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THE MARINE OBSERVER.

NOVEMBER, 1928.

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THE MARINE OBSERVER'S LOG.

It is hoped that these pages will be filled each month with a selection of the contributions of Mariners in manuscript, or remarks from the Logs and Reports of regular Marine Observers.
Responsibility for statements rests with the Contributor.

WIND ROUND TAHITI AND MUREA.

THE following is an extract from the Meteorological Report of S.S. *Tahiti*, Captain B. M. ALDWELL, Raratonga to Papeete. Observer, Mr. G. M. COOTE, 4th Officer :—
“ On 14th November, 1927, ship bound from Raratonga to Papeete, experienced moderate to fresh S.E. winds and slight to moderate S.E. sea and swell. At 1337 (Tahiti S.T.) ship entered Murea Channel, and immediately experienced moderate N.E. wind and sea. The wind neither veered nor backed, but suddenly changed direction from S.E. to N.E. On entering Papeete Harbour at 1433 the same day the wind died to N.E., 2, and at 2000 was calm, 0, and remained so till 0900 next morning (15th) when, on clearing lee of Venus Point, wind came away E.S.E., 3-4. It would seem as if the S.E. wind on striking the high land of Tahiti followed the coast-line round in an anti-clockwise direction.”

SQUALL.

Mediterranean Sea.

THE following is an extract from the Meteorological Report of S.S. *Osterley*, Commander I. J. HAYES, R.D., R.N.R., London to Australia via Suez. Observer, Mr. R. J. GALPIN, 3rd Officer :—
“ November 7th, 1927, at 4.15 p.m. (1500 G.M.T.) in position 90 miles S. 59° E. (T) from Cape Spartivento Lighthouse (S. Italy) observed heavy Nimbus cloud approaching from N.W. The cloud, well defined, had hard appearance and spread right over the ship, the sky, with the exception of a thin clear space below the cloud all round the horizon of about 10° altitude, being completely blotted out.
“ The cloud kept the same cap-like formation, whilst slowly revolving in an anti-clockwise direction, and appeared to be travelling the same direction and speed of the ship (115°, 16.5 kt.) as it retained its relative position until 6 p.m. Barometer steady, wind steady from N.N.E., force 4, but increasing to 7 at 6 p.m. when

ship overtook cloud. Sea confused, short and choppy, swell from south, slight. Wind appeared to be trapped under cloud as smooth sea could be seen just outside the radius of cloud, and when it passed wind fell light for ten minutes, then veered to N.E. by E., force 2-3, and became very hot and humid. After 6.30 p.m. wind veered further to S.E., and at 8 p.m. steadied at S.S.E., force 2-3."

THUNDERSTORM.

Malacca Strait.

THE following is an extract from the Meteorological Report of S.S. *Clan Macnaughton*, Captain A. W. SIMPSON, Durban to Singapore. Observer, Mr. D. D. INGRAM, 2nd Officer:—

"November 10th, 2000 hours, when near Cape Ricardo Lt. heavy Cu-Nb clouds were observed banking up to leeward in an E.N.E. direction, the wind being from S.W., force 3-4, at 2230 freshened and backed to the N.E. and intense downpour of rain commenced, making it impossible to see more than a few yards in any direction. The rain was accompanied by vivid lightning and intense peals of thunder. At 2240 the vessel was struck on the foremast head by lightning and at the same time a noise resembling an explosion was heard. Flashes of light were seen all over the fore part. The truck and pole were split in pieces and hurled to the deck with great violence. 2310, rain commenced to ease up and wind to veer to its original direction, i.e. S.S.W'ly., force 3, and by midnight the

weather was considerably cleared and visibility improved. Barometer 29.85 in., air temperature 76°, sea temperature 86°, weather r.t.l."

HAIL.

In the Red Sea.

THE following is an extract from the Meteorological Report of S.S. *Herefordshire*, Captain R. MANN, Rangoon to London. Observer, Mr. M. D. LOUTTILL:—

"On November 25th, 1927, at 9.0 a.m. A.T.S. (0609 G.M.T.), when in Latitude 18° 41' N., Longitude 39° 38' E. Barometer 29.99 in., temperature 83° F., wind S.S.E., force 4, moderate sea and swell, sky half covered with Cumulus clouds, first observed a squall working up from E. by S. 10 a.m., barometer steady, 29.99 in., squall much larger and spreading out to northward and overtaking ship slowly, composed of heavy Cu-Nb clouds, with steady rain falling from them. 11.35 a.m., barometer 29.98 in., temperature 83°, wind backed to east and freshened to force 6, with a decided fall in temperature falling to 78° by 11.45 a.m. The squall now approached the ship rapidly, light rain falling till noon. From then till 0.35 p.m. torrential rain fell accompanied by large hailstones from heavy Nimbus clouds. The wind then veered round to its original direction S.S.E. and temperature rose to 83° F. by 1.0 p.m. The barometer remained steady throughout."

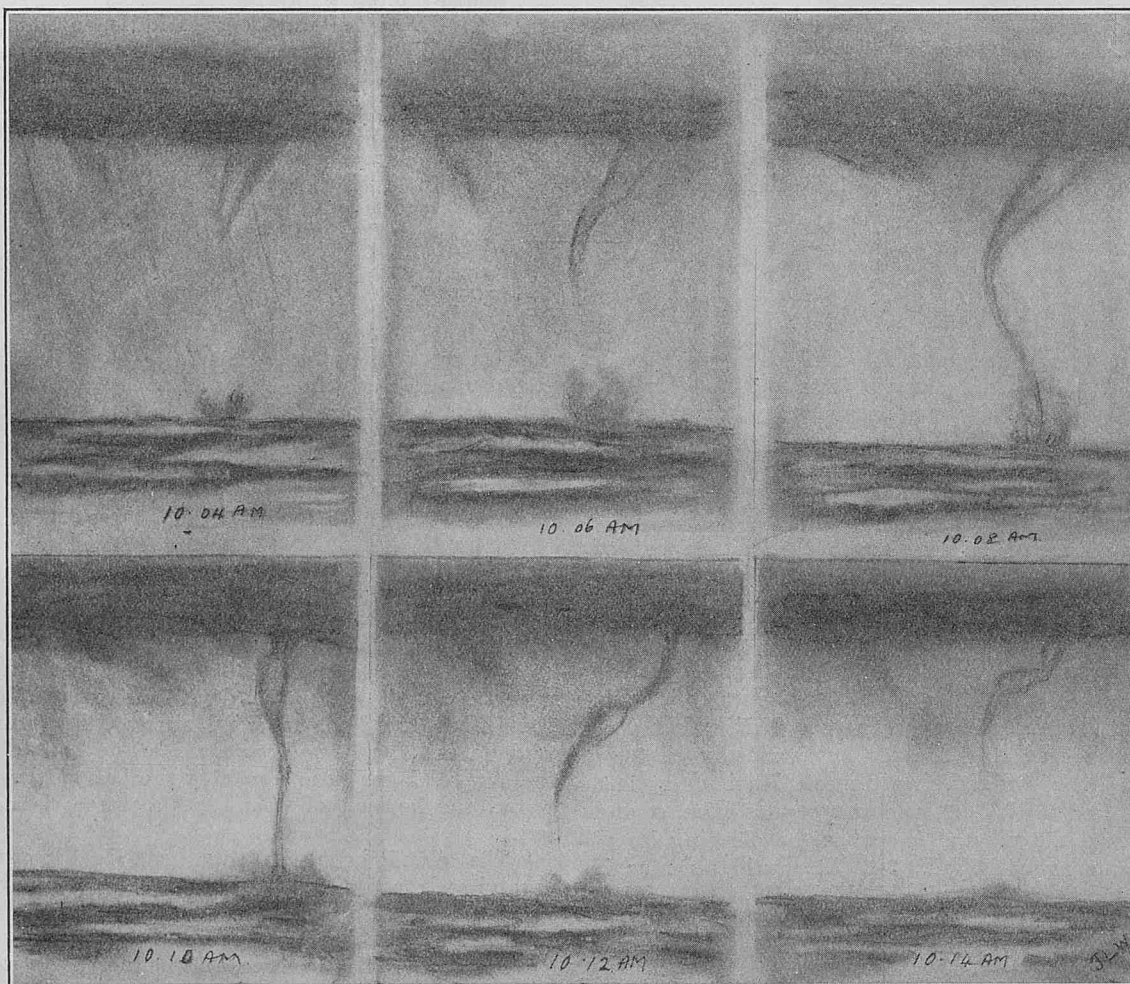
WATERSPOUT.

North Atlantic.

THE following is an extract from the Meteorological Report of S.S. *Craftsman*, Captain W. H. GIBBINGS, San Francisco to London. Observer, Mr. J. L. WILLIAMS, 3rd Officer:—

"November 1st, 1927, at 1004 a.m., A.T.S., in Latitude 39° 46' N., Longitude 40° 18' W. A waterspout was observed having an altitude

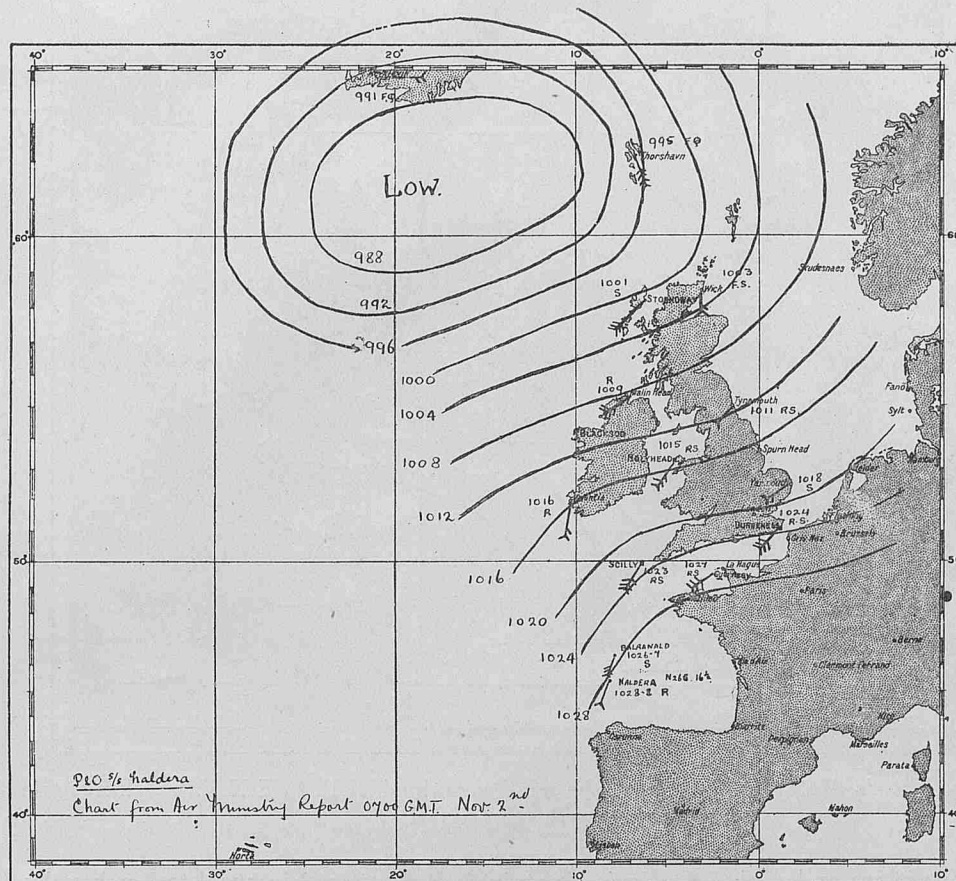
of 1° 21', and remaining in formation for a period of 10 minutes. This phenomenon occurred shortly after a Line Squall, heavy, with rain and hail, had passed over the vessel, travelling in a S.W'ly. direction. Heavy Nimbus and Cu-Nb cloud, wind N.W. by W., force 5, sea N.W. by W. 5, swell N.W. 6, sea temperature 68°, air 57°, wet bulb 54°."



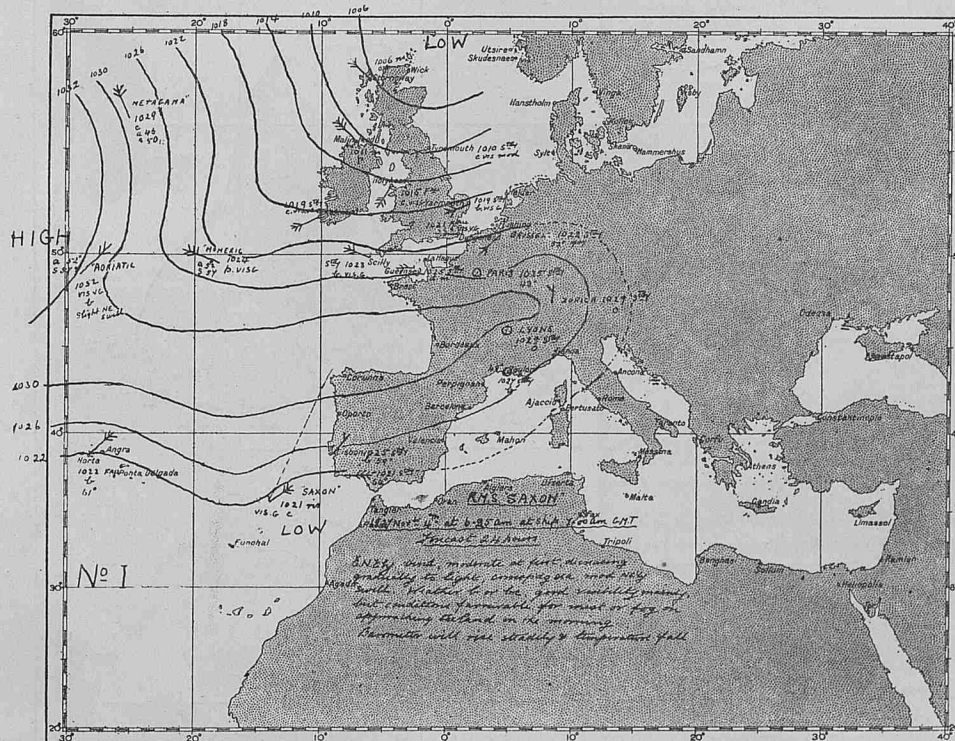
WEATHER CHARTS MADE AT SEA.

Eastern North Atlantic.

Weather Chart made at sea on board S.S. *Naldera*, Captain T. C. E. DAYAS, Sydney to London, by Mr. C. H. HAND, 2nd Officer.



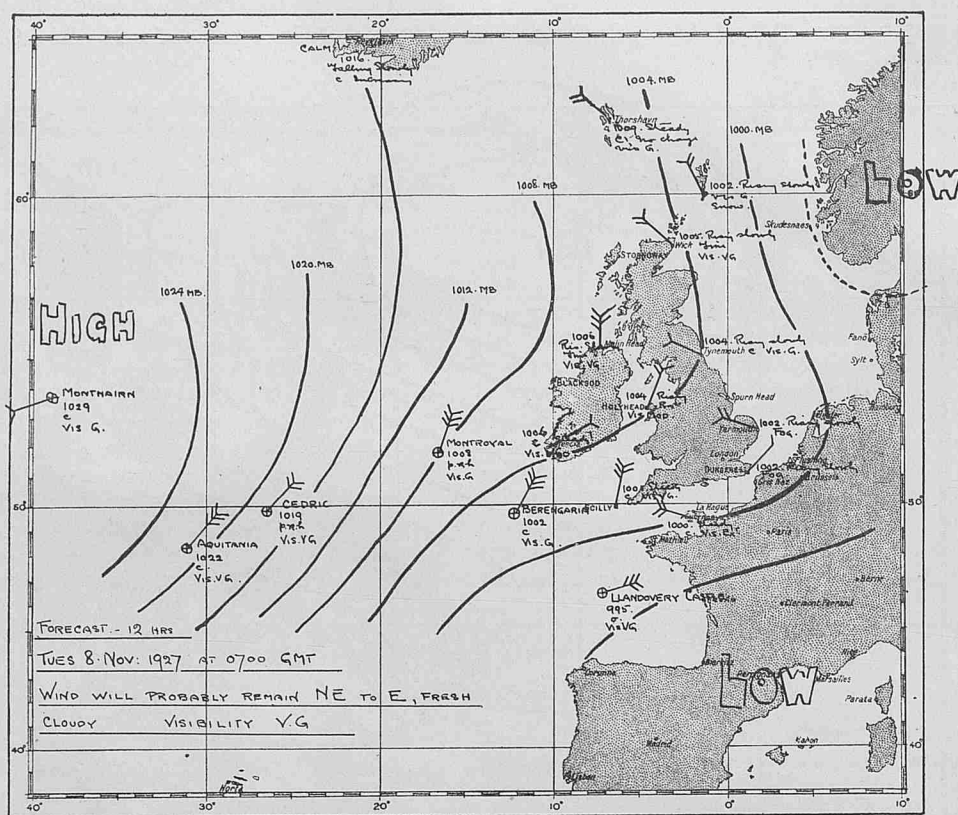
Weather Chart (one of a series) made at sea on board S.S. *Saxon*, Captain G. F. GARDNER, O.B.E., Cape Town to Southampton, by Mr. G. H. PICKERING, 4th Officer.



According to *Saxon's* Meteorological Report the wind remained N.E. by E. during the 4th November, decreasing to force 1-2 by 8 p.m. Weather fine, misty sky at 4 a.m. of the 5th, which cleared when the wind increased in force and backed to N.N.E. at 6 a.m.

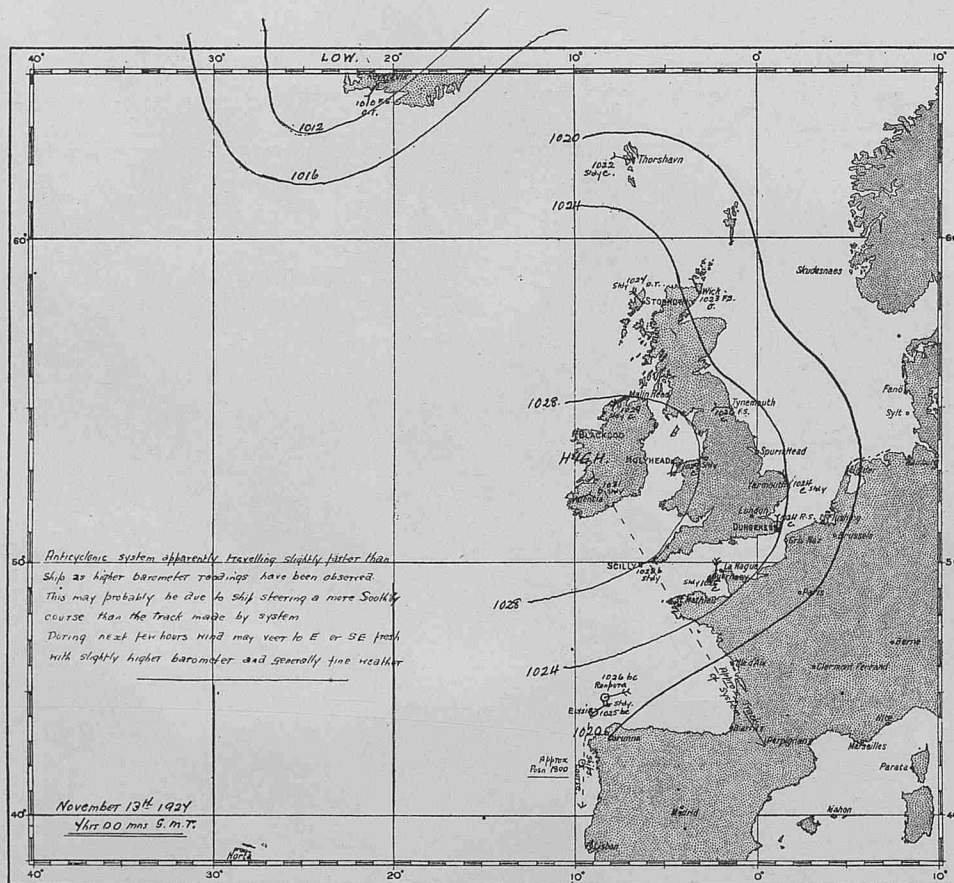
Eastern North Atlantic (continued).

Weather Chart (one of a series) made on board S.S. *Llandovery Castle*, Captain G. OWENS, Marseilles to London, by Lieutenant C. H. WILLIAMS, R.N.R.



According to *Llandovery Castle's* Meteorological Log, the wind remained N.E. to E.N.E., reaching gale force by midnight 8th, with rain squalls.

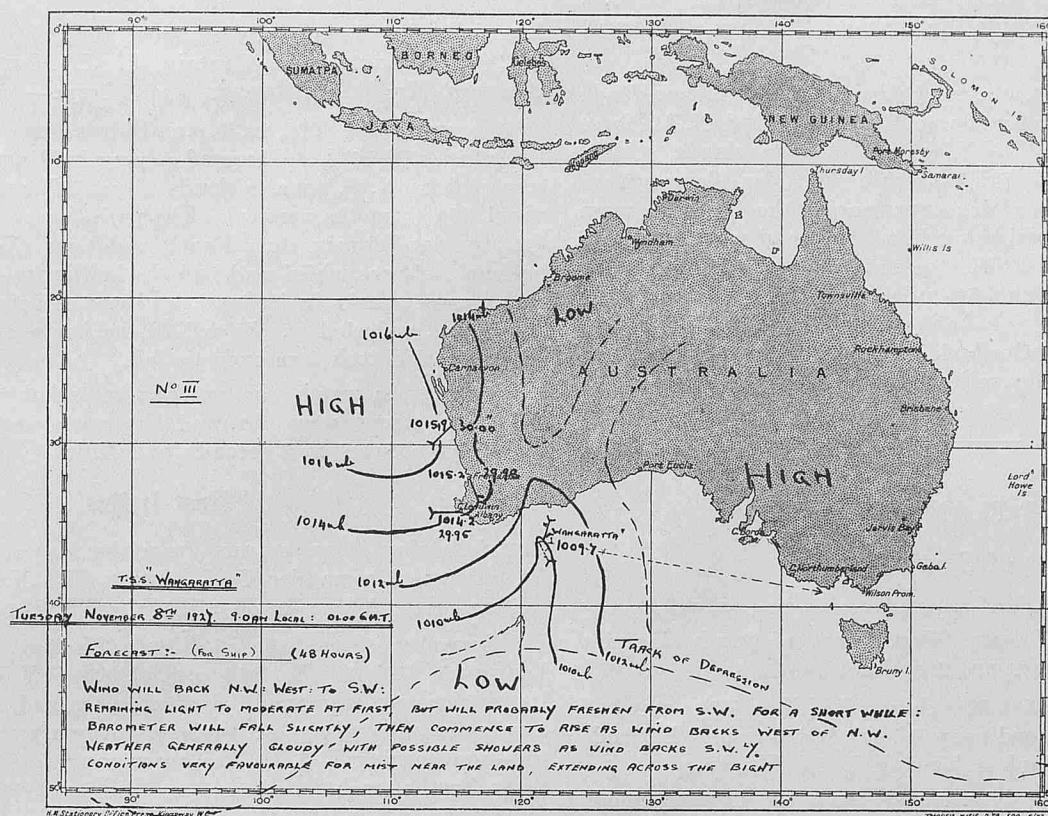
Weather Chart made at sea on board S.S. *Elysia*, Captain A. R. DUNCAN, Liverpool to Bombay, by Mr. A. LAIDLAW.



According to *Elysia's* Meteorological Log, wind remained from E.N.E. throughout the 24 hours, force 4 to 5, weather fine.

Australian Waters.

Weather Chart (one of a series) made at sea on board S.S. *Wangaratta*, Captain W. SCUTT, Colombo to Melbourne, by Mr. S. R. MILLARD, 2nd Officer.



MIRAGE.

Australian Coast.

THE following is an extract from the Meteorological Log of S.S. *Changte*, Captain F. C. GAMBRILL, Melbourne to Sydney. Observer, Mr. BAIGENT:—

"November 15th, 1927, at 2.40 p.m., Latitude $38^{\circ} 07'$ S., Longitude $148^{\circ} 47'$ E., bound from Melbourne to Sydney. Wind N.E., force 0 to 1. Sea calm. Slight N.E. swell. Upper clouds, Ci-St. Barometer 1012.0. Dry Bulb 73° , wet bulb 70° . Sea Temperature 63° . A phenomenal refraction was experienced, the beach between Ricardo Pt. and Cape Everard being lifted so far above the horizon as to appear on top of the Cliffs instead of at the bottom. The shore at Pearl Point, although 16 miles away, seemed more like 8 miles. Towards 4 p.m. a fog bank was noticed to be forming ahead, but the weather remained clear and the smoke of passing vessels could be seen for many miles lying in straight lanes across the sky."

SETTING OF PLANET JUPITER.

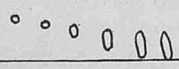
West Coast of South America.

THE following is an extract from the Meteorological Report of S.S. *Orduna*, Captain T. DANIEL, West Coast of South America Ports. Observer, Mr. R. ECKFORD, 3rd Officer:—

"November 13th, 1927, at 0320 ship (G.M.T. 0720), watched Jupiter setting through an ordinary 2" ship's telescope. Latitude 36° S., Longitude 73° W., Jupiter bearing S. 85° W., True.

"As the planet descended it changed from its normal colour through varying shades of pink to deep brownish red as it disappeared. It seemed that for a few seconds the upper limb had stopped, while the lower continued to descend. The whole disappearing instantaneously.

"Sketch will give some idea of its appearance."

Horizon  successive appearance of planet.

METEORS.

North Atlantic.

THE following is an extract from the Meteorological Report of S.S. *Winifredian*, Captain W. H. HARROCKS, Liverpool to Boston. Observer, Mr. A. CRONE, 3rd Officer:—

"November 2nd, 1927, 0012 G.M.T., Latitude $50^{\circ} 15'$ N., Longitude $25^{\circ} 14'$ W. A ball of light blue flame, about half the size of the full moon, appeared in the western sky at an altitude of approximately 40 degrees illuminating nearly the whole of the sky for 2 seconds. It descended slowly for 4 seconds then disappeared, except for a small portion which shot off at an angle of ten degrees in a northerly direction. Thirty seconds later a small meteor fell in the northern sky. Both left long tails and disappeared at about 5° altitude. The first passed between Vega and Altair.

"0020 G.M.T. Another ball of flame in western sky at an altitude of about 25 degrees, disappeared behind clouds."

THE following is an extract from the Meteorological Report of S.S. *Inkum*, Captain J. T. MEETHAN, Nordenham to Savannah. Observer, Mr. H. JOHNSON:—

"30th November, 1927, 3.45 a.m., Latitude $32^{\circ} 38'$ N., Longitude $57^{\circ} 08'$ W. A clearly defined meteor appeared 5° above horizon, bearing S. by E. true, and rose slowly, taking about four seconds,

to an altitude of 35° . It was then observed to 'fall' rather than 'break' into two distinct halves, which disappeared after dropping about 3° ."

Indian Ocean.

THE following is an extract from the Meteorological Report of S.S. *Clan Mactaggart*, Captain F. T. MEE, Adelaide to Aden. Observer, Mr. E. A. HEWSON, 3rd Officer:—

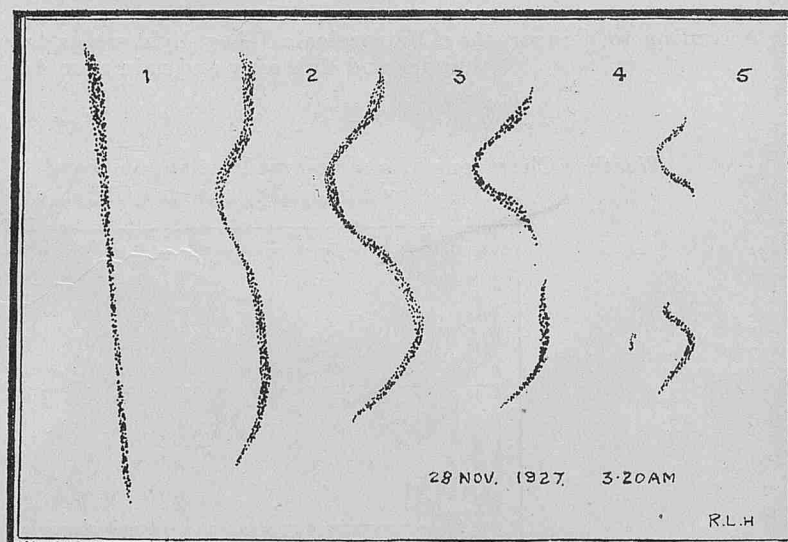
"November 4th, 1927, 10.30 p.m. Ship's Time, in Latitude $7^{\circ} 06'$ N., Longitude $57^{\circ} 57'$ E. Observed a very brilliant meteor. When first seen it bore N.W. true, altitude about 18° , and fell at an angle of about 20° from the vertical. The path traced by the meteor across the sky was between stars Deneb and Vega (Vega setting below the horizon). It resembled and had the brilliance of a rocket, including a shower of sparks in its trail, and was so bright that the foremast, stays, etc., reflected it. It fell to the horizon nearly before losing its light, and took 3 seconds to fall.

"During the watch, the sky was remarkably clear, several other 'shooting stars' were observed but none were of any brilliance; each took about 2 to 3 seconds to fall."

East Indies.

THE following is an extract from the Meteorological Log of S.S. *St. Albans*, Commander G. L. SMITH, R.A.N.R., Thursday Island to Sandakan. Observer, Mr. R. LLOYD HARRY, 2nd Officer:—

"November 28th, 1927, in Sibutu Passage, Latitude $4^{\circ} 41'$ N., Longitude $119^{\circ} 39'$ E., 3.20 a.m. (1920 G.M.T.). Ship brilliantly lit by a meteor, the track of which remained visible for about half a minute, subtending an angle of approximately 20° —from 30° to 50° —and bearing E.S.E. The accompanying sketch shows the forms taken by the track."



SERRATED STREAK OF LIGHT IN SKY.

North Atlantic.

RECEIVED from S.S. *Bolingbroke*, Captain F. H. MOORE. Observing Officer, Mr. J. B. HEWSON:—

"On the morning of 2nd November, 1927, at 0150 G.M.T., in Latitude $52^{\circ} 24'$ N., Longitude $21^{\circ} 11'$ W., a peculiar phenomenon was observed.

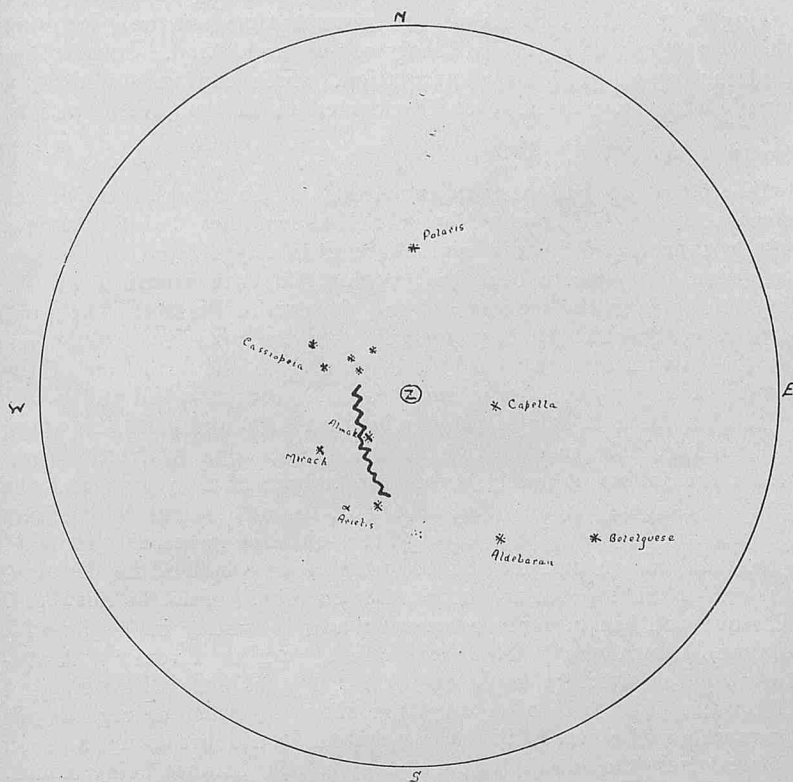
"For two days previous to this time strong gales had been experienced from the East and South—and at night lightning was prevalent. Many meteors had also been observed in all directions for the previous three nights.

"At the above time, wind S. by W., force 10, barometer 995 m.b. rising slowly and sky practically cloudless, after several bright

flashes of sheet lightning in northern sky, a particularly vivid flash was experienced, causing momentary blindness.

"A long 'serrated streak' of bright yellow colour, tinged with green, was observed almost in the zenith.

"This 'streak' remained absolutely stationary and of constant brilliance for about six minutes, then faded slightly for about one minute and abruptly disappeared. There was no change in the weather after this. No thunder was heard. No more lightning was seen. Several meteors were seen, both before and after this occurrence in different parts of the sky—they however left little or no wake and it was impossible to ascertain their radiant point."



Approximate Position and Extent of "Serrated Streak" of yellow and green between 0150 and 0157 G.M.T. on 2nd November, 1927. Latitude $52^{\circ} 24' N.$, Longitude $21^{\circ} 11' W.$

COLOURED HALOS.

Atlantic Ocean.

THE following is an extract from the Meteorological Report of S.S. *Canonesa*, Captain W. H. BRODIE, London to Montevideo. Observer, Mr. F. H. KENT, 2nd Officer:—

"November 8th, 1927, 11.40 p.m. A.T.S., a halo appeared around the moon whose altitude was $86^{\circ} 50'$, with a radius of 22° , no arc of

contact visible. When it first appeared the colours in the spectrum could be seen, but faintly, to be crimson on inner edge thence yellow and bluish green on outside, becoming less distinct until disappearing at November 9th, 0.10 a.m. Reappearing from 1.30 to 1.51 a.m. but of considerably less brilliance. Position at midnight, Latitude $9^{\circ} 53' N.$, Longitude $26^{\circ} 51' W.$ Course 194° 12 knots. Weather at time of occurrence, wind S.S.E., force 1. Sea smooth, slight S.E. swell, Ci-St./Ci-Cu/ Fracto-Cumulus, 8 tenths.

"November 16th, 1927. Noon, Latitude $23^{\circ} 18' S.$, Longitude $41^{\circ} 00' W.$ At 0.30 p.m. a halo appeared around the sun, radius $22\frac{1}{4}^{\circ}$, sun's altitude $79^{\circ} 20'$ approx. Spectrum very distinct. Colours reddish brown next to sun then yellow bluish green, decreasing in brilliancy at 0.50 p.m. Cumulus clouds partially obscuring halo, disappearing at 2.00 p.m. when Cirrus clouds dispersed. Clouds present were Ci/Ci-St/Alt-Cu/Cum/Cu-nb. Wind E.N.E. 3-4. Moderate confused sea and swell, previous weather, forenoon watch, heavy rains."

LUNAR CORONA.

West Coast South America.

THE following is an extract from the Meteorological Report of S.S. *Orduna*, Captain T. DANIEL, West Coast of South America Ports. Observer, Mr. R. ECKFORD, 3rd Officer:—

"November 13th, 1927, being off Cape Carranza, Chile, in approximately Latitude $35^{\circ} 30' S.$, Longitude $72^{\circ} 54' W.$, the moon rose bearing E.N.E. soon after 0000 at ship (G.M.T. 0400). It was very distorted and of a dull red colour.

"Having reached an altitude of 4° , and assumed its normal form, a fine corona was developed; in diameter $2\frac{1}{2}^{\circ}$ with colours. The outer ring being red with a distinctly brownish tinge, and whose edges were sharply defined. Inside of this came a very faint suggestion of yellow, and then the 'Aureole.' The colour of the aureole ranging from the palest shade of blue at its outer margin to white.

"The wind at time of observation was S.S.W., force 3; no cloud whatsoever, and an unusually clear atmosphere. There was a suggestion of mist above the land to the eastward.

"The corona's magnificence was maintained to an altitude of 10° at about 0045 (G.M.T. 0445) when it slowly paled, but perceptibly waxing and waning. The colours meanwhile slowly changed to white, and at 0100 (G.M.T. 0500) it appeared as a white disc of slightly less diameter.

"At 0105 (G.M.T. 0505) it was no longer discernable, the moon's altitude being then 12° .

"The moon was 3^d . 18^h . 30^m . past the full."

NOTE.—Plates produced by Lithographic process, including Charts and other large diagrams, will be found in each number after "Weather Signals."

THE TRADE WINDS.

IV.—The General Circulation.

We have now to consider the general circulation of the air in and above the Trade Wind regions. As the area affected by these winds is a large one, nearly half the area of the globe, it will be obvious not only that they play a very important part in the entire atmospheric circulation of the earth, but also that they cannot be considered apart from the general circulation. We shall therefore be able, without going very far from our immediate subject, to consider the main features of the general circulation, and it will indeed be necessary to do so. Our knowledge of wind is of three kinds:—(i) that derived from the direct observation of winds over sea and land at the surface, (ii) that derived from the direct observation of winds at various heights in the atmosphere, made by means of pilot balloon or other methods, (iii) knowledge of the average winds at various heights derived from the calculated average atmospheric pressures at those heights. This latter type of information will require some further explanation. We start with a chart of the known average distribution of atmospheric pressure at the earth's surface for, let us say, the month of July. To the separate values of pressure shown on this chart we apply a correction for the particular height in the upper air that we wish to investigate, based on our knowledge of the rate of decrease of pressure with height above the surface. On a new chart these corrected decreased values are plotted and the appropriate isobars drawn in the ordinary way. Finally we apply our knowledge of the ordinary relations between wind and pressure near the surface to the pressures on this chart in order to determine the average wind circulation for the chosen height during the month of July. Of these three kinds of knowledge of wind the first is fairly comprehensive and detailed, though as we saw for example in the second article of this series, it is by no means perfect, especially over the oceans. The second is very scrappy, owing to the comparatively small number of the observations, taking the earth as a whole, which it has yet been possible to make. The third is of great value in giving a general idea of the main features of the upper air circulation, but the results must be considered only as an approximation to the truth for they are largely founded on calculation and in this calculation certain assumptions have to be made which may or may not be strictly true.

In the present article we have therefore to present an account of the circulation of the air at and above the surface, primarily in Trade Wind regions, which shall combine the various kinds of knowledge above described. This will differ in some respects from the explanations which have for many years been given in physical geography and other text-books and which are based on HALLEY and HADLEY's theory of the Trade Winds. The description now given is to be regarded as a working hypothesis, that is, a useful summary of the present state of our knowledge. As is the fate of all working hypotheses, it is liable to be modified in the future, when our observational knowledge of the winds of the upper air is increased, but in the present instance the main outlines seem to be pretty well established. We have indeed a considerably better knowledge of the air currents in the heights of the atmosphere than we have of the water currents in the depths of the ocean. It would be more satisfactory if we were also able to give in this article a complete account of the why and wherefore of atmospheric circulation, in other words a general theory. During the last forty years, however, no attempt at a comprehensive description and theory of the circulation has been made. This is due to several causes. The growth of the science of meteorology and especially of knowledge of the dynamical and physical processes of the atmosphere, while great, has only served to show how much there is that we do not yet know and how much more complicated these processes are than was formerly imagined. The theories which held sway until the end of the nineteenth century were too simple and will not stand the light of our newer knowledge, which though very imperfect is steadily growing. In this sense, then, because we know more we feel we know less, and we seem to be standing only in the outer

apartments of a building of enormous complexity. A most important feature of recent years has been the birth and growth of direct observation of the winds of the upper air. By means of these observations we have collected a number of facts about the upper air which we did not know, or were not certain of, before, but we have only touched the fringe of the subject on account of the practical difficulties of making the observations, and in particular the difficulty of reaching high altitudes. We may summarise by saying that meteorologists at the present time are only groping their way towards a general theory of the circulation. Some of the contributory causes of the circulation, which can be stated in a simple manner, will however be referred to in the present article.

Pressure and Wind.

In setting out our present knowledge of the actual facts of the circulation we will start with the well-known fact that the surface winds experienced in any region are definitely related to the distribution of pressure over that region, but are modified by the friction between the moving air and the earth's surface. The wind at any place which corresponds solely to the pressure distribution at the earth's surface would flow parallel to the direction of the isobar at that place; this is known as the gradient wind and is met with at a variable height, usually between 1,500 and 3,000 feet above the surface. The modification at the surface due to friction produces the inflow obliquely across the isobars of a cyclone and the outflow obliquely across the isobars of an anticyclone which may be seen on any synoptic chart. The question whether the wind gives rise to the distribution of pressure or whether the distribution of pressure produces the wind is one that cannot be answered. The question has in fact no meaning and is exactly on a par with the well-known one "Which came first, rain or rivers"? A distribution of pressure with its winds is a balance of forces and if it were possible to alter anything about it, either as regards the pressure or the wind, the whole system would break up and an entirely new one would be formed by a new balance being struck.

The common meaning of the word "gradient," "an inclination," as for example of a land surface, is well-known to everybody. It has been taken into use in connection with atmospheric pressure to mean the rate of change of pressure between two points on the earth's surface where the pressure has been measured at the same time. Hence its application to wind, when we desire to talk of the wind which corresponds to the pressure gradient without taking the effect of friction into account. Later on we shall see that at various heights in the atmosphere the average pressure distribution is different from that at the surface or at other heights. It should be clearly understood that for any height we like to think about the winds will correspond to the pressure distribution at that height, blowing parallel to the isobars. In other words each successive height has its own pressure distribution and hence its own gradient winds. When meteorologists talk of "the gradient wind" without further explanation they are referring to that of the surface pressure distribution.

The Surface Circulation.

The average surface pressures for the world in the months of January and July are shown in two charts published in *THE MARINE OBSERVER*, Vol. IV, No. 42, June, 1927. The main features of the July chart are the five well-defined high pressure areas in the North and South Atlantic Oceans, North and South Pacific Oceans and South Indian Ocean. The continental areas are generally speaking areas of low pressure, as also is the equatorial region and the Southern Ocean south of Latitude 40° S. In the January chart the features of the Southern Hemisphere are essentially the same, but those of the Northern Hemisphere are quite different. The distribution of pressure in this hemisphere shows an extensive area of low pressure centred at about Latitude 60° N. in the North

Atlantic Ocean, and a similar but smaller one in the North Pacific centred at about Latitude 50° N. The continental areas are regions of high pressure while the high pressure areas of the North Atlantic and North Pacific Oceans, so prominent in July, still remain but in modified and less extensive form. These charts do not cover the polar regions, but it may be said that the average pressure decreases very regularly in all longitudes towards the South Pole at all times of the year up to the neighbourhood of the Antarctic Circle. Probably a permanent anticyclone covers the extensive land area in which the Pole is situated. The average pressure in the North Polar region is irregular and intermediate in character, and is variable from month to month, but of the pressure at the Pole itself we have little knowledge. For the earth as a whole the average pressure in other months is of types intermediate between that of January and July.

The main features of the wind circulation associated with these pressure distributions are:—

- (i) A general easterly equatorial wind.
- (ii) The Trade Winds.
- (iii) The prevailing westerly winds of temperate latitudes.

We shall consider these somewhat more fully.

The general easterly wind in the equatorial region is maintained by air flowing in from the Trade Winds of the Northern and Southern Hemispheres. Within this easterly wind are the narrow belts of the Doldrums, which are between the easterly wind of Northern origin and that of Southern origin. The Doldrums therefore represent the meeting place of masses of air whose physical qualities are in general different. The Trade Winds form the chief source of supply for the easterly equatorial wind. These great streams of air, with 2,000 miles of run, come mainly from the eastern sides, but also in part from the equatorial sides, of the great oceanic anticyclones. It is interesting to note that the western margins of the permanent anticyclones, in all oceans are much less clearly marked by the winds than are the eastern margins. The really characteristic Trade Winds are the flows from the eastern sides of the permanent anticyclones and the easterly winds of the Caribbean Sea actually form part of the equatorial flow. It is, however, the usual custom to call all the winds between the Doldrums and the anticyclonic regions the Trade Winds. A part of the air conveyed by the Trade Winds to the equatorial wind, after becoming easterly in direction, turns northward again in the Northern Hemisphere and leaves the equatorial region by passing round the western boundaries of the anticyclonic regions. A corresponding state of affairs occurs in the Southern Hemisphere. The third main feature forms the "Brave West" or South West winds, which are experienced from latitude 40° Northwards in the North Atlantic and North Pacific, and as an uninterrupted belt of 10° or 20° wide in the great Southern Ocean, the "Roaring Forties." These winds are variable and fluctuating and the region in which they prevail in both hemispheres is that in which cyclonic depressions are formed, travel and disappear.

After making allowance for the modification of the surface winds on account of friction there is, on the whole, a very good agreement between the observed winds over the oceans and the average monthly pressure distribution. Over the land surfaces the relation is less clearly marked because of the disturbing local influences of the varying heights of the land and the radiation of heat from the ground. In other words if it were possible to have very detailed wind observations over all the oceans on a particular day a very fair pressure chart could be drawn from them alone, but for the land areas this could not be done. We have just said that the agreement for the oceans is good as a whole. There are a few exceptions, of which the two most important may be mentioned here. The first is the monsoonal circulation of the North Indian Ocean and the Indian peninsula where the winds are roughly speaking at right angles to the isobars. The second is the wind of the equatorial regions which, apart from the winds of tropical cyclones, is not related to the isobars as closely as in other latitudes. The effect of the earth's rotation in deflecting the wind to the right in the Northern Hemisphere and to the left in the Southern Hemisphere is one of the essential factors of the balance of forces in any closed system of isobars, whether cyclonic or anticyclonic, and this effect which is at a maximum in polar regions, becomes less as the equator is approached and is zero at the equator itself.

The Circulations of the Upper Air.

By the use of the method outlined in the introduction to this article, upper air pressure charts have been constructed for various altitudes. The first of these were published by TEISSERENC DE BORT in 1893 and the latest are those which are to be found in Sir NAPIER SHAW'S "Manual of Meteorology," Volume II. Charts are therefore now available for heights which we may regard approximately as 6,500, 13,000, 19,500 and 26,000 feet. FIGURES 6 and 7 are reproduced by kind permission of Sir NAPIER SHAW. FIGURE 6 shows the average pressures at a height of 6,500 feet for the Northern Hemisphere in July and FIGURE 7 those at 26,000 feet in the same month.

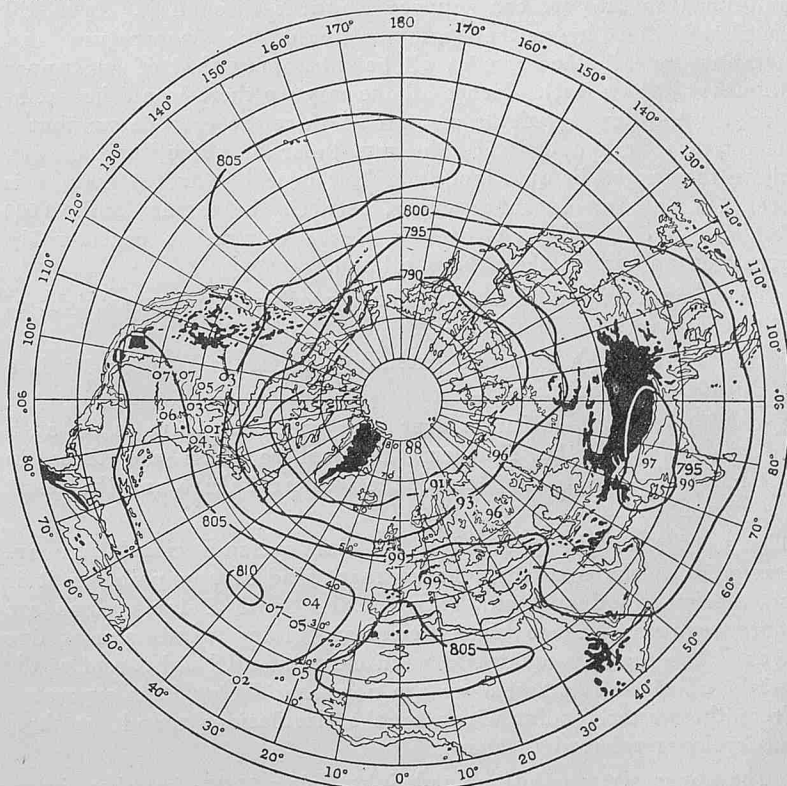


Figure 6.—Distribution of pressure at 6,500 feet for July.
The figures denote pressure in millibars.

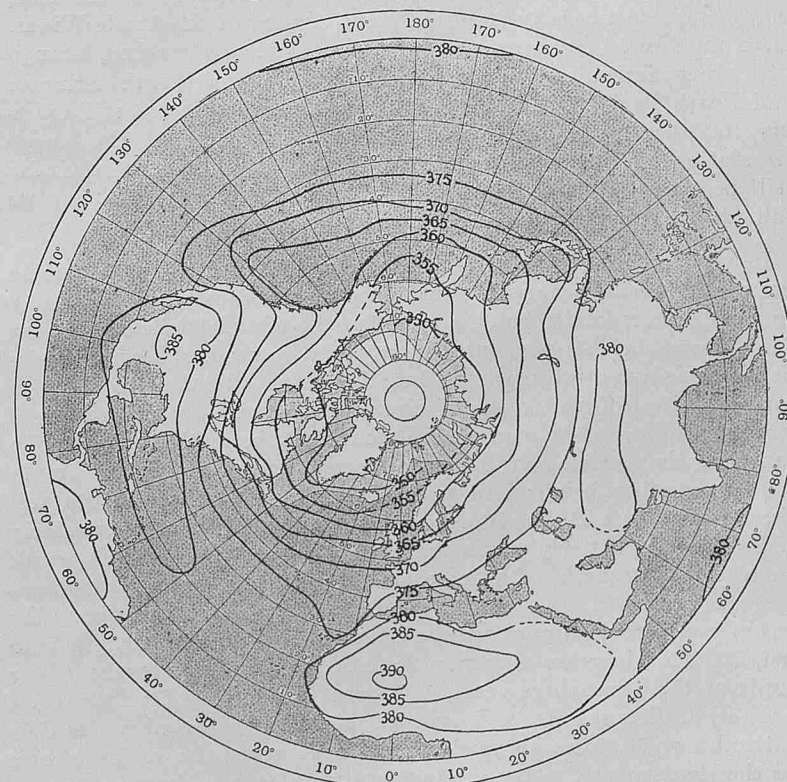


Figure 7.—Distribution of pressure at 26,000 feet for July.
The figures denote pressure in millibars.

Comparing FIGURE 7 with the surface pressures for July we see that at a height of 26,000 feet there is an anticyclone over Northern Africa and relatively low pressure over the middle latitudes of the North Atlantic Ocean. On the surface chart we have the well-known North Atlantic anticyclone and relatively low pressure over Northern Africa. It is not difficult to realise how this state of affairs can exist. The barometer reads high at, let us say, Horta, and relatively low at some point in the Sahara. This means that the weight of a column of air reaching to the upper limit of the atmosphere over Horta is greater than that of a similar column over the Sahara. Consider each of these air columns separately and imagine that we can journey upwards through it. It would be found that in neither column would the temperature and humidity remain the same at all heights up to that of our upper air chart (26,000 feet). Hence all the way up there would be variations in the density of the air. It is therefore easy to see that a height may be found where the remainder of the column of air, above the height in question, is lighter over the Azores than it is over the Sahara. In other words, between the surface and 26,000 feet the average density of the Horta column is considerably greater than that of the Sahara column.

The main features of the distribution of pressure at a height of 26,000 feet are very simple:—

(i) Over each pole and extending as far as latitude 30° is a great low pressure area.

(ii) In lower latitudes over each continent there is an anticyclone. For the Northern Hemisphere these are three in number, centred over Mexico, the Western Sahara and the desert region of Asia.

The isobars of the great North Polar cyclonic circulation are irregular in shape so that the average wind at any point in it is not necessarily due West. Those of the South Polar cyclone are more regular and are nearly circular, giving winds almost due West. The easterly equatorial wind exists at all heights and at the height of 26,000 feet which we are now considering it is separated from the westerly polar winds by the circulations round the three anticyclones referred to above.

The upper air circulations at heights below 26,000 feet show intermediate stages between the circulation at the surface and that at 26,000 feet. Of these, that at 6,500 feet (FIGURE 6) is the most interesting, particularly from the point of view of the Trade Winds. Here the North Polar cyclone is already strongly marked, though with very irregular isobars, and we have the North Atlantic and North Pacific anticyclones of the surface circulation still existing, together with the North African anticyclone of the upper circulation. At this height the monsoonal low pressure of India still persists and there is no sign of the anticyclone which, as we saw above, is superimposed above it at greater heights.

It was explained in the introduction to this article that these upper air pressure charts are not to be regarded as strictly accurate in their minor details, but the fact that the distributions of pressure for different heights pass into one another by gradual stages assures us of their essential truth in broad outline. If they had shown several quite different types of circulation erratically superimposed we should have felt much more doubtful about their truth. To sum up, the circulation tends to become more and more simple with increasing height and probably at heights above 26,000 feet there is little left but the two great polar cyclones with their westerly winds and the easterly winds above the equator. The westerly winds increase in strength with increasing height, the pressure gradient becoming steeper, and are also more constant in direction. The easterly equatorial upper wind similarly increases in strength with height. This increase of strength does not continue to the upper limit of the atmosphere because at great heights the conditions are entirely different. At a height of about 6 miles above middle latitudes or 10 miles above the equator we enter the region known as the stratosphere, where the temperature does not decrease further as we go higher. Here, above the region of clouds and convection

currents, the winds are almost entirely unknown, but it is probable that at a considerable height in the stratosphere the winds are light.

Upper Air Observations.

It would be impossible, within the limits of the present article, to set out detailed summaries of the actual observations of the upper air winds that have so far been made. Although kites carrying thermometers had been flown as early as 1749 by Dr. WILSON, of Glasgow, the direct observation of upper air conditions may be said to have begun with A. L. ROTCH's initial experiment from a moving vessel in Massachusetts Bay in 1901. At the present day regular upper air observations to considerable heights are made at a certain number of land stations while observations over the ocean have been made chiefly during the course of meteorological or oceanographical expeditions. The first expedition setting out with the avowed object of studying the conditions over the Trade Wind region was that of PRINCE ALBERT OF MONACO and Professor HERGESSELL in the Northern Atlantic in 1904 and was followed by TEISSERENC DE BORT and A. L. ROTCH's expeditions during the years 1905-7, in the same ocean. Pilot balloon ascents were made in some of the Hamburg-S. America Liners during 1906-8; this was the first attempt to determine the upper wind direction south of the equator. Other work was also carried out before the war, both in Trade Wind regions (chiefly in the West Indies) and also outside them. The most important expedition since the war is that organised by Dr. ALFRED MERZ and carried out in the German gunboat *Meteor* in the North and South Atlantic Oceans during the years 1925-7. In this great expedition observation of atmospheric circulation went hand in hand with observation of the current circulation at various depths. Over 1,000 ascents were made by means of kites and pilot balloons, but unfortunately no summary of the meteorological results has yet been published.

A recent and important development in upper air observation is the organised scheme whereby a proportion of the ships of H.M. Navy in all parts of the world will make a number of pilot balloon ascents each year. When a sufficient number of such observations have been made it will be possible to begin to investigate the upper air conditions over the oceans on a more systematic scale than has yet been attempted. Some account of this work and of individual ascents made has been given in articles by Commander L. G. GARBETT, R.N., in the MARINE OBSERVER. Other ways in which knowledge of upper air currents has been obtained comprise observation of cloud movements, the transport of volcanic dust and the direct observation of wind at mountain stations. It may here be said that on the whole the upper air observations conform to the general scheme of upper air circulation above described. In the next paragraph we shall deal more fully with the upper air circulation over the Trade Wind regions. The most famous of the volcanic dust observations were those resulting from the great eruption of Krakatoa in August, 1883. Fine dust was projected to a very great height and as observed by sunset glows made the entire circuit of the equatorial region in 12 days, which implies a velocity of nearly 71 miles per hour. This constituted the first actual proof that the easterly current flows round the whole earth. The dust, on the contrary, was observed to spread extremely slowly in northerly and southerly directions. It is interesting, however, to note that the westward velocity of the dust was greater than would be expected and that the spread over the entire earth has not yet been explained.

The Circulation over the Trade Wind Regions.

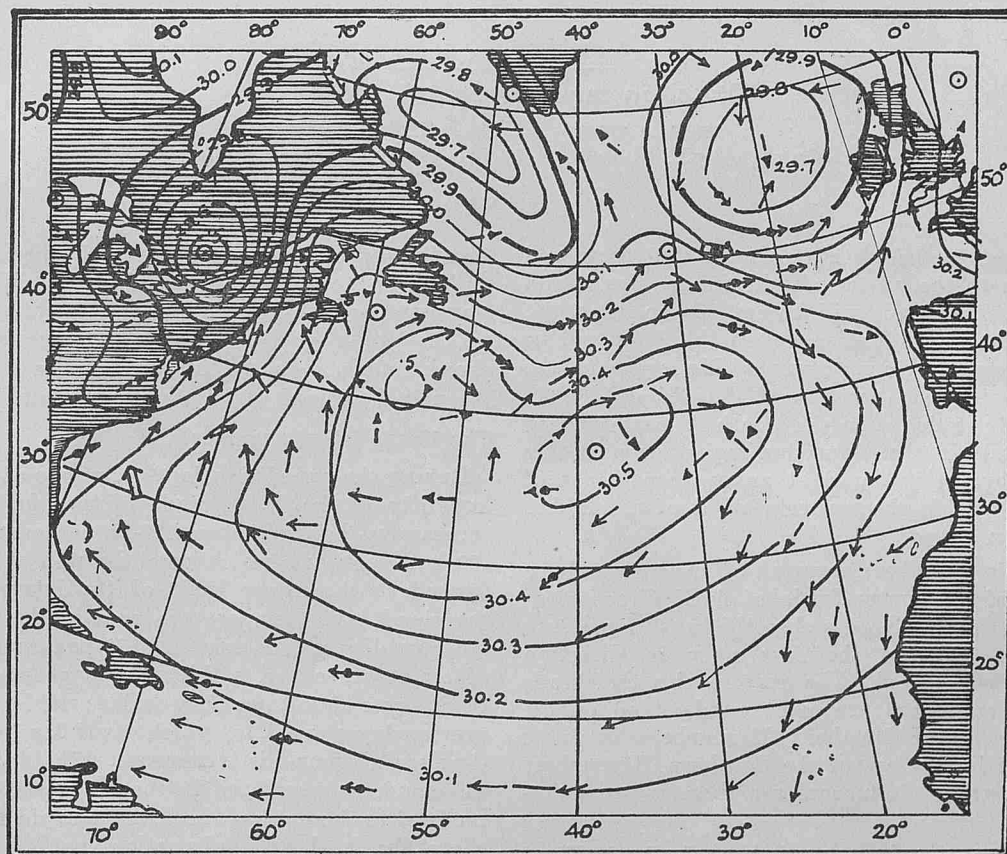
Direct observation has shown that the height to which the N.E. and S.E. Trade Winds of the Atlantic Ocean attain is normally little over 3,000 feet, but very great variations are found to occur. Thus the N.E. Trade Wind sometimes blows at the summit of the Peak of Teneriffe, which is at an altitude of 12,160 feet, and in 1910 JONAS found the E.S.E. Trade Wind in the neighbourhood of Trinidad to reach as high as 13,000 feet. Similar fluctuations have been found in the height at which the Counter-Trade is met, which

has been observed to vary from 6,000 to 30,000 feet. This will serve to emphasise a very important point which should now be clearly stated. We must not imagine that it is only the winds near the earth's surface which are subject to variability of speed and direction. The upper currents in general, including those over the Trade Wind regions, are very variable in character, though conforming on the average to the main outlines of the upper air circulation above described. FIGURES 8 to 10 represent synoptic charts of the North Atlantic Ocean for the three successive days, May 31st to June 2nd, 1883, copied from Captain TOYNBEE'S "Synchronous Weather Charts of the North Atlantic." These show clearly how the oceanic anticyclone varies from day to day within certain limits and so produces the variability in strength and direction of the surface Trade Winds as described in the second article of this series. Just in the same way we must conceive that the pressure distribution at say 5,000 or 10,000 feet varies, at any rate to some extent, from day to day, and considerably from season to season. Furthermore some of the local fluctuations of pressure at the surface will temporarily affect the upper air circulation to the height of our highest map, as for example a large and deep depression in temperate latitudes.

We have stated that the direct upper wind observations are in reasonably good agreement with the upper air pressure charts. W. van BEMMELEN collected observations of the movement of Cirrus cloud in intertropical regions and these also enable isobars of pressure at the height of this cloud to be drawn. The results are very similar to those for the height of 26,000 feet derived as explained above from the surface pressures. With this combined knowledge we can therefore proceed to set out approximately the

directions of the Counter-Trade. The normal state of affairs, proceeding northwards over the region of the N.E. Trade, is for the Counter-Trade to blow successively from S.E., S. and S.W., finally becoming westerly in the latitude of the Azores. Just as the Trade at the surface is an integral part of the circulation round the oceanic anticyclone, so the Counter-Trade is an integral part of the circulation round the upper air anticyclone which as we have seen lies over Northern Africa. Between the Trade and the Counter-Trade in relatively high latitudes of the North Atlantic, an intermediate stratum of wind has been directly observed. This blows from N.W. and probably helps to feed the northern side of the oceanic anticyclone. Over the Trade Wind of the Caribbean the upper winds are easterly or south-easterly in direction and form part of the circulation round the upper air anticyclone which is centred over the Mexican region. Over the South Atlantic ocean a Counter-Trade is formed in exactly the same way as in the North Atlantic, there being an upper air anticyclone over the south-western coasts of Africa. The resulting wind directions, proceeding southward over the Trade Wind region, are N.E., N. and N.W., finally becoming Westerly. Thus in both hemispheres the Counter-Trade forms a connecting link between the upper air easterly wind of equatorial regions and the upper air westerly wind of temperate and polar regions. As regards the other oceans the upper winds over the Trades are somewhat similar in character but we have fewer direct observations to confirm the results. Both in the North and South Pacific Ocean the permanent anticyclones lie much nearer the eastern continental shores, in proportion to the width of the ocean, than is the case in the Atlantic. In the extreme eastern parts of the Pacific the Counter-Trades will have the same

Greenwich Noon, 31st May, 1883.

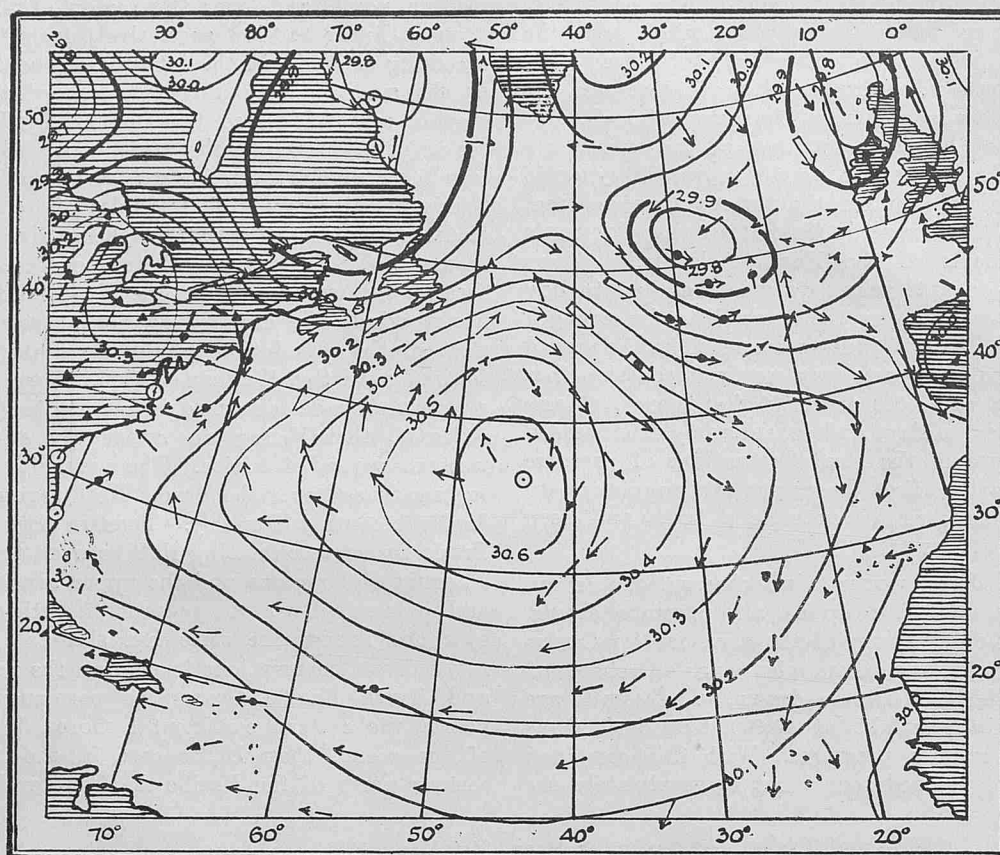


EXPLANATION.

Direction and Force of Wind.
 ○ —→ —→ —→ —→ —→ ●
 Calm, 1-3, 4-6, 7&8, 9&10, 11&12, Squalls.

Figure 8.

Greenwich Noon, 1st June, 1883.



EXPLANATION.

Direction and Force of Wind.

○ —> —> —> —> —> ●
 Calm, 1-3, 4-6, 7&8, 9&10, 11&12, Squalls.

Figure 9.

successive directions as those of the eastern Atlantic, but there will be a large extent of ocean to the westward both in the North and South Pacific where the upper winds will be easterly in direction. Over the eastern part of the South Indian Ocean the wind will be easterly, while in the western part, towards Madagascar, the Counter-Trade takes the successive directions N.E., N. and N.W., with increasing southerly latitude, as in the South Atlantic Ocean. Upper air observations made in the Mauritius region support this view. A N.W. or S.W. current is found at an average height of 10,000 to 13,000 feet. Above this the westerly wind of the higher general circulation has been found.

Thus we see that there is no direct reversal of the wind above the Trades in the sense of a Counter-Trade of fixed direction as imagined by HALLEY. The Counter-Trades obey the laws of pressure distribution in the upper air and therefore vary in direction according to the latitude considered. The reason why the Trade Winds of the Southern Hemisphere are more regular and on the whole stronger than those of the Northern Hemisphere is to be found in the fact that the land areas of the Southern Hemisphere are smaller and their disturbing influences are therefore considerably less.

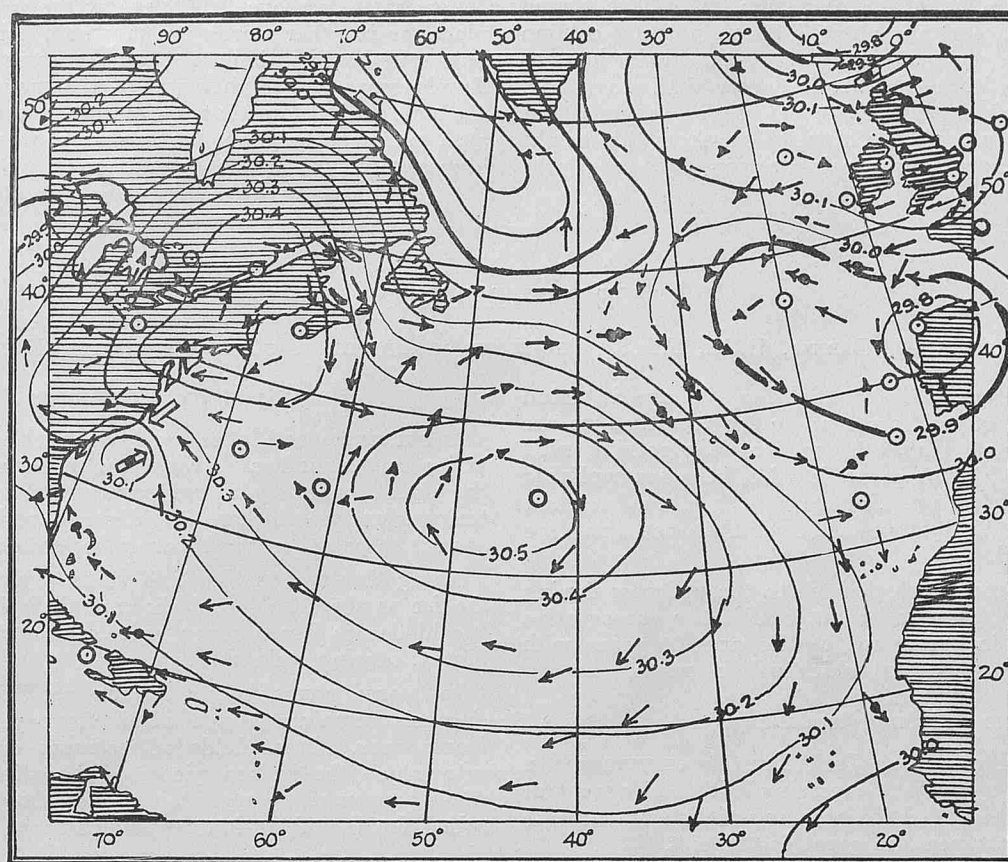
The explanation of the fact that in general the S.E. Trade Wind blows for a few degrees of latitude north of the equator while the N.E. Trade Wind does not penetrate into the Southern Hemisphere is also not difficult. The line of the geographical equator is not the hottest part of the earth's surface. In the first place the maximum heat is received when the sun is directly overhead, which may be at any point between the Tropics of Cancer and Capricorn according to the season. Secondly the actual temperature of the earth, as shown by the average monthly maps, depends on the irregular

distribution of land and water and especially on the preponderance of land in the Northern Hemisphere. Hence it is found that the warmest region is on the average an irregular line running a little to the north of the equator. The geographical equator has no direct influence on the Trades, but the "heat equator" has, being the neighbourhood of greatest convection.

The Trade Wind Cumulus.

During the expedition in 1904, previously referred to, the relative humidity of the N.E. Trade of the North Atlantic was found to increase with height from 70-80 per cent. up to 95 and often to 100 per cent., in which case the well-known Trade Cumulus was formed at the upper limit of the layer of saturated air. Above the cloud layer temperature rose suddenly by several degrees and the humidity was as low as 10-20 per cent. This layer of inversion of temperature had a thickness of about 3,000 feet and the winds in it were feeble and irregular; it lay under the N.W. wind, previously referred to, which itself lay beneath the Counter-Trade, thus giving four distinct strata. The fact that the upper part of the cloud, as mentioned in the first article of this series, is usually inclined to the flat base indicates a rapid falling off of wind velocity above the level of condensation marked by the base. Within the Trade Wind layer there is normally an increase of wind speed with height above the surface up to a certain point, which CAVE found at Barbados in 1909 to be about 1,600 feet. The Trade Wind Cumulus is well shown in the sketches made on board S.S. *Llan-doverly Castle* and published in the MARINE OBSERVER, Vol. V., No. 53, 1928. Similar conditions as regards humidity and the temperature inversion above the trade have also been found at Mauritius.

Greenwich Noon, 2nd June, 1883.



EXPLANATION.

Direction and Force of Wind.

○ → → → → → ●
 Calm, 1-3, 4-6, 7&8, 9&10, 11&12, Squalls.

Figure 10.

General Remarks.

Of the radiation emitted by the sun and received on the earth, light and heat are the most familiar forms because they are perceptible to our senses. There are, however, other kinds of radiation received from the sun, such as the invisible ultra-violet rays. All forms of radiation, including the waves used in wireless transmission are waves in the ether of space and the only difference between them is one of wavelength. Thus the ultra-violet waves are of very short length, those of visible light are longer, the invisible heat waves are longer still, while the wireless waves are again very much longer. Sound waves do not come into this scale as they are purely vibrations of air.

When the sun's radiation falls on a material body, whether it be the earth's surface or the human body, both the invisible heat rays and the visible light rays contribute towards raising its temperature. A large amount of the incoming solar radiation is reflected back into space and lost, either from the upper surfaces of clouds or from parts of the earth's surface. Of the remainder, a small proportion is absorbed or scattered during its downward passage through the atmosphere but the rest reaches the earth's surface, where it is absorbed by the continents and oceans producing a definite rise of temperature. A balance is struck between this gain of heat and the loss of heat due to the earth radiating heat upwards into the air. The importance of the water vapour in the air is very great for the air is heated mainly by the outward radiation of long wavelength from the earth, not by the inward radiation from the sun.

The primary cause of the atmospheric circulation is the unequal heating of the earth's surface and the air due to the difference in the amount of solar radiation received at varying latitudes. The circulation represents a balance between a continual gain and a

continual loss of energy, in which the dissipation of energy due to the turbulence or eddy motion of the air, and the frictional effect between the lowest layers of the air and the earth's surface play an important part. It follows from this state of affairs that constantly recurring fluctuations will be an essential element of the general circulation and these are shown by the changes in the average distribution of pressure and wind from month to month or season to season.

It is not possible, in the present state of our knowledge to show exactly why the pressure distribution is as we know it. Taking a particular case, we cannot explain why there are permanent anti-cyclones in the oceans at about latitudes 30° to 35° N. and S. We do know, however, that the actual pressure distribution is greatly influenced by the configuration of land and water on the earth's surface, with resultant inequalities of heating. For example, the dominant factor of the circulation in the North Polar region is the high land of Greenland which is ice-covered throughout the year.

The atmospheric circulation has a powerful equalizing action on the distribution of temperature. As is well-known the heating effect of the sun is greatest near the equator and least at the poles. But if there were no atmospheric circulation the contrast would be very much greater. It has been calculated that in such circumstances, that is if the polar regions received their heat only by the direct heat of the sun, the temperature during the winter would drop nearly to absolute zero (-460° F.). The transport of heat which does actually occur is carried out partly by the general circulation and partly by the local circulations which have the effect, by means of strong winds, of moving masses of air from lower to higher and higher to lower latitudes.

We have seen that the main features of the upper air circulation at considerable heights are two great cyclones centred one on

each pole and each extending nearly to the equator. This circulation is capable of quite a simple explanation. We have stated that the atmospheric pressure at any point is the weight of a column of air reaching to the extreme upper limit of the atmosphere at that point. We also know that cold air is denser than warm air. Now if we consider a height of say 10,000 feet above the surface in a polar and an equatorial place the column of air from this height to the ground will be heavier in the polar region, because of the

greater density, than in the equatorial region. Therefore there will be less air left above 10,000 feet at the polar than at the equatorial place, or in other words pressure at a height of 10,000 feet over the pole will be less than that at the same height over the equator. Furthermore, the higher we go the more will the pressure above the pole fall below that above the equator. Consequently we get at a sufficient height a low pressure area over each pole with the highest pressure at the equator.

ICE DESTRUCTION.

By HOWARD T. BARNES, D.Sc., F.R.S., PROFESSOR OF PHYSICS, MCGILL UNIVERSITY, MONTREAL.

In giving this little account of Ice Fighting, I have in mind always a time when mankind will wake up to the fact that we are masters of our destiny, and that with modern engineering skill anything in reason is possible. A great deal has been accomplished in spite of a generation grown up with the idea fixed that ice and snow is a visitation of the Almighty like the weather, and therefore incapable of being modified.

It is wonderful in retrospect to look back to the progress during the past 30 years in handling ice and snow, and it is a conservative mind indeed who cannot look forward to the next 30 years with assurance of the tremendous progress which will be made.

Cost of Ice and Snow to Canada.

The annual tax imposed on us by Jack Frost is enormous. In our waterways we find the navigation ceasing with the advent of winter, and where means are found for breaking the ice the expense must be borne by the Government, so great is the cost.

In the great Port of Montreal, closed for five months of the year, the weekly loss runs to \$15,000,000. In the operation of automobiles, no estimate of the millions lost has been made. All our taxi companies report thousands of dollars spent in damage done every winter.

In the operation of the railroads, the clearing of snow from the tracks and the thawing of switches represents much money. In delays to traffic, no estimate has ever been made. Every snow storm costs the City of New York about one million dollars for snow removal.

The great water power plants situated on northern rivers are seriously affected by ice, and many of them reduce to half their summer capacity.

The loss to telephone and telegraph lines due to sleet is very serious.

All this represents loss, and is therefore never considered as money made when saved.

This is why I want the younger generation of this country to think on this matter seriously and to realise the need for careful study of remedial work in saving the vast fortune which is slipping annually through our hands.

Need of Military Preparedness.

In all respects the coming of winter brings the enemy ice and snow with regular recurrence. Ice must be regarded as an enemy to mankind, for since the earliest dawn of history man has been fighting the encroachment of ice for his very life. No one fact of nature has influenced so fundamentally the whole course of human history as ice, for the great ice ages of the past have driven men from their homes and modified the mode of life just as they will in the future.

But what is done in the case of the approach of the enemy must be done in the case of the approach of winter. Preparations must be made, forces organized to meet the oncoming of ice and snow in time to temper its effects and prevent its gaining the hold and paralyzing the industries of the country.

You may ask how can this be done? All I can do is to try to explain to you how it has been done, and what can be done with wonderful results in the future.

Methods of Ice Fighting on the Waterways.

In our rivers and lakes one great barrier is the copious formation of ice on the surface. Every year many grain vessels are caught on the Great Lakes by a sudden drop of temperature. With a low temperature ice thickens rapidly and resists all efforts but that of special ships called ice breakers to move it.

Navigation is impeded and ships injured by the sharp edges of the ice as they are forced through the solid pack. The new ice on a cold day is like a sharp knife, and rapidly cuts wooden or steel plates, causing leaks to start.

In many rivers other serious conditions arise owing to the channels remaining open after the bays and shallow areas have frozen over. Great fields of ice move out and block the channel, into which the broken pieces of shore ice become packed and the whole, cemented by snow blown into the water and fine ice crystals called frazil and anchor ice, which form in the open water on the



Captain J. B. Mercier.

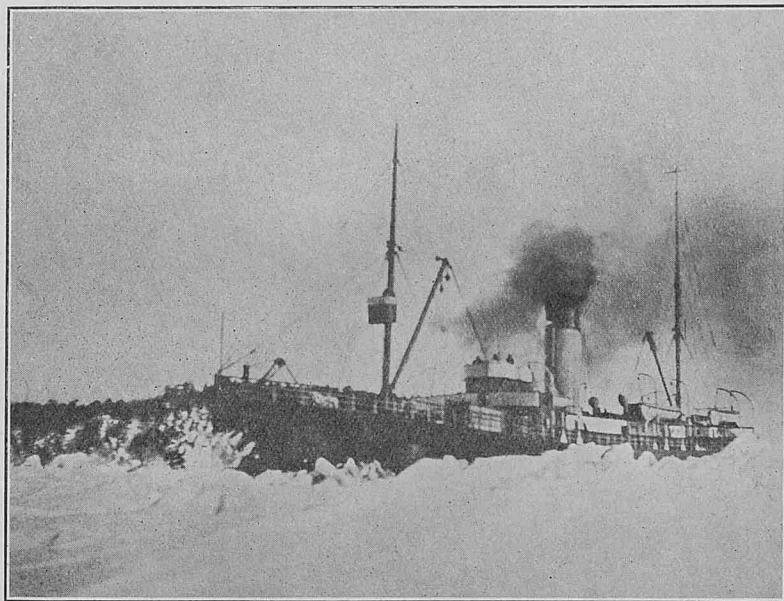
Master of Canadian Ice Breaker *Lady Grey*.

bottom and is carried by the current into the pack. Thus an ice jam is produced which dams back the water and causes the river to overflow its banks and flood the surrounding country. So severe are these winter floods that many farmers have to resort to their upper stories every year and go about from one farm building to another in boats. This results in great loss and suffering to man and beast.

The Canadian Government has three ice breakers on the St. Lawrence River, which are stationed at Quebec City and operate all winter through Cap Rouge, where the great Quebec Bridge is situated, in order to protect the river bank from the flooding. These boats have been working since 1908, and have been wonderfully successful. Previous to that, the Government built ice breaking piers along the shore, to cut the fields of ice as they were carried by the flood waters into the farm lands. Now the floods are eliminated and the value of the farms along the shore has gone up tremendously.

On page 234 is a photograph of Captain J. B. MERCIER, intrepid master of the Canadian Icebreaker *Lady Grey* for 20 years. The Captain has demolished more ice than any other man living. He has freely navigated the St. Lawrence in winter and has kept open the navigation channel between Three-Rivers and the Gulf during many seasons. He is a fearless yet cautious navigator and never has had an accident to his ship. He is now retired after all these years, during which time he has felt a proprietary ownership to all the ice that he has destroyed by his prowess.

Below is given an illustration of ice pack being demolished by an ice breaker, and opposite, a companion picture of the open water of the river in winter, showing how readily the icebreaker can keep the river free of ice.



Ice Pack being demolished by an Ice Breaker.

An ice-breaking steamer should be built for power, and so as to be able to withstand the impact of solid ice several feet in thickness. The vessels are many of them built to ride up on the ice and crush it down by the great weight of the ship. Many of the ships are provided with a propeller in the bow set low in the water, in order to suck the great cakes of ice broken by the crushing and cutting action of the bow down and pass them along under the ship to the stern.

An icebreaker should have twin propellers, so as to enable her to steer when the rudder is disabled or unable to move in the ice. The hull should bulge on the water line to give crushing power to the sides and the whole ship should sway from side to side to bring in the full benefit of the bulge. No ship becomes stuck in the ice packs which has a perceptible oscillation from side to side.

Icebreakers should be provided with steam pipes or condenser water discharge in the bow. Many a ship has been stuck for hours in the solid ice packs which could have been immediately released by warm water or steam.



Open water cleared by Ice Breaker.

Much more progress has been made in Europe with ice-breaking ships; but the bow propeller was invented by an American. This has come from the greater need of opening the Ports of Russia, Sweden and Finland for commerce during the winter. When economical conditions demand, the way will be found for even greater ships and more powerful methods.

The largest ice-breaking ships are found in Russia. Here ships of 12,000 h.p. are used, which can operate through 6 feet of solid ice. Just what is meant by ice thickness is misleading. Solid ice can be broken by certain types of ships; while the great packs of dislodged and broken ice cemented by slush ice, which often attain a thickness of 90 feet if allowed to accumulate, will resist the largest ship. All efforts at ice work should be directed towards prevention, for it is by being prepared that serious accumulations can be avoided.

High Explosives and Heat.

To treat ice accumulations in an emergency such as a jam which causes serious and inconvenient floods, dynamite is often resorted to. It is very useful in many cases, and has saved many a serious situation. A slower explosion is more useful, however, such as that from blasting powder, but this is not so convenient or safe to use. In all use of high explosive, great caution must be taken to prevent careless work, for much of this work is done under exceedingly trying conditions, often in great cold and high wind; it is easier for accidents to occur then.

Heat is the natural enemy of ice, and in many forms it can be applied not only for preventative means, but also to get rid of ice accumulations.

Steam heat and warm water are very effective when continuously applied to water bearing ice. The ice is prevented from sticking to objects in the water, and it is to a great extent prevented from forming.

You must realise that the ice is present in the water all the time even when quite hot. These ice particles increase in number until the freezing point is reached when the water is a saturated solution of ice. To break up the ice molecules in water before it freezes, chemicals such as salt or calcium chloride can be used, but in too large quantities to be a practical means to prevent a river from freezing. When water freezes, the ice particles separate out as solid crystals and float in running water or accumulate on the surface in still water to form the surface sheet. We must realise how difficult it is to cope with ice formation when the only difference between liquid water and solid water is a small fraction of a degree of temperature like a thousandth part of a degree, so small as to escape detection on the most delicate thermometer. Nevertheless, this fact, which is of so much importance, has pointed to us a way to prevent ice and to loosen ice when it is formed. We have merely got to raise the temperature through a very minute temperature above the freezing point to loosen ice. The light of the sun does this in the coldest weather.

To supply artificially enough heat to melt an iceberg or a jam is both physically and financially far beyond the range of feasibility. Skilful, limited applications of heat will, however, accomplish much.

One of my discoveries was that thermit could be used effectively at modest cost. Thermit is a mixture of finely powdered aluminium metal and oxide of iron. When properly ignited, thermit reacts vigorously, generating very high temperatures and producing extremely hot liquid steel. Many of my readers have seen thermit in action in city streets, where rail joints of a trolley line were being welded, or in manufacturing plants.

The energy from this molten steel supplies rays that equal or surpass those of the sun in power to penetrate ice for many feet. The action of the white-hot steel upon the ice is remarkable, converting it into hydrogen and oxygen gases so rapidly that a powerful explosion results. Thermit itself is not explosive and can be handled safely. In addition to disruption by the explosion, the water currents are restored to their original channels and continue to wash away the ice weakened by the heat rays and explosion. In this way a huge jam may readily be broken up so that it will float piecemeal harmlessly down the river, or an iceberg be split into fragments so small as to be no menace to commerce.

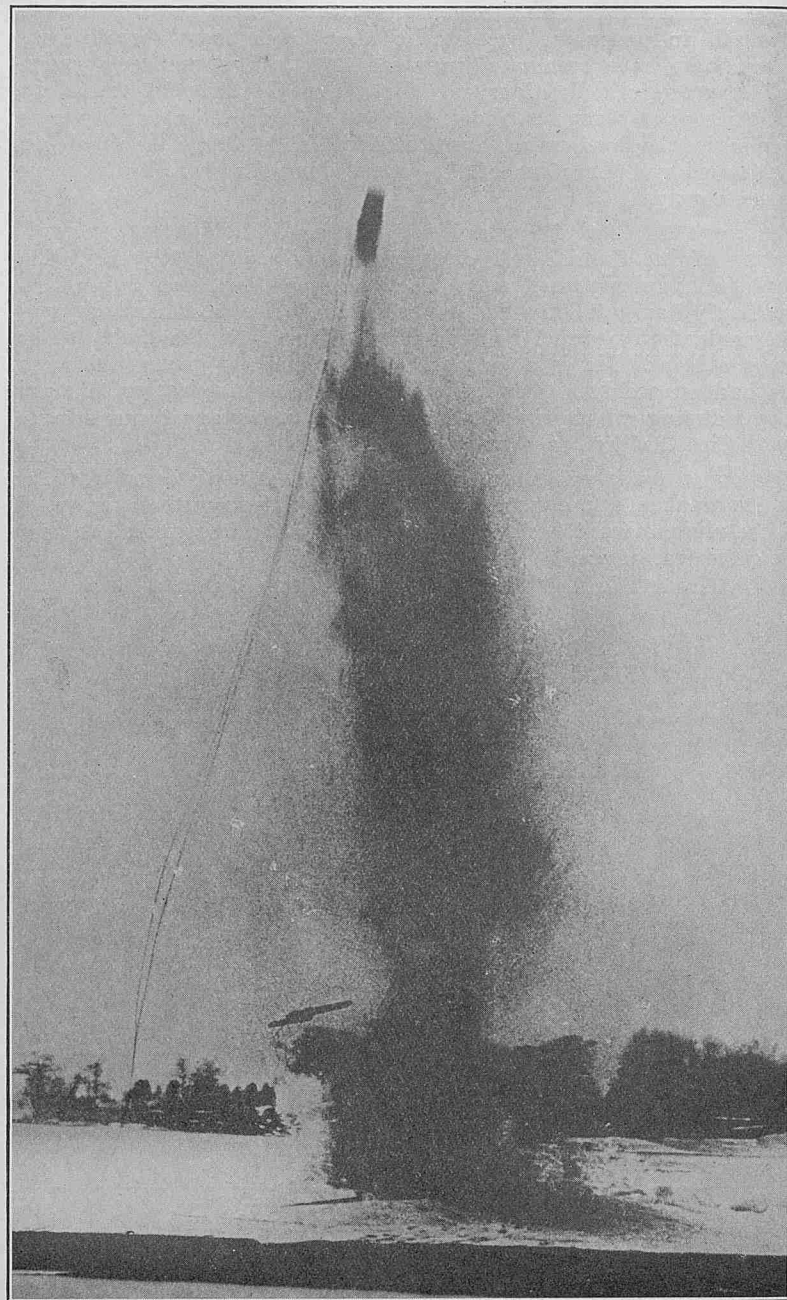


Thermit charge.

The above photograph shows one of the 100 pound thermit heat units which is to be applied for ice destruction. The energy is concentrated here and liberated in the form of a photochemical penetrative ray of great power to honeycomb the most solid ice. The unit is sunk as deep in the ice pack as possible. The picture shows Major H. B. FABER of the U.S. Army who was present and

fired the first heat unit ever used and shown here. This was in February, 1925, when an ice jam was treated by this radiant heat method. On that occasion, 250,000 tons of ice at Waddington, New York, in the St. Lawrence River, moved out in a few hours after the reaction of three thermit charges of ninety pounds each.

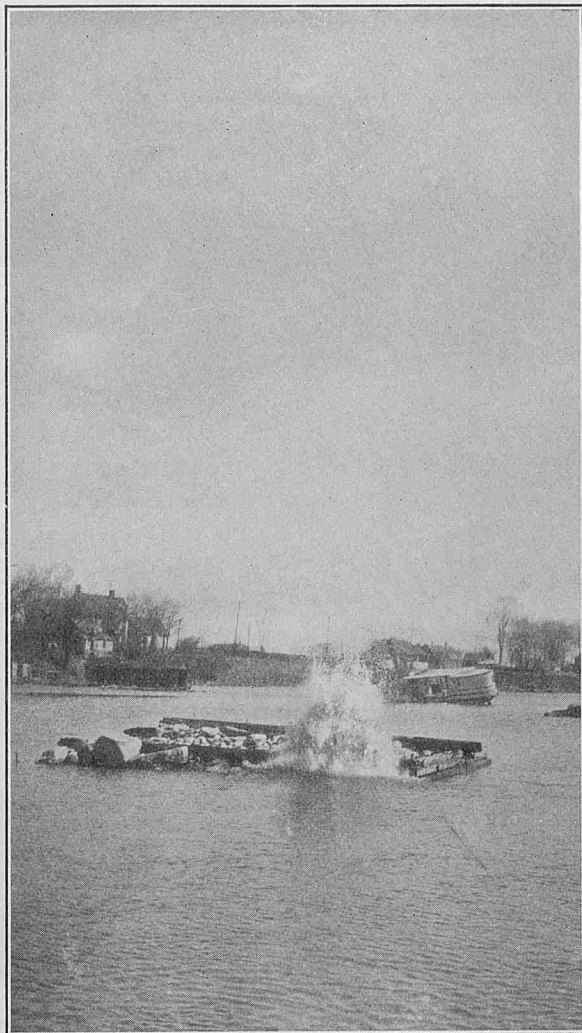
The photograph below shows the effect of a 100 pound heat unit in destroying a great ice pack. The force of the explosion of the ice has cast the entire container 125 feet into the air.



Taking out an ice jam.

The following photograph shows an explosion resulting from the white hot molten steel of the reacted thermit coming into contact with water. The explosion is so slow that it does no harm to bridge structures.

A jam at Ogdensburg, New York, containing a million tons of ice, was removed in nine hours with two ninety-pound charges of thermit. A jam 8,500 square feet in area, nine feet thick, was lifted off a shoal at Morrisburg, Ontario, and broken up by one charge of ninety pounds. Similar operations have been successfully carried through, including the removal, without damage, in ten days, of a dry jam twenty-five miles long at Oil City and Franklin, Pennsylvania. The City of Belleville, Ontario, on the Moira River, was protected from a severe flood last winter by thermit and calcium chloride.



In 1910, I sent out my first expedition to study icebergs. Others followed. In 1924, I observed that water from surface melting flowed all the daylight hours on an iceberg, maintaining a surface temperature at the freezing point. During the night, the water froze. The greatest cracking of the ice and breaking off of fragments occurred early in the morning and immediately after sunrise. These observations prompted the thought that strains could be set up at will in a great ice mass by local applications of heat at a high enough temperature to cast powerful rays into the ice.

The first tests were made in 1926. One berg treated was approximately five hundred feet square at water level, with cliffs rising on one side seventy-five feet to one hundred feet. A hole was bored into it about three feet and charged with one hundred pounds of thermit. When this charge was fired, flames shot upward one hundred and twenty-five feet and the explosion threw off great masses of ice. The intense heat in direct contact with the hard ice sent a temperature wave into the mass which caused a great deal of cracking and visible disruption. This cracking went on all the evening. Towards morning there was a very loud report. Later in the day we found the great bulk of the interior had come away. The day following revealed the full effect of the cracking, for the whole plateau in which the charge had been placed was split and broken away, almost across the thermit hole. Approximately a third of the ice was split off. Had we placed a few more charges, the whole berg would have been broken up. Sinking the charges deeper into the ice, as could easily be done, would have increased their effectiveness.

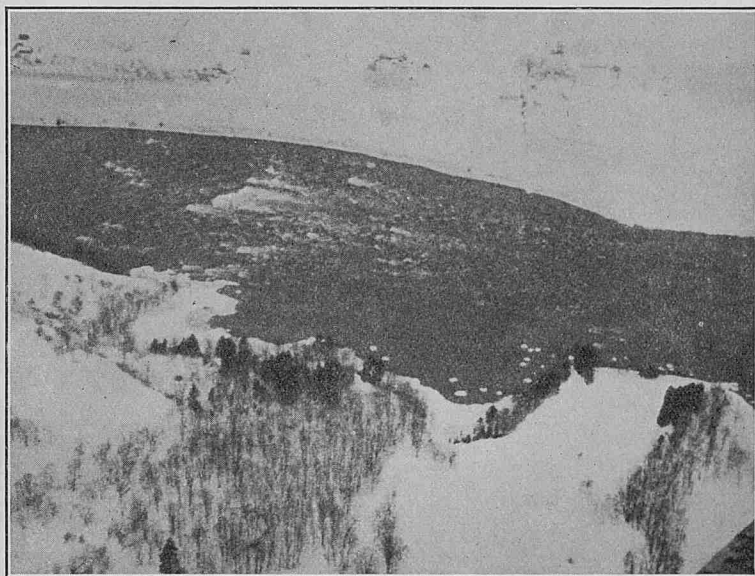
Aero-Ice.

In the remarkable development of aerial navigation, there are new problems arising from day to day. The introduction of the air mail, with the subsequent necessity for night flying in all weathers, has shown that the formation of ice on the struts, wings

and propeller of the aeroplane is a menace. It is generally acknowledged that very little is known of this phenomenon, and that the pilot is often brought down by serious interference. From the result of an enquiry sent out to pilots all over Canada and the United States, it appears that the problem is a real one and deserving of the most careful study. Luckily, it is possible to interpret and explain most of the problems of aerial ice by the similitude of water-borne ice. Thus hail, snow and fine ice sand of the atmosphere resemble the frazil and slush ice of our rivers, while the frost and sleet resemble the anchor ice which is formed on the bottom of a swiftly flowing stream.

The surface of the aeroplane is cooled by virtue of its great speed through the air after it has had a small deposit of dew or thin ice on it, just as the wet bulb thermometer is cooled in the sling psychrometer.

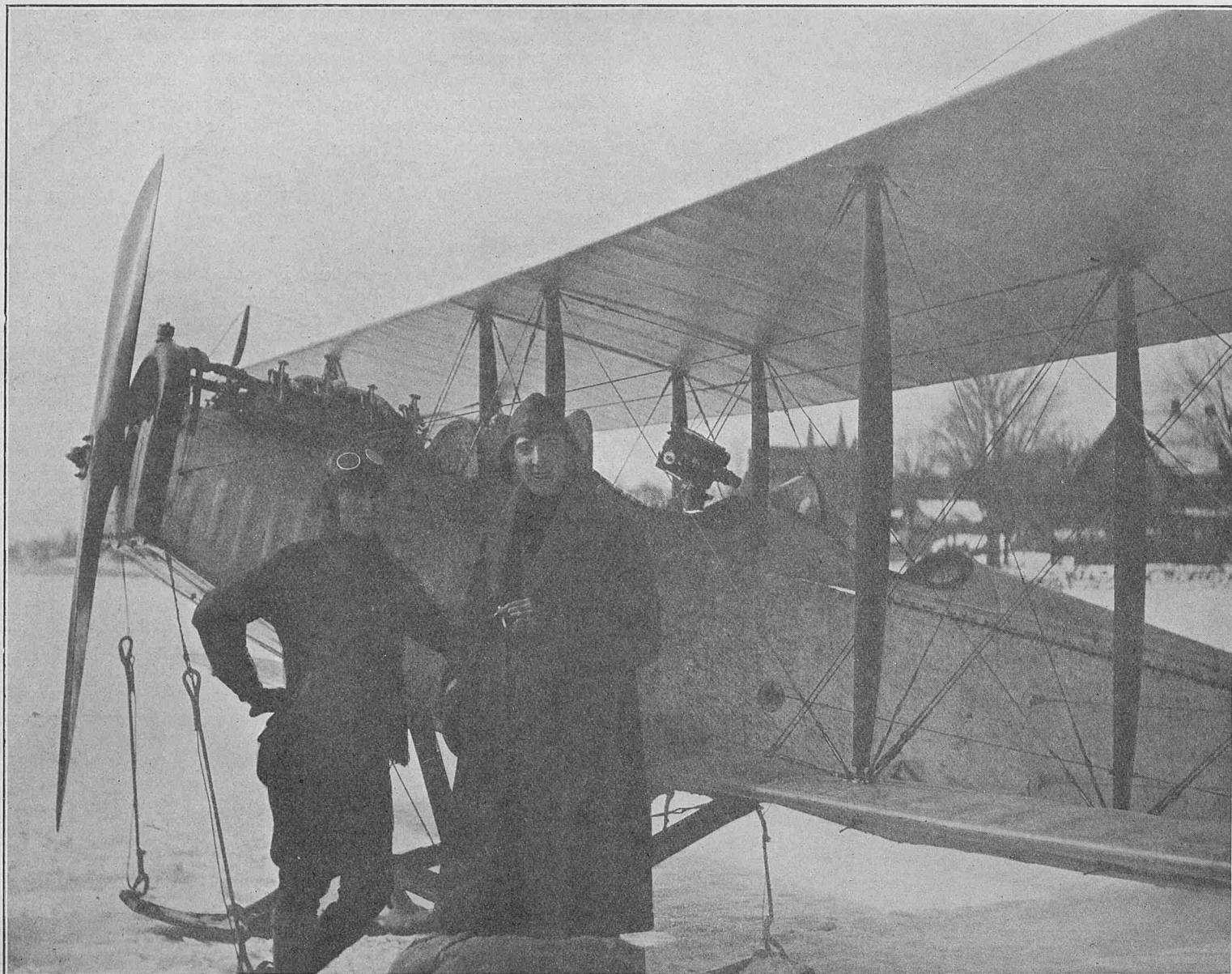
The cooling of the surface is also effected by nocturnal or terrestrial radiation. This is a very rapid process at times when the air is very clear and may lower the surface of the plane several degrees in as many minutes. When so cooled, the surface easily takes up ice from a cloud or a humid space. Thus it is possible, in an otherwise clear air, to have a rapid deposit of ice when the temperature of the air is a few degrees above or below the freezing point. Where the velocity is the highest, which is around the propeller blades, the ice appears to deposit very rapidly, just as anchor ice grows in water on objects over which the water currents are swiftest. This problem is receiving at the present time the attention of scientists, and a solution will doubtless be obtained by employing a covering material for the surface of the aeroplane to which ice does not readily adhere.



The aeroplane serves a useful purpose in ice engineering, and on page 238 is a photograph of the small plane used by the author in aerial surveys of the St. Lawrence in winter. The motion picture operator and pilot are shown in the foreground. The above photograph is an aeroplane view of the Long Sault on the upper St. Lawrence in the middle of winter. No ice forms over this stretch.

Future Developments.

For the future we may look for great development in ice preventive methods and new discoveries in the field. The great thing is to have courage and determination and not to be deterred by our natural dread of ice, which has come to us far down the ages as an inheritance from the terrible stress of privation and suffering of the ice ages. We shall overcome to a great extent the loss from ice, but we must be prepared to meet the enemy when it strikes. We know fairly well when it is likely to do so, but never the exact moment of the onslaught.



The Aeroplane serves a useful purpose in ice engineering.

WEATHER SIGNALS.

II.—WIRELESS WEATHER SIGNALS.

WIRELESS WEATHER BULLETINS.

The Key and Decode Tables of the International Weather Telegraphy Code will be found on pages 20 to 23 of Volume V No. 49. (The January, 1928, Number.)

The method of decoding station weather reports made in code was described in the British "Weather Shipping" Bulletin, on pages 37 and 38 of Volume V No. 50. (The February, 1928, Number.)

The same method of decoding weather reports applies in all cases where the International Code is used.

The letters given in the descriptions which follow give the key to the tables for decoding the figures.

Where *other* than International code tables are used they are published along with the signals described and an explanation is given.

SOUTH-WEST AFRICA, UNION OF SOUTH AFRICA, AND PORTUGUESE EAST AFRICA.

Spark and C.W. Issues.

REPORTS of weather conditions at 0630 G.M.T. at South African ports are broadcast daily by Coast W/T Stations, mostly in International Code, expressed by Key letters as follows:—

I_n BBBSB. DDFww VNRRR

I_n=Indicator letters of observation station (generally the station's W/T call signal).

B_r=Only used for Capetown, Mossel Bay, East London, Durban, Lourenço Marques,* Beira and Mossoril,† (for other stations a dash will be sent). It represents the following:—

At Capetown ... Run, or undertow in docks, Table LV.

At Mossel Bay ... Instructions regarding anchorage, Table LVI.

* Refers to the bar near Inyack Island.

† Refers to the bar at the Mozambique Port.

At East London,
Durban, Lourenço
Marques, Beira,
and Mossoril. } State of bar. Table LVII.

RRR=Rainfall in whole millimetres.

The remaining Key letters are International Code.

Barometric pressure is given in mbs. and tenths. (To convert to inches, see Table LVIII.)

A dash (—) will be sent should any portion of a report not be available. In the absence of a complete report from any station the station's indicator letters followed by the words "not received" will be transmitted.

Details of Reports.

1. Transmitting station... **Walvis Bay** (Latitude 22° 58' S.; Longitude 14° 30' E., approx.).

Call signal ... **VNV.**

Messages directed to ... **CQ.**

Wave length ... 600 m. spk.

Times of transmission:

0840 G.M.T. (observations at following stations at 0630 G.M.T.).

1230 G.M.T. (forecast for coast in plain language).

2000 G.M.T. (forecast for coast in plain language).

2. Observation stations, 0840 report:

Indicator		Position (approx.)	
Letters.	Station.	Lat. S.	Long. E.
VNC	Capetown ...	33° 56'	18° 29'
VNJ	Port Nolloth ...	29° 14'	16° 51'
VNV	Walvis Bay ...	22° 58'	14° 30'
CRM	Mossamedes ...	15° 12'	12° 09'
CRL	Loanda ...	8° 49'	13° 13'

1. Transmitting station... **Capetown** (Latitude 34° 09' S.; Longitude 18° 19' E., approx.).

Call signal ... **VNC.**

Messages directed to ... **CQ.**

Wave length ... 600 m. spk.

Times of transmission:—

0830 G.M.T. (observations at following stations at 0630 G.M.T.).

1220 G.M.T. (forecasts for coasts in plain language).

2. Observation stations, 0830 report:—

Indicator		Position (approx.)	
Letters.	Station.	Lat. S.	Long. E.
VNO	East London ...	33° 02'	27° 55'
VNQ	Port Elizabeth ...	33° 59'	25° 37'
MB	Mossel Bay ...	34° 11'	22° 09'
VNC	Capetown ...	33° 56'	18° 29'
VNJ	Port Nolloth ...	29° 14'	16° 51'
VNV	Walvis Bay ...	22° 58'	14° 30'

1. Transmitting station... **Port Elizabeth** (Latitude 33° 59' S.; Longitude 25° 37' E. approx.).

Call signal ... **VNQ.**

Messages directed to ... **CQ.**

Wave length ... 600 m. spk.

Times of transmission:—

0820 G.M.T. (observations at following stations at 0630 G.M.T.).

1250 G.M.T. (forecast for coasts in plain language).

2. Observation stations, 0820 report:—

Indicator		Position (approx.)	
Letters.	Station.	Lat. S.	Long. E.
VND	Durban ...	29° 52'	31° 03'
VNO	East London ...	33° 02'	27° 55'
VNQ	Port Elizabeth ...	33° 59'	25° 37'
MB	Mossel Bay ...	34° 11'	22° 09'
VNC	Capetown ...	33° 56'	18° 29'

1. Transmitting station... **Durban** (Latitude 29° 49' S.; Longitude 31° 01' E. approx.).

Call signal ... **VND.**

Messages directed to ... **CQ.**

Wave length ... 600 m. spk.

Times of transmission:—

0810 G.M.T. (observations at following stations at 0630 G.M.T.).

1205 G.M.T. (forecast for coasts in plain language).

2. Observation stations, 0810 report:—

Indicator		Position (approx.)	
Letters.	Station.	Lat. S.	Long. E.
CRT	Beira ...	19° 50'	34° 51'
CRZZ	Lourenço Marques ...	25° 58'	32° 36'
VND	Durban ...	29° 52'	31° 03'
VNO	East London ...	33° 02'	27° 55'
VNQ	Port Elizabeth ...	33° 59'	25° 37'

1. Transmitting station... **Lourenço Marques, Polana** (Latitude 25° 58' S.; Longitude 32° 36' E. approx.).

Call signal ... **CRZZ.**

Messages directed to ... **CQ.**

Wave length ... 2,400 m. c.w.

Time of transmission:—

0800 G.M.T. (observations at following stations at 0630 G.M.T.).

2. Observation stations, 0800 report:—

Indicator		Position (approx.)	
Letters.	Station.	Lat. S.	Long. E.
VNO	East London ...	33° 02'	27° 55'
VND	Durban ...	29° 52'	31° 03'
CRZZ	Lourenço Marques ...	25° 58'	32° 36'
CRT	Beira ...	19° 50'	34° 51'
CRV	Mozambique ...	15° 02'	40° 45'

1. Transmitting station... **Mozambique** (Latitude 15° 02' S.; Longitude 40° 45' E. approx.).

Call signal ... **CRV.**

Messages directed to ... **CQ.**

Wave length ... 600 m. spk.

Time of transmission:—

0900 G.M.T. (observations at following stations at 0630 G.M.T.).

2. Observation stations 0900 report:—

Indicator		Position (approx.)	
Letters.	Station.	Lat. S.	Long. E.
CRV	Mozambique (Mossoril) ...	14° 57'	40° 40'
CRT	Beira ...	19° 50'	34° 51'
CRZZ	Lourenço Marques ...	25° 58'	32° 36'

MADAGASCAR.

Spark Issues.

THE following W/T Stations broadcast, *en clair*, information concerning weather in Madagascar and a weather forecast for the day on 600 metres (spark) in each case:—

W/T	Call	Position.		Time.
Station.	Sign.	Lat.	Long.	
Majunga ...	HYE	15° 43' S.	46° 20' E.	0900 G.M.T.
Diégo Suarez	HYD	12° 15' S.	49° 23' E.	0830 „
Tamatave ...	HYL	18° 08' S.	49° 26' E.	0800 „

MAURITIUS.

Spark Issues.

Mauritius W/T station, approximate Latitude 20° 24' S., Longitude 57° 35' E., call sign **BZG**, transmits, during the cyclone season (1st November to 15th May), on a wavelength of 600 metres spark, *on request*, the latest weather information received from Mauritius Observatory. (See also Mauritius W/T storm warnings.)

SPECIAL WEATHER TELEGRAPHY TABLES NOT NEW INTERNATIONAL CODE. (SOUTH AFRICA).

Table LV.

Run or Undertow (at Table Bay Docks).

Code figure.	Meaning.
0 ...	No run.
1 ...	Slight run.
2 ...	Moderate run.
3 ...	Heavy run.

NOTE.—“Run” is a local term for the undertow, due to a heavy swell in the Bay, which causes vessels to range so heavily along the quays that it is difficult to hold them.

Table LVI.

Instructions regarding Anchorage at Mossel Bay.

Code figure.	Meaning.
1	It is recommended that vessels should anchor well up the Bay towards Seal Island in not less than 9 fathoms of water, and veer plenty of cable.
5	It is recommended that vessels should take up ordinary anchorage with beacons in line in about 7 fathoms.

Table LVII.

State of bar (at East London, Durban, Lourenco Marques, Beira and Mossoril).

Code figure.	Meaning.
1	Bar smooth.
2	„ breaking slightly.
3	„ rough.
4	„ breaking heavily.
5	„ dangerous.
6	„ impassable.

NOTE.—At East London the use of 1, 2, and 3 also implies that work with lighters is possible, and 4, 5, and 6, that it is impossible.

Table LVIII.

Conversion of Millibars to Inches.

Equivalent in Mercury Inches at 32°, and Latitude 45° of Millibars.

Mb.	In.	Mb.	In.	Mb.	In.	Mb.	In.	Mb.	In.	Mb.	In.	Mb.	In.
925	27.32	940	27.76	960	28.35	980	28.94	1000	29.53	1020	30.12	1040	30.71
926	27.35	941	27.79	961	28.38	981	28.97	1001	29.56	1021	30.15	1041	30.74
927	27.38	942	27.82	962	28.41	982	29.00	1002	29.59	1022	30.18	1042	30.77
928	27.41	943	27.85	963	28.44	983	29.03	1003	29.62	1023	30.21	1043	30.80
929	27.44	944	27.88	964	28.47	984	29.06	1004	29.65	1024	30.24	1044	30.83
930	27.46	945	27.91	965	28.50	985	29.09	1005	29.68	1025	30.27	1045	30.86
931	27.49	946	27.94	966	28.53	986	29.12	1006	29.71	1026	30.30	1046	30.89
932	27.52	947	27.97	967	28.56	987	29.15	1007	29.74	1027	30.33	1047	30.92
933	27.55	948	28.00	968	28.59	988	29.18	1008	29.77	1028	30.36	1048	30.95
934	27.58	949	28.03	969	28.62	989	29.21	1009	29.80	1029	30.39	1049	30.98
935	27.61	950	28.05	970	28.65	990	29.24	1010	29.83	1030	30.42	1050	31.01
936	27.64	951	28.08	971	28.67	991	29.26	1011	29.86	1031	30.45	1051	31.04
937	27.67	952	28.11	972	28.70	992	29.29	1012	29.89	1032	30.48	1052	31.07
938	27.70	953	28.14	973	28.73	993	29.32	1013	29.92	1033	30.51	1053	31.10
939	27.73	954	28.17	974	28.76	994	29.35	1014	29.94	1034	30.53	1054	31.13
		955	28.20	975	28.79	995	29.38	1015	29.97	1035	30.56		
		956	28.23	976	28.82	996	29.41	1016	30.00	1036	30.59		
		957	28.26	977	28.85	997	29.44	1017	30.03	1037	30.62		
		958	28.29	978	28.88	998	29.47	1018	30.06	1038	30.65		
		959	28.32	979	28.91	999	29.50	1019	30.09	1039	30.68		

WIRELESS STORM WARNINGS.

MADAGASCAR.

Spark Issues.

CYCLONE warnings are broadcast when necessary by the following stations on a wave length of 600 metres (spark), in each case:—

Zaudzi (Mayotta I.): Latitude 12° 47' S., Longitude 45° 16' E., Call Sign **HYH**.

Majunga: Latitude 15° 43' S., Longitude 46° 20' E., Call Sign **HYE**.

Diégo Suarez: Latitude 12° 15' S., Longitude 49° 23' E., Call Sign **HYD**.

Tamatave: Latitude 18° 08' S., Longitude 49° 26' E., Call Sign **HYL**.

The warning, originating from the observatory at Antananarivo, will be broadcast at every even hour during the probable passage of the cyclone when within the range of the W/T stations, alternately by Zaudzi and Majunga W/T stations in the case of a cyclone affecting the Mozambique Channel, and alternately by Diégo Suarez and Tamatave W/T stations in the case of a cyclone affecting the area north-east and east of Madagascar.

The warning will be preceded by the Danger Signal **TTT (— — —)** repeated ten times at short intervals on full power. The warning will be broadcast one minute after the Danger Signal, and will be repeated three times at intervals of ten minutes.

If the Danger Signal *only* is broadcast it will indicate, in the absence of precise information, that there is reason to expect the passage of a cyclone.

During the whole period of this service Zaudzi and Tamatave W/T stations will remain permanently on watch.

MAURITIUS.

Spark Issues.

Mauritius W/T station, call sign **BZG**, broadcasts, during the cyclone season (1st November to 15th May), on a wavelength of 600 metres spark, when it is known that a cyclone is in existence, the latest weather information *immediately* this information is received at the W/T station from Mauritius Observatory.

Requests from ships for further information will be forwarded at once to the Observatory.

Continuous watch will be kept at the W/T station.

III. WIRELESS TIME SIGNALS.

UNION OF SOUTH AFRICA.

Spark Issue.

TIME signals actuated automatically from the Royal Observatory at the Cape by direct land line are broadcast by **Cape Town W/T station**, call sign **VNC**, Latitude 34° 09' S., Longitude 18° 19' E. (approx.), on a wavelength of 600 metres (spark).

The time signals are broadcast according to the New International System of W/T time signals and the procedure is as follows:—

G.M.T.									
h. m. s.			h. m. s.						
20	56	05	to	20	56	50	■ ■ ■	repeated 5 times at 10 second intervals.	
	57	00	„	57	50	■ ● ● ■	repeated 10 times at 5 second intervals.		
	57	55	„	58	00	{ 55 56 57 58 59 60	Time Signal.		
	58	08	„	58	10	■ ●			
	58	18	„	58	20	■ ●			
	58	28	„	58	30	■ ●			
	58	38	„	58	40	■ ●			
	58	48	„	58	50	■ ●			
	58	55	„	59	00	{ 55 56 57 58 59 60	Time Signal.		
	59	06	„	59	10	■ ■ ■ ●			
	59	16	„	59	20	■ ■ ■ ●			
	59	26	„	59	30	■ ■ ■ ●			
	59	36	„	59	40	■ ■ ■ ●			
	59	46	„	59	50	■ ■ ■ ●			
20	59	55	„	21	00	{ 55 56 57 58 59 60	Time Signal.		

PORTUGUESE EAST AFRICA.

Spark and C.W. Issues.

DELAGOA BAY.—LOURENÇO MARQUES. W/T time signals are transmitted automatically by means of the pendulum clock at Campos Rodrigues Observatory.

The transmission of the signals is made simultaneously by **Ponta Vermelha W/T station**, Lat., 25° 58' 05" S., Long., 32° 35' 39" E., call sign **CRZ**, wave length 600 metres (spk.) and **Polana W/T station**, Lat., 25° 27' 40" S., Long., 32° 35' 59" E., call sign **CRZZ**, wave length 2,400 metres, C.W., and the new International system of W/T time signals is used.

The transmitting times are:—

G.M.T.					
h. m. s.		h. m. s.			
From	7	57	00	to	8 00 00
„	18	57	00	„	19 00 00

G.M.T.

						Signal.										
h.	m.	s.	h.	m.	s.											
7 18	57	00	to	7 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Note.—The error of the Observatory clock is stated never to exceed a few hundredths of a second.

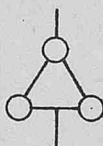
Mozambique.

STORM signals are displayed at Sebastian fort on receipt of information by cable from Mojanda in Madagascar. They consist of warning signals which are as follows:—

By day,



By night.






The lights displayed in the night signal are *white*.

The cone is hoisted at the Northern yardarm and the lights on the same mast.

MADAGASCAR.

SIGNALS indicating the localities threatened by a cyclone are exhibited at the following ports: Tamatave, Andovoranto, Vatomantri, Mahanoro Manajari, Farafangana, Fort Dauphin, Tuléar, Ambobihé, Morondava, Maintirano, Namela, Majunga, Analalava, Nosi Bé, Diégo Suarez, Vohemar, Maroantsetra, Dzauzdi, and St. Mary.

The signals, which are made from a flagstaff by a black cylinder and black cones, are as follows:—



Signal.	Locality threatened.
	Between Diégo and Antálaha.
	Between Antálaha and St. Mary.
	Between St. Mary and Vatomandri.



































Signal.	Locality threatened.
■	Between Vatomandri and Mananjari.
▼	
▼	Between Mananjari and Farafangana.
■	
▼	Between Farafangana and Fort Dauphin.
▼	
■	Between Diego and Nosi Bé.
▲	
■	Between Nosi Bé and Majunga.
▲	
■	Between Majunga and Maintirano.
■	
■	Between Maintirano and Morondava.
▼	
▼	Between Morondava and Tuléar.
■	
■	Between Tuléar and Fort Dauphin.
▼	
▲	

REUNION ISLAND.

CYCLONE signals are displayed at Port des Galets, St. Denis, St. Paul, and St. Pierre signal stations, and also on the Vigie flagstaff, St. Denis, to indicate the probable approach and general track of cyclones in the vicinity of Reunion. The signals are to be taken as a general guide only, for the assistance of mariners as to the best way of avoiding cyclones.

The symbols employed (*black*) and their meanings are as follows:—

Signal.	By Day.	Meaning.
		Cyclone expected.
		Cyclone approaching from the north-eastward.

Signal.	By Day.	Meaning.
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		

and gun fired. The lights displayed are white.

MAURITIUS.

Storm Signals.

DURING the cyclone season, from 1st November to 15th May, annually, a storm signal is hoisted daily, except Sundays and public holidays, at the Port office at Port Louis, to indicate the weather conditions prevailing in the vicinity of Mauritius. The storm signal consists of four International Code flags and a cone.

The upper flag refers to the quadrant from east to north.
 The second " " " north to west.
 The third " " " west to south.
 The fourth " " " south to east.

(The flags are placed vertically.)

When the signal is headed by a cone the information refers to the area within a circle with a radius of 300 miles.

When the answering pennant is hoisted below the fourth flag it indicates that no information has been received, and that the signal refers to the previous day.

Signification of Flags.

























A. There are no indications of disturbed weather.

- B. Weather is unsettled, but there are no indications of a cyclonic storm.
- C. Weather is unsettled, and may lead to the formation of a cyclonic storm.
- D. There are indications that a cyclonic storm is forming.
- E. There is distinct evidence of the existence of a cyclonic storm.
- F. The disturbed weather is apparently due to an extra tropical storm to the southward, "Southerly buster."
- G. The weather is clearing, but the sea may still be heavy.
- H. The cyclonic storm is moving south-westward.
- I. The cyclonic storm is moving southward.
- J. The cyclonic storm is moving south-eastward.
- K. The cyclonic storm is moving westward, northward of Mauritius.
- L. The cyclonic storm is moving eastward, southward of Mauritius.

















The above signals are made when bad weather is approaching, and it is not safe for any vessel to proceed to sea.

Cyclone Signals.

When bad weather is approaching and precautions are necessary in the harbour, the following cyclone signals are made to vessels in the harbour and roadstead from the flagstaff of the Port office, Port Louis, at the head of the harbour.

Signal.	By Day.	Meaning.
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		

Vessels are required to answer the signals by hoisting their national ensign at the main.

Signal.	By Night.	Meaning.
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		

and gun fired

Blue Red Black.

Special Notices regarding Personnel.

The Marine Superintendent will be glad to receive information of special distinctions gained and retirements, &c., of Marine Observers.

Obituary.

The death of Captain ARTHUR F. ROSE of M.V. *Centaur* on May 17th, 1928, at St. John of God Hospital, Fremantle, W. Australia, is noted with regret.

Captain ROSE was well known in Western Australia. A sail trained officer, he was for some time Chief Mate of the ship *Greta*. After obtaining his master's certificate in 1904, he joined the BLUE FUNNEL LINE, and saw much service in the China and Western Australian trades.

Captain ROSE has been a member of the corps of marine observers since 1925.

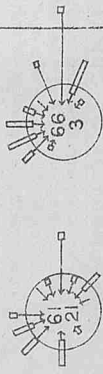
SOUTH PACIFIC.

WINDS ON THE TRACKS FROM PANAMA TO AUSTRALIAN
AND NEW ZEALAND PORTS.
(MIDDLE PORTION.)

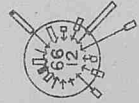
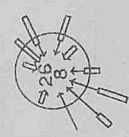
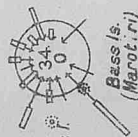
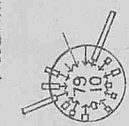
DECEMBER

Observations of ships regularly observing for the British Meteorological
Office 1920-1926.

COOK ISLANDS
Rarotonga



Pitcairn I.



Maria Theresa Rf.

EXPLANATION OF WIND ROSE.

Each wind rose refers to the ocean areas enclosed by 5° of Latitude and Longitude. The arrows which fly with the wind show by their length the frequency of the winds and by their thickness the various forces; light winds forces 1 to 3, moderate winds 4 to 7, and gales 8 to 12.



The circle supplies a scale for estimating the frequency of winds from any direction. From the heads of the arrows to the circumference of the circle represents 5 per cent of the whole number of observed winds (100 per cent = 2 inches). The upper figures in centre of wind rose are the total number of observations upon which the rose is based, the percentage of calms being given underneath. The frequency of the winds can be obtained by measuring with the scale below.

As 10° of longitude measures 2 inches on this chart an arrow measuring one degree of longitude in length represents 10 per cent of observations from that direction.

SOUTH PACIFIC.

CURRENTS ON THE TRACKS FROM PANAMA TO AUSTRALIAN AND NEW ZEALAND PORTS. (MIDDLE PORTION.)

NOVEMBER, DECEMBER AND JANUARY.

*Observations of ships regularly observing for the British Meteorological
Office 1910-1926.*

Cook
Islands
Rarotonga

Pitcairn I.

Rapa

Bass Is.
(Marotiri)

Henderson I.

Meria Theresia Rf.

EXPLANATION OF CURRENT ROSES.

The current roses are drawn from
observations within the pecked lines.
Arrows show the current length
represents frequency, thickness strength.

6-12 miles per day

13-24 " " "

25-48 " " "

49-72 " " "

73 " " and above

Distance from tail of arrow to circle represents
5%.

Scale 0 10 20 30 40 50%

The upper figure in the centre of the rose
gives total number of observations, the lower
figure the percentage frequency of currents less
than 6 miles per day. The roses are drawn so that
their centres lie within the areas to which they
refer.

MAXIMUM DRIFTS REPORTED.

Name of Ship	Date Day Year	Middle Lat. Long.	Current Set Drift	Wind Dir. Force
Hororata Rimutaka	15 1919	35° 00'S 139° 31'W	N 80° W 30	SSE 5
	20 1924	33° 15'S 158° 47'W	N 79° W 29	SE 3

NOVEMBER.

SOUTH PACIFIC.

CURRENTS ON THE TRACKS FROM PANAMA TO AUSTRALIAN AND NEW ZEALAND PORTS. (MIDDLE PORTION.)

NOVEMBER, DECEMBER AND JANUARY.

Observations of ships regularly observing for the British Meteorological
Office 1910-1926.

COOK ISLANDS
Rarotonga

Rapa I.

Bass Is.
Marotini

Picauini

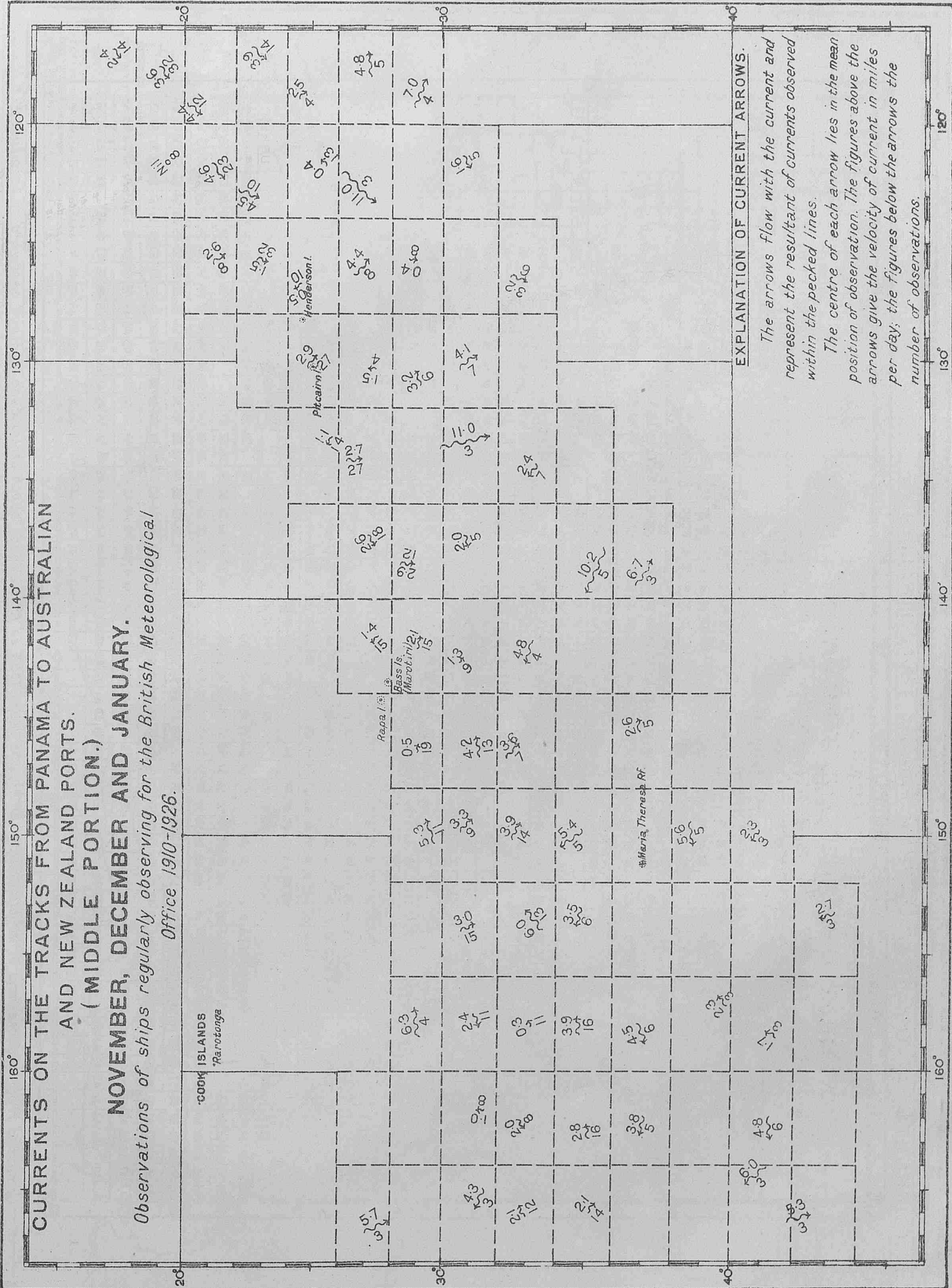
Henderson I.

Maria Theresa Rf.

EXPLANATION OF CURRENT ARROWS.

The arrows flow with the current and represent the resultant of currents observed within the pecked lines.

The centre of each arrow lies in the mean position of observation. The figures above the arrows give the velocity of current in miles per day; the figures below the arrows the number of observations.

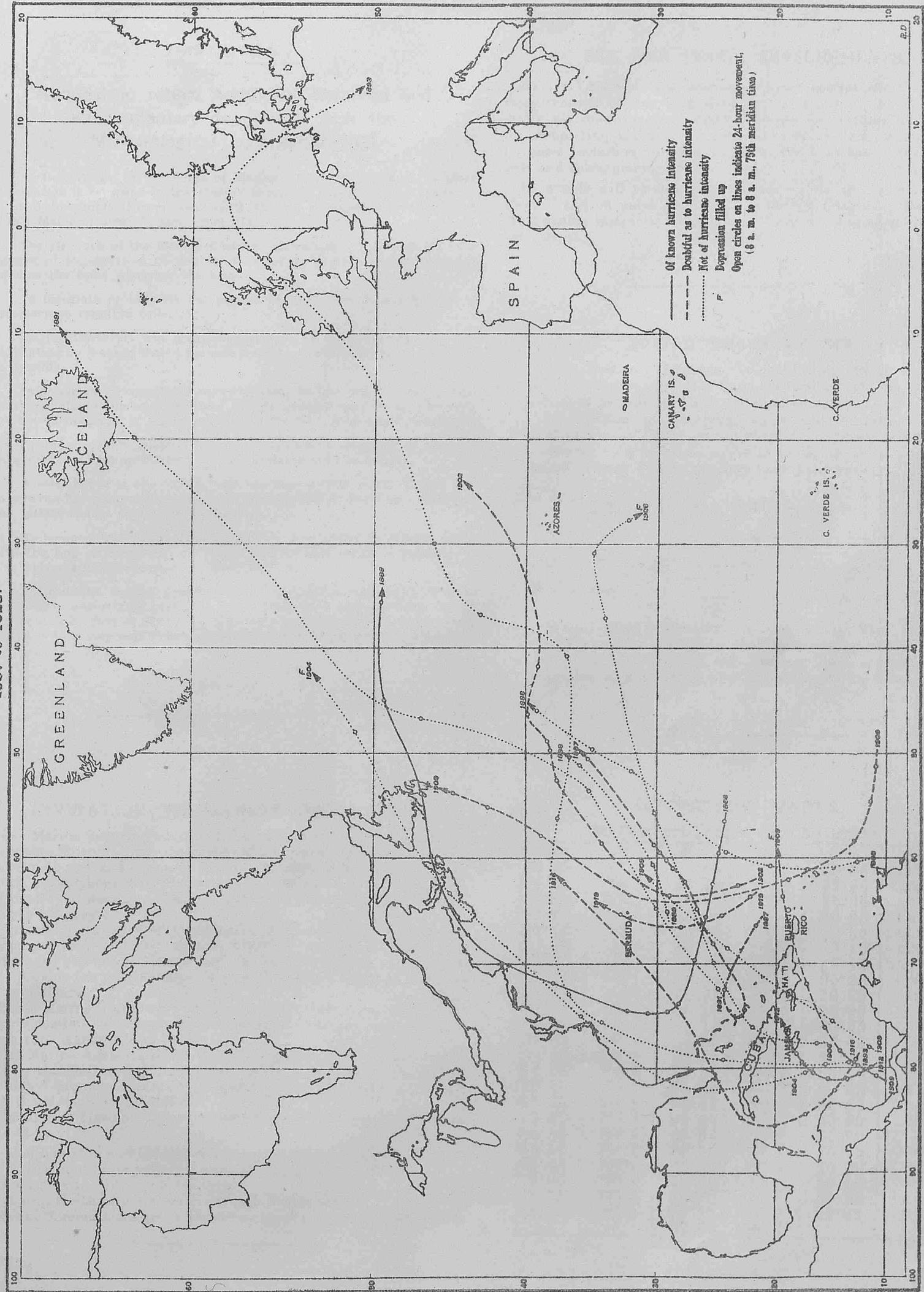


INDIAN OCEAN.
MEAN SEA SURFACE TEMPERATURES FOR MONTH OF NOVEMBER,

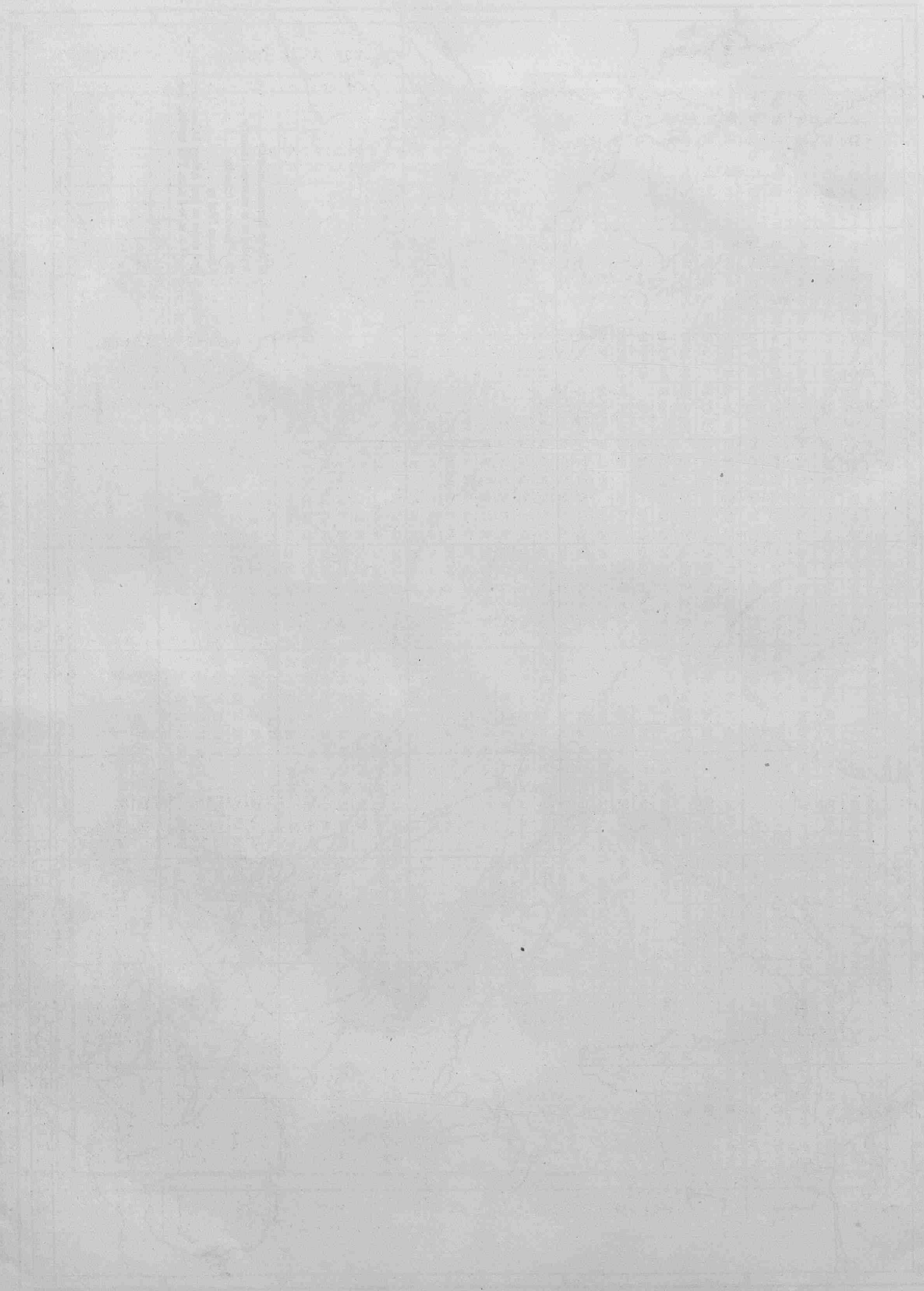


Computed from observations of British Ships during the years 1855 to 1917 except south of Latitude 30°S and eastward of Longitude 40°E.
where the observations are for the years 1855 to 1895, and south of Latitude 30°S. and westward of Longitude 40°E, 1855 to 1878.

Tracks of Tropical Cyclones of North Atlantic, November
1897 to 1923.



From "West Indian Hurricanes & other Tropical Cyclones of the North Atlantic Ocean," by Charles L. Mitchell, published in "Monthly Weather Review," Supplement No. 24, of the U.S. Weather Bureau.



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NOTICES.

IMPORTANT.

Request to return Additional Remarks and supplementary documents with the Meteorological Log and Form 911.

As the interest of the Corps of Marine Observers increases, so more information is returned to the Marine Division, and there is a tendency to send in supplementary documents to the Meteorological Log and Ship's Meteorological Report Form 911.

The strength of the Marine Division is constant, that is to say, the number of assistants in the Marine Division to handle the data received remains the same whatever the amount.

To maintain or increase the output of published information it is necessary to regulate collection.

Marine Observers will greatly assist, and in so doing, help towards publication by making their Logs and Reports when returned as complete as possible.

Information or considered views in reply to the Marine Superintendent's circulars or notes of enquiry in this Journal may be conveniently written on the pages in the Log and Form 911 for "Additional Remarks."

In this space narratives of experiences in storms, accounts of unusual phenomena and abnormal currents experienced should be entered.

A selection of a few of the best weather charts made during the voyage can be appropriately attached to the fly-leaf of the Log. Sketches and photos should be similarly attached.

By forwarding all information which it is intended to return, along with the Log or Form 911, Marine Observers will make it possible to give better acknowledgment for work well done.

The remarks, weather charts, sketches and photos, now being received are greatly appreciated and it is hoped that these may increase, but if justice is to be done to them, it is necessary that they should be properly placed so that they may receive the greatest possible amount of attention.

INVITATION TO MARINE OBSERVERS.

The Marine Superintendent will be pleased to see the Captains of Observing Ships or their Observing Officers when they are in London, between 10 a.m. and 4 p.m. at Room 319, Adastral House, Kingsway, W.C.2. Telephone No., Holborn 3434, Extension 421. Telegrams, Marine Superintendent, Weather, London. (Nearest Station, Temple, District Railway.)

Personal touch is not only conducive to efficient work, but by this means we may be better able to advance upon lines which will further the practice of Meteorology in Navigation and at the same time provide the most suitable data for the general needs of Meteorological Science.

Those Marine Observers who do not come to London wishing to discuss matters connected with Marine Meteorology, are asked to consult the Agents at the Ports.

The Marine Agencies in the British Isles are visited at least once a year by the Marine Superintendent, and it is hoped by these means to further promote voluntary co-operation between ships at sea, and with the Meteorological Office.

Usually the Marine Superintendent visits the Marine Agencies as follows:—

Southampton and Cardiff, first week of March.

Belfast and Liverpool, last week of May.

Glasgow and Liverpool, October.

Leith, North Shields and Hull, mid November.

Marine Agencies are given about two weeks notice of exact dates.

SEA AND SWELL MEASUREMENTS.

Marine Observers are invited to make special efforts to obtain measurements of Sea and Swell in all parts of the Oceans and under all conditions of weather. These observations are required for completing scales for routine observation and for many other purposes including information upon which to base form of ship's hull and construction.

An article will be found in Volume II, No. 19, upon "Sea and Swell" and on pages 43-8, of "The Marine Observer's Handbook" 4th Edition, instructions are given. Form 684 may be obtained from the Agents.

POSTAL ARRANGEMENTS.

THE MARINE OBSERVER is published, when circumstances permit, on the first Wednesday of the month previous to that to which the number refers.

If captains of observing ships will forward to the Meteorological Office the particulars required hereunder, endeavour will be made as far as mails permit to post the latest number for use on their homeward passage.

S.S..... Captain.....

Port of Call.....

Date of Homeward Departure.....

Postal Address.....

When this information is not given THE MARINE OBSERVER is addressed to the Commanding Officer, s.s., c/o the owners, and captains are requested to make their own arrangements for forwarding.

CONVERSION TABLE.

To Convert Inches into Millibars.

Inch.	mb.	Inch.	mb.	Inch.	mb.
27.50	931.2	28.65	970.2	29.85	1,010.8
27.55	932.9	28.70	971.9	29.90	1,012.5
27.60	934.6	28.75	973.6	29.95	1,014.2
27.65	936.3	28.80	975.3	30.00	1,015.9
27.70	938.0	28.85	976.9	30.05	1,017.6
27.75	939.7	28.90	978.6	30.10	1,019.3
27.80	941.4	28.95	980.3	30.15	1,021.0
27.85	943.1	29.00	982.0	30.20	1,022.7
27.90	944.8	29.05	983.7	30.25	1,024.4
27.95	946.5	29.10	985.4	30.30	1,026.1
28.00	948.2	29.15	987.1	30.35	1,027.7
28.05	949.9	29.20	988.8	30.40	1,029.4
28.10	951.6	29.25	990.5	30.45	1,031.1
28.15	953.2	29.30	992.2	30.50	1,032.8
28.20	954.9	29.35	993.9	30.55	1,034.5
28.25	956.6	29.40	995.6	30.60	1,036.2
28.30	958.3	29.45	997.3	30.65	1,037.9
28.35	960.0	29.50	999.0	30.70	1,039.6
28.40	961.7	29.55	1,000.7	30.75	1,041.3
28.45	963.4	29.60	1,002.4	30.80	1,043.0
28.50	965.1	29.65	1,004.0	30.85	1,044.7
28.55	966.8	29.70	1,005.7	30.90	1,046.4
28.60	968.5	29.75	1,007.4	30.95	1,048.1
		29.80	1,009.1		

ICE CHART. WESTERN NORTH ATLANTIC.

LETTERS OF TRANSATLANTIC TRACKS INDICATE

- (C) From 1st September to 31st January, inclusive.
- (F) From 16th May to Opening of Belle Isle route, and to 30th November when not using the Belle Isle route.
- (E) Westbound, on approaching Cape Race steer a course to pass 10 miles S. of Cape Race. Eastbound, steer from position 25 miles S. of Cape Race.
- (G) From the opening of the Straits of Belle Isle to 14th November.

These routes are liable to alteration when, owing to abnormal ice conditions, it is considered advisable by the steamship lines who are parties to the Track agreement.

ROUTE NOTICES.

For latest information re Tracks see pages 73-4, Vol. V. No. 52 of this Journal.

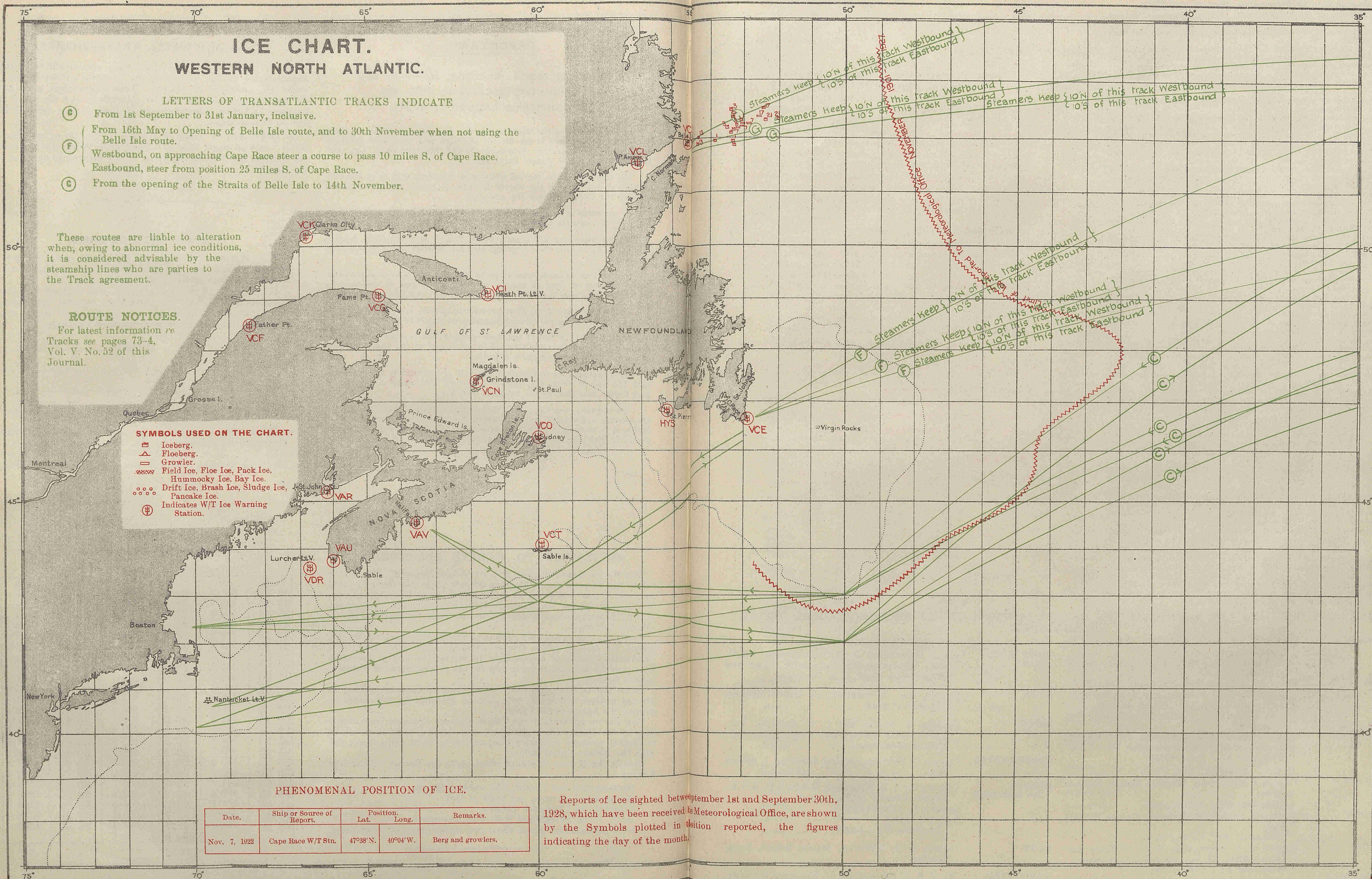
SYMBOLS USED ON THE CHART.

- Iceberg.
- Floeberg.
- Growler.
- Field Ice, Floe Ice, Pack Ice, Hummocky Ice, Bay Ice.
- Drift Ice, Brash Ice, Sludge Ice, Pancake Ice.
- Indicates W/T Ice Warning Station.

PHENOMENAL POSITION OF ICE.

Date.	Ship or Source of Report.	Position. Lat. Long.	Remarks.
Nov. 7, 1922	Cape Race W/T Stn.	47°38'N. 40°04'W.	Berg and growlers.

Reports of Ice sighted between September 1st and September 30th, 1928, which have been received by the Meteorological Office, are shown by the Symbols plotted in position reported, the figures indicating the day of the month.



NOTICES.

MARINE METEOROLOGY.

Co-operation of Shipowners, Masters and Mates.

The Director of the Meteorological Office is authorised to lend tested Instruments to Captains of British-owned ships who undertake to make 4 hourly observations and keep Meteorological Logs for the Office.

The instruments supplied for this purpose are one barometer, four thermometers with screen, two hydrometers and in some cases a Barograph and rain gauge is added to the equipment.

Tested instruments are also lent to a number of British Atlantic Liners which make special coded W/T weather reports to the Office.

The number of ships co-operating with the M.O. using official tested instruments on loan is limited.

Vessels observing regularly for the Meteorological Office to which office instruments are not lent, keep Form 911, Ship's Meteorological Report, using the ship's instruments, the barometer being compared with Standards. The number of ships regularly contributing approved forms of all descriptions to the Marine Division is limited to 500.

Captains and Officers who wish to co-operate with the Meteorological Office should apply *by letter* to The Director, Meteorological Office, Air Ministry, Kingsway, London, W.C.2, or *in person* between the hours of 10 a.m. and 4 p.m., to the Marine Superintendent at the same address or to any of the gentlemen whose names and addresses are given below acting as agents at the respective ports. A waiting list is kept of the names of ships whose commanders have offered to regularly co-operate.

Marine Observers (i.e., Captains and Officers who regularly observe for the Meteorological Office) will greatly assist if they will send in Meteorological Logs immediately on completion through the Port Meteorological Officer or Agent, at the same time notifying him of any possible instrumental defects.

Defective instruments will then be replaced and new Log Books, etc., provided.

In London and at base ports where there is not an Agency, notification of defects should be sent to headquarters on arrival, with the Meteorological Log.

Vessels making voyages of less than two months' duration are requested to retain their logs until nearly filled up, but the log should be returned in all cases at least twice yearly.

W/T Registers and Forms 911 should in all cases be sent directly to the Meteorological Office, London. The Port Meteorological Officer at Liverpool and the Visiting Officer in London board vessels co-operating with the Meteorological Office, and the agents visit ships at their ports when circumstances permit.

Postage abroad incurred on behalf of the Meteorological Office in returning logs will be refunded. Postage from British Empire ports need not be prepaid, if the envelope is marked O.H.M.S., and addressed to the Director, Meteorological Office, London.

Captains and Officers whether they observe regularly for the Meteorological Office or not are urged to report exceptional phenomena in air or sea. Reports of weather experienced in or near Tropical Cyclones or hurricanes, also abnormal currents are specially desired.

Ships on the List of Voluntary Observers to the Meteorological Office which have a mercurial barometer are indicated by the letters M.L., W.T. and M.

These are selected ships for reporting weather observations made at specified times by W/T to "All Ships," and they are invited to perform this service, which is for the benefit of all shipping fitted for W/T reception.

For sample weather report message see Chapter I. of "Wireless and Weather an Aid to Navigation," page 6, and page 18 of Vol V., No. 49, of this Journal.

THE MARINE OBSERVER is sent monthly to all ships regularly contributing Logs, Forms and W/T Registers to the Meteorological Office. It is hoped that each ship will preserve *all* her copies. Personal copies of Numbers are sent to those whose special contributions are published in them. A suitable cover may be obtained from H.M. Stationery Office, price 2s.

NAUTICAL OFFICERS AND AGENTS OF THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE, AIR MINISTRY.

LONDON ... Captain L. A. BROOKE SMITH, R.D., R.N.R., Marine Superintendent.
Commander J. Hennessy, R.D., R.N.R., Senior Nautical Assistant.
Room 319, Adastral House, Kingsway, W.C.2.
(Telephone No.: *Holborn 3434 Extension 421*).
Nearest station Temple, District Railway.
Mr. W. T. GRIEVES, Visiting Officer for the Port of London.

LIVERPOOL ... Lieut. Commander M. CRESSWELL, R.N.R., Port Meteorological Officer, Dock Office.
(Telephone No.: *Bank 8959*).

BELFAST ... Captain J. MCINTYRE, Harbour Master, Harbour Office.
(Telephone No.: *Belfast 4090*).

CARDIFF ... Captain T. JOHNSTON, Technical College, Cathays Park.
(Telephone No.: *Cardiff 6813*).

GLYDE ... Captain M. C. CORRANCE, Board of Trade Surveyor's Office, 73, Robertson Street, Glasgow.
(Telephone No.: *Central 2283-4*).

FREMANTLE, W. Australia. Captain J. J. AIREY, Deputy Director of Navigation, Customs House.
(Telephone No.: *B 1391*).

HONG KONG, China. Lieut. Commander J. H. DRUMMOND, D.S.C., R.N., Superintendent, Admiralty Chart and Chronometer Depot, H.M. Dockyard.

HULL ... Captain Geo. B. STURDY, c/o Mr. W. HAKES, Commercial Road.

LEITH ... Captains G. BLACK and C. G. BONNER, V.C., D.S.C., Leith Salvage and Towage Co., Ltd., 2, Commercial Street.

SOUTHAMPTON Captain D. FORBES, Nautical Academy, 1, Albion Place.

SYDNEY, New South Wales. Commander G. D. WILLIAMS, D.S.O., R.D., R.N.R., Deputy Director of Navigation.
Captain C. LINDBERGH, Customs House.
(Telephone No.: *B6491*).

TYNE ... Captain J. J. MCEWAN, Marine School, South Shields.

VANCOUVER, British Columbia. Mr. T. S. H. SHEARMAN, 61, Exchange Building, 553, Granville Street.
(Telephone No.: *Seymour 3309*).

LATE PRESS.

DERELICTS AND FLOATING WRECKAGE.

Date.	Position.		Description.
	Latitude.	Longitude.	
NORTH SEA.			
3.9.28	51°11'N.	1°37'E.	Mast, 2 ft. above water connected with wreck, dangerous to navigation.
18.9.28	53°48'N.	0°26'E.	Floating wreckage, half wooden barge.
IRISH SEA.			
8.9.28	53°12'N.	4°54'W.	Partly submerged object having appearance of small sailing vessel bottom up, dangerous to navigation.
ENGLISH CHANNEL.			
4.9.28	48°55'N.	4°45'W.	Partly submerged spar about 40 ft. long.
NORTH ATLANTIC.			
2.9.28	42°50'N.	66°53'W.	Schooner's topmast about 50 ft. long, with cross-trees attached.
4.9.28	58°36'N.	31°51'W.	Small spherical buoy, painted dark blue, with white letter <i>H</i> .
7.9.28	31°36'N.	75°47'W.	Black can buoy.
10.9.28	25°06'N.	80°16'W.	Large log.
11.9.28	35°18'N.	75°—'W.	Four masted schooner <i>Wellington</i> on fire aft.
15.9.28	49°17'N.	15°25'W.	Damaged empty lifeboat adrift.
NORTH PACIFIC.			
3.9.28	50°04'N.	160°55'W.	Spar projecting 5 to 10 ft. out of water.

1

Ships not contributing logs or reports within a reasonable period will automatically be removed from the list and the free issue of THE MARINE OBSERVER discontinued; it is, therefore, earnestly requested that changes of service, probable periods of lay up or transfer of Commanders may be notified whenever possible.

The numbers which appear before the names of ships equipped for making coded W/T reports to the Meteorological Office, London, are used for the purpose of identification when the observations are re-transmitted in synoptic messages by Wireless or Cable.

Those ships in this list which have the letters M.L., W.T. or M. after their names in the equipment column are "Selected ships" invited to make by W/T, standard form reports of observations taken at arranged G.M. Times to "All Ships." See "Wireless and Weather an aid to Navigation."

2

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 14.9.28.	Date Received.
<i>Atreus</i> ...	Rundle, G. G. ...	H. Nicholas ...	No. A.	A. Holt ...	Form 911 31.5.28 to 11.7.28 ...	7.8.28
<i>Atsuta Maru</i> ...	Narui, N. ...	Y. Osada ...	" A.	Nippon Yusen Kaisha ...	" 16.3.28 to 16.4.28 ...	24.4.28
<i>Auditor</i> ...	Owen, W. T. ...	" ...	" M.	Harrison ...	" 15.5.28 to 10.8.28 ...	23.8.28
<i>Autolyceus</i> ...	Dunlop, J. K. ...	T. Bell ...	" A.	A. Holt ...	" 7.7.28 to 25.7.28 ...	13.8.28
<i>Ausonia</i> ...	Stafford, W. D.S.C., R.D., Lt.-Commr., R.N.R.	J. J. Wiseman ...	" A.	Cunard ...	" 21.8.27 to 8.10.27 ...	11.10.27
<i>Avon</i> ...	Spriddell, F. G., R.D., Commr., R.N.R.	R. H. East ...	" M.	R.M.S.P. ...	" 17.2.28 to 28.3.28 ...	29.3.28
<i>Balmoral Castle</i> ...	Chave, Sir B., K.B.E.	" ...	" A.	Union Castle ...	" 6.4.28 to 23.4.28 ...	24.4.28
<i>Balranald</i> ...	Townshend, W. P., Capt., R.N.R.	H. Stinn, G. Owen, F. Ward ...	M.L.	P. & O. Branch ...	Met. Log. 31.3.28 to 5.8.28 ...	16.8.28
<i>51 Baltic</i> ...	White, E. R., R.D., Commr., R.N.R.	T. F. Pratt, A. C. I. Anson ...	W.T.	White Star ...	W.T. Reg. 6.8.28 to 25.8.28 ...	29.8.28
<i>Bampton Castle</i> ...	Hutchings, A. H. ...	E. Hamlyn ...	No. A.	Union Castle ...	Form 911 6.8.28 to 25.8.28 ...	28.8.28
<i>Banffshire</i> ...	Wynne, R. H. ...	W. D. E. Campbell ...	" A.	Turnbull Martin ...	" 28.4.28 to 4.8.28 ...	28.8.28
<i>Baradine</i> ...	Rollo, W. ...	C. B. Roche, B. H. Pollitt, D. F. Lambard, G. C. Case ...	M.L.	P. & O. Branch ...	Met. Log. 3.7.28 to 22.7.28 ...	25.8.28
<i>Barpeta</i> ...	Chandler, H. V. ...	B. R. Faithfull ...	No. M.	British India ...	Form 911 26.1.28 to 1.6.28 ...	4.6.28
<i>Barrabool</i> ...	Rhodes, H. R. ...	T. G. Davies ...	" M.	P. & O. Branch ...	" 18.7.28 to 15.8.28 ...	3.9.28
<i>Baychimo</i> ...	Cornwall, S. A. ...	W. H. Deans ...	" A.	Hudson's Bay Co. ...	" 7.7.28 to 22.7.28 ...	21.8.28
<i>59 Belgeland</i> ...	Morehouse, W. A. ...	F. Good, F. Clitty, C. H. Otterson ...	W.T.	Red Star ...	W.T. Reg. 7.7.27 to 14.9.27 ...	13.10.27
<i>Beltana</i> ...	Allin, C. H. C. ...	D. M. Stafford ...	" M.	P. & O. Branch ...	Form 911 19.8.28 to 8.9.28 ...	11.9.28
<i>Benalder</i> ...	Fairweather, J. J. ...	L. A. Sayers ...	No. M.	Ben Line ...	" 24.6.28 to 9.8.28 ...	13.8.28
<i>Benalla</i> ...	Sheepwash, J. ...	S. W. Du Fosse ...	" A.	P. & O. Branch ...	" 22.5.28 to 8.7.28 ...	18.7.28
<i>Bendigo</i> ...	Nicholl, R. N. C. ...	R. M. Richardson ...	" M.	" ...	" 28.7.28 to 13.8.28 ...	3.9.28
<i>Benefactor</i> ...	Jones, C. W. ...	G. Davidson ...	" M.	Harrison ...	" 10.2.28 to 3.7.28 ...	11.7.28
<i>Bengloe</i> ...	McCorquodale, A. ...	J. A. Myles, W. C. A. Robson, S. A. T. Bullock ...	" M.	Ben Line ...	" 1.6.28 to 18.6.28 ...	7.8.28
<i>51 Berengaria</i> ...	Roston, Sir A. H., K.B.E., R.D., Capt. R.N.R.	" ...	" A.	Cunard ...	" 25.4.28 to 26.5.28 ...	14.6.28
<i>Berrima</i> ...	Short, C. E. ...	G. H. Durrant ...	No. M.	P. & O. Branch ...	W.T. Reg. 11.4.28 to 21.5.28 ...	8.6.28
<i>Bogota</i> ...	Pape, E. R. ...	G. A. Thexton ...	" M.	" ...	Form 911 19.8.28 to 4.9.28 ...	7.9.28
<i>Brenda</i> ...	Lamont, A. ...	N. Ross ...	" A.	R.M.S.P. Co. ...	" 11.7.28 to 4.9.28 ...	10.9.28
<i>Brighton</i> ...	Hill, A. ...	Mr. Munton ...	O.C.	Scottish Fishery Bd. ...	" 10.8.28 to 31.8.28 ...	4.9.28
<i>British Colonel</i> ...	Taylor, R. J. ...	F. W. Sherlock ...	No. M.	Southern Railway ...	Telegraphic Report 13.9.28 ...	13.9.28
<i>British Consul</i> ...	Putt, R. O. ...	C. H. Humphries ...	" M.	British Tankers ...	Form 911 18.4.28 to 16.6.28 ...	21.6.28
<i>Bronte</i> ...	Crappier, J. S. ...	J. B. Scott ...	" A.	Lampart & Holt ...	" 28.6.28 to 16.7.28 ...	30.7.28
<i>Bruyere</i> ...	Birch, A. ...	" ...	" A.	" ...	" 25.3.28 to 26.4.28 ...	8.6.28
<i>Bulysses M.V.</i> ...	Head, B. P. ...	A. J. Clatworthy ...	" M.	Anglo-Saxon Petroleum Co ...	" 17.7.28 to 22.8.28 ...	23.8.28
<i>Cambria</i> ...	Copland, C. P. ...	O. W. L. Jones ...	C.C.	L.M. & S. Rly ...	" 31.7.28 to 22.8.28 ...	10.9.28
<i>Cameronia</i> ...	Gemmell, W. ...	" ...	M.L.	Anchor ...	Form 911 25.3.28 to 16.4.28 ...	18.4.28
<i>Camito</i> ...	Forrester, W. T., O.B.E.	H. H. Dunning, W. E. Grant, C. M. Schofield, G. M. Roberts ...	" B.	Elders & Fyffes ...	Met. Log. 30.1.28 to 27.5.28 ...	7.6.28
<i>Canadian Importer</i> ...	Forson, A. ...	" ...	No. A.	Canadian Gov. Mercantile Marine ...	Form 911 2.8.28 to 2.9.28 ...	14.9.28
<i>Canadian Inventor</i> ...	Boulton, F. W. ...	O. D. Alcorn ...	" A.	" ...	" 17.9.27 to 30.10.27 ...	19.11.27
<i>Canadian Winner</i> ...	Hocking, N. P. ...	R. J. Watson ...	" M.	" ...	" 26.7.28 to 7.8.28 ...	23.8.28
<i>Canonesa</i> ...	Brodie, W. H. ...	T. Wetherall ...	" M.	Furness Houlder ...	" 13.2.28 to 3.4.28 ...	11.4.28
<i>Cape of Good Hope</i> ...	Lamont, J. ...	J. J. Lewis ...	No. A.	Lyle S.S. Co. ...	" 31.3.28 to 15.5.28 ...	8.6.28
<i>35 Carmania</i> ...	Brown, F. G., R.D., Capt., R.N.R.	W. M. Stewart, E. R. Taylor, E. Gleave ...	W.T.	Cunard ...	W.T. Reg. 6.8.28 to 24.8.28 ...	28.8.28
<i>Carnarvon Castle</i> ...	Stanley, W. F., R.D., Commr., R.N.R.	W. G. Smith, T. C. Goldstone, J. B. McReynolds ...	M.L.	Union Castle ...	Met. Log. 9.3.28 to 1.7.28 ...	17.7.28
<i>34 Caronia</i> ...	Hossack, W. H., R.D., Capt., R.N.R.	H. G. Hayward, D. McMillan, T. Parry ...	W.T.	Cunard ...	W.T. Reg. 20.8.28 to 7.9.28 ...	11.9.28
<i>Casanare</i> ...	Browne, S. ...	" ...	No. A.	Elders & Fyffes ...	Form 911 20.8.28 to 7.9.28 ...	11.9.28
<i>Cavina</i> ...	Riseley, A. D. ...	" ...	" A.	" ...	" 13.7.28 to 19.8.28 ...	25.8.28
<i>52 Cedric</i> ...	Smith, R. G. ...	W. Walker, N. E. Banks, D. W. Chamberlain ...	W.T.	White Star ...	" 16.7.28 to 18.8.28 ...	28.8.28
<i>53 Celtic</i> ...	Berry, G. ...	J. Law, D. K. Crawford, A. R. Stevens ...	"	" ...	W.T. Reg. 13.8.28 to 2.9.28 ...	5.9.28
<i>Centaur</i> ...	Rose, A. F. ...	E. D. Potts, N. L. Thompson, J. Cockburn ...	M.L.	A. Holt & Co. ...	Form 911 12.8.28 to 2.9.28 ...	4.9.28
<i>Ceramic</i> ...	Musgrave, T. ...	" ...	No. A.	White Star ...	W.T. Reg. 30.7.28 to 19.8.28 ...	23.8.28
<i>Changte</i> ...	Gambrill, F. C. ...	— Thomas, — Tyer, — Allan ...	M.L.	Yuill & Co. ...	Form 911 30.7.28 to 19.8.28 ...	22.8.28
<i>Changuinola</i> ...	Thorburn, R. A., R.D., Commr., R.N.R.	W. G. Chanter ...	No. A.	Elders & Fyffes ...	Met. Log. 21.8.27 to 6.2.28 ...	26.4.28
<i>Chindwin</i> ...	Paterson, G. ...	" ...	" A.	Henderson ...	Form 911 22.1.28 to 10.5.28 ...	15.5.28
<i>Chinkiang</i> ...	Stringer, C. B. L. ...	R. J. Powerie ...	M.L.	China Navigation Co ...	Met. Log. 16.12.27 to 6.4.28 ...	16.5.28
<i>Chirripo</i> ...	McCollum, F. ...	" ...	No. A.	Elders & Fyffes ...	Form 911 13.7.28 to 14.8.28 ...	23.8.28
<i>City of Baroda</i> ...	McMillan, J. ...	A. Beaton, T. C. Hodgkinson ...	M.L.	Ellerman ...	Met. Log. 14.4.28 to 29.6.28 ...	23.7.28
<i>City of Benares</i> ...	Anderson, W. W. ...	F. Forsyth ...	No. A.	" ...	Met. Log. 10.4.28 to 29.7.28 ...	6.9.28
<i>City of Brisbane</i> ...	Seaborne, F. O., D.S.C.	R. Jones ...	" A.	" ...	Form 911 7.7.28 to 11.8.28 ...	21.8.28
<i>City of Canterbury</i> ...	Bremner, D. M. ...	R. H. Hodgson ...	" A.	" ...	Met. Log. 5.3.28 to 20.5.28 ...	6.6.28
<i>City of Carlisle</i> ...	Mordue, J. A. ...	" ...	" A.	" ...	Form 911 15.3.28 to 16.4.28 ...	19.4.28
<i>City of Chester</i> ...	Letton, F. W. ...	C. C. Duncan, A. J. Barnett, R. Mowbray ...	M.L.	" ...	" 3.2.28 to 1.4.28 ...	10.4.28
<i>City of Edinburgh</i> ...	Wyper, J. ...	G. H. Hummell ...	No. M.	" ...	" 2.4.28 to 4.6.28 ...	8.6.28
<i>City of Hong Kong</i> ...	Walton, H. L., O.B.E., R.D., Commr., R.N.R.	H. Saunders ...	" A.	" ...	" 1.8.28 to 15.8.28 ...	24.8.28
<i>City of London</i> ...	Parker, F. W., R.D., Commr., R.N.R.	H. H. Asher ...	No. A.	" ...	Met. Log. 31.3.28 to 27.8.28 ...	30.8.28
<i>City of Osaka</i> ...	Smith, W. H. ...	R. K. Walker ...	No. M.	" ...	Form 911 18.5.28 to 6.6.28 ...	27.8.28
<i>City of Rangoon</i> ...	Jones, P. ...	E. R. Wildermuth, R. H. Stewart, F. E. Broadbent ...	M.L.	" ...	" 18.8.28 to 30.8.28 ...	8.9.28
<i>City of Venice</i> ...	Lee, A. ...	" ...	No. A.	" ...	Form 911 4.2.28 to 22.4.28 ...	27.4.28
<i>City of Yokohama</i> ...	Singleton, J. G. ...	R. Willott Leese ...	" A.	Ellerman ...	" 22.6.28 to 2.8.28 ...	3.9.28
<i>Clan Alpine</i> ...	Lyall, A. B. ...	K. M. Banks ...	" A.	" ...	Met. Log. 28.3.28 to 9.7.28 ...	1.8.28
<i>Clan Kenneth</i> ...	Young, A. H., Commr., R.D., R.N.R.	F. H. Turton, J. E. Owen ...	" A.	" ...	Form 911 18.2.28 to 1.3.28 ...	12.3.28
<i>Clan Lamont</i> ...	Urquhart, P., D.S.C.	P. de Gruchy ...	" A.	" ...	" 21.6.28 to 29.7.28 ...	21.8.28
<i>Clan Lindsay</i> ...	Giles, H. J., R.D., Commr., R.N.R.	E. P. Smith ...	" A.	" ...	" 12.4.28 to 23.6.28 ...	25.6.28

LIST OF VOLUNTARY OBSERVING SHIPS

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Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 14.9.28.	Date Received.
<i>Clan MacBean</i> ...	Worthington, J. H. ...	J. E. Clayton ...	No. A.	Clan ...	Form 911 5.3.28 to 31.8.28 ...	4.9.28
<i>Clan Macbeth</i> ...	Horn, R. ...	T. A. Watkinson ...	" A.	" ...	" 1.4.28 to 27.4.28 ...	21.5.28
<i>Clan Macfadyn</i> ...	Stenson, F. J. R.D., Capt. R.N.R.	A. Dowds ...	" A.	" ...	" 30.4.28 to 18.5.28 ...	8.6.28
<i>Clan Macfarlane</i> ...	Redford, L. F. ...	T. A. Pearson ...	" A.	" ...	" 4.7.28 to 28.7.28 ...	3.9.28
<i>Clan Macgillivray</i> ...	Mackinlay, A. ...	J. Garis ...	" A.	" ...	" 13.5.28 to 1.6.28 ...	8.8.28
<i>Clan Macindoe</i> ...	Holman, W. G. ...	A. Hunter ...	" A.	" ...	" 11.6.28 to 4.7.28 ...	7.8.28
<i>Clan Mackellar</i> ...	Smith, W. P. ...	A. Woodrow ...	" A.	" ...	" 21.6.28 to 29.7.28 ...	25.8.28
<i>Clan Macphee</i> ...	Gourlay, J. B. ...	G. Short, B. Edgar, E. Mowatt.	M.L.	" ...	Met. Log. 21.11.27 to 18.4.28 ...	17.5.28
<i>Clan Macnaughton</i> ...	Simpson, A. W. ...	J. W. Fox ...	No. A.	" ...	Form 911 26.3.28 to 20.4.28 ...	14.5.28
<i>Clan Macnagart</i> ...	Makepeace, F. ...	E. A. Hewson ...	" A.	" ...	" 19.6.28 to 12.7.28 ...	7.8.28
<i>Clan Macwhirter</i> ...	Waterhouse, J. ...	W. A. Robbie, E. A. Brown S. W. Brown.	M.L.	" ...	Met. Log. 1.10.27 to 26.4.28 ...	30.4.28
<i>Clan Malcolm</i> ...	George, L. S. ...	R. L. Ranford, J. F. Hubbard P. Evans.	"	" ...	" 23.2.28 to 9.6.28 ...	29.6.28
<i>Clan Morrison</i> ...	Porterfield, W. M. ...	H. R. Crosscombe ...	No. A.	" ...	Form 911 24.6.28 to 26.7.28 ...	25.8.28
<i>Clan Murdoch</i> ...	Neill, G. A. ...	W. J. Jones ...	" A.	" ...	" 7.8.28 to 24.8.28 ...	8.9.28
<i>Clan Randal</i> ...	Fraser, R. K. ...	R. Cameron ...	" A.	" ...	" 19.7.28 to 20.8.28 ...	25.8.28
<i>Clan Ross</i> ...	Openshaw, L. G. ...	R. K. Phillips ...	" A.	" ...	" 11.4.28 to 12.5.28 ...	8.6.28
<i>Clan Sinclair</i> ...	Taylor, P. V. ...	J. H. Dennis ...	" A.	" ...	" 4.8.28 to 15.8.28 ...	24.8.28
<i>Clan Urquhart</i> ...	Baker, E. W. ...	R. Silk ...	" A.	" ...	" 27.6.28 to 2.8.28 ...	25.8.28
<i>Comorin</i> ...	Borland, J. Mc.L., C.B., D.S.O., R.D., Capt. R.N.R.	E. C. White ...	" M.	P. & O. ...	" 20.3.28 to 6.5.28 ...	23.5.28
<i>Corinthic</i> ...	Lloyd, W. ...	E. M. Burt, M. Bennett, I. A. Macnaughton.	M.L.	White Star ...	Met. Log. 4.2.28 to 18.5.28 ...	22.5.28
<i>Cornwall</i> ...	Wilde, H. J. ...	H. M. Knight ...	No. A.	Federal ...	Form 911 27.3.28 to 9.5.28 ...	15.5.28
<i>Crawford Castle</i> ...	Morgan, A. O., R.D., Commr. R.N.R.	J. A. Wilson ...	" A.	Union Castle ...	" 30.10.27 to 1.12.27 ...	15.12.27
<i>Culebra</i> ...	Rathkins, C.E., R.D., Commr. R.N.R.	P. Cooper, R. N. Fletcher, W. S. Thomas.	M.L.	R.M.S.P. Co. ...	Met. Log. 28.4.28 to 28.6.28 ...	6.7.28
<i>Cumberland</i> ...	Macmillan, D. ...	J. Marks ...	"	Federal ...	Form 911 25.2.28 to 3.4.28 ...	24.4.28
<i>Cyclops</i> ...	Cosker, W. ...	K. A. Owens ...	No. A.	A. Holt ...	" 27.6.28 to 30.8.28 ...	4.9.28
<i>Daga</i> ...	Wiles, N. ...	A. Olding ...	No. M.	P. Henderson ...	" 19.5.28 to 6.7.28 ...	13.8.28
<i>Dakotian</i> ...	Robb, J. ...	W. R. Atkinson ...	" A.	Leyland ...	" 30.3.28 to 24.6.28 ...	2.7.28
<i>Dardanus</i> ...	Clarke, J. W. ...	R. Millar ...	" A.	A. Holt ...	" 12.5.28 to 6.6.28 ...	19.7.28
<i>Darian</i> ...	Masters, W. ...	... ..	" A.	Leyland ...	" 12.11.27 to 24.11.27 ...	5.12.27
<i>Darro</i> ...	Matthews, G. P. ...	... ..	" M.	R.M.S.P. Co. ...	" 17.5.28 to 2.7.28 ...	18.7.28
<i>Delphic</i> ...	Evans, W. ...	... ..	" M.	White Star ...	" ... ..	...
<i>Demerara</i> ...	Willan, F. G. L., R.D., Capt. R.N.R.	F. Jeyes ...	" M.	R.M.S.P. Co. ...	" 30.4.28 to 21.6.28 ...	25.6.28
<i>Demosthenes</i> ...	Ogilvy, A. ...	... ..	" M.	Aberdeen ...	" 14.3.28 to 23.4.28 ...	28.4.28
<i>Denis</i> ...	Harris, F. C. P. ...	A. Blewett ...	" A.	Booth ...	" 7.8.28 to 28.8.28 ...	30.8.28
<i>Desado</i> ...	Hannam, F. S. ...	A. F. Walker, R. Barff ...	" M.	R.M.S.P. Co. ...	" 27.5.28 to 20.7.28 ...	23.7.28
<i>Desna</i> ...	Green, J. ...	R. Wilson ...	" M.	... ..	" 12.6.28 to 30.7.28 ...	14.8.28
<i>Deucalion</i> ...	Melling, C. F. ...	... ..	" A.	A. Holt ...	" 23.6.28 to 31.7.28 ...	2.8.28
<i>Devon</i> ...	Kinnell, G. ...	D. Clegg ...	" M.	Federal ...	" 5.8.28 to 24.8.28 ...	11.9.28
<i>Dieppe</i> ...	Marmery, S. ...	Mr. Parsons ...	C.C.	Southern Railway ...	Telegraphic Report 5.9.28 ...	5.9.28
<i>Dimboola</i> ...	Roy, C. M. ...	H. L. Price ...	No. A.	Melbourne S.S. Co. ...	Form 911 11.5.28 to 19.7.28 ...	21.8.28
<i>Domala, M.V.</i> ...	Kitson, A. G. ...	H. Robertson ...	" M.	British India ...	" 19.4.28 to 26.5.28 ...	26.6.28
<i>Domitia, C.S.</i> ...	Campos, V., O.B.E., Lt.-Commr. R.N.R.	H. Hutchins, T. J. C. Dexter J. Dyer.	M.L.	Telegraph Construc- tion & Maintenance.	Met. Log. 4.1.28 to 24.1.28 ...	1.3.28
<i>Dominic</i> ...	Saxton, C. ...	J. A. Moon ...	No. A.	Booth ...	Form 911 14.3.28 to 1.5.28 ...	8.5.28
<i>Doric</i> ...	Bolton, S., D.S.C., R.D., Commr. R.N.R.	G. T. Kavanagh ...	" M.	White Star ...	" 29.7.28 to 18.8.28 ...	23.8.28
<i>Dorington Court</i> ...	Clarke, E. J. ...	P. Jones ...	" A.	Halpin & Co. ...	" 28.6.28 to 6.7.28 ...	16.8.28
<i>Dromore Castle</i> ...	MacMahon, J., R.D., Commr. R.N.R.	... ..	" A.	Union Castle ...	" 23.6.28 to 18.7.28 ...	4.9.28
<i>Dryden</i> ...	Major, T. W. ...	E. W. Hardie ...	" M.	Lampert & Holt ...	" 6.4.28 to 1.5.28 ...	5.5.28
<i>Dunaff Head</i> ...	Milner, T. F., R.D., Lt.-Commr. R.N.R.	S. Duff ...	" A.	Ulster S.S. Co. ...	" 18.7.28 to 7.9.28 ...	8.9.28
<i>Dundrum Castle</i> ...	Goodacre, R.W., R.D., Commr. R.N.R.	A. R. J. Tilston ...	" A.	Union Castle ...	" 13.4.28 to 11.5.28 ...	21.5.28
<i>Dunluce Castle</i> ...	Morgan, A. O. ...	F. O. Wilbraham ...	" A.	... ..	" 19.8.28 to 7.9.28 ...	11.9.28
<i>Dunrobin</i> ...	Ramsay, J. D. ...	C. H. Kendall ...	" A.	Glen & Co. ...	" 20.7.28 to 22.8.28 ...	8.9.28
<i>Duquesa</i> ...	Owen, R. ...	C. G. Adlard ...	" M.	Furness Withy ...	" 22.1.28 to 15.3.28 ...	19.3.28
<i>Durenda, M.V.</i> ...	Beeching, P. H. ...	F. E. Liles ...	" M.	British India ...	" 21.6.28 to 22.7.28 ...	7.8.28
<i>Edinburgh Castle</i> ...	Gardener, G. F., O.B.E., Lt.-Commr., R.N.R.	G. W. F. Lloyd ...	" A.	Union Castle ...	" 21.7.28 to 9.9.28 ...	11.9.28
<i>Egori</i> ...	Sola, P., D.S.O. ...	R. W. Pattinson ...	" A.	Elder Dempster ...	" 29.7.28 to 17.8.28 ...	8.9.28
<i>Ellora</i> ...	Baird, S. K. ...	... ..	" M.	British India ...	" ... ..	...
<i>El Paraguay</i> ...	Fletcher, G. ...	F. F. Feint, D. Murray ...	" M.	Houlder Bros. ...	Form 911 23.10.27 to 15.12.27 ...	20.12.27
<i>Elpenor</i> ...	Gordon, A. L. ...	C. Kavanagh, J. E. Cliff ...	M.L.	A. Holt ...	Met. Log. 5.2.28 to 29.5.28 ...	18.6.28
<i>Elvysia</i> ...	Duncan, A. R. ...	A. Laidlaw, G. S. Sinclair, H. M. Sanders.	"	Anchor ...	" 12.5.28 to 15.7.28 ...	24.7.28
<i>Empress of Asia</i> ...	Hailey, A. J., Lt.- Commr. R.N.R.	L. C. Hogg ...	"	Canadian Pacific ...	" 25.2.28 to 15.6.28 ...	14.7.28
<i>Empress of Canada</i> ...	Robinson, S., C.B.E., R.D., Commr. R.N.R.	A. G. Simmons ...	"	" ...	" 17.3.28 to 28.6.28 ...	15.8.28
<i>Empress of France</i> ...	Griffiths, E. ...	E. Roberts, L. Outram, W. Griffith.	"	" ...	" 7.1.28 to 25.4.28 ...	10.5.28
<i>Empress of Russia</i> ...	Hosken, A. J. ...	L. C. Barry, R. A. Leicester, J. S. Clarke, J. H. Reid.	"	" ...	" 7.4.28 to 19.7.28 ...	13.9.28
<i>Endeavour</i> ...	Law, E. F. B., Commr. R.N.	C. S. E. Lansdown, P. Barlow, W. H. Dickinson.	"	His Majesty's Ship ...	" 14.3.28 to 11.7.28 ...	16.7.28
<i>Essequibo</i> ...	Kirkwood, J. H. ...	J. H. E. Evans ...	No. M.	R.M.S.P. Co. ...	Form 911 17.5.28 to 2.7.28 ...	28.7.28
<i>Eumacrus</i> ...	Read, J. W. ...	... ..	" A.	A. Holt ...	" 11.7.28 to 16.7.28 ...	21.8.28
<i>Euryades</i> ...	Findlay, J. ...	W. K. Hole ...	No. A.	A. Holt ...	" 11.8.28 to 22.8.28 ...	30.8.28
<i>Explorer</i> ...	Ling, J. T. ...	H. W. Gostage ...	" M.	Harrison ...	" 27.4.28 to 25.8.28 ...	28.8.28
<i>Explorer</i> ...	Allan, J. ...	A. Stout ...	" A.	Scottish Fishery Board.	" 9.8.28 to 30.8.28 ...	4.9.28
<i>Ferndale</i> ...	Thompson, W. ...	R. S. Hartrick ...	No. M.	Aberdeen Common- wealth.	" 7.7.28 to 5.8.28 ...	23.8.28
<i>Flandria</i> ...	Maars, L. ...	S. R. Hemmes ...	" M.	Holland Lloyd ...	" 29.6.28 to 14.8.28 ...	18.8.28
<i>Fordsdale</i> ...	Richardson, A. V. ...	... ..	" M.	Aberdeen Common- wealth.	" 25.7.28 to 13.8.28 ...	4.9.28

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 14.9.28.	Date Received.
<i>Francisco</i> ...	Scales, H. ...	F. Elgin ...	No. A.	Ellerman Wilson ...	Form 911 30.6.28 to 8.8.28 ...	13.8.28
<i>Freya</i> ...	J. M. Murray ...	W. Pirrie ...	" A.	Scottish Fishery Board.	" 1.8.28 to 31.8.28 ...	4.9.28
<i>Gaika</i> ...	Jackson, C. R. ...	L. G. May ...	" A.	Union Castle ...	" 11.9.27 to 4.11.27 ...	7.11.27
<i>Galtymore</i> ...	Yeoman, J. T. ...	" ...	" M.	Furness Withy ...	" 25.9.27 to 24.11.27 ...	1.12.27
<i>Garth Castle</i> ...	Linklater, H. ...	D. F. H. Klases ...	" A.	Union Castle ...	" 14.5.28 to 15.6.28 ...	19.6.28
<i>Gascoyne</i> ...	Johnson, L. ...	P. G. Collins, S. L. R. Simpson	M.L.	A. Holt & Co. ...	Met. Log. 30.12.27 to 20.5.28 ...	30.8.28
<i>Gelria</i> ...	Veldkamp, C. J. ...	A. J. H. Schöler ...	" M.	Holland Lloyd ...	Form 911 25.5.28 to 13.6.28 ...	14.7.28
<i>Glamorganshire</i> ...	Clayton, R. G., D.S.C., R.D., Lt.-Commr., R.N.R.	K. H. Whitaker ...	" M.	R.M.S.P. Co. ...	" 24.2.28 to 12.5.28 ...	18.5.28
<i>Glenamoy, M.V.</i> ...	Homan, C. E. ...	R. H. Bishop, R. W. Emerson, F. S. Howell.	M.L.	Glen Line ...	Met. Log. 5.12.27 to 16.4.28 ...	29.5.28
<i>Glenagarry</i> ...	Angier, J. ...	F. C. White ...	No. M.	" ...	Form 911 20.5.28 to 5.6.28 ...	18.6.28
<i>Glenluce</i> ...	Kennett, W. H. ...	H. B. Porter ...	" A.	" ...	" 15.7.28 to 3.8.28 ...	3.9.28
<i>Glenishane</i> ...	Neil, P. G. ...	" ...	" A.	" ...	" 19.2.28 to 25.5.28 ...	8.6.28
<i>Glenworth</i> ...	Kilgour, H. A. ...	" ...	No.	R. S. Dalgleish ...	" ...	"
<i>Gloucestershire</i> ...	Robin, E. ...	W. Moore ...	" A.	Bibby ...	Form 911 5.5.28 to 15.7.28 ...	23.7.28
<i>Gloxinia</i> ...	Pool, F. G. ...	J. Steward, D. Coughlan ...	" A.	Stag Line ...	" 14.6.28 to 13.7.28 ...	17.8.28
<i>Halesius</i> ...	Samuels, C. ...	R. W. Cook ...	" A.	R. P. Houston ...	" 29.5.28 to 27.6.28 ...	30.6.28
<i>Haliartius</i> ...	Felton, W. J. ...	C. C. Reeder ...	" A.	" ...	" 23.6.28 to 13.7.28 ...	7.8.28
<i>Harmonides</i> ...	Hughes, W. F. ...	K. T. Roper ...	" A.	" ...	" 6.7.28 to 18.7.28 ...	1.8.28
<i>Hatimura</i> ...	Lane, S. R., R.D., Capt., R.N.R.	" ...	" M.	British India ...	" 27.11.27 to 6.1.28 ...	6.2.28
<i>Hauraki, M.V.</i> ...	Hannaford, J. Norton, A. T. ...	T. Marshall, R. B. Denniston, F. C. Cochran.	M.L.	Union S.S. Co., N.Z. ...	Met. Log. 29.11.27 to 5.3.28 ...	1.6.28
<i>Henry C.S.</i> ...	Bicker Caarten, A. ...	A. R. Moss ...	No. M.	W. I. & Panama Telegraph Co.	Form 911 3.7.28 to 26.7.28 ...	30.8.28
<i>Herald</i> ...	Haselfoot, F.E.B., Capt., D.S.O., R.N.	D. G. V. Williams, W. H. Martin.	M.L.	His Majesty's Ship ...	Met. Log. 13.3.28 to 10.7.28 ...	22.8.28
<i>Herefordshire</i> ...	Mann, R. P. ...	M. D. Louttill ...	No. A.	Bibby ...	Form 911 21.4.28 to 30.6.28 ...	9.7.28
<i>Herminius</i> ...	Roberts, T. V. ...	D. W. MacGregor ...	" A.	Shaw, Savill & Albion	" 17.4.28 to 27.5.28 ...	4.6.28
<i>Herschel</i> ...	Watson, W. W. ...	J. F. Maurey ...	" A.	Lampport & Holt	" 27.5.28 to 24.8.28 ...	31.8.28
<i>Hertford</i> ...	Kettlewell, C. R. ...	J. R. Ricketts ...	M.L.	Federal ...	" ...	"
<i>Hibernia</i> ...	Roberts, W. Ivor, M.B.E.	R. Woodall, A. Marsh ...	C.C.	L.M. & S. Railway ...	Telegraphic Report 14.9.28 ...	14.9.28
<i>Highland Laddie</i> ...	Jones, T. J. ...	E. F. Smart ...	No. A.	Nelson ...	Form 911 22.4.28 to 12.6.28 ...	9.7.28
<i>" Piper</i> ...	Collings, D. ...	R. G. Owen, A. Southgate ...	M.L.	" ...	Met. Log. 1.12.27 to 22.6.28 ...	7.8.28
<i>" Pride</i> ...	Robinson, R. H. ...	F. Quelch ...	No. A.	" ...	Form 911 16.6.28 to 10.8.28 ...	14.8.28
<i>" Prince</i> ...	Davis, J. ...	J. Harrison ...	" A.	Prince ...	" 13.5.28 to 25.5.28 ...	8.6.28
<i>" Rover</i> ...	Ashby Graves, F. ...	N. F. Seaton ...	" A.	Nelson ...	" 17.28 to 17.8.28 ...	8.9.28
<i>Hildebrand</i> ...	Peregrine, D. ...	" ...	" A.	Booth ...	" 21.7.28 to 26.8.28 ...	4.9.28
<i>Hobson's Bay</i> ...	Kydd, O. J. ...	R. Pearce, H. Benson, A. McLeod, K. McKenzie.	M.L.	Aberdeen Commonwealth.	Met. Log. 7.2.28 to 18.5.28 ...	7.6.28
<i>Holbein</i> ...	Gough, W. A. ...	F. Delaney ...	No. A.	Lampport & Holt	Form 911 10.6.28 to 29.6.28 ...	11.9.28
<i>54 Homerie</i> ...	Parker, W. H., C.B.E., R.D., Capt., R.N.R.	H. G. Morgan, S. B. Morfee, W. T. Poustie.	W.T.	White Star ...	W.T. Reg. 9.8.28 to 24.8.28 ...	27.8.28
<i>Hororata</i> ...	Holland, E. ...	A. E. Bamforth ...	No. A.	New Zealand S.S. Co.	Form 911 26.3.28 to 10.7.28 ...	14.7.28
<i>Hubert</i> ...	Briscoe, W. ...	G. G. Westhorp ...	" A.	Booth ...	" 13.7.28 to 23.8.28 ...	8.9.28
<i>Huntingdon</i> ...	Ashworth, W. ...	H. G. Letts ...	" A.	Federal ...	" 30.6.28 to 23.7.28 ...	30.8.28
<i>Huntsman</i> ...	Russell, H. ...	J. Richardson ...	" M.	Harrison ...	" 13.4.28 to 15.6.28 ...	3.9.28
<i>Hydaspes</i> ...	Williams, P. E. ...	P. McMillan ...	No. M.	R. P. Houston ...	Form 911 13.6.28 to 9.7.28 ...	7.8.28
<i>Ingoma</i> ...	Barrow, R. K. ...	W. P. Baker ...	" M.	Harrison ...	Form 911 9.6.28 to 20.7.28 ...	24.7.28
<i>Inkum</i> ...	Meethan, J. T. ...	H. A. Belsham ...	" A.	J. H. Welsford ...	" 9.5.28 to 10.6.28 ...	23.7.28
<i>Iris, C.S.</i> ...	Hughes, H. R. ...	L. V. Vicker, D. MacDonald	M.L.	Pacific Cable Board ...	Met. Log. 25.8.27 to 3.10.27 ...	21.3.28
<i>Iroquois</i> ...	Jackson, A. L. Commr., R.N.	H. L. Jenkins ...	"	His Majesty's Ship ...	" 2.8.27 to 21.11.27 ...	31.1.28
<i>Ixion</i> ...	Reed, G. C. ...	C. W. A. Murphy ...	No. A.	A. Holt ...	Form 911 7.6.28 to 23.6.28 ...	3.7.28
<i>Japanese Prince</i> ...	Marshall, F. ...	W. Venn ...	" A.	Prince ...	" 9.6.28 to 24.6.28 ...	3.7.28
<i>Jervis Bay</i> ...	Chaplin, W. R. ...	R. W. Laycock ...	" M.	Aberdeen Commonwealth.	" 20.12.27 to 23.4.28 ...	14.5.28
<i>Justin</i> ...	Bush, H. ...	G. E. Thomas ...	" A.	Booth ...	" 28.6.28 to 13.7.28 ...	13.8.28
<i>Kaisar-i-Hind</i> ...	Manley, G. ...	R. H. Hand ...	" M.	P. & O. ...	" 23.6.28 to 15.8.28 ...	18.8.28
<i>Kalyan</i> ...	Cornwall Jones, B. ...	" ...	" M.	P. & O. ...	" 1.7.28 to 20.7.28 ...	21.8.28
<i>Kamo Maru</i> ...	Enya, S. ...	" ...	" A.	Nippon Yusen Kaisha	" 20.5.28 to 22.6.28 ...	25.6.28
<i>Kangaroo</i> ...	Buckeridge, G. ...	E. Hutchinson, J. Kavanagh, H. Brackenridge.	M.L.	State Service Australia.	Met. Log. 7.9.27 to 6.3.28 ...	22.5.28
<i>Karamea</i> ...	McIntosh, A. ...	" ...	" M.	Shaw, Savill & Albion	" ...	"
<i>Karapara</i> ...	Miller, A. C. ...	J. Smail ...	No. M.	British India ...	Form 911 6.6.28 to 20.7.28 ...	13.8.28
<i>Kashmir</i> ...	Mallalue, R., R.D., Lt.-Commr., R.N.R.	W. C. Riley ...	" M.	P. & O. ...	" 25.6.28 to 21.8.28 ...	3.9.28
<i>Kentworth Castle</i> ...	Chave, Sir B., K.B.E.	R. C. Longman, L. A. J. Keeble, W. Dryden, W. Wyeth.	M.L.	Union Castle ...	Met. Log. 18.4.27 to 8.8.27 ...	19.10.27
<i>Kent</i> ...	Matthews, C. ...	W. C. Wilkinson ...	No. A.	Federal ...	Form 911 21.12.27 to 24.1.28 ...	31.1.28
<i>Khiva</i> ...	Stringer, R. H., O.B.E., R.D., Commr., R.N.R.	G. W. Wood, D. Meakle, V. A. Nicolls, A. Robson.	M.L.	P. & O. ...	Met. Log. 13.10.27 to 14.4.28 ...	23.4.28
<i>Khyber</i> ...	Hester, C. W., R.D., Commr., R.N.R.	C. G. R. Fleming ...	"	P. & O. ...	" 3.5.28 to 14.8.28 ...	11.9.28
<i>Knight Companion</i> ...	Cox, B. T., D.S.O., R.D., Lt. Commr., R.N.R.	J. H. Isherwood, S. R. Evans, G. R. Cheetham.	No. M.	A. Holt ...	Form 911 19.5.28 to 26.7.28 ...	17.8.28
<i>Koolinda, M.V.</i> ...	Buckeridge, J. ...	" ...	" M.	State Service, Australia.	" 27.6.28 to 12.7.28 ...	27.8.28
<i>Kovno</i> ...	Dossor, W. A. ...	F. Barnard, S. Butcher ...	M.L.	Ellerman Wilson ...	Met. Log. 24.12.27 to 2.7.28 ...	6.7.28
<i>37 Laconia</i> ...	Doyle, M. ...	E. W. Connell, A. B. Fasting, F. G. Russell ...	W.T.	Cunard ...	W.T. Reg. 22.7.28 to 12.8.28 ...	18.8.28
<i>Laguna</i> ...	Mander, T. ...	" ...	No. A.	Pacific S.N. Co. ...	Form 911 20.8.28 to 9.9.28 ...	13.9.28
<i>Lahore</i> ...	Gordon, L. M., R.D., Commr., R.N.R.	E. B. Elcoate ...	" M.	P. & O. ...	Form 911 21.2.28 to 14.3.28 ...	12.9.28
<i>Lalande</i> ...	Hamill, H. ...	A. E. Warburton ...	No. A.	Lampport & Holt	Form 911 16.2.28 to 13.5.28 ...	29.5.28
<i>Lancashire</i> ...	Crumplin, W. E. ...	R. Allen ...	" A.	Bibby ...	" 3.6.28 to 11.8.28 ...	14.8.28
<i>36 Lancastria</i> ...	Oram, B.B., R.D., Commr., R.N.R.	L. R. Sharp, G. Overton, P. L. Williams.	W.T.	Cunard ...	W.T. Reg. 18.8.28 to 1.9.28 ...	4.9.28
					Form 911 12.8.28 to 2.9.28 ...	3.9.28

LIST OF VOLUNTARY OBSERVING SHIPS

v

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 14.9.28.	Date Received.
<i>Laomedon</i> ...	Hatfield, F. ...	R. L. Haldstock ...	No. A.	A. Holt... ..	Form 911 7.8.28 to 23.8.28 ...	8.9.28
<i>La Paz</i> , M.V. ...	Morgan, D. R. ...	J. W. Richards ...	" M.	Pacific S.N. Co. ...	22.8.28 to 9.7.28 ...	28.7.28
<i>55 Lapland</i> ...	Harvey, H. ...	J. C. Flett, — Bullied, — Harries ...	W.T.	Red Star ...	W.T. Reg. 6.8.28 to 24.8.28 ...	31.8.28
<i>Largs Bay</i> ...	Clifford, — ...	... ..	No. M.	Aberdeen Common-wealth. ...	Form 911 6.8.28 to 25.8.28 ...	29.8.28
<i>64 Laurentic</i> ...	Trant, E. L., R.D., Commr. R.N.R.	J. W. Peters, R. Conway, J. Webbe ...	"	White Star ...	W.T. Reg. 19.8.28 to 7.9.28 ...	11.9.28
<i>Lautaro</i> , M.V. ...	Leyne, R. W. ...	J. T. Denley ...	No. M.	Pacific S.N. Co. ...	Form 911 2.9.28 to 8.9.28 ...	11.9.28
<i>Leicestershire</i> ...	de Legh, P. ...	R. S. Evans H. G. Walton, J. K. Gemmell, D. Burt. ...	M.L.	Bibby ...	Met. Log. 12.5.28 to 15.8.28 ...	8.9.28
<i>Leighton</i> , M.V. ...	Lindesay, J. M. ...	... ..	No. A.	Lamport & Holt ...	Form 911 24.3.28 to 30.5.28 ...	4.6.28
<i>Leitrim</i> ...	Robertson, A. ...	... ..	" A.	Dowie, J., & Co. ...	Form 911 1.5.28 to 20.5.28 ...	19.6.28
<i>Limerick</i> ...	Molyneux, P. L. ...	F. J. Schibild ...	" M.	Federal... ..	" 15.4.28 to 26.5.28 ...	2.7.28
<i>Llandaff Castle</i> ...	Gilbert, E. F. ...	R. Bayer ...	" A.	Union Castle ...	" 10.5.28 to 5.7.28 ...	11.9.28
<i>Llandoverly Castle</i> ...	Kerbey, J. H. ...	C. H. Williams, G. Moon, P. Clissold. ...	M.L.	" ...	Met. Log. 19.4.28 to 8.5.28 ...	9.6.28
<i>Loch Katrine</i> ...	Buret, T. J. C. ...	R. A. Stenhouse, E. E. Collins. ...	No. A.	R.M.S.P. Co. ...	" 5.4.28 to 13.6.28 ...	28.6.28
<i>Logician</i> ...	Gibbings, W. ...	... ..	No. A.	Harrison ...	Form 911 1.3.28 to 25.5.28 ...	4.6.28
<i>London Importer</i> ...	Fowler, W. H. ...	F. F. Feint, J. H. Metcalfe, J. G. Freeman. ...	M.L.	Furness Withy ...	Met. Log. 8.1.28 to 31.3.28 ...	14.4.28
<i>Lord Antrim</i> ...	Jarvis, F. E. ...	... ..	No. A.	Ulster S.S. Co. ...	Form 911 25.6.28 to 8.8.28 ...	13.8.28
<i>Loriga</i> , M.V. ...	Clapham, E. C. ...	D. P. Morgan ...	" A.	Pacific S.N. Co. ...	" 19.4.28 to 2.8.28 ...	7.8.28
<i>Losada</i> , M.V. ...	Ross, J. ...	D. Beamer ...	" M.	" ...	" 18.6.28 to 7.7.28 ...	14.7.28
<i>Macedonia</i> ...	Harrison, R. ...	C. J. L. Hayward ...	" M.	P. & O. ...	" 7.7.28 to 28.8.28 ...	3.9.28
<i>Macharda</i> ...	Hanna, R. G. ...	T. Johnston ...	" M.	Brocklebank ...	" 25.6.28 to 9.8.28 ...	21.8.28
<i>Mahronda</i> ...	Addy, M. J. ...	J. Kettlewell ...	No. M.	" ...	" 7.5.28 to 13.7.28 ...	17.7.28
<i>Mahar</i> ...	Charlton, W. L. ...	J. W. B. Robertson, C. Cadwallader, S. S. Slade. ...	M.L.	" ...	Met. Log. 27.1.28 to 21.4.28 ...	7.6.28
<i>Maimoa</i> ...	Johnson, J. W. ...	... ..	"	Shaw, Savill & Albion	" ...	"
<i>Maimyo</i> ...	Smith, G. C. ...	H. M. Drummond ...	No. A.	Brocklebank ...	Form 911 5.11.27 to 15.6.28 ...	7.8.28
<i>58 Majestic</i> ...	Metcalfe, G. R., Lt-Commr. R.N.R.	W. W. Pearsor, L. Thompson, W. T. Fitz Gerald, A. H. Young. ...	W.T.	White Star ...	W.T. Reg. 16.8.28 to 30.8.28 ...	3.9.28
<i>Makalla</i> ...	Maugham, J. W. ...	J. B. Newman ...	No. M.	Brocklebank ...	Form 911 12.6.28 to 30.6.28 ...	19.7.28
<i>Makambo</i> ...	Blain, A. W. ...	R. Perry, R. W. Holmes, T. MacRae. ...	M.L.	Burns Philp ...	Met. Log. 20.8.27 to 22.1.28 ...	20.3.28
<i>Makura</i> ...	Brown, T. M. ...	W. A. Todd, D. Burgess, A. Gell. ...	"	Canadian-Australasian	" 26.1.28 to 11.5.28 ...	11.7.28
<i>Malabar</i> , M.V. ...	Donaldson, A. ...	K. Morris ...	"	Burns, Philp & Co. ...	" 28.12.27 to 13.4.28 ...	4.7.28
<i>Malakula</i> ...	Adamson, F. L. ...	N. Grayson ...	No. M.	Brocklebank ...	Form 911 23.5.28 to 20.6.28 ...	17.7.28
<i>Malancha</i> ...	Whitham, F. ...	R. Humble, F. Moore ...	" M.	" ...	" 3.4.28 to 19.6.28 ...	30.6.28
<i>Malda</i> ...	Gray, T. N. ...	S. G. James ...	" M.	British India ...	" 25.6.28 to 5.7.28 ...	1.8.28
<i>Maloja</i> ...	Ohlson, B. J., D.S.O., R.D., Commr. R.N.R.	A. D. Dennis ...	" M.	P. & O. ...	" 25.6.28 to 7.9.28 ...	11.9.28
<i>Malwa</i> ...	Norman, W. A. ...	... ..	" M.	" ...	" 18.5.28 to 27.6.28 ...	30.6.28
<i>Mamari</i> ...	Falconer, H. ...	B. Rudkin ...	" A.	Shaw, Savill & Albion	" 16.5.28 to 27.6.28 ...	9.7.28
<i>Manchester Brigade</i> ...	Stott, C. H. ...	W. S. Eustace, E. E. Bonnaud, W. R. Cullen. ...	M.L.	Manchester Liners ...	Met. Log. 3.3.28 to 14.8.28 ...	29.8.28
<i>Manchester Corporation.</i>	Makin, T. ...	... ..	No. A.	" ...	Form 911 20.7.28 to 31.8.28 ...	8.9.28
<i>Manchester Hero</i> ...	Riley, J. E. ...	H. Anderton, J. H. Emmett, A. W. Hanchett. ...	M.L.	" ...	Met. Log. 6.9.27 to 18.2.28 ...	23.2.28
<i>Manchester Producer</i>	Struss, F. D. ...	J. W. Moss ...	No. A.	" ...	Form 911 29.7.28 to 27.8.28 ...	8.9.28
<i>Manchester Regiment</i>	Foale, J. R. ...	P. D. Barr ...	" A.	" ...	" 4.2.28 to 9.3.28 ...	14.3.28
<i>Manipur</i> ...	Cochran, G. N. ...	R. Penston, G. B. Falconer ...	No. M.	Brocklebank ...	" 18.6.28 to 9.8.28 ...	23.8.28
<i>Manistee</i> ...	Edwards, A. E. ...	J. D. Patterson, A. Sandham, W. E. A. Duff. ...	M.L.	Elders & Fyffes ...	Met. Log. 17.6.28 to 20.7.28 ...	9.8.28
<i>Manora</i> ...	Hudson, H. T., R.D., Commr. R.N.R.	W. H. Cruse ...	No. M.	British India... ..	Form 911 29.4.28 to 13.7.28 ...	21.8.28
<i>Mantua</i> ...	Davis, H. C., D.S.C., Commr. R.N.R.	... ..	" M.	P. & O. ...	" 13.5.28 to 5.7.28 ...	12.7.28
<i>Marella</i> ...	Mortimer, S. ...	A. G. Hill, R. Duddell, A. G. Thomas. ...	M.L.	Burns Philp ...	Met. Log. 1.10.27 to 30.1.28 ...	1.6.28
<i>Marengo</i> ...	Curlie, J. ...	H. Bryan, J. Ford, F. Barnard S. Butcher. ...	"	Ellerman Wilson ...	" 27.3.28 to 30.6.28 ...	6.7.28
<i>Marefield</i> ...	Berry, V. ...	T. Connolly ...	No. A.	Woods, Tyler & Brown	Form 911 3.5.28 to 19.5.28 ...	9.6.28
<i>Margha</i> ...	Hughes, C. G. ...	P. Wright, P. B. Moore, W. E. Jones, W. G. Jones. ...	M.L.	British India... ..	Met. Log. 11.3.28 to 3.6.28 ...	11.6.28
<i>Marquesa</i> ...	Smiles, R. S. ...	L. Owen ...	No. M.	Furness Houlder ...	Form 911 29.4.28 to 4.7.28 ...	12.7.28
<i>Matakana</i> ...	Thurston, H. P. ...	J. J. Finn, J. Dickson, C. E. Mayer. ...	M.L.	Shaw, Savill & Albion	Met. Log. 31.3.28 to 7.8.28 ...	10.8.28
<i>Mataroa</i> ...	Kershaw, W. A. R. ...	... ..	"	" ...	" ...	"
<i>Matheran</i> ...	Ison, W. A. ...	J. Richardson ...	No. M.	Brocklebank ...	Form 911 26.5.28 to 14.8.28 ...	3.9.28
<i>Matiana</i> ...	Green, F. V. ...	J. R. Precious ...	" M.	British India... ..	Form 911 20.12.27 to 12.2.28 ...	20.2.28
<i>Matra</i> ...	Cornish, N. P. ...	W. Gibson, H. A. Turner ...	" M.	Brocklebank ...	" 25.6.28 to 28.7.28 ...	21.8.28
<i>Maunganui</i> ...	Toten, A. T. ...	C. R. Carlyon, A. J. Herbert Aldwell, B. M. ...	" M.	Union S.S. Co. of N.Z.	" 28.4.28 to 7.7.28 ...	23.7.28
<i>32 Mauretania</i> ...	McNeil, S.G.S., R.D., Capt. R.N.R.	R. H. C. Crawford, C. B. Osborne B. J. P. Tuck. ...	W.T.	Cunard ...	W.T. Reg. 5.8.28 to 21.8.28 ...	23.8.28
<i>Megantic</i> ...	Kearney, J. ...	F. E. Patchett ...	No. A.	White Star ...	26.8.28 to 10.9.28 ...	14.9.28
<i>22 Melita</i> ...	Stewart, A. ...	J. Shearer, T. Gillette ...	W.T.	Canadian Pacific ...	Form 911 16.7.28 to 2.8.28 ...	13.8.28
<i>Memnon</i> ...	Dougall, W. T. ...	J. A. C. McGregor ...	No. A.	A. Holt... ..	W.T. Reg. 18.8.28 to 2.9.28 ...	7.9.28
<i>21 Metagama</i> ...	McQueen, D. S. ...	W. P. Haines, N. Duck ...	W.T.	Canadian Pacific ...	Form 911 29.5.28 to 2.8.28 ...	15.8.28
<i>Middlesex</i> ...	MacRae, A., D.S.C., Lt-Commr. R.N.R.	C. Roberts ...	No. M.	Federal... ..	W.T. Reg. 9.6.28 to 27.6.28 ...	1.9.28
<i>Minna</i> ...	Mackenzie, G. G. ...	... ..	" A.	Scottish Fishery Brd.	4.8.28 to 22.8.28 ...	1.9.28
<i>Minnesota</i> ...	Finch, E., R. D., Commr. R.N.R.	... ..	" M.	Atlantic Transport...	Form 911 23.3.28 to 7.5.28 ...	12.5.28
<i>Minnetonka</i> ...	Gates, T. F., C.B.E. ...	H. E. McCartney ...	" M.	" ...	" 7.7.28 to 9.8.28 ...	21.8.28
<i>Minnevaska</i> ...	Claret, F. H., C.B.E., Commr. R.N.R.	... ..	" M.	" ...	" 6.8.28 to 26.8.28 ...	29.8.28
<i>Mirror</i> , C.S. ...	Jones, T. M.B.E. ...	J. G. West ...	" M.	Eastern Tel. Co. ...	" 12.8.28 to 1.9.28 ...	4.9.28
<i>Mississippi</i> ...	Wylie, J. T. J. ...	W. M. Shoesmith ...	No. A.	Atlantic Transport...	Form 911 30.7.28 to 18.8.28 ...	23.8.28
<i>Modasa</i> ...	Gilchrist, J. W. ...	R. E. T. Parsons ...	" M.	British India... ..	" 13.2.28 to 18.3.28 ...	10.4.28
<i>Moldavia</i> ...	Stringer, R.H., O.B.E., R.D., Commr. R.N.R.	C. B. Holmes ...	No. M.	P. & O. ...	Form 911 7.7.28 to 10.8.28 ...	15.8.28
<i>Mongolia</i> ...	Furlong, G. H. S., R D., Capt., R.N.R.	A. H. Cole ...	" M.	" ...	Form 911 18.2.28 to 10.8.28 ...	25.8.28
					" 30.6.28 to 20.7.28 ...	14.8.28
					" 8.7.28 to 27.7.28 ...	3.9.28

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 14.9.28.	Date Received.
24 Montcalm ...	Landy, E. ...	F. H. Steel, M. Williams, L. Thornton.	W.T.	Canadian Pacific ...	W.T. Reg. 19.8.28 to 6.9.28 ...	11.9.28
25 Montclare ...	Griffiths, J. N. ...	A. Mansey, F. E. Bevis, C. Draper.	"	" " ...	" 5.8.28 to 24.8.28 ...	29.8.28
27 Montclair ...	Dott, J. F. ...	E. A. Shergold, E. Stephens, W. J. Roberts.	W.T.	Canadian Pacific ...	W.T. Reg. 22.6.28 to 10.7.28 ...	14.7.28
Montoro ...	Williams, D. J. ...	J. Campbell ...	M.L.	Burns, Philp & Co. ...	Form 911 26.7.28 to 11.8.28 ...	13.8.28
26 Montrose ...	Notley, A. H., R.D., Commr. R.N.R.	J. A. Coldwell ...	W.T.	Canadian Pacific ...	Form 911 22.6.28 to 10.8.28 ...	13.8.28
20 Montroyal ...	Freer, A., R.D., Capt., R.N.R.	A. Mackie ...	"	" " ...	Form 911 31.1.28 to 6.3.28 ...	10.4.28
Moresby ...	Edgell, J. A., O.B.E., Capt., R.N.	W. H. Martin ...	M.L.	His Majesty's Australian Ship.	W.T. Reg. 21.7.28 to 4.9.28 ...	7.9.28
Morvada ...	Henderson, D. A., Commr., R.N.	"	"	"	" 9.8.28 to 24.8.28 ...	27.8.28
Mulbera ...	Mills, T. L., O.B.E., R.D., Commr. R.N.R.	H. J. O'Donohoe ...	No. M.	British India ...	Met. Log. 29.8.27 to 15.12.27 ...	23.1.28
	Caffyn, F. ...	J. Rose ...	" M.	"	Form 911 23.5.28 to 18.6.28 ...	21.6.28
			"	"	" 12.6.28 to 16.7.28 ...	28.7.28
Nagara ...	Foster, E. ...	C. K. Brown ...	" M.	R.M.S.P. Co. ...	" 26.8.27 to 21.1.28 ...	26.1.28
Nagoya ...	Bedwell, L. A. ...	S. Gerran ...	" M.	P. & O. ...	" 26.5.28 to 19.8.28 ...	23.8.28
Naldera ...	Dayas, C. T. E. ...	C. H. Hand, W. T. Banks, Hartley, J. W. ...	M.L.	"	Met. Log. 10.3.28 to 14.6.28 ...	20.6.28
Nardana ...	Moth, F. L. ...	S. C. T. Smith ...	No. M.	British India ...	Form 911 17.3.28 to 20.4.28 ...	30.4.28
Narkunda ...	Collyer, R. M. M., R.D., Commr. R.N.R.	M. Boyd ...	" M.	P. & O. ...	" 28.7.28 to 16.8.28 ...	10.9.28
Nellore ...	Hignett, A. H., R.D., Lt.-Commr., R.N.R.	A. J. Brown ...	" M.	P. & O. ...	" 25.5.28 to 14.6.28 ...	12.7.28
Nerbudda ...	Williams, B. N. ...	J. A. Farley ...	" M.	British India ...	" 27.5.28 to 14.6.28 ...	23.7.28
Nestor ...	Houghton, G. K. ...	A. Caird, N. Anderson, R. T. Dryden.	M.L.	A. Holt ...	Met. Log. 8.1.28 to 13.5.28 ...	24.5.28
Newby Hall ...	Storey, J. K. ...	"	"	Ellerman ...	" 13.10.27 to 21.3.28 ...	20.6.28
Newfoundland ...	Zeal, R. C. ...	"	"	Furness Withy ...	" 28.2.28 to 23.7.28 ...	28.7.28
	Westgarth, W. A., D.S.C.	R. F. Handley, E. Sainty, E.B. Burke, D. Hetherington.	"	"	"	"
Niagara ...	Foxworthy, A. W. ...	R. N. Turner, V. Knight, Hill, T. V. ...	"	Canadian-Australasian	" 4.4.28 to 19.7.28 ...	15.8.28
Ningchow ...	Brown, J. S. ...	G. Webb ...	"	"	"	"
Norfolk ...	Beale, H. E. ...	M. H. Vincent ...	No. A.	A. Holt ...	Form 911 9.6.28 to 9.7.28 ...	7.8.28
Norna ...	Mead, G. F. ...	A. Hocken ...	" A.	Federal ...	" 17.7.28 to 23.8.28 ...	25.8.28
Norseman, C.S. ...	Wright, J. W. ...	T. R. Ness ...	" A.	Scottish Fishery Brd.	" 2.8.28 to 3.9.28 ...	8.9.28
Northumberland ...	Douglas, W. ...	R. W. Greenfield ...	" M.	Western Tel. Co. ...	" 14.7.28 to 30.7.28 ...	24.8.28
	Upton, H. L., D.S.C., Lt.-Commr. R.N.R.	A. J. Robertson, A. Weatherall, J. F. Clements.	M.L.	Federal ...	Met. Log. 30.10.27 to 25.3.28 ...	17.4.28
Nova Scotia ...	Furneaux, S. ...	A. Hender ...	No. A.	Furness Withy ...	Form 911 12.7.28 to 10.8.28 ...	13.8.28
Nowshera ...	Rowe, S. N. ...	W. D. L. Reeves ...	" M.	British India ...	" 16.4.28 to 24.5.28 ...	29.5.28
Nubian ...	Watmough, T. M. ...	"	" A.	Leyland ...	" 19.8.27 to 30.10.27 ...	11.11.27
Nuddea ...	Morrison, W. C. ...	"	" M.	British India ...	" 4.7.28 to 20.7.28 ...	1.8.28
Oaklands Grange ...	St. Clair, C., D.S.C. ...	C. F. Foxwell ...	" A.	Houlder Bros. ...	Form 911 21.7.28 to 17.8.28 ...	21.8.28
57 Olympic ...	Marshall, W., C.B., D.S.O., R.D., Commadore, R.N.R.	A. E. Harvey, A. J. Fisher, J. Clark.	W.T.	White Star ...	W.T. Reg. 2.8.28 to 16.8.28 ...	20.8.28
	Matheson, C. G., D.S.O., R.D., Capt., R.N.R.	W. Elliot, C. K. Blake, J. M. M. Swan-on.	M.L.	Orient ...	Form 911 23.8.28 to 5.9.28 ...	10.9.28
Orania ...	Hoskins, W. ...	"	"	"	Form 911 2.8.28 to 6.9.28 ...	10.9.28
Orbita ...	Dominy, R. H., C.B.E., Commr., R.N.R.	J. Lloyd Jones ...	No. A.	Leyland ...	Met. Log. 4.3.28 to 7.6.28 ...	14.6.28
Orcoma ...	Mander, T. ...	T. J. Waylor, R. H. Sissons, J. W. Fraser, J. Allan.	" M.	R.M.S.P. Co. ...	Form 911 11.6.28 to 13.8.28 ...	15.8.28
Orduna ...	Daniel, T. ...	R. D. Eckford ...	"	"	" 8.5.28 to 12.7.28 ...	20.7.28
Orestes ...	Flynn, G. A. ...	R. Martin ...	No. M.	Pacific S.N. Co. ...	Met. Log. 31.5.28 to 14.8.28 ...	30.8.28
Orita ...	Duncan, E. E. ...	D. W. Hutchinson, H. D. Griffiths.	" A.	R.M.S.P. Co. ...	Form 911 7.4.28 to 18.6.28 ...	21.6.28
Ormonde ...	Rice, W. V., D.S.O., D.S.C., Commr. R.N.	H. P. Price ...	"	A. Holt ...	Form 911 26.3.28 to 29.6.28 ...	10.7.28
Ormonde ...	Sarson, M. J. ...	"	No. A.	Pacific S.N. Co. ...	Met. Log. 21.12.27 to 24.5.28 ...	4.6.28
Oronsay ...	Shelford, W. S., Lt.-Commr., R.N.R.	"	M.L.	His Majesty's Ship ...	" 30.10.27 to 26.2.28 ...	2.5.28
Oroya ...	Ridyard, A. ...	P. H. Ray ...	No. M.	Orient ...	Form 911 8.10.27 to 30.10.27 ...	5.12.27
Orsova ...	Cameron, E. P., R.D., Commr., R.N.R.	H. Schofield, L. J. Vesty, A. Croft Cohen, H. A. Whittle, A. Addison.	M.L.	"	Met. Log. 5.2.28 to 8.5.28 ...	12.5.28
Orvieto ...	O'Sullivan, F. R. ...	J. G. Goldsworthy, G. L. Carter, T. Fox Russell, C. D. Lane.	"	"	" 19.5.28 to 1.8.28 ...	8.8.28
Osterley ...	Sarson, M. J. ...	A. F. C. Gray ...	No. A.	"	" 3.5.28 to 1.8.28 ...	8.9.28
Otahi ...	McNish, R. ...	J. McCulloch ...	" A.	"	" 17.12.27 to 20.1.28 ...	24.1.28
Otira ...	Wood, C., D.S.C. ...	S. Winton ...	" M.	New Zealand S.S. Co.	Met. Log. 20.1.28 to 25.5.28 ...	1.6.28
Otranto ...	Staunton, H. G., C.B.E., R.D., Commr., R.N.R.	O. C. Davies ...	" M.	Shaw, Savill & Albion	" 22.3.28 to 28.4.28 ...	8.5.28
Oxfordshire ...	Foster, W. L. ...	"	" A.	Orient ...	" 29.1.28 to 30.3.28 ...	14.4.28
Pacific Shipper, M.V.	Fairclough, H. ...	"	" A.	Bibby Bros. ...	" 19.5.28 to 1.8.28 ...	8.8.28
Pacture ...	Sapsworth, S. A. ...	V. R. Watkins ...	" A.	Furness Withy ...	" 3.5.28 to 1.8.28 ...	8.9.28
Pakeha ...	W. P. Clifton Mogg, Lt.-Commr. R.N.R.	H. C. Smith, G. Almond, G. Lindsay.	M.L.	Elders & Fyffes	" 17.12.27 to 20.1.28 ...	24.1.28
Paneras ...	Reynolds, H. B. W. ...	W. Griffiths, C. C. Veal, J. Nichales.	M.L.	Shaw, Savill & Albion	Met. Log. 20.1.28 to 25.5.28 ...	1.6.28
Pareora ...	Evans, J. O. ...	J. Greenaway ...	No. A.	Booth ...	" 13.12.27 to 14.6.28 ...	25.7.28
Paris ...	Cook, C. L. ...	Mr. Biles ...	C.C.	Hain S.S. Co. ...	Form 911 13.1.28 to 11.2.28 ...	10.4.28
Fatia ...	Makepeace, S. ...	J. D. S. Sloper ...	No. A.	Southern Rly.	Telegraphic Report. 31.7.27	31.7.27
Pelsander ...	Slater, H. N. ...	H. E. Readslaw ...	" A.	Elders & Fyffes	Form 911 7.7.28 to 12.8.28 ...	14.8.28
Pennland ...	Making, V. ...	C. J. Murray, A. Lewis, J. Mackie.	No. A.	A. Holt ...	" 7.7.28 to 29.8.28 ...	8.9.28
Peshawar ...	Wilding, H. G. ...	J. C. Mellonie, S. H. Baldwin, A. M. Tolfree.	M.L.	Red Star ...	" 29.7.28 to 19.8.28 ...	25.8.28
			"	P. & O. ...	Met. Log. 19.11.27 to 25.3.28 ...	11.4.28

LIST OF VOLUNTARY OBSERVING SHIPS

vii

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 14.9.28.	Date Received.
<i>Polycarp</i> ...	Jackson, T. H. ...	H. W. Taggart ...	No. A.	Booth ...	Form 911 1.7.28 to 22.8.28 ...	25.8.28
<i>Port Adelaide</i> ...	Swan, L. H. ...	E. N. Rogerson, F. J. Lavers, L. H. Potter.	M.L.	Commonwealth & Dominion.	Met. Log. 3.2.28 to 18.6.28 ...	6.7.28
<i>Albany</i> ...	Needham, R. ...	C. F. Post, E. R. Rowlands, H. E. Braine.	"	"	" 22.1.28 to 4.7.28 ...	11.7.28
<i>Auckland</i> ...	Durham, R. S., D.S.C.	W. R. Johnston ...	"	"	" 16.3.28 to 27.7.28 ...	7.8.28
<i>Bowen</i> ...	Hearn, G. W. ...	J. G. Thom ...	No. A.	"	Form 911 28.10.27 to 15.12.27 ...	6.1.28
<i>Campbell</i> ...	Reynolds, P. J. ...	L. M. Bayly, R. Forrest, J. Stannard.	M.L.	"	Met. Log. 4.12.27 to 31.3.28 ...	18.5.28
<i>Caroline</i> ...	Hoad, A. C. ...	H. Pinkney, E. M. Fenton, S. Moate, J. Dedman.	"	"	" 2.3.28 to 30.6.28 ...	30.4.28
<i>Darwin</i> ...	Sawbridge, I. R. ...	E. T. N. Lawrey, L. W. Cady, A. A. Cooper, J. Rowland-Hill.	"	"	" 8.3.28 to 5.9.28 ...	20.7.28
<i>Denison</i> ...	Ferris, J. ...	E. G. Jones, H. M. Post, N. M. Muzzell.	"	"	" 5.4.28 to 13.7.28 ...	11.9.28
<i>Dunedin, M.V.</i>	Farmer, F. ...	A. G. Rhind ...	"	"	" 5.5.28 to 8.6.28 ...	21.7.28
<i>Fremantle, M.V.</i>	Kearney, F. J. ...	R. D. Elson ...	No. A.	"	Form 911 28.1.28 to 23.5.28 ...	15.6.28
<i>Gisborne, M.V.</i>	Craven, R. ...	R. Carter, L. Copeland, G. G. Langford, C. L. Webb.	A.	"	Met. Log. 1.1.28 to 28.4.28 ...	4.6.28
<i>Hobart</i> ...	Hayter, S. W. ...	J. C. Goddard, A. McClouman, J. T. Weldin.	M.L.	"	" 7.1.28 to 11.5.28 ...	15.5.28
<i>Hunter</i> ...	Cottell, S. C. ...	J. E. Fairbairn ...	"	"	" 9.6.28 to 17.7.28 ...	16.5.28
<i>Huon</i> ...	Compton, J. E. ...	A. R. Martin, L. H. B. Bloye, W. E. Simpson.	No. A.	"	Form 911 12.11.27 to 1.4.28 ...	30.8.28
<i>Melbourne</i> ...	Hudson, J. J. ...	J. G. Lewis, G. L. H. Dean, A. G. Newbury, W. B. Hopkins.	M.L.	"	Met. Log. 19.2.28 to 28.7.28 ...	10.4.28
<i>Nicholson</i> ...	Jack, J. ...	W. G. Jones, J. F. Martin, E. O. Round.	"	"	" 12.10.27 to 27.3.28 ...	17.8.28
<i>Pirte</i> ...	Kippins, T. ...	T. L. Kidwell, E. E. Roswell, K. D. Morgan.	"	"	" 3.2.28 to 9.6.28 ...	12.4.28
<i>Sydney</i> ...	Higgs, W. G. ...	R. Stannard, W. B. Craig, C. E. Midwinter.	"	"	" 13.4.28 to 23.5.28 ...	22.8.28
<i>Victor</i> ...	Williams, R. ...	D. F. Morgan ...	"	"	" 5.6.28 to 20.6.28 ...	27.6.28
<i>Wellington</i> ...	Jones, C. ...	J. A. Cartwright ...	No. A.	"	Form 911 5.1.28 to 29.1.28 ...	23.7.28
<i>President Jackson</i>	Kohlmeister, W. O. ...	C. H. Moen, S. Hansson ...	"	Pacific Mail S.S. Co...	" 1.2.28 to 10.5.28 ...	30.7.28
<i>President Jefferson</i>	Nichols, F. R. ...	A. C. Matson ...	A.	Admiral Oriental Line	" 28.9.27 to 16.5.28 ...	20.2.28
<i>Protea, H.M.S.A.S.</i>	Dalglish, J., Lt-Commr., S.A.N.S.	R. E. Wilks ...	M.L.	South African Naval Service.	Met. Log. 18.6.28 to 10.8.28 ...	12.6.28
<i>Protestilus</i> ...	Williams, T. G. ...	"	"	A. Holt ...	Form 911 18.6.28 to 10.8.28 ...	21.6.28
<i>Pyrrhus</i> ...	Elford, W. J. ...	"	No. A.	"	"	13.8.28
<i>Quiloa</i> ...	Cave, S. ...	"	No. M.	British India...	"	"
<i>Ranpara</i> ...	King, A. M., D.S.C.	E. J. Spurling ...	No. M.	P. & O. ...	" 13.6.28 to 26.7.28 ...	2.8.28
<i>Rawalpindi</i> ...	Thornton, E. J. ...	A. G. Stansfield ...	"	"	" 12.8.28 to 31.8.28 ...	3.9.28
<i>60 Regina</i> ...	Davies, E. ...	R. S. Walker, E. A. A. Crowley, J. Boyce.	W.T.	White Star - Dominion	W.T. Reg. 12.8.28 to 31.8.28 ...	5.9.28
<i>Reinder</i> ...	Pitman, R. R. ...	H. Horwood ...	C.C.	G.W. Railway	Telegraphic Report 23.2.28 ...	23.2.28
<i>Remuera</i> ...	Cameron, J. J. ...	A. Yarwood ...	No. A.	New Zealand S.S. Co.	Form 911 17.2.28 to 2.6.28 ...	9.6.28
<i>Rhezenor</i> ...	Stout, G. L. ...	J. G. Freeman ...	"	A. Holt...	" 30.5.28 to 2.9.28 ...	8.9.28
<i>Rhodesian Transport</i>	Bullock, F. W. H. ...	"	"	Houlder Bros.	" 17.4.28 to 14.8.28 ...	30.8.28
<i>Rimutaka</i> ...	Hemming, F. A. ...	F. Pretty, H. S. Cashmore, F. Cooke, E. Foster.	M.L.	New Zealand S.S. Co.	Met. Log. 13.4.28 to 10.8.28 ...	16.8.28
<i>Ripley Castle</i> ...	Morgan, A. O., R.D., Commr., R.N.R.	T. E. Wilford ...	No. A.	Union Castle ...	Form 911 2.3.28 to 4.5.28 ...	8.5.28
<i>Risaldar</i> ...	Matthews, E. G. ...	R. H. Friedlander ...	No. M.	Asiatic S.N. Co. ...	" 4.11.27 to 19.11.27 ...	12.12.27
<i>Rona</i> ...	Wallis, J. A. ...	W. G. Balharrie ...	No. M.	Colonial Sugar Refining Co.	" 1.6.28 to 23.6.28 ...	27.8.28
<i>Rother</i> ...	Woodhead, T. H. ...	S. Duckels ...	No. A.	Goole Steam Shipping	" 15.6.28 to 21.7.28 ...	8.8.28
<i>Rotorua</i> ...	Hunter, J. L. B. ...	E. Lawrence, L. Griffiths, T. M. Devitt.	M.L.	New Zealand S.S. Co.	Met. Log. 21.1.28 to 8.5.28 ...	23.5.28
<i>Royal Transport</i>	Oliver, R. C. ...	R. Hughes ...	No. A.	Houlder Bros.	Form 911 14.3.28 to 30.5.28 ...	15.6.28
<i>Ruapehu</i> ...	McKellar, A. W., R.D., Capt., R.N.R.	A. Landles, D. M. Lambert, W. J. Newton.	M.L.	New Zealand S.S. Co.	Met. Log. 19.1.28 to 14.5.28 ...	23.5.28
<i>St. Albans</i> ...	Smith, G. L., Commr., R.A.N.R.	W. McIntyre, J. Kavanagh, R. L. Harry, B. W. Dun.	"	Eastern and Australian.	" 30.9.27 to 16.2.28 ...	7.5.28
<i>St. Helier</i> ...	C. Bell ...	C. W. Sanderson ...	C.C.	G.W. Railway	Telegraphic Report 13.9.28 ...	13.9.28
<i>St. Julien</i> ...	Richardson, L. ...	E. E. Moodie ...	"	"	" 12.9.28 ...	12.9.28
<i>St. Andrew</i> ...	Bearpark, E. W. ...	C. S. Williams, D. E. Sibson.	No. A.	Ranikin Gilmour	Form 911 1.7.28 to 20.7.28 ...	30.8.28
<i>38 Samaria</i> ...	Malin, R. G., Lieut-Commr., R.N.R.	"	W.T.	Cunard ...	" 29.7.28 to 18.8.28 ...	22.8.28
<i>Sardinian Prince</i> ...	Brown, J. F. ...	G. A. Davies ...	No. A.	"	W.T. Reg. 29.7.28 to 18.8.28 ...	23.8.28
<i>Saxon</i> ...	Gardner, G. F., O.B.E.	R. May ...	"	Prince ...	Form 911 5.7.28 to 5.9.28 ...	14.9.28
<i>Scholar</i> ...	Whyte, D. L. ...	"	A.	Union Castle ...	" 29.6.28 to 16.7.28 ...	17.7.28
<i>Scotia</i> ...	Prichard, S. D., M.B.E.	W. T. Griffith ...	M.	Harrison ...	" 27.6.28 to 10.9.28 ...	14.9.28
<i>33 Scythia</i> ...	Prothero, W. ...	R. Sell, G. H. Morris, J. G. Bradley.	C.C.	L.M. & S. Railway	Telegraphic Report 8.9.28 ...	8.9.28
<i>Sheaf Mount</i> ...	Whitfield, G. A., O.B.E.	A. Macarthur ...	W.T.	Cunard ...	W.T. Reg. 6.8.28 to 26.8.28 ...	31.8.28
<i>Sheaf Spear</i>	"	"	"	"	Form 911 4.8.28 to 27.8.28 ...	30.8.28
<i>Shropshire, M.V.</i>	Adamson, B. W. ...	S. J. Dring, T. B. Fishley, W. L. Whiteside, R. Cumming, W. H. Brittain, L. McDermott.	M.L.	W. A. Souter ...	" 25.6.28 to 31.7.28 ...	17.8.28
<i>Socrates</i> ...	Taylor, F. C. ...	W. E. Jordan ...	"	Bibby ...	Met. Log. 4.2.27 to 25.7.27 ...	17.9.27
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			"	Hunting & Son	" 18.6.28 to 25.7.28 ...	27.7.28
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<i>Tahiti</i> ...	Aldwell, B. M. ...	C. R. Carlyon ...	A.	Union S.S. Co. of N.Z.	" 16.5.28 to 3.6.28 ...	7.8.28
<i>Taiyang</i> ...	Frame, A. M. ...	F. Stratford, A. C. Kennedy, R. Bagent.	M.L.	Yuill & Co. ...	Met. Log. 15.11.27 to 9.4.28 ...	23.6.28
<i>Talthybius</i> ...	Wilson, R. J. ...	"	No. A.	A. Holt ...	Form 911 23.5.28 to 4.6.28 ...	21.6.28
<i>Tamara</i> ...	Hartman, W. H. ...	F. W. Lutyens ...	M.	Shaw, Savill & Albion	" 9.6.28 to 15.7.28 ...	19.7.28

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed. Received up to 14.9.28.	Date Received.
<i>Tanda</i> ...	Pilcher, E. T. Lieut.-Commr., R.N.R.	G. C. Smith, H. Monday, J. W. Kavanagh, R. Millington.	M.L.	E. & A. S.S. Co. ...	Met. Log 2.9.27 to 31.1.28 ...	3.4.28
<i>Taranaki</i> ...	Wood, C.	Shaw, Savill & Albion
<i>Tarantia</i> ...	Munro, D. ... R.D., Commr., R.N.R.	A. Morrice ...	No. A.	Anchor ...	Form 911 2.5.28 to 5.7.28 ...	14.7.28
<i>Tetrestias</i> ...	Wilkinson, W. H. ...	R. Singleton ...	" A.	A. Holt & Co. ...	" 3.5.28 to 7.7.28 ...	18.7.28
<i>Tekoa</i> ...	Barnett, H. ...	A. W. Marshall ...	" M.	New Zealand S.S. Co.	" 28.5.28 to 25.6.28 ...	2.8.28
<i>Telamon</i> ...	Willecox, J. H. ...	F. A. Brown ...	" A.	A. Holt ...	" 4.6.28 to 9.7.28 ...	14.7.28
<i>Tetala</i> ...	Brice, E. H.	" A.	Elders & Fyffes ...	" 23.7.28 to 1.9.28 ...	4.9.28
<i>Teucer</i> ...	Dodds, R. ...	J. M. Kirk ...	" A.	A. Holt ...	" 23.7.28 to 26.6.28 ...	14.7.28
<i>Themistocles</i> ...	Young, A. D. ...	H. C. Howe ...	" M.	Aberdeen ...	" 4.2.28 to 22.2.28 ...	16.4.28
<i>Theseus</i> ...	Jones, E. ...	W. A. Fyffe ...	" A.	A. Holt ...	" 15.7.28 to 1.8.28 ...	8.9.28
<i>Titan</i> ...	Power, J. J. ...	G. W. Best, P. Cross, R. A. Shennan.	M.L.	" ...	Met. Log. 4.3.28 to 15.7.28 ...	18.7.28
<i>Tongariro</i> ...	Burton Davies, J. ...	E. A. Burton, A. E. Williams, E. A. Quick, D. Baldwin.	"	New Zealand S.S. Co.	Met. Log. 4.3.28 to 27.6.28 ...	2.7.28
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<i>Trematon</i> ...	Evans, B. ...	J. Jenkyn, C. Warren, R. Kitson.	M.L.	Hain S.S. Co. ...	Met. Log. 25.1.28 to 5.5.28 ...	11.5.28
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<i>Umvolsi</i> ...	Barnes, E. W. ...	R. Dyns ...	" A.	Bullard King ...	" 20.5.28 to 8.6.28 ...	19.6.28
<i>Valacia</i> ...	Inch, F.	" M.	Cunard ...	" 13.7.28 to 31.7.28 ...	23.8.28
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<i>Vigilant</i> ...	Simpson, E. S. S. ...	J. Hunter ...	" A.	Scottish Fishery Board.	" 17.6.28 to 30.6.28 ...	20.7.28
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November, M.O., 1928.

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