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WIRELESS DIRECTION FINDERS IN MERCHANT SHIPS.

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THE following notes deal with the use of a wireless direction finder fitted on board a merchant ship. They do not deal with wireless direction finders mounted on land for the purpose of informing ships of their bearings from the land station.

A wireless direction finder can be used to take bearings of any ship or coast wireless station which is using its transmitter. Its utility to the seaman as an aid to navigation and for determining the position of other ships is obvious, and these notes have been compiled to show how the powers given by a direction finder can best be utilised.

Bearings obtained by means of ships' direction finders can be made use of by Navigators in just the same way as visual bearings of the same objects. As wireless direction finder bearings are usually taken at distances far greater than that at which visual bearings are possible, certain extra precautions may be necessary, and one of the objects of these notes is to explain these extra precautions and the necessity for them.

Direction finder bearings are usually *needed* when making a land-fall after a prolonged period without sights, or during thick weather when landmarks are obscured. As the effective accuracy of every instrument improves with practice in its use, opportunities should always be taken to obtain bearings by means of the direction finder when the position of the ship is known accurately, and the observed and correct bearings should be compared in order that any error in the direction finder, or on the part of the men who use it, may be discovered and removed.

Fog, rain, mist and falling snow have no effect upon the accuracy of direction finder bearings, though severe electrical disturbances may make its use very difficult. Cases have occurred of direction finder bearings being upset by heavy spray breaking right over the ship and impairing the insulation of the apparatus, but this is not a common cause of trouble and will disappear as soon as the insulation can be restored.

Modern direction finders have reached a high degree of accuracy, and, provided that no accidental damage is caused to the instrument or its fittings, experience shows that the direction finder itself is accurate in about 95 per cent. of the recorded bearings.

When the direction finder is installed it can be corrected to such a pitch that there are no residual errors to apply, but any accidental

alteration of the aerials, or the placing of metal articles or rigging near to them, or accident to the wires connecting the aerials to the instrument, will throw the correction out altogether. (These remarks apply especially to the type of direction finder making use of large fixed aerials.)

We can start with the assumption that barring accidents to the aerial or unauthorised alteration of rigging, the direction finder viewed as a piece of electrical apparatus is an accurate instrument. Its scale is graduated in degrees and, from a purely electrical point of view, the bearings obtained by it will not as a rule differ from accuracy by more than one mark on the scale, that is, by more than one degree.

There remain two points to consider. Firstly, what must be done to the bearings as observed by the direction finder to translate them into a form which is useful for navigation and, secondly, what are the causes external to the ship which are likely to make direction finder bearings unreliable.

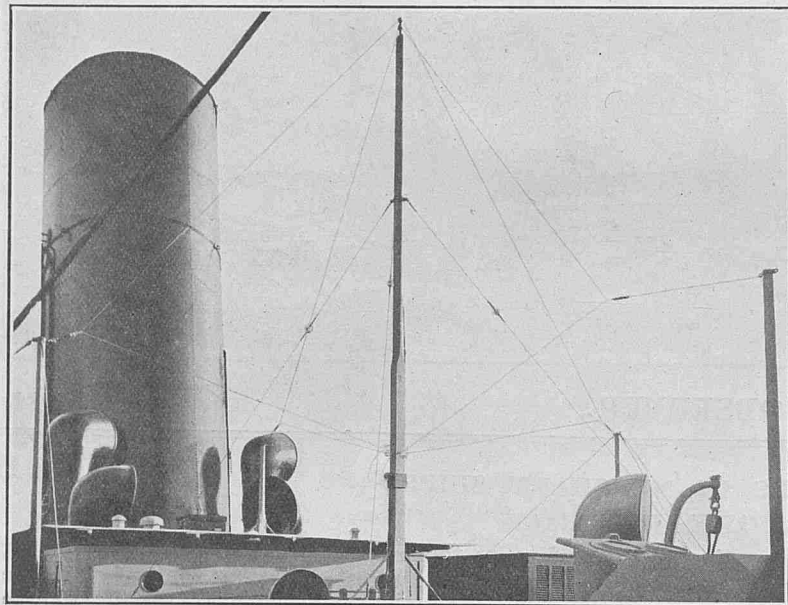
Taking the first of these two, a direction finder can only take bearings relative to the keel line of the vessel; it has no knowledge of North and South. In this respect a direction finder bearing resembles a pelorous bearing, and a single bearing is not of very much use unless the direction of the ship's head is known accurately at the moment when the bearing is taken.

Provided that the direction of the ship's head by compass is noted accurately at the moment when the direction finder bearing is taken, there is no difficulty in translating the relative bearing into a compass bearing. But this is an important proviso, and is not easy to fulfil with a ship yawing in a following sea. However good the system of signals between the wireless observer and the compass may be, there will always remain the natural lag of a magnetic compass, and under such conditions the only way to avoid error is to take several observations in rapid succession and use the mean.

The compass bearing having been arrived at, it should be translated into a true bearing before it is laid off. If this is done the bearing can be laid off backwards *from* the station the bearing of which has been taken. If a magnetic bearing is used it must be laid off from the approximate position of the ship to the station whose bearing has been taken. In most parts of the world there is a noticeable difference in variation between two points, separated by the distance at which

direction finder bearings are usually required, and if the reciprocal of a magnetic bearing as observed on board a ship is laid off from a shore station some 70 miles away the change in variation will in many places introduce an appreciable error. Hence it is best always to work with direction finder bearings which have been translated to true bearings. Each one of a batch of bearings should be translated into a true bearing, any one which comes out much different to the average should be discarded, and the mean of the remainder used for navigational purposes.

It must be remembered that the bearings taken by a wireless direction finder are great circle bearings, which must be translated into rhumb line bearings before they are fit for use on a chart on Mercator's projection. This correction, which is called the "half convergency" correction, is negligible at distances up to 70 miles in all cases and is only worth noticing at distances under 100 miles in latitudes above 50.



S.S. Mooltan. D.F. aerials supported on posts.

In the course of ordinary navigation bearings are not likely to be required at distances over 100 miles, because the fixes obtained in such a way are not very sharp as compared with those obtained by the ordinary methods of navigation, but occasions may arise when information of this nature would be of great assistance, and on such occasions the half convergency correction must be applied.

It is rather laborious to calculate the half convergency, but it has been tabulated for all probable circumstances by Mr. E. JACKSON, and Mr. R. KEEN has produced a most ingenious diagram from which the half convergency correction can be taken out by inspection.

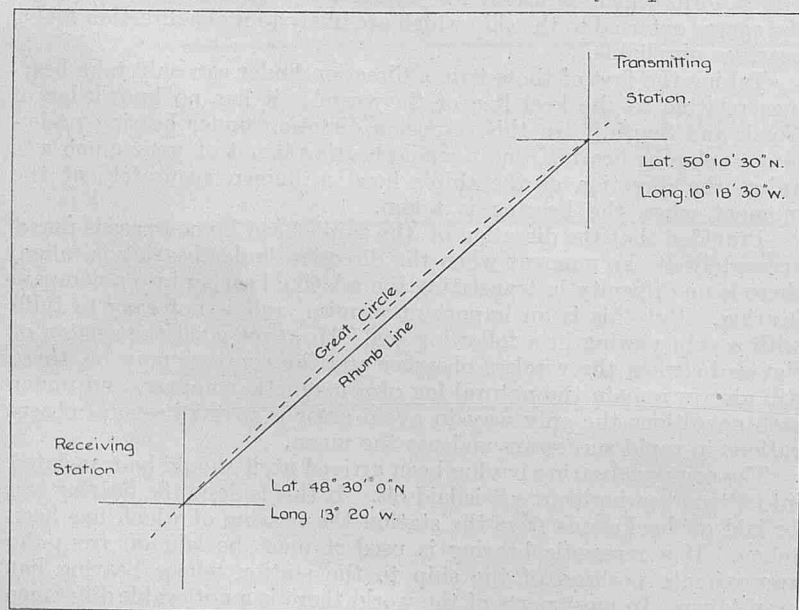


Fig. 1.

In all cases the table or diagram must be entered with the Diff. Long. and Mid. Lat. between the dead reckoning position of the ship and the position of the station whose bearing has been observed. The direction in which to apply the half convergency is most easily ascertained by making a rough diagram purporting to be on Mercator's projection (and therefore showing rhumb lines as straight lines) showing the rough position of the transmitting station and the ship, and the rhumb line joining them. A freehand indication of the great circle should then be dotted in, taking the form of a curve bellying out towards the nearest Pole. This will show at a glance which way the half convergency correction should be applied to translate a rhumb line bearing into a great circle bearing or *vice versa*. If the two positions are one each side of the Equator the half convergency correction can be neglected at any distance at which a wireless direction finder bearing could be useful for navigation.

A glance at the following extract from Mr. JACKSON'S Tables gives an idea of the magnitude of the half convergency correction.

Diff. Longitude in Minutes of Arc.

Mid. Lat.	50	100	150	200	300	400	500
70° ...	0° 24'	0° 45'	1° 10'	1° 35'	2° 21'	3° 5'	4° 0'
60° ...	0° 23'	0° 42'	1° 5'	1° 30'	2° 10'	2° 50'	3° 40'
50° ...	0° 20'	0° 38'	0° 57'	1° 18'	1° 55'	2° 30'	3° 13'
40° ...	0° 16'	0° 32'	0° 48'	1° 6'	1° 36'	2° 8'	2° 42'
30° ...	0° 13'	0° 25'	0° 37'	0° 50'	1° 15'	1° 40'	2° 3'
20° ...	0° 8'	0° 17'	0° 26'	0° 39'	0° 51'	1° 10'	1° 25'
10° ...	0° 4'	0° 9'	0° 13'	0° 17'	0° 26'	0° 35'	0° 43'

It is worth remembering that if two direction-finding stations, say, 200 miles apart, take bearings of one another simultaneously, and if both forget to apply the half convergency error, then there will be a discrepancy between the bearings equal to twice this error.

Turning to the causes of error external to the ship, we find that there are two separate and distinct classes. The first of these is called "night effect" and is caused by a physical distortion of the wave front and which usually takes place during the first half hour after sunset and the first half hour before sunrise. It is sometimes met with at other times during the hours of darkness, but not at all often. The effect is that of a fluctuation of the apparent direction of the signal, (called wandering) and its presence can always be recognised by an expert operator, who would give warning that direction finder bearings were temporarily unreliable. The actual inconvenience caused by "night effect" is very small so long as the signals of which the bearings are being taken are caused by a "spark" transmitter. When more modern methods of transmission are employed "night effect" must be expected during the whole of the hours of darkness. This matter is rather obscure and is now undergoing close investigation. There is no doubt that if modern methods of transmission (continuous wave or interrupted continuous wave) can be made as free from "night effect" as is the case with spark transmission, considerable advantages in other directions can be gained by its use, but if no way can be found of eliminating the severe "night effect" errors which are now experienced, it appears that the older method of transmission should be retained for wireless direction finder purposes in spite of its other disadvantages.

When spark transmitters are in use "night effect" lasts only for a short period and the maximum error so far recorded is 7 degrees, errors of as much as 5 degrees being very rare. There is no means of knowing in which direction "night effect" should be allowed, a long series of observations generally showing that it varies considerably and irregularly both in amount and direction. All that can be done is to avoid the use of direction finder bearings during the half hours immediately after sunset and before sunrise.

The other cause of error is called "land effect," and is due to distortion of the wireless wave which takes place if the line joining the transmitter and receiver cuts a coast line at an acute angle. An abrupt coast line causes worse distortion than a low coast line, and the least safe angle at which the coast line and line of bearing may intersect seems to be something between 15 and 25 degrees.

"Land effect" is always present, day and night, and the only safeguard is to determine by practical trial the lines of bearing from

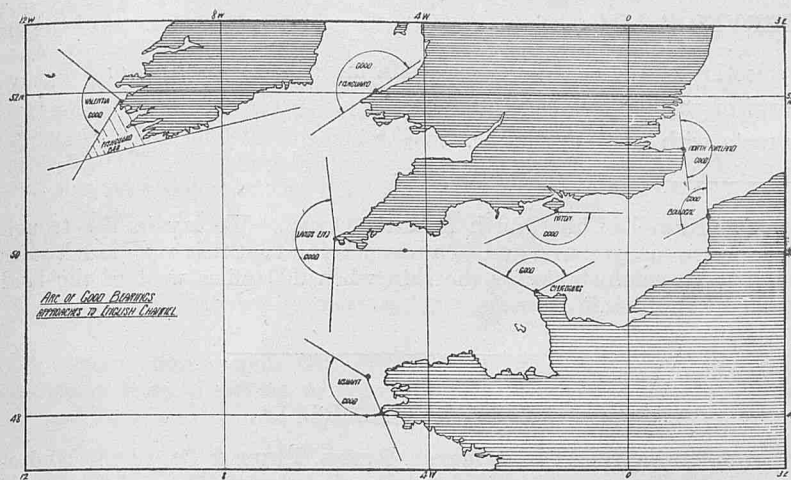


Fig. 2.

each station between which land effect is not present. A very large number of observations are required before "arcs of good bearings" can be delineated even roughly, and for the most important stations, but some headway has been made and the two sketches show roughly the arcs of good bearing of the principal stations in the English Channel and the Gulf of St. Lawrence. Fig. 2 and Fig. 3.

For other stations a careful study of a large scale chart is the only guide.

An examination of this subject shows that there is a sad lack of wireless transmitting stations on land situated in positions which are useful for navigation with the assistance of a marine direction finder. Steps are being taken to erect supplementary wireless transmitting stations specially to act as "beacons" for ships' direction finders. Progress in this direction is slow, but there are now some half dozen such stations on the N.E. coast of the United States. Beacon stations are best situated in Light Vessels, because in this way all chance of "land effect" can be eliminated. The typical Lightship can only carry a very poor aerial, but sufficient knowledge is now available to enable a range sufficient for the purposes of navigation to be obtained under such conditions. There are not many places where all maritime navigational requirements will not be satisfied by a beacon station having a range of 100 miles to a ship's direction finder, and half of this will usually be enough. Indeed, a range of 20 miles may be sufficient for beacon stations which operate over narrow waters. Beacons such as the latter, having only a short effective range, should be arranged to transmit frequently, say, once in five minutes. Once in ten minutes should be often enough for a beacon station having a longer range.

As stated at the beginning of this paper, a direction finder once properly installed can be regarded as an accurate instrument. Like most other instruments it requires a good deal of adjustment after erection before it is fit for use, and it is of advantage for all users of the instrument to know how this adjustment is carried out.

When the apparatus is first brought on board and assembled there are possibilities of several distinct causes of error, and these must be tested for and removed one by one by the installing engineers. All this work can be carried out by means of internal tests. When the installing engineers have completed their work the instrument requires a final test for one remaining error, which can only be detected by actual bearings of distant stations. This process is usually called "calibrating" and is best carried out when the ship is at sea because in most docks or harbours ships are so screened by cranes and dock-sheds, and the presence of "land effect" is so probable, that really accurate results are almost impossible.

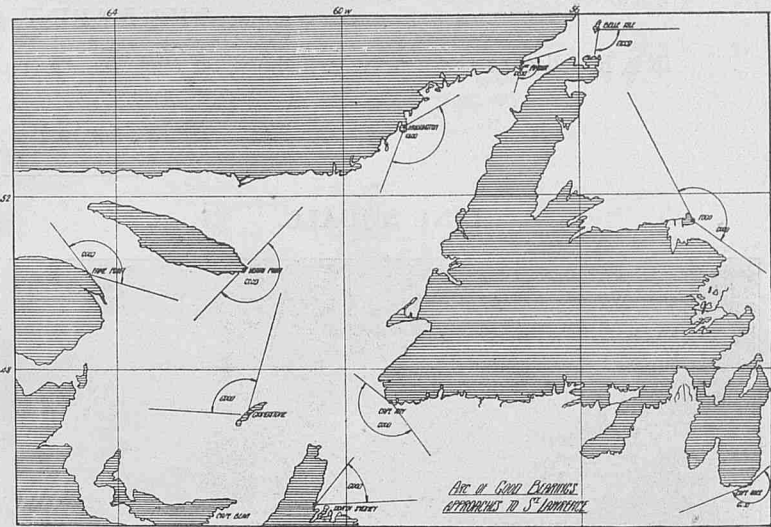


Fig. 3.

If a round of bearings are taken by an uncalibrated direction finder and compared with the correct bearings of the same station, it will be found that a regular quadrantal error exists, rising to its maximum on the bow and quarter bearings, and disappearing right ahead and on the beam. This error can be reduced or entirely eliminated in most direction finders, but in any case whether the error is to be removed or recorded for future application, careful and accurate bearings are required, and these can only be obtained by the hearty co-operation between the navigating staff and the wireless staff. The direction of the ship's head by compass must be observed when each wireless observation is taken, and the correct bearing must also be obtained by independent means. A well-calibrated direction finder should be quite free from all quadrantal error.

The best way to carry out the work of calibration is to arrange for some land station, easily visible from seaward and clear of "land effect," to transmit at regular intervals for one minute in each ten minutes and to steam the ship on a steady course so that the land station is on the bow or on the quarter. In each period of transmission an accurate comparison can be made between the visual and direction finder bearings, and the necessary adjustments can be carried out between transmissions. Three such comparisons ought to be sufficient to reduce the maximum error to very small proportions.

In a well-arranged direction finder the pure quadrantal error will have the same maximum numerical value in each quadrant, and if it is reduced to zero in one quadrant it will disappear all round. Accurate calibration can only be effected when the correct relative bearings are on or very near to the bow or quarter. Having finished with the bow and quarter bearings check observations should be obtained all round, particularly right ahead.

If the installing engineers have done their work well there should be no error except the quadrantal error to remove during calibration and if this is the case correct bearings on either bow or quarter imply accuracy all round, but if any error other than the quadrantal error has been allowed to remain then bearings may be right in one quadrant and wrong in the others. This will be revealed by the check bearings.

Distance—up to 100 miles—makes practically no difference to the accuracy of observation except in the case of exceedingly short distances such as half a mile or less.

As a final test, one comparatively short range bearing *right ahead* should be compared with the visual bearing. If a very strong signal from right ahead, and signals from either bow or quarter give accurate results, there can be nothing wrong with the direction finder.

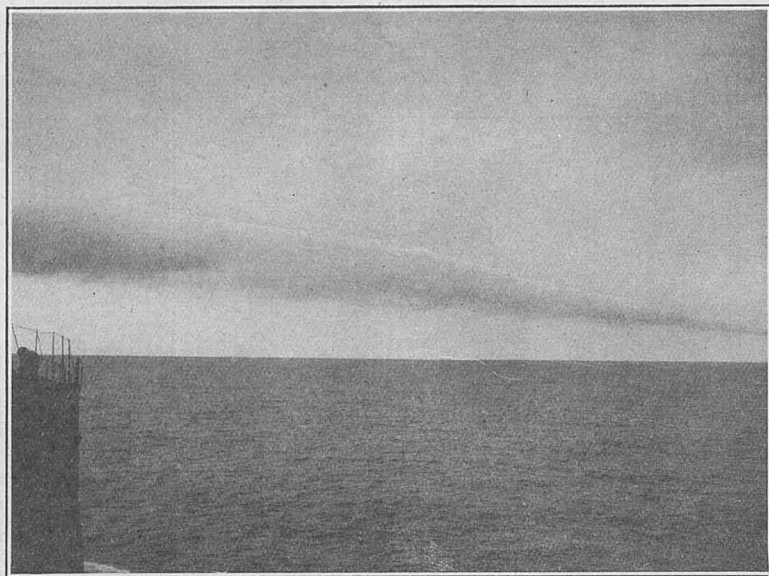
Note.—Plates produced by Lithographic process, including Charts and other large diagrams, will be found in each number after "Weather Signals."

THE MARINE OBSERVERS' 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.

LINE SQUALL.



THE photograph above was contributed by S.S. *Nore*, Captain R. M. M. COLLYER, Observer Mr. L. J. EDWARDS, (London to Port Said), and was taken on May 4th, 1921, at 9.30 a.m. in Latitude $32^{\circ} 33' N.$, Longitude $28^{\circ} 28' E.$

The following notes were made at the time :—

“ 6.00–7.00 a.m.—A—Cu.
S

“ 8.00 a.m.—Barometer 1008.2 (29.77), Wind E. by N.2.

“ 9.30 a.m.—Observed remarkable Cu-Nb cloud forming to the southward which increased slowly in size, shaped like an airship with well-defined edges.

“ 10.00 a.m.—Wind veered to S.W. 3. Cloud passed ahead and dispersed in N.E. without rain.”

SET ON TO THE LAND.

THE following is an extract from a letter received from Mr. W. E. MULLEN, observing officer of S.S. *Huanchaco*, Captain J. H. JENKINS :—

“ On May 17th, 1923, when 18 miles W. by S. of the Evangelistas-Magellan Straits—our Rudder Post fractured in a very heavy gale. We were several days before assistance arrived, and you will fully appreciate our dangerous position. I did not, and could not find opportunity to observe.

“ We were three days without observations and were desirous of meeting m/v *La Paz*, who was to tow us into a port of refuge; in estimating the *Huanchaco*'s position we allowed for a S.E. set—1 mile per hour. *La Paz* had stellar observations at 6 p.m. and informed us of it; at 7.30 p.m. we observed her and found our estimated position only 3 miles in error. This coupled with subsequent observations, proves the existence of the dangerous set on to the land, and that the cautionary note on the Charts in Sailing Directions cannot be over emphasized.

“ In our struggle to get to the Westward, steering with sails (and jury rig when it was possible), I noticed a great difference in the height and conduct of the mountainous sea then running. When we were under about 80 miles off the land, the sea was very dangerous and somewhat confused by what I believe to have been the back throw from the shore, which is steep to and iron bound for hundreds of miles. Outside of 80 miles the sea was more true and like unto our westerly

sea and swell of the North Atlantic Ocean. We lay in the trough of the sea many times, and I can assure you that it is very much safer and more comfortable for the ship when 200 miles west of the land than at 20 miles.”

LIFE BUOY DRIFTS.

THE following report from Messrs. BURNS, PHILP & Co. to the Hydrographical Department, Department of Defence, Commonwealth of Australia, has been forwarded by the Hydrographer of the Navy :—

“ Two life-buoys were brought in to Port Moresby by the *Elevara* from Daru, and we have a letter from the Resident Magistrate, Daru, advising that the life-buoys were washed up at Turi Turi Village on the 15th May and 4th June. Turi Turi Village is about 10 miles West of Daru, and Mr. LEONARD MURRAY, the Official Secretary, in speaking of the matter mentions that an interesting feature of the life-buoys being found at Turi Turi, is that up to the time of their being discovered, no South-east weather had been experienced, calms and North West winds prevailing. Mr. MURRAY also informs us that another life-buoy was picked up in the vicinity of Cape York Peninsula.”

These life-buoys belonged to the S.S. *Mindini*, which was wrecked on Mellish Reef on the 8th March, 1923.

The position of Mellish Reef is Latitude $17^{\circ} 25' S.$ Longitude $155^{\circ} 52' E.$, and of Turi Turi, is Latitude $9^{\circ} 07' S.$, Longitude $143^{\circ} 02' E.$

The drift of the lifebuoys was, therefore, N. $56^{\circ} W.$ for a distance of 899 miles, the first life-buoy travelling at the rate of not less than 13.2 miles per day and the second at the rate of not less than 10.2 miles per day.

ANTI-SOLAR RAYS.

THE following notes have been received from Captain G. PARK, S.S. *Bahadur*, coasting, Calcutta to Bombay :—

“ 11th May, 1923.— $18^{\circ} 50' N.$, $85^{\circ} 25' E.$ Counter-glow to the East with faint streamers; one streamer strengthened and slowly extended to meet its companion streamer from the West to form a complete and distinct arc of 15° at South.

“ 14th May, 1923.—Cocanada Roads. Sun setting behind Nb. approximately 20° in height, sky covered with Ci. or Ci.haze. 15 minutes before actual sunset counter-glow commenced and strengthened to throw out streamers steady and uniform in all directions from eastward. The sun set a dull red and sent out its glow and streamers over Nb. to meet the streamers from the easterly glow until the whole sky appeared to be full of streamers.

“ If I call the colour of the sky light grey and the streamers of the same colour then the streamers were interspaced by light blue.

“ The streamers did not actually meet on the horizon owing to a dark area of approx. 7° , but by following the definite lines of the streamers the centre point was certainly on or near the horizon and not below.

“ 16th May, 1923.— $15^{\circ} 15' N.$, $82^{\circ} 05' E.$ Counter-glow to eastward with faint streamers, after sunset. The counter-glow developed before the westerly glow but not so clear.

“ 19th May, 1923.—Cuddalore Roads. Sun setting behind Cu-Nb. where there was lightning display. Cu-Nb. slowly rising and showing a fringe of variable soft colours in rolls and not rainbow lines. Pink predominated.

“ 6.10 p.m., counter-glow with streamers, 6.15 p.m., westerly glow, 6.18 A.T.S. sunset, 6.30 p.m. wind S. by E. 4. Cu-Nb. $\frac{WNW}{3}$
Bar. 29.75, 84° , 85° , 7 p.m. wind S.W. 4.

"7.20 p.m. wind WNW 5, air full of dust to obscure Cuddalore Lt. distant 4'.

"21st May, 1923.—Sun set behind Cu.-Nb. Position $10^{\circ} 35' N.$ $80^{\circ} 15' E.$ Distinct counter-glow commenced 5 minutes before sunset with streamers 2° above horizon towards the setting sun. Counter-glow appeared earlier and lasted longer than west glow. Streamers passed behind St.-Cu. and appeared lost when touching A.-Cu. Perhaps this was on account of the light and shade.

"22nd May, 1923.—Position $8^{\circ} 05' N., 81^{\circ} 48' E.$ Sun setting behind Cu.-Nb. Patch of Ci.-St. and Ci.-Cu above Cu.-Nb. otherwise sky blue and clear. Cu.-Nb fringed with various soft colours. Shades of green predominated. These colours seemed to be reflected on to the Ci.-St.

"6 p.m. counter-glow with streamers showing faintly. 6.15 p.m., streamers from the West, or sun came out strongly as definite black or dark lines and continued to the east horizon.

"The Ci.-St. and Ci.-Cu were white, and the streamers passing below dulled these clouds but not to obscure them. Sunset 6.12 A.T.S."

The observations of anti-solar rays given by Captain PARK are most interesting. The area over which the phenomenon was seen as well as the frequency of its appearance (six times in twelve days) show that the cause to which it was due was neither local nor passing.

The effect is due to sun rays shining on dust at a considerable height in the atmosphere. The blue of the sky is caused by the scattering of light by air molecules and by minute dust particles for the blue rays of light being shorter are scattered more completely than the longer red rays. When the sun is low the blue rays of the sunlight are scattered away from the observer and only the longer red rays reach him, hence the colour of the sunset. Larger dust particles are illuminated by the sun's rays and will make the sky appear whiter and brighter. If the sun's rays shine on these larger dust particles through a gap in the clouds they will illuminate those in their path and there will appear to the eye a beam of light with sharply defined edges. It is in this way that the phenomenon described as "the sun drawing water" is formed, only the beams then are made visible by the light falling on water drops rather than dust.

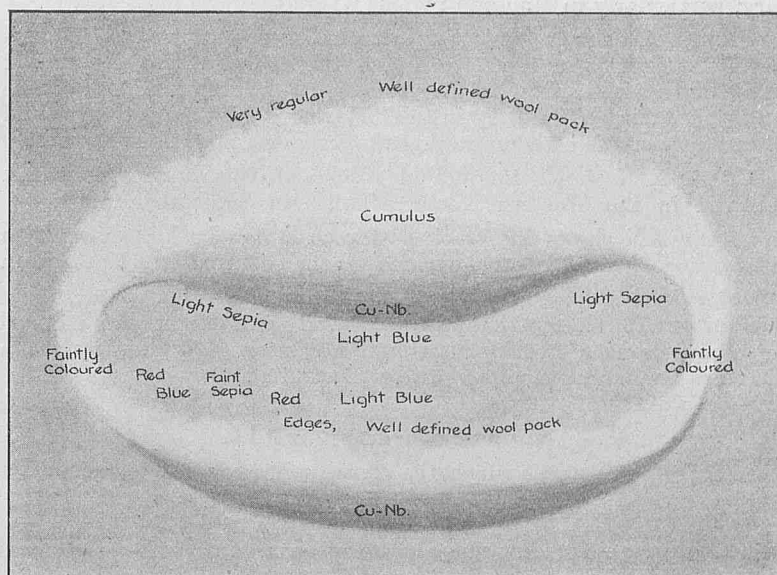
Now, if there happens to be a vast number of these larger dust particles in the atmosphere and Cumulus or Nimbus clouds near the western horizon at sunset, there will be visible a number of parallel beams of light stretching across the sky interspersed with dark strips where the cloud shadows fall.

The apparent convergence of these beams towards the sun in the West, and to an opposite point in the East, is due to perspective in the same way that straight railway lines appear to converge.

The atmospheric conditions during the early part of May 1923 had given rise to a fairly steady north-westerly wind over the Indian Peninsula and it seems probable that this wind was carrying a large amount of dust from India out over the Bay of Bengal not only at the surface, as is mentioned by Captain PARK at 7.20 p.m. on the 19th, but also at higher altitudes.

The colours reported by Captain PARK certainly confirm the supposition that the air was heavily dust laden. The dull red of the sun is familiar to those acquainted with the sandstorms of the Red Sea. The light grey of the illuminated sky, the light blue of the part shadowed by cloud would imply there was a certain amount of light reflected as white by larger dust particles instead of being dispersed as blue by the usual small dust.

TWO LINE-SQUALLS.



THE following is an extract from the Meteorological Log of S.S. *Elpenor*, Captain T. R. EVANS, Observer, Mr. L. JOHNSTON, 3rd officer, Liverpool to China:—

"May 13th, 1923.—11.26 a.m. (Latitude $28^{\circ} 46' N.$, Longitude $122^{\circ} 26' E.$), Heishan Island, N. $70^{\circ} W.$ 10 miles. 11 a.m. A line-squall appeared on the N.W. horizon and at 11.26 a.m. passed over vessel travelling at considerable velocity. The edges of Cumulus being very regular and well defined, a second squall was observed to be joined to the first by a very narrow band at the extreme east and west points of the squall. A remarkable feature was the colouring of the clouds, a light coloured sepia being the most prominent and common, but light shade of green, blue and red were also observed. The second squall passed over the vessel a few minutes after the first when the wind backed for a few minutes to N.W., force 3. No rain fell and the barometer remained steady at 1019.0 mb. Attached thermometer $297^{\circ} a.$ "

WIRELESS AND WEATHER—AN AID TO NAVIGATION.

CHAPTER VI.

TROPICAL REVOLVING STORMS.

OF all the uses to which wireless communication may be put by the navigator as regards weather, there is probably none in which it has greater value than in these storms.

The Tropical Revolving Storm is more nearly a perfect vortex than any other cyclone, being of a more compact, intense form; and at sea experience in these storms has taught us more of the Laws of Storms than any other experience.

It will, therefore, be well to briefly summarise these laws and with them the rules which have stood us in such good stead for handling ships.

A Tropical Revolving Storm may be described as an intense whirl in the atmosphere, in which there is usually a calm centre, sometimes called by seamen the vortex; round this region of calm there is a belt of winds of hurricane force beyond which the wind blows in a direction round, but towards, the centre. In the Northern Hemisphere the air circulates in the opposite direction to the hands of a watch; in the Southern Hemisphere the air circulates in the same direction as the hands of a watch.

The area covered by a Tropical Revolving Storm may vary in diameter from 20 miles to some hundreds of miles; the wind in the

same part of a storm may vary considerably, at times being hurricane force, at others lulling into little more than a strong breeze. As well as this circular motion, Tropical Revolving Storms have a forward or progressive motion. They frequently originate near the Equator but seldom within 6° of it. At first moving westward with gradually increasing speed, they often travel round the western edge of the great ocean anti-cyclones, recurving near the tropics when their progressive speed is reduced. Thence they travel north-east or south-east, according to hemisphere, and eastward, increasing speed, spreading, and dying out in middle or high latitudes, or they may coalesce with other weather systems of middle or high latitudes. Their tracks often vary, particularly in Monsoon regions where they are most erratic.

FIGURE 12 shows conjectural tracks of the centre of Tropical Revolving Storms in Northern and Southern latitudes. Generalized tracks of Tropical Revolving Storms which have occurred in all oceans are being published monthly in the "Marine Observer"; they should be carefully studied when entering those regions in cyclone seasons.

CHART XIX shows the actual tracks of two hurricanes which occurred in the Western North Atlantic in September, 1921.

CHART XX shows the track as far as it can be laid down with observations available of a cyclone which occurred in the Arabian Sea in November, 1920.

FIGURE 13 shows the average wind circulation in Tropical Revolving Storms in Northern and Southern latitudes, by which the rules for handling ships may be illustrated.

Nomenclature, Figure 13.

Path : the path along which the centre will probably travel.

Track : the track along which the centre has travelled.

Right Semi-circle : looking along the path, that half of the storm which lies to the right.

Left Semi-circle : looking along the path, that half of the storm which lies to the left.

Trough : the line of lowest barometer athwart the path.

Dangerous Quadrant : the advance quadrant of that semi-circle which lies on the side of the path nearest to the normal direction of recurvature, so named because a ship caught in the dangerous quadrant may be blown towards the path over which the ring of hurricane winds and the centre will pass, or the storm may recurve and pass over her. It should be noted that the strongest winds are usually found in rear of the trough, hence it often blows hardest with the first rise of the barometer.

Navigable Semi-circle : that semi-circle which lies on the side of the path furthest from the normal direction of recurvature.

Centre : at the centre of the storm the barometer is always lowest and there is comparative calm; here the sea is extremely dangerous, running in all directions, and has been described as a "boiling pot."

When the centre approaches a ship she may experience increasing wind with violent squalls, later hurricane force, with mountainous seas; as the centre passes over her the wind drops; when it has passed the wind may come from the opposite point of the compass with renewed and increased violence; as the storm recedes from the position of the ship the wind moderates; this is illustrated by A, A1, A2, etc., shown in the FIGURE. Much rain, thunder and lightning may be experienced. There is often a patch of blue sky over the centre, known as the *Bull's Eye*.

Vertex : the most Westerly point reached by the centre when recurvature takes place. Also known as the *Cod* of the Track.

Angle of Indraft : the angle which the direction of the wind makes with an isobar.

Thus in North Latitude, if near the centre the wind blows along an isobar and the centre bears 8 points to the right when facing the wind, there is said to be no indraft, or if the wind blows at an angle of 2 points to an isobar, and the centre bears 10 points to the right of an observer facing the wind, the indraft is said to be 2 points. It must, however, be remembered that isobars in these storms are not always circular and therefore the angle of indraft may not conform to the angle of the bearing of the centre, minus 8 points.

Tropical Revolving Storms are known as Cyclones in the Indian Ocean, Hurricanes in the West Indies and South Pacific, and Typhoons in the China Seas.

Seasons.

Hurricanes of the West Indies : June to November, September being the month of greatest frequency.

Hurricanes of the North Pacific and Typhoons of the China Seas : All months of the year, July to October being the months of greatest frequency.

Hurricanes of the South Pacific : November to April, months of greatest frequency January to March.

Cyclones of the Arabian Sea : April to January, months of greatest frequency June, October and November; storms seldom occur in the month of August.

Cyclones of the Bay of Bengal : April to December, September being the month of greatest frequency.

Cyclones of the South Indian Ocean : October to July, months of greatest frequency December to April.

Precursory Signs.

Swell. The action of the violent winds in the right hand rear quadrant of revolving storms in Northern latitudes, or in the left hand rear quadrant in Southern latitudes, blowing mainly in the direction of advance of the system, develops large waves which pass onward as swell. This swell travels to great distances and at a greater speed than the storm. Thus swell frequently gives the first warning of an approaching revolving storm.

CHART XX shows the track of a cyclone which occurred in the Arabian Sea between November 20th and 28th, 1920. On November 20th, at 8 p.m., S.S. *Brodholme*, from Suez to Sabang was in latitude 13° 16' N., longitude 53° 10' E.; the wind was N.N.E., a fresh breeze, weather fine, barometer 1015.6 (29.99 ins.). The only indication of the existence of a disturbance was a heavy easterly swell. At that time the centre was distant about 550 miles to the eastward.

CHART XIX. shows the tracks of two hurricanes which occurred at the same time in the Atlantic in September, 1921. On September 9th, 1921, at 8 a.m., S.S. *Carmarthenshire*, Captain E. C. WAKEMAN, from Hull to Galveston, was in Latitude 29° 01' N., Longitude 63° 23' W. The barometer was normal for the time of year and conformed to the diurnal range, wind S.S.E. a gentle breeze, with a moderate S.E. swell. By 10 p.m., in Latitude 28° 14' N., Longitude 66° 52' W., the swell had become heavy from the Southward and the barometer had fallen slightly, with the wind a gentle South Easterly breeze. At this time a hurricane was centred some 900 miles to the Southward of *Carmarthenshire* in the Caribbean Sea, of which she had received information by wireless. Had the period and length of the swell been taken it would have been shown by the table on page 65 that even if the swell could clear the Islands it could not have reached *Carmarthenshire* in the time from No. II. Hurricane.

The swell indicated the presence of No. I. Hurricane, the centre of which was distant within 100 miles to the Southward at 10 p.m. on September 9th. She passed ahead of No. I. Hurricane, experiencing its wind circulation with force 5 at most. This swell was undoubtedly caused by the Southerly winds in the right rear quadrant of No. I. Hurricane.

The following example is useful in that it shows that observations recorded indicate that there may be exceptions to the rule.

In April, 1922, a number of steamers were in a cyclone in the Arabian Sea in which the wind reached hurricane force near the centre. For the first four days of its known existence, April 18th to 22nd, it moved little.

On April 22nd it was centred in approximately Latitude 10° N., Longitude 69° E.; whence it travelled N.N.W. at not more than 100 miles per day.

R.M.S. *Macedonia*, Captain A. F. VINE, from Bombay to Aden, steamed across the front of this cyclone on April 23rd, its centre then distant some 400 miles to the Southward and Eastward of her track. The winds logged never exceeded force 3 though their direction conformed to the circulation of this cyclone.

There appears to have been no unusual swell at this distance, as the report stated "No indications whatever of the proximity of a cyclone except low barometer."

Table for finding Velocity of Waves Transmission.

Wavelength in Deep Sea.		Velocity of Transmission of Individual Waves in Deep Sea.		Velocity of Transmission of the Disturbance or Group in Deep Sea.	
Feet.	Seconds.	Feet per Second.	Nautical Miles per Hour.	Feet per Second.	Nautical Miles per Hour.
25	2.2	11.3	6.7	5.7	3.4
50	3.1	16.0	9.5	8.0	4.8
75	3.8	19.6	11.6	9.8	5.8
100	4.4	22.6	13.4	11.3	6.7
150	5.4	27.7	16.4	13.9	8.2
200	6.3	32.0	19.0	16.0	9.5
300	7.7	39.2	23.2	19.6	11.6
400	8.9	45.2	26.8	22.6	13.4
500	9.9	50.6	30.0	25.3	15.0
600	10.9	55.4	32.8	27.7	16.4
700	11.8	59.8	35.4	29.9	17.7
800	12.6	63.8	37.8	31.9	18.9
900	13.3	67.7	40.1	33.9	20.1
1,000	14.1	71.4	42.3	35.7	21.2

Cirrus clouds originating over the vortex extend to great distances. When cirrus is observed forming a V the point of convergence may indicate the direction of a storm from the observer.

At 8 a.m. on September 9th, 1922, the Motor Ship *La Paz*, Captain C. H. CHRISTIAN, from Colon to London, when in Latitude 20° 00' N., Longitude 64° 45' W., logged Cirrus from S.S.E., at this time No. II. Hurricane, CHART XIX., was centred 400 miles S.S.E. of *La Paz*.

Sky Colouring. Tropical Revolving Storms are often heralded by remarkable sky colouring, the heavens being red or copper colour at sunset and sunrise.

On June 9th, 1920, S.S. *Rotenfels*, Captain A. TAYLOR, O.B.E., from Basra to Bombay, encountered a cyclone in the Northern part of the Arabian Sea.

The sunset of June 8th was described by Captain TAYLOR as follows:—

"Sun when 10° above horizon became obscured by heavy dull coppery coloured bank—emerged just above horizon a dull brick red and much distorted, then dipped quite clear.

"To the North, low detached inky scud travelling slowly from N.E., heavy Cumulus clouds on horizon to the Eastward. In zenith streaks of rippled Cirro-Cumulus just tinted copper colour. Above bank obscuring sun, patches of bright peacock blue.

"Western sky gorgeously coloured by huge bank of bright coppery red cloud. Eastern horizon, dull grey banks of Cumulus."

The Barometer. Apart from the fall of the barometer at any place over which a tropical cyclone passes there are precursory signs which are of very great importance.

According to Mr. J. ELIOT, for many years Director General of Observatories in India:—

"In the Bay of Bengal. If the reduced barometer reading is, at any time during the cyclone season, a tenth of an inch below the normal for the time of day, the possibilities are two to one that a cyclonic storm has formed in the Bay; if the decrease below normal is 0.15 inch the probabilities are at least three to one, and if two thirds below it is practically certain that a cyclonic storm has formed."

It must be remembered that the barometer frequently stands above the normal on the outskirts of a storm in formation.

In order to find out how frequent, variation from the normal pressure was in regions of tropical revolving storms, an examination was made in the Marine Division in 1922 of barometer readings recorded four-hourly in May, between Latitude 10° N. and 12° N., and Longitude 60° E. and 70° E. in the Arabian Sea during 1857 to 1905, a region where many cyclones have occurred.

In that region a decrease of pressure of 3 mb. ($\frac{1}{10}$ inch) below normal is infrequent, amounting to 6 per cent. of observations in 48 years. While searching the logs it was found that a number of ships had recorded barometer 3 mb. below normal and that cyclones had occurred later in the vicinity.

The following table, compiled from a great number of observations, taken between the Equator and Latitude 5° N. in the Atlantic made under Captain TOYNBEE'S supervision by Mr. CHARLES HARDING,

may be used with sufficient accuracy for the purpose of mariners throughout the Tropics.

In tropical cyclone regions the barometer reading having been corrected for index error and reduced to the datum laid down in CHAPTER II., the correction given in the table below for diurnal range should be applied.

This corrected reading should then be compared with the normal for the place, indicated by the normal isobars given upon the Meteorological Ocean Chart for the month. If there is a departure from that normal of 3 mb. ($\frac{1}{10}$ inch) or more the mariner may expect that there may be a cyclone forming or formed at no great distance and should be on the alert for other signs.

Table to Correct Barometer pressure for diurnal variation within the Tropics.

Ship's Time.	Northern Spring.	Northern Summer.	Northern Autumn.	Northern Winter.
	mb. inches.	mb. inches.	mb. inches.	mb. inches.
4 a.m. ...	+ 1.0 .03	+ 0.8 .02	+ 0.8 .02	+ 1.0 .03
8 a.m. ...	+ 1.0 .03	+ 0.7 .02	+ 0.8 .02	+ 1.0 .03
Noon ...	+ 0.3 .01	+ 0.5 .02	+ 0.3 .01	+ 0.2 .01
4 p.m. ...	+ 1.3 .04	+ 1.2 .04	+ 1.2 .04	+ 1.3 .04
8 p.m. ...	+ 0.5 .02	+ 0.3 .01	+ 0.5 .02	+ 0.6 .02
Midnight ...	+ 0.4 .01	+ 0.5 .02	+ 0.5 .02	+ 0.5 .02

We have been taught for many years in order to pass the Board of Trade examination for Master and Mate that "a cessation of the diurnal range may foretell a tropical revolving storm."

Now the diurnal range of the barometer is due to atmospheric pressure waves which sweep regularly round the earth from east to west, being at a maximum in the Tropics where they are clearly indicated by the rise and fall of the barometer. That they cease when there are violent atmospheric disturbances is not proved by observation, for if hourly barometer readings are plotted and a curve drawn through them, it would be found that the diurnal range continues right into a cyclone, though when the gradient is steep or the storm is passing quickly over the place of observation this range is masked by the rapid fall of the mercury.

The 4-hourly barometer readings taken on board S.S. *Miami*, Captain MAXWELL BROWN, in a West Indian hurricane in September, 1922, which have been plotted with observations of wind, weather swell, position, course and speed upon FIGURE 14, on which the normal pressure is also shown, afford an example of the continuance of the diurnal range near, and in a Tropical Revolving Storm. Her aneroid was found by subsequent comparisons not to be sufficiently constant for determining the departure from the normal.

Rules for Handling Ships.

Young officers will do well to reproduce the storm cards given in FIGURE 13 on tracing paper, as it is most necessary to thoroughly understand why the wind veers, backs, or retains one direction for a time in a cyclonic storm when a ship is hove to and nearly stationary, or when she is proceeding at speed.

In the Northern hemisphere let *B* be the position of a ship hove to; if this is indicated by a dark spot on a sheet of white paper, and the transparent card drawn across it from right to left representing a revolving storm moving west, the shifts of wind will conform to the arrows at *B. 1* and *B. 2*, that is, the wind **veers***.

Replace the spot at *B. 2* by a small piece of lead attached to the end of a piece of twine, with the left hand draw the lead to the left, at the same time moving the storm card over the lead in the same direction, but slower than the lead; it will be noted that the wind will **back**.* This represents a ship sailing or steaming in the same direction

* The terms Veer and Back are used in accordance with those laid down by the International Meteorological Conference for both Hemispheres.

i.e., *Veering*. West to North to East to South.

Backing. West to South to East to North.

Formerly at sea we used these terms in the sense that the wind *veered* when the shifts were with the sun and that it *backed* when the shifts were against the sun.

Thus shifts from East to West through South in the Northern hemisphere were termed *veering*, while in the Southern hemisphere they were termed *backing*.

The old terms should not be used for they will only cause confusion, since International Agreement has been obtained.

but faster than the storm. The exercise may be carried out to represent every conceivable example and will be far more useful than learning any rules by heart.

Similarly, if values be assigned to the isobars represented by the circles on the card, the behaviour of the barometer in a cyclonic storm retaining the same gradients may be understood.

Having mastered this it will be a simple matter to grasp the following rules which were laid down for sailing ships. When there is reason to believe that a revolving storm is approaching, it is necessary to know, first, the bearing of the vortex, and second, which semi-circle the ship is in.

In order to ascertain these it is necessary for a single observer to be stationary. Therefore, **heave to**, assuming that you are in the dangerous quadrant.

In North Latitude heave to on the Starboard Tack. In South Latitude heave to on the Port Tack.

Derived from average indraft and Buys Ballot's Law, the following rule for finding the bearing of the centre is laid down in the Barometer Manual.

"Face the wind and the centre will bear 12 points to the right in the Northern hemisphere at the commencement of the storm; when the barometer has fallen 10 mb. ($\frac{3}{10}$ inch), 10 points to the right; and when the barometer has fallen 20 mb. ($\frac{6}{10}$ inch) or more, 8 points to the right.

"In the Southern hemisphere, facing the wind, the centre bears 12 points to the left at the commencement of the storm; when the barometer has fallen 10 mb. ($\frac{3}{10}$ inch), 10 points to the left; and when the barometer has fallen 20 mb. ($\frac{6}{10}$ inch) or more, 8 points to the left."

There are known to be variations from this rule, for instance, Dr. MELDRUM found from a great many observations in the South Indian Ocean, that north-easterly, and easterly winds often blow almost directly towards the centre in the region of Mauritius.

Individual examples cannot be taken for establishing rules, but examples are useful in that if they do not prove the amount of indraft on their occasions they illustrate the need for caution in accepting the rule, and the need for carefully recorded observations of wind direction, position and barometer, also time, for the purpose of establishing rules by averages.

At 5.20 p.m. on February 13th, 1904, a steamer was in the centre of a cyclone in the South Indian Ocean. R.M.S. *Orontes*, Captain J. F. RUTHVEN, at this time was 75 miles distant, bearing N.W. $\frac{1}{4}$ N. and logged wind N.W. by W., her barometer having fallen 12 mb. since she entered the outskirts of the storm. The dead reckoning positions of both ships were carefully checked, working both backward and forward from celestial fixes, and have been plotted in FIGURE 15, which shows the number of points the centre lay to the left of the direction facing the wind, also the theoretical bearing by Rule.

Another example has been given in CHAPTER IV. with special reference to time.

In the Northern Hemisphere. Having hove to on the starboard tack if the wind veers, the ship is in the right semi-circle; remain hove to, as the wind shifts she will come up and head the sea.

If the wind remains steady in direction and increasing in force with falling barometer, the ship is near, or on the path, run with the wind on the starboard quarter; this will take the ship into the left or navigable semi-circle. If the wind backs, the ship is in the left semi-circle, run with the wind on the starboard quarter until the barometer rises.

In the Southern Hemisphere. Having hove to on the port tack, if the wind backs the ship is in the left semi-circle, remain hove to, as the wind shifts she will come up and head the sea.

If the wind remains steady in direction and increasing in force with falling barometer, the ship is near or on the path, run with the wind on the port quarter; this will take the ship into the right or navigable semi-circle.

In the South Indian Ocean on the southern side of a cyclone there is a strong S.E. wind. It is therefore difficult to tell when the S.E. Trade forms part of a cyclone.

In the South Indian Ocean if the S.E. Trade increases to a gale it is wise to heave to and watch the barometer. If the wind shifts to the south or east the passage of the centre with respect to the ship may be inferred.

If the wind shifts from S.E. towards south, run with the wind on the port quarter in a direction northward of west.

If the wind remains steady and increases in force and the barometer falls, it is probable that the ship is on the path of the storm, a most dangerous position. In such case when the barometer has fallen 20 mb. ($\frac{6}{10}$ inch) the bearing of the centre may be nearly 8 points from the wind direction and it is best to run to the northward of west keeping the wind well out on the port quarter.

By running to the North Westward with a South Easterly wind before the barometer has fallen 20 mb. you may be heading direct for the centre because in these cyclones South Easterly winds, except close to the centre, have a great indraft. An examination of FIG. 16, which gives, according to MELDRUM, flow lines of wind which are mainly conjectural but are supported by observation, will make the reasons for the rules for the South Indian Ocean clear.

The following example in the writer's own experience may serve further as an illustration.

"The Barque *Peri*, Captain F. FISHER, from Fremantle to London, via the Cape, had a light S.E. trade at noon on May 31st, 1898, in Latitude 17° 59' S., Longitude 77° 53' E. At 2 p.m. the trade, steady in direction, freshened considerably and royals and light staysails were furled, by 2.30 p.m. the wind increased to a moderate gale, force 7, all hands were called and sail was shortened to lower topsails and fore topmast staysail.

"In the first dog watch the wind steady from S.E. had increased somewhat, and the weather looked dirty, the fore topsail and fore topmast staysail were stowed and the ship hove to on the port tack.

"At about four bells in the first dog watch the wind moderated a little but soon increased to a strong gale, veered a little and there were frequent showers. During the second dog watch the wind was from S.E. by S., force 9, squally with rain. At about eight bells the fore lower topsail and fore topmast staysail were set, the yards squared in, and the ship kept away with the wind on the port quarter, steering W.N.W. The foresail reefed and upper topsails were next set, but when an attempt was made to sheet home the main topgallant sail, it blew to ribbons.

"During the first watch the wind veered. By midnight a whole gale was blowing with heavy squalls and high sea and the wind had veered to S.S.W. From midnight the wind moderated and the weather improved.

"On June 2nd, 1898, at noon in Latitude 19° 13' S., Longitude 72° 39' E., we had a moderate trade wind with passing showers. That day we spoke the Ship *Aristomene* from Chittagong to Dundee, and she reported having lost a complete suit of sails and sustained other damage on May 31st in Latitude 16° S., Longitude 80° E., and that she was putting in to Mauritius for repairs."

Years afterwards, in examining the records of the Alfred Observatory, Mauritius, the following entry was found.

"Ship *Aristomene*, May 30th to 31st, 1898, Latitude 16° 42' S., Longitude 79° 07' E., to Latitude 17° 08' S., Longitude 77° 17' E., wind force 11. Variable from S.E., sudden shift to S.S.W. and S.W., terrific squalls with high dangerous sea."

Now, at noon on May 31st, *Peri* was S.E. by S. 62 miles from *Aristomene*: later the ships were probably nearer together. From the fact that *Aristomene* had a sudden shift of wind from S.E. to S.S.W. it may be inferred that she was in the right semi-circle at that time.

Her course for rounding the Cape was E.S.E., and it seems likely that this cyclone had recurved and was travelling in a South Easterly direction.

By heaving to with a strong South Easterly wind and waiting until the barometer had fallen, Captain FISHER was able to obtain a more reliable bearing of the centre and also to establish that he was near the path of the storm. By running to the Northward of West with the wind on the port quarter he avoided the centre and the strongest winds and heaviest seas, and made a fair wind of it.

The foregoing rules were laid down for sailing ships based upon much experience and the result of many researches. This experience was probably the most valuable contribution which is ever likely to be made to Marine Meteorology, for it embodied examples whereby it was first found that the wind circulated round a calm centre. There were cases where ships scudding before the wind made several complete circles. Probably the most notorious cases being those of the Brig *Charles Heddle* in February 1845, and the Ship *Earl Dalhousie* in May 1863, in the South Indian Ocean.

These rules are of great value to steamers. With wireless telegraphy it may often happen that by obtaining reports from ships in the

vicinity of a Tropical Revolving Storm, Commanders may be in a position to avoid them altogether.

However, there may not be reporting ships in the wind circulation of a Tropical Revolving Storm, from whose observations the centre may be fixed, and direction of movement determined; while pressure of circumstances or absence of sea room may render such a course often impossible.

Warnings by wireless telegraphy giving the position and probable movement of storms are made by many Weather Offices, but it should always be remembered that these can only be reliable, if reliable information from the vicinity of the storm is available at the Weather Office. Hence the need for reports to the shore.

Once a ship enters the wind circulation of a storm her commander will be best guided by his own observations, and reports from other ships in the vicinity, and the following example is useful to illustrate a simple way of charting such observations.

Simple method of finding approximate position and movement of Centre. Compiled from observations reported on the outskirts of a Cyclone.

On June 9th, 1920, a steamer "A" in the Arabian Sea, bound E.S.E., near the Tropic of Cancer, observes precursory signs of a cyclone, she immediately takes observations and broadcasts a report addressed to all ships commencing "Urgent," and framed in the manner recommended in Weather Signals, but ends the message by adding: "Please reciprocate observations at 1500 G.M.T. and 1900 G.M.T." This gives sufficient time for acknowledgments, and if necessary, times can be arranged for transmission of the 1500 G.M.T. and 1900 G.M.T. observation reports.

CHART XXI.—"A" plots her own position and 1500 G.M.T. observations in the usual way.

"B" and "C" observations are plotted similarly when received, and bearings are laid off on the chart in accordance with the rule, and the approximate position of the centre of the cyclone is roughly located by the mean taken between the intersections of these bearings. This is carried out in all ships intercepting the reports. "A" should heave to, but she does not. "B" continues on her course W.N.W. at speed.

"C" has left port that day and had information that the cyclone is travelling N.W., and now she knows by its position that it has crossed her course ahead, and even if it recurves she will not approach the vortex within a dangerous distance. She therefore hauls a little to the Southward of her course, and continues at a speed consistent with sea and swell.

During the first watch the weather conditions experienced by "A" and "C" indicate that they are drawing nearer to the centre.

When the 1900 G.M.T. observations are received, the process is repeated and the centre is indicated to lie some 50 miles further to the E.N.E. than it was at 1500 G.M.T. All ships receiving the reports now know that the cyclone has probably recurved and is travelling in a direction Northward of East.

"A" should run with the wind on the starboard quarter to the Westward until the barometer rises and then heave to until the wind backs to the Southward of West when she can proceed on her course with caution.

"B" knows that while the storm travels Eastward she is receding from it on her course W.N.W.

"C" who, with falling glass and increasing and veering wind as he proceeded W.S.W. would, without the information obtained by W/T., think that he was overhauling the storm and approaching the trough from its rear, now knows that the storm has recurved, and if he keeps more to the Southward, the weather will improve as the trough passes. When the barometer rises, course to the Westward may be resumed.

If reports such as these which synchronise can be obtained, steamers will have good information for avoiding the intense part of the storm field with minimum risk and loss of time.

It must always be remembered that the wind may not conform to the rule, and in this case "C's" wind was probably affected in direction by the S.W. monsoon which has usually set in by June. This method only gives rough approximates.

Routine Reports and Weather Charts.

When Routine Reports by coast stations and ships are reciprocated, which synchronise, simple weather charts made by navigating officers

will have an important bearing on safe navigation in Tropical Revolving Storms, of which the following will serve as an illustration.

Suppose that S.S. *Arracan*, Captain M. WILLIS, from Rangoon to Aden, on the morning of December 6th, 1922, could have constructed CHART XXII. for the Bay of Bengal on which is given the departure from the normal barometer at coast stations.

With the barometer 4 mb. (.12 inch) below normal at Port Blair, the chances are two to one that a cyclone has formed, and the pressure distribution indicates that it is centred at some distance S.W. of that station.

As *Arracan* proceeds on her course a light S.E. breeze is experienced, increasing with occasional rain squalls from Cumulo-Nimbus, and there was a long swell from S.E. From midnight the barometer fell, and at 8 a.m. on December 7th the wind backed to E.N.E.

CHART XXIII. is made, and from it *Arracan* sees that a cyclone is centred in Latitude $9\frac{1}{2}^{\circ}$ N., Longitude $89\frac{1}{2}^{\circ}$ E. The Meteorological Chart of the Indian Seas for December shows that in this month cyclones have travelled West, North West, and Northward, in the latter case recurring to the N.N.E. It will now be safest to heave to and, by arranged reciprocation of reports, to ascertain the track the centre is following.

However, Captain WILLIS was not in possession of the information now at our disposal, and he proceeded on his course. At 7.30 p.m., in consequence of the threatening appearance, violent rain squalls and average steadiness of the wind, he decided that they were in the direct path of a storm whose centre was to the South, and accordingly altered course to keep the wind on the starboard quarter. At 10 p.m. the wind backed to N.E., force 11, precipitous sea.

CHART XXIV. for morning of December 8th shows that the storm is centred in about Latitude $11\frac{1}{2}^{\circ}$ N., Longitude $89\frac{3}{4}^{\circ}$ E., and CHART XXV. shows the track made by the centre of the storm, also that made by *Arracan*. She crossed ahead of the centre and probably was dangerously near the ring of hurricane winds which has caused seas which have made many a fine ship founder.

Dimensions of Hurricane Winds.

Recent experiences in storms have enabled us to obtain fairly accurate measurements of the dimensions of the ring of hurricane winds.

On December 2nd, 1922, the American S.S. *Eclipse*, Captain HAWKINS, encountered a cyclone in the Arabian Sea; it travelled 200 miles that day and, estimated by the times logged when it passed over her position, the ring of winds of hurricane force was only 4 miles thick, while the calm centre was only 4 miles in diameter, thus winds of hurricane force only covered an area of about 12 miles in diameter.

S.S. *Sardinia* only distant 80 miles from the centre, had a strong breeze, force 6, and barometer 51.4 mb. (1.52 in.) higher than that at the centre, which indicates an intensely steep barometric gradient.

On September 21st, 1922, a West Indian hurricane passed over Bermuda; it had travelled at the rate of 13 knots since the previous day.

Captain H. P. DOUGLAS, C.M.G., R.N., of H.M.S. *Mutine*, in Hamilton Harbour, noted the times when the wind attained hurricane force, when it fell calm, when it came away at hurricane force again, and when it fell below hurricane force. The ring of hurricane winds was 15 miles thick in advance of the centre; the centre was about 7 miles in diameter and the hurricane wind was 19 miles thick in rear. As so frequently happens the greatest force of wind was in rear of the trough.

This hurricane originated in the Tropics, recurved in about Latitude 25° N., Longitude 66° W., and crossing the Atlantic reached the French coast. On September 25th, 1922, it was centred in Latitude $51\frac{1}{2}^{\circ}$ N., Longitude $17\frac{1}{2}^{\circ}$ W., and had spread to such an extent that its wind circulation had a diameter of about 1,000 miles. At this time observation did not show the extent of the hurricane winds; the system was no longer tropical. Several ships reported wind of that force near the centre.

(To be continued.)

WEATHER SIGNALS.

II. WIRELESS WEATHER BULLETINS.

UNITED STATES OF AMERICA (Contd.).

The following Naval Radio stations broadcast Weather Bulletins, which are of the same general character and based upon the observations of 0100 G.M.T. (civil), except where otherwise stated, taken at the stations mentioned in the lists below.

An explanation of the code used is given later.

Gulf Coast.

Key West (Fla.)—approximate Latitude $24^{\circ} 33' N.$, Longitude $81^{\circ} 48' W.$, call sign NAR, transmits a weather bulletin at 0255 and 0300 G.M.T. (civil) on wavelengths of 1,451 metres (C.W.), and 5,700 metres (arc) respectively.

The bulletin is in two parts. The first part gives barometer reading (corrected), wind direction, and force at:—

Indicator Letters.	Station.	Position (approx.) Lat. Long.	Indicator Letters.	Station.	Position (approx.) Lat. Long.
H	Hatteras, N.C. ...	$35^{\circ}14' N.$ $75^{\circ}32' W.$	FW	Fortworth, Tex. ...	$32^{\circ}30' N.$ $97^{\circ}40' W.$
C	Charleston, S.C. ...	$32^{\circ}43' N.$ $79^{\circ}52' W.$	KN	Kingston, Jam. ...	$18^{\circ}01' N.$ $76^{\circ}48' W.$
JA	Jacksonville, Fla. ...	$30^{\circ}19' N.$ $81^{\circ}51' W.$	TI	Turks Island ...	$21^{\circ}31' N.$ $71^{\circ}08' W.$
MI	Miami, Fla. ...	$39^{\circ}35' N.$ $84^{\circ}13' W.$	HA	Havana, Cuba ...	$23^{\circ}10' N.$ $82^{\circ}22' W.$
K	Key West, Fla. ...	$24^{\circ}33' N.$ $81^{\circ}48' W.$	GO	Guantanamo Bay (Cuba).	$19^{\circ}54' N.$ $75^{\circ}12' W.$
P	Pensacola, Fla. ...	$30^{\circ}21' N.$ $87^{\circ}19' W.$	SI	Swan Island ...	$17^{\circ}24' N.$ $83^{\circ}57' W.$
BW	Burrwood, La. ...	$28^{\circ}57' N.$ $89^{\circ}23' W.$	SJ	San Juan, P.R. ...	$18^{\circ}28' N.$ $66^{\circ}06' W.$
GV	Galveston, Tex. ...	$29^{\circ}19' N.$ $94^{\circ}48' W.$			
BV	Brownsville, Tex. ...	$25^{\circ}53' N.$ $97^{\circ}26' W.$			

The second part which is sent *en clair*, consists of:—

- (1) A forecast of winds and weather for the 24 hours commencing at 0500 G.M.T. (civil) for the areas shown on the chartlet.
- (2) Storm warnings for, and the location and expected movement of storm-centres affecting these areas (see Chartlet), except that of the Caribbean Sea.
- (3) Hurricane warnings when necessary

See under
W/T Storm
Warnings,
p. 69.

Brownsville (Tex.)—approximate Latitude $25^{\circ} 53' N.$, Longitude $97^{\circ} 26' W.$; call sign NAY, transmits a weather bulletin at 0500 G.M.T. (civil), on a wavelength of 2,255 metres (spark).

The bulletin is divided into two parts. The first part gives the barometer reading (corrected), wind direction, and force at:—

Indicator Letters.	Station.	Position (approx.) Lat. Long.	Indicator Letters.	Station.	Position (approx.) Lat. Long.
K	Key West, Fla. ...	$24^{\circ}33' N.$ $81^{\circ}48' W.$	GV	Galveston, Tex. ...	$29^{\circ}19' N.$ $94^{\circ}48' W.$
TA	Tampa, Fla. ...	$27^{\circ}35' N.$ $82^{\circ}29' W.$	CC	Corpus Christi, Tex. ...	$27^{\circ}48' N.$ $97^{\circ}23' W.$
P	Pensacola, Fla. ...	$30^{\circ}21' N.$ $87^{\circ}19' W.$	BV	Brownsville, Tex. ...	$25^{\circ}53' N.$ $97^{\circ}26' W.$
MO	Mobile, Ala. ...	$30^{\circ}43' N.$ $88^{\circ}03' W.$	KN	Kingston, Jam. ...	$18^{\circ}01' N.$ $76^{\circ}48' W.$
BW	Burrwood, La. ...	$28^{\circ}57' N.$ $89^{\circ}23' W.$	SI	Swan Island ...	$17^{\circ}24' N.$ $83^{\circ}57' W.$

The second part which is sent *en clair* consists of:—

- (1) A forecast of wind and weather for the 24 hours commencing at 0500 G.M.T. (civil) for the areas shown on the chartlet, except that for South Atlantic Coast.
- (2) Storm warnings for, and the location and expected movement of storm-centres affecting the Gulf of Mexico.
- (3) Hurricane warnings

See under
W/T Storm
Warnings,
p. 69.

Brownsville also transmits a forecast for the coast of Texas, from Corpus Christi to Brownsville at 1700 G.M.T. (civil) on the same wavelength.

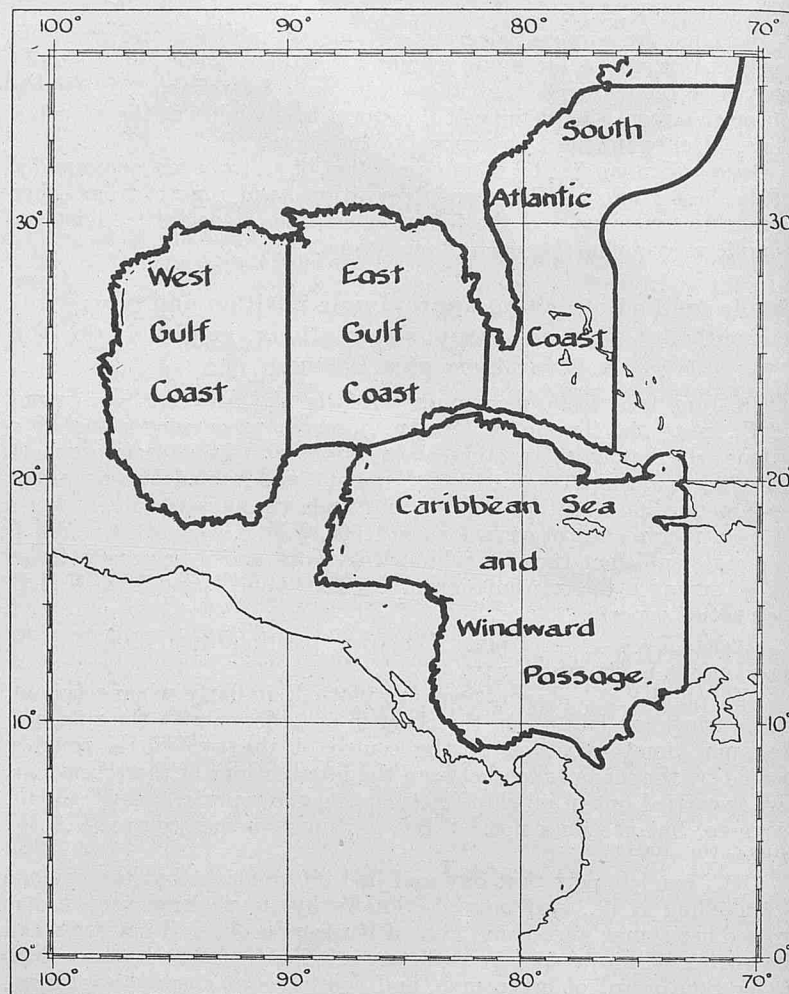
In addition to the foregoing, systematic broadcasts of local forecasts of wind and weather, storm warnings, and observations of barometric pressure, direction and force of the wind, etc., at 1300 G.M.T. are maintained by the following W/T stations:—

Galveston, Tex.; approximate Latitude $29^{\circ} 19' N.$; $94^{\circ} 48' W.$; call sign NKB, at 1630 G.M.T. (civil) on a wavelength of 1,817 metres (spark).

New Orleans, La.; approximate Latitude $29^{\circ} 53' N.$; $90^{\circ} 02' W.$; call sign NAT, at 1530 and 1600 G.M.T. (civil), on a wavelength of 2,600 metres (spark). The 1530 message from this station also contains a summary of meteorological conditions over the United States at 1300 G.M.T.

Pensacola, Fla.; approximate Latitude $30^{\circ} 21' N.$; Longitude $87^{\circ} 19' W.$; call sign NAS, at 1645 G.M.T. (civil), on a wavelength of 1,330 metres (c.w.).

Chartlet of U.S. Marine Forecast Areas.



West Indies.

San Juan (Porto Rico); approximate Latitude $18^{\circ} 28' N.$; Longitude $66^{\circ} 06' W.$, call sign NAU transmits a weather bulletin at 0200 G.M.T. (civil) on a wavelength of 600 metres (spark), repeating same on 4,850 metres (c.w.), during the hurricane season (June to November inclusive) only. The bulletin is divided into two parts:—

The first part gives the 0000 G.M.T. (civil) readings of the barometer (corrected) and the direction and force of the wind at:—

Indicator Letters.	Station.	Position (approx.) Lat. Long.	Indicator Letters.	Station.	Position (approx.) Lat. Long.
SJ	San Juan, P.R. ...	$18^{\circ}28' N.$ $66^{\circ}06' W.$	SD	Santa Domingo, S.D.	$18^{\circ}28' N.$ $69^{\circ}53' W.$
ST	St. Thomas, Virgin Is.	$18^{\circ}23' N.$ $64^{\circ}55' W.$	SL	Puerto Plata, S.D.	$19^{\circ}49' N.$ $70^{\circ}42' W.$
BT	Basseterre, St. Kitts	$17^{\circ}18' N.$ $62^{\circ}43' W.$	LU	Castries, St. Lucia	$14^{\circ}01' N.$ $61^{\circ}00' W.$
RS	Roseau, Dominica	$15^{\circ}17' N.$ $61^{\circ}24' W.$	W	Willemstadt, Curaçao.	$12^{\circ}10' N.$ $69^{\circ}00' W.$
BB	Bridgetown, Barbados.	$13^{\circ}09' N.$ $59^{\circ}35' W.$	PS	Port of Spain, Trinidad.	$10^{\circ}40' N.$ $61^{\circ}30' W.$

The second part which is sent *en clair* will give, when necessary, information regarding hurricanes or tropical storms. (See under W/T Storm Warnings, p. 69.)

The above bulletin is repeated by the San Juan (WKAQ) Station of the Radio Corporation of Porto Rico by wireless telephony at 0100 G.M.T. (civil), wavelength 360 metres, and by Guantanamo W/T Station, call sign NAW, at 0200 G.M.T., daily (June to November only), on a wavelength of 4,543 metres (c.w.).

Caribbean Sea.

By arrangement with the United Fruit Company (owners of the W/T Station) the U.S. Weather Bureau broadcast weather bulletins through Swan Island W/T Station, approximate Latitude $17^{\circ} 24' N.$, Longitude $83^{\circ} 57' W.$; call sign US, at 0445 and 1730 G.M.T. (civil) on a wavelength of 2,240 metres (spark).

The 1730 bulletin is divided into two parts. The first part which is broadcast only throughout the hurricane season (June to November

inclusive) gives the 1300 G.M.T. (civil) readings of barometer (corrected) direction and force of the wind at :—

Indicator Letters.	Station.	Position (approx.). Lat. Long.	Indicator Letters.	Station.	Position (approx.). Lat. Long.
SI	Swan Island ...	17°24'N. 83°57'W.	PP	Port au Prince, Haiti.	18°37'N. 72°17'W.
BZ	Belize, Honduras	18°00'N. 88°20'W.	CFG	Cienfuegos, Cuba	22°11'N. 80°33'W.
BFD	Bluefields, Nicaragua.		LFE	La Fé, Cuba	
W	Willemstadt, Curaçao.	12°10'N. 69°00'W.	KN	Kingston, Jamaica	18°10'N. 76°48'W.
SJ	San Juan, P.R. ...	18°28'N. 66°06'W.	TI	Turks I., Bahamas	21°31'N. 71°08'W.

The second part of the 1730 G.M.T. bulletin is broadcast daily throughout the year, en clair, and consists of :—

- (1) A forecast of wind and weather for the areas shown on the chartlet, p. 68, except that for the South Atlantic Coast.
- (2) When the conditions warrant these forecasts will be supplemented by storm or hurricane warnings. Warnings of "Northers" during the winter months will also be broadcasted.

The 0445 G.M.T. bulletin, based upon observations taken at 0100 G.M.T. (civil), will also be broadcast daily throughout the year. It consists only of forecasts and warnings of the same character and for the same areas as are contained in the second part of the 1730 G.M.T. bulletin.

Code used in First Part of the foregoing U.S. Weather Bulletins.

The messages always begin with the letters USWB (United States Weather Bureau). The indicator letters are followed by a group of five figures for each station.

The first three figures give barometer reading corrected, in inches and tenths, the first 2 or 3 being omitted (see Table XXX., p. 57. April number of this Journal for Conversion of inches to millibars).

The fourth figure gives the wind direction true (Table XXV., p. 57, April number).

The fifth figure gives the wind force by Beaufort Scale except when the force exceeds 9, when words instead of figures will be used.

An x will be inserted in place of a missing figure. If the report from a station cannot be supplied the word "missing" will be inserted after the indicator letters.

Bermuda Islands.

The W/T Station at Bermuda Dockyard; approximate Latitude 32° 19' N., Longitude 64° 50' W., broadcasts weather conditions prevailing at Bermuda at 0015 and 1215 G.M.T. (civil), on a wavelength of 1,600 metres, and at 0020 and 1220 G.M.T. (civil), on a wavelength of 600 metres.

UNITED STATES OF AMERICA (Contd.).

WIRELESS STORM WARNINGS.

Storm warnings are broadcasted when necessary by the following W/T stations. The areas to which the warnings refer are given in the text of the message.

Gulf Coast.

W/T Station.	Time (G.M.T.)	Wavelength. (Metres).
Key West ...	NAR 0255	1451 C.W. }
	0300	5700 arc. }
Brownsville ...	NAY 0500	do. do. }
	1700	2255 spk. }
	Midt.	
Galveston ...	NKB 1630	1817 spk.
	2300	
New Orleans ...	NAT 1530 1600	
	2200 0300	2600 spk.
Pensacola ...	NAS 1645	
	2300	1330 C.W.

Hurricane warnings are also transmitted when necessary by the above stations and repeated every two hours until 0500 G.M.T.

West Indies.

W/T storm and hurricane warnings, June to November (inclusive) only.

W/T Station.	Time (G.M.T.)	Wavelength. (Metres).
San Juan* ...	NAU 0200†	600 spk. }
	1500	4850 C.W. }
Do. ...	WKAQ 0100† 1400†	360 wireless telephony.
	1800†	
Whilst—		
Guantanamo (Cuba)	NAW	2726 spk. }
Port au Prince (Haiti)	NSC	2225 spk. }
St. Croix } Virgin	NNI	450 spk. }
St. Thomas } Islands	NBB	1685 spk. }

In second part of Weather Bulletin.

transmit hurricane warnings when necessary and repeat them every 4 hours.

Caribbean Sea.

Swan Island W/T Station call sign US, transmits storm warnings daily throughout the year at 0445 and 1730 G.M.T. (civil) for the areas shown on the chartlet, p. 68, except that of the South Atlantic Coast. In the 1730 transmission the storm warning is contained in the second part of the weather bulletin which is issued at that time. Whenever a hurricane is in progress, Swan Island will broadcast information every two hours and at the even hour, regarding its location, direction, progress and intensity.

* If the anticipated meteorological conditions are reported normal, the message "Weather Normal" will be sent.
† Issued in English and Spanish.

III. VISUAL STORM WARNINGS.

UNITED STATES OF AMERICA, (GULF COAST), AND WEST INDIAN ISLANDS.

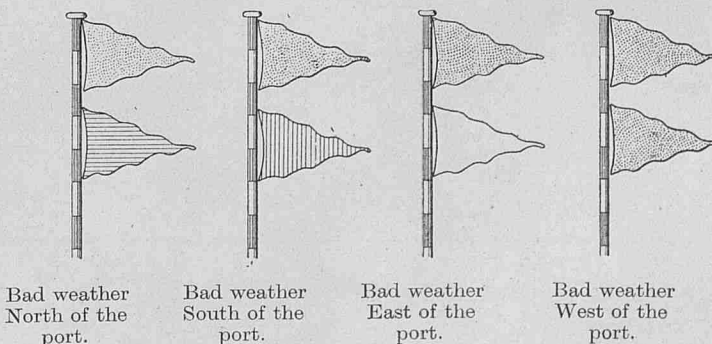
Descriptions of the visual, storm and hurricane warnings, with their explanations, displayed at Stations on all coasts of the United States will be found in the April number of this Journal, p. 58.

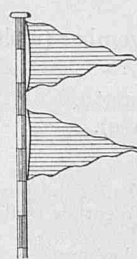
These warnings are also displayed at certain places in the following West Indian Islands :—St. Kitts, Porto Rico, Jamaica (Kingston), Vieques Island, Santo Domingo, Haiti, Dominico, St. Thomas, Virgin Islands of the U.S.A., Grand Turk Island, Swan Island, Turks Islands and Cuba.

MEXICO.

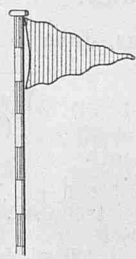
A new system of visual storm and wind signals has been established at ports on the coasts of Mexico.

(1) Storm signals are used to give warning of the existence of cyclonic disturbances whether distant or near, or, of the existence of bad weather outside the port. These storm signals which consist of pennants only and their meanings, are as follows :—

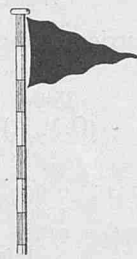




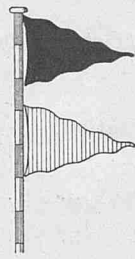
Northerly gale from Matamoros begun. (Gulf ports only.)



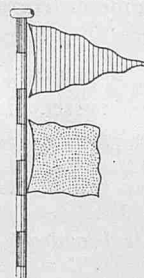
Gulf Ports.—Cyclone in Caribbean Sea. Pacific Ports.—Distant cyclone.



Gulf Ports.—Cyclone in Gulf of Mexico. Pacific Ports.—Cyclone close by.

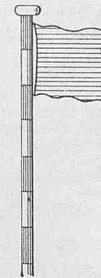


Cyclone at the Port, or will pass close by on that day.



Gale or hurricane from the West.

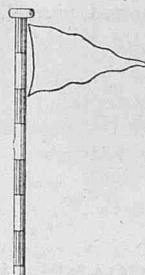
Yellow White. Blue. Red. Black.



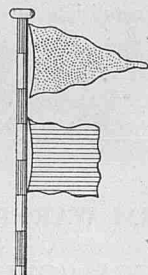
Northerly gale expected the following day. (Gulf Ports only).

Night Signals.—Two red lights, vertical, are hoisted to indicate that navigation may be dangerous.

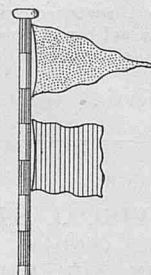
(2) The following signals consisting of pennants, denoting the strength, and flags the direction of the wind, are used to indicate its probable strength and direction from the time of hoisting the signal until the following 0600. They will be lowered, if necessary, to hoist a storm signal and in the evening when no longer visible :—



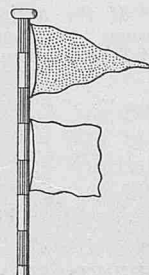
Light or moderate winds.



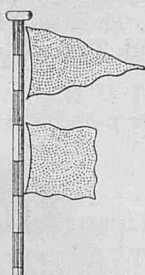
Moderate or strong North-easterly winds.



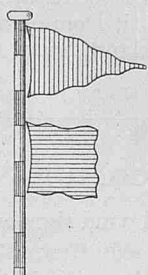
Moderate or strong South-easterly winds.



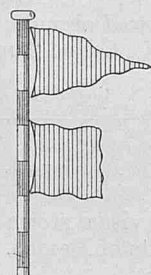
Moderate or strong Easterly winds.



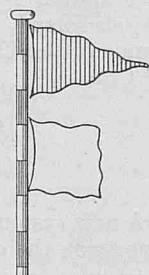
Moderate or strong Westerly winds.



Gale or hurricane from the North.



Gale or hurricane from the South.



Gale or hurricane from the East.

Special Notices regarding Personnel.

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

Captain J. Waterhouse, late of the S.S. *Clan Mackay*, has been appointed a Marine Superintendent of the Clan Line. When afloat he was a regular observer for the Meteorological Office, taking a keen interest in all matters appertaining to Marine Meteorology, especially to the application of Wireless Weather reporting as an aid to safe and economical navigation. Captain WATERHOUSE commenced his sea career in the sailing ships of the Sierra Line in June, 1889. Joining the Clan Line as 4th Officer ten years later, he rose to command in January, 1913, his last ship being the *Clan Mackay*.

During his last voyage, when at Apia, Samoa, in March, 1923, Captain WATERHOUSE observing signs of an approaching hurricane sent out the first Wireless warning and put to sea. Cruising on the outskirts of the disturbance he broadcasted throughout the position of the storms centre and weather experienced at his position. Returning to port he found that an even worse hurricane had swept the island than that of March, 1889 when H.M.S. *Calliope* was the only vessel in the harbour to escape destruction by putting to sea.

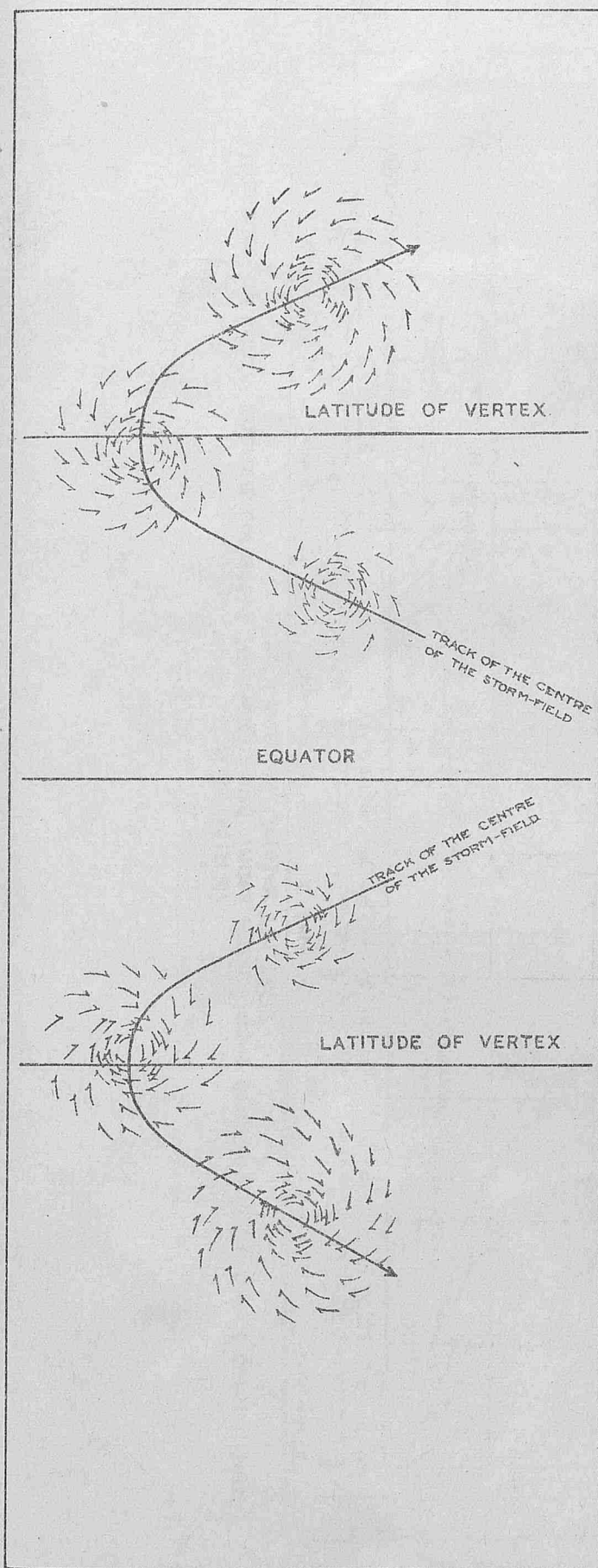


Fig. 12 — "WIRELESS AND WEATHER"

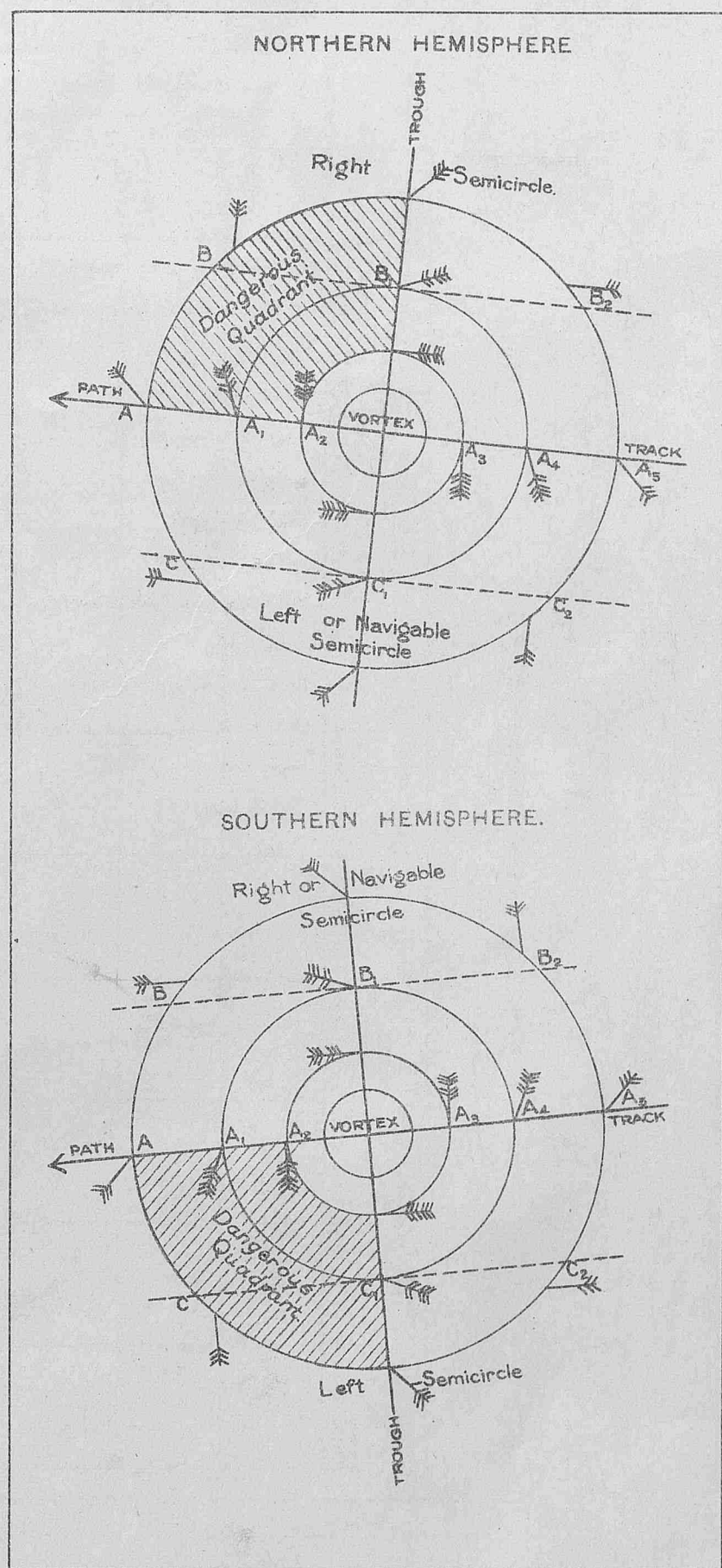


Fig. 13 — "WIRELESS AND WEATHER"

S.S. MIAMI
Pressure by ship's aneroid corrected for Height and Index error. Index error found by direct comparison at Liverpool, October 7th, 1922.

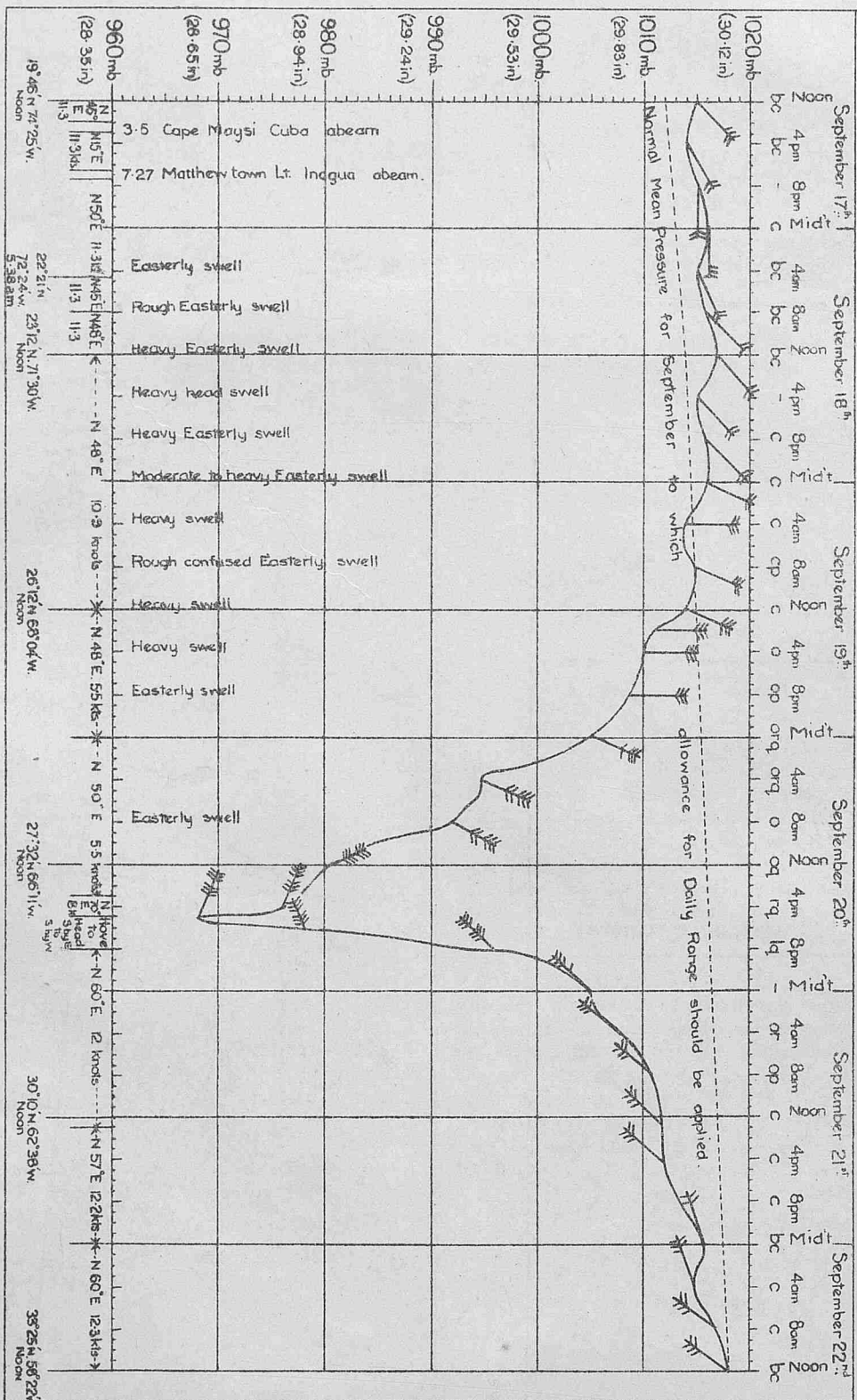
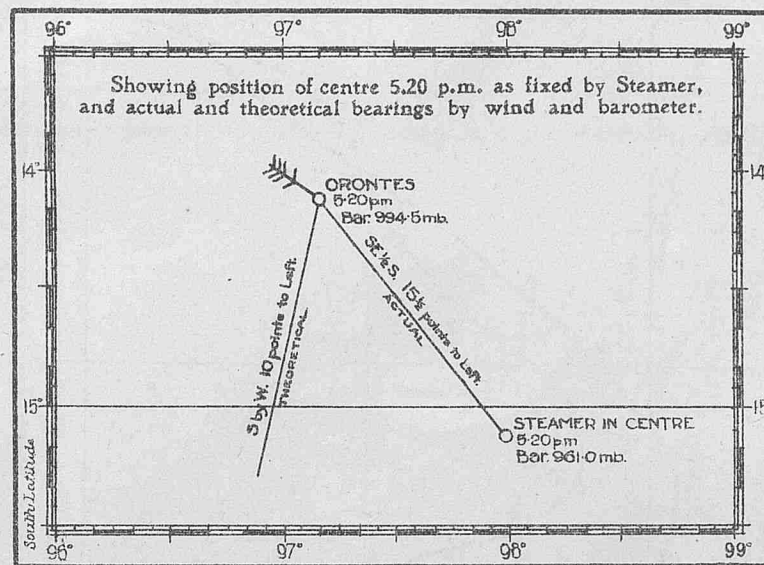
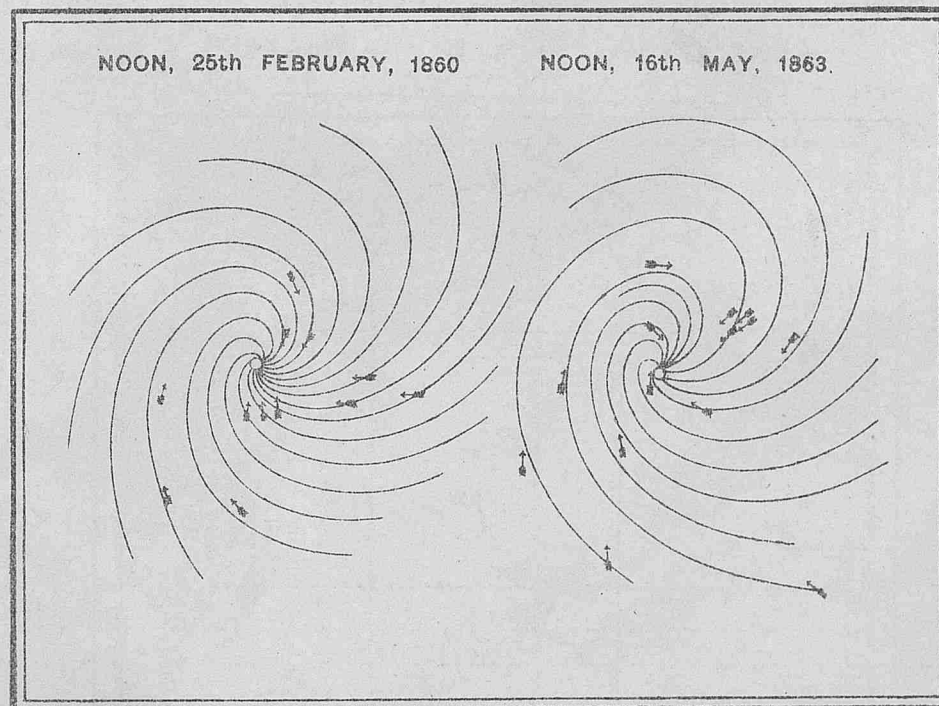


Fig. 14. — "WIRELESS AND WEATHER."



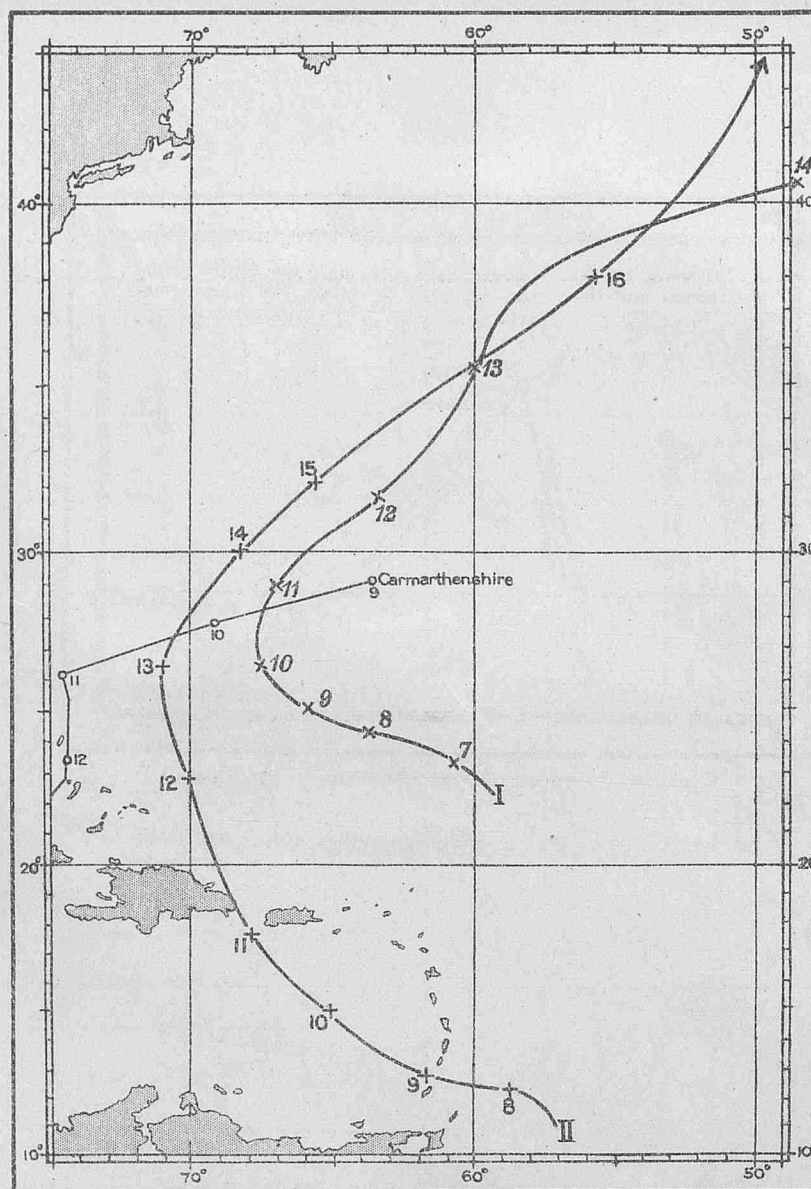
Cyclone S. Indian Ocean, February 13th. 1904.

Fig. 15—"WIRELESS AND WEATHER".



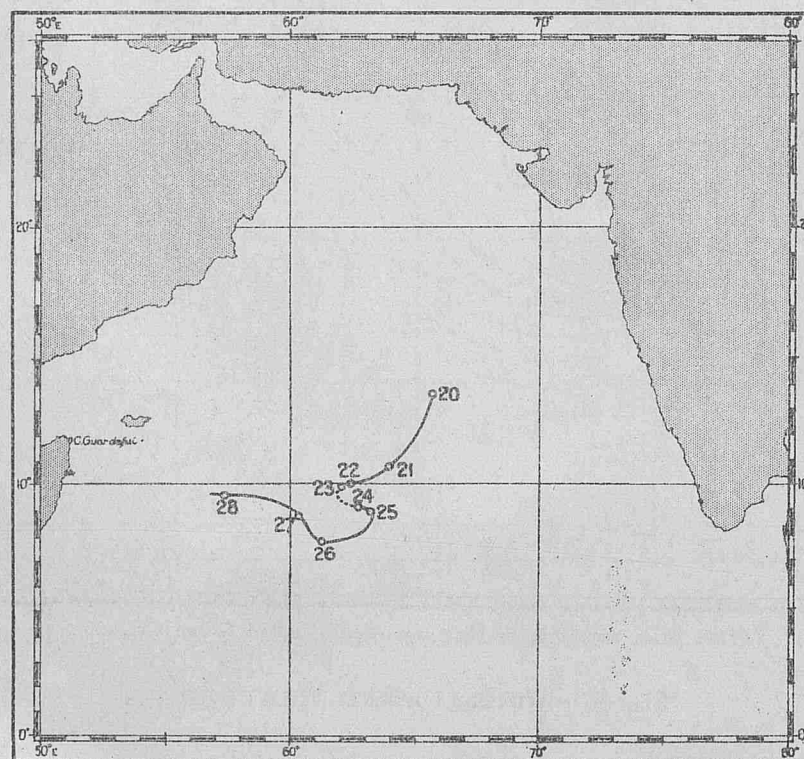
Flow lines according to Meldrum—South Indian Ocean Cyclone.

Fig. 16—"WIRELESS AND WEATHER".



Tracks of September Hurricanes 1921.

Chart XIX — "WIRELESS AND WEATHER."



Track of Cyclone with noon positions. Nov. 20-28, 1920.

Chart XX — "WIRELESS AND WEATHER"

FIXING POSITION OF CENTRE OF A CYCLONE IN THE ARABIAN SEA.
BY MEANS OF OBSERVATIONS REPORTED BY SHIPS.

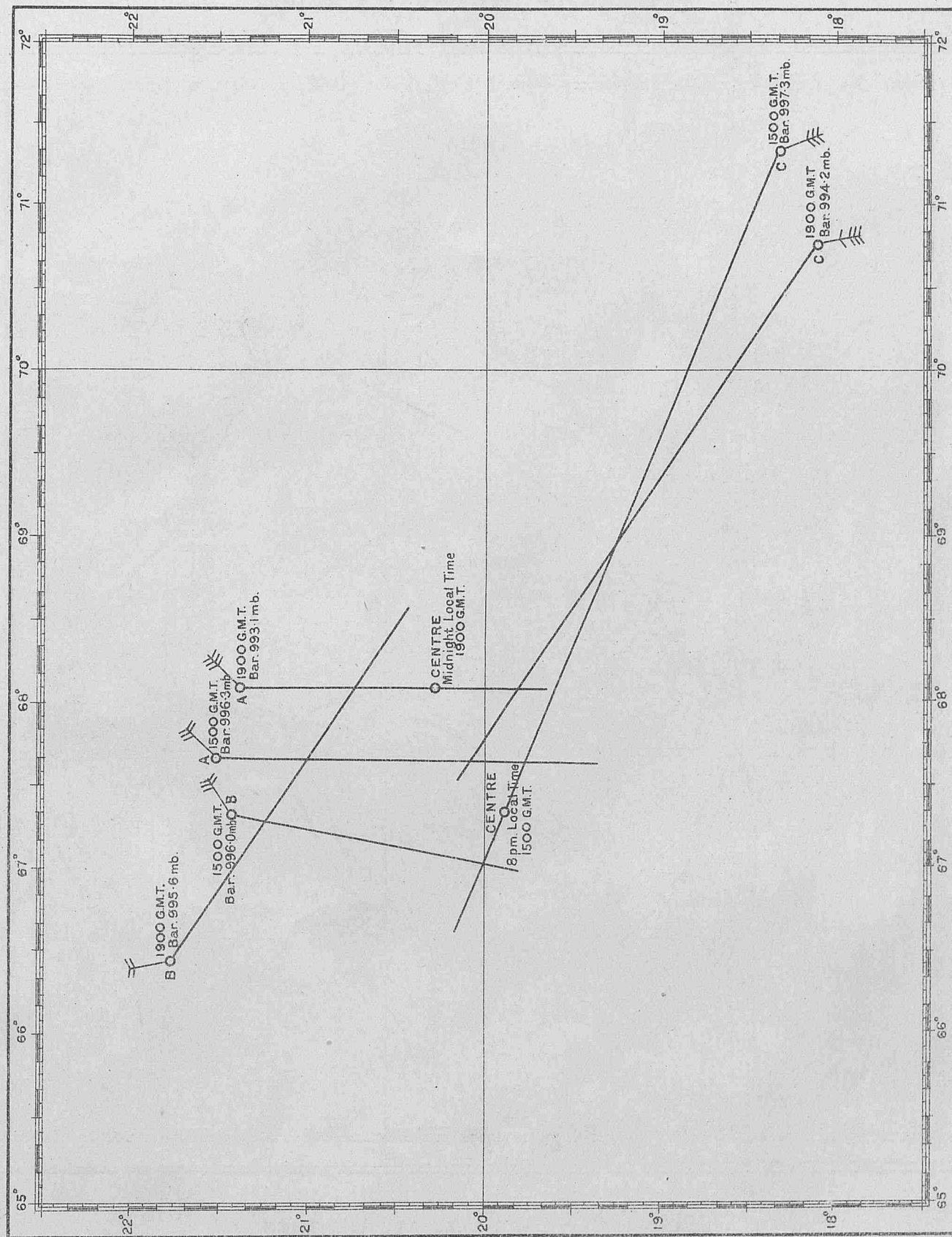


Chart XXI — "WIRELESS AND WEATHER."

MORNING OF DECEMBER 6TH. 1922.

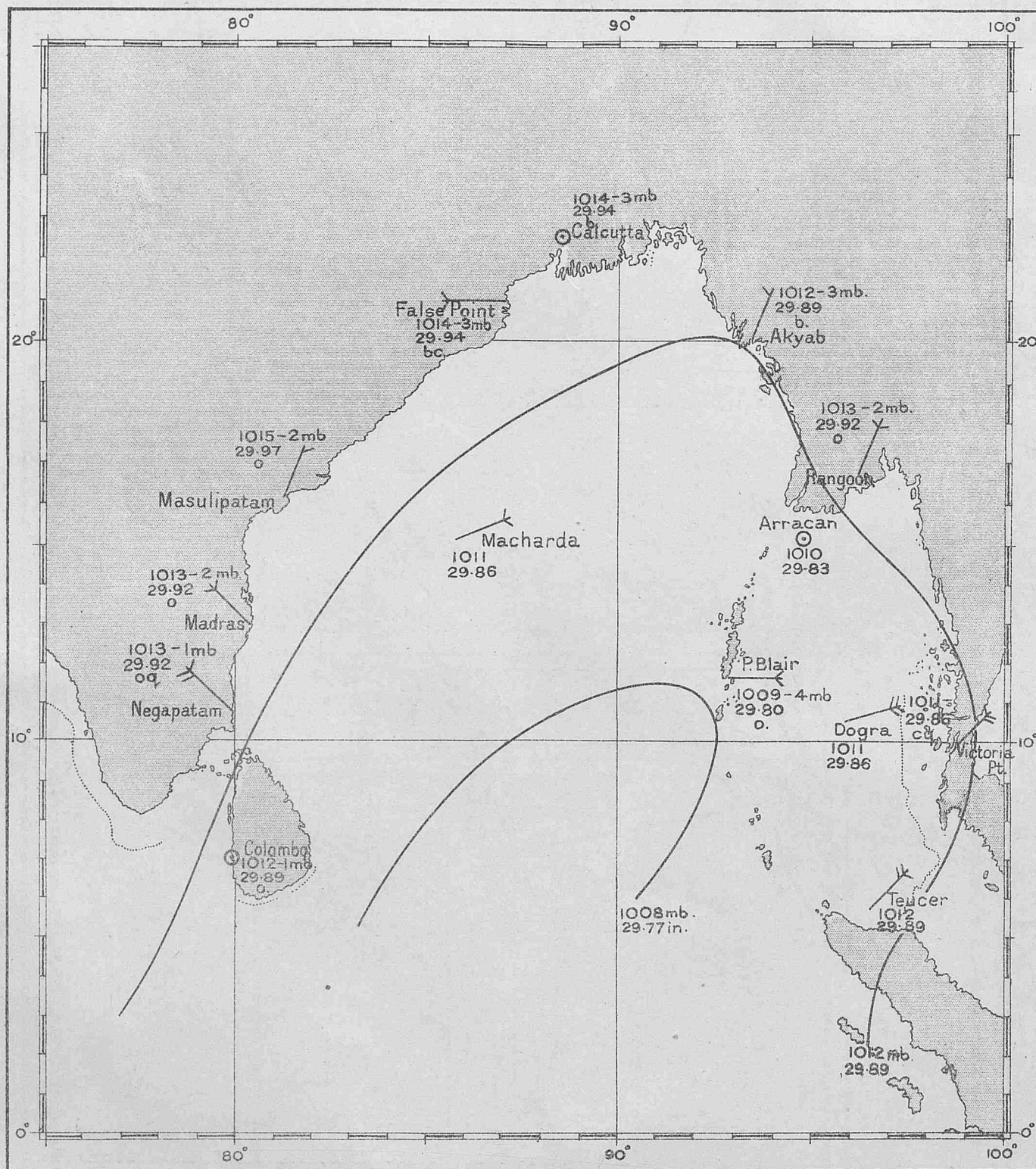


Chart XXII — "WIRELESS AND WEATHER"

MORNING OF DECEMBER 7TH. 1922.

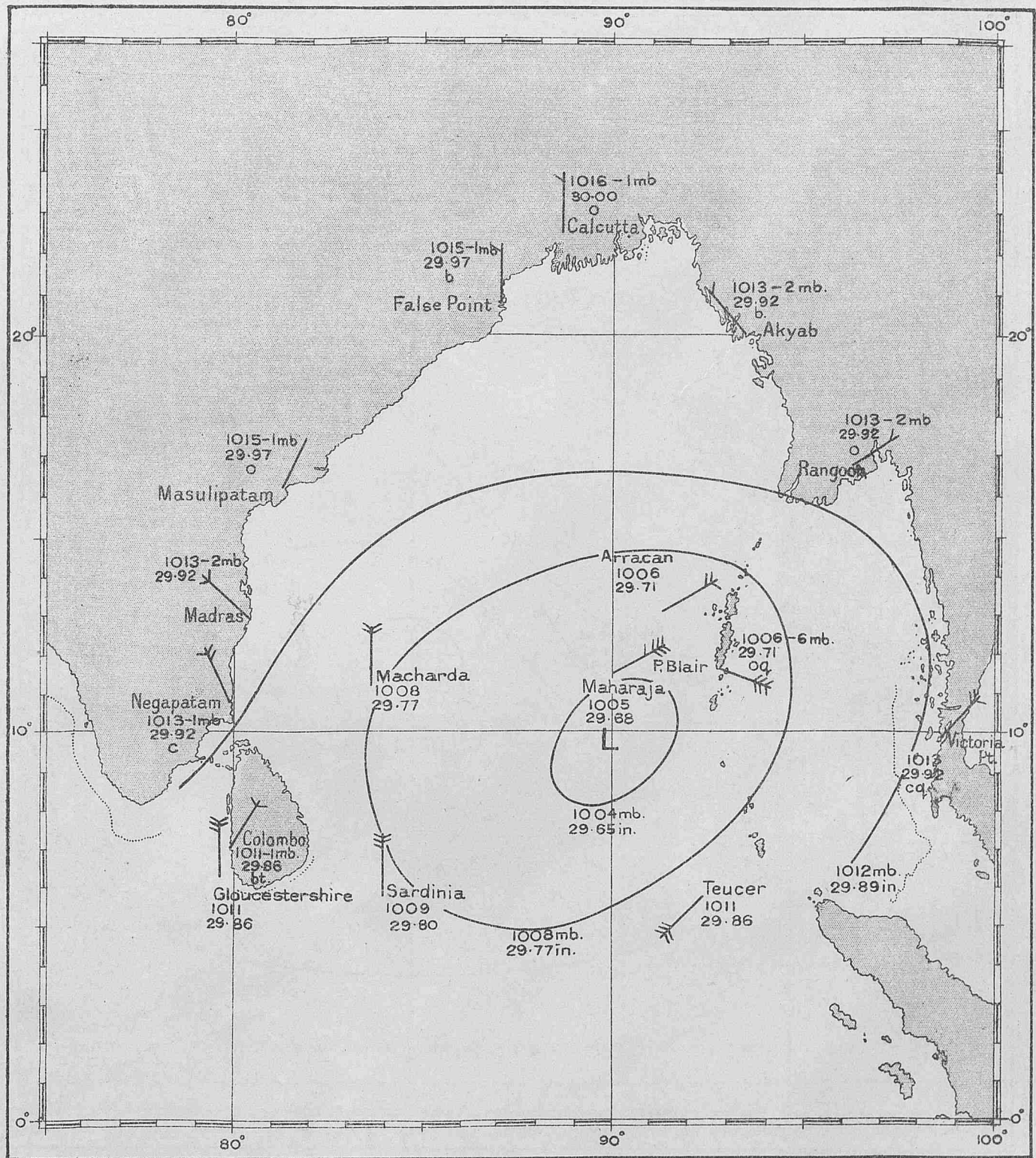


Chart XXIII — "WIRELESS AND WEATHER."

MORNING OF DECEMBER 8TH. 1922.

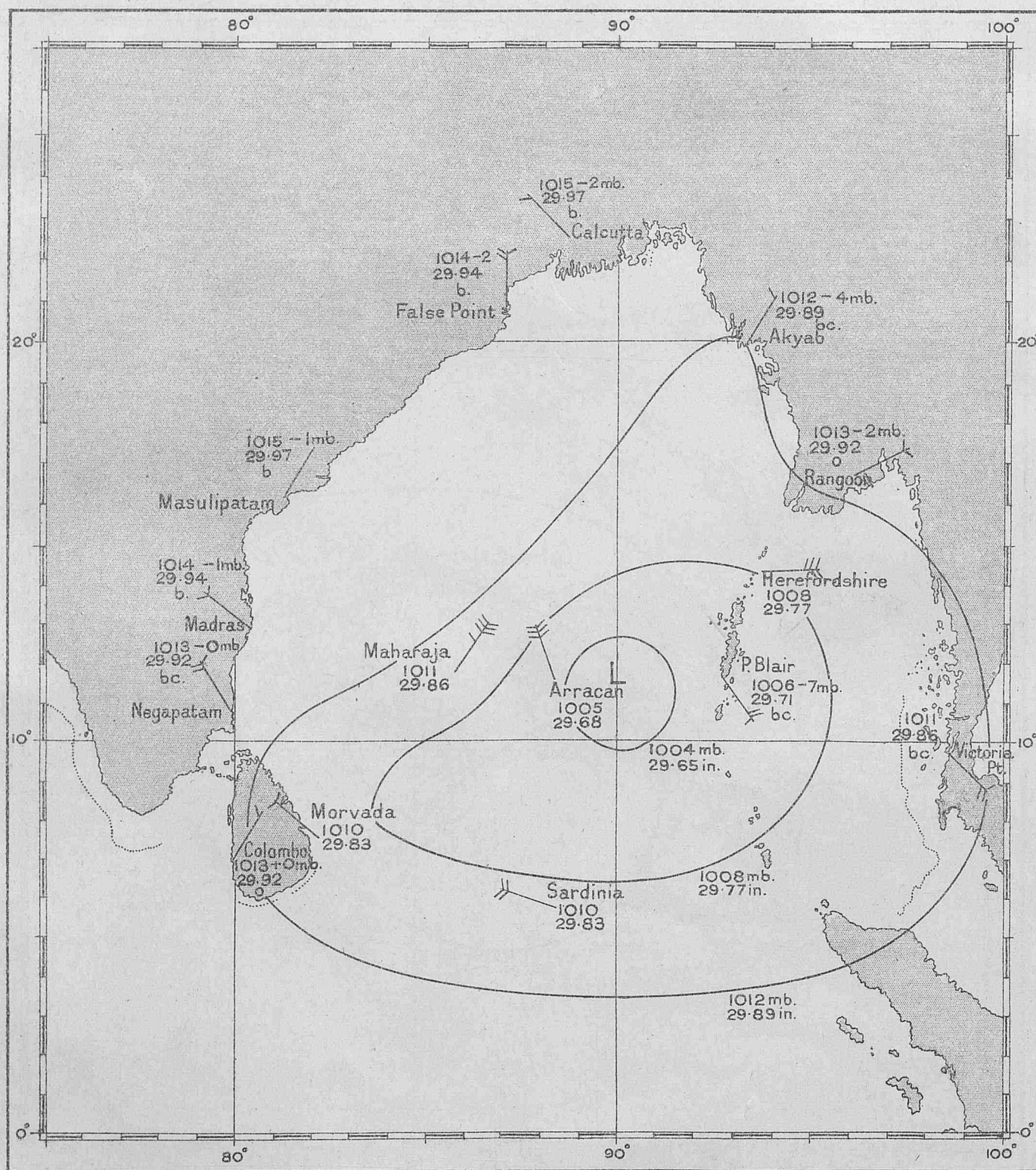
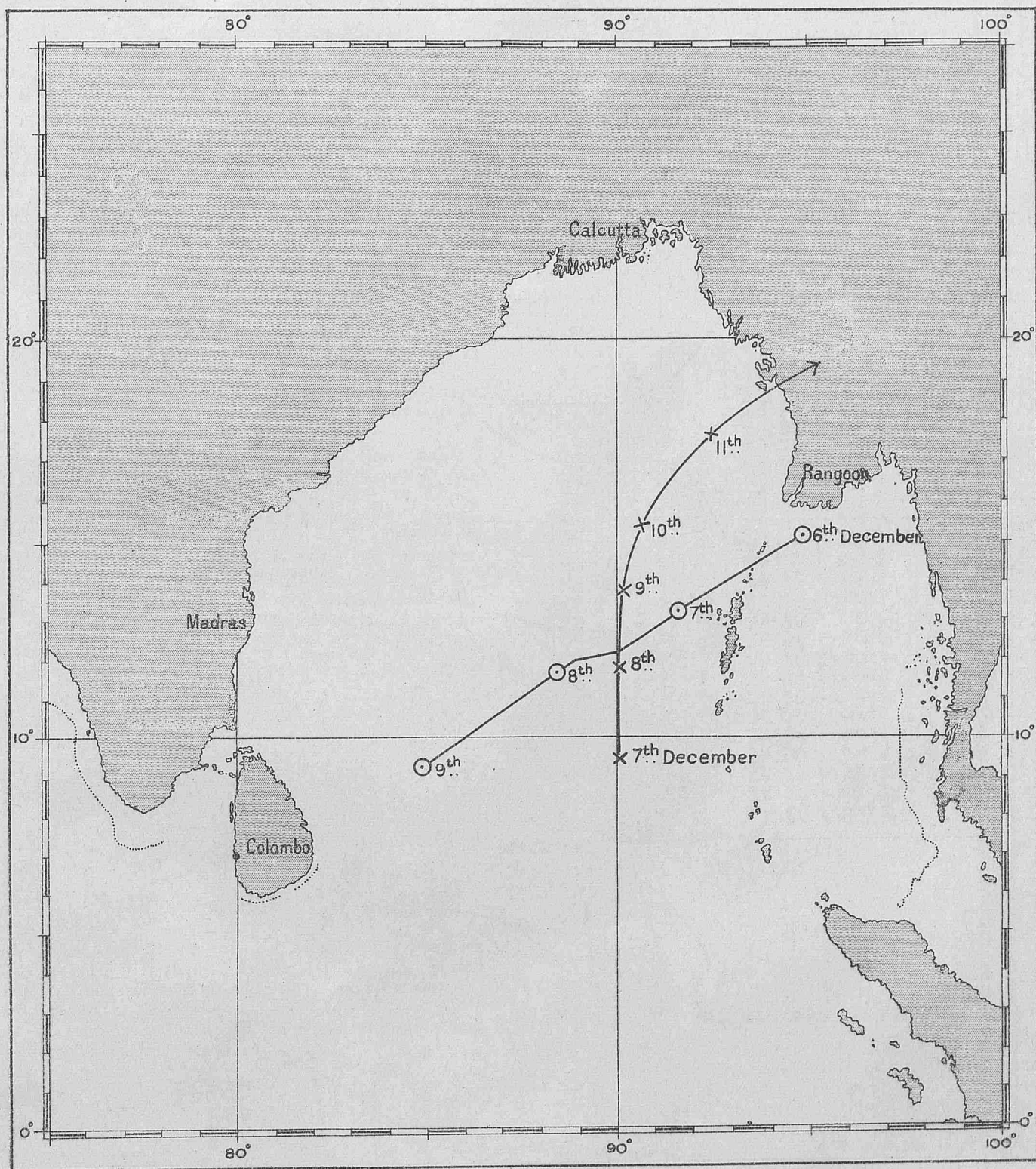


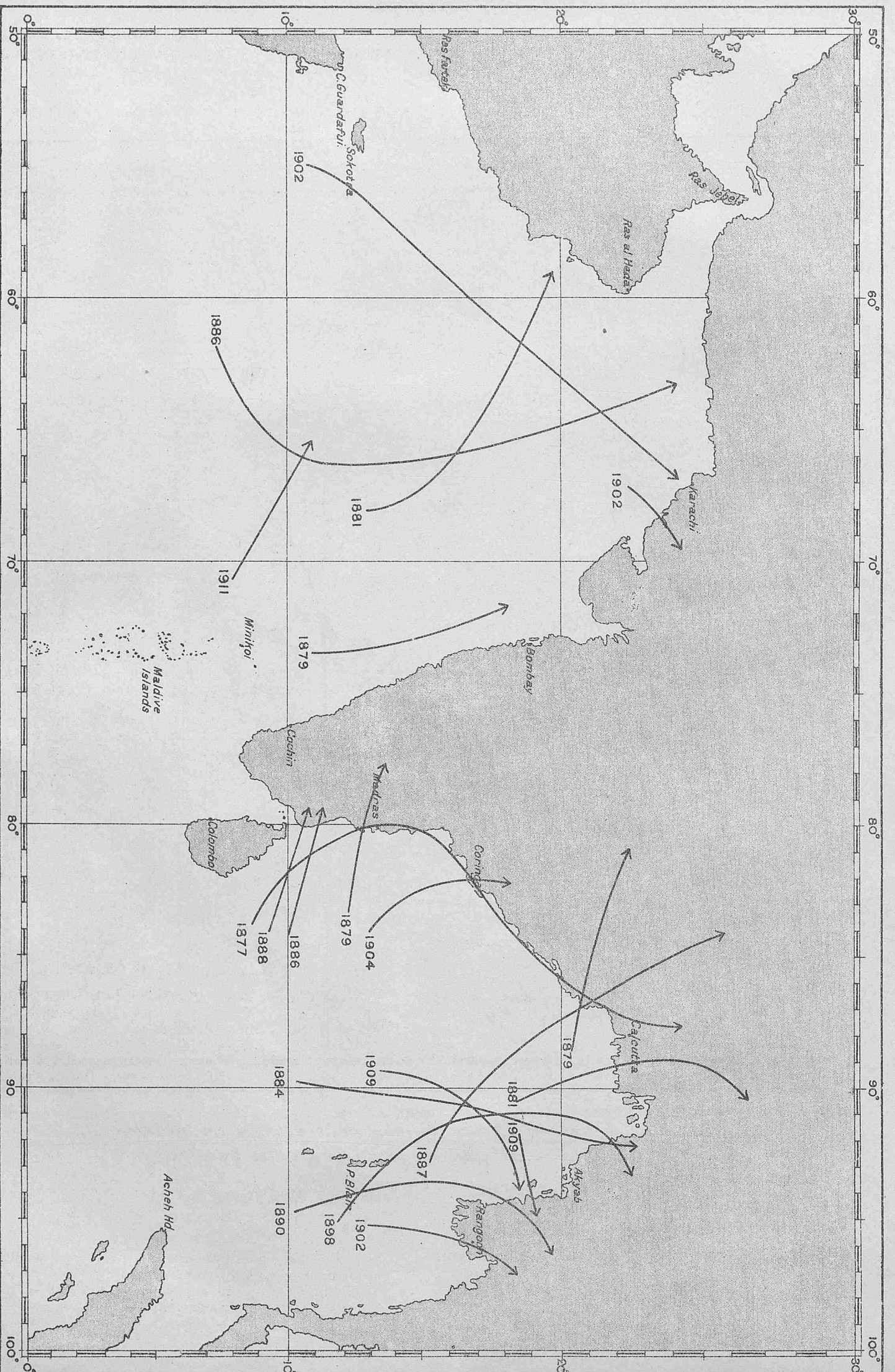
Chart XXIV — "WIRELESS AND WEATHER".



x — x Track of cyclone showing position of centre at 8 am. daily.
 ○ — ○ Course and position of s.s. Arracan at 8 am. daily.

Chart XXV — "WIRELESS AND WEATHER"

CYCLONE TRACKS OF THE ARABIAN SEA AND BAY OF BENGAL.



H. M. Stationery Office Press, Kingsway, W.C.2.

Ps. 5018/1896. W. 17839 E. A. 2135/88. 1500. 4/14.

Tracks of cyclones which have occurred in the Arabian Sea and Bay of Bengal during the month of May. The year is indicated by the figures at commencement of track.

From "Monthly Meteorological Charts of the East Indian Seas", and "Hurricanes and Tropical Revolving Storms", M.O. 220 (1).

NOTICES.

INTERNATIONAL ICE PATROL SERVICE.

The ice patrol service will shortly be resumed.

Having located the ice the following messages will be sent out daily by the ice patrol vessel (call sig. NIDK). The time used in all messages is 75th meridian time:—

- (a) At 1100 and 2300 G.M.T. (civil) ice information on a wavelength of 600 metres (spark). These messages will be sent three times in succession with an interval of 2 minutes between each.
- (b) At 0000 and 1200 G.M.T. (civil) ice information on a wavelength of 1621 metres (C.W.) These messages will be sent three times in succession with an interval of 2 minutes between each.
- (c) At 0100 G.M.T. (civil) a message will be sent to the Hydrographic Office, Washington, through the nearest land wireless station, defining the ice, danger zone, its Southern limits or other definite ice news, while other messages will be sent during the night if any later information is obtained by the patrol vessel.
- (d) Ice information will be given at any time to any ship with which the patrol vessel can communicate on commercial traffic wavelengths.

Note.—Broadcasting by spark transmission will be eliminated as soon as possible and vessels are advised to equip themselves with C.W. receivers.

The work of the ice patrol will be greatly facilitated if masters of vessels will wireless the following data to the ice patrol vessel as soon as they are within working distance:—

- (a) Icebergs or other obstructions sighted, giving date, time, latitude, longitude, and direction of drift, if an iceberg, together with the sea temperature at the time.
- (b) Surface temperature of the sea every four hours when between 39°N. and 48°N. and crossing 52°W. and 44°W. either East bound or West bound; and giving latitude and longitude, course, and speed, at time of each observation.

These data will facilitate the plotting of a temperature curve which will be useful in locating the branches of the Labrador Current.

ICE REPORTS.

Commanders of ships in the Trans-North Atlantic and Southern Ocean Trades are earnestly requested to have the Ice Report Form 912 completed and returned at the end of each passage. A nil return is desired if no ice is seen.

These forms are supplied with the Marine Observer each month to regular observing ships in these Trades.

Invitation to Marine Observers.

The Marine Superintendent will be pleased to see Captains of observing ships, who may be in London, between 10 a.m. and 4 p.m., at Room 319, Adastral House, Kingsway, W.C.2. Telephone No. :—Regent 8000. Extension 421. Telegrams, "Marine Superintendent, Weather, London."

(Nearest station—Temple, District Railway.)

CHARTS OF NORMALS AND FREQUENCIES READY FOR DISTRIBUTION TO REGULAR OBSERVING SHIPS ON REQUEST.

The reprints of Meteorological Charts notified in "Aims and Objects" of the January number of this Journal are now ready.

Upon written application being made by the Commanders of Ships on the List of Regular Observers one set of these Charts for the North Atlantic and/or the East Indian Seas will be sent with the understanding that they will be preserved in the Ship.

These Charts may be purchased from the Admiralty Chart agents.

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		

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 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.

ICE CHART.

WESTERN NORTH ATLANTIC.

LETTERS OF TRANSATLANTIC TRACKS INDICATE

- (A) Westbound 1st April to 30th June, inclusive.
- (E) Eastbound 25th March to 7th July, inclusive.
- (E) From 11th April to 15th May, or until the Cape Race Route clear of ice.
- (F) From 16th May to the opening of Belle Isle route.

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 front page of Ice Chart published with April Marine Observer.

SYMBOLS USED ON THE CHART.

- Iceberg.
- Floesberg.
- 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 DRIFTS OF ICE.

Date.	Ship or Source of Report.	Position. Lat. Long.	Remarks.
May 1, 1891	"A vessel" ...	34° N. 70° W.	Berg.
May 1, 1891	S.S. Renfrew ...	40° N. 34° W.	3 small pieces of ice.
May 20, 1897	S.S. Lord Lands-downe.	38°20' N. 45°10' W.	2 small pieces, 6 ft. by 6 ft. and 12 ft. by 4 ft. out of water.
6, 1908	S.S. Oceano ...	150-200 miles N. of Bermuda.	Pieces.
27, 1909	S.S. Reventazon ...	32°28' N. 44°10' W.	60 ft. long, 10 ft. high.
15, 1911	S.S. Camillo ...	10 miles E. of Nantucket Shoal L.V.	Small berg.
11, 1914	S.S. Indradeo ...	42°18' N. 62°43' W.	Large slabs of field ice and growlers 100-150 ft. long, 5 ft. out of water.
17, 1915	S.S. Pola ...	38°16' N. 61°50' W.	Some field ice.
16, 1920	U.S. Hydrographic Bulletin.	45°11' N. 36°42' W.	Berg.
18, 1921	U.S.R.C. Seneca ...	40°16' N. 58°00' W.	Berg.
12, 1922	S.S. Lingan ...	40°40' N. 60°00' W.	Heavy field ice extending east and west 20 miles.

Reports of Ice sighted between 1st and March 31st which have been received by Meteorological Office, are shown by the Symbols plotted in position reported, the figures indicating the day of the month.

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, Ships Meteorological Report, using the ship's instruments, the barometer being compared with Standards.

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. 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.

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.

All Masters who wish to assist in developing the rapid interchange of Meteorological information and Weather Forecasting at sea can do so by using the form of W/T Weather Report suggested in "Weather Signals," given in this Journal, January Number.

The Marine Observer is sent monthly to all ships regularly contributing Logs, Forms and W/T Registers to the Meteorological Office.

Marine Agencies and Port Meteorological Offices.

LIVERPOOL	..	(Port Meteorological Office) Commander G. H. Lloyd, R.D., R.N.R., Dock Office. Telephone No.: Bank 8959.
CARDIFF	..	Captain T. Johnston, Technical College.
LEITH	..	Captains G. Black and C. G. Bonner, V.C., D.S.C., Leith Salvage and Towage Co., Ltd., 2, Commercial Street.
THE CLYDE	..	Captain M. Corrance, Board of Trade Surveyor's Office, 73, Robertson Street, Glasgow.
HULL	..	Captain Geo. B. Sturdy, Ellerman's-Wilson Line, Ltd.
SOUTHAMPTON	..	Captain D. Forbes, Nautical Academy, 1, Albion Place.
TYNE	..	Commander E. S. Macleod, R.D., R.N.R., Board of Trade Surveyor's Office, North Shields.
DUBLIN	..	(Captain M. H. Clarke, Chief Surveyor, Ministry of Industry and Commerce, Marine Department, 27, Eden Quay.
HONG KONG	..	Lieut.-Commander P. W. S. Henderson, R.N., Superintendent, Admiralty Chart and Chronometer Depot.
VANCOUVER	..	T. S. H. Shearman, Esq., Room 40, Post Office Building.
AUSTRALIA	..	The Commonwealth Meteorologist.

The Deputy Directors of Navigation act as sub-agents as follows:—

SYDNEY	..	Captain G. D. Williams, D.S.O., Customs House.
MELBOURNE	..	Captain L. J. Bolger, Electricity Commissioners Building, 23, William Street.
FREMANTLE	..	Captain J. J. Airey, Dalgety's Buildings.

LATE PRESS.

DERELICTS AND FLOATING WRECKAGE.

Date.	Position.		Description.
	Latitude.	Longitude.	
NORTH SEA.			
6.3.24	54°55'N.	0°03'W.	Fishing vessel, green, bottom up, awash.
12.3.24	54°00'N.	4°28'E.	Drifter or steam trawler, bottom up, 3 or 4 ft. above water.
13.3.24	54°30'N.	3°40'E.	Derelict, bottom up.
17.3.24	140 miles North of Spurn.	East by of the	Vessel floating bottom upwards, keel about 3 ft. out of water.
19.3.24	54°26'N.	3°55'E.	Floating wreckage, dangerous to navigation.
ENGLISH CHANNEL.			
9.3.24	50°23'N.	2°04'W.	} Mast projecting 6 ft., apparently attached to submerged wreckage, dangerous to navigation. Mast projecting about 5 ft., attached to wreckage. Spar standing out of water 4 ft., with pin rail attached, apparently attached to submerged wreckage.
10.3.24	50°21'N.	2°18'W.	
13.3.24	50°21'N.	2°27'W.	
15.3.24	50°20'N.	2°33'W.	
16.3.24	50°16'N.	2°36'W.	Stump of mast evidently attached to wreckage, showing 4 ft. above water.
23.3.24	49°41'N.	3°54'W.	Large water-soaked log, 20 ft. long, 2 ft. thick, showing 2 ft. above water, dangerous to navigation.
IRISH SEA.			
12.3.24	53°27'N.	4°11'W.	Submerged object.
MEDITERRANEAN.			
25.3.24	35°—N.	18°—E.	Red cone buoy.
NORTH ATLANTIC OCEAN.			
1.3.24	36°33'N.	73°48'W.	Black wooden buoy showing about 8 ft. out of water.
2.3.24	40°19'30'N.	73°18'W.	Several logs, about 35 ft. long, 10 ins. diameter, fastened together.
2.3.24	36°59'N.	60°50'W.	Raft, about 14 ft. square, built of 10 in. timbers, boarded and bolted.
3.3.24	24°45'N.	74°14'W.	Partly submerged object, about 150 ft. long.
5.3.24	40°07'N.	66°55'W.	Large spar, projecting 3 ft. out of water.
5.3.24	41°10'N.	55°06'W.	Piece of timber, about 20 ft. long, 18 ins. diameter.
6.3.24	35°58'N.	73°21'W.	Large spar, projecting about 10 ft. above the water, apparently attached to submerged wreckage.
7.3.24	23°24'N.	74°25'W.	Waterlogged capsized hulk, about 100 ft. long, showing 5 ft. out of water.
9.3.24	48°49'N.	24°32'W.	Red conical buoy.
9.3.24	35°30'N.	45°19'W.	Spar, about 50 ft. long.
9.3.24	38°45'N.	73°38'W.	Three heavy timbers, attached to planking, about 8 ft. long and 6 ft. wide.
9.3.24	38°15'N.	74°49'W.	Bell buoy in working order.
9.3.24	28°57'N.	74°13'W.	Capsized derelict, about 200 ft. long, showing about 8 ft. above water.
10.3.24	29°42'N.	12°04'W.	Capsized wooden hull, 250 ft. long, 4 ft. out of water, keel painted red, very dangerous.
12.3.24	40°08'N.	73°38'W.	} Two large pieces of wreckage. Wreckage. Buoy, vertical white and black stripes, tripod—upper part marked "I."
12.3.24	40°07'N.	73°58'W.	
12.3.24	30°14'N.	75°13'W.	
14.3.24	48°07'N.	7°04'W.	
20.3.24	44°27'N.	24°58'W.	Vertical standing spar, 6 ft. high.
20.3.24	22°55'N.	57°15'W.	Large spar, with apparently heavy weight attached, floating perpendicular.
25.3.24	48°—N.	6°02'W.	Piece of wreckage.
GULF OF MEXICO.			
2.3.24	25°46'N.	85°56'W.	Tree, 30 ft. long, 1 ft. diameter.
5.3.24	28°30'N.	89°00'W.	Partly submerged tree, about 15 ft. long.
7.3.24	26°06'N.	96°05'W.	Large tree, 3 ft. diameter, with large roots.
8.3.24	29°08'N.	94°21'W.	Log, about 40 ft. long and about 4 ft. diameter.
9.3.24	28°58'N.	94°—W.	Red buoy.

LIST OF VOLUNTARY OBSERVING SHIPS.

The following is a complete list of ships regularly contributing observations to the Meteorological Office.

The names of the Captains and Officers, as ascertained from logs and reports received, are given with the date and description of last log, register or report received up to the time of going to press.

Marine Observers are requested to take this as complete and grateful acknowledgment for the work they have contributed, as it has been found necessary to reduce as far as possible the correspondence of the Marine Superintendent, which was largely composed of letters acknowledging logs and reports, in order that more time may be devoted to obtaining results from the data received.

Only in special cases will individual letters be sent.

Excellent awards will be made at the end of the financial year. The names of Commanders and Officers gaining these awards will be published in a special list in "The Marine Observer."

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 number of voluntary observing ships is at present limited to a maximum total of 500.

Commanders are requested to point out any errors which may occur in the list.

M.L. = Equipped with tested Instruments for keeping Meteorological Log.

W.T. = Equipped with tested Instruments for making coded W/T reports to the Meteorological Office, London.

No. = Keeps Ship's Meteorological Report Form 911 with ship's instruments.

C.C. = Equipped with tested Instruments for making Cross Channel Telegraphic Reports to the Meteorological Office, London.

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed.	Date Received.
<i>Aba</i> ...	Hughes, J. ...	W. J. Dodd ...	No.	Elder Dempster ...	Form 911 10.1.24 to 15.2.24 ...	20.2.24.
<i>Abaris</i> ...	Rippon, A. P. ...	R. C. Jones ...	"	L. Walford ...	" 11.8.23 to 21.8.23 ...	24.8.23.
<i>Abinsi</i> ...	Wright, J. B. ...	V. Baddeley ...	"	Elder Dempster ...	" 12.12.23 to 18.1.24 ...	25.1.24.
<i>Actor</i> ...	Haylett, E. ...	F. Medwell ...	"	Harrison ...	" 3.5.23 to 31.5.23 ...	4.6.23.
<i>Adda</i> ...	Toft ...	G. R. Langmaid ...	"	Elder Dempster ...	"	"
<i>Adriatic</i> ...	Beadnell, F. E. ...	A. E. Dyer, J. Collins, G. Howe, R. H. Shaw. ...	W.T.	White Star ...	{ W.T. Reg. 12.11.23 to 1.12.23 ... Form 911 12.11.23 to 1.12.23 ...	6.12.23. 5.12.23.
<i>Agapenor</i> ...	Ramsay, J. ...	P. S. Atkins ...	No.	A. Holt ...	" 16.1.24 to 26.1.24 ...	11.3.24.
<i>Alban</i> ...	Whayman, W. R. ...	H. A. W. Waterhouse ...	"	Booth ...	" 20.10.23 to 8.11.23 ...	24.11.23.
<i>Albania</i> ...	Gibbons, G. R.D. ...	"	"	Cunard ...	" 22.10.23 to 20.11.23 ...	5.12.23.
<i>Aleppo</i> ...	Duncan, W. B. ...	H. B. Smith ...	"	Ellerman Wilson ...	" 28.4.23 to 30.6.23 ...	5.7.23.
<i>Algerian Prince</i> ...	Rowlands, D. ...	R. C. Proctor ...	"	Prince ...	" 15.12.23 to 6.2.24 ...	11.2.24.
<i>Alpore</i> ...	Gordon, L. M. R.D. ...	N. K. Stone ...	"	P. and O. ...	" 11.10.23 to 28.11.23 ...	27.12.23.
<i>Almanzora</i> ...	Mackenzie, G. A. ...	H. Chamberlain ...	"	R.M.S.P. ...	" 11.8.23 to 27.9.23 ...	6.10.23.
<i>Alondra</i> ...	Prendergast, J. J. ...	H. Martin ...	"	Yeoward ...	" 9.2.24 to 3.3.24 ...	13.3.24.
<i>Alpeteo</i> ...	Verstichelen, A. ...	R. Janssen ...	"	American Petroleum ...	" 27.12.23 to 10.2.24 ...	20.2.24.
<i>Anglia</i> ...	Sorge, P. ...	W. H. Hughes ...	C.C.	L.M. & S. Rly. ...	Telegraphic Report 19.2.24 ...	19.2.24.
<i>Antiochus</i> ...	Sprott, E. J. ...	J. J. Daniel ...	No.	A. Holt ...	Form 911 2.1.24 to 18.1.24 ...	11.3.24.
<i>Appam</i> ...	Yardley, H. A. ...	B. Holt, W. H. Muirhead, E. Kingan. ...	M.L.	Elder Dempster ...	Met. Log. 9.8.23 to 5.1.24 ...	10.1.24.
<i>Aquilania</i> ...	Charles, Sir J. T. W., K.B.E., C.B., R.D., Commadore, R.N.R. ...	J. L. Croasdaile, P. A. Morgan, A. T. Hamer. ...	W.T.	Cunard ...	{ W.T. Reg. 27.11.23 to 13.12.23 ... " 19.12.23 to 10.1.24 ...	19.12.23. 14.1.24.
<i>Arafura</i> ...	Gordon, A. S. ...	H. Jeans ...	No.	Eastern and Australian ...	Form 911 18.8.23 to 12.11.23 ...	24.12.23.
<i>Araguaya</i> ...	Matthews, J. E. P. ...	F. J. Elvy ...	"	R.M.S.P. ...	" 17.12.23 to 1.2.24 ...	8.2.24.
<i>Arana</i> ...	Moir, A. G. ...	R. Jones ...	"	" ...	"	"
<i>Armada Castle</i> ...	George, J., O.B.E. ...	L. G. May ...	"	Union Castle ...	Form 911 11.1.24 to 2.3.24 ...	4.3.24.
<i>Arracan</i> ...	Willis, M. ...	R. MacInnes, H. Poole, D. Frame, A. Olding. ...	M.L.	P. Henderson ...	Met. Log. 6.10.23 to 25.12.23 ...	24.1.24.
<i>Arundel</i> ...	Short, H. ...	Mr. Hill ...	C.C.	Southern Rly. ...	Telegraphic Report 13.3.24 ...	13.3.24.
<i>Arundel Castle</i> ...	Hague, J. W., Capt., R.N.R. ...	G. Blailhock, C. Williams, C. Keen. ...	M.L.	Union Castle ...	Met. Log. 3.8.23 to 12.12.23 ...	14.12.23.
<i>Assyria</i> ...	Erskine, R. ...	J. Hamilton ...	No.	Anchor ...	Form 911 25.1.24 to 20.2.24 ...	26.2.24.
<i>Astronomer</i> ...	Booth, W. M. ...	W. A. Hall, J. Jackson, S. Leyland. ...	M.L.	Harrison ...	Met. Log. 20.11.23 to 16.2.24 ...	14.3.24.
<i>Athenic</i> ...	Jones, J. L. ...	A. C. I. Anson ...	No.	White Star ...	Form 911 1.2.24 to 11.2.24 ...	13.3.24.
<i>Atsuta Maru</i> ...	Saito, B. ...	S. Mizogucki ...	"	Nippon Yusen Kaisha ...	" 25.12.23 to 25.1.24 ...	30.1.24.
<i>Auldmuir</i> ...	Ramsay, J. D. ...	P. D. Thompson ...	"	Glen & Co. ...	" 26.1.24 to 10.2.24 ...	15.2.24.
<i>Ausonia</i> ...	Diggle, E. G., R.D., Capt., R.N.R. ...	J. Ashcroft ...	"	Cunard ...	" 10.2.24 to 3.3.24 ...	6.3.24.
<i>Author</i> ...	Kinlock, R. ...	A. Goddard ...	"	Harrison ...	Form 911 29.8.23 to 7.10.23 ...	12.10.23.
<i>Ballena</i> ...	Pape, E. R. ...	W. Webster ...	No.	P.S.N. Co. ...	" 19.9.23 to 11.10.23 ...	15.10.23.
<i>Baltic</i> ...	Roberts, J., C.B.E., D.S.O., R.D., Capt., R.N.R. ...	E. S. Bell, A. E. Weller, G. D. R. Eales, C. Cochrane. ...	W.T.	White Star ...	{ W.T. Reg. 26.11.23 to 15.12.23 ... Form 911 20.1.24 to 10.2.24 ...	20.12.23. 18.2.24.
<i>Bambra</i> ...	Wyles, W. S. ...	H. W. Norris, F. Humble, J. E. Turner, P. Bolton. ...	M.L.	State Service, Australia ...	Met. Log. 8.6.23 to 14.10.23 ...	11.12.23.
<i>Bampton Castle</i> ...	Swiney, W. A. ...	F. Norfolk, L. C. Chapman, H. A. Deller, E. Crocker, C. B. Hoggan. ...	M.L.	Union Castle ...	{ Met. Log. 21.2.23 to 3.5.23 ... " 2.9.23 to 9.12.23 ...	28.1.24.
<i>Banffshire</i> ...	Wynne, R. H. ...	L. W. Evans ...	No.	Turnbull Martin ...	Form 911 17.12.23 to 29.1.24 ...	4.2.24.
<i>Barambah</i> ...	Mayne, W. ...	T. Swann ...	"	Commonwealth Govt. ...	" 4.8.23 to 5.9.23 ...	16.10.23.
<i>Baron Cawdor</i> ...	Baillie, T. ...	A. Campbell ...	"	Hogarth & Sons ...	" 16.1.24 to 28.1.24 ...	11.3.24.
<i>Beaufort</i> ...	Knowles, C. H., D.S.O., Commr., R.N. ...	H. L. Wheeler ...	M.L.	His Majesty's Ship ...	Met. Log. 31.7.22 to 3.10.22 ...	10.10.22.
<i>Belgenland</i> ...	Bradshaw, J. ...	"	M.L.	Red Star ...	"	"
<i>Benalder</i> ...	Cole, J. H., D.S.O. ...	A. K. Watson ...	No.	Ben Line ...	Form 911 6.9.23 to 6.10.23 ...	24.10.23.
<i>Benedict</i> ...	Aspinall, W. ...	H. R. Mackay, K. S. Monro ...	"	Booth ...	" 17.6.23 to 13.8.23 ...	27.8.23.
<i>Bengloe</i> ...	McCorquodale, A. ...	G. M. Duff ...	"	Ben Line ...	" 27.1.24 to 10.2.24 ...	3.3.24.
<i>Berengaria</i> ...	Irvine, W. R. D., R.D. Capt., R.N.R. ...	J. A. Myles, G. Overton, E. R. Taylor, R. F. Bovey. ...	W.T.	Cunard ...	W.T. Reg. 7.2.24 to 21.2.24 ...	25.2.24.

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed.	Date Received.
<i>Bernini</i> ...	Evans, W. ...	J. C. Dawson ...	No.	Lampert & Holt ...	Form 911 7.10.23 to 10.12.23...	30.12.23.
<i>Berrima</i> ...	Hussey Cooper, E. M., R.D., Commr., R.N.R.	J. S. Wheeler ...	"	P. & O. Branch ...	" 21.11.23 to 5.12.23...	28.12.23.
<i>Bolingbroke</i> ...	Landy, E., Sargent, A. H., Aikman, E. ...	R. Campbell, R. F. Walker, W. P. Hains.	M.L.	Canadian Pacific ...	Met. Log. 22.2.23 to 18.10.23...	14.11.23.
<i>Borda</i> ...	Holland, R. ...	...	No.	P. & O. Branch ...	Form 911 18.10.23 to 24.2.24...	29.2.24.
<i>Bosworth</i> ...	McDonald, J. ...	J. Alexander ...	M.L.	Canadian Pacific ...	Met. Log. 19.5.23 to 8.8.23 ...	29.8.23.
<i>Bothwell</i> ...	Dott, J. F. ...	K. Hutchings ...	No.	...	Form 911 1.2.24 to 15.2.24 ...	18.2.24.
<i>Braemar Castle</i> ...	Whitfield, G. I. ...	C. G. Dann ...	"	Union Castle ...	" 27.9.23 to 23.1.24 ...	31.1.24.
<i>Brandon</i> ...	Freer, A., R.D., Commr., R.N.R.	J. Mackenzie ...	"	Canadian Pacific ...	" 21.10.23 to 20.11.23	27.11.23.
<i>Brecon</i> ...	Griffiths, J. N. ...	...	M.L.	...	Met. Log. 9.5.23 to 29.7.23 ...	27.8.23.
<i>Brighton</i> ...	Hill, A. ...	Mr. Munton ...	C.C.	Southern Railway ...	Telegraphic Report 14.3.24 ...	14.3.24.
<i>British Engineer</i> ...	Piper, H. C. ...	A. Campbell ...	...	British Tankers ...	Form 911 17.11.23 to 8.1.24 ...	14.1.24.
<i>British Lantern</i> ...	Taylor, R. J. ...	C. O. Tucker ...	"	...	" 5.1.24 to 23.1.24 ...	25.2.24.
<i>Browning</i> ...	Davies, G. W. ...	W. Simcox ...	"	Lampert & Holt ...	" 13.3.23 to 9.4.23 ...	14.4.23.
<i>Bruyere</i> ...	Heasley, W. S. ...	W. S. Perry ...	"	...	" 22.12.23 to 8.3.24 ...	12.3.24.
<i>Bulla</i> ...	Daniel, F. ...	...	"	Commonwealth Govt.	" 28.4.23 to 17.5.23 ...	5.6.23.
<i>Cabotia</i> ...	Lawson, — ...	...	No.	Anchor Donaldson ...	...	...
<i>Calyso</i> ...	Brown, A. M. ...	A. Snowden, E. Ford, J. S. Landers.	M.L.	Ellerman's Wilson ...	Met. Log. 20.10.22 to 11.11.23	27.11.23.
<i>Cambria C.S.</i> ...	Wightman, H. G. E., D.S.C.	...	M.L.	Eastern Tel. Co. ...	...	...
<i>Cambria</i> ...	...	V. S. Phillips ...	C.C.	L.M. & S. Rly. ...	Telegraphic Report 29.2.24 ...	29.2.24.
<i>Camito</i> ...	Scudamore, J. H. H., D. S. C., R.D., Commr., R.N.R.	D. A. Jack, D. Hay, D. V. Smith.	M.L.	Elders & Fyffes ...	Met. Log. 23.10.23 to 23.2.24...	28.2.24.
<i>Canada</i> ...	Smith, R. S. ...	F. W. Laws ...	No.	White Star-Dominion	Form 911 3.12.23 to 22.12.23...	24.12.23.
<i>Canadian Inventor</i> ...	Roberts, R. P. ...	S. M. Holinden ...	"	Canadian Govt. Mer- chant Marine.	" 19.9.23 to 22.10.23...	11.2.24.
<i>Canadian Scottish</i> ...	Millar, W. H. ...	S. Fieldhouse ...	"	" " "	" 19.8.23 to 1.12.23 ...	7.1.24.
<i>Canadian Skir- misher.</i> ...	Millar, W. H. ...	G. B. Price ...	"	" " "	" 28.5.23 to 5.8.23 ...	5.9.23.
<i>Carlow Castle</i> ...	...	R. C. Longman ...	W.T.	Union Castle	...	...
<i>Carmania</i> ...	McNeil, S. G. S., R.D., Capt., R.N.R.	P. J. Robinson, J. S. Glendinning, H. R. Lane.	W.T.	Cunard ...	W.T. Reg. 25.10.23 to 18.11.23	20.11.23.
<i>Caronia</i> ...	Diggle, E. G., R.D., Capt., R.N.R.	J. H. Wood, R. Allen, G. H. Morris.	W.T.	...	W.T. Reg. 7.10.23 to 27.10.23...	30.10.23.
<i>Carpentaria</i> ...	Rowe, S. N. ...	...	M.L.	British India ...	Form 911 7.10.23 to 27.10.23...	31.10.23.
<i>Cassandra</i> ...	Mitchell, W. E. ...	A. Murray ...	No.	Anchor Donaldson ...	Met. Log. 22.4.23 to 16.10.23...	27.11.23.
<i>Cedric</i> ...	Metcalfe, G. R., Lt.- Commr., R.N.R.	T. F. P. Pratt, W. Pearson, J. W. Peters.	W.T.	White Star ...	Form 911 26.10.23 to 19.11.23	27.11.23.
<i>Celtic</i> ...	Greame, C. H., R.D., Commr., R.N.R.	R. S. Walker, O. V. Lucas, G. T. Kavanagh, H. J. Yates.	W.T.	" " "	Form 911 4.2.24 to 23.2.24 ...	27.2.24.
<i>Ceramic</i> ...	Summers, A. H. ...	H. A. Billiald ...	No.	...	Form 911 3.2.24 to 23.2.24 ...	26.2.24.
<i>Changsha</i> ...	Frame, A. M. ...	...	M.L.	...	W.T. Reg. 18.11.23 to 9.12.23...	11.12.23.
<i>Chignecto</i> ...	Green, J. ...	A. F. Walker ...	No.	...	Form 911 17.12.23 to 5.1.24 ...	7.1.24.
<i>China</i> ...	King, A. M., D.S.C.	E. Cox Walker ...	"	...	Form 911 18.11.23 to 9.12.23...	12.12.23.
<i>Chindwara</i> ...	Jones, W. H. ...	C. E. Cara ...	M.L.	British India ...	Form 911 17.12.23 to 5.1.24 ...	7.1.24.
<i>Chindwin</i> ...	Esslemont, C. ...	J. Walker, W. Wilson, A. McCallum.	M.L.	P. Henderson ...	Met. Log. 22.9.23 to 6.12.23 ...	12.12.23.
<i>Chinhua</i> ...	Bvers, G. ...	...	No.	China Nav. Co. ...	" 25.10.22 to 23.7.23...	6.9.23.
<i>City of Alexandria</i> ...	Bedford, G. B. ...	T. C. Higgins ...	No.	Ellerman ...	...	...
<i>City of Baroda</i> ...	Haddy, B. H. ...	A. V. Radcliffe, R. J. Witton, A. B. Carson.	M.L.	...	Met. Log. 20.6.23 to 15.9.23 ...	4.10.23.
<i>City of Batavia</i> ...	Spencer, H. ...	B. Moloney ...	No.	...	Form 911 23.1.24 to 22.2.24 ...	26.2.24.
<i>City of Benares</i> ...	Macdonald, K., O.B.E.	A. A. Fullerton ...	"	...	" 6.2.24 to 7.3.24 ...	14.3.24.
<i>City of Brisbane</i> ...	Pine, R. ...	W. Robinson ...	"	...	" 23.11.23 to 14.12.23 ...	12.2.24.
<i>City of Canterbury</i> ...	Bremner, D. M. ...	W. H. Matheson ...	"	...	" 21.9.23 to 3.10.23 ...	8.10.23.
<i>City of Chester</i> ...	Teague, R. E. ...	F. S. Honeyman, P. C. Wilson, M. G. Fraser.	M.L.	...	Met. Log. 3.8.23 to 29.10.23 ...	31.10.23.
<i>City of Dunkirk</i> ...	Seaborne, F. O. ...	W. Leadbeater ...	No.	...	Form 911 21.9.23 to 4.10.23 ...	17.10.23.
<i>City of London</i> ...	Martin, D. ...	C. Inglis ...	"	...	" 10.2.24 to 21.2.24 ...	4.3.24.
<i>City of Marseilles</i> ...	Henderson, R. C. ...	G. M. Womersley ...	"	...	" 31.10.23 to 19.12.23 ...	24.12.23.
<i>City of Newcastle</i> ...	Oliver, R. E., D.S.C.	C. Paton ...	"	...	" 26.9.23 to 22.10.23...	31.10.23.
<i>City of Rangoon</i> ...	Williams, T. L. ...	W. Ibbotson, S. L. Hoare, T. A. Dexter.	M.L.	...	Met. Log. 25.4.23 to 9.8.23 ...	16.8.23.
<i>City of Valencia</i> ...	Williamson, W. A. ...	A. R. Muir ...	No.	...	Form 911 2.7.23 to 7.8.23 ...	14.8.23.
<i>City of Yokohama</i> ...	Jinks, J. W. ...	J. C. McWhirter ...	"	...	" 23.10.23 to 12.11.23 ...	24.11.23.
<i>Clan Buchanan</i> ...	George, L. S. ...	P. G. de Gruchy ...	"	Clan ...	" 11.10.23 to 10.1.24 ...	14.1.24.
<i>Clan Lindsay</i> ...	Baker, C. W. ...	S. J. Shennan ...	"	...	" 19.1.24 to 15.2.24 ...	11.3.24.
<i>Clan Macbeth</i> ...	Young, A. H. ...	D. S. Rae ...	"	...	" 4.1.24 to 29.1.24 ...	13.3.24.
<i>Clan Macgillivray</i> ...	Young, A. H. ...	A. Campbell ...	"	...	" 27.11.23 to 8.12.23...	13.12.23.
<i>Clan Macindoe</i> ...	Miller, W. ...	D. A. Stark ...	"	...	" 6.9.23 to 29.11.23 ...	7.12.23.
<i>Clan Macinnes</i> ...	Mee, F. T. ...	A. Lynch, R. Dando ...	"	...	" 4.12.22 to 25.3.23 ...	17.4.23.
<i>Clan Mackay</i> ...	Rayner East, H. ...	J. A. Forster, J. Steven, J. E. Gordon.	M.L.	...	Met. Log. 30.6.23 to 25.10.23...	30.10.23.
<i>Clan Mackellar</i> ...	Cowie, J. G. ...	C. W. Banbury, W. S. Simpson	No.	...	Form 911 15.1.24 to 31.1.24 ...	25.2.24.
<i>Clan Mackenzie</i> ...	Young, G. ...	W. G. Arthur, J. M. Lorimer	"	...	" 17.11.23 to 13.12.23 ...	24.12.23.
<i>Clan Mackinnon</i> ...	Thomson, W. ...	V. Wilson, W. S. Holden, T. Kay.	M.L.	...	Met. Log. 6.9.23 to 24.2.24 ...	27.2.24.
<i>Clan Macnaughton</i> ...	Gray, J. N. ...	A. G. Storkey, F. Burnes ...	No.	...	Form 911 19.1.24 to 24.2.24 ...	26.2.24.
<i>Clan Macphee</i> ...	Gourlay, J. B. ...	P. H. Aydon, J. H. Mellor, J. Macdougall.	M.L.	...	Met. Log. 26.5.23 to 21.11.23...	17.1.24.
<i>Clan Maclair</i> ...	Phillips, G. P. ...	J. O. Woodall ...	No.	...	Form 911 28.11.23 to 30.12.23 ...	2.1.24.
<i>Clan Malcolm</i> ...	Higgins, C. J. ...	T. G. Young, A. Cameron ...	M.L.	...	Met. Log. 5.8.23 to 10.11.23 ...	14.11.23.
<i>Clan Morrison</i> ...	Porterfield, W. M. ...	D. A. Evans ...	No.	...	Form 911 28.7.23 to 11.8.23 ...	22.8.23.
<i>Clan Murdoch</i> ...	Pagan, Q. C. ...	R. E. Owen ...	"	...	...	...
<i>Clan Ranald</i> ...	Henderson, C. W. ...	S. J. Green ...	"	...	Form 911 8.12.23 to 22.1.24 ...	28.1.24.
<i>Clan Ross</i> ...	Christian, W. G. M. ...	P. M. Werrey Easterbrook ...	"	...	" 3.8.23 to 8.10.23 ...	19.10.23.
<i>Clan Sinclair</i> ...	Neill, G. A. ...	F. B. Parker ...	"	...	" 27.1.24 to 6.2.24 ...	4.3.24.
<i>Clan Urquhart</i> ...	Sharpand, C. C. ...	R. H. Law ...	"	...	" 17.1.24 to 8.2.24 ...	6.3.24.

LIST OF VOLUNTARY OBSERVING SHIPS

iii

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment	Line.	Last Log, Register, or Report Contributed.	Date Received.
<i>Colonia, C.S.</i> ...	Campos, V., O.B.E., Lt.-Comdr. R.N.R.	S. A. Garnham, A. S. Muir, W. E. Allen, S. Hall.	M.L.	Telegraph Construction & Maintenance.	Met. Log. 27.10.23 to 22.11.23	26.11.23.
<i>Colonial</i> ...	Barrow, R. K. ...	A. V. Jones ...	No.	Harrison ...	Form 911 15.9.23 to 29.11.23...	20.12.23.
<i>Colombia</i> ...	Gittins, R. P. ...	J. Crangle ...	"	Leyland ...	" 9.2.24 to 21.2.24 ...	10.3.24.
<i>Columbia</i> ...	Gemmell, W. ...	S. G. Taylor ...	"	Anchor ...	" 16.2.24 to 25.2.24 ...	14.3.24.
<i>Comino</i> ...	Nuttall, E. L. ...	A. McVicar ...	"	Furness Withy ...	" 3.1.24 to 15.2.24 ...	7.3.24.
<i>Cooee</i> ...	Festa, M. ...	C. Keen, D. C. Rees ...	"	Commonwealth Govt. ...	" 29.6.23 to 16.8.23 ...	8.10.23.
<i>Copenhagen</i> ...	Kerr, J. J. ...	W. G. Rees ...	"	Glen & Co. ...	" 27.4.23 to 6.6.23 ...	23.7.23.
<i>Corinthic</i> ...	Hart, F. ...	W. T. Fitzgerald, M. Bennett, F. G. Rogers.	M.L.	White Star ...	Met. Log. 26.1.23 to 15.5.23 ...	22.5.23.
<i>Cornish City</i> ...	Bowen, T. S. ...	G. S. Dawes ...	No.	Reardon Smith ...	Form 911 16.11.23 to 21.12.23	7.1.24.
<i>Cornwall</i> ...	Robertson, H. W. ...	W. W. Glover ...	"	Dowie, J., & Co. ...	" 5.12.23 to 26.12.23...	18.2.24.
<i>Cyclops</i> ...	Cosker, W. ...	J. P. Makepeace ...	"	A. Holt ...	" 9.12.23 to 3.1.24 ...	3.3.24.
<i>Dardanus</i> ...	Shaw, A. T. ...	A. Morton ...	No.	A. Holt ...	Form 911 23.11.23 to 6.2.24 ...	8.2.24.
<i>Darian</i> ...	Masters, W. ...	G. F. Parkinson ...	"	Leyland ...	" 2.2.24 to 14.2.24 ...	25.2.24.
<i>Darro</i> ...	Smith, W. E., D.S.O., R.D., Capt. R.N.R.	E. H. Giller ...	"	R.M.S.P. Co. ...	" 17.11.23 to 13.1.24...	17.1.24.
<i>Daytonian</i> ...	Walker, C. J., D.S.O.	W. T. Golwin ...	"	Leyland ...	" 21.12.23 to 25.1.24...	30.1.24.
<i>Delta</i> ...	Brooks, C., D.S.O., R.D., Commr. R.N.R.	J. O. V. Young ...	"	P. & O. ...	" 2.2.24 to 22.2.24 ...	3.3.24.
<i>Demerara</i> ...	Hill, T. A. ...	H. J. Holland, A. Hambly ...	"	R.M.S.P. Co. ...	" 1.1.24 to 24.2.24 ...	29.2.24.
<i>Demosthenes</i> ...	Williams, ...	R. Woodgates ...	"	Aberdeen ...	" 8.12.23 to 26.1.24 ...	30.1.24.
<i>Desado</i> ...	Wakeman, E. C. ...	T. Powell, F. Collinson ...	"	R.M.S.P. Co. ...	Form 911 16.12.23 to 9.2.24 ...	14.2.24.
<i>Desna</i> ...	Adam, C., R.D., Commr. R.N.R.	H. D. Jackman ...	"	"	"	"
<i>Deucalion</i> ...	Batt, A. E. ...	W. G. Smith ...	"	A. Holt ...	" 5.2.24 to 19.2.24 ...	22.2.24.
<i>Devon</i> ...	Gardner, H. W. ...	"	"	New Zealand S.S. Co. ...	" 23.8.23 to 13.10.23...	19.10.23.
<i>Dieppe</i> ...	Marmery, S. ...	Mr. Parsons ...	C.C.	Southern Railway ...	Telegraphic Report. 24.1.24 ...	24.1.24.
<i>Digby</i> ...	Chambers, F. W., D.S.C.	J. Pascoe, J. W. Murphy, W. P. Paterson.	M.L.	Furness Withy ...	Met. Log. 29.3.23 to 22.9.23 ...	3.10.23.
<i>Discoverer</i> ...	Worthington, B. Sawyer, E. I.	J. Stanhope ...	No.	Harrison ...	Form 911 21.8.23 to 8.12.23 ...	7.3.24.
<i>Dogra</i> ...	Blance, T. ...	H. Hardwick ...	"	Asiatic S.N. Co. ...	" 6.12.23 to 17.2.24 ...	11.3.24.
<i>Domala, M.V.</i> ...	Whittingham, W. E.	C. E. Merchant ...	"	British India ...	"	"
<i>Doric</i> ...	Davies, J. ...	A. Thompson ...	"	White Star ...	Form 911 27.1.24 to 17.2.24 ...	21.2.24.
<i>Dorington Court</i> ...	Barcham, H. C. ...	H. Tulloch ...	"	Haldin & Co. ...	" 23.5.23 to 12.6.23 ...	19.6.23.
<i>Dramatist</i> ...	Gibbings, W. H. ...	R. W. Roberts ...	"	Harrison ...	" 2.10.23 to 2.11.23 ...	8.11.23.
<i>Dromore Castle</i> ...	Linklater, H. ...	S. S. Smith ...	"	Union Castle ...	" 11.11.23 to 1.12.23...	4.2.24.
<i>Dryden</i> ...	Knight, R. A. ...	G. D. Oldfield ...	"	Lampart & Holt ...	" 28.10.23 to 2.1.24 ...	18.2.24.
<i>Dundrum Castle</i> ...	Mumford, C. E. ...	H. Bunn ...	"	Union Castle ...	"	"
<i>Duendes</i> ...	Pape, E. R. ...	"	"	Pacific S.N. Co. ...	" 10.2.24 to 4.3.24 ...	6.3.24.
<i>Duquesa</i> ...	Merville, A. ...	C. Lockwood, R. Martin, D. Thornton.	"	Furness Withy ...	" 21.12.23 to 17.2.24...	28.2.24.
<i>Durenda</i> ...	Wilson, W. ...	W. Cruse, C. McFarlane ...	"	British India ...	" 17.2.24 to 11.3.24 ...	14.3.24.
<i>Eastern</i> ...	Laing, J. D. ...	J. W. Kavanagh, F. R. Miller, H. H. Litchfield.	M.L.	Eastern and Australian	Met. Log. 14.2.23 to 16.8.23 ...	8.10.23.
<i>Ebani</i> ...	Faill, — ...	W. McKeown ...	No.	Elder Dempster ...	"	"
<i>Edinburgh Castle</i> ...	Culverwell, J. N., Strong, H., R.D., Commr. R.N.R.	— Perkins ...	M.L.	Union Castle ...	" 13.7.23 to 13.11.23...	21.11.23.
<i>Eemland</i> ...	Van Noppen, C. D.	G. W. Yonwen ...	No.	Holland Lloyd ...	Form 911 26.8.23 to 18.11.23...	11.12.23.
<i>Egori</i> ...	McDowall, J. ...	K. Redmore ...	"	Elder Dempster ...	" 25.11.23 to 10.12.23	12.12.23.
<i>El Cordobes</i> ...	Noton, F. G. ...	N. H. Oldham ...	"	British & Argentine S.N. Co.	" 4.1.24 to 4.2.24 ...	8.2.24.
<i>Elmina</i> ...	Millson, H. E. ...	"	M.L.	Elder Dempster ...	Met. Log. 20.9.23 to 13.12.23...	4.3.24.
<i>El Paraguay</i> ...	Ellis, F., D.C.M. ...	W. E. Williams ...	No.	Houlder Bros. ...	Form 911 30.12.23 to 29.2.24...	4.3.24.
<i>Elpenor</i> ...	Evans, T. R. ...	D. L. Evans, C. Houghton, L. Johnstone, C. Mock.	M.L.	A. Holt ...	Met. Log. 12.8.23 to 26.11.23...	1.12.23.
<i>Elysia</i> ...	Evans, D. L. ...	"	"	"	"	"
<i>Empress of Asia</i> ...	Kinnaird, J. ...	A. Grant ...	No.	Anchor ...	Form 911 17.11.23 to 7.12.23...	1.1.24.
<i>Empress of Australia</i> ...	Douglas, L. D., R.D., Lt. Commr. R.N.R.	F. C. Stratford ...	M.L.	Canadian Pacific ...	Met. Log. 4.10.23 to 28.1.24 ...	5.3.24.
<i>Empress of Britain</i> ...	Robinson, S., C.B.E., R.D., Commr. R.N.R.	"	M.L.	"	" 24.11.22 to 23.5.23...	26.6.23.
<i>Empress of Canada</i> ...	Latta, R. G. ...	S. C. Fox, J. B. Marriott, O. F. Pennington.	W.T.	"	W.T. Reg. 18.10.23 to 2.11.23 } Form 911 Met. Log. 29.6.23 to 6.12.23 ...	6.11.23. 8.1.24.
<i>Empress of France</i> ...	Hailey, A. J. ...	"	M.L.	"	"	"
<i>Empress of Russia</i> ...	Robinson, S., C.B.E., R.D., Commr. R.N.R.	"	"	"	"	"
<i>Endeavour</i> ...	Griffiths, E. ...	R. V. Everett, A. S. Phillips, B. Grant.	M.L.	"	" 13.6.23 to 17.11.23...	21.11.23.
<i>Essequibo</i> ...	Hosken, A. J. ...	A. B. Smith, J. D. Vosper, J. P. Napier, C. S. Morris, J. M. H. Twibill, R. H. Graham.	M.L.	"	" 12.7.23 to 17.12.23...	29.1.24.
<i>Eumaeus</i> ...	Geary Hill, S. A., D.S.O., Commr. R.N.	"	"	"	"	"
<i>Euripides</i> ...	Nares, J. D., D.S.O., Capt. R.N.	H. Exton Turner ...	M.L.	His Majesty's Ship ...	" 3.7.22 to 8.6.23 ...	18.6.23.
<i>Eurybates</i> ...	Pearce, A. W. ...	G. Pattison ...	No.	R.M.S.P. Co. ...	Form 911 7.12.23 to 23.1.24 ...	4.2.24.
<i>Explorer</i> ...	Read, J. W. ...	E. R. Pritchard ...	"	A. Holt ...	" 19.2.24 to 26.2.24 ...	6.3.24.
<i>Fitzroy</i> ...	Collins, P. J., O.B.E.	H. S. Cox, A. R. Payne, F. Fuller.	M.L.	Aberdeen ...	Met. Log. 25.8.23 to 12.12.23...	27.12.23.
<i>Flandria</i> ...	Lloyd, R. ...	J. A. Havard ...	No.	A. Holt ...	Form 911 9.1.24 to 23.1.24 ...	4.3.24.
<i>Flinders</i> ...	Lamont, A. ...	Scientific Staff ...	M.L.	Scottish Fishery Board ...	Met. Log. 9.4.23 to 30.11.23 ...	27.11.23.
<i>Francisco</i> ...	Woodhouse, A. F. B., Lt.-Commr. R.N.	C. W. Sabine ...	M.L.	His Majesty's Ship ...	" 25.7.23 to 1.11.23 ...	10.11.23.
<i>Frankel</i> ...	Veldkamp, G. J. ...	H. D. Sicherer ...	No.	Holland Lloyd ...	Form 911 6.11.23 to 19.12.23...	24.12.23.
<i>Frankfjels</i> ...	Henderson, D. A., Lt.-Commr. R.N.	A. B. Foulston ...	M.L.	His Majesty's Ship ...	Met. Log. 25.7.23 to 1.11.23 ...	10.11.23.
<i>Freienfels</i> ...	Wilkins, J., O.B.E.	J. A. Vickers ...	No.	Ellerman Wilson ...	Form 911 16.12.23 to 22.1.24...	26.1.24.
<i>Gallie</i> ...	Gatley, E. ...	H. J. Prout ...	"	Royal Fleet Auxiliary ...	" 20.6.23 to 15.9.23 ...	27.11.23.
<i>Gallie</i> ...	Gardiner, J. ...	J. W. Allingham, T. Chernside, G. E. Thomas.	M.L.	India Office Shipping ...	Met. Log. 2.9.23 to 10.12.23 ...	18.12.23.
<i>Gallie</i> ...	Cleugh, J. W. ...	C. F. Bennett, H. Wilson, R. Soper.	"	"	" 10.11.23 to 29.2.24...	10.3.24.
<i>Gallie</i> ...	Summers, F. F., R.D., Commr. R.N.R.	H. C. Rugg ...	No.	White Star ...	" 7.11.23 to 9.12.23 ...	14.12.23.

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log Register, or Report Contributed.	Date Received.
<i>Galtymore</i> ...	Ledsome, J. S. ...	D. Wilson ...	No.	Furness Withy ...	Form 911 18.1.24 to 29.1.24 ...	1.2.24.
<i>Garret</i> ...	Visser, C. W. ...	S. de Boo ...	"	Rotterdam Lloyd ...	" 18.1.24 to 22.2.24 ...	7.3.24.
<i>Garthgarry, Ship</i> ...	Roberts, D. ...	W. Wylie, J. Pearce, H. Bento ...	M.L.	Marine Nav. Co. ...	Met. Log. 15.7.22 to 27.7.23 ...	4.10.23.
<i>Gascoyne</i> ...	Mills, A. ...	P. G. Collins ...	No.	Dalgaty & Co. ...	Form 911 2.12.23 to 14.1.24 ...	25.2.24.
<i>Gelria</i> ...	Kolkman, J. M. ...	" ...	"	Holland Lloyd ...	" 23.11.23 to 2.1.24 ...	14.1.24.
<i>Gladiator</i> ...	Ruffell, — ...	D. H. Bryant, W. E. Shotton ...	"	Harrison ...	" 7.1.24 to 8.3.24 ...	12.3.24.
<i>Glenamoy, M.V.</i> ...	Angier, J. ...	L. C. Riggs ...	"	Glen Line ...	Form 911 6.11.23 to 25.1.24 ...	11.2.24.
<i>Glenapp, M.V.</i> ...	Griffiths, J. E. ...	F. Poate ...	"	" ...	" 8.1.24 to 27.1.24 ...	4.2.24.
<i>Glenluce, M.V.</i> ...	Kennett, W. H. ...	A. Hodd ...	"	" ...	" 12.9.23 to 10.12.23 ...	14.12.23.
<i>Gloucestershire</i> ...	Robin, E. ...	T. E. Field ...	"	Bibby ...	" 8.12.23 to 17.2.24 ...	19.2.24.
<i>Gorala</i> ...	D'Cruz, A. B. ...	A. R. H. Barton ...	"	British India ...	" 2.11.23 to 13.11.23 ...	27.12.23.
<i>Gorgon</i> ...	Hughes, J. W. ...	J. E. Cooper ...	"	Dalgaty & Co. ...	" 16.11.23 to 29.12.23 ...	11.2.24.
<i>Governor Musgrave</i> ...	Coastad, C. ...	C. B. Odman, E. W. Hughes ...	"	Commonwealth Light-house Service.	" 20.7.23 to 11.10.23 ...	5.12.23.
<i>Graciana</i> ...	Yeoman, J. T. ... Clark, J. ...	P. Hays, M. C. Turner ...	M.L.	Furness Withy ...	Met. Log. 23.3.22 to 29.9.22 ...	25.10.22.
<i>Haliartus</i> ...	Marsh, L. V. ...	W. H. Upton ...	No.	R. P. Houston ...	" 16.8.23 to 3.10.23 ...	20.11.23.
<i>Harmonides</i> ...	Hughes, W. J. ...	R. P. Davies ...	"	" ...	" 31.1.24 to 6.2.24 ...	25.2.24.
<i>Harmony, Auxy.</i> ...	Jackson, J. C. ...	A. W. Bush ...	"	Moravian Mission ...	" 15.11.23 to 5.3.24 ...	19.12.23.
<i>Hatarana</i> ...	Cutbush, H. M. ...	J. L. Durkee, F. Wells, E. B. Heath.	M.L.	British India ...	Met. Log. 28.4.23 to 25.7.23 ...	8.8.23.
<i>Hauraki, M.V.</i> ...	Thompson, R. F. ...	" ...	"	Union S.S. Co., N.Z. ...	Form 911 27.10.23 to 4.1.24 ...	11.2.24.
<i>Hazel Branch</i> ...	Shoeman, A. C. ...	D. McLeish ...	No.	Nautilus ...	" 16.3.23 to 18.6.23 ...	23.6.23.
<i>Henry Holmes, C.S.</i> ...	Barnet, P. K. ...	R. S. Young ...	"	W. I. & Panama Telegraph Co.	" 3.1.24 to 26.1.24 ...	22.2.24.
<i>Herald</i> ...	Bicker-Caarten, A. ...	R. Rudd. ...	"	His Majesty's Ship ...	" ...	"
<i>Herefordshire</i> ...	Harvey, J. R., Commr., R.N.	" ...	M.L.	" ...	" ...	"
<i>Herschel</i> ...	Stanley, W. ...	P. Flood, G. Whitworth, P. S. Cooper, H. Moore.	"	Bibby ...	Met. Log. 18.8.23 to 30.1.24 ...	22.2.24.
<i>Hibernia</i> ...	Carey, W. J. ...	S. C. Smith ...	No.	Lampport & Holt ...	Form 911 8.12.23 to 14.2.24 ...	16.2.24.
<i>Highland Enterprise</i> ...	Tanner ...	R. Woodall ...	C.C.	L.M. & S. Rly. ...	Telegraphic Report. 13.3.24 ...	13.3.24.
<i>" Glen</i> ...	Pond, R. H. ...	D. R. S. Webster ...	No.	Nelson ...	Form 911 22.12.23 to 5.3.24 ...	11.3.24.
<i>" Heather</i> ...	Jones, T. J. ...	H. H. Thomas ...	"	" ...	Form 911 17.12.23 to 9.2.24 ...	25.2.24.
<i>" Laddie</i> ...	Powell, G. A. ...	G. Watson, R. Sinclair Davies, J. C. Morton.	M.L.	" ...	Met. Log. 23.12.22 to 22.3.23 ...	28.3.23.
<i>" Laird</i> ...	Alford, C. ...	S. E. Jackson ...	No.	" ...	Form 911 1.1.24 to 24.2.24 ...	28.2.24.
<i>" Piper</i> ...	Davis, G. O. ...	A. S. Jones, J. S. Collins, J. H. Cables.	M.L.	" ...	Met. Log. 1.9.23 to 14.1.24 ...	16.1.24.
<i>" Pride</i> ...	Collings, D. ...	H. McKinnon, H. Devlin, R. R. Soanes.	"	" ...	" 16.8.23 to 1.1.24 ...	9.1.24.
<i>" Rover</i> ...	Robinson, R. H. ...	W. Watson, S. G. King, F. Abbott.	"	" ...	" 14.6.23 to 7.11.23 ...	16.11.23.
<i>" Warrior</i> ...	Ashby Graves, F. ...	W. T. Breen ...	No.	" ...	Form 911 1.1.24 to 22.2.24 ...	27.2.24.
<i>Hobsons Bay</i> ...	Brooke, W. ...	J. E. Williams, E. Bailie, Mr. Edwards.	M.L.	Commonwealth Govt. ...	Met. Log. 27.11.23 to 29.2.24 ...	12.3.24.
<i>Holbein</i> ...	Kydd, O. J. ...	G. P. Kitto ...	No.	Lampport & Holt ...	Form 911 25.11.23 to 15.12.23 ...	24.12.23.
<i>Homerio</i> ...	Symons, P. ...	W. Hill, F. Patchett ...	W.T.	White Star ...	W.T. Reg. 27.9.23 to 13.10.23 ...	16.10.23.
<i>Honorius</i> ...	Howarth, F. B., Commr., R.N.R.	" ...	"	" ...	Form 911 " ...	"
<i>Huanchaco</i> ...	Samuels, — ...	" ...	No.	R. P. Houston ...	" ...	"
<i>Hubert</i> ...	Redyard, A. ...	H. G. Cruickshank, J. Aldhouse.	"	Pacific S.N. Co. ...	Form 911 4.11.23 to 16.2.24 ...	5.3.24.
<i>Hurunui</i> ...	Evans, T. G. ...	C. C. Beal ...	"	Booth ...	" 24.12.23 to 7.1.24 ...	11.2.24.
<i>Ibex</i> ...	Burton Davies, J. ...	A. Smith, S. Bryant, J. Carpenter.	M.L.	New Zealand S.S. Co. ...	Met. Log. 2.2.23 to 22.6.23 ...	6.7.23.
<i>Ikal</i> ...	Langdon, C. ...	" ...	C.C.	G.W. Railway ...	Telegraphic Report. 13.3.24 ...	13.3.24.
<i>Iroquois</i> ...	Meetham, J. T. ...	E. Lightfoot ...	No.	Welsford, J. H. ...	Form 911 9.6.23 to 19.6.23 ...	26.7.23.
<i>Ixion</i> ...	Tinson, C. W., O.B.E., Commr., R.N.	R. H. Lucy, C. R. Brent, G. A. R. J. Leslie, E. E. Addis.	M.L.	His Majesty's Ship ...	Met. Log. 1.8.23 to 28.11.23 ...	10.1.24.
<i>John Pender, C.S.</i> ...	Baetens, F. ...	A. K. Sanderson ...	No.	" ...	" ...	"
<i>Junin</i> ...	Smythe, T. W., O.B.E.	B. C. Farrow ...	No.	Eastern Tel. Co. ...	" 18.1.24 to 7.2.24 ...	19.2.24.
<i>Kaikoura</i> ...	Benson, C. W. ...	R. D. Eckford ...	"	Pacific S.N. Co. ...	" 22.11.23 to 30.12.23 ...	4.1.24.
<i>Kaisar-i-Hind</i> ...	Downton, M. ...	H. Emmett, C. Pilcher, N. Anderson, J. Hopkins.	M.L.	New Zealand S.S. Co. ...	Met. Log. 19.6.22 to 23.6.23 ...	26.6.23.
<i>Kamo Maru</i> ...	Manley, G. ...	H. J. M. Perry ...	No.	P. & O. ...	Form 911 25.10.23 to 19.1.24 ...	19.2.24.
<i>Kangaroo</i> ...	Okano, Y. ...	S. Matsumura ...	"	Nippon Yusen Kaisha ...	" 29.11.23 to 2.1.24 ...	8.1.24.
<i>Karroo</i> ...	Norris, H. C. ...	G. Buckridge, R. J. Sinclair, F. Humble.	M.L.	State Service Australia ...	Met. Log. 4.6.23 to 1.11.23 ...	20.12.23.
<i>Kashima Maru</i> ...	Robinson, T. ...	S. J. Nash ...	No.	Ellerman Bucknall ...	Form 911 30.6.23 to 11.7.23 ...	27.7.23.
<i>Kashmir</i> ...	Shinomiya, T. ...	M. Takada ...	"	Nippon Yusen Kaisha ...	" 2.1.24 to 9.2.24 ...	14.3.24.
<i>Kellett</i> ...	Bartlett, E. B., O.B.E.	J. Paice ...	"	P. & O. ...	" 6.1.24 to 12.1.24 ...	19.1.24.
<i>Khiva</i> ...	Haselfoot, F. E. B., D.S.O., Commr., R.N.	E. H. B. Baker, W. C. Jenks ...	M.L.	His Majesty's Ship ...	Met. Log. 28.10.23 to 15.11.23 ...	5.12.23.
<i>Khyber</i> ...	Redhead, C. M., D.S.O., R.D., Capt., R.N.R.	J. Maxwell, L. Fraser, A. L. Hill.	M.L.	P. & O. ...	" 26.10.23 to 19.2.24 ...	22.2.24.
<i>Kia Ora</i> ...	Pinckney, L. D., O.B.E.	J. B. Livingstone ...	No.	" ...	" 8.11.23 to 23.12.23 ...	29.12.23.
<i>Kitano Maru</i> ...	Thurston, H. P. ...	A. E. Lockhart ...	"	Shaw Savill & Albion ...	" 20.12.23 to 30.1.24 ...	11.3.24.
<i>Knight Companion</i> ...	Kamada, N. ...	G. Chilara ...	"	Nippon Yusen Kaisha ...	" 6.1.24 to 31.1.24 ...	11.3.24.
<i>Kovno</i> ...	Beale, H. E. ...	E. H. Powell ...	"	A. Holt ...	" 29.9.23 to 11.10.23 ...	16.10.23.
<i>Kurmark</i> ...	Casson, D. H., R.D., Commr., R.N.R.	E. R. Massam, G. H. Duncan, L. Griffiths.	M.L.	Ellerman Wilson ...	Met. Log. 5.5.23 to 27.11.23 ...	3.12.23.
<i>Lady Brenda</i> ...	Cartmer, G. E., O.B.E.	J. R. Laurensen, S. E. Clowser, C. H. Porter.	M.L.	Graham & Co. ...	" 27.6.23 to 28.11.23 ...	3.12.23.
<i>Lady Denison Pen-der C.S.</i> ...	Young, W. J. ...	B. L. Brind ...	No.	Dawson ...	Form 911 25.9.23 to 4.10.23 ...	13.10.23.
<i>Laguna</i> ...	" ...	" ...	"	Eastern Tel. Co. ...	" ...	"
<i>Lalande</i> ...	Mander, F. ...	F. W. Parker ...	"	Pacific S.N. Co. ...	Form 911 14.12.23 to 7.1.24 ...	4.2.24.
<i>Lancashire</i> ...	Bambra, W. A. ...	N. Webster ...	"	Lampport & Holt ...	" 26.12.23 to 19.1.24 ...	4.2.24.
<i>Laomedon</i> ...	Beckett, F. W. ...	T. L. Owen ...	"	Bibby ...	" 29.9.23 to 6.12.23 ...	17.12.23.
<i>La Paz, M.V.</i> ...	Smith, A. H. ...	A. J. Barclay ...	"	A. Holt ...	" 18.11.23 to 27.2.24 ...	4.3.24.
	Ross, J. ...	R. Collister ...	"	Pacific S.N. Co. ...	" 15.12.23 to 8.1.24 ...	11.2.24.

LIST OF VOLUNTARY OBSERVING SHIPS

V

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed.	Date Received.
<i>Laplace</i> ...	Davies, G. W. ...	A. Hughes I. O. Jones ...	No.	Lamport & Holt	Form 911 11.11.23 to 3.12.23...	10.12.23.
<i>Lapland</i> ...	Howell, T. ...	B. T. Harris, H. H. Grace, J. M. Appleby.	W.T.	Red Star ...	W.T. Reg. 5.10.23 to 24.10.23 ...	2.11.23.
<i>Lassell, M.V.</i> ...	Turner, J. E. ...	A. T. Crilly ...	No.	Lamport & Holt	Form 911 5.10.23 to 24.10.23 ...	27.11.23.
<i>Leicestershire</i> ...	De Legh, P. ...	R. Cuming ...	M.L.	Bibby ...	" 2.10.23 to 12.10.23...	18.10.23.
<i>Leitrim</i> ...	Robertson, A. ...	H. C. Roberts ...	No.	Dowie, J., & Co. ...	" 8.12.23 to 17.1.24 ...	26.1.24.
<i>Levant C.S.</i> ...	West, G. W. ...	...	...	Eastern Tel. Co. ...	" 26.11.23 to 16.12.23 ...	30.12.23.
<i>Lexington</i> ...	Adams, S. E. ...	Coverdale, Meyrick, W. Corlett.	M.L.	Furness Withy ...	Met. Log. 14.9.22 to 5.12.23 ...	17.12.23.
<i>Ling Nam</i> ...	Westgarth, W. A. ...	...	No.	Chunghwa Nav. Co. ...	...	...
<i>Llanstephan Castle</i> ...	Wilford, T. H. ...	...	...	Union Castle ...	Form 911 15.10.23 to 14.12.23 ...	17.12.23.
<i>London Commerce</i> ...	Young, H. J., D.S.C.	E. A. Bennett ...	...	Furness Withy ...	" 3.2.24 to 9.3.24 ...	12.3.24.
<i>Loreto, M.V.</i> ...	Splatt, W. A. ...	F. Binnion ...	...	Pacific S.N. Co. ...	" 9.9.23 to 7.1.24 ...	14.1.24.
<i>Losada M.V.</i> ...	Barkley, E. ...	A. H. Turner ...	...	" ...	" 25.12.23 to 17.1.24 ...	23.1.24.
<i>Macedonia</i> ...	Potter, H. W., R.D., Commr., R.N.R.	G. Readman ...	No.	P. & O. ...	...	...
<i>Macharda</i> ...	Cochran, G. ...	W. Moore ...	...	Brocklebank ...	Form 911 12.12.23 to 8.3.24 ...	14.3.24.
<i>Mahana</i> ...	Kershaw, W. A. R. ...	F. M. Smith ...	...	Shaw Savill & Albion	" 9.11.23 to 21.12.23...	11.1.24.
<i>Maharaja</i> ...	Hartock, L. ...	...	...	Asiatic S.N. Co. ...	" 23.9.23 to 29.10.23...	17.12.23.
<i>Mahopac</i> ...	Puttick, J. ...	F. J. Mummery ...	...	Atlantic Transport	" 23.4.23 to 3.8.23 ...	27.8.23.
<i>Maihar</i> ...	Rowe, J. P. ...	C. Straw L. Robertson, R. G. Widdon.	M.L.	Brocklebank ...	Met. Log. 22.9.23 to 10.12.23...	26.1.24.
<i>Mainyo</i> ...	Hamilton, G. ...	R. A. L. Williams ...	No.	" ...	Form 911 10.2.24 to 23.2.24 ...	4.3.24.
<i>Marine</i> ...	Seymour, A. ...	J. W. Prier ...	...	Atlantic Transport	" 29.5.23 to 8.6.23 ...	18.6.23.
<i>Majestic</i> ...	Hayes, Sir B. F., K.C.M.G., D.S.O., R.D., Commodore R.N.R.	A. F. Butcher ...	W.T.	White Star ...	W.T. Reg. 4.1.24 to 17.1.24 ...	21.1.24.
<i>Makambo</i> ...	Williams, G. E. ...	A. Brown, W. R. Robertson, F. C. Ree, D. Wilson.	M.L.	Burns Philp ...	Met. Log. 28.3.23 to 10.9.23 ...	4.12.23.
<i>Makura</i> ...	Brown, T. M. ...	...	...	...	...	...
<i>Makura</i> ...	Griffiths, G. I. ...	...	...	...	...	...
<i>Makura</i> ...	Crawford, R. ...	C. A. Stein, R. B. Denniston, T. A. McPherson, R. K. Parry, W. W. Fish, A. Lansley.	M.L.	Canadian-Australasian	" 30.6.23 to 26.10.23...	17.11.23.
<i>Malancho</i> ...	Whitham, F. ...	J. Robertson ...	No.	Brocklebank ...	Form 911 13.12.23 to 12.1.24...	23.1.24.
<i>Malda</i> ...	Gray, T. N. ...	J. Hayward ...	...	British India ...	" 6.12.23 to 12.1.24 ...	16.1.24.
<i>Manchester Corporation.</i> ...	Everest, J. E. ...	F. H. Moorhouse ...	...	Manchester Liners ...	" 20.1.24 to 23.2.24 ...	28.2.24.
<i>Manchester Mariner</i> ...	Riley, J. E. ...	...	M.L.	" ...	...	...
<i>Manchester Merchant.</i> ...	Barclay, J. ...	A. H. Boyd, A. E. Ricketts...	No.	" ...	Form 911 28.1.24 to 10.2.24 ...	25.2.24.
<i>Mandasor</i> ...	Kershaw, R. W. ...	W. Baxter ...	...	Brocklebank ...	" 1.12.23 to 7.1.24 ...	28.1.24.
<i>Manhattan</i> ...	Lazell, F. W. ...	...	...	Atlantic Transport	" 12.3.23 to 7.4.23 ...	11.4.23.
<i>Manipur</i> ...	Scurr, T. W. ...	G. W. Barker ...	...	Brocklebank ...	" 3.10.23 to 25.12.23...	28.12.23.
<i>Manistee</i> ...	Isaacson, J. M. ...	F. McCollm, A. M. Houghton, L. C. Bach.	M.L.	Elders & Fyffes	Met. Log. 11.7.23 to 4.11.23 ...	21.12.23.
<i>Marburn</i> ...	Clews, A. H. ...	A. M. Watt, W. R. Reid, W. Masson.	M.L.	Canadian Pacific ...	" 12.5.23 to 6.10.23 ...	26.10.23.
<i>Marcella</i> ...	Mortimer, S. ...	Burdiss, Pemberton, Thompson	M.L.	Burns Philp ...	" 12.7.23 to 22.11.23...	3.3.24.
<i>Margha</i> ...	Milne, R. A. ...	J. Strachan, R. W. Cooper, H. Watkins, H. M. Maguire.	M.L.	British India ...	" 27.10.23 to 8.1.24 ...	17.1.24.
<i>Marglen</i> ...	Griffiths, J. N. ...	A. Pennington ...	No.	Canadian Pacific ...	Form 911 16.2.24 to 7.3.24 ...	11.3.24.
<i>Maryland</i> ...	Pollard, F. W., D.S.O., R.D., Commr., R.N.R.	F. T. Good ...	...	Atlantic Transport	" 21.1.24 to 28.2.24 ...	11.3.24.
<i>Mashobra</i> ...	Gallie ...	M. W. K. Bishop ...	...	British India ...	...	...
<i>Masirah</i> ...	Thowless, E. ...	R. C. Baker ...	...	Brocklebank ...	Form 911 30.7.23 to 26.8.23 ...	26.11.23.
<i>Massilia</i> ...	Caithness, J. B. ...	E. Richardson ...	...	Anchor ...	" 23.1.24 to 24.2.24 ...	10.3.24.
<i>Matakana</i> ...	Bosdet, V. J. ...	H. C. Mont, S. Oswald ...	...	Shaw, Savill & Albion	" 20.6.23 to 31.7.23 ...	11.8.23.
<i>Matheran</i> ...	Cornish, N. P. ...	...	M.L.	Brocklebank ...	Met. Log. 14.10.23 to 9.1.24 ...	5.2.24.
<i>Mathura</i> ...	Hanna, R. G. ...	H. H. Armstrong ...	No.	" ...	Form 911 26.1.24 to 25.2.24 ...	13.3.24.
<i>Matiana</i> ...	Langlands, D. H. ...	W. G. E. D. Rawlingson ...	...	British India ...	" 28.12.23 to 21.1.24...	1.2.24.
<i>Matina</i> ...	Henderson, J. ...	J. W. Parsons, H. Carden, N. A. Moore.	M.L.	Elders & Fyffes	Met. Log. 9.9.22 to 24.3.23 ...	26.4.23.
<i>Mauretania</i> ...	Rostron, A. H., C.B.E., A.-d.-C., R.D., Capt.	G. H. Jones, P. O. Davis, W. C. A. Robson.	W.T.	Cunard ...	W.T. Reg. 21.10.23 to 4.11.23...	8.11.23.
<i>Megantic</i> ...	Berry, G. ...	H. J. C. Day, R. Conway ...	W.T.	White Star ...	Form 911 29.9.23 to 14.10.23...	23.10.23.
<i>Melita</i> ...	Landy, E. ...	Mr. Blair, Mr. Jones, Mr. Webster.	W.T.	Canadian Pacific ...	W.T. Reg. 24.10.23 to 15.11.23 ...	17.11.23.
<i>Memnon</i> ...	Salter, G. H. ...	P. L. Pallot, T. F. Evans ...	No.	A. Holt ...	" 4.12.23 to 19.12.23...	1.1.24.
<i>Menominee</i> ...	Finch, E. ...	H. E. McCartney ...	...	Atlantic Transport	Form 911 14.1.24 to 26.1.24 ...	7.2.24.
<i>Mesaba</i> ...	Claret, F. H. ...	L. A. Williams ...	...	" ...	" 19.8.23 to 17.9.23 ...	21.9.23.
<i>Metagama</i> ...	Henderson, W. ...	H. A. MacCallum, M. Jack, H. Parry.	W.T.	Canadian Pacific ...	W.T. Reg. 2.7.23 to 11.7.23 ...	27.8.23.
<i>Miami</i> ...	Maxwell Brown, W. E. ...	E. Lowndes ...	No.	" ...	W.T. Reg. 21.1.24 to 9.2.24 ...	14.2.24.
<i>Michigan</i> ...	Tribe, A. E. ...	L. A. Williams ...	...	Elders & Fyffes	Form 911 17.1.24 to 17.2.24 ...	26.2.24.
<i>Minderoo</i> ...	Richardson, E. ...	B. J. Bennie, W. J. McPhedron, J. H. Oxtan.	M.L.	Atlantic Transport	" 25.1.24 to 9.2.24 ...	25.2.24.
<i>Minnedosa</i> ...	Sibbons, H. ...	R. Fegan, R. Walker, J. Soames.	W.T.	West Australia Nav. Co.	Met. Log. 16.2.23 to 10.7.23 ...	17.9.23.
<i>Mirror, C.S.</i> ...	Sherwood, C. A. ...	C. E. F. St. John ...	No.	Canadian Pacific ...	W.T. Reg. 19.1.24 to 7.2.24 ...	11.2.24.
<i>Mississippi, M.V.</i> ...	Wylie, J. T. J. ...	A. H. Middleton ...	...	Eastern Tel. Co. ...	Form 911 18.1.24 to 8.2.24 ...	11.2.24.
<i>Missouri</i> ...	Hutchison, J. G. ...	W. W. Howard ...	...	Atlantic Transport	" 9.1.24 to 22.1.24 ...	11.2.24.
<i>Moena</i> ...	Morzer Bruyns, M. F. ...	J. H. Nieboer ...	...	" ...	" 31.1.24 to 9.2.24 ...	6.2.24.
<i>Moldavia</i> ...	Burleigh, C. W., D.S.O., R.D., Capt., R.N.R.	F. T. Ferraby ...	...	Nederland ...	" 30.7.23 to 2.9.23 ...	6.9.23.
<i>Mongolian Prince</i> ...	Chilvers, J. ...	H. A. Shaw ...	No.	P. & O. ...	" 8.12.23 to 12.1.24 ...	4.2.24.
<i>Monkbarns, Ship</i> ...	Davies, W. ...	M. B. Glasier ...	...	" ...	" 14.12.23 to 7.3.24 ...	11.3.24.
<i>Montclair</i> ...	Rennie, A., O.B.E.	H. McFadyen, S. W. Keay...	W.T.	Prince ...	Form 911 6.1.24 to 29.1.24 ...	11.2.24.
<i>Montclair</i> ...	Webster, G. S., R.D., Commr., R.N.R.	E. J. Jones M. Cresswell, M. Jack.	W.T.	J. Stewart & Co. ...	W.T. Reg. 13.10.23 to 20.11.23 ...	21.1.24.
<i>Montlaurier</i> ...	Turnbull, J., C.B.E., R.D., Capt., R.N.R.	...	No.	Canadian Pacific ...	W.T. Reg. 27.1.24 to 15.2.24 ...	19.2.24.
<i>Montrose</i> ...	Landy, E. ...	R. Antrobus ...	W.T.	" ...	Form 911 27.1.24 to 15.2.24 ...	20.2.24.
<i>Morrada</i> ...	Mills, T. L., O.B.E., R.D., Commr., R.N.R.	J. Norris, D. Lonie, F. Dyson	M.L.	" ...	W.T. Reg. 17.2.24 to 7.3.24 ...	10.3.24.
					W.T. Reg. 3.2.24 to 21.2.24 ...	26.2.24.
					Form 911 4.2.24 to 21.2.24 ...	27.2.24.
					Met. Log. 15.9.23 to 27.11.23...	29.11.23.

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed.	Date Received.
<i>Mulbera</i> ...	Steadman, W. R. ...	R. L. Burrige, E. Holland...	No.	British India	Form 911 21.1.24 to 22.2.24 ...	26.2.24.
<i>Musician</i> ...	Egerton, J. J. ...	O. Stanhope ...	"	Harrison ...	" 5.4.23 to 17.6.23 ...	2.8.23.
<i>Nagara</i> ...	Turner, E. A. ...	C. E. Mason ...	"	R.M.S.P. Co. ...	" 11.12.23 to 3.2.24 ...	6.2.24.
<i>Napierian</i> ...	Kerruish, W. ...	T. Griffiths ...	"	Leyland ...	" 14.2.24 to 26.2.24 ...	14.3.24.
<i>Nardana</i> ...	Brown, H. ...	K. C. Le Breton ...	"	British India	" 15.9.23 to 18.2.24 ...	28.2.24.
<i>Nariva</i> ...	Macey, W. H. ...	W. H. Grimshaw, F. O. Newton, H. H. Lancaster.	M.L.	R.M.S.P. Co. ...	Met. Log. 3.5.23 to 27.6.23 ...	29.6.23.
<i>Nascopie</i> ...	Smellie, T. F. ...	P. Lloyd, R. J. Summers, R. S. Mott.	M.L.	Hudson's Bay Co. ...	" 15.6.23 to 24.10.23...	31.10.23.
<i>Navarino</i> ...	Crichton, J. S. ...	J. Annan ...	No.	Glen & Co. ...	Form 911 13.12.23 to 12.1.24...	22.1.24.
<i>Nacasa</i> ...	Willan, F. G. L. ...	P. R. Locks ...	"	R.M.S.P. Co. ...	" 16.11.23 to 4.1.24 ...	7.1.24.
<i>Navigator</i> ...	Mowat, J. ...	" ...	"	Harrison ...	" 29.4.23 to 26.6.23 ...	11.7.23.
<i>Nwab...</i> ...	Smith, J. F. ...	" ...	"	Asiatic S.N. Co. ...	" 7.12.23 to 4.2.24 ...	25.2.24.
<i>Nbraska</i> ...	Collins, A. R. D. ...	J. Vivian ...	"	R.M.S.P. Co. ...	" 20.6.23 to 31.8.23 ...	24.9.23.
<i>Nellore</i> ...	Murray, F. S., R.D., Lt. Commr., R.N.R.	G. Aspinall ...	"	P. & O. ...	" 24.10.23 to 18.12.23	27.12.23.
<i>Nestor</i> ...	Owen, R. D., O.B.E.	W. J. Eyson ...	"	A. Holt ...	" 11.12.23 to 17.12.23	11.2.24.
<i>Nevasa</i> ...	Swanson, C. J. ...	E. C. T. West ...	"	British India	" 12.10.23 to 21.12.23	4.1.24.
<i>Newby Hall</i> ...	Kendall, J. W. ...	E. J. Myles, C. H. Webb, T. A. Dexter.	M.L.	Ellerman ...	Met. Log. 4.7.23 to 24.1.24 ...	4.3.24.
<i>Niagara</i> ...	Rolls, J. T. ...	R. M. Scott, N. G. Buxton, O. C. Bray.	M.L.	Canadian-Australian...	" 2.6.23 to 28.9.23 ...	29.10.23.
<i>Ningchow</i> ...	Wilson, C. A. ...	R. A. Hannay ...	No.	A. Holt ...	Form 911 7.1.24 to 15.2.24 ...	20.2.24.
<i>Nizam</i> ...	Park, G. ...	" ...	"	Asiatic S.N. Co. ...	" 21.4.23 to 1.5.23 ...	29.5.23.
<i>Nore</i> ...	Randall H. W., R.D., Capt., R.N.R.	J. C. Ablewhite, R. W. Mackie, H. C. Slinn.	M.L.	P. & O. ...	Met. Log. 3.11.23 to 22.1.24 ...	26.1.24.
<i>Norfolk Range</i> ...	Moore, J. E. W. ...	R. F. Handley ...	No.	Furness Withy ...	Form 911 17.1.24 to 2.2.24 ...	14.2.24.
<i>Norman</i> ...	Morton Betts, W. ...	D. A. Hodgson ...	"	Union Castle ...	" 24.12.23 to 11.1.24...	11.3.24.
<i>Norseman, C.S.</i> ...	Barter, H. O., R.D., Commr., R.N.R.	S. M. Hammond, E. R. Duffey, L. M. Cooper.	M.L.	Western Tel. Co. ...	Met. Log. 12.2.23 to 21.8.23 ...	24.9.23.
<i>Northumberland</i> ...	Haines, F. P. ...	" ...	No.	Federal ...	Form 911 16.6.23 to 28.7.23 ...	31.7.23.
<i>Nortonian</i> ...	McCormick, J. ...	T. Miller ...	"	Leyland ...	" 3.12.23 to 5.1.24 ...	9.1.24.
<i>Nubian</i> ...	Watmough, T. M. ...	G. H. Jolly ...	"	" ...	" 30.6.23 to 13.9.23 ...	18.9.23.
<i>Nyanza</i> ...	Carpendale, F. W. J. ...	F. Aheir, C. H. Hand, F. Ardern.	M.L.	P. & O. ...	Met. Log. 17.9.23 to 7.1.24 ...	12.1.24.
<i>Odland I.</i> ...	Villiamsen ...	H. Svendgaard ...	No.	Hannevig Bros. ...	Form 911 19.12.23 to 2.1.24 ...	4.1.24.
<i>Ohio</i> ...	Lainson, W. H. ...	W. Paine, C. K. Brown, G. C. Clairmonte.	M.L.	R.M.S.P. Co. ...	Met. Log. 18.5.23 to 2.12.23 ...	13.12.23.
<i>Olympia</i> ...	Duncan, A. R. ...	H. Gorman, J. F. Adam, D. Haig.	M.L.	Anchor ...	" 22.3.22 to 26.8.23 ...	1.10.23.
<i>Olympic</i> ...	Howarth, F. B., Commr., R.N.R.	J. C. M. Boyce, C. W. Couch	W.T.	White Star ...	W.T. Reg. 21.2.24 to 7.3.24 ...	10.3.24.
<i>Omar</i> ...	Simmer, G. L., R.D., Commr., R.N.R.	W. M. McRitchie, C. V. Dodgson, L. E. Fordham, H. S. Schofield, T. J. Jones.	M.L.	Orient ...	Form 911 21.2.24 to 7.3.24 ...	11.3.24.
<i>Onitsha</i> ...	Williams, T. E. ...	D. Rollo ...	No.	Elder Dempster ...	Met. Log. 22.9.23 to 6.1.24 ...	16.1.24.
<i>Oranian</i> ...	Watmough, T. M. ...	R. J. S. Pope ...	"	" ...	Form 911 1.9.23 to 21.9.23 ...	20.11.23.
<i>Orari</i> ...	Robinson, F. W. ...	C. H. Denton, C. F. Hicks, E. Mills.	M.L.	Leyland ...	Form 911 12.2.23 to 26.4.23 ...	30.4.23.
<i>Orator</i> ...	Flynn, D. ...	J. C. Sinclair ...	No.	New Zealand S.S. Co. ...	Met. Log. 3.2.23 to 19.7.23 ...	25.7.23.
<i>Orbita</i> ...	Parker, W. H., C.B.E., R.D., Capt., R.N.R.	D. R. Lee, H. H. Lancaster...	W.T.	Harrison ...	Form 911 2.7.23 to 22.7.23 ...	22.8.23.
<i>Orcoma</i> ...	Pleignier, H. T. S. ...	G. B. Wardall, J. J. Buckley, C. H. Wenton.	M.L.	R.M.S.P. Co. ...	W.T. Reg. 23.11.23 to 13.12.23	17.12.23.
<i>Orduna</i> ...	Warner, G. E. ...	J. W. Carr, J. Vivian, A. A. Martin.	W.T.	Pacific S.N. Co. ...	Form 911 17.2.24 to 4.3.24 ...	7.3.24.
<i>Oriana</i> ...	Christian, G. H. ...	G. Pattison, Mason, G. F. Nicholson, Cruikshank.	M.L.	" ...	Met. Log. 23.11.23 to 8.2.24 ...	14.2.24.
<i>Orita</i> ...	Dominy, R. H., C.B.E., Commr., R.N.R.	F. W. Hockey, H. S. Roberts, —, Gale.	M.L.	R.M.S.P. Co. ...	W.T. Reg. 6.1.24 to 17.2.24 ...	21.2.24.
<i>Ormonde</i> ...	Douglas, H. P., C.M.G., Capt., R.N.	" ...	M.L.	Pacific S.N. Co. ...	Form 911 6.1.24 to 18.2.24 ...	21.2.24.
<i>Ormonde</i> ...	Staunton, H. G., C.B.E., R.D., Commr., R.N.R.	T. G. McGregor, H. MacLean, F. J. L. Butler.	M.L.	" ...	Met. Log. 26.1.23 to 14.8.23 ...	18.8.23.
<i>Ormuz</i> ...	James, L. V., D.S.C.	J. S. Metcalf, A. J. Croft-Cohen, I. E. G. Golds-worthy, L. A. Keeble.	M.L.	" ...	Met. Log. 15.8.23 to 9.12.23 ...	12.12.23.
<i>Oroya</i> ...	Chittenden, A. ...	S. Lewis ...	No.	His Majesty's Ship ...	" ...	"
<i>Orsova</i> ...	Matheson, C. G., D.S.O., R.D., Commr., R.N.R.	C. Fox, J. C. K. Dowding, N. Whinfield, J. C. Jackson.	M.L.	" ...	Met. Log. 14.10.23 to 29.1.24	5.2.24.
<i>Ortega</i> ...	Christian, C. H. ...	D. W. Hutchinson...	No.	" ...	Met. Log. 19.8.23 to 5.12.23 ...	17.12.23.
<i>Orvieto</i> ...	Shelford, W. S., Lt.-Commr., R.N.R.	G. H. Wylie, A. J. Baxter, G. E. Martin, A. O. H. O'Brien, M. C. Lester.	M.L.	Pacific S.N. Co. ...	Form 911 25.10.23 to 12.1.24...	16.1.24.
<i>Osterley</i> ...	Coad, A. J., R.D., Commr., R.N.R.	F. G. Goodman, T. B. Grainger-Grieve, E. Hatch.	M.L.	Orient ...	Met. Log. 20.9.23 to 3.1.24 ...	31.1.24.
<i>Othello</i> ...	Pearson, Z. C. ...	A. J. Walker ...	No.	" ...	Form 911 14.12.23 to 14.2.24...	28.2.24.
<i>Otira</i> ...	Elford, H. E. ...	V. R. Bowling ...	"	" ...	Met. Log. 11.11.23 to 26.2.24...	3.3.24.
<i>Oxfordshire</i> ...	Adamson, B. W. ...	W. L. Whiteside, C. J. Blyten-Beesley, H. J. Jarrett.	M.L.	" ...	" 22.7.23 to 6.11.23 ...	27.11.23.
<i>Pakeha</i> ...	Hartman, W. H. ...	W. L. P. Cox ...	No.	" ...	Form 911 31.1.24 to 6.3.24 ...	13.3.24.
<i>Paparoa</i> ...	Ashworth, F. ...	A. E. Lettington ...	"	" ...	" 24.11.23 to 13.12.23	1.1.24.
<i>Paris</i> ...	Cook, C. L. ...	Mr. Biles...	C.C.	" ...	Met. Log. 22.12.23 to 1.3.24 ...	5.3.24.
<i>Patrol, C.S.</i> ...	Bredenberg, F. ...	Gardiner, Albrecht, Morrell...	M.L.	Shaw, Savill & Albion New Zealand S.S. Co. Southern Rly. Eastern Extension (A. & C.) Telegraph Co.	Form 911 23.12.23 to 2.2.24 ...	11.2.24.
<i>Persic</i> ...	Davies, E. ...	N. E. Banks ...	No.	" ...	Telegraphic Report. 19.2.24 ...	19.2.24.
<i>Peshawur</i> ...	Hester, C. W., R.D., Commr., R.N.R.	B. W. Snow, T. C. Fairburn, J. Tickell, J. D. Parker.	M.L.	" ...	Met. Log. 1.7.23 to 14.9.23 ...	25.2.24.
<i>Philadelphus</i> ...	Baker, J. A. ...	G. W. B. Lloyd ...	No.	White Star P. & O.	Form 911 20.12.23 to 29.1.24...	31.1.24.
<i>Polypheusus</i> ...	Hatfield, J. ...	F. Silva ...	"	" ...	Met. Log. 30.8.23 to 9.2.24 ...	18.2.24.
<i>Poona</i> ...	Cherry, W. G. W. ...	F. J. Ablewhite ...	"	" ...	Form 911 21.10.23 to 23.12.23	24.12.23.
<i>Port Albany</i> ...	Robinson, C. A. ...	G. L. Hazlewood, A. W. Jenkyns, J. S. Beardshaw, W. B. Craig.	M.L.	" ...	" 12.1.24 to 26.2.24 ...	6.3.24.
<i>" August</i> ...	Hearn, G. W. ...	G. T. Harris, R. C. Carter, C. F. Coate.	M.L.	" ...	Form 911 2.1.24 to 16.1.24 ...	28.1.24.
<i>" Caroline</i> ...	Renaut, F. A. ...	E. G. Fullick P. H. Pedrick, T. Palmer.	M.L.	" ...	Met. Log. 18.5.23 to 23.9.23 ...	2.10.23.

LIST OF VOLUNTARY OBSERVING SHIPS

vii

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed.	Date Received.
<i>Port Curtis</i> ...	Van den Bergh, C.	A. G. Rhind ...	No.	Commonwealth & Dominion.	... ..	...
„ <i>Darwin</i> ...	Jack, J. ...	E. T. N. Lawrey, E. W. R. Young.	No.	„ „ „	Form 911 1.12.23 to 9.1.24 ...	11.2.24.
„ <i>Hacking</i> ...	Stickland, A. E. ...	Rowland Hill ...	M.L.	„ „ „	13.10.23 to 4.12.23...	14.1.24.
„ <i>Hunter</i> ...	Cottell, S. C. ...	C. P. Thrower, W. R. Johnston, L. Copeland, A. G. Newbury.	M.L.	„ „ „	Met. Log. 4.5.23 to 22.9.23 ...	27.9.23.
„ <i>Lyttelton</i> ...	Ferris, J....	W. L. Lynd, E. Leavett, G. Fergusson, G. H. Harvey.	M.L.	„ „ „	24.2.23 to 16.8.23 ...	18.8.23.
„ <i>Melbourne</i> ...	Kearney, F. J. ...	D. G. H. Bradley, R. B. Linklater, T. L. Kidwell.	M.L.	„ „ „	11.9.23 to 17.1.24 ...	28.1.24.
„ <i>Nicholson</i> ...	Hoad, A. C. ...	W. G. Jones, C. R. Townshend, G. G. Langford.	M.L.	„ „ „	5.10.23 to 4.2.24 ...	11.2.24.
„ <i>Pirie</i> ...	Higgs, W. G. ...	H. C. Jeffery, E. E. Roswell, R. S. Stannard, E. N. Rogerson.	M.L.	„ „ „	25.8.23 to 26.12.23...	30.12.23.
„ <i>Sydney</i> ...	Lea, W. H. ...	H. E. Higgs, A. W. Sams, A. R. Martin, J. Fishwick.	M.L.	„ „ „	15.6.23 to 16.10.23...	20.10.23.
„ <i>Victor</i> ...	Jack, J. ...	J. Hunter, R. S. Keating, R. T. R. Tomsett.	M.L.	„ „ „	6.4.23 to 3.9.23 ...	14.9.23.
<i>President Jackson</i> ...	Griffith, J. ...	E. Walker ...	No.	Pacific S.S. Co. ...	Form 911 21.12.23 to 20.1.24...	11.3.24.
<i>Protea</i> , H.M.S.A.S.	Dalglish... ..	H. McMaster ...	„	South African Naval Service.	14.5.23 to 29.6.23 ...	31.7.23.
<i>Protesilaus</i> ...	Wilkinson, H. ...	T. Miners, R. C. Neville, A. Woolfenden, F. Smith.	M.L.	A. Holt ...	Met. Log. 27.9.23 to 14.12.23...	8.1.24.
<i>Pyrrhus</i> ...	Clark, G. T. ...	F. Berry ...	No.	„ ...	Form 911 28.4.23 to 7.5.23 ...	10.5.23.
<i>Rajah</i> ...	Park, G. ...	... ..	No.	Asiatic S.N. Co. ...	Form 911 17.6.23 to 10.7.23 ...	15.8.23.
<i>Regina</i> ...	Morehouse, W. A. ...	A. Hulme ...	„	White Star-Dominion ...	10.11.23 to 2.12.23...	6.12.23.
<i>Reindeer</i> ...	Mulhall, W. ...	... ..	C.C.	G.W. Railway ...	Telegraphic Report 14.2.24 ...	14.2.24.
<i>Rhodesian Transport</i> ...	Fowler, W. H. ...	E. A. Insley ...	No.	Houlder Bros. ...	Form 911 19.9.23 to 9.1.24 ...	2.2.24.
<i>Rialto</i> ...	Mordue, J. A. ...	... ..	„	Ellerman Bucknall ...	1.11.23 to 2.1.24 ...	18.1.24.
<i>Rimutaka</i> ...	Hemming, F. A. ...	E. W. Smith, H. Horwood, R. S. Cox.	M.L.	New Zealand S.S. Co.	Met. Log. 22.9.23 to 6.2.24 ...	11.2.24.
<i>Romney</i> ...	Leicester, F. S. ...	E. S. Phillips, E. King ...	No.	Lamport & Holt ...	Form 911 3.2.24 to 1.3.24 ...	10.3.24.
<i>Royal Fusilier</i> ...	Dawson, J. ...	... ..	„	London & Edinburgh S.S. Co.	... ..	...
<i>Royal Transport</i> ...	Dove, J. ...	F. W. Pawson ...	„	Houlder Bros. ...	Form 911 3.7.23 to 13.10.23 ...	17.10.23.
<i>Ruapehu</i> ...	Holland, E. A. ...	J. D. Tooms, G. Kinnett, P. J. Connolly, F. Cooke.	M.L.	New Zealand S.S. Co.	Met. Log. 6.11.23 to 7.3.24 ...	13.3.24.
<i>Sachem</i> ...	Furneaux, S. ...	C. Waldron ...	No.	Furness Withy ...	Form 911 20.12.23 to 23.1.24...	26.1.24.
<i>Samaria</i> ...	Horsburgh, G. ...	E. Esson ...	„	Cunard ...	24.9.23 to 10.10.23...	16.10.23.
<i>Sandown Castle</i> ...	Jackson, C. R. ...	W. F. Malden ...	„	Union Castle ...	13.10.23 to 2.11.23...	16.11.23.
<i>Saoirse</i> , Yacht ...	O'Brien, C. ...	H. S. Hodges ...	„	C. O'Brien ...	1.9.23 to 6.10.23 ...	7.11.23.
<i>Sardinia</i> ...	Cadiz, F. G., D.S.C.	A. F. Wiles ...	„	P. & O. ...	1.1.24 to 21.1.24 ...	4.2.24.
<i>Saturnia</i> ...	Black, J. ...	T. Ure ...	W.T.	Anchor Donaldson ...	24.11.23 to 16.12.23 ...	27.12.23.
<i>Saxoleine</i> ...	Biddick, E. ...	C. S. Rodgers ...	No.	Hunting & Son ...	Form 911 23.11.23 to 17.12.23 ...	27.12.23.
<i>Saxon</i> ...	Stanley, W. F., R.D., Commr., R.N.R.	R. S. W. Harris ...	„	Union Castle ...	4.1.24 to 22.1.24 ...	26.1.24.
<i>Saxonia</i> ...	Storey, F. E., R.D., Capt., R.N.R.	E. S. Simmonds ...	„	Cunard ...	18.1.24 to 10.3.24 ...	11.3.24.
<i>Scholar</i> ...	O'Connor, T. ...	H. Hall ...	„	Harrison ...	27.9.23 to 23.10.23...	2.11.23.
<i>Scientist</i> ...	Hansen, W. A. ...	D. G. Russell ...	„	„	28.12.23 to 22.2.24...	5.3.24.
<i>Scindia</i> ...	Mathews, W. ...	H. D. Campsie ...	„	Anchor ...	19.10.23 to 1.1.24 ...	7.1.24.
<i>Scotia</i> ...	Telfer ...	O. W. L. Jones ...	C.C.	L.M. & S. Rly. ...	31.10.23 to 24.1.24...	28.1.24.
<i>Scottish Bard</i> ...	McDonnell, S. ...	W. H. Campbell ...	No.	Tankers, Ltd. ...	Telegraphic Report 24.12.23 ...	24.12.23.
<i>Scottish Borderer</i> ...	Jeffrey, D. G., D.S.O.	G. F. Widger ...	„	Form 911 25.8.23 to 14.9.23 ...	1.10.23.	
<i>Scythia</i> ...	Prothero, W. ...	T. Parry, D. S. Kite, R. Allen.	W.T.	Cunard ...	8.11.23 to 26.11.23...	19.12.23.
<i>Sheaf Mount</i> ...	Groves, C. V. ...	J. L. Forster ...	No.	Souter, W. A. ...	Form 911 20.1.24 to 22.1.24 ...	18.2.24.
<i>Sheaf Spear</i> ...	Whitfield, G. A., O.B.E.	A. E. Harvey, W. H. Grise-wood.	M.L.	„	Form 911 30.1.24 to 8.2.24 ...	16.2.24.
<i>Sicilia</i> ...	Miller, E. C., R.D., Commr., R.N.R.	H. Sanders ...	No.	P. & O. ...	Met. Log. 4.12.23 to 31.12.23...	21.1.24.
<i>Socrates</i> ...	James, F. R. ...	E. R. Hartley ...	„	„	18.3.23 to 20.8.23 ...	8.10.23.
<i>Soetaboemi</i> ...	Ruhaak, G. H. ...	W. N. de Wijn ...	„	Lamport & Holt ...	Form 911 23.12.23 to 5.1.24 ...	25.2.24.
<i>Somerset</i> ...	Barnett, H. ...	C. H. Landfield ...	„	Rotterdam Lloyd ...	19.1.24 to 6.2.24 ...	25.2.24.
<i>Somme</i> ...	Miles, F. R., Commr., R.N.R.	B. K. Berry, C. C. Prosser, D. P. Larham.	M.L.	New Zealand S.S. Co.	28.12.23 to 15.1.24...	8.2.24.
<i>Songster</i> ...	Thompson, W. ...	W. F. O'Neill ...	M.L.	R.M.S.P. Co. ...	17.11.23 to 1.1.24 ...	4.1.24.
<i>Spectator</i> ...	Owen, W. F. ...	L. Seddon ...	No.	Harrison ...	Met. Log. 24.4.23 to 28.11.23...	17.12.23.
<i>Spero</i> ...	French, H. E. ...	E. A. Gould, G. Mussared ...	M.L.	„	13.10.23 to 5.11.23...	19.2.24.
<i>Stephan</i> , C.S. ...	Carlton, G. F., O.B.E., Commr., R.N.R.	L. J. Hegarty, J. Matthews, F. B. Bolingbroke.	M.L.	Ellerman Wilson ...	Form 911 25.10.23 to 14.11.23 ...	5.12.23.
<i>Surrey</i> ...	Kettlewell, C. R. ...	G. W. Allard, S. E. Hobbin, D. McIntyre.	M.L.	Telegraph Construction & Maintenance.	Met. Log. 8.6.23 to 17.2.24 ...	13.3.24.
<i>Sussex</i> ...	Upton, E. C. S. ...	W. A. Ewington ...	No.	Federal ...	5.5.23 to 3.10.23 ...	10.10.23.
<i>St. Albans</i> ...	„	„	„	„	27.5.23 to 3.11.23 ...	7.11.23.
<i>St. Patrick</i> ...	Bearpark, E. W. ...	W. P. Baker ...	„	Eastern and Australian Rankin Gilmour ...	Form 911 27.7.23 to 7.9.23 ...	21.11.23.
<i>Taiyuan</i> ...	Hamilton, H. E. ...	R. D. Thomas, W. Bailley, D. D. Tyer.	M.L.	„	Form 911 16.10.23 to 26.1.24...	11.3.24.
<i>Tambora</i> ...	Huisman, N. ...	H. Van Manen ...	No.	Rotterdam Lloyd ...	Met. Log. 30.4.23 to 5.10.23 ...	20.11.23.
<i>Teiresias</i> ...	Reynard, J. G. ...	W. F. Dark ...	„	A. Holt ...	Form 911 23.11.23 to 12.1.24...	26.1.24.
<i>Teucer</i> ...	Hannev, T. W. ...	J. C. Norton ...	„	„	23.7.23 to 2.8.23 ...	14.8.23.
<i>Themistocles</i> ...	Jermyn, W. M. ...	R. H. Harrison ...	„	„	20.9.23 to 18.1.24 ...	4.2.24.
<i>Theseus</i> ...	Williams, D. T. ...	W. Cowperthwaite ...	„	Aberdeen ...	8.11.23 to 5.3.24 ...	11.3.24.
<i>Titan</i> ...	Ireland, T. R. ...	J. P. Williams, A. C. H. Jones, D. J. Davies, C. Taylor.	M.L.	A. Holt ...	Met. Log. 1.12.23 to 8.2.24 ...	15.2.24.
<i>Tottori Maru</i> ...	Karita, I. ...	S. Ariyoshi ...	No.	Nippon Yusen Kaisha	Form 911 2.11.23 to 8.3.24 ...	12.3.24.
<i>Transmitter</i> , C.S. ...	Jones, L. T., M.B.E.	S. P. Sheldon ...	„	Eastern Tel. Co. ...	7.10.23 to 16.11.23...	1.1.24.
<i>Traveller</i> ...	Jones, E. W. ...	„	„	Harrison ...	7.12.23 to 2.2.24 ...	18.2.24.
<i>Tredenham</i> ...	Evans, J. O. ...	C. Warren ...	„	Hain S.S. Co. ...	4.8.23 to 8.10.23 ...	18.10.23.
					13.11.23 to 4.1.24 ...	11.1.24.

Name of Vessel.	Captain.	Observing Officers.	Official Meteorological Equipment.	Line.	Last Log, Register, or Report Contributed.	Date Received.
<i>Trematon</i> ...	Hicks, F. H. ...	J. Christopher, D. Thomas, F. J. Webb.	M.L.	Hain S.S. Co. ...	Met. Log. 28.8.22 to 30.3.23 ...	18.4.23.
<i>Tuscania</i> ...	Bone, D. W. ...	J. McGill Brown ...	No.	Anchor ...	Form 911 3.2.24 to 9.2.24 ...	3.3.24.
<i>Tuscanstar</i> ...	Thomas, R. J. ...	W. H. Webster ...	"	Blue Star ...	" 20.5.23 to 3.7.23 ...	11.7.23.
<i>Tyndareus</i> ...	Adcock, F. ...	F. Robinson ...	"	A. Holt ...	" 14.10.23 to 20.11.23	17.12.23.
<i>Ulysses</i> ...	Hazeland, J. H. D.	W. J. Peard ...	No.	A. Holt ...	Form 911 2.11.23 to 17.11.23...	11.12.23.
<i>Valucia</i> ...	Doyle, M. ...	J. W. Caunce ...	"	Cunard ...	" 27.9.23 to 15.12.23...	24.12.23.
<i>Valdura</i> ...	Mitchell, A. ...	J. Campbell, J. Anderson, A. M. S. Well.	M.L.	Gow Harrison ...	Met. Log. 19.4.23 to 20.10.23...	20.12.23.
<i>Valemore</i> ...	Griffiths, J. ...	H. Miller... ...	No.	Furness Withy ...	Form 911 22.11.23 to 29.12.23	30.12.23.
<i>Vardulia</i> ...	Townley, J. C. ...	E. Greave ...	"	Cunard ...	" 1.1.24 to 10.2.24 ...	13.2.24.
<i>Vasconia</i> ...	Inch, F. ...	W. P. Armour ...	"	" ...	" 20.1.24 to 27.2.24 ...	3.3.24.
<i>Vellavia</i> ...	Birnie H. C., D.S.O., R.D., Commr., R.N.R.	" ...	"	" ...	" 4.11.23 to 16.11.23...	24.11.23.
<i>Ventura de Larrinaga</i> ...	Keay, W. S. ...	H. J. Kay ...	"	Larrinaga ...	" 15.1.24 to 14.2.24 ...	11.3.24.
<i>Verbania</i> ...	Hatcher, W. H., R.D., Commr., R.N.R.	A. Bridgwater ...	"	Cunard ...	" 4.2.24 to 10.3.24 ...	12.3.24.
<i>Verentia</i> ...	Stafford, W., D.S.O., R.D., Lt-Commr., R.N.R.	A. S. W. Watts ...	"	" ...	" 24.12.23 to 30.1.24...	6.2.24.
<i>Victoria</i> ...	Fisher, F. T. ...	J. Males, E. Peacock, J. Archer	M.L.	China-Australia ...	Met. Log. 29.3.23 to 29.8.23 ...	6.10.23.
<i>Vittoria</i> ...	Jackson, G. W. ...	F. Galbraith ...	No.	Vittoria S.S. Co. ...	Form 911 10.5.23 to 20.6.23 ...	26.6.23.
<i>Waihero</i> ...	Showman, A. C. ...	G. Atwood ...	No.	Union S.S. Co., N.Z....	Form 911 23.2.23 to 16.5.23 ...	20.6.23.
<i>Waiotapu</i> ...	Ruxton, G. M. ...	F. A. Wilson ...	"	Canadian-Australasian	" 8.5.23 to 3.6.23 ...	26.6.23.
<i>Walmer Castle</i> ...	Chave, Sir B., K.B.E.	C. Hylem ...	"	Union Castle ...	" 11.12.23 to 28.1.24...	29.1.24.
<i>Wangaratta</i> ...	O'Connor, E. W., D.S.C.	T. W. Wordingham, M. Chant, W. Hunt.	M.L.	British India ...	Met. Log. 1.6.23 to 10.11.23 ...	1.12.23.
<i>Warfield</i> ...	Steel, R. ...	W. A. Hughes ...	No.	" ...	Form 911 28.10.23 to 30.11.23	27.12.23.
<i>War Nizam</i> ...	Putt, R. O. ...	" ...	"	British Tankers ...	" ...	" ...
<i>Welshman</i> ...	Rollerson, W. ...	J. F. Spears ...	"	White Star-Dominion	Form 911 30.12.23 to 6.2.24 ...	11.2.24.
<i>Winifredian</i> ...	Harrocks, W. ...	W. R. C. Baker ...	"	Leyland ...	" 5.1.24 to 4.2.24 ...	11.2.24.
<i>Woodarra</i> ...	Reilly, J. V. ...	F. L. Sampson, L. D. Graham, F. W. Felgate, A. V. Fisher.	M.L.	British India ...	Met. Log. 10.2.23 to 9.8.23 ...	23.8.23.
<i>Yorkshire</i> ...	Millson, G. C. ...	E. Jones ...	No.	Bibby ...	Form 911 13.10.23 to 12.12.23	24.12.23.
<i>Zeeland</i> ...	Thomas, A. J. ...	W. Jackman ...	No.	Red Star ...	Form 911 31.1.24 to 24.2.24 ...	26.2.24.
			Unless otherwise stated, vessels on the above list are S.S.			
<i>Conway, H.M.S.</i>	Broadbent, H. W., R.D. Capt., R.N.R.	The Senior Cadets...	Cadets' M.L.	...	Cadets' Met. Log. 23.9.23 to 15.12.23	19.12.23.
<i>Pangbourne Nautical College.</i>	Tracy, A. F. G., Commr., R.N.	" " ...	"	...	Cadets' Met. Log. 24.9.23 to 15.12.23	20.12.23.
<i>Worcester, H.M.S.</i>	Sayer, M. B., O.B.E., R.D., Capt., R.N.R.	" " ...	"	...	Cadets' Met. Log. 21.9.23 to 18.12.23	1.1.24.
<i>Abaco</i> ...	...	The Keepers ...	Lighthouse Register.	...	Lighthouse Register 1.7.23 to 1.1.24	3.3.24.
<i>Cay Lobos</i> ...	...	" ...	"	...	Lighthouse Register 1.7.23 to 31.12.23	3.3.24.
<i>Double Headed Shot</i> ...	...	" ...	"	...	Lighthouse Register 1.7.23 to 31.12.23	3.3.24.
<i>Inagua</i> ...	...	" ...	"	...	Lighthouse Register 1.7.23 to 31.12.23	3.3.24.
<i>Sombrero</i> ...	...	" ...	"	...	Lighthouse Register 1.7.23 to 31.12.23	25.2.24.
<i>Watling Island</i> ...	...	" ...	"	...	Lighthouse Register 1.8.23 to 31.12.23	3.3.24.
<i>Cape Pembroke (Falkland Is.).</i>	...	" ...	"	...	Lighthouse Register 1.7.23 to 31.12.23	3.3.24.

LIST OF SHIPS CO-OPERATING THROUGH THE METEOROLOGICAL OFFICE WITH THE MINISTRY OF AGRICULTURE AND FISHERIES (FISHERIES LABORATORY, LOWESTOFT) IN THE COLLECTION OF WATER SAMPLES, ETC.

Name of Vessel.	Captain.	Observing Officer.	Line.	Last Case of Water Samples, Reports, etc., Received.	Date Received.
<i>Alban</i> ...	Whayman, W. R. ...	R. Griffiths ...	Booth ...	Water Samples ...	5.12.23.
<i>Hildebrand</i> ...	Maddrell ...	Mr. Allan ...	" ...	" " ...	9.1.24.
<i>Patia</i> ...	Downes, F. J. ...	S. A. Sapsworth ...	Elder & Fyffes ...	" " ...	5.2.24.
<i>Tortuguero</i> ...	Martin ...	H. H. Dunning ...	" " ...	" " ...	28.12.23.