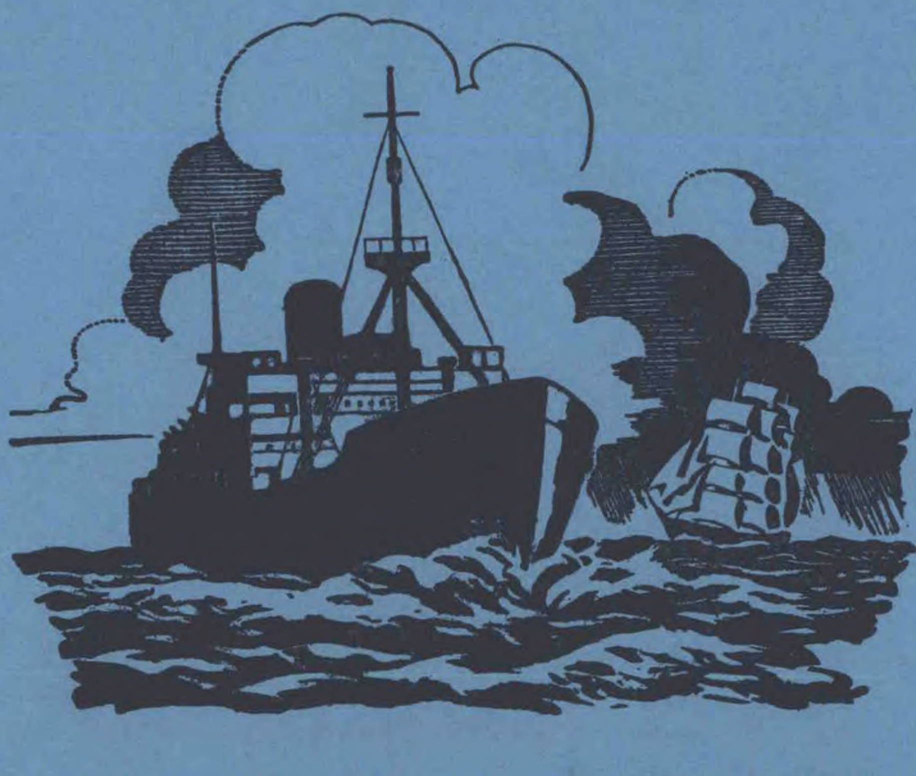
M.O. 624

The Marine Observer

A quarterly journal of Maritime Meteorology



Volume XXVII No. 176

April, 1957

SIX SHILLINGS NET

M.O. 624 AIR MINISTRY

THE MARINE OBSERVER

A QUARTERLY JOURNAL OF MARITIME METEOROLOGY PREPARED BY THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE

VOL. XXVII **No. 176** **APRIL, 1957**

TABLE OF PRINCIPAL CONTENTS

Letters to the Editor, and books for review, should be sent to the Editor, "The Marine Observer," Meteorological Office, Headstone Drive, Harrow, Middlesex

Published for the Meteorological Office by

HER MAJESTY'S STATIONERY OFFICE

To be Purchased from York House, Kingsway, LONDON, W.C.2, 423 Oxford Street, LONDON, W. 1, P.O. Box 569, LONDON, S.E.1, 13a Castle Street, EDINBURGH, 2, 109 St. Mary Street, CARDIFF, 39, King Street, MANCHESTER, 2, Tower Lane, BRISTOL, 1, 2 Edmund Street, BIRMINGHAM, 3, 80 Chichester Street, BELFAST, or from any bookseller

PRICE 6s. NET or £1 5s. 0d. per annum (including postage)

Editorial

The Commission for Maritime Meteorology of the World Meteorological Organisation is the international body which deals with all questions concerning meteorology at sea, including the organisation of the Selected Ship Scheme. This Commission has been in existence since 1907. It might be said to be the lineal successor to the international body of seafarers which met in Brussels in 1854 to consider the collection of meteorological information from the oceans, and which was in fact the first International Meteorological Conference to be held.

This Commission held a Conference in Hamburg at the Seewetteramt (marine headquarters of the West German Meteorological Service) in October 1956. This Office is not far from the site of the former Deutsche Seewarte, which was always so active in maritime meteorology (and whose building was destroyed during the war), and is conveniently sited in the San Pauli district, overlooking the docks and shipyards, a very suitable setting for a conference on maritime meteorology.

Twenty-three nations were represented at this Conference and it was appropriate that 18 of the delegates have seen considerable sea service either as professional seamen, as meteorologists or as oceanographers. Two of them are Port Meteorological Officers, Mr. Crawford from Cape Town and Mr. Goodfellow from Hong Kong. So the nautical atmosphere was not lacking.

The Conference lasted a fortnight and the subjects discussed ranged over the whole field of maritime meteorology. Concerning the Selected Ship Scheme, there was evidence that the total number of voluntary observing ships in the world has increased from about 2,400 to about 2,800 since the Commission's last conference in 1952. Despite this gratifying increase, all meteorological services agree that there is still a great need for more reports from ships at sea, particularly from those oceanic areas where shipping is relatively sparse. The Commission has therefore recommended that all countries make a special effort to increase the number of " auxiliary " ships making non-instrumental observations, with the addition of pressure and temperature readings, when in these particular areas. The ships' own instruments will be used, provided their accuracy is acceptable to the Port Meteorological Officer, and such ships will use the code group PPXTT where PP is the last two figures of pressure in whole millibars, X indicates that the ship is not a selected or supplementary ship and TT is the air temperature. Steps were taken with a view to recruiting ships flying the " flags of convenience " of Panama, Honduras, Liberia and Costa Rica. Encouragement is to be given to all countries to try to increase their number of selected ships and to endeavour to get all ships to continue sending radio weather messages when in coastal waters. A recommendation was also made that a simplified uniform address be used for ships' radio weather messages addressed to the shore, the object being to economise and to simplify the voluntary observer's work at sea.

The Commission made recommendations as to the manner in which voluntary observing ships could best contribute to the programme of the International Geophysical Year. Arrangements are being made for Port Meteorological Officers in all ports to visit as many ships as possible with the object of ensuring that all ships which trade in relatively unfrequented waters (Southern Ocean, South Pacific, Indian Ocean and central South Atlantic Ocean) make meteorological observations of one kind or another during the I.G.Y. Selected ships will continue to use the normal meteorological logbook, but for other ships an agreed international form has been drawn up for recording the observations, and a chart will be issued to each ship showing the particular area from which reports are required. Details as to the type and quality of observations was gone into; broadly the observations to be made aboard ship will be the same as are normally required, but emphasis will be placed on accuracy, particularly of cloud observations. The Commission also made detailed provision, on an international basis, for these I.G.Y. observations to be extracted from the logbooks and forwarded to the W.M.O. headquarters, where they can be readily made available for scientific purposes. In this work there is no doubt that the use of Hollerith cards will prove invaluable, and a special form was evolved in which observations will be mechanically reproduced in a standard layout.

The application of meteorology to a seaman's job is so obviously important that the Commission gave it considerable thought. A committee had, since the Commission's earlier conference in 1952, been compiling an international booklet which gives advice concerning the " meteorological care of cargo ". This booklet, which is intended to explain to the mariner in simple, straightforward terms how best to apply the elementary principles of meteorology to the care of the cargo in the ship's hold, has now been recommended by the Commission for publication by the W.M.O., and it is hoped that it will be available before the end of the year. It is perhaps interesting to note that a representative of the British Chamber of Shipping, who attended the Conference by invitation, confirmed that such a booklet on this rather complicated subject would be welcomed by the shipping industry. During the course of the Conference a series of three lectures on the subject of " Meteorology as applied to the navigation of ships " and one on the " Practical value of special cloud observations " were given. As all these lectures concerned items of practical interest to the mariner, it is hoped to publish at least a summary of them in a later number of *The Marine Observer*.

In return for the observations which are voluntarily made aboard ship, all meteorological services strive to provide the best possible radio weather service for seamen. In considering this question, the Conference recommended the introduction of a short and simple forecast code, for use by those countries which are at present unable to issue forecasts in English as well as in their own language. There are at present quite a few countries which are, for various reasons, only able to issue forecasts in their own language, although it has been internationally agreed that these should also be issued in English, when possible, as this is a language which is generally understood by seamen.

The Commission also took steps to overcome certain confusion which exists owing to the various uses of the word " storm " (" storm force wind ", " storm warning ", " tropical storm ", " thunderstorm ", " magnetic storm ", etc.). It was recommended that an amendment be made to the existing Beaufort scale as follows:

Force 7 to be " near gale " instead of " moderate gale "
Force 8 to be " gale " instead of " fresh gale "
Force 9 to be " strong gale " as at present
Force 10 to be " storm " instead of " whole gale "
Force 11 to be " violent storm " instead of " storm ".

Some changes in the wind-speed equivalents of the Beaufort scale were recommended.

The Commission also recommended that the term " gale warnings " be restricted to (expected) winds of Beaufort force 8-9, " storm warnings " be used for winds of force 10 and above, and that " warnings of tropical cyclones " be the general term for use in areas where such cyclones are liable to occur.

At its conference in 1952, the Commission had recommended the introduction of an up-to-date international ice nomenclature, and after certain amendments had been made, at the request of countries bordering the Baltic, this nomenclature was adopted for international use in 1956. Delegates had been asked to bring to the Hamburg Conference all their available ice photographs, and a committee of ice experts made a selection of these photographs in order to illustrate the nomenclature. It is hoped that these illustrations will soon be made available for international use. All these recommendations need approval by the Executive Committee of the World Meteorological Organisation before they can come into force.

Other items, of a more general nature, which were discussed by the Commission included: a code for reporting sea ice from ships, shore stations and aircraft;

measurement of sea temperature and rainfall at sea; illustration of cloud forms; the provision of blank weather maps for use by voluntary observers at sea on an international basis; observing and reporting sea waves; and maritime climatology.

As a change from the formal work of the Conference, delegates had the opportunity of inspecting the German fishery research ship *Anton Dohrn*, which is not only fitted up as a marine biological laboratory, but also has a very well appointed hospital, and a meteorological office from which radio weather bulletins are issued primarily for the benefit of German trawlers, but similarly for trawlers of all nationalities. For this purpose the ship carries a meteorologist aboard all the time. While the visitors were aboard this ship, films were shown illustrating the application of meteorology to the fishing industry. Delegates also were taken on a tour of the extensive docks of Hamburg and were very hospitably entertained by their German hosts on several occasions; two other delegations also provided hospitality. Social activities do much to facilitate the work of a conference of this nature, as it brings the delegates into more personal contact. The atmosphere throughout the Conference was most cordial, and it is pleasing to record that no political questions of any kind arose.

Five working groups were established to deal with the general work of the Commission between sessions; its next session will not take place till some time in 1961.

The Conference was presided over by Commander C. E. N. Frankcom, who had been President of the Commission since 1946. In accordance with the rules of the Organisation, he could not be re-elected at the conclusion of the Conference, and Dr. H. Thomsen of Denmark was unanimously elected in his place. Dr. Thomsen is an oceanographer and meteorologist; he had sea experience aboard the Danish research ship *Dana* from 1926 to 1938, including a cruise round the world from 1928 to 1930, and is a keen yachtsman. There is no doubt that this Commission, under Dr. Thomsen's presidency, will continue to have the interests of seamen at heart.

MARINE SUPERINTENDENT.

THE MARINE OBSERVERS' LOG

April, May, June

The Marine Observer's Log is a quarterly record of the most unusual and significant observations made by mariners.

The observations are derived from the logbooks of marine observers and from individual manuscripts. Photographs or sketches are particularly desirable.

Responsibility for each observation rests with the contributor.

SEA SNAKES

Indian coastal waters

M.V. *Clan Maclean*. Captain H. Whitehead.

7th April to 21st May, 1956. Whilst at anchor at Visakhapatnam, Sandheads (mouth of Hoogly River), Coconada and Madras, a considerable number of sea snakes, yellow and brown in colour and of varying sizes, was seen. At night they would swim around in the circle of light from a floodlight, and when they came to the edge of this circle they would dive.

Note. Dr. Parker of the Natural History Museum comments:

" The identity of the snakes cannot be determined from the description, as there is a number of species all somewhat similar in colour in that part of the world. The behaviour may be normal. It is suggested that as these snakes approach the edge of the circle of light the visual impression of the darkness would provoke the same reaction as the approach of a large floating object in daylight, i.e. avoidance by diving. I do not know whether this has been recorded as normal behaviour."

MARINE LIFE

South Pacific Ocean

M.V. *Cumberland*. Captain A. E. Williams. Liverpool to Auckland. Observers, Mr. B. Anstey, 2nd Officer, and Mr. C. Hill, 3rd Officer.

7th May, 1956, 1500 G.M.T. While the vessel was in the vicinity of the Humboldt Current, samples of water were taken from the sea-water bucket and examined under a magnifying glass and an improvised microscope constructed from sextant

telescopes. The only living creature found was a prawn-like animal as illustrated, with a body $\frac{1}{16}$ in. long. Sea temp. 77°F. Current during day 225°, 8 miles.

Position of ship: 5° 20'S., 106° 42'W.

Note. Mr. P. J. Harding of the Natural History Museum states that this was probably one of the many species of *Copepod* which are found in the sea at all depths and in all latitudes.

HURRICANE

Mexican coastal waters

M.V. *Portland Star*. Captain R. S. Hopper, D.S.C. Los Angeles to Balboa.

11th–13th June, 1956. At 1530 G.M.T. (11th) warning was received from the U.S. Weather Bureau, San Francisco, of a suspected tropical depression at about 12°N., 94½°W., moving W. at 4 kt. A first advisory message at 0245 (12th) from the same source, originating via S.S. *Pacific Unity*, indicated a centre at 13°N., 96½°W., moving WNW. at 12 kt. This advisory requested three-hourly reports from shipping in the vicinity, and placed the centre 600 miles ahead of the ship, where it would pass approximately 140 miles to the S. of our track in 24 hours. At 0500 (12th) a further advisory placed the centre at 13°N., 113°W., moving WNW. at 10 kt, considerably to the W. of the previously presumed position. A report at 1500 located it at 13° 40′N., 99° 50′W., and gave the same direction and speed of advance with high seas and heavy swell. At the ship during the last watch of the 12th (1300–1700) the sky was chaotic with almost continuous vivid lightning and frequent thunder claps. Moderate rain from 1600, slight sea and swell and the barometer 29·90 in., steady. At 2100 (12th), wind variable, force 3, overcast, slight sea and low swell from SE'ly, occasional heavy rain, barometer 29·89 in., steady. At 0100 (13th) wind was NE'E., force 5–6, overcast, heavy rain, barometer 29·84 in., steady; rough sea, heavy head swell (course 120°) and between the crests a smaller cross-swell was noticed travelling in a SSW'ly direction. At 0200 the wind backed suddenly to NNE. and increased to force 10, the barometer falling sharply to 29·41 in., with heavy rain, rough sea and heavy swell. At 0245 the wind speed was 90 kt, measured with the captain's anemometer. These conditions remained until 0325, with the barometer at 29·12 in., wind variable, mainly SE'ly, 30 kt, high breaking sea and confused swell, patchy sky about 6/8 clouded. Visibility improved to approximately 4 miles as the rain ceased. Several high breaking waves, judged to be about 30 ft in height, passed in a NW'ly direction. This was presumed to be the centre. The engines were at full speed but no apparent progress was made through the water as indicated by the patent log. At 0415 the centre passed. The wind veered S'ly and increased in force, gusts exceeding 100 kt, the swell then running from the same direction. The barometer, which had steadied, fell to 29·06 in., then commenced rising abruptly. The air was filled with rain and driving spray, so hard as to be painful on contact with exposed skin, and reducing visibility to less than 65 ft, the distance between bridge and foremast. The swell, running at intervals of 10–12 sec, was estimated to be not higher than 25 ft. The barometer continued to rise sharply and at 0500 it read 29·50 in., rising, although conditions had not moderated and did not begin to do so until 0600 when the wind was S., force 9, barometer 29·65 in., and the ship began to gather way, thereafter continuing to moderate until 0800 when all was again normal. It is supposed that the hurricane experienced was not the one predicted, but was a further disturbance originating in the Mexican coastal ranges and blowing to seaward.

Position of ship at centre: 16° 48′N., 101° 10′W. (estimated).

Note. This observation was forwarded to the United States Weather Bureau, who comment:

"We note the vessel's report mentioned the receipt of only three advisories which were issued in connection with this storm. However, our records show that a total of seven advisories were issued at six-hourly intervals; the first was released for broadcast at 1500 G.C.T. on 12th June and the last at 0300 G.C.T. on 14th June, 1956. The last warning stated that the hurricane was approximately 110 miles north-west of Acapulco, Mexico, and was expected to move on to the Mexican coast in the next few hours. In addition to inclusion of these hurricane warnings in the twice-daily shipping bulletins issued by Radio KPH (Bolinas) and KTK (San Francisco, California), rebroadcasts of the warnings were also made at hourly intervals by these stations, the former station transmitting at odd hours and the latter at 20 minutes past even hours G.C.T.

"Although radio shore stations were requested to contact all ships in the storm area to obtain special reports at frequent intervals, only a very few vessels were under way near the storm area. Owing to the scarcity of reports received, it was necessary to state in several of the warnings issued that the storm's position as given was ' poor ' or only ' fair '.

" In regard to the warning received by the M.V. *Portland Star* at noon on 12th June; following release of this advisory, it was noted that the hurricane's position was in error. Although a correction was issued promptly for broadcast, stating that the storm's position should be 13·3°N., 98·1°W., instead of 13·3°N., 113·1°W., as originally broadcast, we assume that the M.V. *Portland Star* failed to receive it. This was unfortunate, and the error in the advisory in question is much regretted. Thus the storm that the M.V. *Portland Star* encountered on 13th June was the same as the one which was mentioned in the first advisory.

" The M.V. *Portland Star* was one of the few vessels which furnished frequent reports on this occasion, and we are very grateful for the co-operation of the captain and his officers. These important messages were of much assistance to our forecasters in issuing the advisories while this hurricane was in progress."

VIOLENT THUNDERY SQUALL

Somali Coast

S.S. *Empire Fowey*. Captain W. T. C. Lethbridge. Mombasa to Aden. Observers, all observing officers.

23rd April, 1956, 0847 G.M.T. Dark banks of Cb with low base had been observed to NW., and an exceptionally violent squall struck the ship at 0847. The wind had been SW., force 3, for some time, then veered to W. at 0830 and violently to NE. as the squall struck. The wind reached approximately force 11 by 0850, and by 0856 was estimated as a good force 11. Visibility was reduced to about 150 yd immediately, and at times even the forecastle could not be seen. Torrential rain was being driven at great force horizontally, and the previously slight sea was raised to waves of great regularity with period of approximately 2 sec and height 3–4½ ft. Driving spray filled the air and broad light-blue bands along the direction of the wind were at times visible in the sea. At about 0858 the wind suddenly backed to N'W., but continued at force 11. Vivid lightning and loud thunder occurred frequently. From 0915 to 0940 a gradual improvement took place, with moderating wind and rain and a clearing sky from the eastward. By 0940 it was possible to make full speed again, the vessel having been almost stopped during the period 0850–1215. With the clearing sky, complex cloud formations were evident in the E., and overhead an unusual type of cloud best described as a close-knit Ac mammatus, but of a low height for Ac. It was remarkably regular in size of the cloudlets forming it, and was of a thick woolly appearance. The cloud base gradually lifted, but the promise of a fully-cleared sky, in the 1200 weather report, had not materialised.

Position of ship at 0847: 05° 45'N., 49° 15'E.

Note. This phenomenon was probably associated with instability on the inter-tropical front, which usually lies in these latitudes in April or May. It does not appear to have been extensive enough to be called a tropical cyclone. Tropical cyclones are extremely rare in the western part of the Arabian Sea, S. of 10°N.

THUNDERSTORM

Brazilian waters

S.S. *Lalande*. Captain L. Ankers. Brazil to United Kingdom. Observer, Mr. M. P. Roberts, 3rd Officer.

4th–5th June, 1956, 2200 G.M.T. (4th). Occasional flashes of bright lightning appeared on the horizon ahead of vessel. By 2300 the flashes, tinged with blue, illuminated the sea almost continuously. Both chain and forked varieties were clearly discernible. The centre of the storm, without rain, but with occasional thunder, was apparently overhead at midnight. At 0030 torrential rain commenced, lasting 15 min. At 0050 the sky overhead was cloudless, but there was cloud all round the horizon to an altitude of about 45°. The lightning was still continuous, though pink in colour, and the thunder more regular. At 0125 light rain commenced, conditions otherwise unchanged. By 0155 the rain and thunder had ceased. The lightning was still continuous, but once more white. By 0220 lightning was decreasing. At 0230 conditions were normal with light rain. Wind NW'N, force 1–2, backing to N., force 3. Barometer 1010·5 mb., steady. Air temp. 77°F.

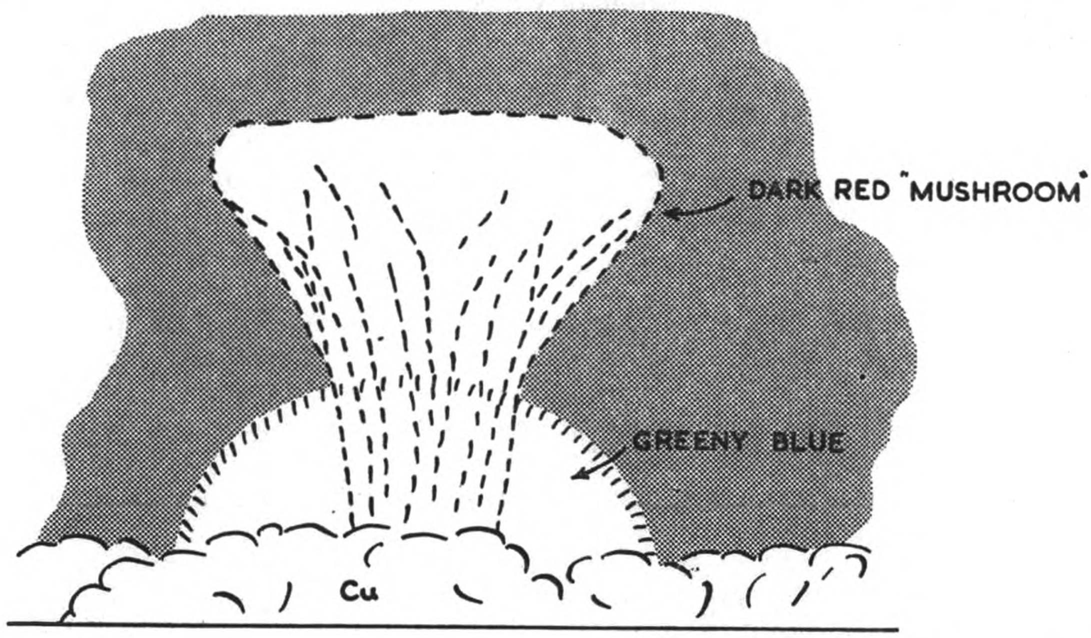
Position of ship at 2200 (4th): 20° 00'S., 39° 20'W.

ABNORMAL LIGHTNING

South Pacific Ocean

M.V. *Port Hobart*. Captain F. J. Lavers. Auckland to Balboa. Observer, Mr. P. Beattie, 3rd Officer.

11th May, 1956, 0930 G.M.T. Flashes of light were observed behind some low-lying Cu to north-westward. With each flash the sky was illuminated with a greeny-blue colour and afterwards a solid wedge of dark-red light rose slowly from



behind the cloud. Four such flashes were seen over a period of about 6 min. The wedges resembled the " mushroom " of an atomic explosion and they diminished gradually after about 1 sec at an altitude of approximately 12°. No lightning was observed in the hours before or after the phenomenon. Cloud, 3/8 Cu.

Position of ship: 19° 28'S., 127° 56'W.

Note. This is an unusual observation. Upshoots of abnormal forms of lightning from behind a cloud have been previously seen, both at sea and on land, but there are not many instances on record. Three earlier observations have been published in this journal. In the observation of S.S. *Inkum*, in the August 1928 number, a thin line of light shot upward, bursting when overhead like a rocket. In the observation of M.V. *Kaipaki*, July 1952 number, diverging lines of orange-coloured flashes shot up vertically several times; on two occasions they " mushroomed out ". In the observation of M.V. *Ajax*, October 1952 number, a single shaft resembling a rocket shot up suddenly.

WATERSPOUT

North Atlantic Ocean

S.S. *Clan Chattan*. Captain J. McCrone. Port Said to Liverpool. Observer, Mr. K. Barr, 3rd Officer.

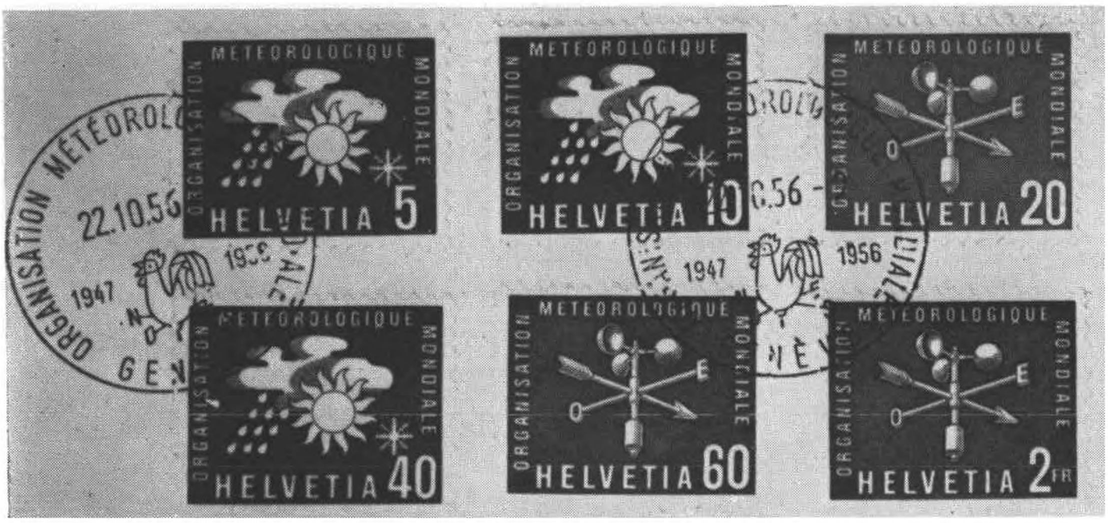
28th May, 1956, 0920 G.M.T. A most unusual waterspout was observed bearing due E. from the ship. It originated from a large Cb with rain falling, and stretched diagonally towards the horizon, as illustrated in the drawing on page 81. The waterspout lasted about 3 min before dissolving. There were 4/8 cloud at time

Photo by C. E. Birtchnell

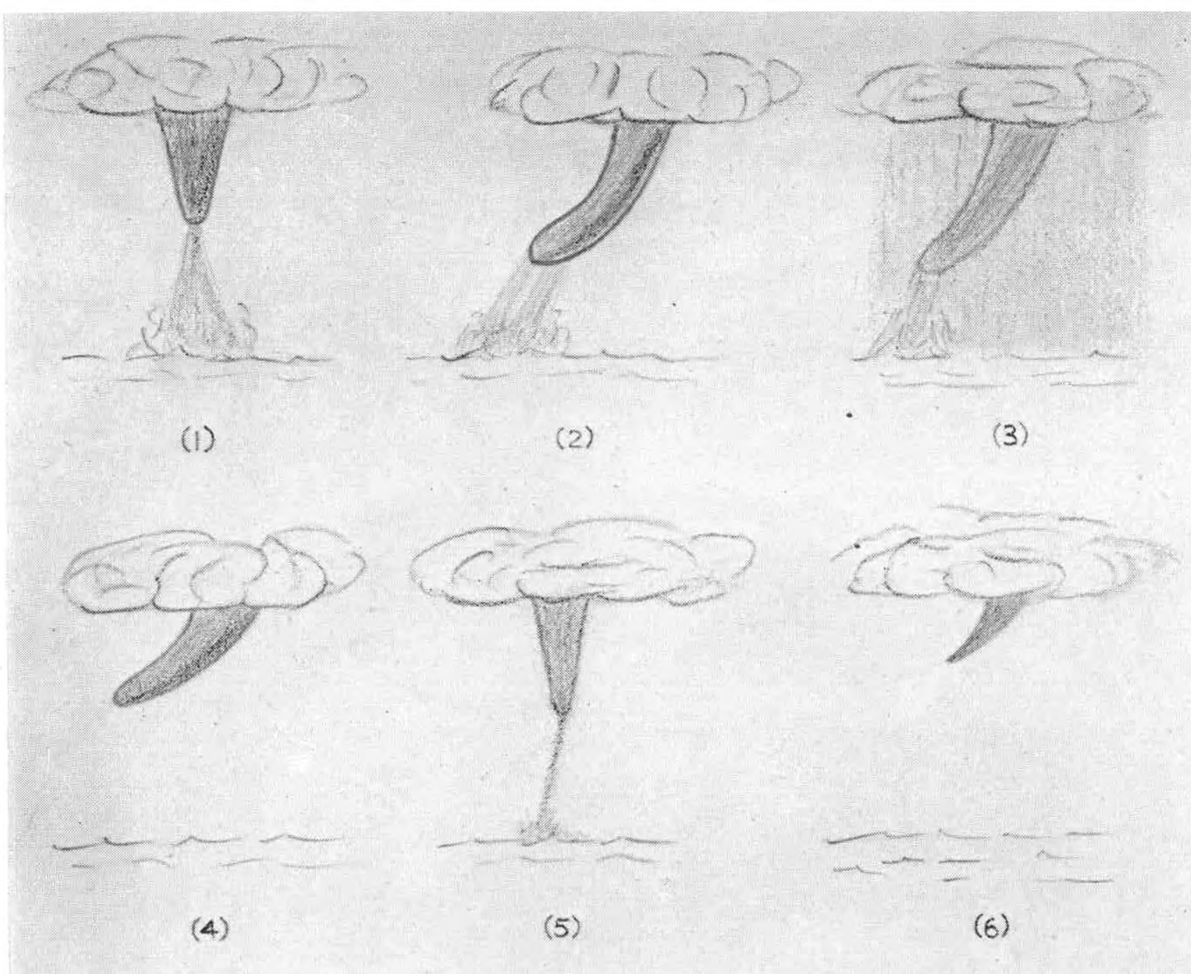
Photographs taken on board O.W.S. *Weather Explorer*, facing approximately s. (see page 81).

Photo by C. E. Birtchnell

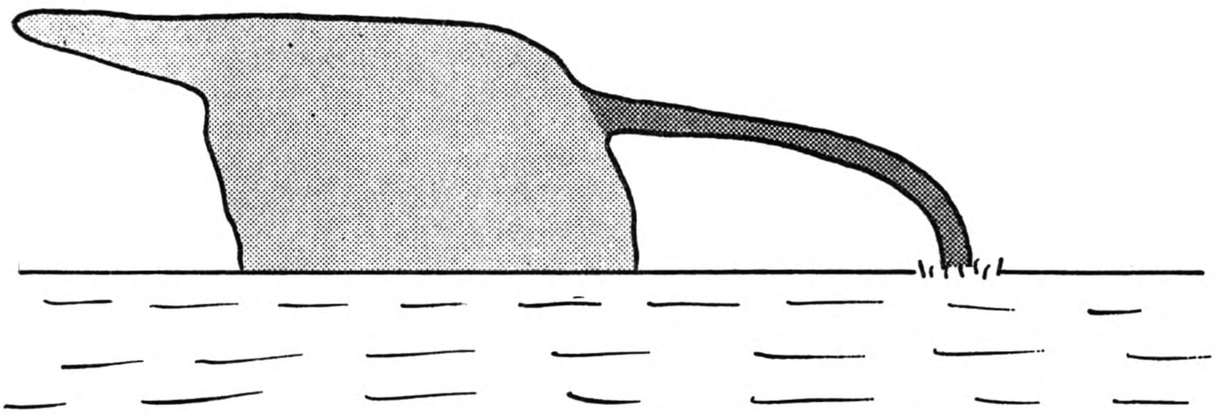
(*Opposite page 81*)



W.M.O. stamps (see page 121).



Drawings of a waterspout observed from S.S. *Orcades* (see page 81).



of observation, consisting of C_L2, C_M6 and C_H2. Wind sw'ly, force 4, visibility excellent.

Position of ship: 42° 28'N., 9° 39'W.

Note. This is a very unusual form of waterspout, of which the upper portion is roughly horizontal. According to Wegener's theory of the formation of waterspouts, quoted in Part I of Mr. Gordon's article on waterspouts on page 50 of the January 1951 number of this journal, the upper end of a waterspout is a horizontal vortex within the Cb cloud, this vortex bending downwards to emerge from the cloud towards the sea. The article states that the horizontal part of the vortex, normally hidden by the surrounding cloud, has been seen once or twice, but gives no indication that it has ever been seen reaching far out of the cloud as in the present observation, which may therefore be a unique one.

Indian Ocean

S.S. *Orcades*. Captain N. W. Smith. Colombo to Fremantle. Observer, Mr. N. I. Collett, Junior 3rd Officer.

15th April, 1956. At 0625 G.M.T. a waterspout was sighted at some distance on the port bow. It was then clearly defined, except towards the sea surface, where definition was obscured by rising spray (see Fig. 1, on opposite page). The wind being on the starboard bow (S'E., force 3), after a minute the base of the waterspout was observed to have moved down wind from the parent cloud, the surface wind being apparently stronger than that at cloud-base level (Fig. 2). At 0627 the waterspout was veiled by falling rain (Fig. 3). It was not possible to say whether this rain was falling round the waterspout or between it and the observer, but it came from the same cloud. The radar placed the rain squall at 16 miles distance; subsequently, however, no echo was received from the waterspout itself. At 0630, when the rain ceased, the waterspout was seen to have parted, and only a decreasing funnel of cloud remained hanging downwards (Fig. 4). At 0632, however, the funnel of cloud was seen to stretch and dip to the sea surface again, forming a second waterspout, more attenuated than its predecessor (Fig. 5). This lasted until 0635 when it again parted and finally resolved into the base of the cloud (Fig. 6). Wind S'E., 10 kt. Corrected barometer, 1010 mb. Air temp. 85·4°F, sea 86°. Cloud 4/8 large Cu (C_L2). The cloud associated with the waterspout had a much lower base and was of darker hue than the remaining cloud; presumably it was a Cb, but the top was hidden by the other clouds.

Position of ship at 0625: 1° 16'S., 86° 35'E.

CLOUD

Irish Sea

O.W.S. *Weather Explorer*. Captain K. R. H. Wem. Station "Kilo" to Greenock.

5th April, 1956. Between 1200 and 1500 G.M.T., heading NNE'wards through the Irish Sea, the ship passed through a cold front which was moving slowly sw. and which lay from Armagh to Holyhead at 1200. There was a veer of wind from 330° to 360°, a fall in temperature from 47° to 45°F and a drop in dewpoint from 46° to 33° between 1200 and 1500. At 1500 the ship was in the cold N'ly airstream behind the front. Unusual cloud formations occurred at about this time and are shown in the photographs opposite page 80, looking approximately towards sw. and w. The photographs almost join, parts of a dark cloud mass of Cb, with base about 6,000 ft., appearing in each. The interest in these photographs lies, however, in the masses of lenticular Ac in the centre of each photograph. They are typical wave clouds and are believed to be due to the formation of lee waves in the air stream, resulting from its flow over the Mourne mountains (about 2,800 ft).

Position of ship at 1500: 53° 48′N., 5° 18′W.

Northern Malacca Strait

S.S. *Empire Fowey*. Captain W. T. C. Lethbridge. Singapore to Colombo. Observer, Mr. D. H. R. White, 2nd Officer.

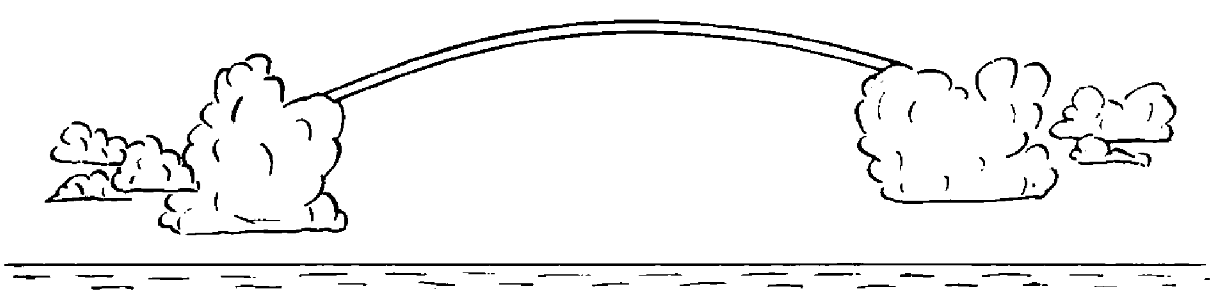
10th April, 1956. C_L3 (Cb without anvil), also some C_L1 (fair-weather cumulus) high in foreground of photograph (opposite page 96) and background of thick C_L2 (towering cumulus). Defined as C_L3 because of fibrous appearance in places, and precipitation which was later observed.

UNIDENTIFIED PHENOMENON

Arabian Sea

M.V. *Ajana*. Captain F. W. Mould. Aden to Fremantle. Observers, Mr. J. T. Duhig, 3rd Officer, and Mr. G. Ashurst, Radio Officer.

25th April, 1956, 1930–2030 G.M.T. A thin white band, not appearing to be



cloud, joined two tufts of towering Cu. The band remained as such until the clouds dispersed. Altitude 7°. Horizontal sextant angle between clouds 52°. Cloud, 2/8 Cu. Full moon; smooth sea; light airs. Air temp. 83°F, sea 86°.

Position of ship: 9° 30′N., 54° 20′E.

HIGH FOG

Yellow Sea

M.V. *Glenorchy*. Captain R. A. Hanney. Yokohama to Taku Bar.

22nd June, 1956, 1400 G.M.T. Observed a " bridge " of fog, about 15 miles in length, forming an arc lying about 045°–225° and touching the horizon on either beam. The fog or cloud belt appeared to be about 300 ft thick and about 1 mile wide, the width being estimated by the time taken by the ship in passing beneath it. The tops of the masts appeared just to touch the underside of the cloud, and during the passage beneath it the light from the almost full moon was shut out. From the northern edge of the belt rose a secondary belt of similar formation at 90° to the general direction of the primary one (against the wind direction at the time). This secondary belt appeared higher, less dense and less clearly defined than the first. The wind was SSW. to SW., force 2, and increased to force 4 after passing the fog belt. The sky assumed a chaotic appearance with much Fn and Cb, becoming overcast, and two hours after the phenomenon thick fog was encountered and later heavy rain. Before the phenomenon the barometer fell steadily (10 mb in the preceding 11 hours) and stood at 1000·2 mb at the time.

Three more of these cloud belts or arcs were passed, lying roughly parallel to the first one (roughly with the wind direction) though less clearly defined, more dispersed, at a greater height and slowly dissipating; they still had this unusual " rainbow " or " bridge " effect. Air temp. 71°F, dew point 69°, sea 69°.

Position of ship: 33° 33′N., 124° 27′E.

SEA SMOKE

North Atlantic Ocean

S.S. *Canadian Victor*.

7th April, 1956, 1330 ship's time. Sea smoke was observed as far as the horizon. The edge of the smoke was well-defined, extending in a NE'ly direction, with tide rips also extending in a NE'ly direction. Air temperature 47°F, sea 70°. By 1400 the sea temperature was decreasing rapidly, and the smoke dissipated.

Position of ship: 40° 30′N., 63° 40′W.

Note. This observation was forwarded to us by the Director, Canadian Meteorological Division.

ABNORMAL REFRACTION

Tunisian waters

S.S. *Tagelus*. Captain A. S. M. Jamieson. Lisbon to Port Said. Observers, the Master and Mr. D. G. Whiteley, 2nd Officer.

15th April, 1956. Whilst traversing the Galita Channel, Tunisia, between 1030 and 1430 G.M.T. the following phenomena were observed. At 1200 wind E'ly, 2 kt; cloud 8/8 thick As, visibility good, although some haze over coastline; rippled sea, very low swell; air temp. 63°F, wet bulb 59°, sea 61°. At 1300 the above conditions prevailed, but an increase of dry bulb temperature to 75° was observed, with negligible increases in wet bulb and sea temperatures.

At about 1315 a greenish fog or smoke bank was observed on the northern horizon, followed shortly afterwards by a distortion of the horizon immediately to the eastward of the bank, giving the impression of an island of considerable size

with two smaller islets westward. A loaded tanker, steering a W'ly course, suddenly appeared greatly elongated, with masts and radar tower " buckling ".

By 1330 these phenomena had disappeared and at 1400, whilst rounding Ras Engela, a rapid drop in dry bulb temperature to 65°, with wind E'S, freshening to force 3, was experienced.

(See note at top of page 85.)

Strait of Gubal

S.S. *Tagelus*. Captain A. S. M. Jamieson. Port Said to Abadan. Observer, Mr. D. G. Whiteley, 2nd Officer.

20th April, 1956, 1300 G.M.T. The vessel was proceeding E. through the Strait of Gubal, and when 5 miles N. of the west point of Shadwan Island, 25 miles distant from the southern extremity of the Gebel Zeit range, the southern and northern extremities of the range appeared to have cavities extending to about half their apparent depth. These cavities appeared to be filled with a heavy whitish mist; the upper points were joined as if by a slender perforated edge. The observation of this phenomenon was perforce abandoned after some 20 min, owing to other duties. Air temp. 80°F, wet bulb 74°, sea 71°. Cloud nil; visibility excellent. Wind 320°, 5 kt.

South Pacific Ocean

M.V. *Tyrone*. Captain N. Fraser. Sydney to Balboa. Observer, Mr. B. P. Telfer, 3rd Officer.

28th June, 1956. At 1415 G.M.T., just prior to moonrise, a bright red glow was observed on the horizon on the bearing on which the moon was expected to rise.

A red light suddenly appeared and at first was taken to be a hurricane lamp, lit by a small boat about 2 miles away, on our approach. The light spread to 2° in width and was obviously in, not on, the water, as it did not lift to the swell; it had the appearance of a flaming log, but the " flames " were motionless. Three minutes later a line of white light appeared over an arc of about 10° of the horizon. The moon then rose and the red, flame-like light disappeared, to be replaced by two half-moon shaped glows in the water. As the moon rose, the irregularities on its upper limb were plainly visible to the naked eye, and when just clear of the horizon the lower limb appeared to have a dent in the edge at about five o'clock. Visibility was exceptionally good—Altair, Enif and Mars were visible on rising. Air temp. 72°F, wet bulb 64°, sea 73°. Barometer 1022·8 mb. Light airs, smooth sea, low SE'ly swell. Clear sky with a trace of Ac lent. (C_M4).

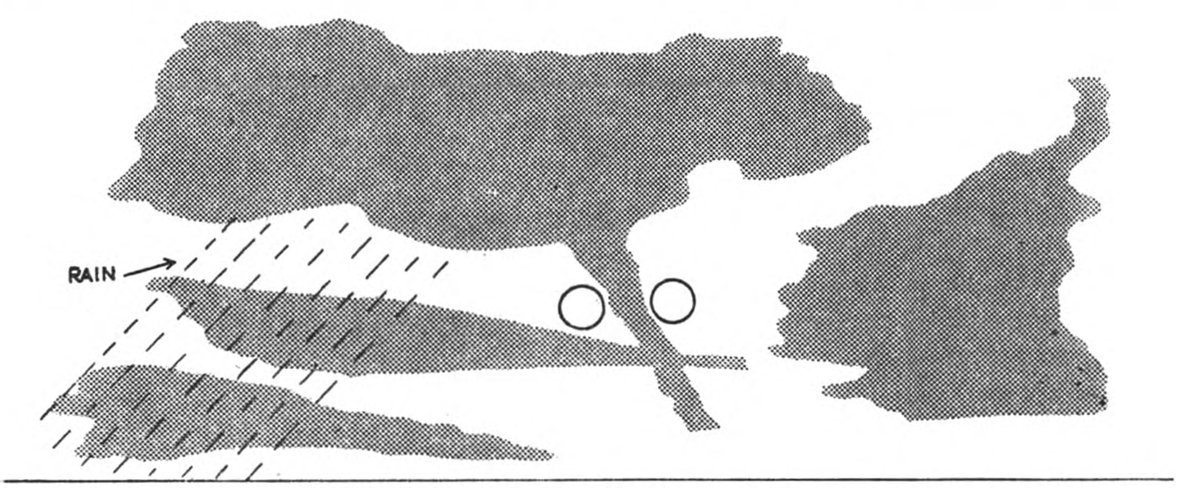
Position of ship: 24° 24'S., 127° 45'W.

Note. This is a very unusual and interesting observation and we have had only one similar report before, the observation of M.V. *Winchester Castle*, published on page 78 of the April 1953 number of this journal. In the present observation what was seen was a distorted image of the moon in the sea just before moonrise. In the earlier observation a distorted image of the sun was seen in the sea just after sunset. It is not possible to give any precise explanation of the course of the refracted light rays from the sun or moon below the horizon which would produce such images.

North Atlantic Ocean

M.V. *Salaverry*. Captain J. E. Evans. Liverpool to Curaçao. Observer, Mr. C. Rowntree, 2nd Officer.

14th June, 1956, 2145 G.M.T. Shortly before sunset, with the sun at an altitude of 2° 35', bearing 298°, twin suns were observed side by side, quite clearly separated.



The image was to the right of the true sun, there being no distortion of either. This phenomenon persisted for 2 min, after which the image gradually elongated in the direction of the true sun, eventually merging with it within ½ min. The cloud directly above the sun before, during and after the phenomenon was Fn. It was not possible to take a photograph.

Position of ship: 32° 52'N., 39° 22'W.

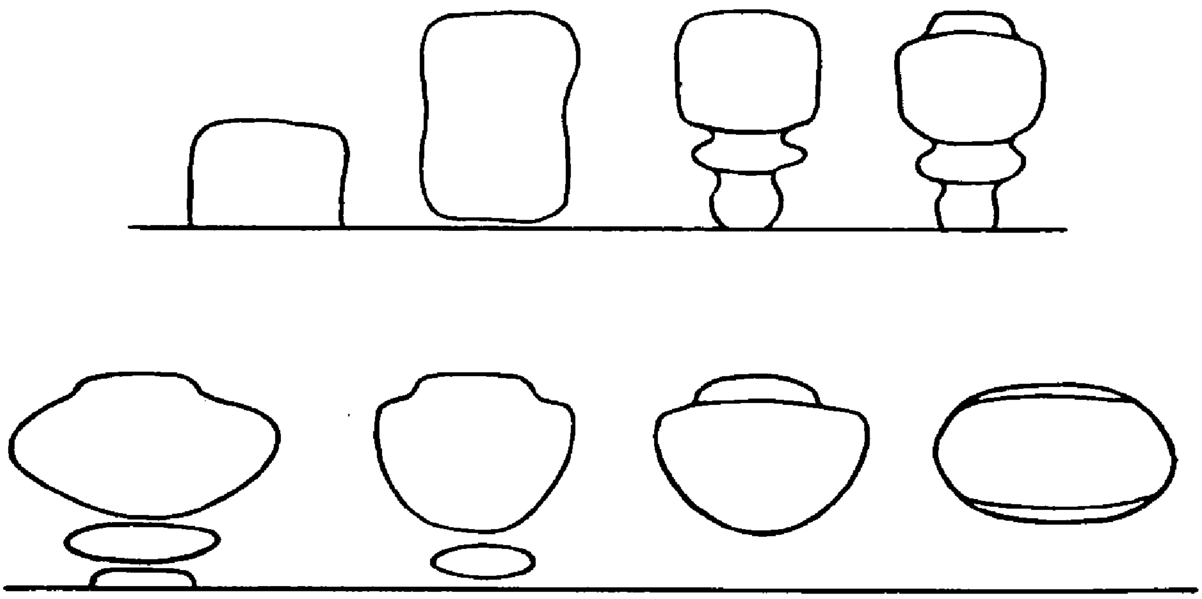
Note. This is an extremely interesting observation of lateral mirage and appears to be a unique one. For lateral mirage it is necessary for the air to be stratified into vertical masses of different densities. Ordinary abnormal refraction, which may produce an image vertically above the object, is produced by a more or less horizontal distribution of layers of air of different densities. The textbooks on meteorological optics give no observations of lateral mirage made in the open sea. Such mirages have been seen on land in the vicinity of walls or cliffs, when the temperature of these differed widely from that of the air close to them. There is also an observation of the duplication of the sails of a vessel on Lake Geneva by lateral mirage. The vessel was just inside the edge of the shadow thrown on the water by adjacent hills and therefore in an air temperature cooler than that above the sunlit lake just beyond the shadow.

The observation (page 83) of S.S. *Tagelus* is also interesting since the great elongation of the tanker implies a considerable degree of extension by lateral distortion.

Mozambique Channel

S.S. *Umtata.* Captain D. L. Weston. At anchor at Lourenço Marques. Observer, Mr. J. H. Szablowski, 2nd Officer.

19th June, 1956, 0437 G.M.T. approx. Abnormal refraction was observed at sunrise, when the sun appeared to be greatly distorted and of vivid crimson-red colour. The principal distorted shapes of the sun took place consecutively, as shown in the sketch below. Air temp. 60°F, wet bulb 55°, sea 65°. Wind 335°, force 1–2.



Rippled sea, no swell. Clear sky, hazy horizon. Corrected barometer 1014·7 mb, steady and rising.

Position of ship: 25° 59′S., 32° 35′E.

RED AND GREEN FLASHES

North Atlantic Ocean

M.V. *Cambridge.* Captain P. P. O. Harrison. Curaçao to London. Observers, the Master and Chief Officer.

10th May, 1956. Sunset at 2141 G.M.T. When the lower limb of the sun was $\frac{1}{4}$° above the horizon it emerged from Sc cloud with a brilliant red flash. The sun had a very red colour as it continued to descend. When the upper limb was $\frac{1}{4}$° above the horizon a green flash in the form of a narrow band around this limb was seen, except just at the apex of the limb which was obscured by the Sc cloud. There was considerable mirage effect as the last of the sun disappeared.

Position of ship: 35° 48′N., 43° 32′W.

GREEN FLASH

Tasman Sea

M.V. *Kopua.* Captain A. H. M. Hely. Goff's Harbour, N.S.W., to Lyttleton, N.Z. Observer, Mr. A. N. Howie, Chief Officer.

11th May, 1956. At sunrise there was 7/8 Sc cloud reaching almost to the horizon. As the sun appeared there was a very brilliant deep blue flash followed by a brilliant green one. The combined flash lasted for $1\frac{1}{2}$–2 sec.

Position of ship: 38° 19′S., 167° 44′E.

Note. This observation was sent to us by the Director of the New Zealand Meteorological

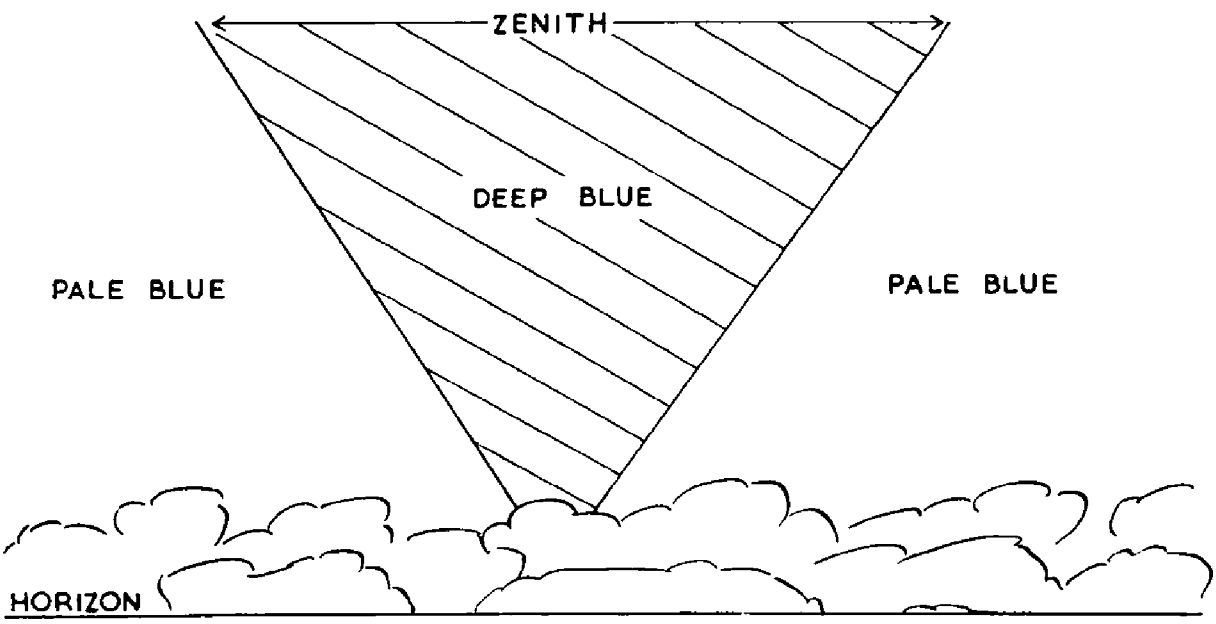
Service. A few instances of the change of colour from blue to green at sunrise and from green to blue at sunset have been published in this journal, but it is rather rare as atmospheric absorption usually prevents the blue rays, and the still more rarely observed violet rays, from being seen.

SKY COLORATION

South Pacific Ocean

M.V. *Wanstead*. Captain I. W. Jackson. Auckland to Panama. Observers, Mr. R. Hall-Soloman, Chief Officer, and the Radio Officer.

6th April, 1956, 0315 G.M.T. An interesting example of sky coloration was observed at sunset. A wedge-shaped piece of sky, in the E., was coloured deep



blue, almost purple, and the sky on either side of the wedge was a very pale blue. The wedge was extremely well defined and covered an arc of from approximately 10° above the horizon, where it disappeared into the clouds, to the observers' zenith. The thick end of the wedge, directly overhead, was covering an arc in the sky of about 50°. A particularly heavy shower of rain was directly in line between the sun and the observed phenomenon. The outstanding feature of this peculiarity was the extremely fine definition of the sides of the wedge and the sudden change from purple to pale blue. Air temp. 79°F, barometer 1011·5 mb.

Position of ship: 27° 05′S., 133° 38′W.

Note. This is an interesting observation since the colour effect described is not what is usually seen. The normal aspect of the clear eastern sky after sunset is as follows. At sunset a steely-blue segment, darker than the rest of the sky, begins to rise up from the horizon opposite the place of sunset. This is the shadow of the earth thrown by the sun on to the earth's atmosphere. The earth-shadow has a narrow band of rose or purple colour, known as the counterglow, along its curved upper boundary. The whole rises fairly quickly in altitude, with the shadow encroaching on and eventually obliterating the counterglow. The shadow rises to the zenith, but before this it generally becomes invisible owing to the progressive darkening of the whole sky.

SCINTILLATION OF STARS

South Pacific Ocean

M.V. *Wanstead*. Captain I. W. Jackson. Auckland to Panama. Observers, the Master and Mr. R. Arnott, 3rd Officer.

13th April, 1956, 0400 G.M.T. An unusually clear night with 1/8 cloud. Stars with altitudes of less than 30°, all round the horizon, were observed to be changing colour rapidly. Sirius, altitude 15°, bearing W., was particularly bright; when observed with the naked eye, it could be seen that there were at least three different colours present at the same time on separate parts of the star. When observed through a telescope, it was indeed a wonderful and extraordinary sight—five distinct and separate colours could be seen at the same time. These colours were red, blue, violet, green and yellow, in different parts of the star, but merging into each other, and the effect was like a very bright multi-coloured light in the sky. This phenomenon continued until the star set and most of the colours in the spectrum could be seen from time to time. Air temp. 77°F, barometer 1008·4 mb.

Position of ship: 8° 00'S., 99° 00'W.

AURORA

North Atlantic Ocean

S.S. *Warkworth.* Captain N. Thompson. Swansea to Montreal. Observer, Mr. W. J. Childerstone, 3rd Officer.

28th May, 1956. Aurora was observed in the northern sky forming a brilliant effect. The main arc was the brightest display and was formed between the bearings of 300° and 020°, with its highest altitude to the base 7° and to the outer rim 9°. Brilliant pulses of light were observed to run in an E.–W. direction through the arc, attaining their maximum brilliance at the highest altitude of the arc. From the arc radiating upwards and outwards were definite singular streamers of a weaker kind, these fading at an altitude of approximately 45°. The display lasted from 0230 to 0300 G.M.T., then faded to a dim glow for a further 30 min. The star Capella was observed throughout.

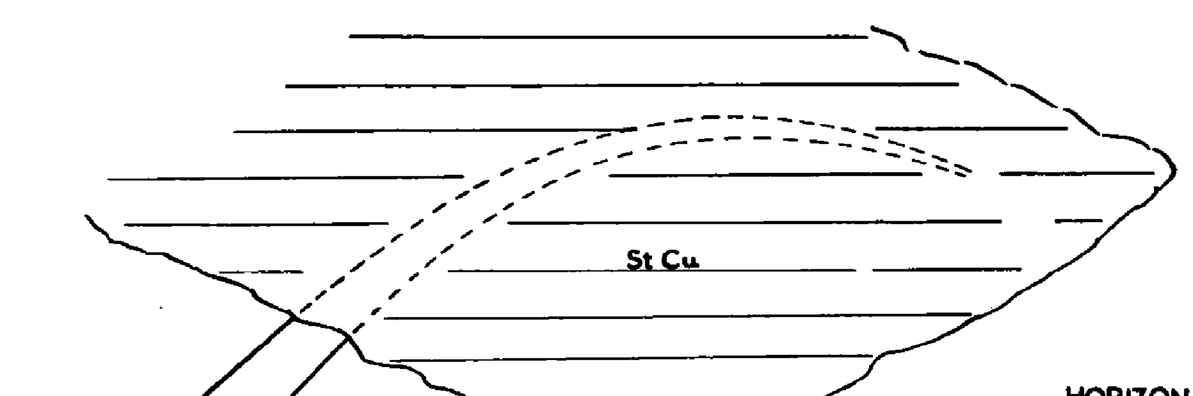
Position of ship at 0300: 47° 00'N., 57° 42'W.

UNIDENTIFIED PHENOMENON

Indian Ocean

M.V. *Australind.* Captain J. F. Wood. Aden to Sydney. Observer, Mr. B. D. Diggle, 2nd Officer.

16th June, 1956. At 1855 G.M.T. a rainbow-like arc of pure white light appeared, bearing approximately 060°. Up to an altitude of 40° above the horizon it was



quite strong and easily distinguished; above this it gradually lost its brilliance and finally disappeared from view at an altitude of 75°, bearing approximately 140°. The arc appeared to be behind thin Sc cloud rather than superimposed upon it, as, at its brightest point, viz. near the horizon, no cloud obscured the arc. To the westward the sky was clear and the moon bore approximately 260°. This phenomenon persisted until 1913 and then disappeared in a matter of seconds, the upper part of the arc instantaneously and the lower part gradually. Bright moonlight throughout. Air temp. 74°F. Barometer 1015 mb.

Position of ship: 17° 15'S., 80° 30'E.

LUNAR HALO

South African waters

M.V. *Roxburgh Castle*. Captain C. W. Armstrong, R.D., R.N.R. Southampton to Lourenço Marques. Observer, Mr. R. Patterson, 2nd Officer.

22nd April, 1956, 0120–0135 G.M.T. A well-defined lunar halo of radius 35° was seen, with a width twice that of a normal rainbow. The altitude of the moon, which was setting, was 10°. Air temp. 60·5°F, wet bulb 59·5°. Barometer 1026·4 mb. Cu and Cb cloud. Very light drizzle.

Position of ship: 31° 51′S., 29° 25′E.

Note. This is an observation of one of the rare halos, Feuillée's halo, which has been only very occasionally seen, with radii of from 32° to 36°. The observation is therefore valuable. There is an observation of it by M.V. *Dominion Monarch*, radius 33½°, on page 127 of the July 1952 number of this journal.

ICE

Stockholm

M.V. *British Peer*. Captain C. O. Stibbs. Observer, Mr. R. B. Woodcock, navigating apprentice.

16th April, 1956, at about 1730 G.M.T. Approaching Stockholm in loaded condition. The photograph (opposite page 96) was taken from the eyes of the ship and shows the crack made by the forefoot in the fast-ice, which was from 18 to 24 in. thick.

CHANGES OF SEA TEMPERATURE

South African waters

M.V. *Roxburgh Castle*. Captain C. W. Armstrong, R.D., R.N.R. London to Lourenço Marques via the Cape. Observer, Mr. R. Patterson, 2nd Officer.

Between 2200 G.M.T. on 21st April, 1956, when Bashee Lighthouse bore 205°, 15 miles distant, and 0200 on 22nd, when Cape Hermes Lighthouse was 5 miles distant, the sea temperature rose from 66°F to 78°. Conditions were otherwise normal.

Between 0600 and 1000 on 23rd, whilst under Lourenço Marques pilotage, and up to the dock area, the sea temperature fell from 78° to 57°. Conditions were again otherwise normal. Density of water on arrival was 1016.

Note. We can find no reference in the Admiralty Pilot or elsewhere to a fall of sea temperature on entering Lourenço Marques. Inshore countercurrents are known, however, to flow at times along parts of the coast between East London and Porto de Moçambique inside the warm south-going Agulhas Current. As the countercurrents are northerly they would be cooler than the Agulhas Current. The presence of such a current at the time of the above observation is therefore a possible explanation of the variation of temperature.

FALL OF SEA TEMPERATURE

North Pacific Ocean

S.S. *Baron Glenconner*. Captain T. R. Reid. Tokyo to British Columbia.

14th June, 1956. At 0545 G.M.T., sea temp. 59·2°F, dry bulb 63·4°, wet bulb 62·8°; wind 120°, 3 kt; shallow mist. At 0615 mist cleared and wind increased to 9 kt; sea temp. 70·4°, dry bulb 66·5°, wet bulb 65·4°. Sea temperatures in each case were taken well forward and clear of any discharges. An unusually large shoal of fish on the sea surface, covering an area of some 2 square miles, was noticed 10 min prior to the first observation.

Position of ship at 0545: 36° 29′N., 148° 34′E.

Note. This observation was made within the flow of the North Pacific Current, the continuation of the Kuro Shio after it leaves the coast of Japan and begins to flow eastward across the ocean. The mean sea temperature of the region of observation is about 63°F, from

M.O.484, *Monthly Meteorological Charts of the Western Pacific Ocean.* It is now recognised that streaks and patches of cooler water may occur in the main flow of warm currents such as the Gulf Stream and the Kuro Shio. An observation of this kind made in the Gulf Stream will be found on page 27 of the January 1955 number of this journal.

DISCOLOURED WATER

North Atlantic Ocean

S.S. *Tamaroa.* Captain B. Forbes Moffatt. Liverpoool to Curaçao. Observer, Mr. W. J. Lynam, 3rd Officer.

10th June, 1956, 1300 G.M.T. Numerous lumps of a dark brown substance were observed floating on the surface of the sea. These varied from about 6 in. to 1 ft in diameter and the surrounding sea surface appeared to be covered with a thin film of oil extending outwards, mainly away from the wind, to a distance of up to 6 ft. Much marine life was observed at the same time in the vicinity, e.g. porpoises, turtles and many small fish. Wind SE., force 1–2. Air temp. 65°F, sea 65°.

Position of ship: 39° 50′N., 25° 14′W.

Note. Dr. H. W. Parker of the Natural History Museum comments as follows:

"The description of the material suggests oil sludge but this would not encourage marine life around it. Alternatively it could conceivably have been decomposing gulf weed. There might be some oiliness from such a mass which would also harbour a fair amount of fish and other marine life on which the porpoises and turtles might have been preying."

Arabian Sea

S.S. *Blairclova.* Captain J. MacVean. Basra to Western Australia.

27th April, 1956. Observed discoloured water stretching in streaks from horizon to horizon. The discoloration was a mixture of dirty red and yellow, and was not a discharge from a vessel. No soundings at 600 fm.

Position of ship: 13° 56′N., 71° 18′E.

Note. Dr. T. J. Hart, of the National Institute of Oceanography, comments as follows:

"The extent of the streaks clearly points to microscopic algae as the cause, but so many kinds have been reported from that part of the world that one cannot even make a decent guess at which might be concerned without a sample. Most discoloured water reports, however, have been closer to land, so that *trichodesmium* or *noctiluca* are more likely to have been the cause than the smaller flagellates as recorded south of Bombay and on the Malabar coast."

Arabian Sea (Malabar coast)

S.S. *Tagelus.* Captain A. S. M. Jamieson. Fao to Singapore. Observer, Mr. D. G. Whiteley, 2nd Officer.

6th May, 1956, 1030 G.M.T. A well-defined streak of greenish-brown discoloured water was observed about a mile to the E.; the discoloration extended roughly in a N.–S. direction for about 2 miles, the vessel subsequently passing through the southern extremity. Close observation revealed that the discoloration was due to a brownish scum with considerable ash or dust in suspension immediately beneath the surface of the water. Steady soundings of 40 fm were obtained throughout. Wind 030°, force 2. Air temp. 88°F, wet bulb 80°, sea 86°. Low swell.

Position of ship: 09° 50′N., 75° 40′E.

Note. Dr. Hart, National Institute of Oceanography, comments on this observation as follows:

"It sounds like a *Trichodesmium* specimen to me; the dust-like appearance of the rafts of algae below the surface with the sun on them is very typical. Other types of algae blooms are, however, known to the north and south, i.e. in the Gulf of Manaar, and of course there is always the chance that it was somebody pumping out double-bottom tanks. It does not sound like man-made fouling to me, but in the absence of a sample it is still not possible to be certain about it."

(A note on the desirability of obtaining samples appeared on page 48 of the January 1955 number of this journal.)

PHOSPHORESCENT WHEELS

Persian Gulf

S.S. *Smoky Hill.* Captain H. Evans. Bandar Mashur to Aden. Observers, the Chief Officer, Mr. K. B. Youngs, navigating apprentice, two other apprentices and three members of the watch on deck.

The following is an abstract of the observation sent to us from the journal of Mr. Youngs, together with his replies to our questions about certain details of the phenomena.

3rd April, 1956, 1930 S.M.T. The sea was a mass of flashing patches of light, each one being of considerable size, perhaps 100 yd across. The flashes were not abrupt and gave the impression of luminous bodies in the water rising to the surface and then sinking down again. The nearer patches often went dim without completely disappearing, the length of time that each was bright and dim being approximately equal. It was not certain whether the patches stayed in the same position, but there seemed to be little, if any, change. Over a period of about 30 sec all phosphorescence disappeared.

Ten minutes later the display was resumed in the form of parallel bars of light travelling towards the ship from about four points on the port bow, leaving her on the starboard quarter. The bars passed the ship at regular intervals of about 3 sec. Then a brighter patch was seen ahead, and as this was approached it was seen to be an area of jumbled blotches of light, the parallel bar formation having ceased. As this area was watched the profusion settled itself out and began to resemble a slowly revolving wheel. Each " spoke " of the wheel was disjointed, consisting of several separate bars of light, the component bars decreasing in intensity of light with distance from the centre of rotation. The spokes were not straight, but curved slightly in a clockwise direction. The centre round which all revolved was a brighter spot which showed no movement. This was passed by the ship at a distance of about a mile to port. The spokes could also be seen extending far off on the starboard side, not coming to an abrupt end but fading away in the distance.

The wheel showed two types of motion, that of rotation and an outward rippling movement. In addition, each spoke flashed regularly in sections so that not all of it would be visible at once. The flashing occurred at the constant rate of one per second.

A number of other wheels were subsequently seen, for the most part separately, but a few were slightly intermingled. At times wheels could be seen all around the ship. Each wheel appeared to keep a fixed position relative to the others. As each wheel passed astern it became distorted and indistinct, finally appearing as just a glow in the distance. All the wheels that were seen near the ship had the same character as the one described above, with visible centres and curved spokes.

A difference of opinion arose as to which way the first wheel was rotating. It appeared to Mr. Youngs to be turning anticlockwise, with some distant bars moving clockwise, while the Chief Officer and the other two apprentices said the direction was clockwise. Independent opinions were therefore sought from three members of the watch, each of whom gave the movement as anticlockwise.

Note. This is a well-recorded observation, presenting several points of special interest. It confirms three previous observations that the wheel may develop from a moving parallel band formation. A special feature of the present observation is the clearly observed transitional stage of confused movement before the wheel developed. Another noteworthy feature is the number of wheels in action during the period of observation, the duration of which is not given. With the flashing of the wheels, and their different distances from the ship, it would probably have been difficult to estimate the total number, but one gets the impression that this was considerably more than in most, if not all, of the previously recorded observations of this phenomenon. The interruption of the luminosity of each spoke by dark sections is an unusual feature, as also is the periodic flashing of the luminous parts and the outward rippling movement. The curvature of the spokes has been previously seen on several occasions.

Finally we come to the very interesting point that different persons saw the wheel rotating in opposite directions. One of the apprentices suggested that there was no actual rotation but that the appearance of rotation was an optical illusion caused by the continuous systematic flashing, in which case the direction might not appear the same to different persons. Once the impression is formed that the rotation is in a certain direction it would be very difficult or impossible to change the mental picture. This is an interesting theory and might well be correct as regards this particular night of observation. This does not mean that the rotation of the majority of phosphorescent wheels could be explained in this way. Normally they are not complicated by flashing, and different observers of the same wheel see the same direction of rotation. Assuming that there is in most cases a genuine appearance of rotation of the wheel, it must be clearly understood that there cannot be any actual rotation of the mass of water. The rotation must be that of some form of stimulus to the light-producing organisms, though of the nature and mode of operation of this stimulus we are at present entirely ignorant. In this connection the observation of S.S. *Canton*, published in the October 1954 number of this journal, is of very great interest. On this occasion the stimulus seemed to be acting more slowly, so that the successive lighting up and fading out of individual water areas did not blend into the appearance of a rotating wheel; with close attention the successive illumination of adjacent areas could be clearly distinguished.

PHOSPHORESCENCE

French West African waters

S.S. *Warkworth.* Captain N. Thompson. Tyne to Monrovia. Observer, Mr. C. Harrow, 2nd Officer.

15th April, 1956. Circular patches of phosphorescence were observed round the vessel up to a radius of approximately 200 ft. The average diameter of these patches was about 3 ft, and their appearance resembled the reflection of a lighted port on the water. These patches lit up with a weak light for a fraction of a second and were then extinguished—once within the arc of the vessel's lights they could no longer be seen. This phenomenon lasted for about 20 min. Wind w'ly, force 1. Air temp. 65°F, sea 67°. Slight sea and swell.

Position of ship: 64 miles north of Cape Verde.

M.V. *Pacuare.* Captain A. Thompson. Southampton to British Cameroons. Observer, Mr. J. Bull, 3rd Officer.

9th May, 1956, 2200 G.M.T. Observed bright phosphorescent patches in water when crossing 100-fm contour, continuing with less frequency and dying away at 2245. The bow wave was very bright and wave crests could be seen to the horizon, giving the appearance of a storm-swept sea. The patches were approximately 40 ft in diameter, circular or oval. On approaching, they appeared as a dull green glow beneath the surface, but when close, waves of light would radiate outward to clearly defined edges, as the burst of an underwater bomb. The vessel passed close to six of these patches and others could be seen at varying distances. Wind 320°, force 4. Air temp. 63·4°F, wet bulb 61·5°, sea 62·1°. Course 182°, speed 13·2 kt.

Position of ship: 19° 55'N., 17° 29'W.

Persian Gulf

S.S. *Velletia.* Captain J. G. Nettleship. Mena al Ahmadi to Spezia. Observers, the Master, Chief and 4th Officers.

2nd April, 1956, between 1638 and 1652 G.M.T. Pulsations of light surrounded the ship in distinct waves, but with no definite continuous direction. Vessel in 47 fm of water, according to the chart. The echometer showed two distinct traces on the graph with a depth of 4 fm between them, gradually tapering off to a single line of soundings as the phenomenon ceased. The surface of the sea was considerably disturbed, possibly by large shoals of very small fish. The indications were that these shoals were 4 fm below the surface of the water, and being so closely packed gave off a phosphorescent glow in waves as they shot across and around the ship's track. Sky cloudless, wind calm. Air temp. 80°F, sea 78°.

Position of ship: 26° 25′N., 53° 40′E.

Note. Dr. D. H. Cushing, of the Ministry of Agriculture, Fisheries and Food, comments as follows:

"I think that the interpretation of the phenomenon reported is right. We have seen a similar effect in the North Sea without the phosphorescence. When a shoal is recorded near the surface, the presence of fish breaking the surface is sometimes noticed."

S.S. *San Leopoldo.* Captain J. A. Whyborn. Lyttleton to Mena al Ahmadi. Observer, Mr. R. G. Broderick, 3rd Officer.

17th April, 1956, at about 2030 S.M.T. When in 26° 23′N., 54° 38′E., about 8½ miles NW. of Jazíreh-e Fárúr, a strange effect was noticed on the sea surface, about 2 miles away on the port bow. On approaching the area large bands or ripples of faint light appeared to be travelling in a confused way across the surface. Further inspection showed that these bands were spreading out from several central points distributed fairly evenly over an area about 2 miles across, in the same way as the circular ripples produced by raindrops in a puddle of water. Each band was about 70 yd wide and gave a faint white light. They spread, in unison, from the various central points, at intervals of a little more than 1 sec. They travelled at a considerable speed, so that by the time one circular band was formed the previous one was vanishing, at a radius of about ½ mile. When first seen it was supposed that the effect was being produced by moon shadows, as the moon was at an altitude of about 35° in the west, and there was a large number of small misty clouds. The clouds were, however, all moving in the same direction and could not have produced the effect of localised circular ripples. There was some general phosphorescence in the water but the presence of moonlight made observation of this difficult. The depth of water was about 24 fm according to the chart. The phenomenon was also seen by the helmsman and the lookout.

Note. This is a very valuable observation, as it provides us with a second instance of the spreading out of luminous circular bands from a centre. The only previous observation of a similar kind that we know of is that of M.V. *Scottish Eagle*, published on page 78 of the April 1956 number of this journal. The differences between the two observations are very interesting. In the present one a number of centres were seen in operation at the same time with one circular band from each, disappearing as the next one emerged. In the previous observation only one centre was seen and the accompanying sketch showed four concentric bands visible simultaneously.

M.V. *British Caution.* Captain D. E. O. Arthur. Fao, Iraq, to Venice. Observer, Mr. Scott, 3rd Officer.

30th May, 1956, about 2245 S.M.T. When in approximate position 26° 30′N., 54° 41′E., about 14 miles E. of Kais (Qais) Island light-vessel, lights appeared on the horizon resembling those of a town bearing roughly SW. There was, however, no town in this direction. When examined with binoculars the appearance of a town still persisted, with the addition of a shimmering effect, probably due to abnormal refraction. Some minutes later the lights appeared to merge together and come nearer the ship, and then resembled a luminiferous island parallel to which the vessel was steaming at a distance of about a mile. Patches of luminosity then began to appear, each about 6 ft across, arranged in lines which were spaced a cable apart; they crossed the bow from port to starboard, extending towards the main body of light. The lines then became wider and more numerous, but the patches composing them did not increase in brightness. The patches seemed to be on or above the sea surface, but were not affected by the waves.

After a further few minutes a change occurred. The parallel line formation disappeared and the patches were seen to be moving fairly slowly in an anticlockwise direction round circles of from 100 ft to 300 ft in diameter. When the vessel passed through a circle the patches of light disappeared on reaching the ship's port side and reappeared in the same formation on the starboard side. After about 20 min the whole effect ceased near the ship but was still seen in the distance on the starboard quarter. The vessel continued on the same course, 113°, and at the same speed. After a further 15 or 20 min more circles appeared, of varying sizes. The patches on the starboard side were small, about 1–2 ft in diameter, and were rotating in circles of about 20 ft diameter. After 10 min these dropped astern and no further phosphorescence was seen.

The moon had risen, bearing 109°, but the phenomena observed were definitely not moonlight reflections on the water. These reflections were orange in colour and were affected by the waves, while the circles of luminescence were pale bluish-white and steady.

At midnight the weather was fine and clear, wind WNW., force 2, sea slight. Air temp. 81°F, sea 85°.

Note. The above interesting observation was forwarded to us by Mr. N. Peter, Lecturer, South Shields Marine and Technical College, to whom Mr. Scott had sent it. It affords a new example of the amazing variety of forms which the phosphorescence of the sea can assume. The revolution of luminous patches round the circumference of circles has, so far as we know, not been placed on record before.

Macassar Straits

M.V. *Naticina.* Captain J. A. McGherrie. Kawasaki to Balik Papan. Observer, Mr. W. I. Simpson, 2nd Officer.

13th June, 1956, 1828 G.M.T. Vessel passed through an area of flashing phosphorescent sea. The phenomenon took the form of circular patches approximately 6 ft in diameter, spaced about 4 ft apart, which flashed every 4 sec. Each flash appeared to come from exactly the same spot as the previous flash.

Soundings, 43 fm. Air temp. 78°F, sea 84·2°. Sky 8/8 Cb (type C_L9) with heavy thunder and lightning about 15 min previously. Moderate rain at time of phenomenon, which lasted for 35 min and then slowly faded away.

Position of ship: 1° 24′S., 117° 06′E.

SUDDEN UPRISING OF FISH AND PHOSPHORESCENCE

Arabian Sea

M.V. *Dagmar Salén.* Captain S. Isenberg. Bandar Mashur to Kwinana, Western Australia. Observers, the Master, Mr. R. Fredin, 1st Officer, Mr. T. Strömberg, 2nd Officer, Mrs. I. Strömberg and Ordinary Seaman A. Korvo.

14th April, 1956. At 1715 G.M.T. the ship was over a depth of about 2,000 fm. The sea was dead calm and the sky was cloudless with stars shining and no moon. The ship's wake was slightly phosphorescent, but the rest of the sea was dark. Ordinary Seaman A. Korvo was on lookout duty on the bridge and Mrs. Strömberg was near him. They saw the water begin to " boil " by the sudden appearance of many thousands of fish, of about the size of mackerel. The master and the 1st and 2nd Officers were called from the chartroom to see this phenomenon, which is referred to in Rachel L. Carson's book, *The Sea Around Us.* After the observers had been watching for 2 or 3 min another phenomenon appeared. About 10°–20° forward of the starboard beam, at a distance of about 300–400 yd, phosphorescence bubbled up from below the surface in the form of a cone of light which spread at the surface into a circular luminous area, having a diameter of between 100 and 150 yd. This was repeated three more times at intervals of between 2 and 4 min, but each time in a different place.

Note. The above is an abstract of an interesting observation which was kindly sent to us by Vice-Admiral J. D. Nares, D.S.O., Director of the International Hydrographic Bureau, Monaco. The following comment is from Professor Hans Petterson, leader of the Swedish Deep-Sea Expedition:

" The observers on board the *Dagmar Salén* appear to have seen one of the rare occasions when the ' deep scattering layer ', observed in 1947 by the Swedish Deep-Sea Expedition in the *Albatross* as well as by other research ships, breaks through to the ocean surface with its phosphorescent plankton organisms and its fish shoals feeding on them. Observations of this kind appear to be well worthy of being brought before the general public through *The Marine Observer*."

Vice-Admiral Nares suggests that we may wish to make further remarks on this observation. The uprising from below the sea-surface of masses, balls or cones of luminous organisms spreading out to patches of various sizes at the surface, is a well-known, if not very frequent, phenomenon. We have published 11 previous instances of it in the last 33 years. The latest of these were the observations of S.S. *Leicestershire* and M.V. *Sussex* on page 136 of the July 1956 number. We have also had a number of observations of the appearance of points or small patches of light on the surface, which rapidly expand into larger areas, no uprising from below the surface having been seen.

METEORS

North Atlantic Ocean

S.S. *Paloma Hills*. Puerto le Cruz to Portland, Maine. Observer, Mr. H. A. Fleet, Chief Officer.

5th March, 1956, 0906 G.M.T. A meteor was observed moving from Dubhe, bearing 330°, altitude 29°, towards Deneb, bearing 049°, altitude 24°. When first sighted, and until bearing N., it was dim and appeared orange in colour. After bearing N. and until disappearing, the brightness was increasing in intensity, and there was a trail of considerable length. Two small balls of light, one behind the other in the trail, changed colour from orange to green and then to white. When disappearing near Deneb the trail broke up into several pieces, faltering in velocity and fading as it started to distend. Duration approximately 6–8 sec.

Position of ship: 21° 46′N., 65° 40′W.

C.S. *Lord Kelvin*. Observer, Mr. J. Moore, 2nd Officer.

21st April, 1956, 0105 G.M.T. A large and vivid meteor was observed bearing 080°, altitude approximately 15°, which was below and to the left of Arcturus. It appeared oval in shape, and lighted up all the eastern part of the horizon. It was an intense white in colour, gradually decreasing in intensity and leaving a reddish-white trail. Duration of flight about 5 sec. Sky cloudless and moon (three days from full) shining brightly.

Position of ship: 39° 30′N., 69° 40′W.

Note. The observations of C.S. *Lord Kelvin* and S.S. *Paloma Hills* were forwarded to us by the Director, Canadian Meteorological Division.

Arabian Sea

S.S. *City of Derby*. Captain W. G. McCulloch. Bandar Shapur to Mombasa. Observers, Mr. D. Turner, 2nd Officer, and Mr. M. J. Swift, 3rd Officer.

19th April, 1956, 1500 G.M.T. Unusually bright meteor observed, bearing 020°, about 40° altitude. First appeared in very bright burst of white light, then fell steeply to about 10° altitude with long vivid green trail.

Position of ship: 15° 40′N., 57° 15′E.

Central American waters

S.S. *Pacific Reliance*. Captain P. F. Owens. Los Angeles to Balboa. Observers, Mr. J. A. Lee, 3rd Officer, and Mr. W. J. Jennings, Radio Officer.

11th May, 1956, 0220 G.M.T. An exceptionally bright greenish-red meteor was observed in a NNW'ly direction from the vessel. It appeared for approximately 3 sec, falling from altitude 45° to altitude 10° through the constellation of Ursa Major, and lit up the area brilliantly. It was very large, about equalling the apparent size of the sun.

Position of ship: 7° 54′N., 79° 49′W.

Indian Ocean

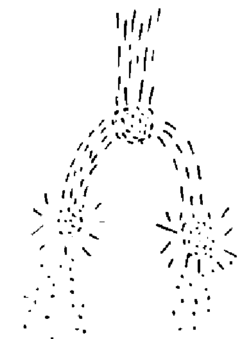
M.V. *Port Lincoln*. Captain E. J. Arnold. Fremantle to Hull. Observer, Mr. J. H. Lloyd-Davies, 3rd Officer.

6th May, 1956, 2213 G.M.T. A meteor was observed approximately 5° SE. of Arcturus and disappearing in the vicinity of Unuk (α Serpentis). Of exceptional brilliance, white in colour, it illuminated the heavens within a path of 4°–5° on either side of it as it travelled. It was visible only for about 1 sec. Sky covered with a very thin semi-transparent layer of Cs.

Position of ship: 7° 00′S., 67° 01′E.

S.S. *Baron Renfrew*. Captain W. Warden. Lourenço Marques to Port Elizabeth. Observer, Mr. G. Downie, 2nd Officer.

25th June, 1956. At 2315 G.M.T. a bright white flash was seen between Mars and Canopus, slightly nearer to Canopus. The flash was followed by a fireball or meteor,



which fell vertically and then broke in two, each part disintegrating before disappearing. Its bearing was approximately SSE. and its altitude from 40° to 15°. The estimated time of visibility was 2–3 sec and the magnitude that of Venus. Wind NNE., force 3–4. Cloud, 2/8 Ci. Clear moonlight, cloud to northward.

Position of ship: 33° 35′S., 27° 20′E.

South Pacific Ocean

S.S. *Mataroa*. Captain R. G. James, R.D., R.N.R. Wellington to Balboa. Observer, Mr. L. Mounsey, 3rd Officer.

10th May, 1956, 0845 G.M.T. A bright meteor of a yellowish colour and of about the same magnitude as Arcturus, was observed in the SE. It appeared about 5° below and to the left of α Pavonis at approximately 15° altitude and travelled westward in a straight line, falling very slightly. The body was visible for approximately 3–5 sec and covered about 15° of arc. A reddish trail about 5° long persisted for about 6 sec after the body disappeared. Sky 2/8 Cu, but clear in direction of observation.

Position of ship: 27° 42′S., 135° 25′W.

11th May, 1956, 0622 G.M.T. A brilliant meteor was observed in the SE. at about 35° altitude, bearing 140°, near α and β Arae; it disappeared at approximately 30° altitude, bearing 115°. The arc of flight was of the order of 25° and the body was visible for about 5 sec. It travelled in a straight line, leaving a yellowish trail about 3° long which persisted momentarily and then faded. When the meteor was first seen its magnitude was about equal to that of Vega, but, in the middle of its flight, it became brighter than Jupiter (magnitude 1·7) before fading.

Position of ship: 25° 21′S., 130° 44′W.

The Weather Forecast

By P. F. McAllen

(Reproduced by kind permission of the Editor of *The Sperry Review*)

(Mr. McAllen, who may be well known to some of our readers as a weather forecaster on B.B.C. Television, is also a keen yachtsman. He has spent much of his spare time sailing on the Solent in small one-design yachts, and has occasionally raced during Cowes week.)

From the remotest periods, man has practised the art of weather forecasting. Before the advent of modern scientific aids, predictions were confined mainly to changes in local weather conditions based on observation of wind and sky, but in its more sublime form the art has been treated in the writings of more than one eminent philosopher. In recent years, the growing need of mariners and aviators to have precise information of weather conditions likely to be encountered on their intended routes has been largely responsible for bringing about the development of weather forecasting from a naïve art to a scientific study. Thus, apart from its many other functions, the weather forecasting service has come to comprise an essential part of the complex system of modern transportation.

Reliable and frequent weather observations by thousands of skilled observers on land, sea and in the air form the foundation upon which all forecasts are made. The observations are plotted symbolically on an outline map at regular intervals throughout the day and night. The maps give the forecaster a synopsis of the current weather situation and, for this reason, they are called " synoptic charts ".

No country could forecast weather effectively without the co-operation of its neighbours. For example, when a forecast is made for 24 hours ahead for the British Isles, the forecaster needs to study synoptic charts over an area which covers the whole of Europe and the North Atlantic, bounded by Greenland in the north and the Mediterranean in the south. If then he wished to give an outlook for a further 24 hours this area might have to be extended westward to include North America and eastward well into Asia.

To make this possible there exists the World Meteorological Organisation, with its headquarters in Geneva, one of the many functions of which is to co-ordinate the arrangements for exchanging information. Weather observations from the majority of countries are interchanged and an internationally agreed code is used for transmitting them. The international weather code not only enables reports to be passed by land-line or radio in a compact form, but also makes it possible for the reports to be understood by meteorologists of all nations irrespective of language. For the meteorologist, the political divisions of the world are virtually non-existent and he has a share in what must be one of the best examples of international co-operation in being.

Observing weather is, in itself, a specialised branch of the weather service, and surface observations are prepared in a standard form to include the following information:

(*a*) barometric pressure and barometric changes;
(*b*) temperature and humidity of the air;
(*c*) direction and speed of the wind;
(*d*) type, height and amount of cloud;
(*e*) visibility;
(*f*) details of past and present weather.

Apart from the standard instruments such as barometers, wet and dry bulb thermometers and other equipment that the meteorologist has at his disposal for recording details of surface weather conditions, a number of observing stations have special facilities to enable upper-air observations to be made.

At sea, information is supplied by ships which take part in a voluntary reporting scheme. About 500 British cargo and passenger vessels take part and their reports are extremely valuable. Often, when important weather development is taking place at sea away from the main shipping lanes, the forecaster would give much to have many more ships' reports on his chart. Additional and important knowledge

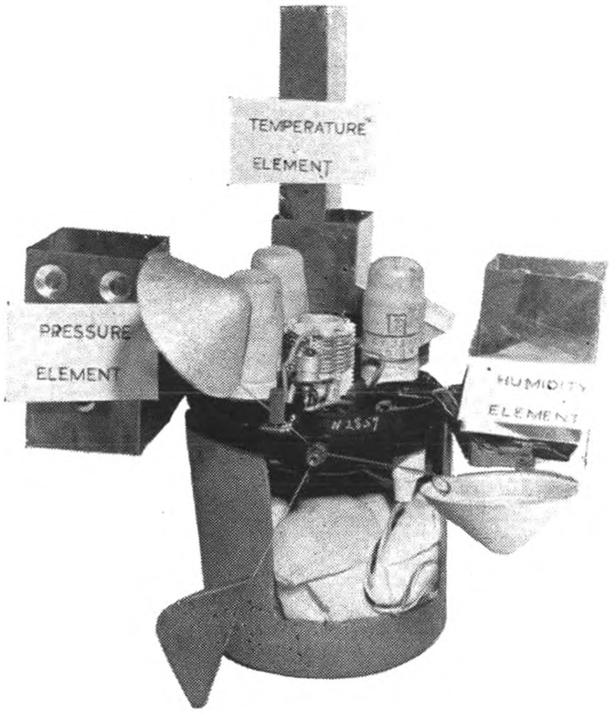
(*Opposite page 96*)

Cumulonimbus cloud observed from S.S. *Empire Fowey* (see page 82).

Photo by R. B. Woodcock

Crack made by the forefoot of M.V. *British Peer* in fast-ice near Stockholm (see page 88).

(*Opposite page 97*)



A radio-sonde (see page 97) with the covers removed to reveal its component parts. A small accumulator to provide power for the radio transmitter is carried in the lower compartment.

A Met. Hastings of No. 202 Squadron, Royal Air Force, about to take off from Aldergrove on its long flight out over the Atlantic.

has been gained in recent years about the weather by the establishment of ocean weather ships at strategic stations to maintain a constant watch on the weather.

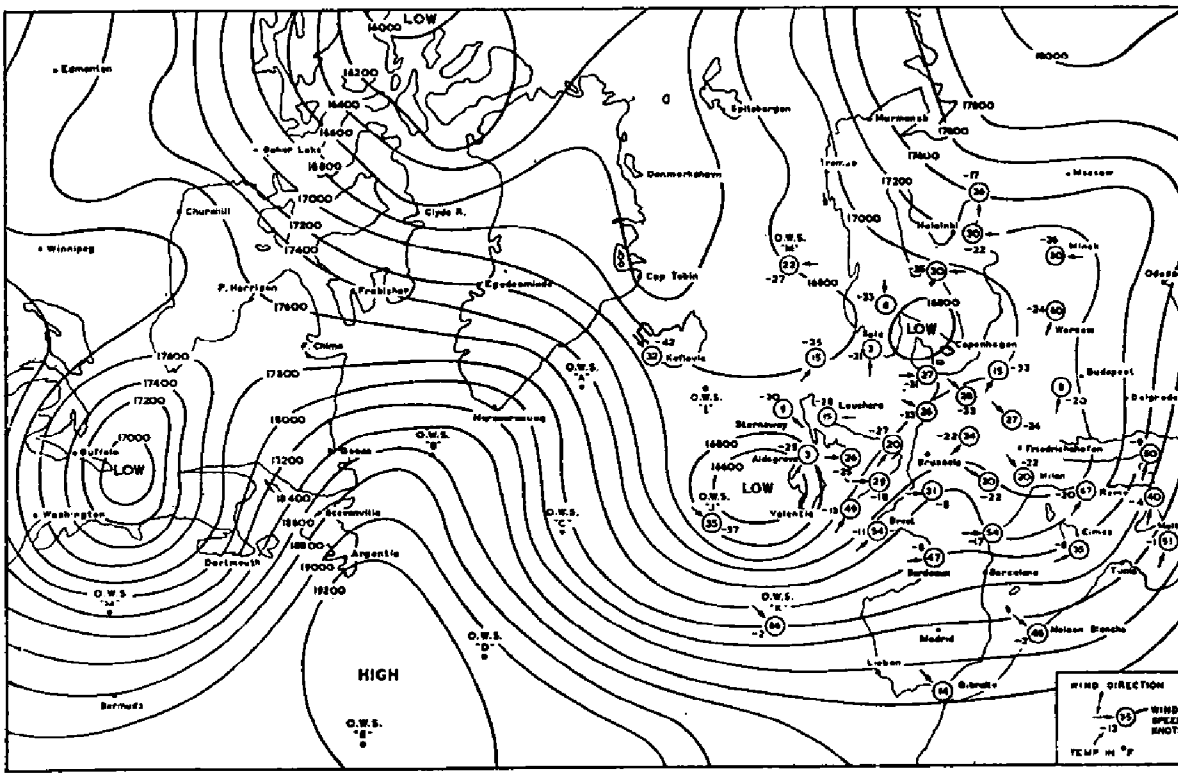
To supplement this information in the vicinity of Great Britain, weather reconnaissance flights are made by aircraft of the Royal Air Force operating from R.A.F. Station, Aldergrove (see photograph of a Met. Hastings on opposite page). These aircraft fly on a triangular track in order to explore a wide area over the Atlantic Ocean. At the end of the first leg, which is normally about 700 miles in length, an ascent is made to approximately 18,000 feet. The second leg is flown at this high level while the return leg is made at low level again. Complete weather observations are transmitted to base every 50 miles. In addition, many R.A.F. and civil aircraft supply weather information whilst making long flights in the normal course of their duties or passenger schedules, and a special flight, operating from Worcester, makes regular high altitude ascents for the purpose of obtaining meteorological data.

With the large number of observing stations and also the many separate forecasting stations in each country, the work of individual stations must be co-ordinated from national Central Forecasting Offices. These national centres maintain constant communication with each other in the reciprocal transmission of all coded observer reports, and the organisation depends upon a highly efficient system of communications. Although radio is used as a means of communication with some overseas stations and with ships, the main system in the British Isles and in Europe is by the meteorological teleprinter system.

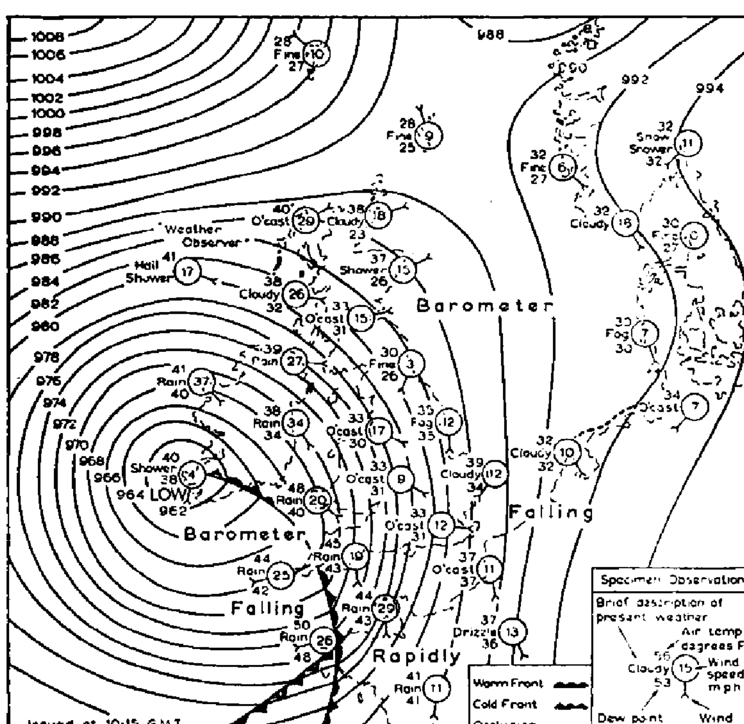
Information about conditions in the upper atmosphere is as important to the forecaster as the surface observations and, in addition to the use of high-flying aircraft, an instrument known as the radio-sonde is employed to obtain this information. The radio-sonde (see photograph on opposite page) was first developed shortly before the last war, and is a device incorporating a lightweight radio transmitter and three meteorological instruments to measure air pressure, temperature and humidity. It is lifted by a free balloon and as it rises the flow of air causes the three cups on the " windmill " to rotate after the fashion of an anemometer. Attached to the rotating spindle is a three-way switch which connects the radio transmitter to each of the three measuring instruments in turn during rotation. As each instrument is " switched in " it transmits a note, varying in pitch according to the values registered by the instrument. The radio-sonde is carefully calibrated with ground equipment so that the pitch of the note transmitted corresponds with known values of pressure, temperature and humidity. The balloon also carries a reflector of metallised nylon mesh to enable its passage to be followed by radar. In this way the speed and direction of the wind can be determined as its ascends. One advantage of the radio-sonde is that it can ascend to a greater height than the aircraft, but in fact both methods have their own applications and both are used regularly to-day.

With this information, which is normally obtained at 12-hourly intervals, the forecaster is able to draw upper-air charts showing the changing conditions at various levels high above the surface, which he studies in conjunction with the synoptic charts when preparing a forecast. Another aid which is prepared from information obtained by upper-air soundings is a special type of graph known in the British Meteorological Office as a tephigram. The tephigram is drawn up by relating the temperature and dew point curves from a radio-sonde ascent and yields essential information regarding the stability of an air mass and, so, the likelihood of convection cloud formation and precipitation. The dew point—being the temperature to which air must be cooled to become saturated—is often a critical factor to be considered by the forecaster. By studying a representative upper-air ascent on a tephigram, it is possible to determine not only whether showers are probable, but also what will be the height of the cloud base and tops, and the heights at which an aviator would expect to experience icing conditions in the cloud.

Yet another aid prepared by the forecaster is that known as the prebaratic chart. It is modern practice in the British Meteorological Office to construct such a chart,



Two diagrams showing the relationship between the Upper Air Chart covering a wide area of the northern hemisphere and the Synoptic Chart showing surface weather conditions during the same period over the British Isles and Northern Europe. From information obtained by upper air soundings, contour lines are drawn on the chart (above) representing the height of selected pressure levels. In this case the contour lines show the height in feet of the 500-millibar pressure level. Upper winds blow along these contour lines so they may be treated like the isobars on the surface chart (right) and aircrew planning a long-distance flight can see the upper winds they are likely to encounter along their route. The surface charts give details of weather conditions at the point of departure and destination. The similarity of the pattern on the two charts over the European area is readily discernible, and an interesting point to notice is the typical displacement towards the south-east of the centre of the low pressure system at the surface in relation to its centre in the upper atmosphere.



and its purpose is to show how the various pressure systems and fronts are expected to develop and where they will be positioned 24 hours later. The charts are prepared in the forecast room at the Central Forecast Office, and are based on calculations and deductions made from surface and upper-air observations over a large area of the northern hemisphere. All forecasting stations receive C.F.O. prebaratic charts four times a day, and they help to maintain a basic uniformity in the forecasts issued by individual stations. An accurately constructed prebaratic chart is, however, only a stage in the preparation of a forecast, as there is still the task, and often the more difficult one, of interpreting the weather likely to be associated with it. It is by the forecaster's description of the weather expected that his work is judged. He would get little credit for forecasting accurately the arrival of a front if the weather he had associated with it in his forecast had changed appreciably *en route.**

Among the most important features of the weather in temperate latitudes are fronts. These are lines drawn along the boundaries between masses of air having different physical characteristics and, in particular, differences in temperature. Since the two main air masses that affect the temperate latitudes can be said to be largely of " tropical " or " polar " origin, by far the most important front is the one that divides them. This is called the polar front, and although it often becomes a complex feature on the chart, and at times rather indistinct, it can usually be traced around the globe in both the northern and southern hemispheres. Its precise position is constantly changing but generally it can be found over the oceans somewhere between latitudes 35° and 65°†. The position of this front can be a critical factor for the forecaster, as nearly all the deep and intense depressions experienced in temperate latitudes are formed at points along this line and a knowledge of its exact location is of considerable value in the determination of future trends.

A forecaster's task is to deduce, by scientific estimation, and experience, the most likely sequence the weather will follow in the future. His assessment must be made from a careful study of all available information of the existing weather conditions over a wide area. When isobars form a conventional pattern on the synoptic chart, such as in a well-defined depression or anticyclone, certain orthodox weather conditions normally prevail, according to the time of year, and forecasting the future trend can be relatively straightforward. Wind speed and direction can be determined from a study of the isobars; the closer the isobars, the greater is the " pressure gradient " and the stronger is the wind. Future changes in wind speed and direction are apparent from tracing the movement of the pressure system as a whole, while individual variations in barometric pressure provide an indication as to the tendency; that is to say whether, for example, a depression may be intensifying or an anticyclone weakening.

However, the problems are not always straightforward and many other factors have to be taken into consideration. A knowledge of the source of an air mass affecting any particular region is essential to accurate forecasting. A mass of air that has remained, say for a week or so, in the circulation of an anticyclone in the Azores region will gradually become warm and humid and have quite different characteristics from air that has spent some time in Polar regions.

Apart from the general description of " tropical " and " polar " air masses, other important distinctions must be made because once these air masses leave their source regions, their passage over land or sea into higher or lower latitudes can change their temperature and humidity considerably. For this reason, subclassifications of " continental " or " maritime " are also made.

There are marked differences in air masses of the same type, and a forecaster knowing the origin of an air mass and, therefore, broadly the type of weather to be expected, would still have to make a careful study of his upper air ascents and surface observations before he could assess the more exacting details of the weather

* A prebaratic or forecast chart, together with a printed statement of existing weather conditions and a weather forecast, is now issued to all vessels leaving the port of London.

†The polar front has a tendency to move polewards in summer.

as is required in a forecast. For example, polar maritime air over the British Isles is usually associated with bright spells and, on many occasions, showers. However, before the forecaster is in a position to say whether or not showers are probable, and if so, how frequently they are likely to occur, he must be able to determine the stability of the air mass with which he is dealing. As polar air moves over a warmer land or sea, convection clouds develop when currents of air warmed at the surface rise vertically and, in rising, are cooled adiabatically (or through expansion). Once the air is cooled to its dew point, continued rising leads to condensation in the form of the familiar cumulus clouds which may or may not produce precipitation.

The more readily these convection currents develop, the more unstable the air is said to be and the greater is the likelihood of precipitation. On many occasions the surface sea temperature is not high enough to set the vertical air currents in motion, but the land usually does become heated by the sun sufficiently to do so. A well-known example of this is provided by the cloud covering which often forms above an island during the hours of daylight and which is visible on the horizon long before the land itself comes into view. By considering the air temperature and dew point information provided on the tephigram in conjunction with the wind speed and surface temperatures, the forecaster can usually arrive at the degree of instability to be expected.

However, the unexpected development of a trough of low pressure, which can form readily in unstable air and which is frequently difficult to detect on the chart, could quite easily result in completely overcast conditions with almost continuous rain when brighter weather had been forecast. The least of the forecaster's worries on a day when the air is unstable is visibility, because the impurities in the air are quickly dispersed by the rising air currents and, except in the heavier showers, visibility is usually good.

Many examples could be given of occasions when the forecaster works to extremely fine limits. The timing of the arrival of a rain belt, or perhaps the formation and development of a depression, often allows him only a very small margin of error in his calculations. Some of his most difficult problems perhaps are those encountered when conditions appear to be favourable for the formation of fog and, in particular, radiation fog. On a clear and cloudless night the ground cools rapidly due to radiation. If the air is very still and the temperature of the ground falls below the dew point of the air in contact with it, the result is usually a deposit of dew. On the other hand, if there is slight motion in the air in the same circumstances, fog will form. This is because still air is a bad conductor of heat or cold, but a slight wind will usually give sufficient turbulence to spread the cooling at the surface upward to a height of a few hundred feet. The density of the fog that forms will depend largely upon the humidity of the surface layer of air. To complicate matters still more, the effect of a further freshening of the wind under these conditions may result in the formation of low cloud instead of fog.

Although on some occasions a forecaster can feel quite confident about the formation of fog, on others when he forecasts fog he is well aware that a slight error in his estimation of the wind velocity could result in the fog turning out to be little more than dew or, perhaps, low clouds or even nothing at all. An error of one or two degrees in his estimation of the night minimum temperature, or the temperature at which he expects fog to form, can have a disastrous effect on his forecasts. It is almost inevitable that a weather forecast will have an element of uncertainty but, fortunately, with the advance of scientific knowledge and the increasingly comprehensive network of observing stations to provide meteorological data, serious errors are becoming less frequent.

There are, in the science of meteorology, a multitude of special conditions with which the forecaster must be familiar, according to the region in which he is located. Phenomena such as the Föhn wind of the Alps and the mistral in the Rhône Valley are caused by effect of the local topography, which must be studied by a forecaster in the area. Hurricanes, typhoons and cyclones are all intensified variations of the circular low-pressure systems that are known so well in these latitudes as depressions. They are known by their individual names according to the part of the world in which they occur. Miniaturised, but sometimes no less dangerous versions of the circular storm are exemplified in whirlwinds, dust devils and, at sea, waterspouts.

In many parts of the world, such as in the monsoon regions or the areas of the trade winds, the forecaster's task is greatly simplified by the general stability of weather conditions. It is in the temperate latitudes where changeable conditions prevail that the meteorologist's skill is taxed to the greatest extent.

The accuracy of weather forecasting has improved considerably during the last two decades and there is little doubt that further improvements may be expected in coming years. New instruments and new techniques are continuously being developed and introduced into general use. In particular, those investigations which are concerned with gaining a greater knowledge of conditions in the upper atmosphere are likely to have an important influence on the advancement of the science. Such investigations have resulted in an increase in the accuracy of forecasting the strong winds in the upper atmosphere which can be of great value to a long-distance airline operator. Furthermore, the relationship between the changing pattern of upper-air conditions and weather experienced at the surface is already becoming clearer and it is confidently expected that further research along these lines will enable the meteorologist to keep pace with the ever-increasing demands made upon him not only by the aviation, marine and other transportation organisations but also by a wide variety of general industries whose activities are dependent upon the weather.

Research in World Weather Patterns

By H. H. Lamb, M.A.
(World Climatology Branch, Meteorological Office, Harrow)

Variations in the extent of ice in the Arctic, and in the numbers of icebergs which affect the shipping lanes in the North Atlantic Ocean, are amongst the most dramatic manifestations of climatic change and variability.

Professional meteorologists, notably Sir Gilbert Walker[1] and C. E. P. Brooks[2, 3] in this country, have been interested in the interrelation between the general state of the atmospheric circulation and the amount of ice. This interest was prompted as long ago as 1922 by W. Wiese,[4, 5] of the Soviet Arctic Institute, who showed that characteristic shifts of a few degrees in the prevailing latitude of depression tracks tend to occur in the seasons following excessive development of ice, or alternatively of open water, in high latitudes. Amongst many other workers in this field the name of I. I. Schell[3, 6] is prominent. The idea of ice extent acting as an indicator of the behaviour of the atmosphere, and hence of our weather for some months or years ahead, has also been eagerly seized upon by many amateur weather prophets.

From the point of view of meteorology, icebergs which break loose into the temperate zone are of no consequence beyond that which arises from their ability to produce a more or less extensive layer of cold melt-water on the ocean surface. What is of some importance to the general circulation of the atmosphere, is the extent and distribution of extensive pack-ice. Nevertheless, Arctic ice is a much better indicator of the weather patterns which prevailed at the time of its formation than of the future condition of the atmosphere.

Ice is not the only feature of the earth's surface which, through its sluggish variations, is capable of affecting the heat budget of the atmosphere over very wide areas. The meteorologist is also concerned with variations in the extent of warm surface water on the oceans, and with the occurrence of dried out or waterlogged soil and persistent snow-cover. The magnitude of the influence of persistent

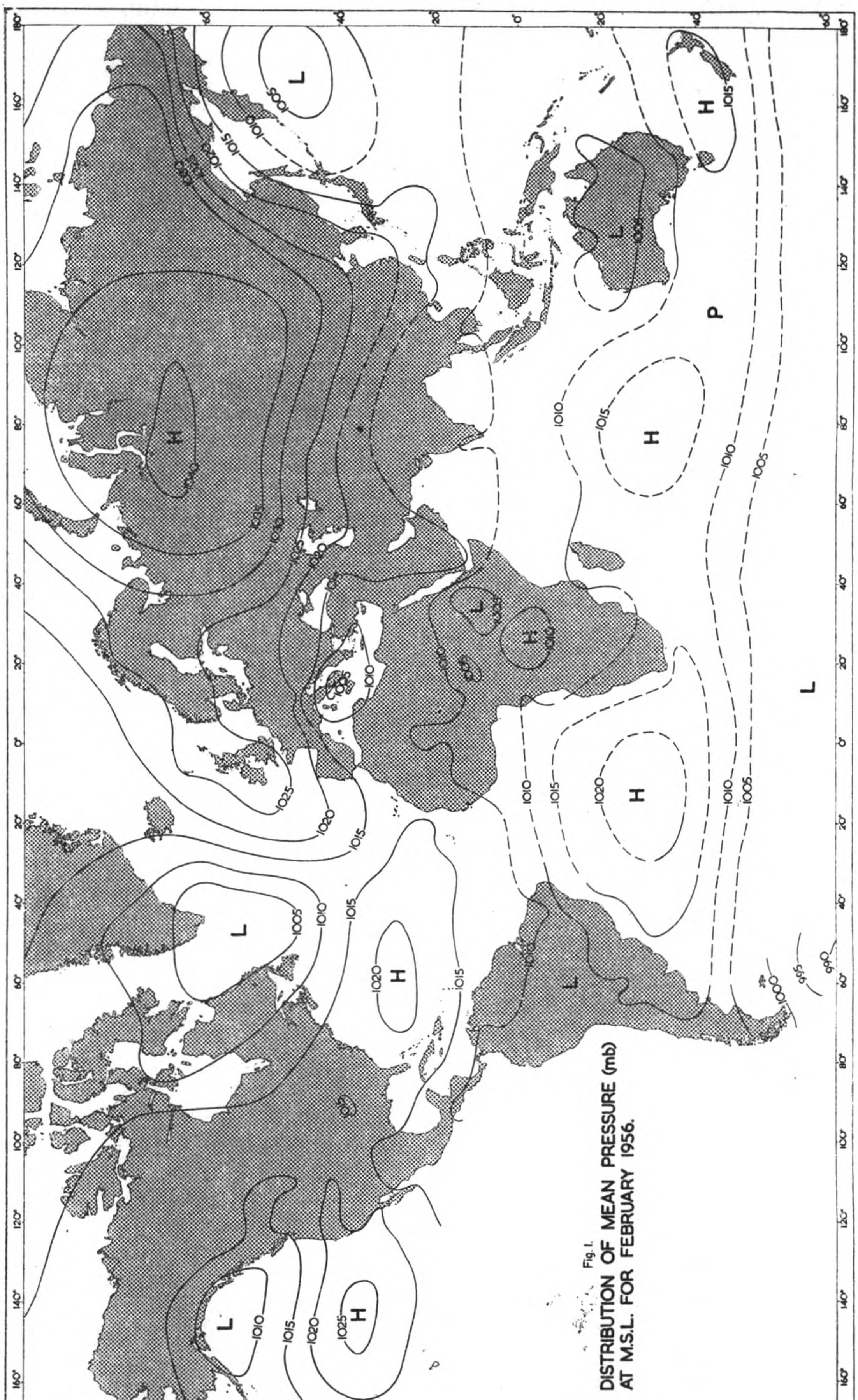


Fig. I.
WORLD DISTRIBUTION OF MEAN PRESSURE (mb) AT M.S.L. FOR FEBRUARY 1956.

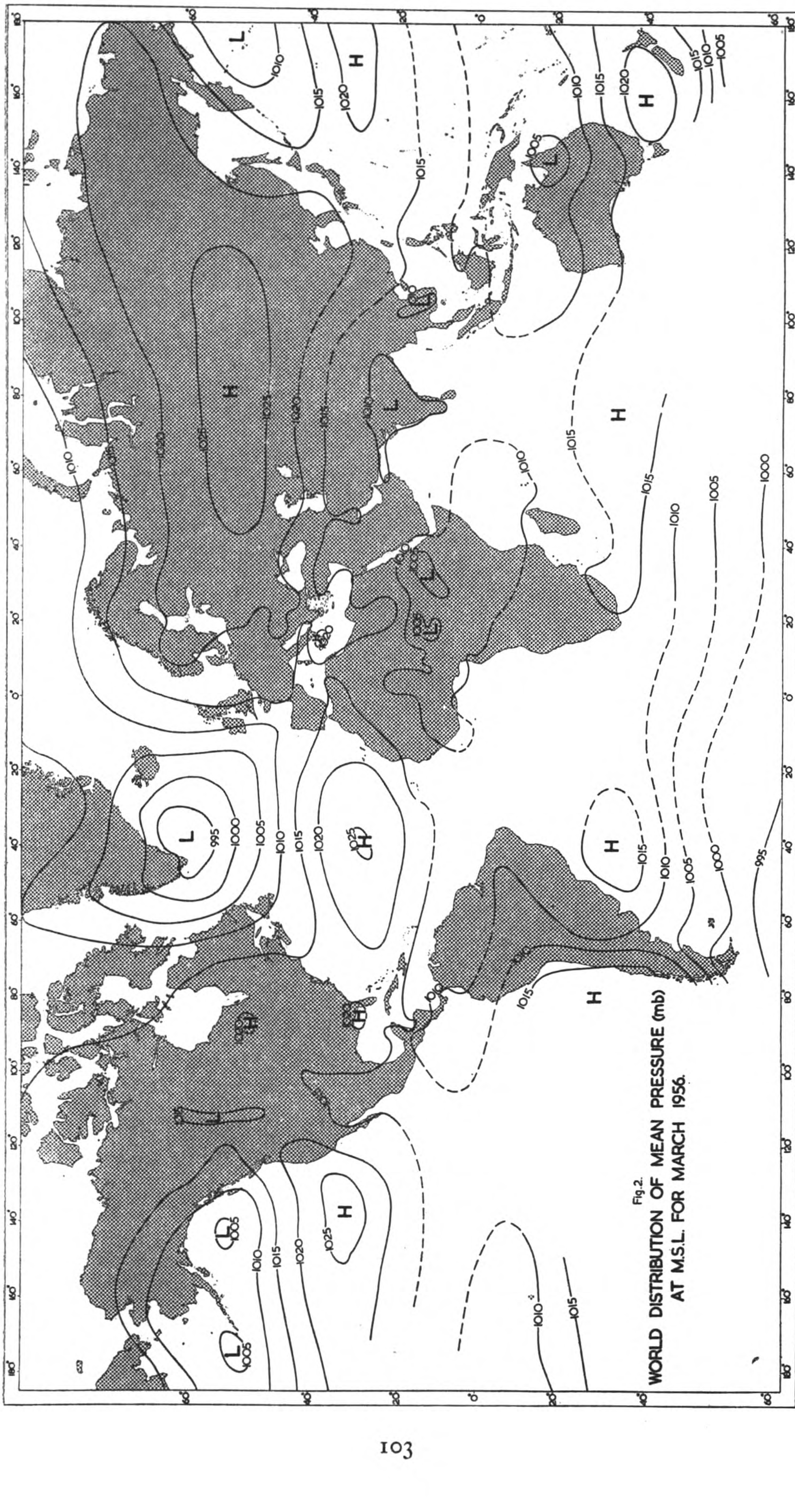
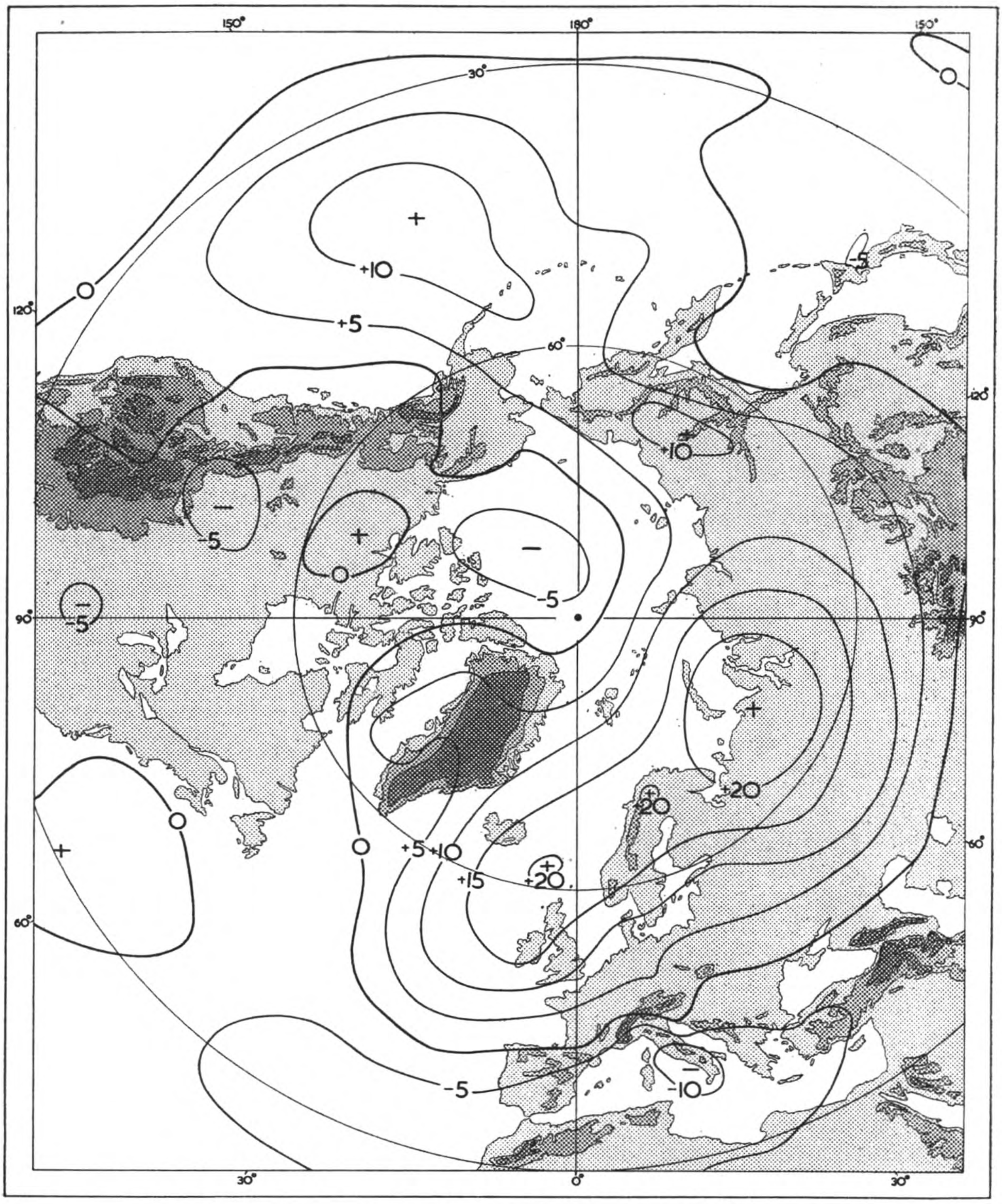


Fig. 2.
WORLD DISTRIBUTION OF MEAN PRESSURE (mb)
AT M.S.L. FOR MARCH 1956.



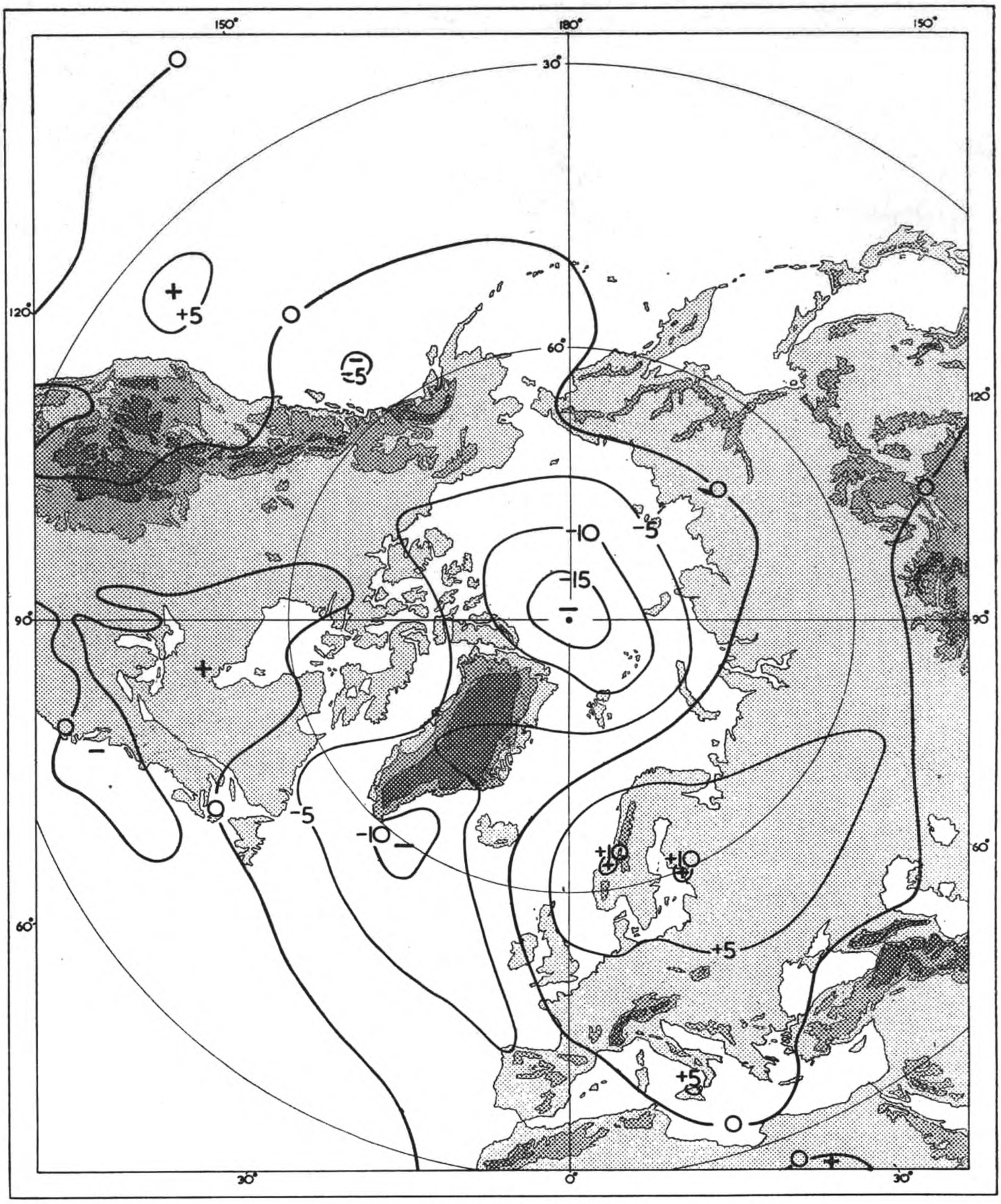
(Light shading indicates land below 1,000 m.; medium, 1,000–2,000 m.; dark, above 3,000 m.)

Fig. 3. Anomalies of pressure (mb) at M.S.L. for February 1956.

anomalies of surface temperature* associated with any of these items can only be settled by making careful numerical estimates of quantities, and by mapping the data on a world scale.

During the past few years, the Climatological Research Division of the Meteorological Office has been drawing maps representing the monthly values of pressure,

* Surface temperature anomalies are departures from normal surface temperature, measured in degrees.



(Key to shading as Fig. 3.)

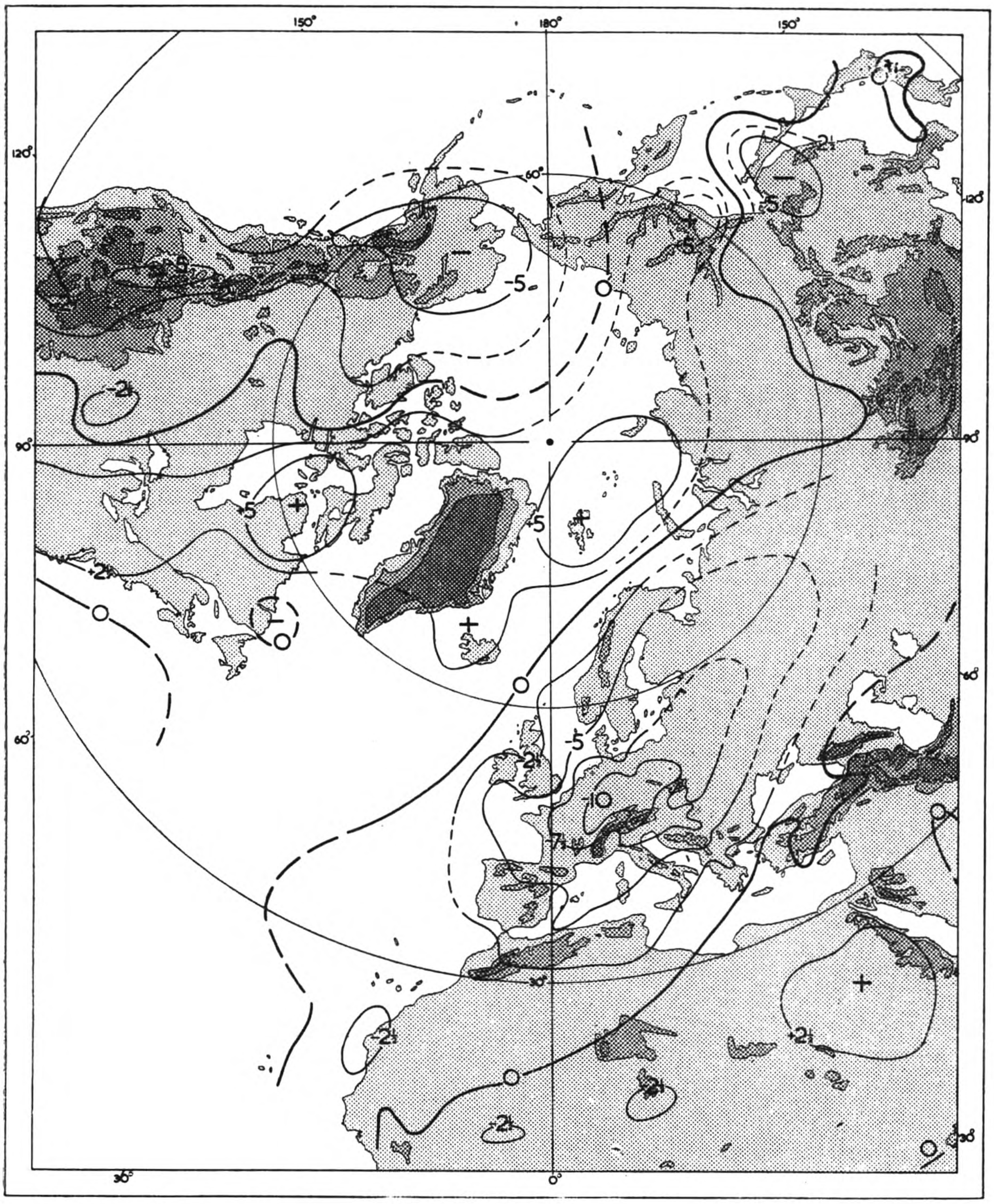
Fig. 4. Anomalies of pressure (mb) at M.S.L. for March 1956.

temperature and rainfall all over the world*. Since 1955, sequences of these maps have been subjected to study at regular monthly discussions, which have raised many points of interest.

This is essentially climatology applied to the service of the forecaster and especially likely to be informative in connection with long-range forecasting.

Samples of the maps are illustrated with this article. (The areas covered by

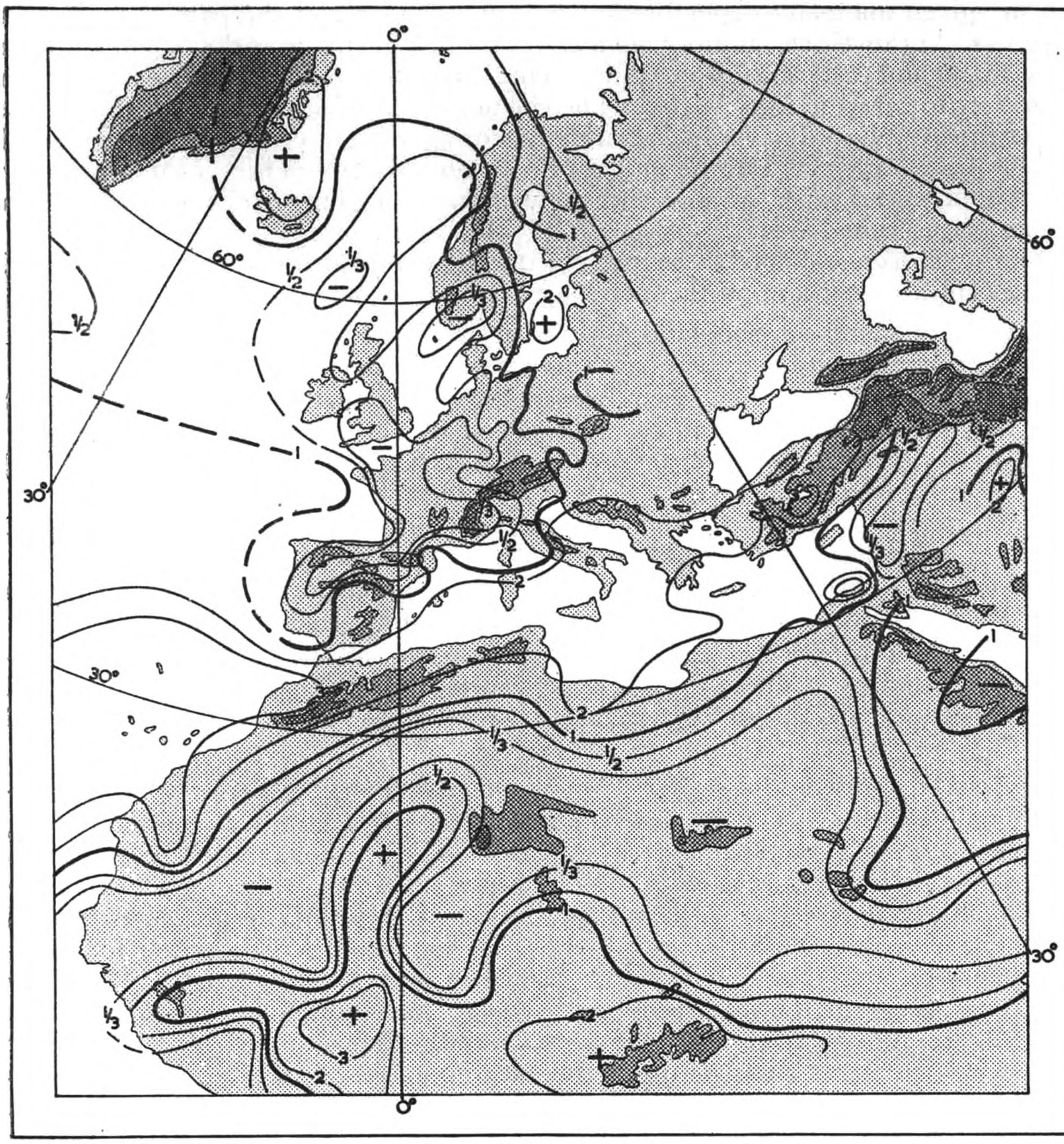
* Ice in the northern seas is not mapped as part of this routine. Its monthly distribution, so far as it has been observed, is given in the yearly volumes published by the Danish Meteorological Institute, Copenhagen (Isforholdene i de Arktiske Have).



(Key to shading as Fig. 3.)

Fig. 5. Anomalies of temperature (°F) for February 1956.

Figs. 3–6 have had to be cut down in order to get sufficient reduction for reproduction in *The Marine Observer*; alternate isopleths have been omitted from Figs. 3 and 4 for the same reason.) The welter of items shown on the rainfall maps (e.g. Fig. 6), many of which could be of some serious concern in the localities affected, is probably too much for the mind to grasp in its entirety. Rainfall patterns are not only governed by the larger scale atmospheric circulation but are strongly affected by the occurrence of heavy convection showers, which are often more or less accidental, and by the geography of the terrain in which each observing station is situated. Clearly, to foretell the amounts of precipitation to be expected promises



(Key to shading as Fig. 3.)

Fig. 6. Isopleths of rainfall, expressed as a fraction of the normal rainfall for the month, for February 1956.

to be a very hard nut for the forecaster to crack, however well he steeps himself in knowledge of his locality and its own characteristic effects.

If we are to arrive at a useful understanding of the large-scale features and controlling influences of the atmospheric circulation, we must try to describe and discuss the state of that circulation in terms of a very small number of significant items or indicators.

Our experience to date of the monthly maps of pressure distribution (which automatically describes the winds) and of temperature anomalies encourages the belief that the essential characteristics of the state of the general atmospheric circulation can be usefully described in terms of the five indicators enumerated below. We see, for instance, that anomalies of temperature affect regions of some size, this size being related to the dimensions and position of such features as quasi-stationary anticyclones and prevailing windstreams.

It seems, too, that there is plenty to be learnt about the prospects of persistence of any given anomaly, depending on the time of year and the part of the world affected. For instance, summer regimes established in July over the region between Greenland and eastern Europe, which includes the British Isles, have a considerable tendency to carry on into August. The characteristics of late winter which become apparent over Scandinavia in February, if not during the course of January, tend to dominate much of Europe and continue into March. These results must be attributed to the work[7] of an earlier generation, using similar charts, though of a much more limited area.

Our own discussions of these maps in the Meteorological Office at Harrow tend to concentrate attention on the following aspects:

(1) The search for some index of the overall intensity of the circulation in the northern and southern hemispheres respectively.

(2) The intensity of the main branches of the circulation—e.g. the brave west winds of middle latitudes, the trade winds, the polar easterlies (when these are recognisable) and any pronounced meridional (northerly or southerly) airstreams. The mainstreams of the upper westerlies which constitute the dominant flow in the upper troposphere—indeed through the greatest part of the mass of the atmosphere—also receives due attention.

(3) The search for " anchored " features—i.e. any major feature which behaves as if it were anchored—in the surface or upper level circulation.

(4) The position and intensity of the subtropical and higher-latitude anticyclones; of the dominant centres of the sub-polar cyclonic belts; and of the intertropical convergence (also known as the " meteorological equator ").

(5) The position and intensity of the main features of the Eurasian monsoon.

The maps, upon which these features are discerned and our discussions based, are a remarkable product of the co-operative effort of individual observers at the world-wide network of observing stations ashore and in ships at sea. The monthly figures for land stations are communicated to us by radio in the international exchange of abbreviated " Climat " messages on the fifth day of the following month. The isobars and temperature isopleths over the oceans are obtained by averaging values at the intersections of each 10° of latitude and longitude, taken from all the individual weather maps of the month; these are the ordinary synoptic maps drawn several times daily for the entire northern or southern hemispheres respectively in many main meteorological centres (e.g. Dunstable, Frankfurt, Paris, Washington, Pretoria and probably elsewhere also). In the case of the North Atlantic and much of the northern hemisphere, the values obtained in this way are further confirmed by similar information as derived from the daily maps of the German and Norwegian Meteorological Services.

The day may come when daily weather maps of the entire world are drawn and studied for forecasting purposes, though the chart material would have a formidable bulk—formidable alike for the mental digestion of the forecaster and the storage capacity of his archives. So far the monthly maps here illustrated are believed to represent the first continuing effort to study world weather patterns as they occur. Even this routine produces 19 maps a month, when the various elements for northern and southern hemispheres have been accounted for.

For the northern hemisphere our routine includes extraction of various types of data, which enables one to see at a glance how far the pattern presented by the monthly map was recognisably repeated on the majority of individual days of the month. The same procedures enable us to identify the actual point during any month when a persistent or set pattern developed and when it broke down.

The southern hemisphere, with its wide ocean spaces having very few islands and being only sparsely covered by shipping, still presents difficulties and, in fact, the required monthly values as yet only come to hand more than a year after the event. The basic daily charts make use of ships' meteorological logs after the vessels have returned to port. At present, therefore, this part of our study can be completed only for research purposes and not for current forecasting.

We are also in the difficult position of not knowing what values to take as normal in many of the least frequented regions. One cannot estimate anomalies until one has a reasonably defined normal value from which to measure departures. This position is being repaired as rapidly as possible: maps of average M.S.L. pressure in each month of the year for the uniform period 1900–39 over the entire northern hemisphere are now available from figures worked up in Germany from the 40 years daily weather maps (the *Historical Daily Weather Maps* produced by the United States Weather Bureau); figures for the southern hemisphere everywhere south of 20°S., averaged for the years 1949–53, have been published by the South African Weather Bureau. The missing zone, 0–20°S., is likely to be covered by data worked up in this country—very largely from material in the possession of the Marine Division of the Meteorological Office.

The illustrative charts here shown include for February and March 1956 the world pressure distribution in millibars and the northern hemisphere pressure anomalies. Temperature in °C departures from normal, and rainfall in percentage of normal (isopleths at 33, 50, 100, 200 and 300%) are reproduced for February only. The weather in Europe was dominated by the north European anticyclone in both months, illustrating the persistence of the general circulation patterns in late winter already alluded to. However, at the western fringe, the broad southerly airstream which had been in mid-Atlantic in February shifted east as far as the British Isles in March; even so, our eastern districts continued to come within the reach of the cold, dry, continental east winds for much of March. Notice how the extent of the region of abnormal cold in February is related to the course of the great westward moving current of Siberian air along the southern flank of the enormous continental anticyclone. The greatest temperature anomalies (10–12°C below normal) were in central Europe, but the greatest damage to vegetation was in France and Spain where cultivation concentrates on plants that are less able to stand abnormal cold. Vines, palms and olives were severely affected. West of this continental winter regime, the broad current of southerly winds in mid-Atlantic, extending as south-easterlies to Greenland and as south-westerlies to the limits of the Barents Sea, corresponds to a broad region of above-normal temperatures. The unusual warmth (mildness would be a better word) over northern Labrador and Quebec is harder to explain, but was probably due to the western position of the Atlantic depressions which swept in some Atlantic air and kept up enough wind to hinder the formation of the usual calm, surface inversion layer with its characteristically very low sub-freezing temperatures.

The January 1956 maps had been far different, associated with an unusually stable anticyclonic regime over most of North America, cold air reaching Florida and the Atlantic depressions being concentrated near Bermuda and in the north-eastern sector between Britain and Norway. A similar situation had maintained mild westerly winds right across central and southern Europe since November. Signs of the breakdown of this regime were first detected over North America from 22nd January onwards, and a radical change in the character of the European winter was feared. This change arrived with bitter easterly gales, and frost sweeping over the European plain, to reach England on the 31st.

It is hoped to devote a later article to discussing a comparison of the 1955 and 1956 summers as seen on these research charts.

REFERENCES

[1] MONTGOMERY, R. B. Report on the work of G. T. Walker. *Mon. Weath. Rev.*, Washington, Suppl. No. 39 (Reports on critical studies of methods of long-range weather forecasting), 1940, pp. 1-26.

[2] BROOKS, C. E. P., and QUENNEL, W. A. The influence of Arctic ice on the subsequent distribution of pressure over the eastern North Atlantic and Western Europe. *Geophys. Mem.*, London, **41**, 1928.

[3] SCHELL, I. I. Polar ice as a factor on seasonal weather. *Mon. Weath. Rev.*, Washington, Suppl. No. 39 (Reports on critical studies of methods of long-range weather forecasting), 1940, pp. 27-51.
[4] WIESE, W. Die Einwirkung des Polareises in Grönlandischen Meere auf die nordatlantische zyklonale Tätigkeit. *Ann. Hydrogr.*, Hamburg, **50**, 1922, pp. 271-280.
[5] WIESE, W. Polareis und atmosphärische Schwankungen. *Geogr. Ann.*, Stockholm, **6**, 1924, pp. 273-299.
[6] SCHELL, I. I. Inter-relations of Arctic ice with the atmosphere and ocean in the North Atlantic-Arctic and adjacent areas. *J. Met.*, Lancaster Pa, **13**, 1956, pp. 46-58.
[7] WIESE, W. Studien über die Erhaltungstendenz der mittleren monatlichen Temperaturanomalien. *Met. Z.*, Braunschweig, **42**, 1925, pp. 217-225.

Waterspouts observed at Ocean Weather Station I

By D. W. S. LIMBERT
(Formerly in the Marine Division, Meteorological Office; at present in the Antarctic with the Royal Society's Expedition for the International Geophysical Year.)

The meteorological log of O.W.S. *Weather Recorder* of 27th June, 1954, when the ship was at Station I (61° 00′N., 15° 20′W.), contained the following observation:

> Several waterspouts were seen between 1030 and 1100 G.M.T. in association with large cumulus and cumulonimbus. The cloud was in a line and appeared to be a weak cold front or instability trough line. . . . The waterspouts were not well developed but showed a cloud funnel (Fig. 1) and an area of spray on the sea surface below. They

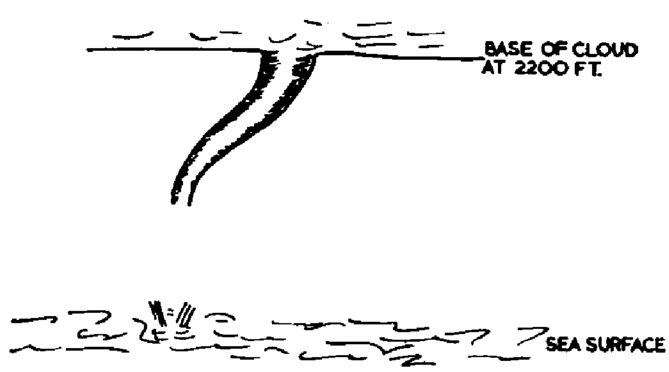


Fig. 1
Sketch of nearest waterspout observed (3 miles distant at 1100 G.M.T.).

> persisted for about five minutes or so each. These funnels were forming and dispersing within sight of the ship for the whole period. The cloud funnel and sea surface both showed plainly a marked core. The closest waterspout was between a quarter and a half mile from the ship at about 1030 G.M.T. The active area moved steadily southwards along the line of the cloud.

Apart from a similar report in August 1953—also at Station I—the Marine Division of the Meteorological Office has no record of any other report of waterspouts north of latitude 60°N. There were several features regarding the appearance of these waterspouts which were worthy of comment, and the availability of upper-air as well as surface data added to their interest.

At the time of the report Station I was on the eastern flank of a ridge of high pressure extending from the Azores High, and was situated in a northerly airstream, with the polar air east of the ship originating over the sea to north of Norway. It seems possible that a warmer subsiding air mass in the high-pressure ridge was deflected by the Icelandic land mass, especially by the mountains in the south, resulting in a strong outflow at the western end of the mountains. The small polar low which had developed by 1200 G.M.T. just west of Station I, and subsequently moved away in a southerly direction (Fig. 2), was probably associated with this situation. At Station I, pressure was rising throughout the day except for a short period at the time of the waterspouts. The relevant surface observations are shown in Table 1.

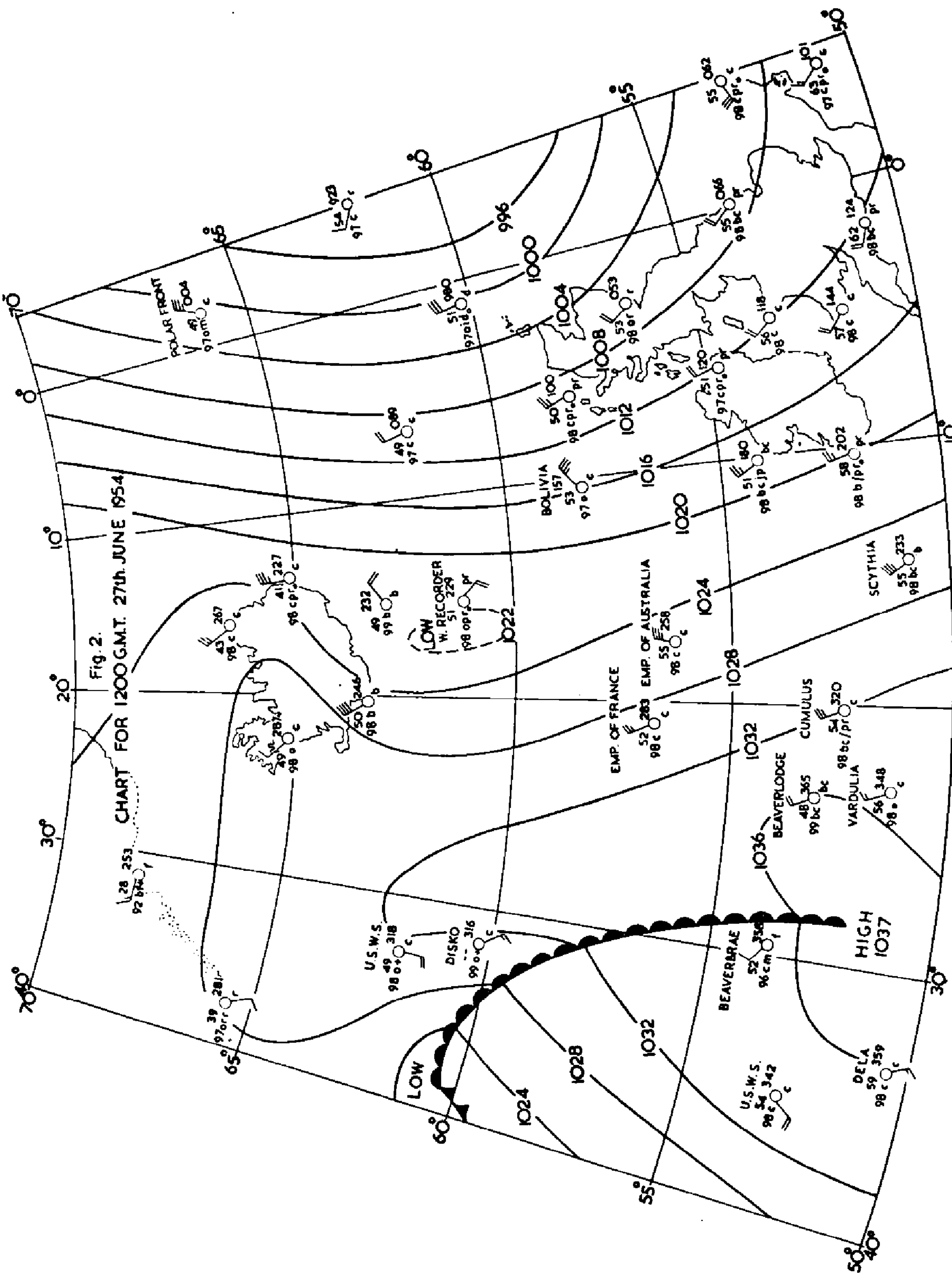


Fig. 2. CHART FOR 1200 G.M.T. 27th JUNE 1954

A. H. Gordon[1] lists several conditions as being favourable to waterspout formation. The two considered to be the most important are a superadiabatic lapse rate* in the layer 50 millibars (about 1,500 feet) thick immediately above the surface and a conditionally unstable lapse rate† to high levels. The 0200 G.M.T. ascent (radiosonde and radar-wind observation) at Station I indicates that the lapse rate slightly

* A superadiabatic lapse rate is a temperature decrease with height greater than the dry adiabatic rate of 5·4°F per 1,000 ft.

† A conditionally unstable lapse rate is one lying between the dry adiabatic rate of 5·4°F per 1,000 ft and the saturated adiabatic rate of about 3°F per 1,000 ft. Thus, if the air should become saturated it would also become unstable.

exceeded the dry adiabatic through the lowest 65 millibars (approximately 2,000 feet) and both the 0200 and 1400 G.M.T. ascents showed conditional instability (Fig. 3). Although at 0900 G.M.T. there was no unusual wind shear*, by 1400 a

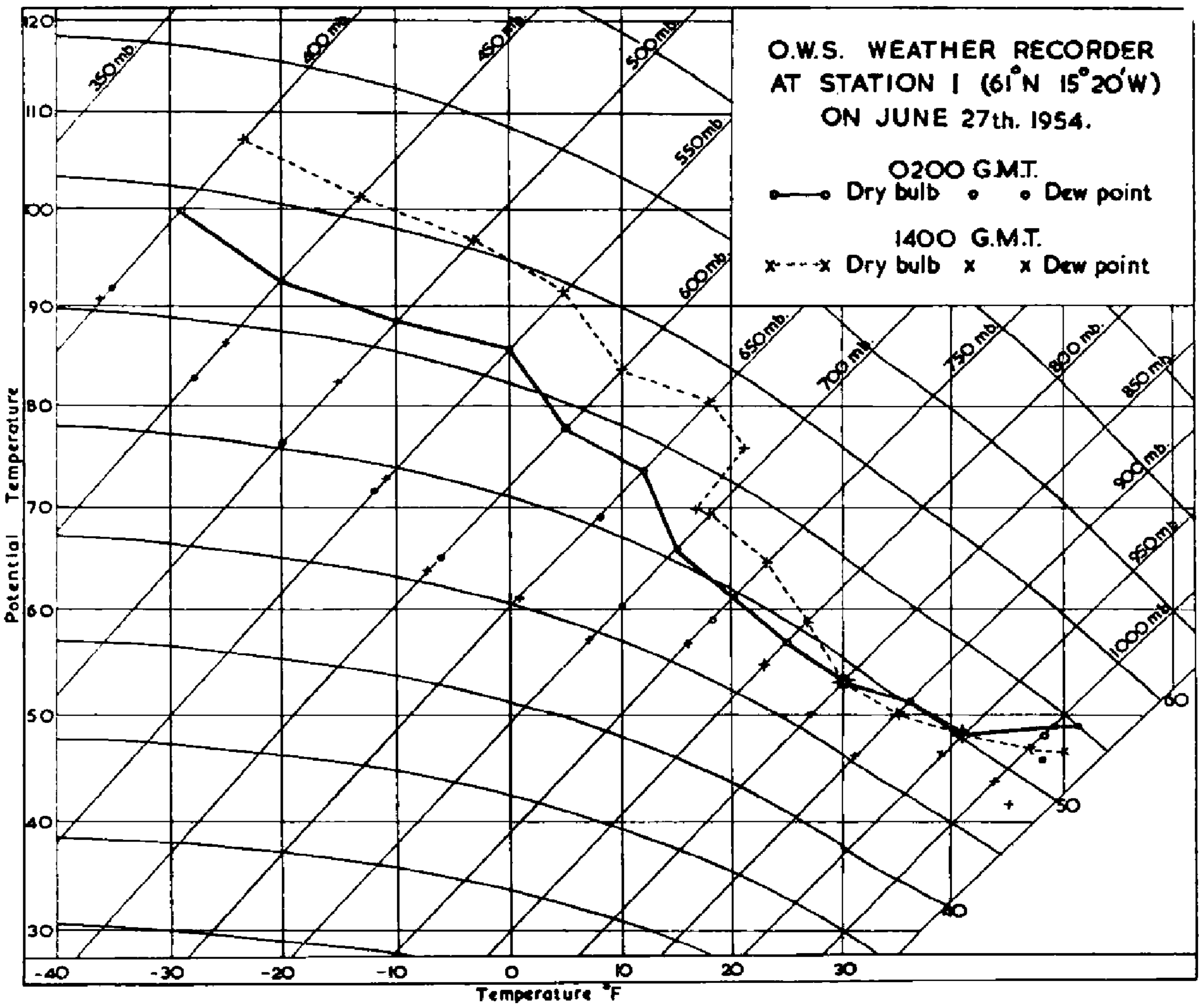


Fig. 3

Tephigram, showing temperatures recorded by the radio-sonde as it ascended from the surface to the 400 mb level (about 25,000 ft). (The horizontal lines are dry adiabatics, the curved lines are saturated adiabatics.)

radar-wind observation disclosed that a well-marked wind shear had developed between the 1000 and 900 millibar levels (see Table 2), and there was a large change in surface wind direction between 1030 and 1100. These circumstances also satisfy another of the criteria given by Gordon. Some of the remaining conditions given by him, e.g. high sea temperature and high humidity mixing ratio†, refer to conditions mainly found in the tropics and sub-tropics and help to explain the much greater frequency of waterspouts in those regions. He also found that the frequency of waterspouts rapidly decreased with winds above force 2.

The air-sea temperature differences, which were first slightly positive and changed to small negative values at the time of the waterspouts, also agree with Gordon's findings, which were that the majority of waterspouts occur when the air temperature is within ±1°F of the sea temperature. Even allowing for a small heating effect by the ship upon the air passing over it (which might be of the order of about 1°F), reference to Table 1 shows that the air temperature could not have been much below the sea temperature for some hours before 1030 G.M.T. However,

* Wind shear is a marked change of wind with height.

† Humidity mixing ratio is the ratio of the mass of water vapour to the mass of dry air with which it is associated.

the air temperatures were below the sea temperatures subsequent to that time, and hence there would then have been a superadiabatic lapse rate between the sea surface and the deck level.

The pressure changes, wind veer and fall in dew point, together with the observation of a line of cumulus and cumulonimbus, would be consistent with a weak localised cold front such as might encourage waterspout formation. It was remarked by the observer that " the active area moved steadily away southwards along the line of the cloud ". This statement implies that the line of cloud was orientated approximately north-south along the line of the air mass discontinuity (see Fig. 4).

In the circumstances described it is possible that the waterspouts were themselves

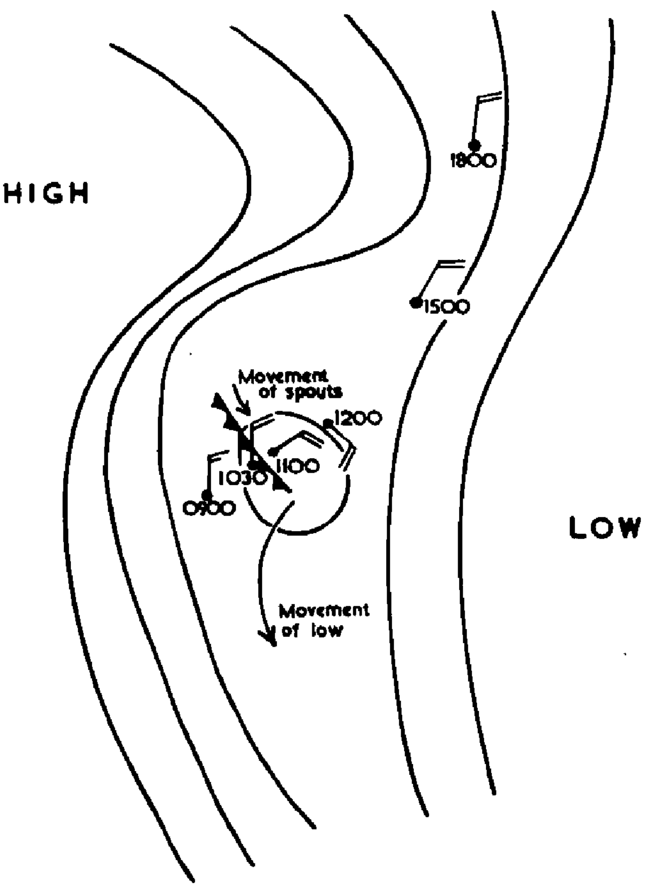


Fig. 4
Suggested positions of ship relative to the moving isobaric pattern.

a visible accompaniment of a polar low in formation. The times when the waterspouts were observed, and the evidence of the charts, both support this possibility. Fig. 4, which is based on the reports contained in Table 1, shows the suggested

Table 1. Surface observations at Station I on 27th June, 1954

Hour G.M.T.	Total cloud amount (oktas)	Wind		Present weather	Pressure (mb)	Temperature			Air-Sea °F	Low cloud amount (oktas)	Type
		Direction (°True)	Speed (kt)			Air °F	Dew point °F	Sea °F			
0001	5	360	15	bc	1016·5	50·6	47·0	51·0	−0·4	2	Cu
0300	2	350	14	b	1017·9	50·3	46·6	50·9	−0·6	1	Cu
0600	5	360	14	bc	1020·0	51·0	49·3	50·7	+0·3	4	Cu
0900	3	360	10	bc	1021·5	51·5	49·0	51·0	+0·5	1	Cu
1030	—	340	(12)	c	1022·5	52·0	49·0	51·2	+0·8	—	Cb
1100	—	060	(12)	c	1022·5	50·0	47·0	51·2	−1·2	—	Cb
1200	6	120	12	cpr$_o$	1022·9	50·5	47·5	51·2	−0·7	3	Cb
1500	2	040	11	b	1024·9	51·0	46·0	51·5	−0·5	2	Sc
1800	4	020	12	bc	1027·0	50·2	43·8	51·5	−1·3	2	Sc

Table 2. Observations of upper winds at Station I on 27th June, 1954

0900 G.M.T.			1400 G.M.T.		
Height (ft)	Direction (°True)	Speed (kt)	Pressure level	Direction (°True)	Speed (kt)
Surface	350	15	Surface	030	12
1,000	340	18	1000 mb (650 ft)	039	14
2,000	330	18	950 mb	002	13
3,000	330	16	900 mb (3,480 ft)	339	13
4,000	340	18	850 mb (4,980 ft)	328	16
5,000	340	20			

positions of the weather ship with respect to the moving pressure pattern. It would be interesting to know whether any waterspouts have been observed previously in a similar synoptic situation.

REFERENCE

[1] GORDON, A. H. Waterspouts. *Mar. Obs.*, London, **XXI**, 1951, pp. 47-60 and 87-93.

Effect of Sub-refraction on Radar Range

(Sub-refraction occurs when the refractive index of the atmosphere either increases with height, or decreases with height at less than the standard rate. As a result of this, the radar rays are bent less, and there is less tendency for them to follow the curve to the earth. Hence, the lobes of the vertical coverage diagram will tend to lift further above the surface, and the radar horizon will occur at a shorter range. In contrast to sub-refraction, when the refractive index decreases with height at more than the standard rate, super-refraction is experienced. In this case the rays are bent more, so that the distance of the radar horizon is increased.)*

We think that the following notes on sub-refraction, written by Mr. R. F. Jones of the Meteorological Office, who has investigated the applications of radar to meteorological problems, and by Captain Wylie, who is Director of the Radio Advisory Service, will prove interesting and useful to our readers. These notes were given in answer to a query by Mr. W. Burger, who wrote:

As a lecturer in marine radar at the Cardiff College of Technology and Commerce, I have been asked questions on several occasions about the effect of sub-refraction on radar detection ranges, and the accompanying meteorological conditions. It is well known that sub-refraction reduces the radar horizon and lifts the lobes, so affecting the detection ranges of low objects.

I have recently read an article dealing mainly with sub-refraction and a report was quoted in which it was stated that rocks 60 feet high had not been detected on the radar screen outside the one mile range. Another report, so the writer tells us, informs us about ships (it does not say " small vessels ") which were not detected until they were approximately three miles distant.

In my own experience, I have seen coastal detection ranges being reduced due to sub-refraction from 20 to 15 miles (East African coast during the west monsoon), but if the above statements are true, they point to a fantastic sub-standard rate of decrease with height of the refractive index, and consequent abnormal contraction of the radar horizon.

I discussed this at length with Mr. D. Arthur Davies, secretary-general of the World Meteorological Organisation. We both tend to believe that the reports mentioned above are not based on reliable information.

I wonder whether you are in a position to provide me with any data showing the reduction of the radar horizon as a result of extreme meteorological conditions favouring sub-refraction. Such information would be extremely helpful, because, if the statements in the article are true, very dangerous situations could be created for the sailor in a radar-equipped vessel when visibility is poor and sub-refraction is present.

Mr. Jones commented:

While sub-refraction can undoubtedly occur, I doubt very much whether its effect can be such as to reduce the radio horizon to the very short distances quoted in the article. The condition most favouring sub-refraction would be a layer of cold moist air overlying a warm dry layer, but over the sea the surface layer is unlikely to be dry and

*From *The Use of Radar at Sea*, London, 1952, p. 76.

the sub-refraction must be primarily due to an excessive lapse of temperature. While large lapses of temperature above the sea surface do occur, a high proportion of the temperature fall is confined to the first foot or less above the sea surface, and the radar transmitter is unlikely to be in this layer. Excessive lapse-rates of temperature above the height of the transmitter are unlikely, since the onset of convection when the lapse rate exceeds the dry adiabatic would militate against the maintenance of any lapse-rate much in excess of the dry adiabatic.

The particular quotation that rocks 60 ft high had not been detected at ranges beyond 1 mile can be dealt with like this:

If the radar aerial is 20 ft above the sea, the above quotation is equivalent to saying that on this occasion the radio horizon for a height of 40 ft (60 ft minus 20 ft) was 1 mile. If the radius of the equivalent earth (i.e. the radius for which the curvature of the rays relative to the earth is zero, and the rays can be drawn as straight lines) is Ka, where a is the earth's radius, the distance r of the radio horizon from a point at height h is given by $r^2 = 2hka$, and

$$k = \frac{1}{1 + a\dfrac{dn}{dh}} \qquad \text{where } \frac{dn}{dh}$$

is the gradient of refractive index with height, and is assumed constant.

For this particular case we have $r = 1600$ metres, $h = 12$ metres, $a = 6{\cdot}37 \times 10^6$ metres, giving $k = 0{\cdot}0167$.

Thus the change of refractive index, δn, in the height interval of 12 metres must have been given by $10^6 . \delta n = 110{\cdot}7$.

But $(n-1) . 10^6 = \frac{79}{T}\left(p - \frac{e}{7} + \frac{4800e}{T}\right)$,

where p and e are in mb, T is in °K, and we can find, if we put $p = 1000$, $T = 290$, $e = 16$ (corresponding to a dewpoint of 14°C),

$$10^6 . \delta n = 0{\cdot}27 . \delta p + 4{\cdot}47 . \delta e - 1{\cdot}43 . \delta T.$$

To make this expression equal to 110·7 we must obviously have an impossible value of δT or δe, or the two combined, and the failure to detect the rocks at ranges greater than 1 mile cannot be ascribed to sub-refraction. If, however, the range of detection was 5 miles we would have $10^6 . \delta n = 2{\cdot}6$, and a fall of 2°C between 20 ft and 60 ft would be sufficient ($\delta e = o$).

The range of 11 miles at which the rocks were normally detected implies a value of $10^6 . \delta n$, equal to about -1, which would accord quite well with a normal slow decrease of vapour pressure with height counteracted to some extent by a fall of temperature with height.

It is important, I think, before explaining poor radar performance by sub-refraction, to be quite sure the set is on its normal performance and then make accurate measurements of the limiting range of detection—so many word-of-mouth reports tend to become exaggerated.

Copies of Mr. Burger's letter and Mr. Jones's comments were referred to Captain Wylie, who says:

I concur with the views expressed by Mr. Burger in his letter, in which he states that both he and Mr. Arthur Davies tend to believe that the extremely short ranges of detection of certain rocks and ships are not based on reliable information.

Quite apart from sub-refraction, the normal ranges of detection of islands and coastal features by radar under average meteorological conditions depend to a great extent upon their shape as well as their height. Specular reflection from roughly conical features can cause very variable detection ranges, depending quite critically upon the angle of view.

For many years we have been receiving reports from ships of radar detection ranges of coastal features, the more important of which are now being incorporated in appendices to the Pilot volumes, and there are particular examples in which the effect of specular reflection is quite marked. For example, the radar reports of St. John's Island (Red Sea) have shown that ships on the normal route, which shape to pass within about 20 miles, will pick the island up on radar at, say, 30 miles. Those which shape to pass over 22 miles off, will not get an echo at all. This suggests that on the NE. side the cliff is sheer to about 150 ft, and then slopes away smoothly to the peak, this latter part giving no echoes.

Having once established the consistent range of detection of an object, it is likely that sub-refraction is the cause of reduced ranges if the reading of the performance monitor is normal, but never to the extent given in the article quoted.

I was very interested to read Mr. Jones's comments, and his conclusion that the failure to detect the rocks at ranges greater than 1 mile cannot be ascribed to sub-refraction, owing to the impossible values of temperature lapse, or moisture content between layers, which would be required.

Another copy of the letter was referred to the Director of the Naval Weather Service, who also considers that the low detection range must have been due to a loss of radar performance.

Ave, atque Vale—The Rough Logbook

When the writer joined the Marine Division of the Meteorological Office some six years ago, one of the first exploratory journeys he made was to the basement at Harrow to see the fair copy of his first meteorological logbook over which, in transcribing from the original, a brother officer had capsized a bottle of ink more than 20 years before. The sight of the ink stain obliterating what might have been valuable information brought to him a flood of memories, notable amongst which was the remark of an old shellback, " There's too much ' duplification ' about this work ".

Since those days paper work at sea has increased many times, and it has often weighed on our conscience that we are not altogether guiltless of adding to the burden.

Those of our voluntary observers who were observing before 1953 will remember that in those days two meteorological logbooks were used; one for the synoptic record, and one for the coded version and record of radio messages. Both were written up " in rough " and then copied into a " fair " version so that there were four books with which the observing officer was expected to deal.

In 1953 a new type of logbook was introduced, wherein the record of radio messages was combined with the meteorological record and this, together with certain rearrangements whereby everything was recorded in the same sequence as that in which it was coded for transmission by radio, we felt would considerably ease the burden of writing which our observers so readily undertook for us. It made things easier in the Marine Division of the Meteorological Office also, for the new logbook then fell into line with the new international Hollerith card which was adopted at that time.

In the reference to the " launching " of this new logbook, in the January 1953 number of *The Marine Observer*, the writer quoted from the minutes of the committee which had drawn up the original ships' meteorological logbook 100 years before: " The Conference . . . looks forward with confidence to occasional enlarged contributions from zealous and intelligent labourers in the great cause of science."

Our confidence that the introduction of the 1953 logbook would similarly increase the field and improve the standard of the observations has been amply justified over the past four years, for we have noticed with pleasure the increased amount and variety of observations which have been entered in the back pages of the meteorological logbooks. Thanks to them, much useful information in a number of branches of science has been gleaned, some of it throwing light into dark places and all of it welcome to the experts to whom it has been referred. For example, a report was made of a species of shark, which normally lives at a depth of several hundred fathoms—only the second time that this had been recorded from a merchant ship. The observations on its luminescence were the first to be received by the Natural History Museum. Other examples, taken at random, concern the sighting of an albatross in the North Atlantic (for the first time in 70 years); the mating habits of flying-fish (there being only one previously published report of these), and two observations of aurorae in low latitudes, which have opened up a little-known aspect of this phenomenon.

The " duplification " mentioned by our friendly shellback has increased somewhat with the increased length of the narratives, referred to above, and in consideration of the passion for forms and returns which now seems to rule most walks of life, including that aboard ship, as well as on the grounds of national economy, we felt that some further reduction in paper work was necessary. Thus, acting on the suggestion of some of our voluntary observers at sea, which was discussed by Port Meteorological Officers at a recent conference at Harrow, we have decided to dispense with the use of the rough copy of the meteorological logbook altogether. Many of our voluntary observing shipmasters will already have heard of this through the circular letters we are sending out with our letters of acknowledgement for logbooks received.

All future observations may, therefore, be entered straight into the copy of the logbook which it is intended to send to us. *Our only request in this respect is that the book shall be kept neatly and written up in ink, not in lead pencil, and definitely not in indelible pencil.*

We shall not expect that all the logbooks that will come to us in future will be quite as neat and tidy as those to which we have been accustomed, but we would emphasize that the meteorological logbook is a document which we intend to preserve for future generations. In our archives we have them going back for more than 100 years, and although the observations will all be punched on to Hollerith cards, as they are easier to handle in this form, the original logbook will be frequently referred to. It is for this reason that we ask for a continuance, as far as possible, of the neatness and legibility which have always been characteristic of ships' meteorological records. In order to encourage observing officers in this, it is necessary to point out that neatness and legibility are additional qualifications for the " Excellent Award ", and this will certainly continue to be so under the new scheme.

There is a large stock of unused rough logbooks in our publications store. At the next routine distribution a label will be fixed on the front cover indicating that these should be used as fair copies. Thus, for the next few months, some ships will receive a green-covered book and others will receive one having a red cover, but all these should be treated as " fair " copies.

When this stock is exhausted and the blank logbook is reprinted there will be, of course, only one type of book for selected ships and one for supplementary ships. This book will be printed much on the lines of the old rough book, with instructions for its use in the front.

If, aboard any particular ship, the master and observing officers prefer to continue with the system of writing up the meteorological logbook in rough for retention in the ship, and sending us a fair copy, we will of course have no objection. Any of our Port Meteorological Officers or Agents will gladly supply an additional book for this purpose.

L. B. P.

Our Oldest Meteorological Logbook

To the collection of old meteorological records held by the Marine Division of the Meteorological Office was recently added, by the courtesy of Captain S. J. Hennessy, the Superintendent of Admiralty Sailing Directions, a meteorological logbook older than any we had hitherto received. It was from H.M.S. *Blonde*, and covers a voyage to the Sandwich Islands from 1824 to 1826.

Blonde was a fifth-rate, 42-gun frigate of 1,103 tons, built at Deptford in 1819. She was on naval service until 1895, serving as a receiving ship, at Portsmouth, from 1870 onwards.

For the voyage covered by this logbook she was specially fitted out to convey the remains of King Kamehameha II and Queen Tamehamalu of the Sandwich Islands (with their suites) back to their homeland. The Queen had died on 8th July, 1824, at the age of 22, and the King six days later in his 28th year; they were both staying at the Osborne Hotel, Adelphi, London, W.C.2. The logbook shows that H.M.S. *Blonde* left Falmouth on 8th October, 1824, and after calling at Madeira, Rio de Janeiro and St. Catherine's Harbour, she rounded the Horn on 20th January, 1825. It is interesting to note that her furthest south was 58° 17'S., which she made in 73° 42'W., and for a considerable time around this period the wind was mainly light to moderate and often easterly. There are even some observations of calm. She spent a month in Valparaiso and felt an earthquake shock there on 2nd March, 1825. On 23rd March, 1825, she saw the twin volcanos of Galapagos Island in eruption and anchored in Elizabeth Bay on 26th March, 1825. She arrived at Byron Bay, Hawaii, on 3rd May, 1825, and for the next two weeks was at various other anchorages in the Sandwich Islands. During this time she took the opportunity of erecting a monument to the memory of the great circumnavigator, Captain Cook, R.N., near the spot where he lost his life.

Homeward bound she arrived at Valparaiso on 7th September and rounded the Horn south of Diego Ramirez on 29th December, 1825, with a westerly wind, strong to moderate, and air temperature 47°F. On 8th January, 1826, she sighted four large icebergs in 42° 45'S., 30° 36'W. This is just within the known northern limit of icebergs. She anchored at Spithead on 15th March, 1826, her mission accomplished.

For this voyage she was commanded by Captain The Honourable George Anson Byron, a cousin and successor of the soldier poet Lord Byron who died at Missolonghi in Greece in April 1824. It was thus during the voyage that the Captain succeeded to the title. He became a full Admiral in 1862, and died in 1868 at the age of 79. A full account of the ship's mission is given in *Voyage of H.M.S. Blonde to the Sandwich Islands*, 1824 *to* 1825, by Captain Lord Byron, R.N. (1836). The logbook is an ordinary foolscap book, strongly bound as was the custom in those days, and it was ruled up by hand to form a meteorological register. It is scrupulously neat and gives evidence of great care and attention. There is throughout not a single blot, deletion or misshapen letter.

L. B. P.

RECRUITMENT OF SELECTED SHIPS IN AUSTRALIA

A study of the Fleet Lists which appear in the January and July numbers of *The Marine Observer* will show that several Commonwealth countries include among their voluntary observing fleets a few ships of United Kingdom registry. This is in accordance with an agreement made at a conference of meteorologists of the British Commonwealth whereby these meteorological services may, in addition to ships registered in their own ports, recruit as selected or supplementary ships, any British or Dominion ship whatever her port of registry, normally voyaging in the waters concerned or using one of the ports under that service as home port.

Countries which have a large seaboard and a comparatively small Merchant Navy must rely for their meteorological information on shipping of other countries. But the cost of supplying instruments obviously limits the number of ships which any country can afford to recruit. Thus it sometimes becomes desirable for the meteorological service of a country in need of observations from the oceans to recruit ships of another country even though such ships are not necessarily based in the area.

Such a case occurred in 1954 when the Canadian Meteorological Service, conscious of many large meteorological gaps in the North Pacific, sought and was given permission to recruit certain United Kingdom registered ships trading in those waters. Again, in 1955, the New Zealand Office recruited three London registered ships on the Montreal-Australia-New Zealand run.

The latest Commonwealth country to increase her voluntary observing fleet in this way is Australia. Recently the Director, Mr. L. J. Dwyer, suggested to us that it would be a great help to Australian meteorology and Australian weather bulletins for shipping if more observations could be gathered from the ocean to the west and south-west of the continent. We ourselves would have been quite happy to recruit more ships on the Cape Town to Australia run, but as our limit of 500 selected ships had already been reached, it was suggested that they should be recruited to the Australian Observing Fleet. The willingness of the owners and masters of the ships concerned to serve a meteorological service other than that of the United Kingdom is very much appreciated by both the British and Australian Meteorological Offices, and the name of the first of these United Kingdom to Australia ships will shortly make its appearance in the Australian Fleet List.

There will be little difference in their function or treatment as observing ships. They will be using the same meteorological logbooks as our own observing ships use, they will receive *The Marine Observer* and they will be eligible for consideration in the Australian Excellent Award scheme. Their observations will in due course reach this Office to augment the ever-increasing store of information which can always be added to with advantage, and although they will normally, of course, be serviced by an Australian Port Meteorological Officer, our own officers will always be at their service for any advice or assistance which may be required when they are this side.

This is yet another case where countries bound together by a common interest in meteorology and a common need for meteorological information are helping each other.

L. B. P.

VISIT TO CENTRAL FORECASTING OFFICE

On 5th October, 1956, a party of 22 cadets from M.V. *Durham*, accompanied by their instructional officer, made the first organised visit by cadets from a sea-going training ship to the Central Forecasting Office at Dunstable.

As well as visiting various sections of the Office, the cadets were given talks on the functions of the Forecasting Office and on the various aspects of forecasting. The value to the Meteorological Office of the work of voluntary observers at sea, and thus to shipping in general, was demonstrated.

We hope that voluntary observers from other ships will be able to make similar visits to Dunstable or to London Airport in the future.

J. C. M.

ASSOCIATION OF NAVIGATION SCHOOLS

The Association of Navigation Schools held its Annual General Meeting for 1956 at the South Shields Marine and Technical College, the " open " session taking place on 1st June. The Mayor of South Shields, Alderman A. Stephenson, formally opened the Conference and welcomed those present. The meeting comprised delegates from 23 navigation schools (including two from Holland and one from India), together with guest representatives from the Royal Navy, Honourable Company of Master Mariners, Ministry of Transport and Civil Aviation, Meteorological Office, Shipping Federation, Institute of Navigation, Merchant Navy Training Board, Ministry of Education, Officers' Federation, etc.

The first item was an address by Lieut.-Commander C. F. Beddoe, R.N., of H.M.S. *Dryad* Navigation School, entitled, " Trends in navigational aids and modern methods of navigation ". He inferred that U.S. Navy technique was being established for navigation in the Royal Navy, with simplified and quicker methods. The basic book now used is H.D.486 (tables of computed altitudes and azimuths), reproduced from the U.S. Navy's H.O.214. This one book, together with the

Nautical Almanac, provides all that is necessary for reduction of sights by the standard method, using " sight forms ". He mentioned that the new U.S./U.K. Nautical Almanac, which will come into use in 1958, would be published in October 1956. He also referred to the new low-altitude observations, which made it possible to observe heavenly bodies with near-zero altitudes and obtain a position accuracy of within two miles. For this it was interesting to hear that temperature was one of the elements for which allowance had to be made. In conclusion he described the " parallel index " method evolved for teaching young officers how to make the fullest use of radar, including a brief description of the radar assisted pilotage trainer.

The next speaker was Captain H. Topley, Principal Examiner of Masters and Mates. He gave the usual résumé of the examination results during the past year, which he said showed a slight improvement on 1954. Figures of percentage passes by candidates of the various categories are shown below, together with those for 1954 for comparison:

	1955	1954
Master	68·6	63·1
First Mate	71·3	62·2
Second Mate	59·8	54·5
Master H.T.	73·1	64·2
Mate H.T.	57·4	58·3
Average ..	65·5	58·3

Observing that it was customary for the Principal Examiner to discuss the common mistakes made by the candidates, and make suggestions which it was hoped would help the teachers, Captain Topley said that to do so again this year would merely be a repetition of what had been said year by year in the past. " Leopards do not change their spots nor, apparently, candidates their weaknesses," he added. Some light relief was provided by his narration of a number of " howlers ", in both written and oral parts of the examinations. The most amusing was the following description by a candidate who being told there was a bubble in the compass wrote: " I would remove the bowl, then take out the screw at the side. Putting my finger in the hole the screw was in, I would work the bubble round until the bubble was at the hole, then I would remove my finger, let the bubble out, put the screw back in place, and return the bowl to its respective position ". Looking ahead, Captain Topley mentioned the shortage of men with the Extra Master qualification. New syllabuses were to be introduced as from 1958, but for the benefit of students now studying for Extra Master it was proposed that for the examinations in July and November 1957 a candidate should have the option of taking the examination under either the old or new syllabus.

Arising out of a question from the writer of these notes, Captain Topley replied that the Ministry was reasonably content with the standard of the subject of meteorology in the examinations. This enquiry gave rise to others from members of the Association, one urging that fishermen should be required to have an increase in weather knowledge and ship stability, in view of the numerous casualties to trawlers in recent times.

Captain W. H. Coombs then gave an historical review of the Officers' Federation. In this he traced the progress made by this organisation since 1921, when arrangements were first made with an insurance company for the purpose of insuring against the risk of the cancellation or suspension of an officer's certificate of competency.

Following a vote of thanks to the Chairman and Governors, those present at the meeting were taken upon a tour of the Marine and Technical College. This is situated at Westoe Village, South Shields, and is not yet completed. Commenced in 1952, building is scheduled to continue to 1960, when it will be a really wonderful establishment and the last word in modernity. M. C.

ISSUE OF W.M.O. STAMPS

Special stamps, in honour of the World Meteorological Organisation, were issued by Switzerland on 22nd October, 1956. For the interest of those of our readers who are philatelists, we reproduce a photograph (opposite page 81) of the complete set, taken from a first day cover. A special postmark, which shows clearly in the photograph, was used for a short time after the first issue of the stamps.

The whole set of these stamps, mint, may be bought for about 8s. 6d. from most stamp dealers (the set, used, costs about 5s.).

Book Review

The Haven-Finding Art: A History of Navigation from Odysseus to Captain Cook, by Professor E. G. R. Taylor. (With a foreword by the Hydrographer of the Navy.) 8¾ in. × 5¾ in. pp. xii+295. *Illus.* Hollis and Carter, London, 1956. 30s.

It is unusual for a woman to display as much knowledge about the art and practice of navigation as is shown by Professor Taylor. But as a professor of geography this is part of her job, and not only is she well versed in navigation, but knowledge of meteorology is another of her qualifications. On reading this book one feels that the author would be an asset on the bridge of any ship. If all the navigational instruments were lost overboard there seems little doubt that Professor Taylor, with all her knowledge of navigational history, and knowing all the " tricks of the trade ", would safely bring the ship into her desired haven from any part of the world.

This is a book that one can quite easily read in an armchair, for much of it is descriptive history; but on the other hand, to get the most out of it one needs to get down to a little serious study with pencil and paper, because of the number of interesting navigational problems which are discussed. The book is divided into five parts: " Introduction ", which is primarily devoted to elementary astronomy, meteorology and oceanography; " Navigation without magnetic compass or chart "; " With compass and chart "; " Instruments and tables "; and the last part is entitled " Towards mathematical navigation ". In the earlier chapters the author shows us how knowledge about the rudimentary art of navigation spread from the Middle East through the Mediterranean to Spain and Portugal, and thence eventually to the more northern countries. Throughout the book one is made to realise how closely meteorology is related to the art of navigation. The author shows us, for example, how the very composition of the compass rose, as we know it today, is historically related to the winds, and in particular to the Tower of Winds in Athens; how, in the early days before the properties of the lodestone had been discovered, the Mediterranean mariner maintained his direction by the feel of a known wind or by the aid of the heavenly bodies. We are shown how, as an alternative to the log-line and sand glass, the speed of a ship was estimated, as a result of experience with a known type of ship, depending on the force of the wind and its relative direction. We are also shown the laborious way in which knowledge about currents and tides was built up. Much of the early knowledge was jealously guarded by certain nations and by individuals, and it was not until books came to be fairly widely used that navigational knowledge became more widespread and shared between the various countries concerned.

The author rightly shows us how, in the very earliest days, the seaman used the same wise precautions that the prudent mariner does today; in other words, he never neglected the use of his lead-line nor did he fail to keep a good look-out, or to take every possible opportunity of endeavouring to verify the speed of his ship. Those well-tried friends of every mariner, the sun amplitude and the pole star, rightly find their place very early in this history of navigation. The book includes some interesting detail about the history of navigational tables and textbooks.

It is perhaps surprising how little certain navigational equipment has changed since the fourteenth century. A compass card of 1363 looks almost exactly similar to that which one would see aboard any modern ship, and a chart of about 1650 isn't very far different from those which we use today, except that there are no soundings marked on it and the grid lines look a little curious.

The reader is perhaps also surprised to note how backward the art of navigation was in this country until it was given such considerable encouragement by Charles II, and how much we owe to the Spanish and Portuguese pioneers in the navigational art.

The last chapter of this book is entitled " The Longitude Solved " and takes us up to the time of William Harrison, inventor of the chronometer, and Cook's voyages. The author shows us that latitude had been a relatively easy problem to solve, and once the way had been found of determining longitude (associated with efficient compasses, which had by then come into use), the mariner had at his disposal all the basic essentials to check his position anywhere in the world, provided the meteorological conditions permitted him to see the heavenly bodies. The Mercator chart, which came into common use about 1590, helped him to portray his position on paper with reasonable accuracy.

The book is well illustrated with some delightful photographs of ancient navigational instruments, charts and other items of interest in navigation, as well as by some very good diagrams. The general style of the book is entertaining, and local historical colour is provided by numerous quotations.

Altogether this is a book which can be recommended to anybody who is at all interested in navigation. C. E. N. F.

Note. Professor Taylor's *The Mathematical Practitioners of Tudor and Stuart England* was reviewed in the April 1955 number of *The Marine Observer.*

Personalities

RETIREMENT.—COMMANDER M. CRESSWELL, R.N.R., retired for domestic reasons from the position of Merchant Navy Agent for the Humber area on 14th December, 1956.

Commander Cresswell was Port Meteorological Officer at Liverpool for 32 years. A notice about his career appeared in the July 1956 number of *The Marine Observer*, on the occasion of his retiring from that position. During the short time that he was in Hull he was chiefly occupied in the encouragement of deep-sea trawler skippers to make non-meteorological observations in high latitudes.

We wish him health and happiness in his retirement. L. B. P.

OBITUARY.—The recent death of CAPTAIN ALEXANDER WILSON, O.B.E., Forth Area Merchant Navy Agent for the Meteorological Office, will be felt with the utmost regret not only by his friends and colleagues in Leith, but also by the many masters and officers of voluntary observing ships which occasionally visited the Forth ports. Our sympathy is extended to his wife and family.

Captain Wilson went to sea in 1911 at 15 years of age, serving his apprenticeship with the Currie Line of Leith. As a young officer he served for a while with both the Ben Line and the Cairn Line, but soon returned to his old company where he served as both Second and Chief Officer. He eventually assumed command of the S.S. *Kirkland* in January 1936.

The Second World War found him at sea in the Mediterranean in command of the S.S. *Kirkland*. He had arrived in Malta when Italy entered the war, and was there during the early air raids on that island. When the Royal and Merchant Navies established the " life-line " from Malta to Alexandria, Captain Wilson took his share of this hazardous task.

His ship helped in the evacuation of troops from Greece and Crete, and took part in running supplies into Tobruk. He was there when it fell. For his services at this time, Captain Wilson was awarded the O.B.E. Returning to this country in 1942, he saw further service in the Atlantic, and carried landing forces in the invasion of Europe.

Captain Wilson remained as master with the Currie Line until 1953, when he retired from the sea. He then became Marine Surveyor in Leith Docks, and Forth Area Merchant Navy Agent, where he continued until his death on 25th October, 1956.

Notices to Marine Observers

B.B.C. Weather Bulletins for Shipping

The five-minute weather bulletins for shipping, which are broadcast on the Light Programme (1500 m. only), include the latest weather reports (wind direction and force, present and past weather, visibility and pressure) from a number of meteorological stations around the coast of the British Isles. (The times of these broadcasts were given in the July 1956 number of *The Marine Observer*, in which, however, the time of the first bulletin on Sundays was inadvertently given as 0645 clock time instead of 0645 G.M.T. and that given as 1200–1205 has now been changed to 1155–1200 clock time.)

At the request of various shipping interests, the selection of stations has recently been improved by the addition of three light-vessels and a lighthouse, and the omission of two shore stations, Manston (Ramsgate) and Leuchars (Dundee), which were of less interest to shipping.

The complete list of stations now reads as follows: Wick, Bell Rock Lighthouse, *Dowsing*, *Galloper* and *Royal Sovereign* light-vessels, Portland Bill, Scilly Isles, Valentia, Ronaldsway, Tiree.

Meteorology for Mariners

This book has now been published at the price of £1. A notice about it appeared in the last number of *The Marine Observer*. Copies may be obtained (plus 11d. postage) from Her Majesty's Stationery Office at any of the addresses shown on the title page of this magazine.

Merchant Navy Agent, Humber

The position of Merchant Navy Agent for the Humber area, rendered vacant by the retirement of Commander Cresswell, has been filled by Mr. W. H. Carr, master mariner, who thus returns to the position which he held for three years before the outbreak of the Second World War in 1939. During the war he served in the Sea Transport Service as a Lieut.-Commander, R.N.R.

Mr. Carr's office address is the same as for Commander Cresswell previously, i.e. c/o Principal Officer, Ministry of Transport, Trinity House Yard, Hull. (Telephone: Hull 36813.)

Merchant Navy Agent, Leith

Captain G. N. Jenkins, who recently retired from command in Shell Tankers, has been appointed Merchant Navy Agent for Leith, to fill the vacancy caused by the death of Captain Wilson.

Captain Jenkins' address is 36 Meadowfield Avenue, Portobello, Midlothian, and he will operate the agency from that address. (Telephone: ABB 2587.)

ERRATA

The following corrections should be made to the map which appeared on pages 24 and 25 of the January number.

(*a*) The route from 78°s., 38°w., across the pole should be labelled " T.A.E. (i.e. Trans-Antarctic Expedition) route "; not " I.G.Y. route ".

(*b*) Delete stations at 72° 30′s., 97°w. (Spain); 68°s., 91°w. (Japan); 77°s., 33°w. (U.S.A.); 75°s., 62°E. (Australia); and 77°s., 162°E. (New Zealand), i.e. the most northerly of the group of three stations.

(*c*) Insert stations at 75°s., 60°w. (U.S.A.); 83°s., 40°w. (T.A.E.) (April–November 1957); 71°s., 23°E. (Belgium); and 68° 32′s., 77° 55′E. (Australia).

(*d*) Transfer the station at 81°s., 68°E., to 82°s., 50°E. (U.S.S.R.); and that at 67°s., 105°E., to 66° 30′s., 93°E. (U.S.S.R.).

(*e*) The station at 71° 30′s., 170°E., is a joint U.S.A. and New Zealand base.

Ode to a Sinner

As the air's below the sea
A five is place before the three,
And nought's a thing you didn't oughter
Wear when entering colder water! Anon.

[Apropos a group 10 (O T_s T_s T_d T_d), inadvertently entered in a logbook as 00372 instead of 05372.]

An Ode to the Principal Observing Officer

Please remember, don't forget,
Always keep the wet bulb wet.
When the reservoir is filled,
Don't forget to use distilled,
And please suspend the screen to wind
Otherwise, my friend, you've sinned—
No doubt you will wonder why
Your dewpoint is a little high.
Another small, but helpful trick—
" Change the muslin and the wick
Every week "—to quote the book;
If you doubt me take a look.
Lastly friend I've one request,
In which, no doubt, you'll do your best
Amongst your countless other jobs—
Please don't forget another obs.

M. D. Squibbs, 3rd Officer.

ABRIDGED LIST OF PUBLICATIONS OF THE METEOROLOGICAL OFFICE

Publications may be ordered from the bookshops of Her Majesty's Stationery Office at the addresses shown on the title page or through any bookseller

Cloud Forms. Definitions and descriptions, with photographs of clouds. (M.O. 233, 6th edition, 1949, reprinted 1953.) 2*s.* 6*d.* (2*s.* 8*d.*)

Handbook of Meteorological Instruments. Part I. Instruments for surface observations. (M.O.577,1956.) 45*s.* (46*s.* 6*d.*)

Handbook of Weather Messages, Codes and Specifications. (M.O. 510.)

Part I. Transmission schedules and station index numbers. (2nd edition, 1955.) 6*s.* (6*s.* 4*d.*)

Part II. Codes and Specifications. (2nd edition, 1954.) 4*s.* 6*d.* (4*s.* 11*d.*)

Part III. Coding, decoding and plotting. (2nd edition, 1954.) 4*s.* 6*d.* (4*s.* 9*d.*)

(*Amendments issued as necessary and priced separately*)

Instructions for the Preparation of Weather Maps with tables of the specifications and symbols. (M.O. 515, 2nd edition, 1954.) 1*s.* 9*d.* (1*s.* 11*d.*)

International Meteorological Code adopted by the International Meteorological Organisation, Washington, 1947. **Decode for use of shipping,** incorporating the code for weather reports from and to ships and the analysis code for use of shipping. (M.O. 509, 3rd edition, 1955.) 1*s.* 6*d.* (1*s.* 8*d.*)

Marine Observer's Handbook. (M.O. 522, 7th edition, 1950, reprinted 1952.) 10*s.* 6*d.* (11*s.* 3*d.*)

Meteorological Handbook for Pilots and Navigators. (M.O. 448, 2nd edition, 1942, reprinted 1952.) 3*s.* 6*d.* (3*s.* 9*d.*)

Meteorology for Aviators. By R. C. Sutcliffe, Ph.D. (M.O. 432, 1940, reprinted 1953.) 10*s.* (10*s.* 11*d.*)

Meteorology for Mariners. (M.O. 593.) *In the Press.*

A Short Course in Elementary Meteorology. By W. H. Pick, B.Sc., F.C.P., F.Inst.P. (M.O. 247, 5th edition, 1938, reprinted 1953.) 4*s.* 6*d.* (4*s.* 9*d.*)

Weather Map. An introduction to weather forecasting. (M.O. 595.) 10*s.* 6*d.* (11*s.* 2*d*).

Meteorology for Mariners. (M.O. 593.) 20*s.* (21*s.*)

Prices in brackets include postage

Printed in Great Britain under the authority of Her Majesty's Stationery Office by
The Campfield Press, St. Albans, Herts.

20415. Wt. 10. K.13. 4/57. S.P. & S. G.9.8.8. S.O. Code No. 40-38-4-57