	—	—	—	—	1883	—	—	—	
Monte Video, Observatorio Nacional Físico-Climatológico.	—	—	—	1910	1910	—	—	1910	—	
Monte Video, Instituto Meteorológico Nacional.	—	—	—	—	—	1910	—	—	—	
Villa Colón, Observatorio Meteorológico.	—	—	—	1902	1902	1906	—	1902	—	
hk. Chili:—										
Servicio Meteorológico de la Dirección del Territorio Marítimo (Valparaíso.)	—	—	1908	—	1908	1908	—	—	—	
Punta Arenas, Observatorio Meteorológico del Colegio Salesiano "S. José."	—	1902	1907	1907	1911	1907	—	—	—	
Santiago, Instituto Central Meteorológico.	—	—	—	—	—	1910	—	—	—	
hl. Falkland Islands:—										
<i>Scottish National Antarctic Expedition, 1902-1904.</i>	—	—	1904	—	1904	—	—	—	—	
Stanley .. .. .	—	—	—	—	—	1912	—	—	—	
i. AUSTRALASIA.										
ia. New Guinea:—										
Papua (Government Gazette) ..	—	—	—	—	—	1911	—	—	—	
ib. Bismarck Archipelago:—										
Nauru, Rakuranga. <i>Deutsche Seewarte, Hamburg.</i>	—	1910	—	—	—	1910	—	—	—	
ic. Australia:—										
Central Weather Bureau, Melbourne.	—	1908	1910	—	1910	1910	1912	1910	—	
Sydney, Commonwealth Weather Bureau.	—	—	—	—	—	—	1912	—	—	
id. Queensland:—										
Brisbane, Government Statistician's Office.	1905	—	—	—	—	1905	—	—	—	
Brisbane, Weather Bureau ..	—	—	—	—	—	1907	—	—	—	



## GEOGRAPHICAL LIST—continued.

Continued.

NAME OF INSTITUTION, &C.	Agricultural and Hygienic, 1710 & 1730.	Rainfall Tables, 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts, 1830.	Weekly or Monthly Weather Reports, 1840.	Magnetic Observations, 3020.	
			General, 1800.	Hourly Values, 1810.	Daily Values, 1820.	Mean Values, 1825.				
<i>i. AUSTRALASIA—cont.</i>										
<i>ie. New South Wales:—</i>										
Sydney, Department of Public Instruction.	—	1902	—	—	1902	1902	—	—	—	
Central Weather Bureau, Melbourne.	—	1908	1908	—	—	—	—	—	—	
Windsor (John Tebbutt) ..	—	—	—	—	—	—	—	—	—	
<i>if. Victoria:—</i>										
Melbourne, Department of Agriculture.	—	1911	—	—	—	1903	—	—	—	
<i>ig. South Australia:—</i>										
Adelaide Observatory ..	—	1907	1907	—	1907	1907	—	—	—	
<i>ih. West Australia:—</i>										
Perth, Commonwealth Bureau Perth, Observatory ..	—	1911	—	—	—	—	—	—	—	
Perth, Government Statistician's Office.	—	1908 1910	1907 1910	—	1907 1910	1907 1910	—	1906	—	
<i>ik. New Zealand:—</i>										
Wellington, Meteorological Office	—	1912	1912	—	1912	1912	1905	—	—	
Wellington, Government Observatory.	—	—	—	—	1904	—	—	—	—	
<i>il. New Caledonia, New Hebrides, and Loyalty Islands:—</i>										
Noumea, Paita (N. Cal.), Port Vila (New Hebrides). Bureau Central Met., Paris.	—	1910	—	—	1910	1910	—	—	—	
<i>k. ARCTIC.</i>										
<i>ka. Arctic Ocean:—</i>										
Ziegler Polar Expedition, 1903-5 ..	—	—	—	—	1905	—	—	—	—	
Netherlands Polar Expedition ..	—	—	1882-3	1882-3	—	—	—	—	—	
<i>kb. Greenland:—</i>										
Dansk Meteorologisk Institut (Copenhagen).	—	—	1909	—	1909	1909	—	—	—	
<i>kd. Islands north of Europe and Asia:—</i>										
Norwegian North Polar Expedition [H. Mohn].	—	—	1896	1896	1896	—	—	—	—	
Spitzbergen (J. Westman) ..	—	—	—	1900	—	—	—	—	—	
<i>l. ATLANTIC.</i>										
<i>lb. Azores, Canaries, Madeira, Cape Verde:—</i>										
Service Météorologique des Açores, Ponta Delgada.	—	—	1910	1910	—	1910	—	—	—	
Teneriffe, Las Palmas and Laguna. Observatorio Central Meteorológico, Madrid.	—	—	—	—	—	1910	—	—	—	
Teneriffe, Las Palmas. Observatorio Do Infante D. Luiz, Lisbon.	—	—	—	—	—	—	—	—	—	
Teneriffe, Las Palmas. Bureau Central Met., Paris.	—	—	—	—	—	1912	—	—	—	
Teneriffe (Puerto de Orotava), Deutsche Seewarte, Hamburg.	—	—	—	—	—	1910	—	—	—	
	—	—	—	—	—	1910	—	—	—	

## GEOGRAPHICAL LIST—continued.

NAME OF INSTITUTION, &C.	Agricultural and Hygienic, 1710 & 1730.	Rainfall Tables, 1180.	Meteorological Observations.				Daily Weather Re- ports and Charts, 1830.	Weekly or Monthly Weather Reports, 1840.	Magnetic Observations, 3020.	
			General. 1800.	Hourly Values, 1810.	Daily Values, 1820.	Mean Values 1825.				
m. INDIAN OCEAN.										
ma. Ocean and Islands north of Equator:—										
Amini Divi, Minicoy. Meteorological Office, India (Simla).	—	—	—	—	—	1911	—	—	—	
mb. Ocean and Islands south of Equator:—										
Christmas Island. Scottish Met. Soc., Edinburgh.	—	—	—	—	—	1910	—	—	—	
Christmas Island. Straits Settlements Gazette.	—	—	—	—	—	1910	—	—	—	
Cocos, Keeling Islands, Observatory, Perth, W.A.	—	—	—	—	—	1907	—	—	—	
Mauritius, Royal Alfred Observatory.	—	—	1911	1905	1911	—	—	1911	1908	
Mauritius. Army Medical Dep., London.	—	—	—	—	—	1903	—	—	—	
Mauritius, Seychelles, Diego Garcia. Meteorological Office, India (Simla).	—	—	—	—	—	1911	—	—	—	
Réunion. Bureau Central Mét., Paris.	—	1910	—	—	—	1910	—	—	—	
Seychelles (Blue Book) .. ..	—	—	1911	—	1911	1911	—	—	—	
n. PACIFIC.										
nd, ne. Pacific Islands North of Equator:—										
Honolulu (R. C. Lydecker) ..	—	—	—	—	1903	—	—	—	—	
Honolulu. U.S. Coast and Geodetic Survey, Washington.	—	—	—	—	—	—	—	—	1910	
Honolulu. U.S. Weather Bureau, Washington.	—	—	—	—	1909	—	—	—	—	
Caroline, Gilbert and Marshall Islands. Deutsche Seewarte, Hamburg.	—	—	—	—	—	1910	—	—	—	
nf, nh. Pacific Islands South of Equator:—										
Samoa Observatory .. ..	—	—	1906	1906	—	1906	—	—	—	
Samoa and Cook Islands. Deutsche Seewarte, Hamburg.	—	—	—	—	1906	1910	—	—	—	
Suva, Department of Agriculture	—	—	1911	—	1911	1911	—	—	—	
Suva, Fiji (J. D. W. Vaughan) ..	—	—	—	—	1905	—	—	—	—	
Makatea. Bureau Central Mét., Paris.	—	—	—	—	1910	1910	—	—	—	
o. ANTARCTIC.										
ob. S. Georgia, and Islands S. of S. Atlantic:—										
Schwedische Südpolar Expedition (Snow Hill).	—	—	1903	1903	—	—	—	—	—	
Scottish National Antarctic Expedition 1902-1904.	—	—	1904	1904	1904	1904	—	—	1904	
Petermann Island (J. Rouch) ..	—	—	—	—	—	1909	—	—	—	
oc. Islands South of Indian Ocean:—										
Deutsche Südpolar Expedition, Winterstation des "Gauss."	—	—	1903	1903	1903	—	—	—	—	
od. Islands to Southward and South-East of New Zealand:—										
National Antarctic Expedition, 1901-1904.	—	—	1904	1904	1904	—	—	—	—	



LIST OF CURRENT METEOROLOGICAL PERIODICALS AND JOURNALS CONTAINING OCCASIONAL ARTICLES ON METEOROLOGICAL SUBJECTS RECEIVED FOR THE LIBRARY OF THE METEOROLOGICAL OFFICE, LONDON.

- Annales de l'Observatoire Municipal, Paris.  
 Annales du Bureau Central Météorologique de France.  
 †Annalen der Hydrographie und maritimen Meteorologie.  
 Annali dell' Ufficio Centrale Meteorologico e Geodinamico Italiano.  
 Annuaire de la Société Météorologique de France.  
 †Annuaire Météorologique de l'Observatoire Royal de Belgique.  
 Astrophysical Journal.  
 Aus dem Archiv der Deutschen Seewarte.  
 Australian Monthly Weather Report.  
 †Beiträge zur Physik der freien Atmosphäre.  
 Boletín mensual del Observatorio meteorológico central de Mexico.  
 Bollettino bimensuale della Società Meteorologica Italiana.  
 Botanical Journal.  
 †Bulletin of the Mount Weather Observatory.  
 Bulletin of the Philippine Weather Bureau.  
 †Bulletin de l'Institut Aerodynamique de Koutchino.  
 Cairo Scientific Journal.  
 †Ciel et Terre.  
 Comptes rendus hebdomadaires des séances de l'Académie des Sciences, Paris.  
 †Das Wetter.  
 Geographical Journal.  
 Globe (Le), Journal Géographique.  
 Indian Meteorological Memoirs.  
 Jahrbuch der Astronomie und Geophysik (H. J. Klein).  
 Journal of the Franklin Institute.  
 Journal of the Meteorological Society of Japan.  
 Journal of the Royal United Service Institution.  
 Journal of the Scottish Meteorological Society.  
 Journal of the Royal Society of Arts.  
 London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science.  
 Memoirs and Proceedings of the Manchester Literary and Philosophical Society.  
 Memorias de Sociedad Científica "Antonio Alzate," Mexico.  
 Meteorologische Zeitschrift.  
 Mitteilungen aus dem Gebiete des Seewesens, Pola.  
 Monthly Meteorological Bulletin of the Nicolas Central Physical Observatory.  
 Monthly Notices of the Royal Astronomical Society.  
 Monthly Weather Review of the U.S. Weather Bureau.  
 Nature.  
 Nature (La).  
 Nautical Magazine.  
 Oversigt over det Kongelige danske Videnskabernes Selskab Forhandlinger.  
 Petermann's (Dr. A.) Mitteilungen aus Justus Perthes' Geographischer Anstalt.  
 Proceedings of the American Philosophical Society.  
 Proceedings of the Cambridge Philosophical Society.  
 Proceedings of the Royal Institution.  
 Proceedings of the Royal Irish Academy.  
 Proceedings of the Royal Society of Edinburgh.  
 Proceedings of the Royal Society of London.  
 Quarterly Journal of the Royal Meteorological Society.  
 Scientific Proceedings of the Royal Dublin Society.  
 Scottish Geographical Magazine.  
 Smithsonian Contributions to Knowledge.  
 Smithsonian Miscellaneous Collections.  
 †Symons's Meteorological Magazine.  
 Tijdschrift van het Koninklijk Nederlandsch Aardrijkskundig Genootschap.  
 † Publications which give information for the upper air, obtained with balloons or kites.

APPENDIX XVIII.

INSTITUTIONS ON THE PRESENTATION LISTS OF THE METEOROLOGICAL OFFICE.

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Avonmouth ...	B.T., Supt. M.M.O.	Leith ...	B.T., Supt. M.M.O.
Barry ...	B.T. Surveyor.	Liverpool ...	B.T., Supt. M.M.O.
Belfast ...	B.T., Supt. M.M.O.	London ...	Admiralty, Hydrographer.
Blyth ...	B.T., Supt. M.M.O.		— Librarian.
Bristol ...	B.T., Supt. M.M.O.		*† — Greenwich Royal Naval College.
Cardiff ...	B.T., Supt. M.M.O.		— Greenwich Royal Observatory.
Dartmouth ...	Admiralty, Royal Naval College.		— Superintendent of Compasses.
	B.T., Supt. M.M.O.		Board of Agriculture.
Dublin ...	Department of Agriculture and Technical Instruction.		— (Fisheries Division).
	General Register Office.		*† Board of Education, Science Library.
	Ordnance Survey Office.		Board of Trade, Consultative Branch.
Dundee ...	B.T., Supt. M.M.O.		— Fisheries and Harbour Department.
Edinburgh...	Fishery Board.		— Library.
	General Register Office.		— Marine Department.
	H.M. Office of Works.		— Standards Department.
	Royal Observatory.		— Supt. M.M.O. Dock Street.
	*† Royal Scottish Museum.		— Supt. M.M.O. Poplar.
Farnborough	Meteorological Office.		
	Royal Aircraft Factory.		
Glasgow ...	B.T., Supt. M.M.O.		
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Middlesbrough.			
Newcastle-on-Tyne.			
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Plymouth ...	B.T., Supt. M.M.O.		
Shields	B.T., Supt. M.M.O.		
North.			
Shields	B.T., Supt. M.M.O.		
South.			
Shrewsbury	Ordnance Survey Office. B.T., Supt. M.M.O.		
Southampton.	Ordnance Survey Office. B.T., Supt. M.M.O.		
Sunderland	B.T., Supt. M.M.O.		
Swansea ...	B.T., Supt. M.M.O.		
Upavon ...	Central Flying School.		
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Aspatria ...	University College of North Wales.		
Bangor ...	Queen's University. "Findlay's Sailing Directions."		
Belfast ...	Liverpool Observatory.		
BexleyHeath	Central Free Library.		
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Birmingham	University Library. Observatory.		
Birr Castle...	The Agricultural Department.		
Cambridge...	Botanic Garden. Cavendish Laboratory. Observatory. Philosophical Society.		

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		Valencia ...	M.O. Observatory.
		York ...	Philosophical Society.
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		Hobart ...	Commonwealth Bureau of Meteorology.
		Melbourne ...	*†Commonwealth Bureau of Meteorology. Commonwealth Statistical Bureau. Department of Agriculture. Observatory. Public Library.
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Ottawa ...	Dominion Observatory.
Toronto ...	Royal Society of Canada.
Victoria (B.C.)	*†Meteorological Office.
	Meteorological Office.

## India and Eastern Asia.

Allahabad ...	Meteorological Office.
Bangalore ...	Mysore Government Observatory.
Bombay ...	Observatory.
Calcutta ...	Meteorological Office.
Colombo ...	Observatory.
Dehra Dun ...	Trigonometrical Survey.
Hong Kong ...	Royal Observatory.
Kodaikanal ...	Observatory.
Simla ...	Meteorological Office.
Singapore ...	Colonial Secretary.
	Principal Civil Medical Officer.

## Mediterranean.

Malta ...	Observatory.
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## South Africa.

Cape Town ...	Meteorological Office.
Pretoria ...	Observatory.
Zomba ...	Meteorological Office.
	Department of Agriculture.

## Indian Ocean.

Mauritius ...	Meteorological Society.
	Royal Alfred Observatory.

## West India Islands and British Honduras.

Belize ...	Colonial Secretary.
Jamaica ...	Government Meteorologist.

## EUROPE.

## Austria-Hungary.

Agram ...	Landesanstalt.
Brünn ...	Natural History Society.
Buda-Pesth ...	Central Meteorological Institute.
Cracow ...	Observatory.
Czernowitz ...	Institute for Cosmical Physics.
Fiume ...	Nautical Academy.
Innsbruck ...	Observatory.

## EUROPE—cont.

## Austria-Hungary—cont.

Kalocsa ...	Haynald Observatory.
Kremsmunster ...	Observatory.
Laibach ...	Seismological Observatory.
Lemberg ...	Technical High School.
O'Gyalla ...	Observatory.
Pola ...	Hydrographic Office.
Prague ...	Hydrographic Office.
	Observatory.
	Royal Society of Sciences.
	University Library.
Trieste ...	Observatory.
Vienna ...	Austrian Meteorological Society.
	Central Hydrographical Bureau.
	*†Central Meteorological Office.

## Belgium.

Brussels (Uccle).	Royal Observatory and Royal Meteorological Institute.
Ostend ...	R. Navigation School.

## Bulgaria.

Sofia ...	Central Meteorological Observatory.
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## Denmark.

Copenhagen ...	Hydrographic Office.
	International Council for the Study of the Sea.
	Meteorological Institute.
	Society of Sciences.

## France.

Besançon ...	Observatory.
Bordeaux ...	Society for the Oceanography of the Gulf of Gascony.
Chevreuse à Jagny.	Observatory.
Lyons ...	Observatory.
Marseilles ...	Meteorological Commission.
Nice ...	Observatory.
Paris ...	Observatory on Mont Blanc.
	"Annales de Géographie."
	Bureau des Longitudes.
	*†Central Meteorological Office.
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Puy-de-Dôme ...	Observatory.
Toulouse ...	Observatory.

## Germany.

Aachen ...	Meteorological Observatory.
	Seismological Observatory.
Berlin ...	Hydrographic Office.
	Institute for Oceanography.
	*†Meteorological Institute.
Bremen ...	Meteorological Observatory.
Breslau ...	University Observatory.
Carlsruhe ...	Central Meteorological Office.
Darmstadt ...	Hydrographical Bureau.
	Physical Institute.
Dresden ...	Meteorological Institute.
Eberswalde ...	Forest Academy.
Frankfort ...	Geophysical Institute.
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	Observatory.
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Potsdam ...	Central Office for International Earth-measurement.
	Observatory.

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Strassburg ...	Imperial Observatory for Earthquake Investigation.
	Meteorological Institute.
Stuttgart ...	Central Meteorological Office.
Wilhelmshaven	Observatory.

## Greece.

Athens ...	Observatory.
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## Italy.

Catania ...	Meteorological Observatory.
Florence ...	Observatory.
Genoa ...	Hydrographic Institute.
Messina ...	Observatory.
Milan ...	Observatory.
Moncalieri ...	Observatory.
Naples ...	Observatory.
Parma ...	Hydrographic Office of the Po.
Pompeii ...	Observatory of Pius X.
Palermo ...	Observatory.
Pesaro ...	Observatory.
Riposto ...	Observatory.
Rome ...	Central Meteorological Office.
	International Agricultural Institute.
	Rocca di Papa Observatory.
Turin ...	Observatory.
Venice ...	Hydrographic Office.
	Observatory.

## Netherlands.

Amsterdam ...	Geographical Society.
	Meteorological Institute.
Helder ...	Institute for the Study of the Sea.
Utrecht, (De Bilt).	*†Royal Meteorological Institute.

## Norway.

Bergen ...	Meteorological Observatory.
Christiania ...	Meteorological Institute.
	University Library.

## Portugal.

Coimbra ...	Observatory.
Lisbon ...	Observatory.
Oporto ...	Serra do Pilar Observatory.

\* Receive all publications, including the Daily Weather Report in those cases which are also marked †.

\* Receive all publications, including the Daily Weather Report in those cases which are also marked †.



## LIST OF INSTITUTIONS receiving PUBLICATIONS—cont.

EUROPE—cont.		EUROPE—cont.	
<i>Azores.</i>		<i>Sweden.</i>	
Ponta Delgada	Meteorological Service.	Stockholm	Central Meteorological Institute.
<i>Roumania.</i>		<i>Switzerland.</i>	
Bucharest	Meteorological Institute.	Upsala	Hydrographic Office.
<i>Russia (including Russia-in-Asia).</i>		<i>Turkey.</i>	
Baku	Nobel's Seismological Observatory.	Constantinople	Meteorological Observatory.
Ekaterinburg	Observatory.	<i>AFRICA.</i>	
Helsingfors	Meteorological Institute.	Algiers	Meteorological Service.
Irkutsk	Observatory.	Cairo	Sanitary Department.
Jurjev	Observatory.		*† Survey Department.
Kazan	Observatory.	Madagascar	Royal Observatory, Antananarivo.
Kieff	Observatory.	<i>AMERICA.</i>	
Koutchino	Aerodynamical Institute.	<i>United States.</i>	
Makeevka	Seismological Observatory.	Albany	State Library.
Moscow	Observatory.	Albuquerque	University of New Mexico.
Nicolaieff	Hydrographic Office.	Allegheny	Observatory.
Odessa	Observatory.	Baltimore	Maryland Weather Service.
Pavlovsk	Observatory.	Berkeley	*University of California.
Pulkowa	Seismological Observatory.	Blue Hill, Boston.	Blue Hill Observatory.
St. Petersburg	Central Seismological Commission.	Cambridge, Mass.	Harvard College Observatory.
	Hydrographic Department.	Cleveland	St. Ignatius' College Observatory.
	Imperial Institute of Forestry.	Columbus	Emerson McMillin Observatory.
	Imperial Russian Geographical Society.	Hot Springs	American Climatological Association.
	Minister of Marine.	Newhaven	Yale University Observatory.
	Naval Academy.	New York	American Geographical Society.
	*†Nicolas Central Physical Observatory.		Central Park Observatory.
Tashkent	Astrophysical Observatory.		Weather Bureau.
Tiflis	Observatory.	Pasadena	Mount Wilson Solar Observatory.
Warsaw	Meteorological Bureau.		
<i>Servia.</i>			
Belgrade	Central Observatory.		
<i>Spain.</i>			
Barcelona	Llinas Observatory.		
Burgos	Observatory.		
Granada	Cartuja Observatory.		
Madrid	Astronomical Observatory.		
	Central Meteorological Institute.		
	Observatory, Chamar-tin de la Rosa.		
Malaga	Society of Sciences.		
San Fernando	Observatory.		
Tortosa	Ebro Observatory.		

\* Receive all publications, including the Daily Weather Report in those cases which are also marked †.

## LIST OF INSTITUTIONS receiving PUBLICATIONS—cont.

AMERICA—cont.		AMERICA—cont.	
<i>United States—cont.</i>		<i>Central America West Indies—cont.</i>	
Philadelphia	American Philosophical Society.	Havana	Central Meteorological Station.
	Franklin Institute.	San Salvador	Observatory.
Reno	Mount Rose Observatory.	<i>Argentina.</i>	
Washington	Carnegie Institution, Department of Terrestrial Magnetism.	Buenos Aires	Meteorological Office.
	Coast and Geodetic Survey.	Cordoba	Astronomical Observatory.
	Department of Agriculture.		Meteorological Office.
	Hydrographic Office.		National Academy.
	National Academy of Sciences.	<i>Brazil.</i>	
	Naval Observatory.	Rio de Janeiro	Meteorological Observatory.
	Research Observatory of the Weather Bureau.		National Observatory.
	Mount Weather.	Rio Grande de Sul.	Astronomical Observatory.
	Smithsonian Institution.	Sao Paulo	Secretary of Agriculture, &c.
	Surgeon General's Office.	<i>Chile.</i>	
	"Terrestrial Magnetism."	Punta Arenas	Observatory.
	War Department.	Santiago	Central Institute of Meteorology and Geophysics.
	*† Weather Bureau.	Valparaiso	Meteorological Service.
Williams Bay, Wis.	Yerkes Observatory.	<i>Ecuador.</i>	
<i>Mexico.</i>		Quito	Observatory.
Guanajuato	Observatory.	<i>Uruguay.</i>	
Leon	Meteorological Observatory.	Monte Video	National Meteorological Institute.
Mexico	"Antonio Alzate" Scientific Society.		Observatory, Villa Colon.
	Central Meteorological Observatory.	<i>ASIA (except Russia).</i>	
Morelia	Meteorological Observatory.	Batavia	Observatory.
Oaxaca	Observatory.	Beyrout	Ksara Observatory.
Puebla	Observatory.		Lee Observatory.
Saltillo	Observatory.	Chemulpo	Observatory.
San Luis Potosi.	Mexican National Astronomical Observatory.	Hitachi	Mt. Tsukuba Observatory.
Tacubaya		Manila	Central Observatory.
		Tokio	Central Meteorological Observatory.
<i>Central America, West Indies.</i>			College of Science, Imperial University, Seismological Institute.
Casablanca	Observatory.		—, Library.
Cienfuegos	Montserrat Observatory.	Zi-ka-wei	*Observatory.
Costa Rica	San José Meteorological Service.		
Guatemala	Meteorological Service.		
Havana	Observatory.		

\* Receive all publications, including the Daily Weather Report in those cases which are also marked †.



## APPENDIX XIX.

## LIST OF MEMBERS OF THE INTERNATIONAL METEOROLOGICAL COMMITTEE AND ITS COMMISSIONS.

(June, 1913.)

## INTERNATIONAL METEOROLOGICAL COMMITTEE.\*

- W. N. SHAW, 1900, Director of the Meteorological Office, London, *President*.  
 G. HELLMANN, 1903, Geheimer Regierungsrat, Professor, Director of the Prussian Meteorological Service, *Secretary*.  
 †H. MOHN, 1873, Professor, Director of the Norwegian Meteorological Service.  
 W. G. DAVIS, 1894, Director of the Meteorological Service of the Argentine Republic.  
 †WILLIS L. MOORE, 1896, Chief of the Weather Bureau, United States of America.  
 †M. RYKATCHEFF, 1896, General, Director of the Russian Meteorological Service.  
 LUIGI PALAZZO, 1900, Professor, Director of the Italian Meteorological Service.  
 FRANCISCO S. CHAVES, 1901, Commandant, Director of the Meteorological Service of the Azores.  
 K. NAKAMURA, 1905, Director of the Meteorological Service in Japan.  
 A. ANGOT, 1907, Professor, Director of the French Meteorological Service.  
 †H. E. HAMBERG, 1907, Director of the Swedish Meteorological Service.  
 J. MAURER, 1907, Director of the Swiss Meteorological Service.  
 R. F. STUPART, 1907, Director of the Meteorological Service of Canada.  
 E. VAN EVERDINGEN, 1910, Professor, Director of the Dutch Meteorological Service.  
 C. H. RYDER, 1910, Captain, Director of the Danish Meteorological Institute.  
 W. TRABERT, 1910, Professor, Director of the Austrian Central Institute for Meteorology and Geodynamics.  
 G. T. WALKER, 1910, Director-General of Indian Observatories.

## INTERNATIONAL COMMISSION ON TERRESTRIAL MAGNETISM.

Appointed at Munich, 1891. Has met at Munich, 1891; Paris, 1896; Bristol, 1898; Paris, 1900; Innsbruck, 1905; Berlin, 1910.

- †General M. Rykatcheff, St. Petersburg, *President*.  
 Prof. Ad. Schmidt, Prussian Meteorological Institute, Potsdam, Germany, *Secretary*.  
 Prof. A. Angot, Central Meteorological Bureau, Paris.

\* The International Meteorological Committee consists of 17 Members, while there is no limit to the number of Members belonging to the Commissions. The members of the International Meteorological Committee are elected from among the directors of independent Institutes or Observatories. Intimation has been received that the Members whose names are marked † vacate their qualifying offices in the current year, 1913.

- Prof. L. A. Bauer, Carnegie Institution, Washington, U.S.A.  
 Prof. Bidlingmaier, Magnetic Observatory, Munich, Germany.  
 Prof. F. H. Bigelow, Meteorological Office, Buenos Aires.  
 Dr. V. Carlheim-Gyllensköld, Stockholm, Sweden.  
 Dr. C. Chree, Kew Observatory, London.  
 W. Dubinsky, The Observatory, Pavlovsk, Russia.  
 Prof. E. van Everdingen, Meteorological Institute, de Bilt.  
 R. L. Faris, Coast and Geodetic Survey, Washington, U.S.A.  
 Captain W. Kesslitz, Hydrographic Office, Pola, Austria.  
 Prof. J. Liznar, Hochschule für Bodenkultur, Vienna.  
 Prof. T. C. Mendenhall, Worcester, Mass., U.S.A.  
 Prof. L. Palazzo, Central Meteorological Office, Rome.  
 Sir A. W. Rücker, Newbury, Berkshire, England.  
 Dr. A. Schuster, Yeldall, Twyford, Berks., England.  
 R. F. Stupart, Meteorological Office, Toronto, Canada.  
 Prof. A. Tanakadate, The University, Tokio, Japan.

## INTERNATIONAL COMMISSION FOR SCIENTIFIC AERONAUTICS.

Appointed at Paris, 1896. Has met at Paris, 1900; Berlin, 1902; St. Petersburg, 1904; Milan, 1906; Monaco, 1909; Vienna, 1912.

- H.I.H. The Grand Duke Konstantin Konstantinowitch, St. Petersburg, *Honorary Member*.  
 H.I.H. The Grand Duke Nicolaewitch, St. Petersburg, *Honorary Member*.  
 H.R.H. The Prince of Monaco, *Honorary Member*.  
 H.R.H. Prince Roland Bonaparte, Paris.  
 Prof. H. Hergesell, Director of the Meteorological Service of Alsace-Lorraine, *President*.  
 Dr. H. Abels, Magnetic and Meteorological Observatory, Katharinenburg, Russia.  
 P. Y. Alexander, 3, Whitehall Court, London.  
 Prof. A. Angot, Bureau Central Météorologique, Paris.  
 Prof. R. Assmann, Aeronautical Observatory, Lindenberg, Germany.  
 Major B. F. S. Baden-Powell, London.  
 Prof. K. Bamler, Rellinghausen bei Essen, Germany.  
 Baron von Bassus, Munich.  
 Prof. A. Berson, Zehlendorf, near Berlin.  
 G. Besançon, Paris.  
 Prof. V. Bjerknes, Geophysical Institute, Leipzig.  
 Commandant Borgatti, Rome.  
 Chef de Bataillon Bouttieaux, Paris.  
 L. P. Cailletet, Paris.  
 Colonel J. E. Capper, Chatham, England.  
 C. J. P. Cave, Petersfield, England.  
 Le Clément de St. Marcq, Military Aeronautical Service, Antwerp.  
 W. H. Dines, Meteorological Office, London.  
 Dr. H. Ebert, Technical High School, Munich.  
 W. de Fonvielle, Paris.  
 Dr. P. Gamba, Geodynamic and Aeronautical Observatory, Pavia.



Captain Antonio Gordejuela, Military Balloon Station, Guadalajara, Spain.  
 Major Gross, Military Aeronautical Department, Berlin.  
 G. Hermite, Paris.  
 Prof. H. H. Hildebrandsson, Upsala.  
 Captain Hildebrandt, Rostock.  
 Captain Hinterstoisser, Military Aeronautical Department, Vienna.  
 H. Hlassek, Physical Observatory, Tiflis, Russia.  
 J. Jaubert, Montsouris Observatory, Paris.  
 Dr. E. Kleinschmidt, Friedrichshafen, Germany.  
 Hofrat Th. von Konkoly, Meteorological Office, Buda-Pesth.  
 Prof. W. Köppen, Deutsche Seewarte, Hamburg.  
 General Kowanko, Military Aeronautical Department, St. Petersburg.  
 W. W. Kusnetzov, The Observatory, Pavlovsk, Russia.  
 Dr. J. Maurer, Zürich.  
 Commandant Moris, Rome.  
 Count J. Morkov, Meteorological Observatory, Nemertchy, Russia.  
 Major-General Neureuther, Munich.  
 Dr. Emilio Oddone, Central Meteorological Office, Rome.  
 Prof. L. Palazzo, Rome.  
 Dr. P. Polis, Meteorological Observatory, Aix-la-Chapelle.  
 Dr. A. de Quervain, Central Meteorological Office, Zürich.  
 Paul Renard, Paris.  
 D. Rjabouchinsky, Koutchino Observatory, Moscow.  
 Major Francisco de P. Rojas, Guadalajara, Spain.  
 Captain C. H. Ryder, Meteorological Institute, Copenhagen.  
 †General Rykatcheff, St. Petersburg.  
 Captain Scheimpflug, Vienna.  
 Colonel Semkovsky, R. Technical Society, St. Petersburg.  
 Dr. W. N. Shaw, Meteorological Office, London.  
 Prof. R. Süring, Meteorological Observatory, Potsdam.  
 Prof. W. Trabert, Meteorological Institute, Vienna.  
 Lieutenant-Colonel F. Trollope, London.  
 Comte de la Vaulx, Paris.  
 J. Vincent, Meteorological Service, Uccle.  
 Colonel Pedro Vives y Vich, Ceuta, Africa.  
 A. V. Wosnessensky, Magnetic Meteorological Observatory, Irkutsk.  
 Dr. N. J. Zukovsky, The University, Moscow.

#### INTERNATIONAL COMMISSION ON RADIATION.

Appointed at Paris, 1896. Reconstituted at Berlin, 1910.  
 Met at Rapperswyl, 1912.

Dr. J. Maurer, Zürich, *President*.  
 Dr. F. Åkerblom, Meteorological Observatory, Upsala.  
 Prof. Frank H. Bigelow, Meteorological Office, Buenos Aires.  
 Prof. C. Chistoni, The University, Naples.

† Intimation has been received that members whose names are marked † vacate their offices in the current year 1913 or in 1914.

Prof. O. D. Chwolson, The University, St. Petersburg.  
 Dr. L. Gorczynski, Meteorological Bureau, Warsaw.  
 Prof. G. E. Hale, Carnegie Institution, Pasadena, U.S.A.  
 A. R. Hinks, Royal Geographical Society, London.  
 R. T. A. Innes, Union Observatory, Johannesburg.  
 Prof. H. H. Kimball, Mount Weather Observatory, Va., U.S.A.  
 E. Marchand, Observatoire du Pic du Midi, Bagnères-de-Bigorre, France.  
 Dr. W. Schmidt, Vienna.  
 Prof. J. Violle, Paris.  
 George W. Walker, Cambridge, England.

#### INTERNATIONAL SOLAR COMMISSION.

Appointed at Southport, 1903. Has met at Cambridge, 1904; Innsbruck, 1905; London, 1909.

†Sir J. Norman Lockyer, K.C.B., F.R.S., Hill Observatory, Sidmouth, *President*.  
 Dr. W. J. S. Lockyer, Hill Observatory, Sidmouth, *Secretary*.  
 Prof. A. Angot, Paris.  
 Prof. F. H. Bigelow, Meteorological Office, Buenos Aires.  
 Prof. K. Birkeland, The University, Christiania.  
 Padre, R. Cirera, S.J., Observatorio del Ebro, Tortosa, Spain.  
 W. G. Davis, Meteorological Office, Buenos Aires.  
 H. Deslandres, Astronomical Physical Observatory, Meudon, France.  
 Prof. E. van Everdingen, De Bilt.  
 Prof. G. E. Hale, Solar Observatory, Carnegie Institution, Pasadena, Cal., U.S.A.  
 Prof. J. von Hann, Vienna.  
 St. C. Hepites, Bucarest.  
 Prof. W. H. Julius, The University, Utrecht.  
 Hofrat Thege von Konkoly, Budapest.  
 Prof. W. Köppen, Deutsche Seewarte, Hamburg.  
 Captain H. G. Lyons, Roehampton, London.  
 E. Marchand, Observatoire du Pic du Midi, Bagnères-de-Bigorre.  
 †Prof. H. Mohn, Meteorological Institute, Christiania.  
 Prof. A. Riccò, Astrophysical, Meteorological and Geodynamical Observatory, Catania.  
 Prof. G. B. Rizzo, The Observatory, Messina.  
 Sir A. W. Rücker, Newbury, Berkshire, England.  
 †General M. Rykatcheff, St. Petersburg.  
 Prof. J. Scheiner, Astrophysical Observatory, Potsdam, Germany.  
 Dr. W. N. Shaw, London.  
 Captain A. Silvado, Rio de Janeiro.  
 A. Steen, Meteorological Institute, Christiania.  
 R. F. Stupart, Meteorological Office, Toronto, Canada.  
 Prof. J. Violle, Paris.  
 Prof. A. Wojeikov, The University, St. Petersburg.  
 Prof. Max Wolf, Astrophysical Institute, Heidelberg.  
 Prof. A. Wolfer, Zürich.

† Intimation has been received that members whose names are marked † vacate their offices in the current year 1913 or in 1914.



## INTERNATIONAL COMMISSION FOR WEATHER TELEGRAPHY.

Appointed at Paris, 1907. Has met in London, 1909 and 1912.

- Dr. W. N. Shaw, London, *President*.  
 Prof. A. Angot, Paris.  
 Prof. E. van Everdingen, De Bilt.  
 Prof. L. Grossmann, representing the Deutsche Seewarte, Hamburg.  
 Prof. G. Hellmann, Berlin.  
 Mr. R. G. K. Lempfert, London.  
 †Prof. H. Mohn, Christiania.  
 †Prof. Willis L. Moore, Washington, U.S.A.  
 Prof. L. Palazzo, Rome.  
 †General M. Rykatcheff, St. Petersburg.  
 Captain C. Ryder, Copenhagen.  
 Mons. J. Vincent, Uccle, Brussels.

## INTERNATIONAL COMMISSION FOR MARITIME METEOROLOGY AND STORM WARNINGS.

Appointed at Paris, 1907. Has met in London, 1909 and 1912.

- Dr. W. N. Shaw, London, *President*.  
 Prof. A. Angot, Paris.  
 Mr. T. F. Claxton, Hong Kong.  
 Mr. W. G. Davis, Buenos Aires.  
 Prof. E. van Everdingen, De Bilt.  
 Mr. J. H. Field, Simla.  
 Dr. C. G. Fineman, Stockholm.  
 Rev. L. Froc, S.J., Zi-ka-wei, Shanghai.  
 Señor José Galbis, Madrid.  
 Prof. L. Grossmann, representing the Deutsche Seewarte, Hamburg.  
 Captain J. M. Harvey, London.  
 Commr. M. W. C. Hepworth, London.  
 Mr. H. A. Hunt, Melbourne.  
 Señor J. M. d'Almeida Lima, Lisbon.  
 Prof. E. Mazelle, Trieste.  
 †Prof. H. Mohn, Christiania.  
 †Prof. Willis L. Moore, Washington, U.S.A.  
 Mons. K. Nakamura, Tokio.  
 Dr. T. Okada, Tokio.  
 Prof. L. Palazzo, Rome.  
 Captain C. Ryder, Copenhagen.  
 †General M. Rykatcheff, St. Petersburg.  
 General Major J. de Schokalsky, St. Petersburg.  
 Dr. J. P. van der Stok, De Bilt.  
 Mr. R. F. Stupart, Toronto, Canada.  
 Dr. G. T. Walker, Simla.  
 The Director of the Hydrographic Institute, Genoa.

† Intimation has been received that members whose names are marked † vacate their offices in the current year 1913 or in 1914.

## INTERNATIONAL RÉSEAU MONDIAL COMMISSION.

Appointed at Paris, 1907. Has met at Monaco, 1909.

The vacancies caused by the death of M. Teisserenc de Bort (*President*), and the resignation of M. Hildebrandsson (*Secretary*) were not filled at the Rome meeting of the International Meteorological Committee. (See p. 19.)

## INTERNATIONAL COMMISSION FOR THE APPLICATION OF METEOROLOGY TO AGRICULTURE.

Appointed at Rome, 1913. Names have been added subsequently by correspondence.

- Prof. A. Angot, Director of the Bureau Central Météorologique, Paris, *President*.  
 Prof. F. E. de Almeida-Figueiredo, Agronomic Institute, Lisbon.  
 A. d'Anderko, Chief of the Forecast Service of the Central Meteorological Institute, Budapest.  
 J. Vincente Arche, Agricultural Engineer, Chief of the Department of Technical Instruction, Madrid.  
 Dr. P. Berthault, Secretary to the Editors of the "Journal d'Agriculture Pratique," Paris.  
 Prof. F. H. Bigelow, Argentine Meteorological Bureau, Buenos Aires.  
 Prof. P. Brounoff, Chief of the Meteorological Bureau of the Department of Agriculture, St. Petersburg.  
 N. G. Cipaianu, Inspector of Agriculture, Bucharest.  
 W. H. Clarke, Director of Agriculture, Darwin, Australia.  
 Dr. Defant, Central Meteorological Institute, Vienna.  
 T. Doharty, Commissioner for Agriculture, Department of Agriculture, Ottawa.  
 M. Louis Dop, Vice-President of the International Institute of Agriculture, Rome.  
 D. Eginitis, Director of the Royal Observatory, Athens.  
 J. Galbis, Director of the Meteorological Service, Madrid.  
 R. B. Greig, Board of Agriculture for Scotland, Edinburgh.  
 Prof. D. van Gulik, Agricultural College, Wageningen.  
 Prof. H. Hergesell, Director of the Meteorological Service of Alsace-Lorraine, Strassburg.  
 J. W. Leather, Department of Agriculture, Simla.  
 Prof. N. Popovici Lupa, Agricultural College, Bucharest.  
 Prof. E. Marchal, Professor at the Agricultural Institute, and Director of the Station for Plant Pathology, Gembloux.  
 A. Maublanc, Director of the Laboratory for Plant Pathology of the National Museum, Rio-de-Janeiro.  
 T. H. Middleton, Board of Agriculture and Fisheries, London.  
 H. Morize, Director of the National Observatory, Rio-de-Janeiro.

† Intimation has been received that members whose names are marked † vacate their offices in the current year 1913 or in 1914.



- T. Okada, Chief of the Forecast Service of the Central Meteorological Observatory, Member of Council of the Agricultural Institute, Tokio.
- L. Palazzo, Director of the Italian Meteorological Service, Rome.
- S. Rona, Director of the Central Meteorological Institute, Budapest.
- Captain C. Ryder, Director of the Central Meteorological Institute, Copenhagen.
- A. Martinez Sanz, Chief Engineer for the Inspection of Partition of Forests, Madrid.
- Dr. W. N. Shaw, Director of the Meteorological Office, London, President of the International Meteorological Committee.
- R. F. Stupart, Director of the Meteorological Service, Toronto.
- J. Vincent, Director of the Meteorological Service, Uccle, Belgium.
- Dr. G. T. Walker, Director-General of Indian Observatories, Simla.
- S. Watzof, Director of the Central Meteorological Institute, Sofia.
- Prof. Wohltmann, Agricultural Institute of the University, Halle-Wittenberg.

## INDEX.

A.						PAGE
Actinometers, testing of	...	...	...	...	...	16
Aerological stations, Azores	...	...	...	...	...	8
—, Brazil	...	...	...	...	...	42
—, Polar Regions	...	...	...	...	...	5, 15, 41
—, réseau of	...	...	...	...	...	14, 41
—, Russia	...	...	...	...	...	49
Aeronautics, Scientific, Commission for.	See	Scientific Aeronautics.	...	...	...	45
Africa, magnetic observatories	...	...	...	...	...	5, 7, 23-25
Agricultural meteorology	...	...	...	...	...	15, 42
Amundsen, Capt., Polar expedition	...	...	...	...	...	44
Angot, M., magnetic research	...	...	...	...	...	7, 22, 24, 93
Application of Meteorology to Agriculture, Commission for	...	...	...	...	...	5, 15, 41
Arctic Sea, aerological stations	...	...	...	...	...	6, 19, 61
—, ice charts	...	...	...	...	...	6, 17
Aspiration psychrometer	...	...	...	...	...	4, 6, 19, 23
Atlantic Ocean, synoptic charts	...	...	...	...	...	4, 7
Atmospheric Electricity, Commission on	...	...	...	...	...	11, 12, 29
Atmospheric pressure, barometric tendency	...	...	...	...	...	5, 14
—, international code	...	...	...	...	...	28
—, latitude correction	...	...	...	...	...	5, 14
—, units	...	...	...	...	...	9
Aurora	...	...	...	...	...	8
Azores, pilot balloon observations	...	...	...	...	...	7
—, weather telegrams from	...	...	...	...	...	
B.						
Barometric pressure.	See	Atmospheric pressure.	...	...	...	11, 29
Barometric tendency	...	...	...	...	...	11, 12, 29
—, "characteristic" of	...	...	...	...	...	60
Beaufort scale of weather	...	...	...	...	...	11, 32
— of wind force, international code	...	...	...	...	...	13, 33-40
—, velocity equivalents	...	...	...	...	...	42
Berson, M., Brazilian aerological investigation	...	...	...	...	...	44
Bildingmaier, M.	...	...	...	...	...	42
Brazil, aerological investigation	...	...	...	...	...	
C.						
Canary Islands, aerological station	...	...	...	...	...	41
Campbell-Stokes sunshine recorder	...	...	...	...	...	5, 17
Cloud	...	...	...	...	...	9, 10, 11, 31
Crochet d'orage	...	...	...	...	...	11
D.						
Danish Meteorological Institute, Arctic ice charts	...	...	...	...	...	6, 61
Deutsche Seewarte, Atlantic synoptic charts	...	...	...	...	...	6, 23
Directors, Conference of	...	...	...	...	...	18
Dubinsky, M., magnetic observations	...	...	...	...	...	47
Dynamic metres	...	...	...	...	...	15
E.						
Ebeltoftshafen, aerological stations	...	...	...	...	...	41
Eiffel's Meteorological Atlas	...	...	...	...	...	4, 7
Eiffel Tower, weather messages	...	...	...	...	...	8
Eisfjord, aerological station	...	...	...	...	...	41
Electricity, Atmospheric, Commission for	...	...	...	...	...	4, 7
Englische hütte	...	...	...	...	...	6, 17
Everdingen, M. van, magnetic research	...	...	...	...	...	44
—, —, —, marine observations form	...	...	...	...	...	19, 60



## G.

	PAGE
Gale ... ..	31, 51, 52
Gewitternase ... ..	11
Gold, E., question of sleet ... ..	17, 20
Gusts, wind velocity ... ..	38

## H.

Hail ... ..	9, 10
Haze ... ..	9
Heliographs, comparison of ... ..	17
Hoar frost ... ..	24
Horta, weather reports ... ..	8
Hours of observation, solar radiation ... ..	16
Hydrometers ... ..	12, 28
Hurricane ... ..	9
	18, 51, 52

## I.

Iceland, weather telegrams ... ..	32
Institutes, meteorological, lists of ... ..	4, 6, 63, 81
International Code, storm warnings ... ..	18, 51
International Code, weather telegraphy ... ..	8-12, 28
International Meteorological Committee ... ..	88
Irkutsk, magnetic station ... ..	44
—, aerological station ... ..	49

## J.

Jakutsk, aerological expedition ... ..	43
--	----

## K.

Karsan, magnetic observatory ... ..	44
Katherinburg, aerological observatory ... ..	49

## L.

Lena River, aerological station ... ..	43
Lightning ... ..	9, 10
Line squall ... ..	11, 30

## M.

Magnetism, Terrestrial, Commission on. See Terrestrial Magnetism.	
Marine observations ... ..	57, 60
Maritime Meteorology and Storm Warnings, Commission for ... ..	6, 18, 22, 50, 92
Mauritius, storm signals ... ..	58
Melander, M., magnetic observations ... ..	44, 47
Messerschmitt, M. ... ..	44
Messina, magnetic observatory ... ..	45
Meteorological institutes, lists of ... ..	4, 6, 63, 81
— telegraphy. See Weather telegraphy.	
Meteorology, agricultural ... ..	5, 7, 23
—, maritime ... ..	6, 18, 19
Mist ... ..	9
Mohn, M., snow-measuring ... ..	16, 48

## N.

Nicolas Central Physical Observatory ... ..	48
Nikolsk-Oussourijskij, observatory ... ..	44
North Atlantic Ocean, synoptic charts ... ..	4, 6, 19, 23
Nova Zembla, aerological station ... ..	43

## O.

	PAGE
Observatories, lists of ... ..	4, 6, 63, 81
—, magnetic ... ..	44

## P.

Palazzo, M., magnetic research ... ..	44
Pavlovsk, aerological station ... ..	49
Pilot balloon observations. See Upper air investigation.	
Podolia, magnetic survey ... ..	47
Polar Commission ... ..	43
Polar expeditions, aerological research ... ..	15, 42
Polar regions, aerological research ... ..	5, 15, 41, 42
—, ice charts ... ..	6, 19, 61
Ponta Delgada, weather reports ... ..	8
Pressure, atmospheric. See Atmospheric pressure.	
Programme of meeting ... ..	4
Psychrometer, aspiration ... ..	6, 17
Pyrheliometer, standardisation of ... ..	16

## Q.

Quiet days, magnetic ... ..	47
-----------------------------	----

## R.

Radiotelegraphy, weather reports ... ..	6, 13
Rain ... ..	9, 10, 31
Rainfall ... ..	12
Rempp, M., aerological observations ... ..	41
Report of Officers of Committee ... ..	4, 22
Réseau Mondial, Commission for ... ..	6, 19, 93
Rime ... ..	24
Robitzsch, M., aerological investigation ... ..	42
Russia, aerological stations ... ..	49
—, magnetic survey ... ..	44, 47
—, meteorological service ... ..	17, 48
Ryder, M., Arctic Ice charts... ..	19, 61

## S.

Scientific Aeronautics, Commission for, atmospheric electricity observa-	7
—, constitution ... ..	89
—, meeting in 1912 ... ..	22
—, Polar Regions, aerological re-	
—, search ... ..	42
—, report ... ..	5, 14, 40
Sea disturbance ... ..	12, 31
Sestola, magnetic observatory ... ..	45
Shaw, W. N., Beaufort scale equivalents ... ..	37
Ship's observations ... ..	57, 60
Sleet ... ..	6, 17, 50
Snow, depth of ... ..	6, 16, 48
— international code ... ..	9, 10, 31
Sodankylä, magnetic observatory ... ..	44
Solar Commission ... ..	91
Solar radiation ... ..	16, 24
—, Commission for ... ..	5, 16, 22, 90
Soukhaya, observatory ... ..	44
Spitzbergen, aerological station ... ..	41, 42
Squall ... ..	31
Stevenson screen ... ..	6, 17
Storm warnings ... ..	6, 18, 51-59
Storm Warnings and Maritime Meteorology, Commission for.	
See Maritime Meteorology and Storm Warnings.	
Sunshine, recording instrument's ... ..	17, 24



## T.

	PAGE
Teisserenc de Bort, L. P. ... ..	14, 40
Telegraphy, Meteorological. <i>See</i> Weather Telegraphy.	
Temperature, international code ... ..	10, 29
—, maximum and minimum ... ..	12, 24, 26
—, thermometer screens ... ..	17
Terrestrial Magnetism, Commission on ... ..	6, 15, 44, 88
Thermometer screens ... ..	17
Thunderstorm... ..	9, 10, 31
Tiflis, aerological station ... ..	49
Time Signals, Commission on ... ..	5
Trappes, dynamical observatory ... ..	40
Tripoli, magnetic observatory ... ..	15, 45

## U.

Upper Air investigation, Arctic regions ... ..	5, 15, 41
—, Azores ... ..	8
—, Brazil ... ..	42
—, reporting of observations ... ..	9, 31
—, réseau of stations ... ..	14, 41

## V.

Vladivostok, observatory ... ..	44, 48
Vologda, magnetic survey ... ..	47

## W.

Wagner, M., aerological observations ... ..	41
Weather, "characteristic" of the ... ..	10, 30
Weather forecasts, Agricultural Commission ... ..	25
Weather reports, agricultural ... ..	24
—, Azores ... ..	7
—, France ... ..	8, 28
—, temperature extremes ... ..	26
Weather telegraphy, international code ... ..	5, 8-12, 28
—, Beaufort scale ... ..	8, 36
—, hours of observation ... ..	12
—, radiotelegraphy ... ..	5, 13
Weather Telegraphy, Commission for, constitution ... ..	92
—, —, —, meeting in 1912 ... ..	22
—, —, —, report ... ..	5, 8, 26-32
Wegener, K., aerological investigation ... ..	41
Werkhoyansk, aerological expedition ... ..	43
Wind velocity, average ... ..	38
—, Beaufort scale equivalents ... ..	13, 33-40
—, change with height ... ..	13
—, international code ... ..	9, 32



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