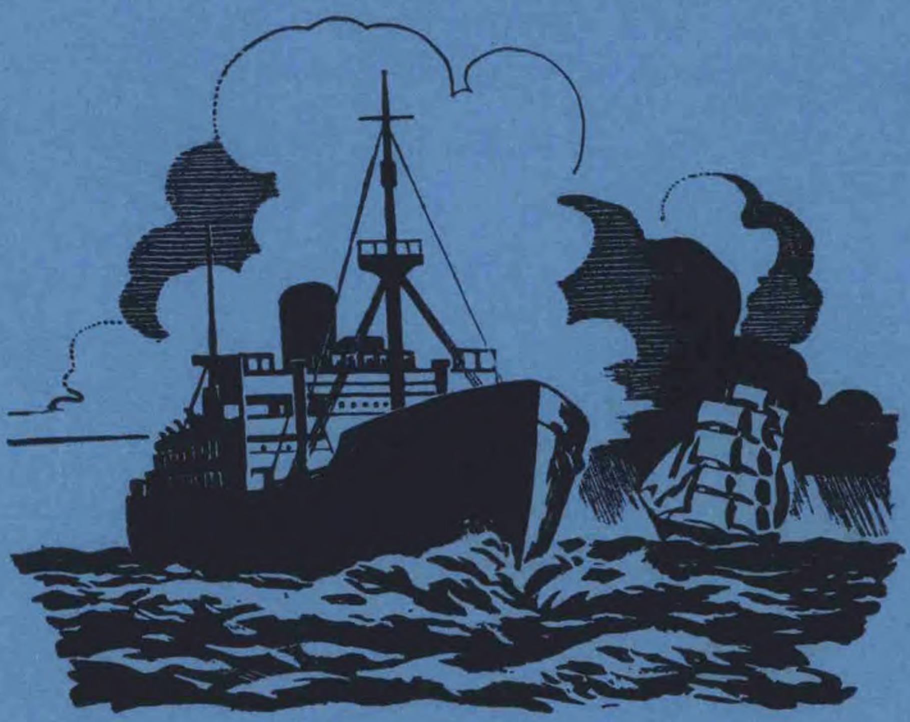
M.O. 493

The Marine Observer



Volume XVIII No. 140

APRIL, 1948

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M.O. 493 AIR MINISTRY

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A Quarterly Journal of Maritime Meteorology

prepared by the

Marine Branch of the Meteorological Office

VOL. XVIII No. 140 APRIL 1948

TABLE OF PRINCIPAL CONTENTS

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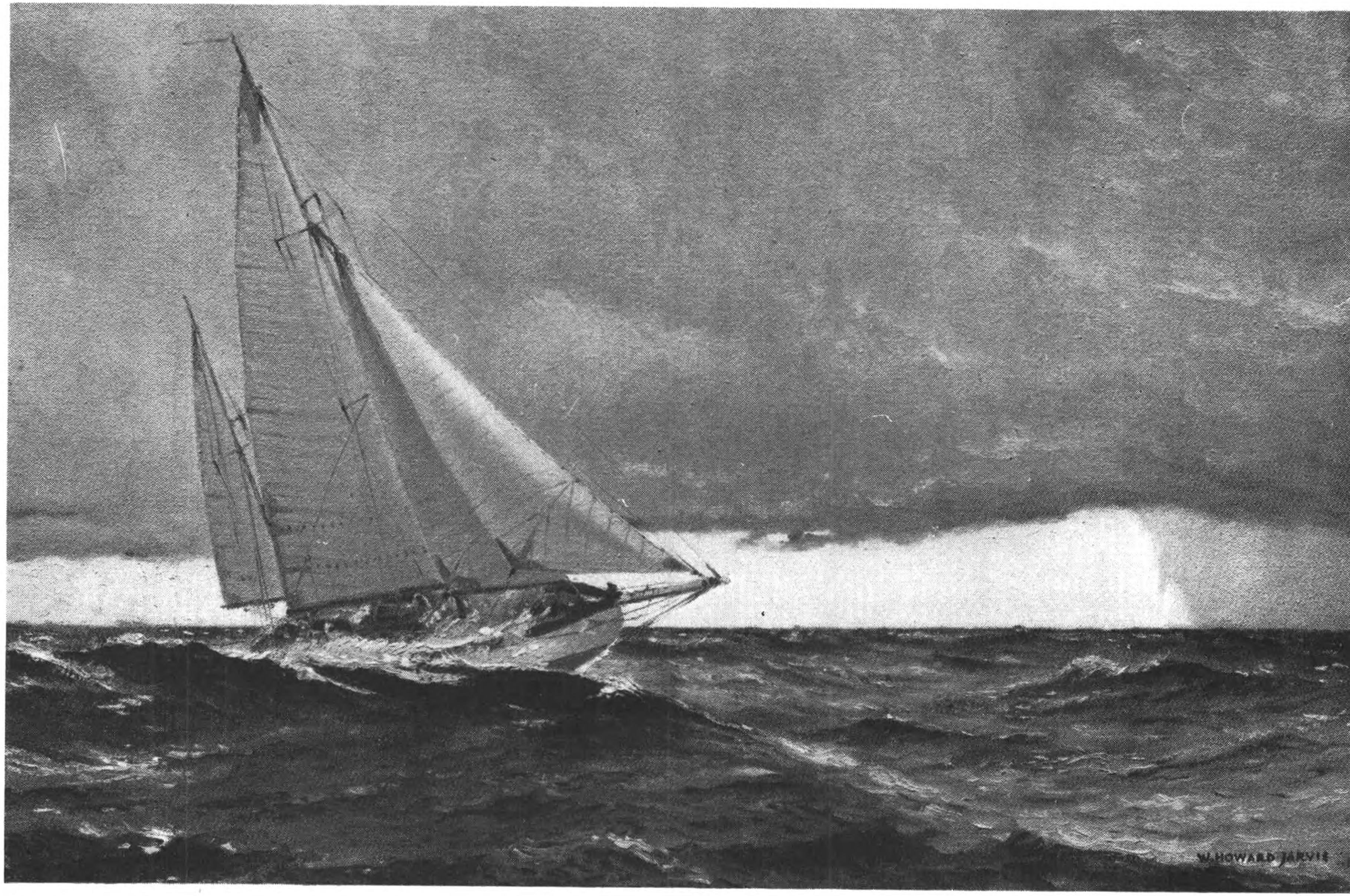


" Squally Weather," by W. Howard Jarvis

EDITORIAL

A study of the shipping papers brings home rather forcibly the fact that, even in this modern age of big ships and power propulsion, the weather still plays an extremely important part in the seaman's life, and in the business of ship operation in general. It is true that "the perils of the sea" due to weather are less than they were in the days of the sailing ship, and modern scientific inventions have helped greatly to minimise those dangers—but almost every gale brings its casualties; collisions, strandings and abandonments still occur with disconcerting frequency, and cargo damage due to rain, sweat and sea is still a matter of concern to ships, consignees and underwriters. Considerable advance has been made of late in ship design and in economy and efficiency in propulsion—the Classification Societies' and National rules as to scantlings, freeboard and general safety are exacting and rigidly enforced—but I think it is true to say that the ship is yet to be designed to go through life without damage of some kind to her cargo or herself. The shipping casualties returns for the year 1947, issued by the Liverpool Underwriters' Association, show that 958 out of a total of 7,392 casualties to world shipping were directly due to the weather. Of the remainder, 15 were due to founderings and abandonments, 1,127 to strandings, 1,466 to collisions and 6 were vessels reported missing; it is safe to assume that a considerable number of these were directly or indirectly due to the weather. 1,536 were due to damaged machinery, shafts and propellers; many of these may have been indirectly caused by heavy weather. The remainder were due to fire, explosions and miscellaneous causes. It is, perhaps, a little comforting to note that the number of total losses included in the above figures was only 103—but the amount of expense caused in even the least spectacular casualty will, at the present high prices of ship repairs, be very considerable, added to which is the length of time needed to carry out repairs.

The above figures do not, of course, include all the cargo damage due to weather which occurs to some extent or other during almost every voyage, despite the most careful precautions taken by ships' officers and others concerned.

So far, we have not mentioned anything about personal injury and loss of life at sea due to the weather. There are no comprehensive statistics regularly to hand, but each year the weather takes its toll of seamen's lives despite all modern life-saving appliances carried in ships and the efforts of the Lifeboat and Coastguard Services of the various countries.

It is true that the human casualties are chiefly concerned with the smaller type of vessel, but even in the largest liner we hear of limbs being broken in heavy weather at sea.

Let us now consider how to lessen this toll of personal and material damage due to the forces of nature. We certainly cannot do much about changing the weather, although scientific experiments are being made in several areas of the world, with the help of aircraft, to produce rain. If these experiments are successful, it is within the bounds of possibility that something might be done to modify or divert a newly-formed depression. At present, however, all we can do is to give warnings when bad weather is expected and take

" The Straggler," by N. Sotheby Pitcher

precautions accordingly. Under the guidance of the International Meteorological Organisation, the Meteorological Services of all countries are striving to provide more adequate information as to present and future weather developments, for the benefit of shipping. It is true that a ship, when at sea in the path of an approaching depression, cannot very often do much more than ensure that everything is secure and snug, ready for the blow, but shipping round the coast can at least seek shelter. In the organisation of this International Weather Service for Seamen, the value of the contributions that the seaman himself provides, by voluntarily sending in meteorological observations by radio, cannot be over-estimated. The clue to the development of an approaching weather system may lie in an isolated report from a ship in the Atlantic.

At the same time, the International Convention for Safety of Life at Sea provides for the practical measures which need to be taken as concerns construction of ships and the provision of life-saving appliances and, in a similar manner, the International Civil Air Organisation deals with safety measures as concerns aircraft. Questions concerning communications at sea are dealt with by the International Telecommunications Union.

In the spring of this year, a conference is to be held in London to revise the International Convention for Safety of Life at Sea, and the opportunity is to be taken to co-ordinate the work of the body responsible for this (at present the Provisional Maritime Consultative Council) with that of the International Civil Air Organisation, the International Telecommunications Union and the International Meteorological Organisation. All these bodies are directly or indirectly concerned with the problem, for safety of life at sea in this modern age concerns aircraft as well as shipping and a measure of co-ordination between the two forms of transport is obviously desirable; though to some extent rivals, they can very much assist each other. Many a seaman owes his life to an air search just as the airman may owe his life to a resourceful ship. Most maritime countries use aircraft even in peacetime to some extent to assist in air/sea rescue work, not only for search purposes, but with the aid of seaplanes or helicopters for actual rescue. It is to be hoped that this Conference—which will probably be closely connected with that of the United Nations Organisation—will do much to enhance safety of life at sea. More will be said about this Conference in a later issue.

From safety of life at sea to marine art is rather a long stride—but there is certainly beauty in a storm, although it is, perhaps, difficult to say the same about a fog. The Society of Marine Artists of Great Britain held its second annual exhibition at the Guildhall during November 1947, and we have been fortunate enough to obtain the permission of the Secretary and the artists concerned to reproduce in this number photographs of some representative paintings from that exhibition, which may be considered to have a meteorological interest. It is regretted that they cannot be reproduced in colour. The picture of "The Straggler" will bring back unpleasant memories to some of us, but it is a reminder of the relationship between the Royal Navy and the Merchant Navy which exists today.

While on the subject of art, I note that the Society for Nautical Research has recently formed a Photographic Record Sub-Committee for the compilation of a collection of maritime photographs at the National Maritime

Museum. Readers of this magazine who are amateur photographers, and wish to contribute to this collection, should send their photographs to the Hon. Secretary, Photographic Record Sub-Committee, Society for Nautical Research, Greenwich, S.E.10.

MARINE SUPERINTENDENT.

APRIL, MAY AND JUNE

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

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

Responsibility for each observation rests with the contributor.

TYPHOON

South China Sea

The following report was received from M.V. *King Robert.* Captain G. Craze. Seattle to Singapore. Observer, Mr. G. Griffiths.

The first indications of the presence of a typhoon, apart from wireless reports, was on 20th June, when vessel was in position lat. 21° 20′N., long. 121° 53′E., when low scud was observed coming up from SSE, with an increasingly S'ly swell, a freshening ENE breeze, and a slowly falling barometer. At 0000 G.M.T. on the 20th, in position lat. 21° 35′N., long. 122° 30′E., the barometer was steady at 1004·8 mb. but commenced to fall slowly so that by 0600 in position lat. 21° 20′N., long. 121° 53′E., it read 1001·2 mb. and was still falling. The wind continued to freshen from ENE, later backing to NE $\times$ N, force 7, by 0600. On 21st June, at 0000, when in D.R. position lat. 20° 30′N., long. 119° 00′E., the barometer read 998·6 mb., falling slowly, the wind was N'ly, force 12 ; the sky was overcast, but no rain had yet been experienced nor was there any thunder or lightning. At 0600 in D.R. position lat. 20° 20′N., long. 118° 25′E., the vessel was at the nearest approach to the centre, which was then estimated to be in position lat. 20° 45′N., long. 119° 50′E., a distance of 80 miles away to ENE. The swell from the centre was from an E'ly direction and the sea from ENE, both being very high, particularly the swell, which at times was estimated to attain a height of 40 ft. Heavy rain began to fall for the first time, but there was no thunder or lightning ; the visibility was ½ cable, owing to the heavy rain and driving spray. Barometer reached its minimum of 992 mb. (29·29 in.). By 1800 in D.R. position lat. 20° 10'N., long. 118° 10'E., the barometer had risen to 996 mb. and continued to rise sharply, the wind was WNW, force 10, with fierce rain squalls. The barometer continued to rise and by 0000 on the 22nd the wind was SSW, force 3, the weather cloudy with occasional rain showers. A typical typhoon sunset was observed on the 21st, the sky a deep coppery colour and the sun deep red. Vessel's course 250°, speed 9·5 knots.

Positions of storm's track as received from Guam and Manila Radio Stations :

18th June at 0000 G.M.T. : First report of a tropical depression slowly intensifying in position 11·3°N., 130·5'E.

18th at 1800	12°N.	129°E.
19th at 1200	15°N.	127°E.
20th at 1200	19·2°N.	121·9°E., now slowly decreasing
21st at 1800	24·9°N.	119°E.
22nd at 0000	25°N.	119°E.

Approximate point of recurvature was at the SW entrance to the Formosa Strait, from where it continued in a NE direction along the China coast and slowly decreased in intensity. Estimated mean speed of advance 11 knots. Track before recurving was in a NNW direction.

CHANGE OF TEMPERATURE

Gulf of Aden

The following is an extract from the Meteorological Record of S.S. *Macharda*. Captain R. A. Penston. Calcutta to Aden. Observer, Mr. J. F. Baker, 3rd Officer.

16th June, 1947. As shown by the following figures an appreciable increase in both the air and sea water temperature was observed after rounding Cape Guardafui from the south. Low barometric readings were also obtained from the vicinity of Ras Hafun northwards.

Date	G.M.T.	Lat. N. ° ′	Long. E. ° ′	Barometer (corrected) in.	Temperature Air °F.	Wet Bulb °F.	Sea °F.
16th June	0	8 35	52 38	29·70	81	78	82
	6	9 40	52 12	29·78	78	75	78
	12	10 50	51 30	29·61	78	73	77
	18	12 01	50 59	29·63	87	80	88
17th June	0	12 13	49 42	29·59	87	81	88
	6	12 22	48 10	29·65	90	83	88
	12	12 28	46 48	29·59	91	79	88

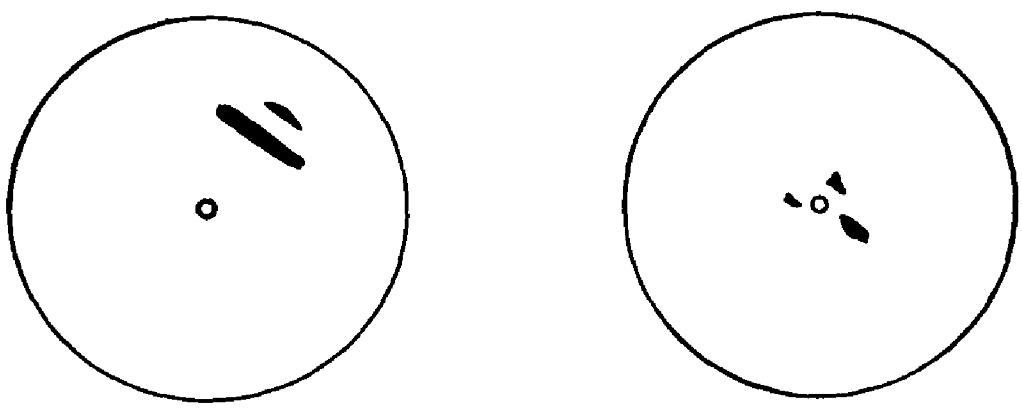
RAIN SQUALL ON RADAR P.P.I.

Pacific Ocean

The following is an extract from the Meteorological Record of M.V. *Port Lincoln.* Captain H. H. Smith, O.B.E. Balbao to Brisbane. Observer, Mr. R. Silvester, 2nd Officer.

4th April, 1947, 0430 G.M.T. Observed on radar screen a heavy rain squall bearing WNW, 30,000 yards distant, approaching vessel rapidly and travelling ESE. At 0445 low bank of nimbostratus stretching from horizon to horizon NNE to SSW bearing WNW, NW'ly wind freshening and increasing to force 5. Barometer 1013·8 mb., steady. At 0500 fine rain in wind, main body of squall astern. Sky overcast (stratus). Wind NW, force 5. Squall passed away towards NE.

Position of Ship : Latitude 21° 27'S., Longitude 139° 20'W.



Rain Squall on Radar P.P.I.

WATERSPOUT

Indian Ocean

The following is an extract from the Meteorological Record of S.S. *Glenaffaric.* Captain J. L. W. Johnston. Colombo to Penang. Observers, Mr. W. E. Willsteed, 2nd Officer, and Mr. A. Wilkins, 3rd Officer.

10th May, 1947, 0430 G.M.T. A waterspout was observed to develop from the base of a large cumulonimbus cloud which had the appearance of a heavy thunder cloud with the typical anvil shape, but without the cirrus or other wisps usually associated with such in its full state of development. Heavy precipitation was observed below this cloud, the estimated base of which was 3,500 ft. and the height approximately 20,000 ft. The waterspout was first observed as a slight bulge at the S'ly end of the cloud base. This grew larger, narrowed and assumed a pipe-like shape. Its shape, however, was at no time constant, varying in thickness slightly and the lower end was always in motion so that its length at times was making an angle of approximately 15° with the vertical on either side. By 0440 the waterspout had formed so that its end was approximately 1,200 ft. above sea level. It then rose slightly to approximately 1,800 ft. and remained steady at this height for a few minutes. The end then dropped rapidly and made contact with the sea for about 2 minutes, rose slowly to approximately 900 ft., and then rapidly retracted into the cloud base at 0450. While the waterspout was complete between cloud and sea, its base remained steady but a slight wavering was observed in its length. While the waterspout was incomplete, no disturbance of the sea could be seen below the end. At the time of observation the ship was steaming 090°, 12 knots, and the phenomenon bore SW × W 4 miles. Weather conditions at the time: barometer, 1011 mb. steady at maximum of forenoon diurnal range; wind W × S, force 2. Temperature: air 88°F., wet bulb 81°, sea 86°, dew point 78°.

Position of Ship: Latitude 05° 52'N., Longitude 84° 29'E.

DUST FOG

Southern Red Sea

The following is an extract from the Meteorological Record of S.S. *Paparoa*. Captain E. A. J. Williams. Milford Haven to Aden. Observer, Mr. A. J. K. Ball, 3rd Officer.

24th April, 1946, 2050 G.M.T. Encountered a thick dust fog, lasting until 0300 on 25th. During this time visibility twice improved, and during the second of these periods Jebel Teir Light, normally visible at 30 miles, was sighted at distance of 3½ miles. One vessel was passed whose lights were sighted when distance was approximately 400 yards. Overhead the sky was quite clear, stars not even dimmed. Steaming lights were reflected back by the very fine dust particles, further detracting from the reduced visibility. The dust was so fine that it could not be felt at the time, but eyes were sore the following morning.

Air quite dry, slight increase in temperature, 84°F. to 87°. Wind force 3.

Position of Ship: Latitude 16° 05'N., Longitude 41° 25'E.

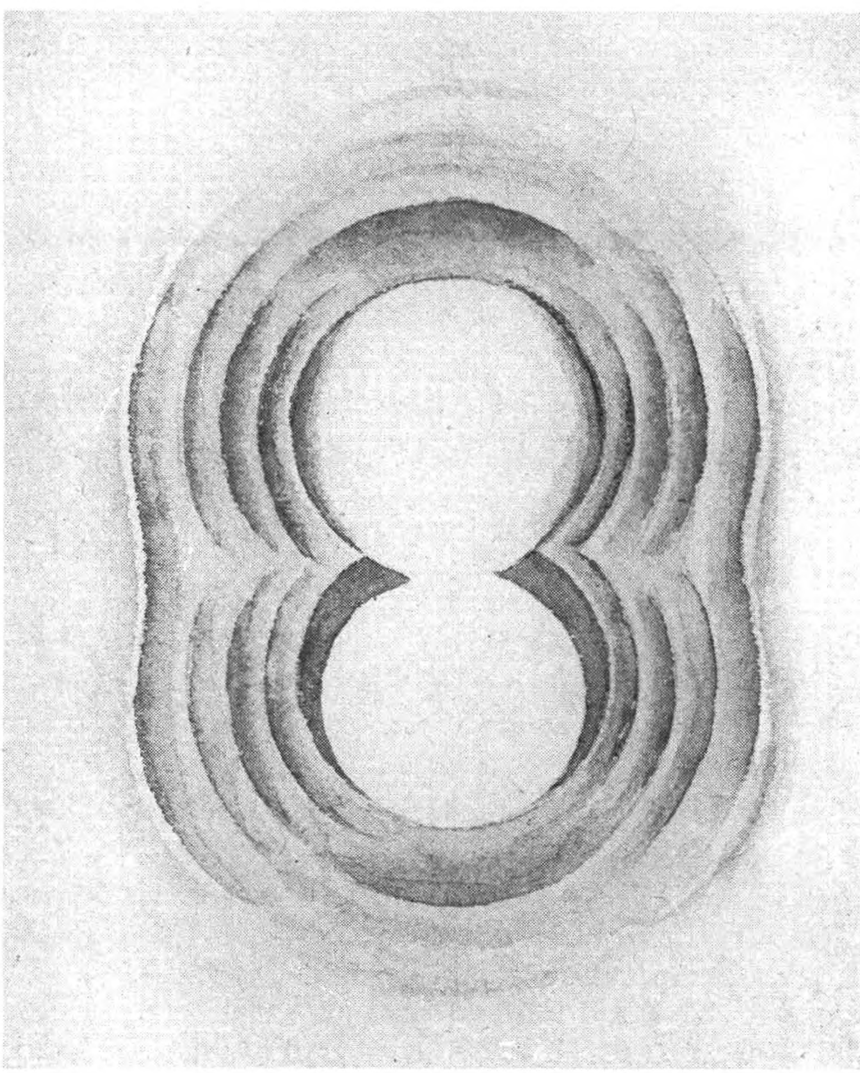
SAND STORM

Mouth of Amazon

The following account was received from M.V. *Chinese Prince*. Captain F. S. Thornton, O.B.E. Observer, Mr. H. E. Jennings, 2nd Officer.

The morning of Sunday 13th April, 1947, opened with very good visibility and sky about 5/10 cloud, mainly Cu. Wind N × E, force 3. By 0300 S.M.T. (0600 G.M.T.) in lat. 01·8 N., long. 46·9 W., cloud had increased to 7/10; 2/10 Cu. 5/10 Ac. Temperature: air 78°, sea 82°, wet bulb 76°. Wind NNE, force 3. The barometer had fallen 3·2 mb. to 1010·1 mb. (diurnal range). At 0400 sky was overcast and a bank of low cloud on the horizon appeared to threaten rain. Visibility had deteriorated slightly and wind was NE, force 4. By 0500 visibility was poor, passing showers were being experienced and radar watch closed up. At 0900 in lat. 02° 8'N., long. 48° 1'W., visibility was considerably under 5 miles and cloud appeared to be 10/10 St. Wind NE, force 4. Temperature: air 80°, wet bulb 76°, sea 81°. Barometer had risen to 1013·6 mb. At 1330 visibility was checked by radar bearing of a passing vessel. At 5,000 yards the vessel was just visible, and at 6,000 yards only an occasional flash of her propeller wake was visible. At 1500 in lat.

3° 7′N., long. 49° 2′W., wind was still NE, force 4. Visibility no better, cloud apparently 10/10 with Ac. the only cloud type visible. Temperature: air 82°, wet bulb 74°, sea 82°. I had suspected that the poor visibility might have been caused by mist due to difference in temperature of the Amazon water and the sea water. These temperatures, however, seemed to disprove this. Shortly after he went on watch at 1600 the Chief Officer, Mr. M. E. Musson, noticed that his new paintwork was being coloured with a golden dust. The signal halyards showed similar effects. At 1700 when taking an azimuth with the sun's altitude approximately 20°, the Chief Officer observed the phenomenon of a double sun. Visibility had by then improved slightly. At 2100 in lat. 4° 7′N., long. 50° 4′W. Wind NE, force 4. Visibility 7. Cloud 7/10; 5/10 Ac., 2/10 Cu. Temperature: air 79°, wet bulb 73°, sea 82°. Barometer 1013·9 mb.



At 0000 on the 14th, visibility increased to about 10 miles. Sky 10/10 cloud, mainly Ac. and As. By daybreak, visibility was very good, although at 0950 I could not take a meridian altitude of Venus because of an apparent haziness in the upper atmosphere. Course throughout these observations was 310°, speed about 16 knots. It was assumed that we experienced the effects of a Harmattan carried across the Atlantic Ocean on the NE Trades.

Note.—It is not possible to say with certainty whether the dust observed on M.V. *Chinese Prince* came from Africa. Observations of dustfall at sea appear to be almost wholly eastward of longitude 30°W., though a German wartime publication states that African dust has fallen at Natal (Brazil). On the other hand dust haze has been observed over a large part of the trade wind region, especially in December to May, and this belt of haze may reach the Amazon region, especially in December to February.

The coast between the Amazon and Cape St. Roque is covered by haze which is partly due to dust blown from the interior of Brazil during the dry season, July to November. It is said, however, to be prevalent near the mouth of Rio Parniaba for 9 months of the year.

The observation of a double sun is a remarkable one, in view of the sun's relatively high altitude. Such observations are usually confined to low altitudes near the horizon. A coloured sketch of this phenomenon and the surrounding sky made by the Chief Officer, was sent, but it is unfortunately impossible to reproduce it. A tracing showing the form of the sun observed is given above. The outer lines indicate bands or fringes of golden light near the sun.

DISCOLOURED WATER

Off the coast of Ecuador

The following is an extract from the Meteorological Record of S.S. *Pipiriki*. Captain A. Hocken. Brisbane to Balbao. Observer, Mr. R. Jeffries, 3rd Officer.

29th May, 1947, 1606 G.M.T. Discoloured water was observed. There were 4 or 5 lanes of a dull yellow colour, running in a S'ly to N'ly direction. The lanes were very distinct, with sharp edges and approximately 20 ft. apart. No soundings were obtained at 150 fathoms; the wind was SE, force 3.

Position of Ship: Latitude 2° 34'S., Longitude 85° 32'W.

PHOSPHORESCENCE

Brazilian Waters

The following is an extract from the Meteorological Record of M.V. *Adolfo*. Captain E. J. Osborne, M.B.E. Ibicuy to Curaçao. Observer, Mr. D. L. Newton, 2nd Officer.

4th April, 1947, 0130 G.M.T. The wind was SSE, force 3, and suddenly dropped to E'ly light airs; the sea was reduced to slight ripples almost instantaneously. At 0215 G.M.T. the vessel entered a mirror-like brilliant phosphorescent sea and the wind dropped to calm. A corona was also in existence around the moon.

Weather conditions at the time: Barometer 29·98 in. steady. Temperature: air 74°F., wet bulb 71°, sea 77°. Cloud: lower type, Cu. and Cb. (precipitating in distance); middle type, Ac. and no upper type. Cloud amount with base under 8,000 ft. was 3/10 at estimated height of 2,000 ft.; total amount was 7/10 with Ac. at an estimated height of 17,000 ft. There was a slight E'ly swell and very good visibility. Course 043°. Speed 12 knots.

Position of Ship: Latitude 27° 07'S., Longitude 45° 25'W.

ABNORMAL REFRACTION

Indian Ocean

The following is an extract from the Meteorological Record of S.S. *Macharda.* Captain R. A. Penston. Birkenhead to Calcutta. Observer, Mr. J. F. Baker, 3rd Officer.

13th April, 1947, 0020 G.M.T. Venus rose bearing 100° (T), visible on the horizon and extremely brilliant. The planet appeared to be scintillating and was seen to change its colour often and abruptly, varying from brilliant white to pink and bright red. The refracted size of the body was at least half the diameter of the moon, and presented a very unusual and pleasing spectacle. Visibility that morning was exceptional ; at daylight the eastern end of Socotra was visible bearing NNE 76 miles.

Weather conditions at the time : Barometer 29·67 in. Wind SE, force 3. Temperature : air 80°F., wet bulb 75°. Sea smooth, slight E'ly swell.

Position of Ship : Latitude 11° 31'N., Longitude 53° 15'E.

MIRAGE

East Coast, British Isles

The following is an extract from the Meteorological Record of S.S. *Empire Spearhead.* Captain A. N. Anderson. Hull to Cuxhaven. Observer, Mr. R. E. Shinn, M.B.E., Chief Officer.

1st April, 1946, 1800 G.M.T. When proceeding eastward, after disembarking pilot off Spurn Point, observed well-marked example of superior mirage. Flamborough Head Lighthouse appeared as two images, the lower image inverted, as also did a number of vessels to northward. There was no evidence of mirage to southward.

Position of Ship : Latitude 53° 34'N., Longitude 00° 32'E.

LUNAR HALO

North Atlantic Ocean

The following is an extract from the Meteorological Record of M.V. *Lobos.* Captain R. H. Sissons. London to Cristobal. Observer, Mr. R. G. Twist, 3rd Officer.

4th April, 1947, 0000 G.M.T. At 0000 G.M.T. and for several hours after, a lunar halo of unusual clarity was observed. The halo formed a complete circle with a radius of 22°. At 0300 when at its brightest, the colours red, orange, yellow and blue could be clearly distinguished. The sky during the whole evening was covered by a very fine film of cirrus cloud.

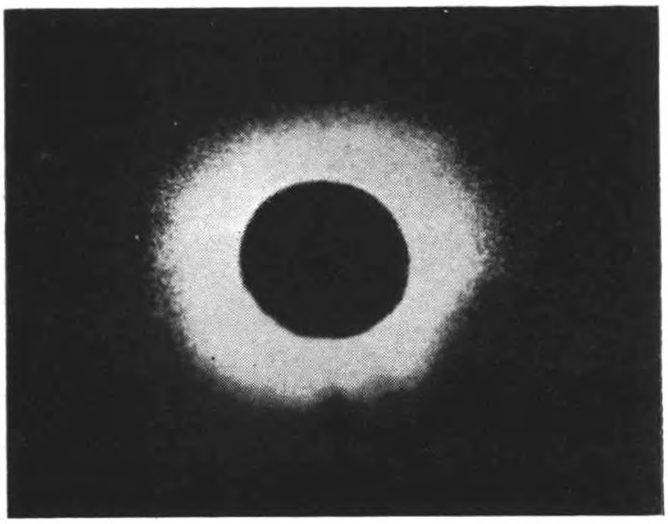
Position of Ship : Latitude 38° 11'N., Longitude 26° 04'W.

TOTAL ECLIPSE OF THE SUN

In Lagos Harbour

The following is an extract from the Meteorological Record of S.S. *John Holt.* Captain A. Kennedy. Observer, Mr. W. L. Harrison.

20th May, 1947. At 1557 Nigerian Standard Time we witnessed a total eclipse of the sun in an absolutely clear sky. At 1530 approximately the light appeared to be failing very slowly as if dusk had been advanced 2 hours. Nevertheless, the full shade glass of the sextant's index glass was necessary to watch the passage of the moon across the sun's face. The failing light had an eerie appearance and all work on the wharf ceased, the unusual quietness adding to the weirdness of the phenomenon. Towards the time of the total eclipse, stars began to appear and the total phase began. The scene was as of night and one could look at the sun with clear binoculars. Four minutes later the light began to return and five minutes after that the Kroo boys were back at their work stowing bags of ground nuts, having had half-an-hour's respite at the sun's expense.



Brazilian Waters

The following is an extract from the Meteorological Record of S.S. *San Felix*. Captain J. B. Marcarthy. Santos, Brazil, to Curaçao. Observer, Mr. D. Stevenson, 2nd Officer.

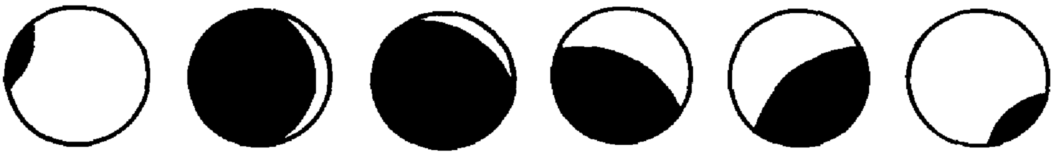
20th May, 1947. The eclipse of the sun was observed to begin at 1130 G.M.T. By 1225 the sun was roughly two-thirds obscured and a ring of reflected light could be seen on the edge of the moon's surface which overlapped the sun. Altitudes of both sun and moon (lower limb) were taken at 12h. 38m. 31s. and 12h. 39m. 18s. respectively. These corrected were: sun 50° 15¼', moon 51° 08¾'. At 1254 the total eclipse occurred, with the sun's corona visible. Venus and several stars were seen. Star sights were taken and the position at 1254 was found to be lat. 11° 24'S., long. 35° 29'W. At 1256½ the sun began to clear from the moon, but no observation was made of the time of last contact.

Weather conditions at the time of eclipse: Barometer 29·91 in. Wind NE, force 2. Temperature: air 77°F., sea 76°. A heavy bank of Cb. to the NW, clear sky to the E with small detached Cu. and thin Cs. and Cc. in the area of the eclipse.

Position of Ship: Latitude 11° 31'S., Longitude 35° 30'W.

Note.—The accompanying excellent photograph was received from S.S. *John Holt*. It shows the outer atmosphere of the sun, known as the solar corona, surrounding the black body of the moon, which is covering every part of the bright disc of the sun that we see normally. In 1947 the sun was near the time of maximum sunspot activity and the form of the corona shown, more or less equal in all directions, is that usually associated with the maximum of the solar cycle. At other times it takes different forms. The irregularity of the moon's edge is due to the common photographic defect of halation, the light from the bright corona adjacent to this part of the moon's edge having spread over it.

Observations of the partial phase of the eclipse have been received from the following ships: M.V. *San Adolfo*, S.S. *Atlantis*, S.S. *Baron Herries*, S.S. *Black Prince*, M.V. *Defoe*, S.S. *Explorer*, S.S. *Memling*, M.V. *Orari*, S.S. *Southern Opal*, M.V. *Staffordshire*. These ships were at varying distances from the narrow belt where the total phase could be observed, so that the maximum amount of the sun's disc covered by the moon varied in each case. The accompanying sketch shows successive phases of the very large partial eclipse observed by S.S. *Southern Opal* in lat. 13° 46'S., long. 33° 33'W.



AURORAE

North Atlantic Ocean

The following is an extract from the Meteorological Record of S.S. *Cavina*. Captain S. Browne. Liverpool to Montreal. Observer, Mr. C. Marchant, 3rd Officer.

24th April, 1946, 0000 to 0400 G.M.T. A very brilliant display of Aurora Borealis ("floating curtains") was observed to the north and ultimately covering the whole sky. The light was more brilliant than that of a full moon and the sky was cloudless. The rays appeared to spread fanwise from a focal point in the north, and were yellowish in places.

Position of Ship: Latitude 48° 53'N., Longitude 37° 03'W. Course 240°.

South Australian Waters

The following is an extract from the Meteorological Record of M.V. *Australia Star*. Captain O. C. Roberts. London to New Zealand via Australia. Observer, Mr. A. K. White, 3rd Officer.

23rd April, 1946, 1200 G.M.T. En route from Fremantle towards Melbourne auroral light was observed bearing S. It faded out about 1230 G.M.T. and reappeared at 1300 arranged as follows: From 140° to 160° there was a bright white light spreading out into a red glow at the top. This red glow was mushroom-shaped and the same depth approximately as the white light. To the right of this and extending from about 160° to 180° was a patch of yellow light. The whole display lasted until 1430, when it disappeared completely. The moon was up, and after the auroral light had disappeared that portion of the sky between 160° and 180° was seen to be a patch of white cloud, whilst between 140° and 160° the sky was perfectly clear. This leads to the belief that the actual display took place between 140° and 160° whilst the rest, i.e. that portion from 160° to 180°, was merely the reflection of the light on the clouds.

Position of Ship: Latitude 36° 15'S., Longitude 120° 45'E.

Australian Waters

The following is an extract from the Meteorological Record of S.S. *Orion*. Captain C. Fox, O.B.E. Melbourne to Colombo. Observer, Mr. G. S. Willis, 3rd Officer.

17th April, 1947, 1540 to 1820 G.M.T. (0120 to 0400 A.T.S. on 18th). Observed good display of Aurora. Rays and diffused light of considerable brilliancy.

1540 G.M.T. Aurora stretched over arc of horizon from 145° (T) to 225° and reached an altitude of approximately 20°. A long low bank of Cb. stretched along horizon to an altitude of 4° to 5°. Rays clearly defined and shifting as searchlight beams. Colour intense white to yellow, latterly red, intense, clear and shaded with purple at eastern end of arc for about 10° and 15° of altitude. Arc increased latterly from 130° to 230° and red light spread along arc at an altitude of about 5° to 7° and above.

1555 Rays disappeared leaving area of diffused light of lesser but marked brilliancy. Red light disappeared, predominating colour now yellow.

1630 Aurora returned with brilliant display, red again, very marked at eastern end.

1720 Aurora practically disappeared.

1810 Venus rose bearing 100° and flashing brilliant red.

1820 Aurora returned again with about its initial brilliancy, then gradually faded to area of diffused light which remained until dawn.

Position of Ship: Latitude 39° 08′S., Longitude 143° 00′E.

The following is an extract from the Meteorological Record of M.V. *Ajax*. Captain D. Rees. Fremantle to Singapore. Observer, Mr. F. A. Harris, 2nd Officer.

17th April, 1947, 2005 G.M.T. A deep red glow was observed in the southern sky. The glare became quite bright almost immediately and remained so until 2015 when it commenced to fade, and disappeared at 2020. The sky was cloudless except up to about 5° above the horizon. The centre of the glare bore 175° and covered an arc of the horizon of about 30°, reaching an altitude of 15° or 20°. The colour remained red throughout and the light was steady.

Position of Ship: Latitude 27° 41′S., Longitude 112° 54′E.

Indian Ocean

The following is an extract from the Meteorological Record of M.V. *Sydney Star*. Captain T. S. Horn, O.B.E. Teneriffe to Fremantle, via Cape of Good Hope. Observer, Mr. G. Cameron Smart, 2nd Officer.

17th April, 1947, 1850 to 2015 G.M.T. (0115 to 0240 A.T.S. on 18th).

1850 G.M.T. Bearing 140° (T) reaching approximate altitude of 40°, diffused auroral light covering arc of horizon of about 80°. White near horizon to red at top of display. No moon, clouds covering area just above horizon. Subsequently there were sharply defined moving rays in a 225° direction. These rays were white when observed, but rapidly turned red and lost their apparent motion.

1935 Area of sky covered by Sc. and Ns.

1940 Auroral light strong enough to show through breaks in clouds and illuminate the edges to a slight degree.

2005 Red light showing through breaks almost to the zenith.

2015 Sky totally overcast with As.—further observation impossible.

Position of Ship: Latitude 37° 22′S., Longitude 94° 10′E.

Other ships reported the aurora on 17th April in Home Waters:

S.S. *Empire Cutlass*, lat. 53° 56′N., long. 03° 15′E. "2030–2400 G.M.T. Northern Lights very pronounced."

M.V. *San Cirilo*, lat. 47° 43′N., long. 08° 26′W. "2100–2300 G.M.T. Aurora Borealis observed."

Gulf of St. Lawrence

The following is an extract from the Meteorological Record of S.S. *Mahia*. Captain J. W. Hart. London to Montreal. Observer, Mr. T. de M. Ogier, 3rd Officer.

18th May, 1947, 0320 to 0430 G.M.T. The first indication of this phenomenon occurred at 0320, when a shaft of light appeared to rise from just above the horizon bearing 310° (T) and reaching an altitude of about 40° in a clear sky. Some minutes later many smaller parallel rays appeared to the northward. These diffused over an arc 282°–000°–066° and at the same time the original shaft faded, appearing again on the same bearing at fairly regular intervals. The maximum altitude of the lower edge of the arc was about 10°. The dark segment under the concave border of the arc was very pronounced at this stage and stars were plainly visible through it. At 0420 the light was partially obscured by Ac. clouds in the NW, the light faded completely at 0430.

Position of Ship: Latitude 48° 29′N., Longitude 62° 33′W.

METEOR

Indian Ocean

The following is an extract from the Meteorological Record of M.V. *Clydebank*. Captain W. Broome. Calcutta to Punta Arenas. Observer, Mr. W. Munday, 2nd Officer.

12th April, 1946, 1832 G.M.T. On a passage from Cochin to Punta Arenas a very bright meteor was observed. It appeared under the constellation of Ursa Major, bearing N 15°E (T) at 10° altitude. Dropped vertically, leaving long trail and vanished on the same bearing at 3° altitude. The meteor was in sight about 4 seconds, coloured blue-white and much more brilliant than the moon, which was midway between the first quarter and full. Fine, clear and practically cloudless night. Wind NW, force 2; barometer 1010·2 mb; air temperature 83°F.

Position of Ship: Latitude 5° 26′N., Longitude 68° 50′E. Course 241° (T).

RADAR STORM DETECTION

CONTRIBUTED BY THE NAVAL METEOROLOGICAL SERVICE

Radar. The term " radar " was coined as a convenient abbreviation of " radio direction and range ", thus indicating a method whereby wireless waves can be used to determine the range and bearing of certain objects or " targets."

The frequencies suitable for this purpose are higher than those normally used for wireless communication, wavelengths being of the order of a metre or less. A short signal or " pulse " lasting about a millionth part of a second is transmitted on any required bearing. On encountering a target, part of the energy of the pulse returns along its original path and by suitable receiving devices can be made to reveal the existence of the target. By analogy with the corresponding effect of sound waves, the indication on the receiver is called an " echo." The speed of travel of the waves, about 186,000 miles per second, is known, and so the range of the target can be found from the time interval between transmission of pulse and reception of echo.

The indicating devices are commonly visual and are of varying design according to the manner in which it is desired to present the information. The " A-scope " (Fig. 1) shows range horizontally and size of echo vertically, the direction of the echo being determined from that of the transmitting aerial. The " plan position indicator " (P.P.I.) (Fig. 2) gives both range and bearing, the screen presentation being in effect a map of the region around the receiver. Range is measured radially from the centre of the indicator (representing the position of the receiver), lines of equal range being shown as concentric circles on the screen, and bearings are marked on the circumference of the screen. The vertical extent of a target can be obtained from a scope giving range horizontally and height vertically.

Meteorological Echoes. It is believed that the first application of radar to detecting weather phenomena was made in H.M.S. *Nigeria* in 1942. Frontal precipitation was detected on a wavelength of 7½ metres, but the information, though valuable, was uncertain, and it was only with the later development of sets operating on centimetre wavelengths that more definite results were obtained.

Although the physical principles governing the production of meteorological echoes cannot yet be said to be fully understood, it is now fairly well established that these echoes are obtained only from precipitation, and are the result of scattering of the energy of the pulse by the rain, sleet, snow or hail constituting the precipitation. No instances have been recorded of echoes from fair weather cumulus, and clouds from which only very light rain or drizzle is falling do not normally give echoes.

Under certain atmospheric conditions, however, the range of detection of targets by a radar set is found to be considerably above or below that normally obtained from the set. When such " anomalous propagation " has been present, echoes associated with low stratus cloud or fog patches have occasionally been recorded.

The various types of precipitation give similar echoes and it is not possible by means of radar to distinguish hail or snow storms from rain storms.

Scattering of radiation can occur only when the wavelength of the radiation is greater than the dimensions of the particle on which it falls. The energy falling on the target surface is then not turned back in the regular manner which enables us to see our reflection in a mirror, but comes off the surface in all directions, so that only a small fraction of it is returned along the path of the incident pulse.

Characteristics of precipitation echoes. With a little experience, it is not difficult to distinguish precipitation echoes from those due to other targets which may also be present. They are frequently much larger than the echoes from other targets, they have a hazy and cloud-like appearance, their size and shape are variable and irregular and may change rapidly, and their intensity also varies within wider limits than those of non-meteorological echoes. These fluctuations of intensity are not readily observable on the P.P.I., as the screen is designed to give a persistent indication, but are well marked on the A-scope, on which a precipitation echo generally appears as a large number of peaks of unequal height (Fig. 1), resembling a patch of longer grass above the general level of " grass " (background noise) characteristic of this representation.

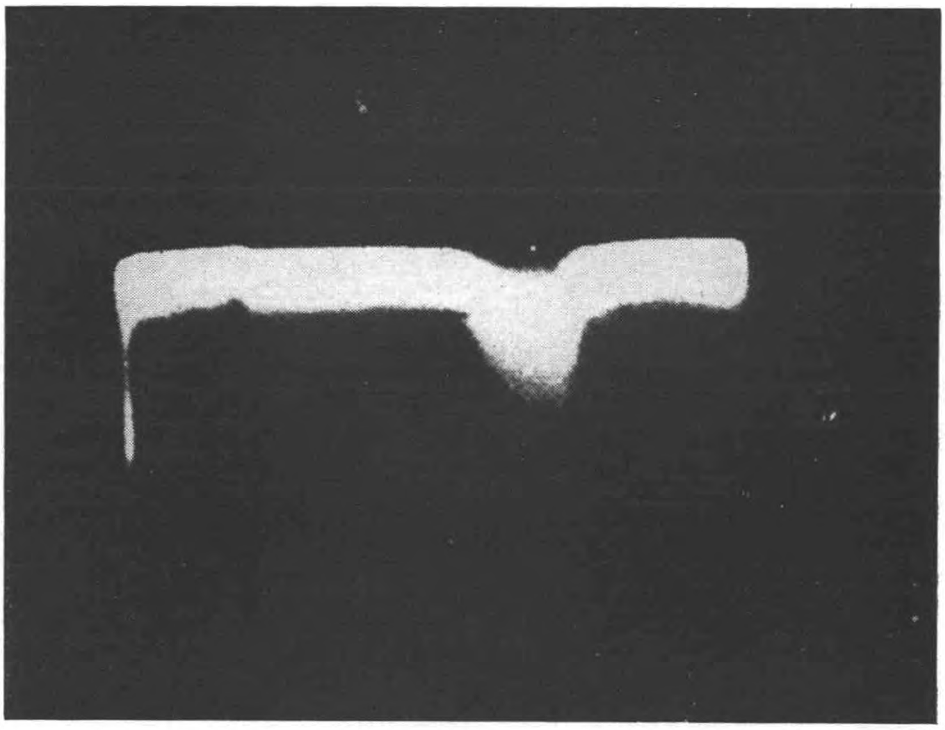
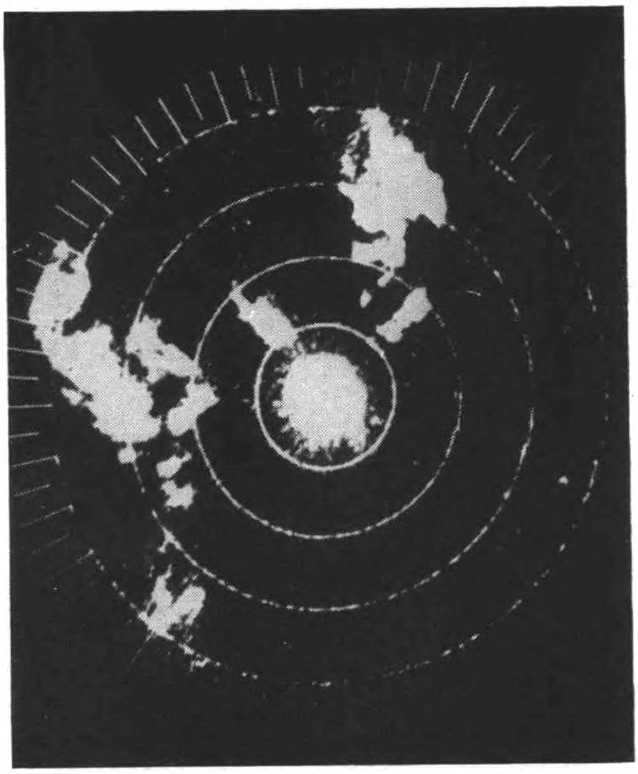


Fig. 1. Precipitation echo on " A " scope. Range is shown horizontally, increasing from left to right, a total of 25 miles. Amplitude of the echo is shown by the vertical extent of the bright trace, increasing downward. The base line is the upper edge of the thick bright horizontal line. Width of the horizontal line is due to the background noise of the receiver. To be seen echo must be of greater amplitude than the noise. Vertical mark at left is original transmitted pulse. The length of this line indicates the limiting level of reception, as all echoes above this amplitude are cut off at this level. Precipitation echo at right shows characteristic fuzzy, indistinct appearance, indicating reflecting area of considerable depth. The base line is not clearly broken. Much of the detail of the fuzzy appearance is lost in the photograph. Amplitude of echo is moderate, below limiting level of receiver.



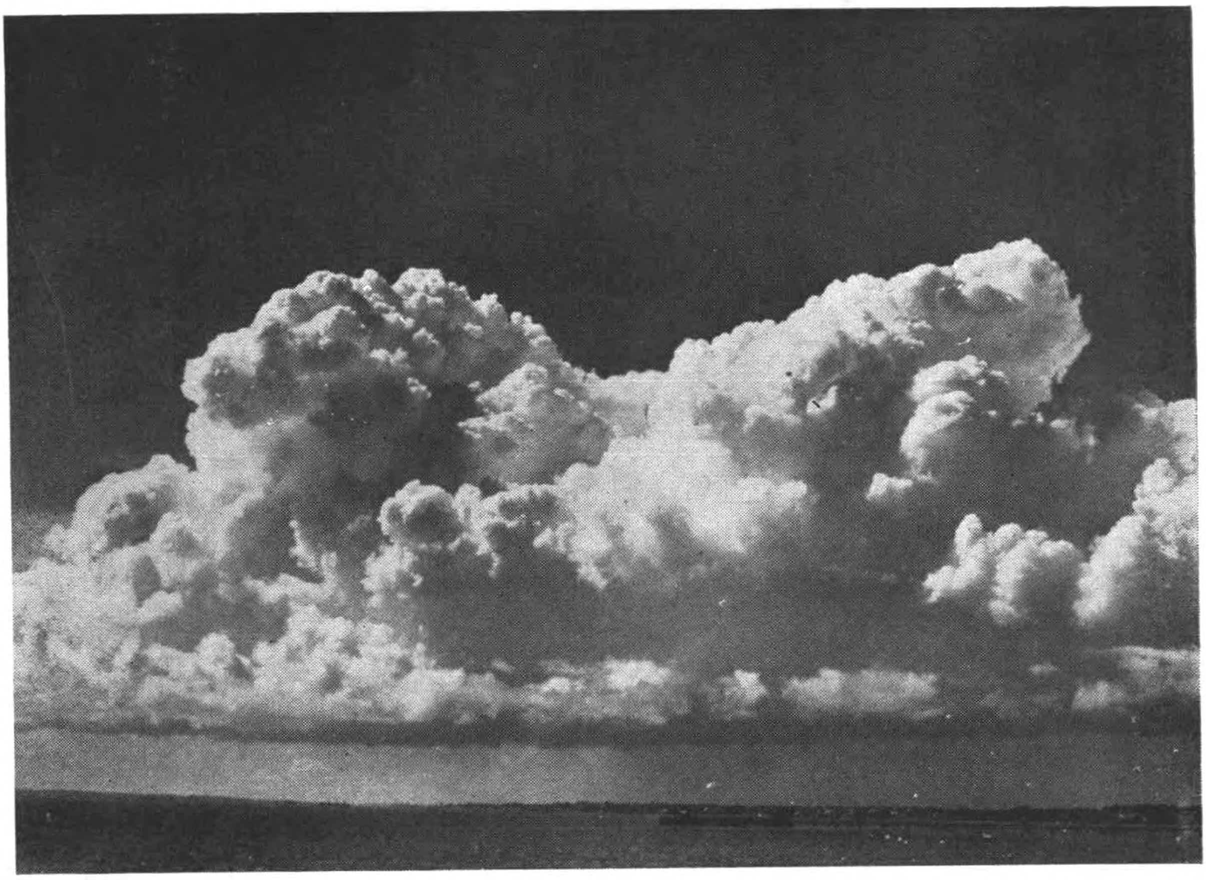


Fig. 2. (Top.) P.P.I. presentation showing the radar echo from precipitation in Cumulus congestus cloud. Range marker circles are at 4 mile intervals. It is noted that the appearance is similar to that of a thunderstorm echo as shown in Fig. 3. Distinction is made by scanning in elevation. No precipitation may reach the surface from these clouds. The irregular distribution of echoes indicates that no front is present.

(Bottom.) A typical Cumulus congestus cloud. These are found at cold fronts and in unstable air masses. If the instability persists to very high levels, the cloud develops into a cumulonimbus with the characteristic anvil.

Fig. 3. (Top.) Echoes from thunderstorms shown on the P.P.I. The concentric lines are 5 mile range circles. By scanning in elevation an assessment of the vertical development may be made. The echoes are obviously from non-frontal storms.

(Bottom.) Cumulonimbus or thunderstorm cloud with anvil. (Cb. incus.)

Corresponding to the movement of the precipitation area, the echoes show motion, which will normally be slower than that of other targets at the same height, and will also differentiate them from fixed targets. When scanning in elevation is possible, the large vertical extent of the precipitation gives a correspondingly extended echo in the vertical, and can be used to estimate the intensity of the storm, e.g. to differentiate a shower from a thunderstorm. The presence of precipitation at great heights also enables echoes from it to be obtained at much greater ranges than from most other targets. Under normal atmospheric conditions with a radar set at surface level, precipitation at 20,000 ft. can be detected up to a maximum distance of about 175 miles. The corresponding maximum ranges of detection for precipitation at heights of 10,000 ft. and 5,000 ft. are about 120 miles and 80 miles respectively. Increasing the height of the radar set above the surface increases the ranges at which precipitation at a given height may be detected.

Under normal atmospheric conditions, the attainment of the extreme ranges quoted above for surface radar systems is only possible with high power and heavy precipitation. As a general rule, it may be taken that the lower the power radiated by the radar system and the lighter the precipitation, the smaller is the range at which an echo will be obtained. Frequency and pulse length, however, also affect both the strength of the echo and the amount of detail which can be observed in its structure. Low frequency and long pulse give greater range, or a stronger echo at the same range. Increasing the frequency or decreasing the pulse length improves the resolution of detailed structure and so facilitates the recognition of the particular phenomenon causing the echo.

There is, however, a limit to the extent to which the frequency can be raised with advantage, even at relatively short ranges. Not all the energy falling on the target is scattered ; a certain proportion is absorbed by the target and converted into heat. This absorption, in the case of liquid water, increases rapidly with frequency in the waveband from 10 cm. to 1 cm. Thus, if the frequency is raised too much in the hope of improving the resolution, the radiation may be completely absorbed in penetrating a small depth of the precipitation region, and the fraction scattered back before this happens will also suffer strong absorption by the drops it encounters on its way back to the outer edge of the region. The very intensity of precipitation would thus operate to conceal its existence. Similarly, an extended region of moderate precipitation could mask the presence of heavier precipitation behind it.

Summing up as far as frequency is concerned, it may be said that the best frequency for long-range detection is around 10 cm. but if strong echoes are being received, greater detail may be observed by reducing the wavelength to about 3 cm.

Forecasting. It is difficult enough to forecast, from the synoptic chart alone, the position or time at which a shower will occur over land ; over the sea, where observations are relatively scarce, the situation is worse. The existence of showers or thunderstorms within 100 miles of a ship can normally be readily detected by radar, and their every movement and change in intensity followed in detail. Even major weather features, such as tropical storms or frontal systems, can seldom be located from the synoptic data available with any precision over the open ocean. Radar cannot locate frontal systems as such, but it can locate and follow precisely any areas of moderate or heavy precipitation associated with them. Fronts giving no precipitation, or only drizzle or light rain, will normally escape detection. Considerable success has also been achieved in determining the precipitation structure of tropical storms, and providing information on the position and movement of the centre.

Radar thus constitutes a powerful addition to the tools available for short-range forecasting. When the phenomenon has been identified from its echo characteristics, its movement can be studied over a short interval of time and its probable future movement thus forecast. Later changes can be noted and the forecast amended if necessary.

As an aid to recognition, some examples are appended of how typical weather phenomena, identifiable from radar echoes, appear on the P.P.I. representation.

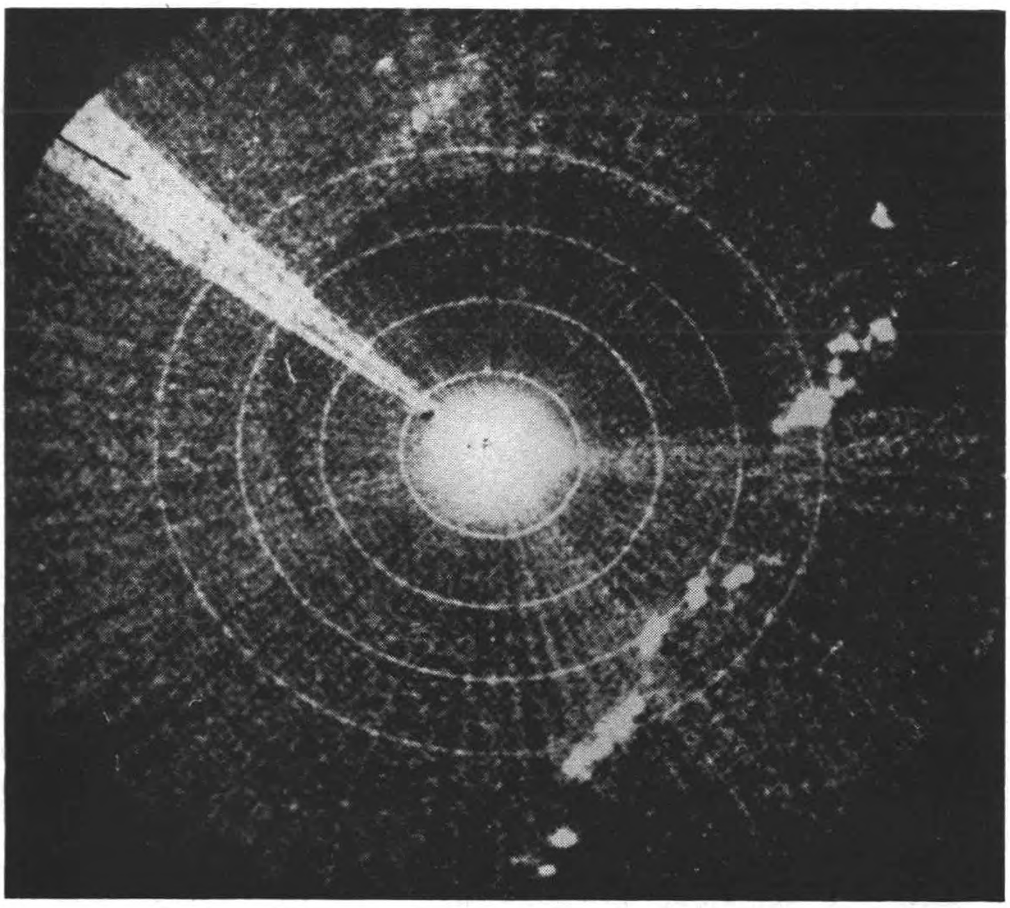


Fig. 4 indicates the echoes received from a well-marked cold front with Cb along its length. The range circles are at 20 mile intervals. The linear distribution of echoes in the S.E. quadrant indicates a belt of frontal precipitation. By tracing the movement of such a precipitation belt, it is possible to predict its time of passage and the eventual clearance almost to minutes.

The convergence zones associated with tropical weather may similarly be detected.

Fig. 5 (*a*)

Fig. 5 (*b*)

Structure of a typhoon as shown on the P.P.I. In Fig. 5 (*a*) the eye of the typhoon is visible. The centre is 40 miles away from the ship on a bearing of 055°. In Fig. 5 (*b*), taken 3½ hours later, the eye is beyond the range of the radar but the approximate bearing and distance of the centre can still be estimated.

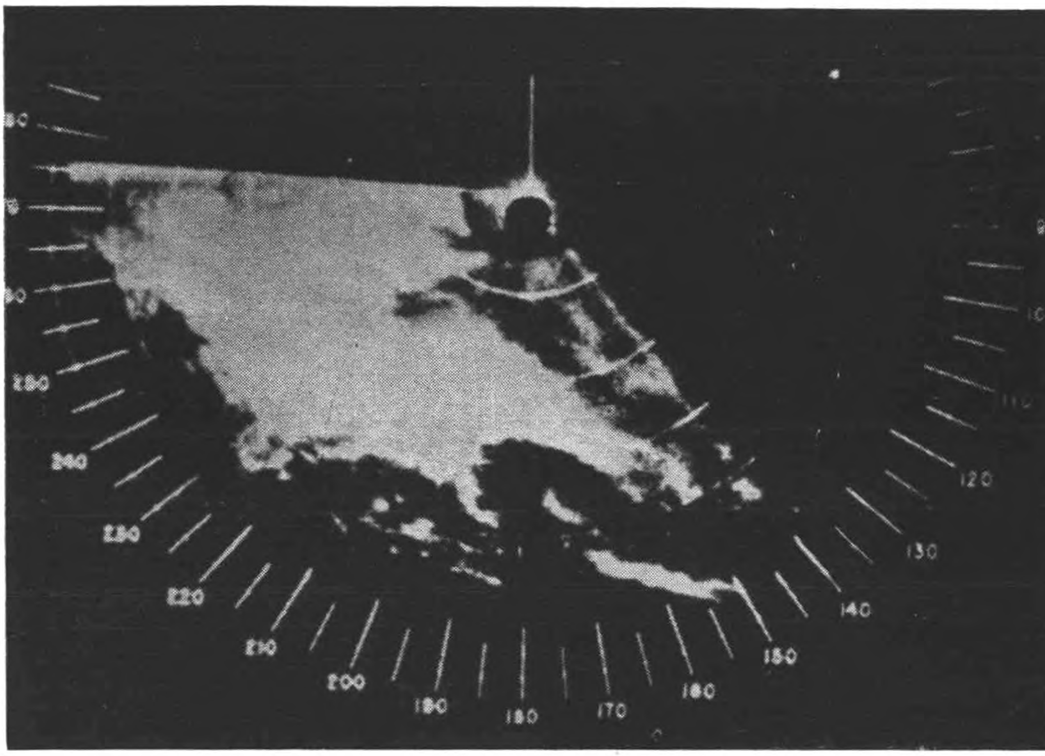


Fig. 6. Precipitation associated with a warm front as it appears on the P.P.I. The range circles are at 10 mile intervals. The size and distribution of the echo in the sector from 150° to 270° should be contrasted with the isolated echoes shown in the previous figures, and is typical of the general widespread precipitation to be expected ahead of a warm front.

ICE CONDITIONS IN THE BALTIC DURING THE WINTER 1946-47

BY T. H. KIRK, B.SC.

Introduction

The winter of 1946-47 in the British Isles was one of extreme severity, marked by an exceptional predominance of cold easterly winds. This fact and the unusual reports of ice off the east coast of England suggest that an examination of ice conditions in the Baltic and North Seas may be of considerable interest.

The approach of winter in north-west Europe is normally marked by the steady establishment of high pressure over land. Incursions of depressions from the Atlantic become less and less frequent and the penetration inland of mild maritime air becomes progressively weaker as winter becomes established. The North Sea, together with the British Isles, is usually subject to the interplay of continental and maritime conditions, and as winter progresses the contrast between the corresponding cold and mild spells becomes greater. The Baltic Sea, being so extensively landlocked, experiences conditions that are more rigidly severe and continental in type, this being especially true of the Gulfs of Bothnia and Finland which are the areas to show the first signs of the approaching freeze-up.

The normal ice year

Let us first consider the average or normal ice conditions prevailing in the Baltic area. As might confidently be expected from general considerations, freezing commences first at the head of the Gulf of Bothnia in late October or very early November, the ice forming along beaches and banks but not at first constituting any real hindrance to navigation. The main ports in this area are generally closed to navigation towards the end of November. By this time ice has started to form at most places along the east coast of the Gulf and at isolated points along the western shore. Some harbours, e.g. Kristinestad, are closed to navigation shortly after the first appearance of the ice, i.e. at the end of November. Others, such as Vaasa, normally keep open until the beginning of January. In the eastern reaches of the Gulf of Finland freezing starts towards the middle of November and gradually

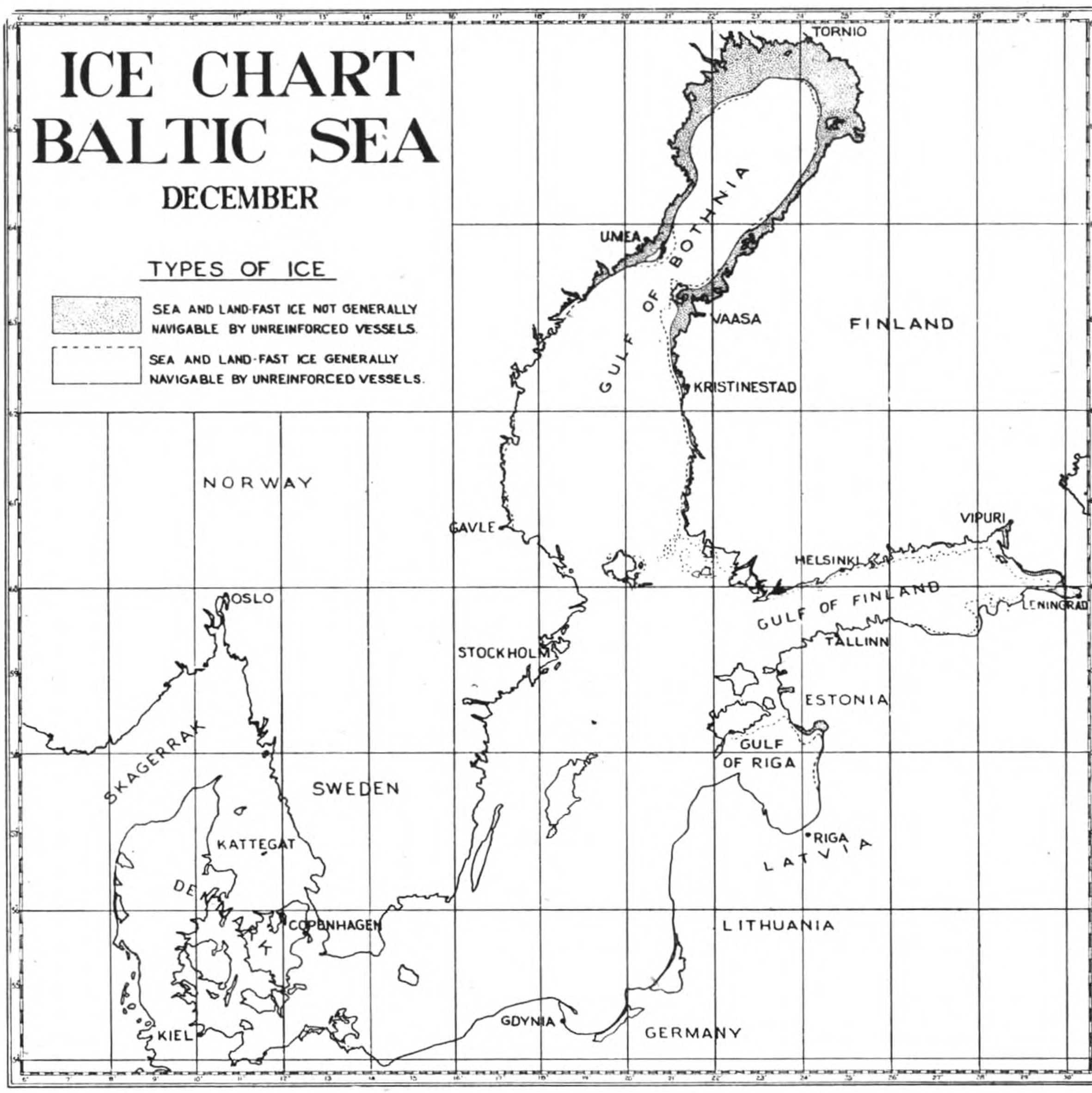


Fig. 1. Adapted from "Ice Atlas of the Northern Hemisphere," published by Hydrographic Office, U.S. Navy.

extends westwards along both shores. Average conditions in December, for the whole Baltic area are shown in Fig. 1. In this diagram, boundaries are shown for ice in two distinct categories; that generally navigable by unreinforced vessels, and ice not normally navigable by such craft. Note that in this month freezing commences in the Gulf of Riga, in enclosed waters along the coasts of Denmark, the Low Countries and Germany, in Oslo fjord and in the lakes near Stockholm.

In January the Gulf of Bothnia freezes over at its narrowest point, roughly along a line from Vaasa to Umea, the ice in the Gulf of Finland becomes much more extensive, main ports such as Leningrad and Vipuri closing to navigation about the middle of the month. Along the Swedish coast to almost as far south as Stockholm the main harbours are generally closed by the middle of the month. Ice forms along the western Danish coast south of Blavands Huk and extends by Sylt Island across the mouth of the Elbe to just west of Borkum.

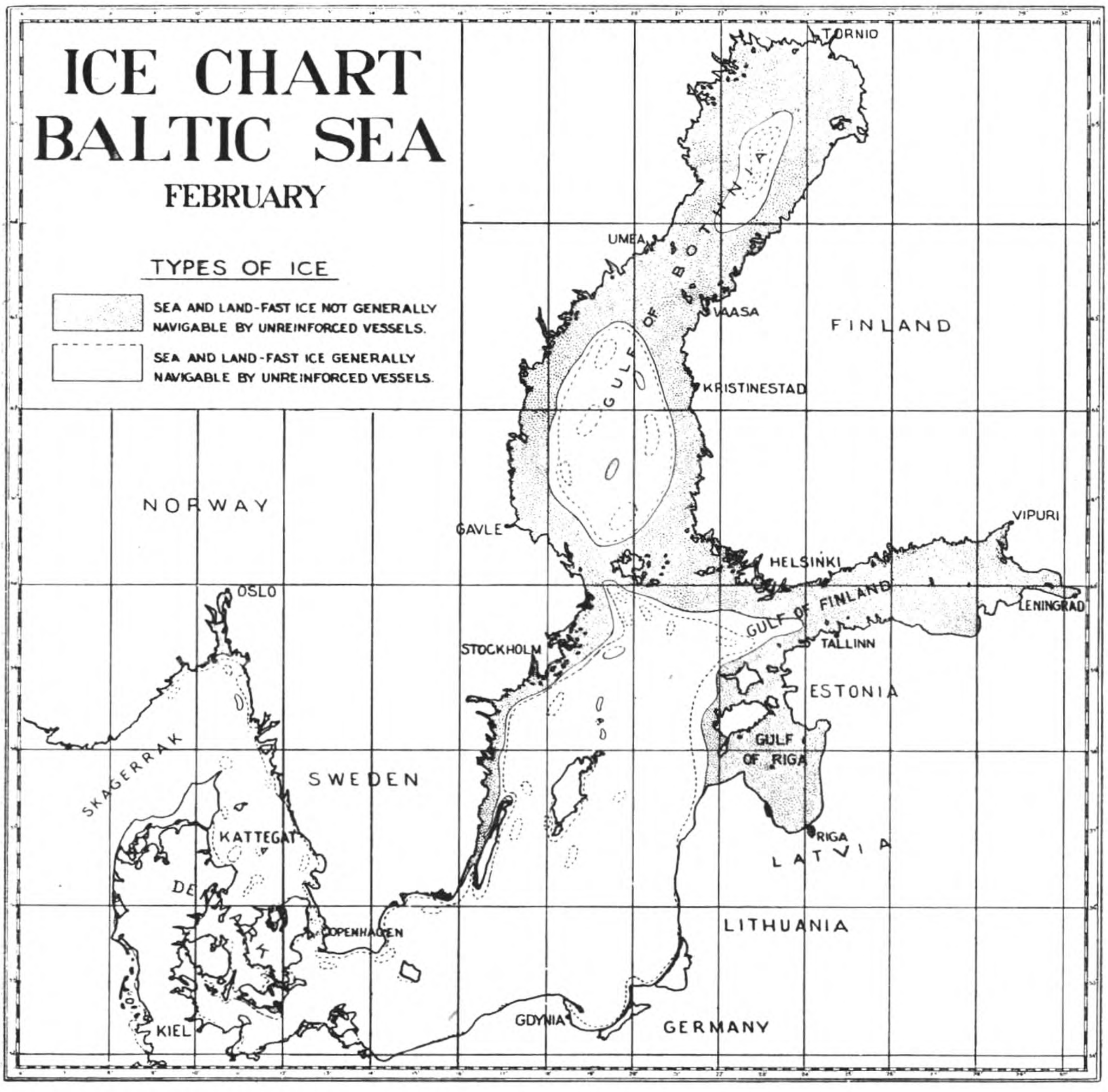


Fig. 2. Adapted from " Ice Atlas of the Northern Hemisphere," published by Hydrographic Office, U.S. Navy.

Fig. 2 shows the ice situation in February. The Gulfs of Finland and Riga are frozen over and the freezing of the whole of the northern half of the Gulf of Bothnia is almost complete. An additional bridge of ice extends from Finland across to Sweden by way of the Aland Islands. The ice off the Elbe estuary and along the Frisian islands is beginning to break up, but east of Denmark ice covers most of the coasts and the Sound has frozen over.

It will be noticed that in the Elbe and to the west the peak of the ice season has already passed in February. Elsewhere, inside the Baltic area proper, February may be regarded as the peak month, except in the extreme north and east where the extension of the ice still continues, the Gulf of Finland and the greater part of the Gulf of Bothnia being frozen over completely in March. Elsewhere, however, the ice decreases in March, the Sound becomes again navigable and little ice remains in the Denmark area.

In April the ice is almost completely confined to the Gulfs of Bothnia, Finland and Riga and the area affected is rapidly decreasing. The main ports in the Gulf of Finland become clear towards the end of the month though Leningrad is usually closed until the beginning of May. In the Gulf of Bothnia, on the Swedish coast, Oregrund, Gavle and Harnosand are open to navigation in April. Farther north, however, the opening is delayed, at Umea until the beginning of May and at more northerly parts such as Pitea and Lulea until the middle of the month. On the Finnish side, Rauma is clear at the beginning of April, Kristinestad only at the beginning of May, while to the north opening dates are further delayed, Kemi and Oulu being the latest, towards the end of the month.

It cannot be emphasised too strongly that the ice conditions in individual years may vary widely from the pattern that has been outlined above. If, however, the results of any year are to be interpreted it is useful at least to have a framework of average or normal conditions into which the unusual characteristics of the particular year may be fitted.

The opening of the 1946-47 ice season in the Baltic

We are now in a position to examine the data of the 1946-47 ice season and to attempt to relate them to meteorological conditions.

Gulf of Bothnia

Kemi, 27th November. Navigation at the ports of Kemi and Tornea is closed by ice (Lloyds Agent).

Pitea, 30th November. Thawing snow and ice in pieces of about 5 in. thickness at quays and loading places in ports of the district. Firm ice along beaches and banks, not important to navigation. Temperature has dropped during the last week from 3°C. above zero to 10° below. Government icebreaker *Ymer* is still at Lulea. Necessary help is available for local icebreaking. No ice difficulties are anticipated in the next 10 days. (Lloyds Sub-Agent.)

Lulea, 19th December. Navigation closed by ice and the last vessel, Swedish steamer *Flora*, left late yesterday for Preston. (Lloyds' Agent.)

Pitea, 21st December. The shipping season is finished, but ports are still open. Weather is mild and there is no risk of ice for another 8 days. There is no ice in the Gulf of Bothnia. Government icebreaker is stationed at Skelleftea. (Lloyds' Sub-Agent.)

Sikea, 29th December. Navigation in Sikea district is closed. (Lloyds' Sub-Agent.)

The above reports suggest that the ice season commenced later than is normal, almost to the extent of one month. Some explanation of this is afforded by an examination of the weather conditions prevailing during this period. In considering the effect of certain types of weather systems attention must be paid to the origin of the air mass affecting the area concerned. It may be briefly stated that if air is drawn from an easterly source at this season, conditions are favourable for an early freeze-up. On the other hand, air

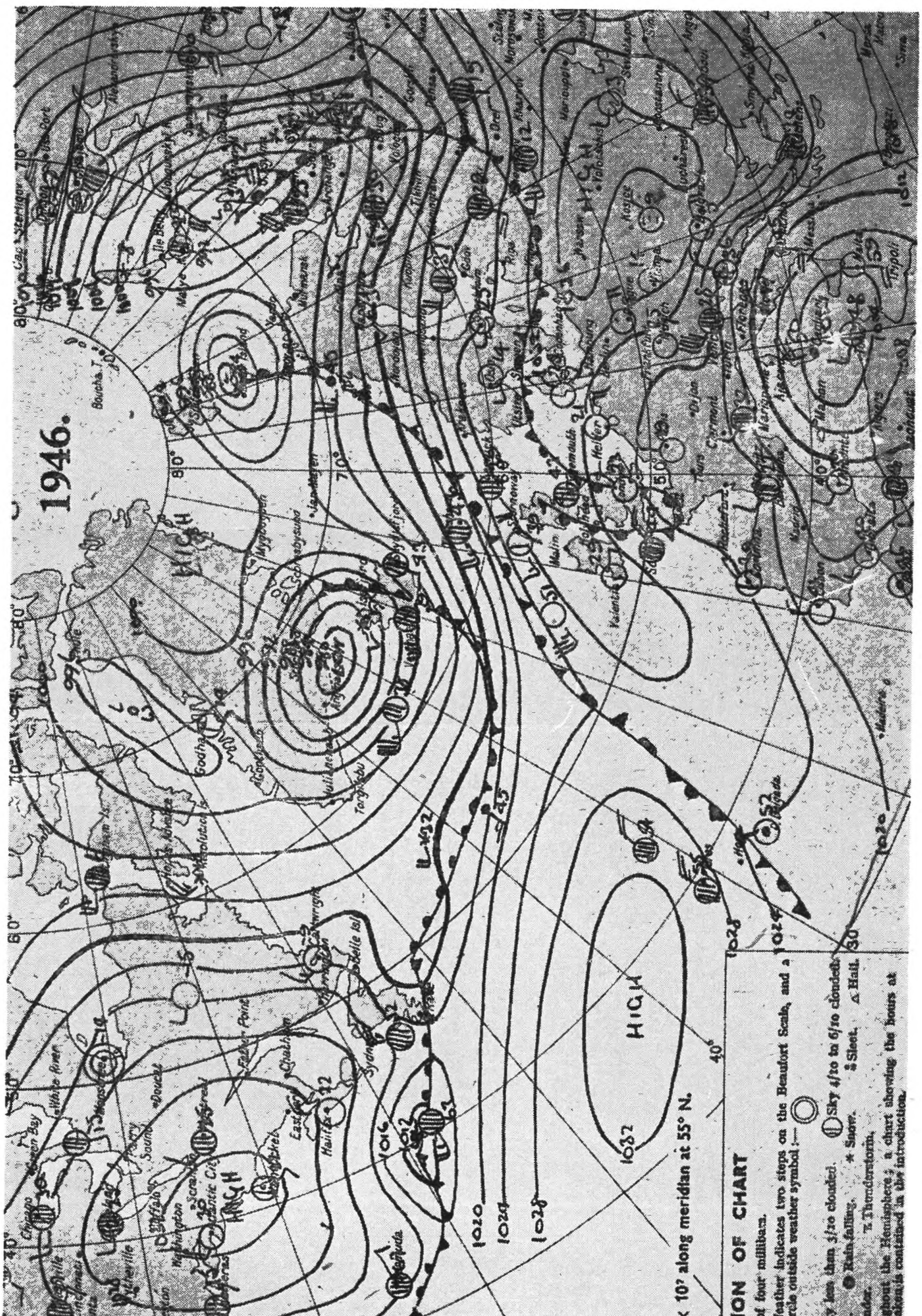


Fig. 3. Synoptic Chart for 20th December, 1946

from a north-westerly or northerly point is from a maritime source and temperatures do not reach such low values. If, further, the air supply is from a south-westerly point, then the source being the relatively warm Atlantic, mild weather prevails with little or no freezing.

During the greater part of November vigorous cyclonic activity predominated and at no time did an easterly trajectory persist for an appreciable period. These conditions are reflected in the monthly meteorological statistics for the British Isles. Rainfall was in excess almost everywhere and mean temperature was above the average, Kew recording the highest minimum temperature for the month since records began in 1871.

From the 1st to 4th December vigorous cyclonic activity on the Atlantic was still penetrating into north-west Europe. On the 5th and following days a ridge of high pressure extended over the Baltic from the Siberian high, and the main cyclonic systems on the Atlantic began to take an easterly track much farther to the south than previously. Temperatures in the Baltic area, however, did not drop appreciably. The air supply was drawn from the SE and at this early stage of the winter was still relatively warm. The warm waters of the Baltic sea must also have had some effect in maintaining relatively high temperatures in the Gulf of Bothnia. Following the 11th, the main high pressure belt had extended from Siberia across North Russia to North Greenland and Alaska. One of the main high-pressure cells over North Russia which had been slowly drifting westwards was established over the South Baltic on the 15th. Milder Atlantic air then began to penetrate to the Gulf of Bothnia around the northern side of this anticyclone. Renewed cyclonic activity occurred along this northern boundary as the main high centre moved to central Russia, with a ridge extending to the British Isles. Fig. 3 shows the synoptic situation on 20th December after the full renewal of vigorous cyclonic activity. Note that temperatures in the south Baltic, southern North Sea and south-east England were far lower than in the Gulf of Bothnia. In the former areas, air was being drawn from the cold continent, while to the north, mild Atlantic air was penetrating well inland. During the remainder of the month milder conditions spread to the whole of the North Sea and Baltic area.

The main freeze-up

Gulf of Bothnia

Helsinki, 10th February. The Gulf of Bothnia between Sweden and Finland is freezing over. Ice is thickening round the Finnish coast and has led to the closing of the harbours of Helsinki, Mantyluoto and Raumo. Icebreakers have so far maintained channels to the harbours of Hango and Abo.

Gulf of Finland

Helsinki, 16th January. Due to ice Helsinki light vessel has been withdrawn from her station.

Hamina, 21st January. Navigation closed. (Lloyds' Agent.)

Kotka, 29th January. Navigation closed. (Lloyds' Sub-Agent.)

Further reports indicate that there was little unusual in these areas and that average conditions were probably predominating.

Swedish Waters

Stockholm, 9th February. One of the coldest spells ever experienced here has brought all shipping to a standstill around Sweden's coasts. With

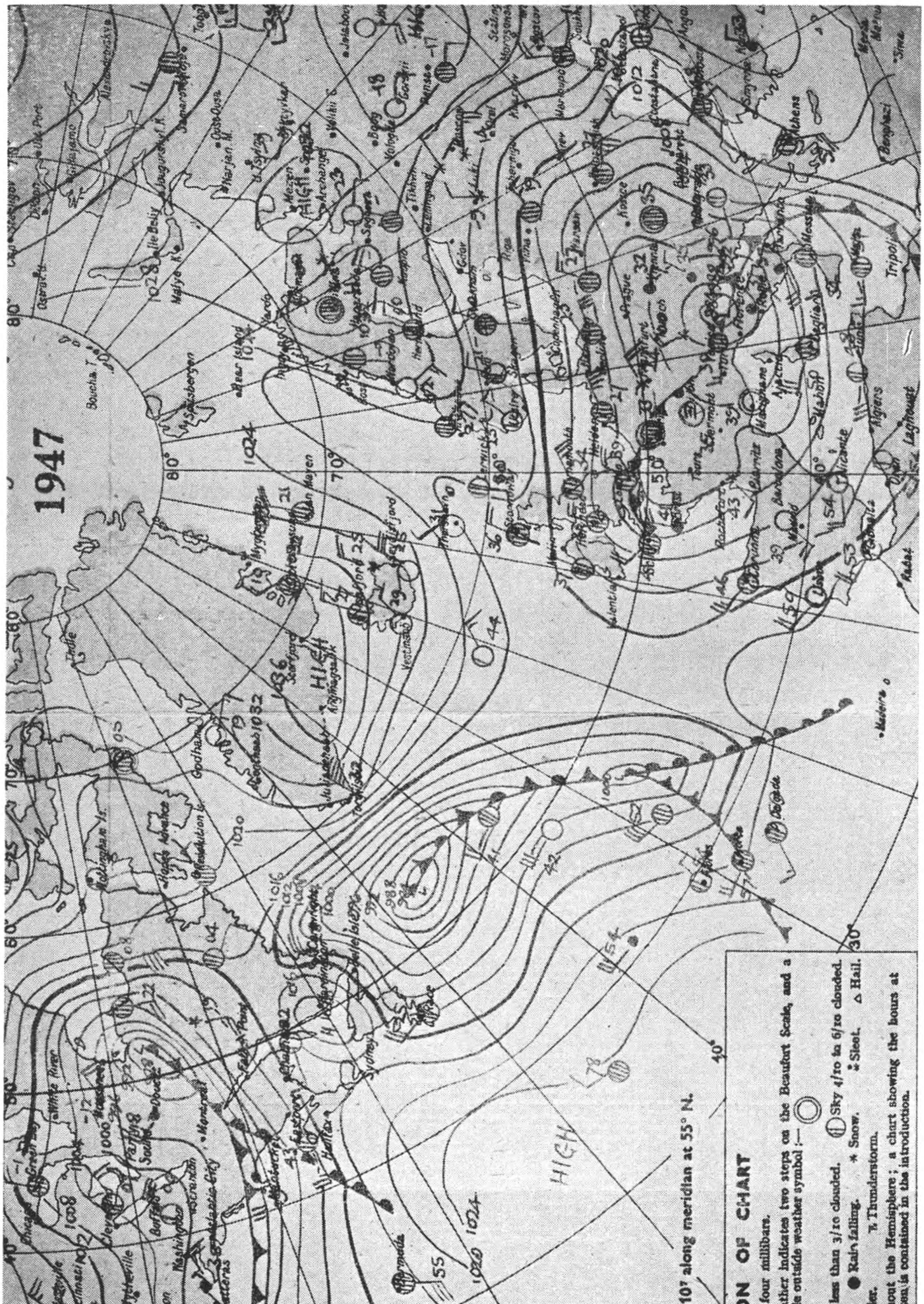


Fig. 4. Synoptic Chart for 5th February, 1947

temperatures of between 8°F. above freezing point to 56 below in some parts, the Sound, between Sweden and Denmark, is one solid mass of ice, and the Baltic is rapidly freezing over. The last ice-free channel, off Falsterbo, for shipping westwards, is slowly covering over, despite efforts by icebreakers to keep it clear. (Reuter.)

Stockholm, 9th February. The Swedish Admiralty has issued a radio warning to all vessels not to leave Swedish ports. If the warning is not heeded, the Navy will stop any Swedish vessel putting to sea, Captain S. Hermelin, Chief of the Icebreaker Division, stated today. At least 20 vessels are known to be frozen fast around the coast of Sweden and there are too few icebreakers to help. Aircraft of the Swedish Air Force are patrolling the coasts searching for ice-locked vessels, many of which do not carry radio and cannot signal for provisions, medicine, or other aid which could be dropped from the air.

Stockholm, 10th February. Ice today completely closed the port of Stockholm. Icebreakers were able to maintain channels for shipping within the harbour, but not in the approaches. Reports of vessels frozen fast along the coast were pouring into the Swedish Admiralty, but a shortage of icebreakers limits the assistance possible.

Kattegat and The Sound

Frederikshavn, 29th January. Laeso Nord light vessel has left station and been towed in here. (Lloyds' Agent.)

Frederikshavn, 30th January. Skagens Rev light vessel has left station and been towed into Hirtshals. (Lloyds' Agent.)

Elsinore, 11th February. The Kattegat and The Sound are almost closed by ice. (Lloyds' Agent.)

Norwegian Waters

Oslo, 8th February. Ice has nearly closed the channels leading into the port of Frederikstad, it was reported today from Hvalo Island, at the entrance to Oslo fjord. Floating ice round the Norwegian coast is causing anxiety to Norwegian port and shipping authorities.

Oslo, 12th February. Icebreakers were hard at work today to keep Oslo fjord open. So far vessels have been able to get through to Oslo and Fredrikstad. (Reuter.)

Paris, 5th March. The port of Oslo, blockaded by ice for several days, was freed when the Danish icebreaker *Isbjorn* passed Moss, in Oslo fjord, at the head of a convoy of 12 ships bound for Oslo. (Reuter.)

Oslo, 6th March. Oslo harbour open. (Lloyds' Agent.)

Kiel Canal and German Waters

Kiel, 6th January. Brunsbuttelkoog, Kiel Canal roads and entrance, and canal from Brunsbuttelkoog to Rendsburg. Ice floes ; navigation closed for craft in tow and for all ships under 100 tons net.

Hamburg, 8th January. Elbe III light vessel has been withdrawn on account of strong drift ice.

Hamburg, 11th January. Ice conditions on the lower River Elbe are becoming more difficult for navigation on account of heavy drift ice. The fairway is kept open by icebreakers. Hamburg harbour traffic is handicapped by sludge ice.

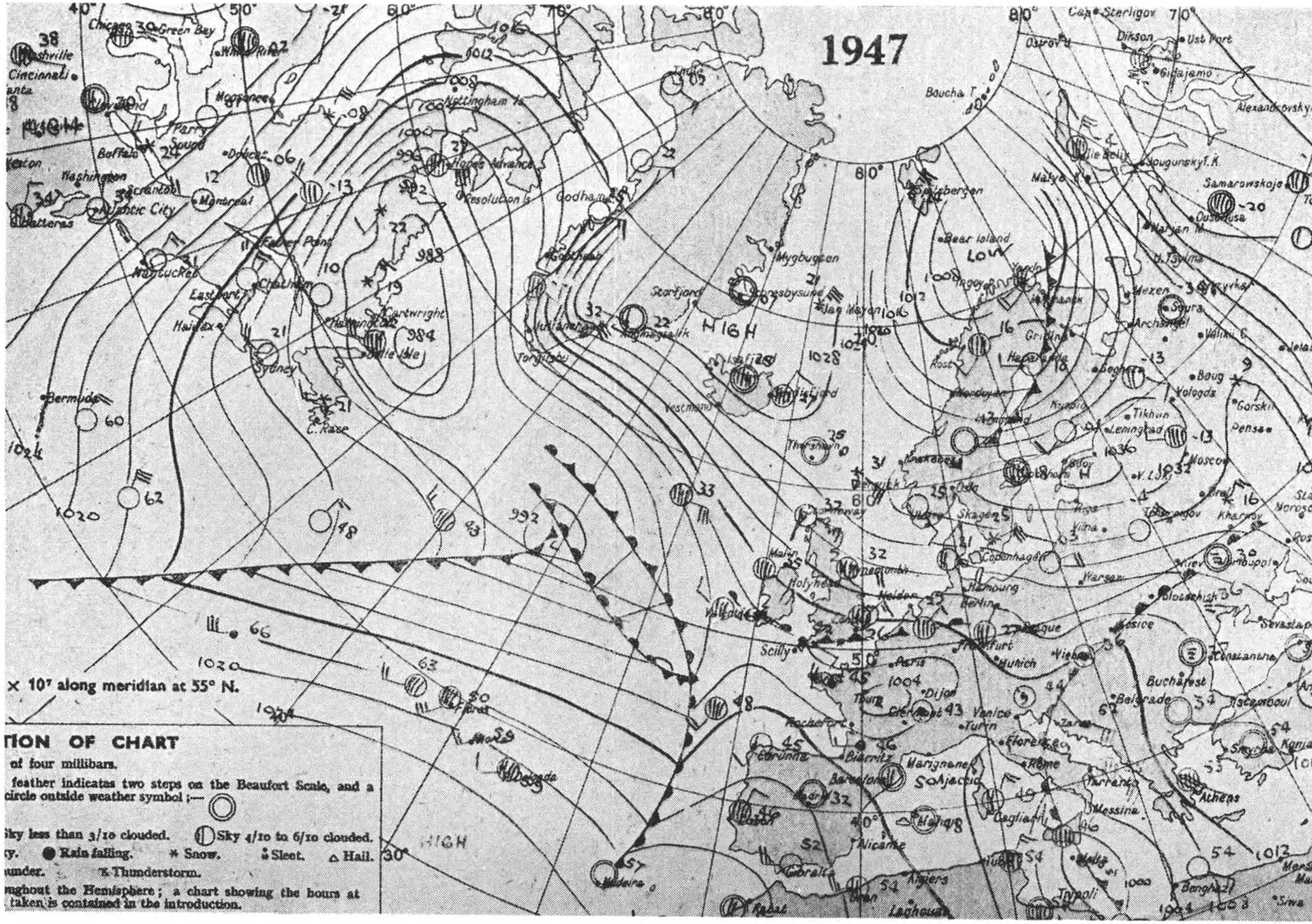


Fig. 5. Synoptic Chart for 12th February, 1947

London, 29th January. The United Baltic Corporation have today received the following telephone message from their Kiel office : Following order received from Senior Naval Officer, Schleswig-Holstein, at 10.45 a.m. today : Owing to ice conditions the entrance to Kiel harbour is closed until further notice.

Hamburg, 30th January. Hamburg, drift ice. Butzfleth, heavy fast ice over 15 cm. thick. Krautsand, close sludge and drift ice. Gluckstadt, loose sludge and young ice. Brunsbuttel, loose sludge. Nenfeldt, close sludge, drift ice. Cuxhaven, heavy drift ice over 15 cm. thick. Traffic is difficult for low-powered vessels. Steamers passing in convoy with assistance of icebreakers. Temperature has risen this evening 1°. It was 12° this morning.

Hamburg, 31st January. Aircraft today parachuted supplies of food to the crew of a stranded German cutter ice-bound in Lubeck Bay, after urgent appeals for help. (Reuter.)

Flensburg, 27th January. Navigation is open only for heavy-powered steamers.

Gdansk, 2nd February. Ice difficult at Gdansk and Gdynia but ports kept open at present by tugs. (Lloyds' Acting Agent.)

Hamburg, 4th February. Hamburg : Drift ice under 15 cm. thick. Cuxhaven and Brunsbuttel : Heavy drift ice, over 15 cm. thick. Temperature minus 5°. Conditions improving but still using icebreakers.

Flensburg, 4th February. Navigation closed. (Lloyds' Agent.)

Hamburg, 11th February. The Norwegian steamer *Finse* is ice-bound in the Baltic 21 miles north-east of Travemunde. The crew of about 20 have been marooned for the past 5 days and their food supplies are exhausted. R.A.F. Martinets from Lubeck are dropping food supplies to the marooned seamen. The R.A.F. is also continuing many flights with food to the small German fishing vessel ice-bound 12 miles off Travemunde for the past 16 days. (Exchange Telegraph Company.)

Gdynia, 7th February. Ice position in Gdansk Bay is very serious and, although the authorities are doing their utmost to keep channels open by the use of tugs as icebreakers, fear ports of Gdynia and Gdansk may be completely closed in another 24 hours. (Lloyds' Acting Agent.)

Hamburg, 12th February. Food is to be flown by the R.A.F. to the Norwegian steamer *Finse*, which has been ice-bound in Lubeck Bay for a fortnight. Naval authorities in Schleswig-Holstein this morning received a signal from the vessel stating that food supplies had run dangerously low. (British United Press.)

Gdansk, 12th February. Powerful vessels still able to enter Gdynia. (Lloyds' Acting Agent.)

Hamburg, 25th February. Ice report 25th February: Hamburg: Fast ice, under 15 cm. thick. Pagensand : Heavy drift ice, over 15 cm. thick. Cuxhaven : Heavy drift ice, over 15 cm. thick. Temperature last night minus 19°C. ; temperature today minus 13°C. Navigation kept open by icebreakers. (Lloyds' Acting Agent.)

Cuxhaven, 26th February. Ice conditions easier and icebreaker in attendance.

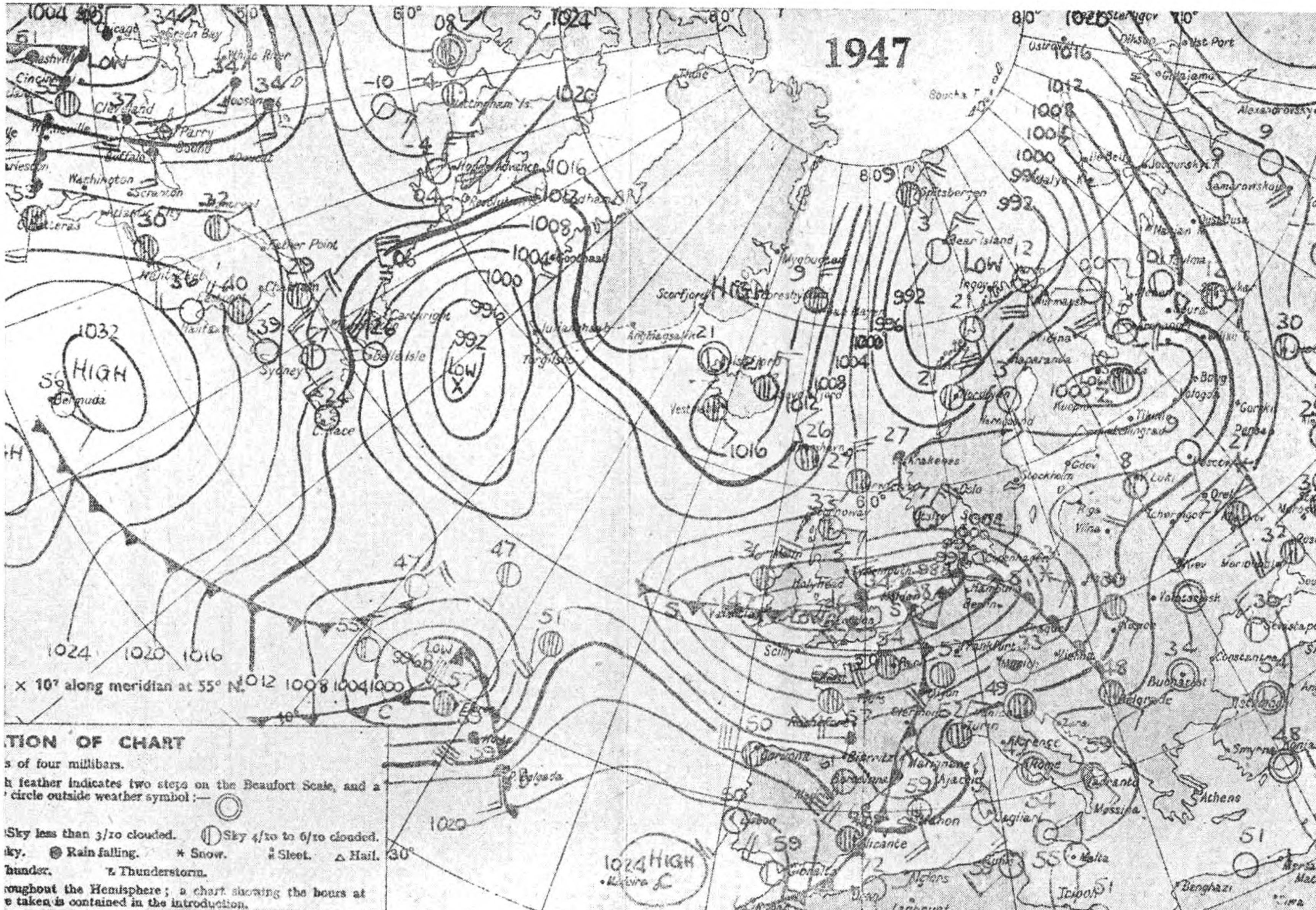


Fig. 6. Synoptic Chart for 14th March, 1947

London, 2nd March. The following information, dated 26th February, has been received: A new cold wave has frozen the ports of Gdansk and Gdynia. At Gdansk, the access to port is frozen over an area of 400 metres, and owing to this exports of coal by sea have been suspended. An American vessel has been immobilised for days. The Port Authorities are doing their best to clear the ice, and the arrival of a powerful icebreaker, the *Atle*, from Sweden, is expected.

Bergen, 6th March. According to a report received from the master, yesterday by the owners of the steamer *Finse* (Sanda), for Lubeck, with ore, the vessel is still fast in the ice outside Lubeck. Supplies have been dropped by aircraft to the vessel, which has sustained damage to rudder. ("Bergens Tidende.")

London, 19th March. A report from Gdansk dated 18th March states: The ice position is improving and it is considered that troopships could enter Gdynia as soon as the entrance to the Baltic sea is open.

London, 12th April. The United Baltic Corporation have received the following report from their Kiel Office, dated 11th April: Ice report: Kiel Canal and Kiel Bay free of ice; buoys being relaid.

Dutch Waters

London, 10th February. Trawlers returning to Lowestoft today report an icefield 3 to 4 miles long and half-a-mile wide on the Terschelling fishing grounds off the Dutch coast which offers danger to fishing vessels operating there. Radio warnings have also been heard from other trawlers about the obstructions.

London, 28th February. The owners of the motor vessel *Kingfisher* state that the vessel is ice-bound in Terschelling harbour.

The above data show that ice conditions were exceptionally severe in the south Baltic and North Sea areas. The meteorological conditions responsible are easily identified. It has already been shown that conditions in the north Baltic were unusually mild until late in December, and that the south Baltic area was experiencing much severer conditions. Early in January an anticyclone over North-west Russia moved west bringing continental polar air from Siberia to most of the area, the milder Atlantic air being held up to the west of the British Isles. By the 7th temperatures below 20°F. were being recorded even in the coastal areas. On the 12th, warmer air from the Atlantic penetrated to the extreme west of the area, later extending to the whole of the Baltic as the main high pressure recorded eastwards. This thaw continued until the 21st when an anticylcone moved north-east to Scandinavia leaving a ridge extending to the British Isles. This situation brought north-east winds to the whole area with a re-establishment of freezing conditions. By the 25th a belt of high pressure extended from Siberia across North-west Russia to the British Isles and much colder air was penetrating westwards to the Baltic, temperatures dropping below 20°F. These conditions persisted until the end of the month. The Monthly Supplement of the Daily Weather Report comments that the frost in England was specially severe on the 29th and records standing since 1881 for late January were broken at Falmouth and Kew. At the beginning of February a high-pressure belt extended from North Siberia across North Russia and Scandinavia to Greenland. Cyclonic activity on the Atlantic, though vigorous, was occurring well to the south, and as depressions moved eastwards into

Europe and the Mediterranean they served to strengthen the easterly winds blowing across the Baltic and North Sea, temperatures falling to below 0°F. in places. This pattern continued with little change throughout the month. Figs. 4 (5th February) and 5 (12th February) show typical weather maps during this exceptional period. The effect of these conditions on south-east England is shown by the fact that the mean maximum temperature at Greenwich was the lowest for any month since before 1841. At the beginning of March temperatures rose slightly as a series of depressions from the Atlantic moved north-east through the Baltic. In the west of the area the main thaw was well under way by the middle of the month, a series of deep depressions moving eastwards across the British Isles into the Baltic enabling warm air to penetrate well into Europe (Fig. 6, 14th March).

Conclusion

The exceptional features of the ice season were undoubtedly :

(*a*) the severity of ice conditions in the south Baltic ;

(*b*) the westward extension of the ice ;

(*c*) the late break-up in the west of the area.

These features are accounted for by the almost unprecedented frequency of strong easterly winds ; not only was the ice extensive off the Dutch coast but reports were received of ice floes some little distance from the east coast of England. The effect of these strong easterly winds in cooling the North Sea was most marked, sea surface temperature off East Anglia falling from 43°F. in the first week of January to 34°F. in the last week of February, most of the cooling taking place in February.

THE FOUR-MASTED BARQUE *PAMIR*

BY COMMANDER C. H. WILLIAMS, R.D., R.N.R.

This fine vessel, which is on the New Zealand list of Meteorological Observing Ships in this journal, was a recent visitor to the Port of London. As large square-rigged sailing ships are a rare sight nowadays the following notes may be of interest.

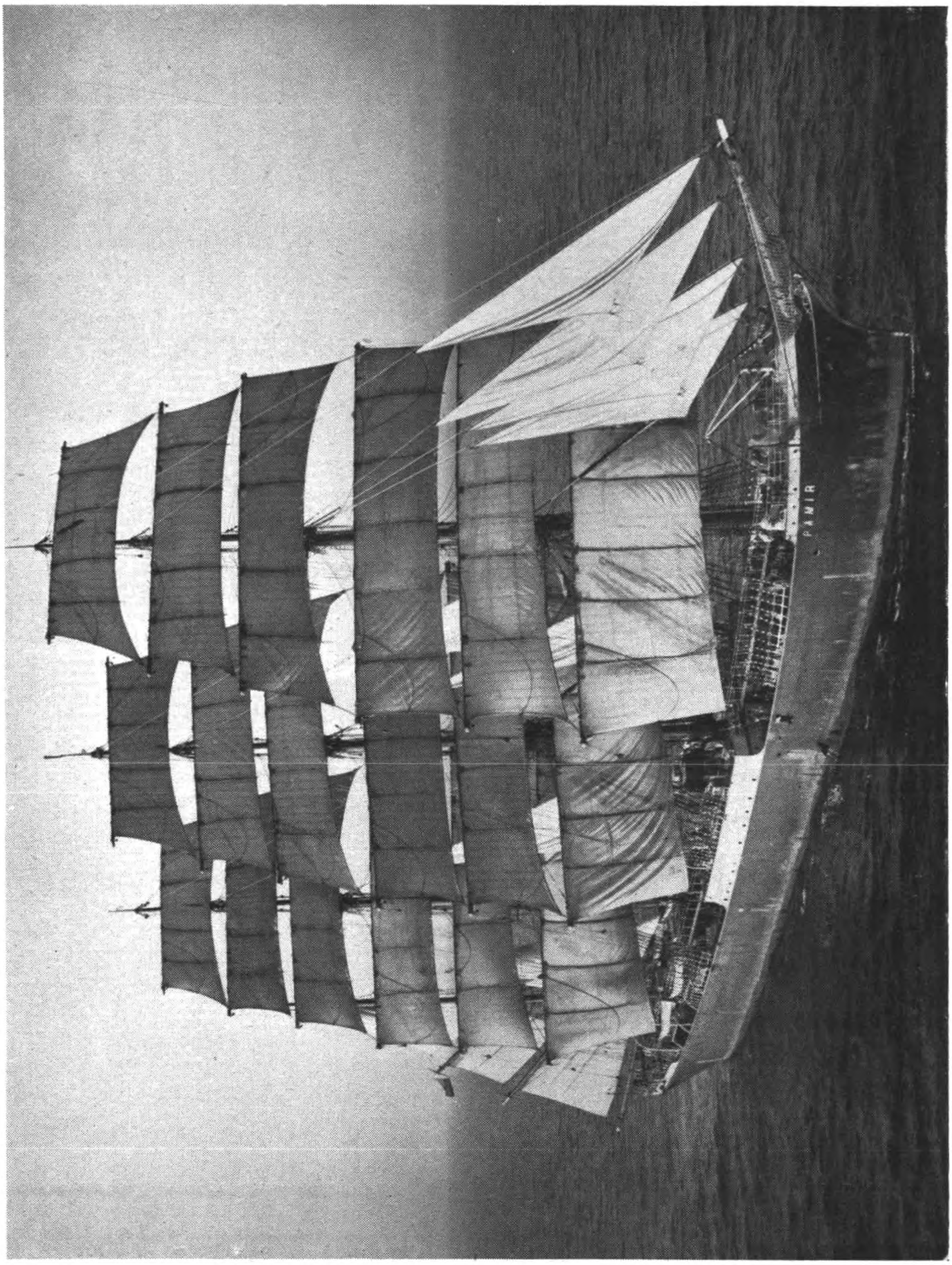
She arrived in London River just before Christmas 1947 after a passage of 80 days from Wellington, New Zealand, via Cape Horn, with a cargo of wool and tallow. Her Master was Captain H. S. Collier (Extra Master, Square Rig). His wife had made the voyage with him.

The *Pamir* was built in 1905 at Hamburg by Messrs. Blohm & Voss for the well-known German sailing ship firm of Laeisz & Company, known to seamen as the Flying " P " Line.

During the first world war the *Pamir*, then still under the German flag, was taken as a prize and in 1918 handed over to Italy as part of the war indemnity. In 1922 she was bought back by her original owners, who ran her for a few years. She was bought by Captain Erikson of Finland in 1931 for use in the Australian grain trade.

Early in the war, in 1941, she was again taken as a prize of war by the New Zealand Government, who are now her owners, and was employed by them mainly on voyages in the Pacific between New Zealand and North America.

She is of 2,796 tons gross, and can carry 4,800 tons of cargo. A four-masted barque with double topgallant sails and royals, she has steel lower



The *Pamir*

Photo: Associated Press, Ltd.

masts and topmasts in one piece, and steel topgallant masts. All her yards are steel. She is heavily rigged and has a double spanker with two gaffs.

Compared with most of the large sailing ships of a few years ago, the *Pamir* has much up-to-date equipment, including brace winches and halyard winches; she also has motor winches at each hatch, wireless telegraphy, electric light and a refrigerator. Her crew is 39 all told. The ship has a midship section, or bridge deck as it would be called in a steamer, and in this section are the Captain's quarters and saloon, the officer's cabins, W/T office, crew's quarters and galley. On the deck of the midship section there is the chartroom and an open-fronted wheelhouse.

During her stay in London the ship was on several occasions open to the public and a large number of people visited her, including of course all the old "square rig" sailors able to spare the time.

From a meteorological point of view her voyage from New Zealand to London had certain points of interest. Captain Collier stated that wireless weather reports from the shore and from other vessels were of considerable use during the voyage.

Before sailing from Wellington, Captain Collier obtained a weather forecast of light northerly winds, on the strength of which information he ordered the tugs, and the ship was soon clear of the land and on the long leg to Cape Horn. They experienced a south-east gale, force 9-10, on the 9th October, 1947, in lat. 50° 27'S., long. 165° 27'W. Ice was sighted in the form of a large berg about 15 miles distant on the 19th October, when in lat. 55° 28'S., long. 128° 38'W., and this information was transmitted by wireless.

Variable winds were experienced with an easterly gale on the 24th October, then westerlies to the Horn, which was rounded on the 29th October in fine weather. She had strong north-west winds on the Atlantic side of the Horn and passed 150 miles to the eastward of the Falklands. Weather reports were sent to the Falklands but no forecasts received from them.

On 8th November in lat. 38° 36'S., long. 34° 33'W., with fresh south-east wind the *Pamir* made a days' run of 297 miles in 23 hours 40 minutes, an average speed of 12·5 knots for the day.

The line was crossed on 22nd November, 50 days out from Wellington, the ship having averaged a speed of 7·5 knots for the 9,039 miles run.

The usual north-east trade wind was experienced to about lat. 23°½N., where the wind became easterly, enabling Captain Collier to steer up for the Azores. Light variable winds prevailed for some days, then a southerly gale with heavy rain when approaching the Azores.

A fair number of ships' wireless weather reports had been received during the voyage, some ships addressing them especially to the *Pamir*. Captain Collier found these very useful. In the vicinity of the Azores wireless weather forecasts were received from those islands; these proved correct and were of great value. The *Pamir* sailed through the islands between Flores and Fayal before the wind shifted. Good westerly winds were now had and on the 14th December the ship ran 296 miles; 12·5 knots average for the day.

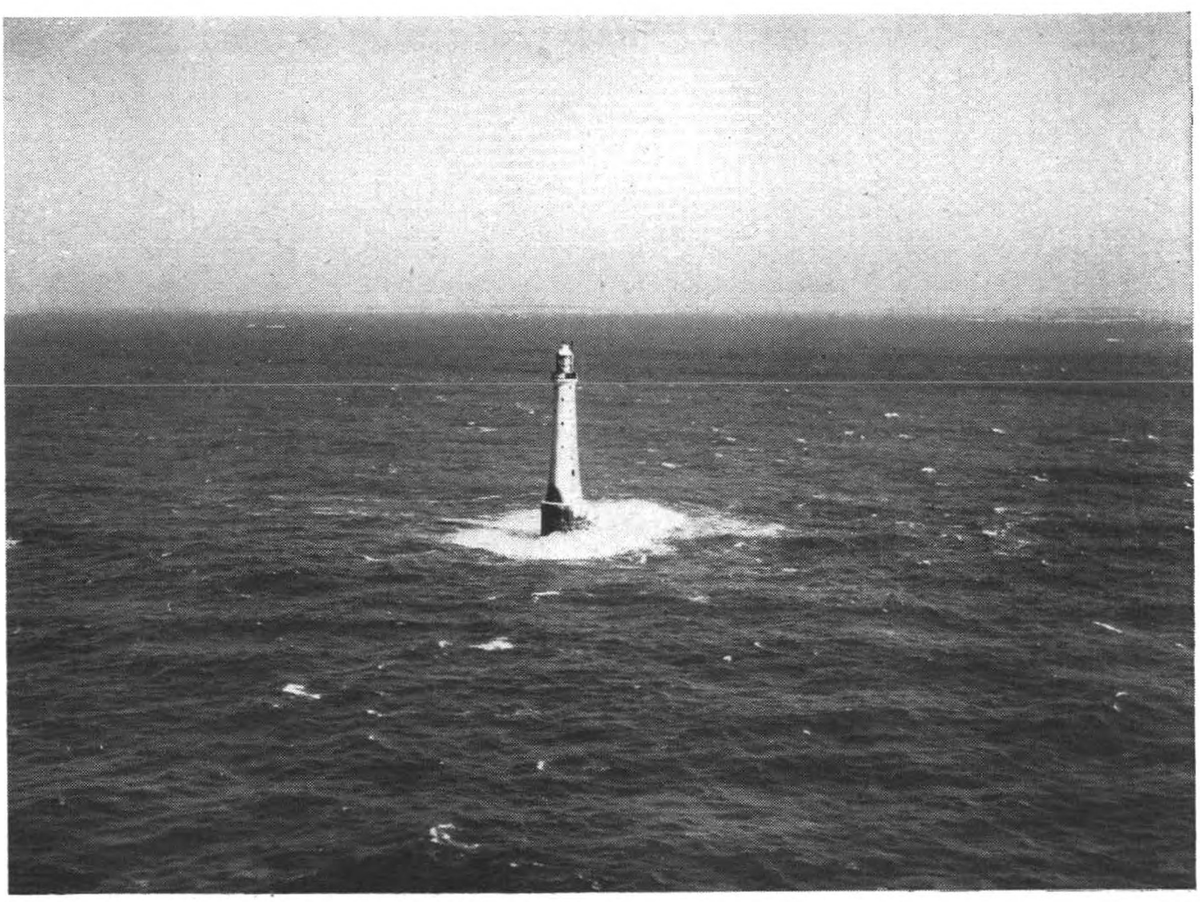
Then some days of light head winds. Approaching the Channel the United Kingdom weather forecasts were received and as these indicated a northerly wind, Captain Collier kept well towards the English coast, close-hauled on the port tack.

On the 20th December, 1947, Bishop Rock, Scilly, was made fine on the lee bow. With a fresh northerly wind she passed the Lizard, only a mile or so off, in fine sunny weather, doing 10 or 11 knots with all sail set. Fresh to moderate northerly wind was carried right up Channel.

At midday on Sunday 21st December, she passed 5 miles off St. Catherines Point. The wind enabled her to lay up for Dungeness, where the main yards were backed, and the pilot boarded her soon after midnight.

A tug was standing by but Captain Collier and the pilot, Captain Smalley, decided to sail as far as possible. The wind conveniently backed to NW × W to allow the ship to sail through the Downs and to the South Edinburgh Channel. Then the tug was made fast and she was towed to Gravesend and so to London.

LIGHTHOUSES OF THE BRITISH ISLES



Bishop Rock Lighthouse (49° 52'N., 6° 27'W.) is a grey circular granite tower, 167 feet in height, situated on Bishop Rock, the highest of a group of rocks, all covered at high water, forming the south-western of the dangers of the Scilly group.

THE IMPORTANCE OF SHIPS' OBSERVATIONS TO THE FORECASTER

Part IV. The Oceans and the Weather

BY T. H. KIRK, B.SC.

1. Introduction

Previous articles of this series have attempted to give some idea of the methods used by the forecaster to interpret observational data, particularly over the sea.

The simplification found necessary to present an overall picture in a relatively small compass may have led to the impression that empirical methods are used to the exclusion of physical reasoning. This is not wholly the case, for the successful forecaster is continually drawing upon a background of physical and geographical knowledge. This article presents some aspects of the physical processes that must be understood before any forecasting technique can be intelligently applied.

The oceans cover nearly three-quarters of the earth's surface. The meteorology and climatology of the oceans must therefore figure prominently in any account of the mechanism of the general circulation of the atmosphere. Our knowledge of marine climatology has been gained from the labours of voluntary marine observers organised originally through the initiative of Lt. Maury of the U.S. Navy and officially recognised at the International Maritime Conference at Brussels in 1853. In these present days when land meteorology is so highly organised it is interesting to note the plaintive comment made by Maury after the conference.

" In all things connected with it the friends of this science have but one cause of regret, and that is, that the instructions under which those twelve men met did not go further and authorise them to include the land as well as the sea in their system of observations, and so make the plan universal."

Maury himself continually stressed the importance of observations from the sea in the search for knowledge of the fundamental physical processes at play in the atmosphere. In his words :

" When we travel out upon the ocean, and get beyond the influence of the land upon the winds, we find ourselves in a field particularly favourable for studying the general laws of atmospherical circulation. Here, beyond the reach of the great equatorial and polar currents of the sea, there are no unduly heated surfaces, no mountain ranges, or other obstructions to the circulation of the atmosphere—nothing to disturb it in its natural courses. The sea, therefore, is the field for observing the operations of the general laws which govern the movements of the great aerial ocean."

And again :

" By studying the winds at sea, we might expect to find them blowing more conformably there than on the land to the general laws which govern the circulation of the atmosphere. And in endeavouring to learn these laws we may look to the sea for the rule, to the land for the exceptions."

Much has been learnt since those early days and the fruits of patient observing at sea have been gathered in the form of meteorological atlases for the different oceans. These atlases depict the climatology of the oceans and afford a background of experience in terms of which the daily variations of weather may be assessed.

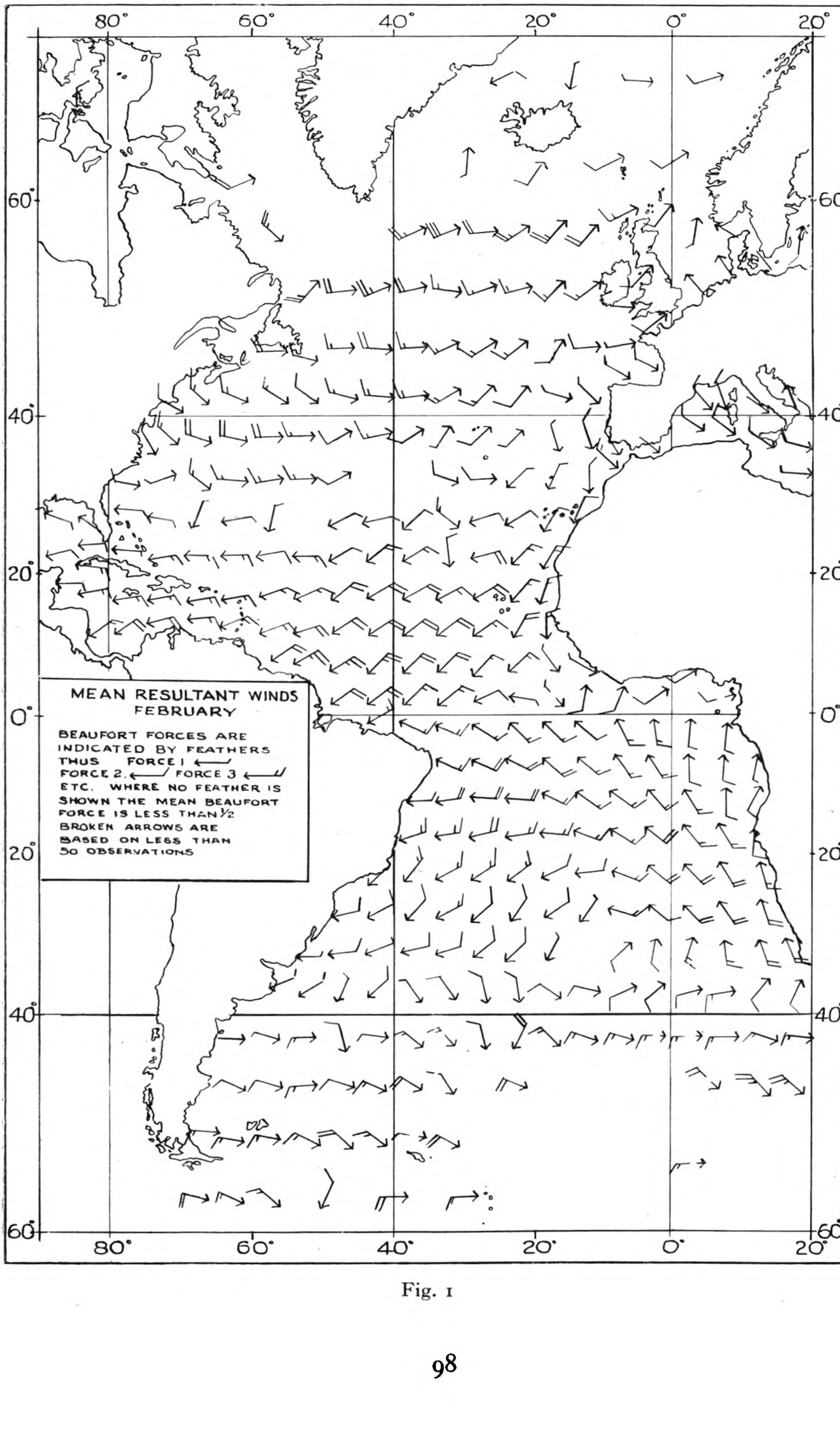
2. Interaction between the Atmosphere and the Oceans

The oceanographer in his work finds that he cannot neglect the effect of the atmosphere. The amount of radiation reaching the sea surface depends on meteorological conditions in the atmosphere. Atmospheric processes determine the temperature of the sea and the evaporation from its surface. The winds not only raise the ocean waves but create drift currents. Radiation, evaporation, precipitation, wind—all these agencies combine to produce a distribution of specific gravity in the sea that gives rise to the main ocean current systems, of which perhaps the best known example is the Gulf Stream.

The meteorologist, too, cannot afford to neglect the effect of the sea on the atmosphere. In its widest implication the modifying influence of the sea is recognised in the classification of climates as *maritime* or *continental*. Air-mass analysis also recognises the important classification of an air-mass as of maritime or continental origin. In the temperate latitudes of the Northern Hemisphere the normal west to east circulation of the atmosphere in conjunction with the distribution of land and sea ensures a selective action which secures for the west coasts of the continents mild oceanic winters while the east coasts have severe continental winters ; for, owing to the cooling of the land-masses in winter the east coasts of continents experience cold winds from the land while the west coasts enjoy relatively warm winds from the adjacent sea areas. Contrast, for example, the winters of Labrador and the British Isles, both situated in approximately the same latitude ! In some places ocean currents maintain sharp temperature contrasts at the sea surface. Weather phenomena depending on the movement of air in one direction or the other across these temperature contrasts may then become very pronounced. In addition, these contrasts provide the mechanism by which the extratropical depressions are created and subsequently fed with energy.

Figs. 1 and 2 show, respectively, the mean distribution of surface winds and surface currents for the Atlantic Ocean in winter. Both charts show closed systems of anticyclonic rotation in the North and South Atlantic basins. To the trade winds of either hemisphere correspond the respective equatorial currents and the relationship is more directly one of cause and effect than can be found elsewhere among the major wind current systems Sea surface currents are of importance to the atmospheric state because they transfer large quantities of heat horizontally from place to place. Popular interest has, from time to time, been stimulated by investigations into the modifying effect of currents on climate, and particularly into the influence of the Gulf Stream on the climate of north-west Europe. This influence is of course intimately associated with the prevailing west to east circulation. The Gulf Stream and its continuation, the North Atlantic Current, transport large quantities of relatively warm surface water to high latitudes. The effect of this warmer water off north-west Europe is twofold. First, polar air-masses blowing over it become warmed by contact with the sea surface and subsequent convection of heat to the upper layers ; secondly, the increased temperature means increased evaporation from the sea surface and hence an increased supply of water vapour in the atmosphere, leading ultimately to precipitation and an accompanying release of latent heat. Both these effects must tend to mitigate the severity of the winters of north-west Europe.

Considerations such as these lead us to consider the sea as a source of



80°
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0°
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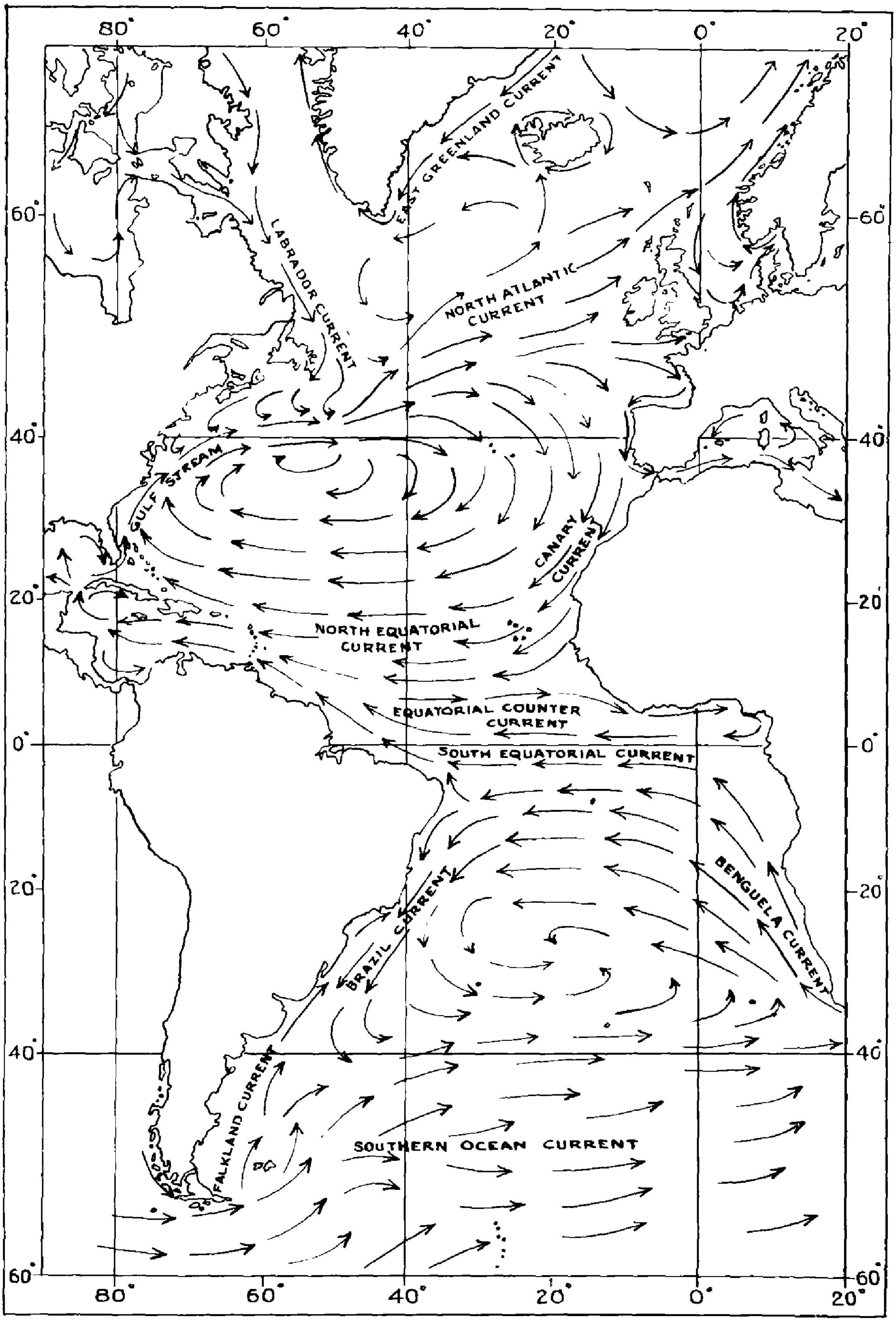
MEAN RESULTANT WINDS
FEBRUARY
BEAUFORT FORCES ARE INDICATED BY FEATHERS THUS FORCE 1 FORCE 2. FORCE 3 ETC. WHERE NO FEATHER IS SHOWN THE MEAN BEAUFORT FORCE IS LESS THAN ½ BROKEN ARROWS ARE BASED ON LESS THAN 50 OBSERVATIONS

Fig. 1



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EAST GREENLAND CURRENT
LABRADOR CURRENT
NORTH ATLANTIC CURRENT
GULF STREAM
CANARY CURRENT
NORTH EQUATORIAL CURRENT
EQUATORIAL COUNTER CURRENT
SOUTH EQUATORIAL CURRENT
BENGUELA CURRENT
BRAZIL CURRENT
FALKLAND CURRENT
SOUTHERN OCEAN CURRENT

Fig. 2

energy, or more practically, as a storehouse of heat. The great storage capacity for heat possessed by the oceans is shown by the fact that for equal volumes the heat capacity of sea water is over 3,000 times as great as that of air. From this it follows that the heat given out by 1 cu. ft. of sea water when cooling through 1° will be sufficient to raise the temperature of 3,000 cu. ft. of air through 1°. The sea, by virtue of its greater heat capacity, can act as a controlling agent for changes of air temperature. In addition to this great capacity for storing heat the sea can afford storage facilities throughout much of its depth and extent and not merely in the superficial layer. This it is enabled to do by means of processes of convection and by the distributing action of currents. To make this point clear a contrast may be drawn between the storage facilities afforded by land and sea.

The land heats up rapidly under the action of the sun's rays due to the fact that the solar radiation is absorbed in an exceedingly shallow layer, the resulting heat being only slowly conducted to the underlying layers. As the temperature of the surface rises a correspondingly higher proportion of the heat received is re-radiated back to space. Once the sun goes down the relatively high temperature of the land surface ensures a rapid radiation of heat and there are no reserves of heat to draw upon. The temperature of the surface must therefore fall rapidly.

Over the sea the action is entirely different. The sun's radiation is absorbed throughout a greater depth and wave action together with vertical mixing ensure a dispersal of heat to much greater depths. Sea water has also a greater specific heat than the materials of which a land surface is composed. These factors both combine to ensure that the change of surface temperature is very small. After sunset, re-radiation to space goes on from the sea surface, but there is no sharp fall in temperature for as one element of surface water is cooled it sinks owing to its greater density and convection immediately brings warmer water to take its place. Thus whether radiation be incoming or outgoing the sea surface tends to maintain a relatively even temperature.

During the summer the oceans are able to acquire a store of heat energy which is made available to the atmosphere during the winter. In the latter season the air has a lower temperature than the sea whose surface layer is continually being cooled, convection replacing this cooled water by warmer water from below. At this season, in temperate latitudes, a considerable depth of water takes part in this process of heat exchange with the atmosphere. This accounts for the large amount of heat made available for atmospheric processes.

Another vital factor already referred to in the mechanism for heat exchange between atmosphere and oceans is water vapour. Evaporation over the oceans is on a grand scale. Especially during the winter, when the oceans are warm relative to the air masses passing over them, evaporation releases vast quantities of water vapour to the atmosphere, the necessary heat required for this transformation being derived from the great ocean store. This water vapour plays its part in atmospheric processes and is eventually condensed and precipitated, releasing to the atmosphere an amount of latent heat equal to that originally absorbed from the sea. Evaporation, therefore, plays a fundamental part in the heat exchange between atmosphere and ocean. It has been stated that the condensation of water vapour in the atmosphere accounts for nearly half the amount of energy which the atmosphere receives.

Of great significance is the fact that the areas of maximum heat transfer from ocean to atmosphere in winter are to be found where the major ocean currents flow from low to high latitudes carrying with them supplies of available heat. With these areas are associated the main permanent frontal zones where depressions form and intensify. For example, the Gulf Stream is a notorious region for the formation and development of depressions which subsequently move across the Atlantic and affect the British Isles.

From these considerations the main point should emerge that the oceans and the atmosphere are continually reacting one upon the other, that their interaction forms a closed cycle of cause and effect and that the broader features of the atmospheric circulation can only be adequately dealt with by taking account of the part played by the oceans.

3. The physical basis of the forecasting problem

We can now appreciate how complex is the physical problem which confronts one who would forecast the weather. It would appear almost impossible to unravel the intricate relations of cause and effect which are involved, say from the earth's absorption of solar radiation to the release of the devastating energy of a tropical storm.

We cannot always think of physical processes on a world-wide scale, however desirable it might be to do so. A certain perspective must be maintained. Events near to us in space and time bulk more largely in meteorology, as in everyday life, than those more remote. And so the everyday forecaster who is concerned with short-period forecasts may choose to neglect everything that happens outside the area covered by his working chart and to limit his official memory to the period covered by the past few synoptic charts. He is justified in doing this only if he has an adequate and continuous supply of observations, for these observations themselves must bear the impress of those external events with which he cannot cope. This empirical approach enables some account to be taken of external events outside the experience of the forecaster, i.e. outside the confines of his meteorological chart. A sequence of observations constitutes, in effect, an integration of the effect of the operation of physical laws ready to the hand of any who would interpret them. Yet knowledge of the inner workings can only be achieved by attempting to reduce the analysis of any situation to its basic physics. Forecasting can never have the certainty that one associates with natural laws unless it be based on the intelligent application of those same physical laws.

Any extension of the period of the forecast must necessitate an extension of the area within which observations are considered essential. If forecasts for the British Isles can eventually be extended to five days then it is certain that a chart covering the whole of the Northern Hemisphere will have to be used. Similar considerations apply in the Southern Hemisphere, where the absence of land areas makes the supply of ships' observations of paramount importance.

THE NEW INTERNATIONAL METEOROLOGICAL CODE (WASHINGTON 1947)

(To be introduced on 1st January, 1949)

Marine observers would doubtless prefer their meteorology without codes! Unfortunately, however, codes are vitally necessary if observations are to be transmitted in highly abbreviated form for international exchange. It is not without interest to write down the substance of an ordinary meteorological observation in plain language; then it is apparent that the meteorological code is a highly efficient " shorthand " adapted to specialised requirements.

International meteorology, before the war, had not attained the state when agreement could be reached on one *universal* meteorological code for use on all occasions and in all areas. This step, highly desirable from the seaman's point of view, has only recently been taken. Success was almost obtained at a meeting of the International Meteorological Organisation held at Paris in 1946, but unfortunately, the proposed code did not satisfy the requirements of many countries who were unable to be represented at that meeting, and the provisional arrangement to introduce the new code on 1st January, 1948, had ultimately to be abandoned. A modified version of the " Paris " code was agreed upon by a fully representative meeting of the International Meteorological Organisation held at Toronto in August 1947, and was subsequently approved by the Conference of Directors in Washington for general introduction on 1st January, 1949.

The most efficient code is one designed for a specific purpose: universality can be achieved only by compromise and at considerable cost to the individual user interests. The needs of meteorological services in the tropics are not identical with those of services in temperate latitudes. Observing at sea has its limitations which are largely unknown to the shore observer, even as the limitations attaching to aircraft observations are of little interest to the marine observer. A code form adapted to meet such a variety of requirements cannot be the ideal one for any individual user; but it must be remembered that its limitations are the price paid for a common code.

Many of the changes made in the code result from the demands of aviation for more precision. Air travellers are at the mercy of bad weather to a greater extent than most users of meteorological reports and forecasts and it is perhaps inevitable that considerations of safety should engender a demand for observations of greater scope and accuracy. Each observer will know how to respond to this call *within the limits set by his individual circumstances.* Nothing more is asked of him than this.

Symbolic Form of Code

The revised form of code is as follows:

$YQL_aL_aL_a$ $L_oL_oL_oGG$ Nddff VVwwW PPPTT $N_hC_LhC_MC_H$ d_sv_sapp
$(8N_sCh_sh_s)$ $(9S_PS_Ps_Ps_P)$ $_0T_sT_sT_dT_d$ $1\,d_wd_wP_wH_w$ ICE C_2Kd_ire

The symbols have the following meanings:

Y	=	Day of Week.
Q	=	Octant of the globe in which ship is situated.
$L_aL_aL_a$	=	Latitude in degrees and tenths, the tenths being obtained by dividing number of minutes by 6 and neglecting the remainder.
$L_oL_oL_o$	=	Longitude in degrees (two figures) and tenths, the tenths being obtained as for Latitude.
GG	=	Greenwich Mean Time.

N	=	Total amount of Cloud.
dd	=	Direction of Surface Wind (in tens of degrees).
ff	=	Speed of Surface Wind in knots.
VV	=	Visibility expressed by two figures. (Distance at which objects can be seen in daylight or at which lights of a specified intensity can be seen at night.)
ww	=	Present Weather, i.e. the weather at the time of observation.
W	=	Past Weather, i.e. weather since last observation
PPP	=	Pressure in millibars and tenths (initial 9 or 10 omitted), e.g. 998·0 mb. coded as 980 ; 1014·7 mb. as 147.
TT	=	Temperature of air in whole degrees Fahrenheit. (Temperatures below 0°F. are subtracted from 100 for coding.)
N_h	=	Amount of Low Cloud.
C_L	=	Form of Low Cloud.
h	=	Height of Low Cloud.
C_M	=	Form of Middle Cloud.
C_H	=	Form of High Cloud.
d_S	=	Course of ship.
v_S	=	Speed of ship.
a	=	Characteristic of barometric tendency during the period of three hours preceding the time of observation.
pp	=	Amount of barometric tendency during the three hours preceding the time of observation expressed in tenths of a millibar (tendency not greater than 9·9 mb.). e.g. tendency = 9·6 mb., pp = 96.
ppp	=	Amount of barometric tendency during the three hours preceding the time of observation expressed in tenths of a millibar (tendency greater than 9·9 mb.). In this case, an additional group (99ppp) is added after the tendency group (d_Sv_Sapp), pp then being coded as 99 ; e.g. tendency = 10·3 mb., d_S = 2, v_S = 4, a = 8, then d_Sv_Sapp 99ppp is coded as 24899 99103.
N_S	=	Amount of Significant Cloud Layer.
C	=	Type of Significant Cloud.
h_Sh_S	=	Height of Significant Cloud base expressed in two figures.
S_PS_P / s_Ps_P	=	For use in describing " Special Phenomena."
T_ST_S	=	Difference between the air temperature and the sea temperature in °F. If the air temperature is below the sea temperature, 50 is added to the numerical value of the difference for coding the report.
T_dT_d	=	Temperature of Dew Point in whole degrees Fahrenheit.
d_wd_w	=	Direction from which waves come.
P_w	=	Period of waves.
H_w	=	Height of waves.
C_2	=	Kind of ice.
K	=	Effect of ice on navigation.
d_i	=	Bearing of ice limit.
r	=	Distance to ice limit from reporting ship.
e	=	Orientation of ice limit.

The new code achieves, for the first time, a uniform type of message from both ship and shore stations. For this reason in the case of certain elements (ff, VV, h_Sh_S) provision is made for a higher degree of accuracy than is normally attainable at sea. Observers at land stations, while using the same form of code, can report with the higher degree of precision permitted by the more favourable conditions ashore.

The following notes are intended to indicate more precisely how observers should code their messages, bearing in mind the limitations at sea, and to offer some explanation of the advantages afforded by the new code.

The first six groups should be reported on all occasions. Any of the remaining groups may be omitted if the relevant information is lacking. If the group d_sv_sapp is omitted 30 must be added to the value of GG.

The group $8N_sCh_sh_s$ gives additional cloud information not necessarily included in the group $N_hC_LhC_MC_H$. Its use is not obligatory, however, and Selected Ships may omit the group at their discretion.

Group $9S_PS_Ps_Ps_P$ is intended solely for the use of land stations and Ocean Weather Ships. It should not be reported by Selected Ships.

Wind Observations

Wind direction in tens of degrees instead of points is a new departure which should not offer any difficulty. All that is involved is a change of scale from 0–32 to 0–36.

Wind speed will henceforth be reported in knots. It is not suggested, however, that the marine observer should observe in knots, but that he should continue his present practice of estimating in Beaufort Force, later converting this to knots by means of a suitable table.

These changes mean that all wind data, at the surface as well as in the upper air, are now expressed in the same units, degrees and knots.

Visibility Observations

The demand for increasingly accurate observations of visibility from land stations has led inevitably to the introduction of a two-figure scale. Uniformity of procedure entails the corresponding use of this code at sea. Provision is made, however, for the lesser degree of accuracy of visibility observations at sea, by the introduction of the decade 90–99.

90	less than 50 yards
91	50 yards
92	200 yards
93	500 yards
94	1000 yards
95	1 nautical mile
96	2 nautical miles
97	5 nautical miles
98	10 nautical miles
99	25 nautical miles.

The use of these code figures should not present any more difficulty than is experienced with the current scale.

Barometric Pressure

Observations of barometric pressure will be reported to the same degree of accuracy as they are entered in the log, i.e. to one-tenth of a millibar.

Thus : 1010·7 mb. will be coded as 107
995·4 mb. will be coded as 954.

Barometric Tendency

The code provides for barometric tendency to be reported directly in tenths of millibars. When the tendency exceeds 9·9 mb., pp is coded as 99 and an additional group 99ppp is inserted after the normal tendency group, ppp then being the actual tendency expressed in tenths of millibars.

Cloud Observations

Amounts of cloud will be estimated in eighths. As the code is direct reading, the code figure is always represented by the number expressing the amount ; thus $\frac{3}{8}$ is coded as 3. Code figure 9 may be used when the sky is obscured or when darkness prevents an observation being made.

The scales for reporting the type of Low, Middle and High cloud have been slightly modified and care should be taken to consult the new definitions rather than to rely on a memory of the old versions.

Only the height of base of Low cloud need normally be reported and the code remains unchanged. Provision has been made, however, for reporting additional cloud information using the group $8N_SCh_Sh_S$, repeated as necessary. This group will be used chiefly by land stations and Ocean Weather Ships. We define the " Significant Cloud Layer(s) " as follows :

(i) the lowest layer of cloud below 20,000 ft. covering more than half the sky ; and

(ii) the lowest layer of cloud, if any, below the layer (i).

If the layers (i) and (ii) are both present they are both reported, two separate groups being used.

(iii) If no layer of cloud below 20,000 ft. covers more than half the sky, the significant cloud layer is the lowest layer of cloud below 20,000 ft.

The height of the significant cloud layer is given in a two-figure code allowing a high degree of precision (heights below 8,000 ft. can be reported to the nearest 50 ft.).

The reporting of significant cloud may on occasions be of considerable use to aircraft, and it is for their benefit that this new method of reporting has been introduced. In some cases information given in the normal cloud group may be duplicated, no real additional information being afforded by the significant cloud group. For this reason the reporting of this group should not be regarded as obligatory but rather as desirable in certain circumstances.

Sea temperature

The method of reporting sea temperature differs in the new code from that adopted in the current code (F*233). It has the advantage of greater simplicity and does not necessitate consulting a scale.

Two figures T_ST_S are reported and these are derived as follows :

T_ST_S represents the *difference between the air temperature and the sea temperature expressed in whole degrees Fahrenheit.* If the air temperature is below the sea temperature, 50 is added to the numerical value of the difference for coding the report, e.g. if the air temperature is 5°F. above the sea temperature $T_ST_S = 05$; if the air temperature is 17°F. below the sea temperature, the coded value is 67.

Wave observations

The reporting of sea and swell as separate elements of observations is not required in the new code. Instead, observers are asked to report measurements or careful estimates of the characteristics of each discernible train of waves. These characteristics are :

d_wd_w — direction from which the waves come
P_w — period of the waves
H_w — height of the waves.

The direction is reported as follows :

00 — calm (no waves).

01–36 Direction from which the waves come in tens of degrees from 010° through 090° to 360° where 01 = 10° and 36 = 360°.

When the waves are confused and the direction is indeterminate the figures 40 are reported.

By *period* of the waves is meant the time required for the passage of successive wave crests or successive troughs at a given point of observation. The code for P_w is as follows :

P_w	PERIOD
2	5 seconds or less
3	5-7 seconds
4	7-9 seconds
5	9-11 seconds
6	11-13 seconds
7	13-15 seconds
8	15-17 seconds
9	17-19 seconds
0	19-21 seconds
1	Over 21 seconds
x	Calm or period unable to be determined.

If the period is an exact number of seconds (odd) then the lower code figure is taken. For example, a period of 11 seconds would be coded as 5.

Periods of less than 5 seconds are of relatively small importance and for this reason are not given separate code figures. Throughout the main body of the code it will be noticed that the average period of each range is numerically twice the corresponding code figure.

Period can be either measured by means of a stop-watch or estimated by counting seconds. Precise instructions will be issued to ensure that all observers follow the same technique of observation. This is of the utmost importance.

The estimation of height may be very difficult at times and, as with period, a strict adherence to the official instructions for observing is essential. In the table for H_w which follows, heights in metres have been included solely to show how the scale was constructed and how the corresponding equivalents in feet have been derived.

H_w	Mean height	
	metres	feet
0	¼	1
1	½	1½
2	1	3
3	1½	5
4	2	6½
5	2½	8
6	3	9½
7	3½	11
8	4	13
9	4½	14

H_w	Mean height (Add 50 to $d_w d_w$)	
	metres	feet
0	5	16
1	5½	17½
2	6	19
3	6½	21
4	7	22½
5	7½	24
6	8	25½
7	8½	27
8	9	29
9	9½	30½

Note.—For heights over 4¾ metres (15 ft.) 50 is added to $d_w d_w$.
The code figure in each case provides for a range of heights, thus :—
1 = ¼ metre to ¾ metre or 1 ft. to 2 ft.
9 = 4¼ metres to 4¾ metres or 13½ ft. to 15 ft.

For heights over 31 ft. the wave height should be reported as the greatest height that can be reported by the code (31 ft.), followed by the word *waves* and the actual height of the wave in feet.

If a wave height lies exactly midway between the heights corresponding to two code figures, the lower code figure should be reported.

Ice Observations

For the first time, ice observations are to be included in the synoptic code. Only occasionally will British ships be called upon to use this particular group ; but other countries, such as Norway, will probably find it convenient to have ice data reported in this way.

It should be noted that the reporting of ice data as part of the synoptic code does not detract in any way from the responsibility of ships' captains to report ice in plain language in accordance with the Convention for the Safety of Life at Sea.

The code provides for the reporting of the following elements :

C_2 Description of kind of ice.
K Effect of the ice on navigation.
d_i Bearing of ice limit.
r Distance to ice limit from reporting ship.
e Orientation of ice limit.

The description of ice does not include bergs and it is therefore recommended that reporting ships should add, in plain language, to their synoptic weather report, the number of icebergs seen at the synoptic hour (e.g. 3 bergs).

The new code will admittedly make more demands on the time and capability of the marine observer. On the other hand the achievement of one universal code which may stand the test of time is of real value.

Revised instructions and logbooks for reporting ships are in course of preparation and will be issued in good time, enabling observers to become familiar with all aspects of the code before its date of introduction, 1st January, 1949.

OBSERVING WEATHER AT SEA
(IV) Observation of Cloud Forms

BY E. W. BARLOW, B.SC.

The purpose of this short article is to give some hints on cloud form observation to those observing cloud at sea. Some knowledge of the ten main cloud types, internationally accepted and used, is presumed. The difficulty in cloud identification arises mainly from the fact that clouds may assume an almost infinite variety of form, and that the classification of these forms, if it is to be of practical use for the average observer, whether at sea or on land, must be quite a simple one. Every one of the ten main types has its own characteristic, which distinguishes it from the other nine, but most of the types have to cover many minor varieties of form or structure, and even, in some cases, major variations.

Cirrus is one of the most individual clouds, but when unobstructed by other lower cloud it is one of the easiest to recognise on account of its feathery, branching or wispy form, silvery-white and clear-cut against the blue of the sky. Its several major varieties of form, and innumerable minor ones, are therefore no hindrance to its identification. Fully-developed cumulonimbi (thunderclouds) when seen from a distance, in profile, are unmistakable on account of their towering height and very solid appearance, though each has its own individuality of form. The flat-topped mass of cirrus by which a thundercloud is often capped is easy of recognition when it has been seen once or twice, in spite of the fact that it varies considerably in size and shape on different occasions.

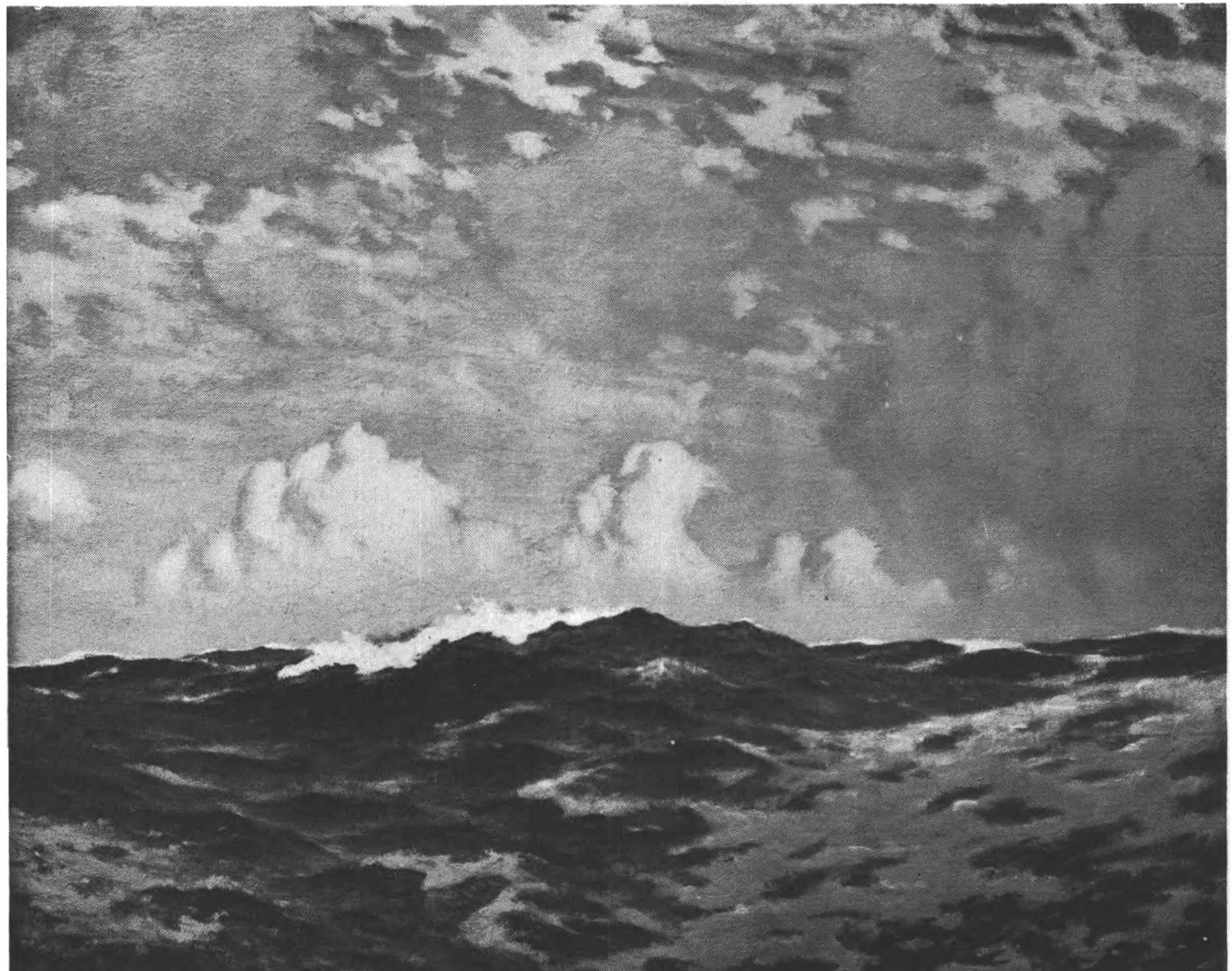
Altocumulus is perhaps the type that will offer the greatest difficulty in the long run. It has to be distinguished on the one hand from stratocumulus, a type of similar general form, but lower in height above the ground and usually composed of cloudlets which appear to be larger, and on the other hand from cirrocumulus, a similar type of greater height than altocumulus and composed of cloudlets that appear very small. The altocumulus cloudlets nevertheless cover a very considerable range of size on different occasions; their form may be circular, oval, very elongated or lozenge-shaped and many varieties of their arrangement and degree of proximity occur, including parallel lines, diverging lines and wave-form patterns. The clouds composing some forms of lenticular altocumulus may be larger than the average stratocumulus cloudlet, but are usually well-separated from each other.

Cirrostratus, altostratus, stratus and nimbostratus are easier to discriminate. These sheet clouds, especially the first three, are more or less formless and therefore show little in the way of minor varieties, except for patches, usually indefinite in form, of different densities. This patchiness, due to the inequality of light transmitted through different parts of the cloud, is most marked, in general, in nimbostratus. Nimbostratus is easy to recognise, being the overcast, lowering, dark sky of bad weather, often with rain falling. Stratus is also an obviously very low cloud, less dark and much less threatening in appearance. At the other extreme, cirrostratus is recognisable, either in its most tenuous form as a uniform milkiness, showing some of the blue colour of the sky through it, or its denser forms which are obviously high cloud and still partake of the general silvery appearance of the cirrus types, by transmitting a very considerable amount of light. Altostratus is denser and greyer and not silvery in character. The only difficulty is that altostratus can exist in different densities and that the denser forms of cirrostratus may not be distinguishable from the lighter forms of altostratus. The denser forms of altostratus similarly grade into nimbostratus.

Cumulus cloud is usually, but not always, seen against blue sky and is distinguished by its flat base, rounded top and its appearance of having vertical height. It often looks very hard-edged and the larger clouds may show strong contrasts of light and shade. Cumulus presents no special difficulty, although its size and vertical height vary very much, from a small cloudlet, when convection is beginning on a summer's day, to a massive heavy-looking cloud with its top a multitude of small curves. A cumulus may continue to grow upward until it becomes a cumulonimbus and it is sometimes doubtful which to record when it is in an intermediate stage. In general an experienced observer can tell when the ratio of height to width has increased beyond that of the cumulus form. The cloud is unquestionably cumulonimbus if either (i) it has a cirrus anvil, though all do not reach this stage; (ii) if when viewed from a distance streaks of precipitation are seen between the base of the cloud and the ground. There is no precipitation from a cumulus.

When small cumuli form in a blue sky and grow in size and number they may subsequently cover the sky or a large part of it, in which case if they

SOME PICTURES EXHIBITED BY THE SOCIETY OF MARINE ARTISTS



" Deep Waters," by George F. Bradshaw

were in sufficiently close contact the whole would rightly be called strato-cumulus. Here again is the difficulty of the intermediate stage, but it is not of much practical importance.

It may be helpful to know that only two cloud types can give steady or widespread rain (or snow), altostratus and nimbostratus. Where nimbo-stratus is present with altostratus above it, as in the case of the mass of superimposed cloud of all heights occurring in a depression, the rain reaching the ground may be coming from both clouds, or only from the altostratus, falling through the nimbostratus. The only other cloud which can give heavy (though not widespread) rain is cumulonimbus. The three cirrus types and altocumulus and cumulus never give precipitation, and stratus very seldom, and then only a light drizzle.

Cloud may be formed at any height up to 40,000 ft. or more in temperate latitudes and 50,000 ft. or more in tropical latitudes. Just as varieties of form must be grouped to get a sufficiently simple classification, so must varieties of height. The ten types allow a grouping into three ranges of height : (i) High cloud, over 18,000 ft. ; (ii) Middle cloud, 8,000–18,000 ft. ; (iii) Low cloud, below 8,000 ft. These values are for temperate regions, but must be regarded only as approximate. Middle cloud types may sometimes occur a little below 8,000 ft. and high cloud types a little below 18,000 ft.

The following way of regarding the ten cloud types may be found useful to an observer who has studied their definitions and the accompanying photographs, but who has not yet had much experience in cloud identification. If we start by separating out the two types, cumulus and cumulonimbus, which have appreciable or marked vertical height in comparison with their horizontal extent, sometimes called " heap " clouds, there remain eight. Six of these eight are true layer or sheet clouds having little thickness ; they can be grouped thus : (i) Cirrostratus, Altostratus, Stratus ; (ii) Cirro-cumulus, Altocumulus, Cumulus. Clouds of the first group, each containing the name stratus, are unbroken sheets (not necessarily covering the whole sky) at each of the three heights, high, middle and low. Clouds of the second group, each containing the name cumulus, consist of sheets composed of separate more or less rounded cloudlets, in close or fairly close proximity ; there is again one type of this cloud for each of the three heights. There remain only cirrus and nimbostratus, usually regarded also as sheet clouds but which are not truly so. The individual forms of cirrus seldom group together to form anything resembling a sheet of cloud, and furthermore some of the forms do not lie horizontal. Nimbostratus is unique in that it is not a true cloud type ; it is only the visible under-surface of a cloud extending to all heights and therefore up to several miles thick. This may be either the great cloud mass of a depression, or a cumulonimbus, and without further remarks the use of the name nimbostratus does not tell us which.

It is fortunate that cloud types remain essentially the same all the world over, but there are regions where some are especially common, while others are absent or infrequent. For example, the voyage from England to South Africa begins in the temperate region where all cloud types can occur. On passing into the North Atlantic trade wind region the change is very notice-able, isolated small flattish " trade cumulus " in a blue sky being the usual experience. In the southern part of this region towards the doldrums the cumuli begin to pile up vertically, leading to the great cumulonimbi of equatorial regions, which may have even more massive form and greater height than those of temperate regions. Passing out of this region the ship enters that of the south-east trades and finally approaches the south temperate region, with skies similar to the corresponding northern regions.

Cloud photographs chosen to illustrate the types are selected to show the typical form, or one of the typical forms, of each type. As already stated, the variations of form are innumerable so that the cloud seen at any time usually differs more or less from the photograph. With experience, many of these variations come to be recognised as variations of one type, but in other cases the cloud form is actually one that is intermediate between two types. It is obvious that such intermediate forms must occur, since in the processes of cloud development, change and dissipation, one type may actually be transformed into another. For example, a sky of pure cirrus may be seen, or one of pure cirrostratus. On another occasion the sky may be a mixed one of cirrus and cirrostratus in different parts of the sky, or it may be a sky of cirrus actually being changed into cirrostratus, a true intermediate type. In both these cases the entry in the log column would be " Ci., Cs.", but in the latter case the fact that the change was taking place should be noted in the " Remarks " column. As another example, cirrostratus may be gradually transformed into altostratus and this in turn may develop into nimbostratus.

The observer should not be disheartened if he feels unable to " place " a cloud variation or transition stage. Some of them would baffle the greatest expert, who might not venture an opinion unless he had had the chance of seeing what the cloud was like previously and also what it was at a later time. Observation of the gradual changes of cloud form, whether it be changing from one definite type to another or not, " cloud history ", in fact, is of the greatest importance in the endeavour to name clouds correctly, and it implies that as a matter of interest the sky should be watched from time to time between the actual hours of observation. In the case of the relatively rare type, cirrocumulus, observers are in fact asked not to record it, unless it has been seen to have developed from cirrus, the reason being that altocumulus composed of very small cloudlets occasionally occurs and might be mistaken for it, if the cloud's history is unknown.

One difficulty in cloud identification arises from the effects of perspective. Whether clouds are of one type only, or of mixed or intermediate types, those near the horizon will be flattened and bunched together by perspective and so will not look the same as clouds of the same actual form at higher altitudes.

The actual skies observed are often complex, sometimes extremely so, with clouds of several different types, which may at different levels largely obscure one another. The identification of the particular types seen on a given occasion is only a part of cloud observation. It has been found that the occurrence of certain cloud forms alone, or in conjunction with others, and the way the clouds are organised or distributed in the sky is of particular significance in regard to the state of weather at the time and the probable changes of weather to be expected. The nature of the changes of cloud form or type observed to be occurring, and even in some cases the altitude of the cloud above the horizon, also affect what may be called " the state of the sky ". It is these states of sky which are recorded in the coded messages for transmission by W/T, since they are what is important to the forecaster receiving the message. The definition of states of sky in the code have to make use of the names of cloud types, so that experience of cloud identification is a necessary preliminary to the recognition of the states of sky required for coding. Apart from coding requirements, the observer will find it interesting to gain experience in relating the sky state to present and future weather. In the days when there were no meteorological services or forecasts and no names for the different clouds, this was done instinctively by the old-time seamen, shepherds and others working in the open. They became quite weather-wise by long familiarity with the sky and its changes. They were recognising and noting the significance of the whole changing " cloud-picture " that we now call the state of the sky.

As examples of different states of the sky the following may be mentioned : (i) fine weather cirrus ; (ii) the cirrus sky in advance of an oncoming depression ; (iii) cirrus changing to cirrostratus, or cirrostratus changing to altostratus in advance of a depression ; (iv) the state of the sky in polar air after the cold front of a depression has passed. The sky may be largely cloudless, with occasional cumulonimbus, giving showers of rain or hail ; (v) the thundery sky.

In the later stages of a thunderstorm when the sky is still overcast by the cumulonimbus overhead, the visible part of the lower cloud often assumes many strange and chaotic forms. It is of no use to try to identify these individual forms on the classification of the ten types, in most cases. On such an occasion we can therefore easily recognise the state of the sky as thundery but cannot define the forms of the actual lower or middle clouds seen.

A cumulonimbus may be regarded as a " cloud factory ", as in the process of spreading out of the higher parts, and in the subsequent decay of the whole, patches of cloud or cloud layers may be formed and spread out at all levels round it. These associated clouds may quite frequently be seen when viewing a cumulonimbus in the distance, and are usually easily identified.

PERSONNEL

OBITUARY.—A distinguished figure in the Merchant Navy, CAPTAIN ROBERT OLDRIEVE PUTT, C.B.E., Commodore Master of the British Tanker Company (the shipping organisation of the Anglo-Iranian Oil Co., Ltd.). died suddenly at sea on 14th December while in command of the M.V. *British Isles*, one of the newest of the Company's ships, which was launched in March this year.

Captain Putt was born at Exmouth 57 years ago and served his seagoing apprenticeship with Messrs. Frank C. Strick & Company. He subsequently served as an officer with Messrs. C. T. Bowring & Company and Messrs. Houlder Bros. & Company. He joined the British Tanker Company in 1917 as Chief Officer of the old S.S. *British Isles*. Thus by coincidence his first and last ships in the Company's service bore the same name. He was promoted to command in 1918 and in June 1937 he was promoted to Senior Post Master (one of the six senior Masters post in the B.T.C.). In July 1945 he was appointed Commodore Master. He was awarded the C.B.E. in the New Year's Honours of 1946. Although he saw war service in many dangerous waters, none of the ships he commanded was sunk.

Captain Putt rendered most valuable service as a voluntary marine observer for many years. Meteorological observations of the highest quality have been recorded aboard the ships under his command since 1921.

With the death of this old associate of ours, we in the Marine Branch feel a deep sense of personal loss.

J. H.

The late Captain R. O. Putt, C.B.E.,
Commodore Master of the British Tanker Company
July, 1945—December, 1947.

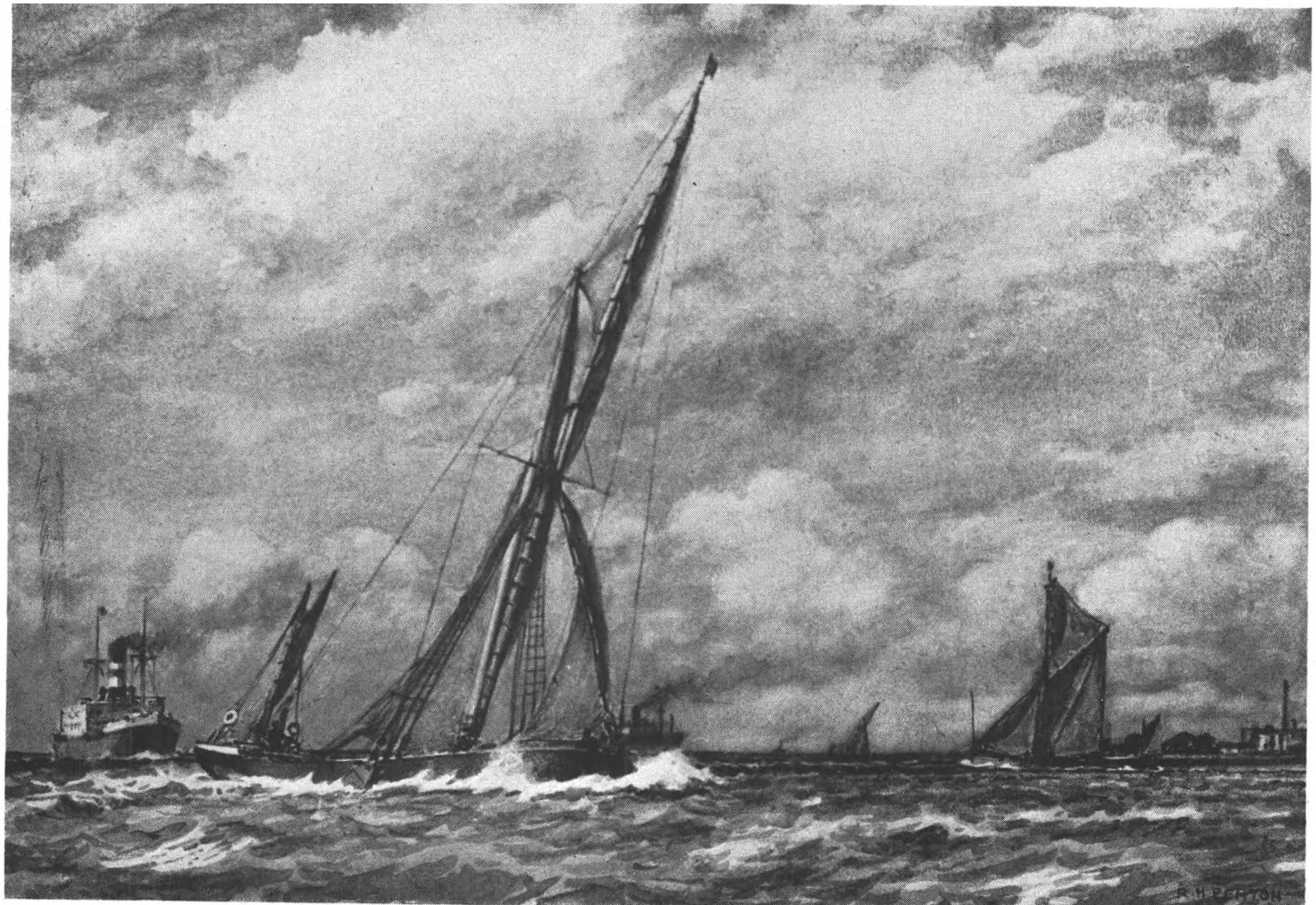
SOUTHERN ICE REPORTS
During the Years 1946 and 1947
April

Year	Day	Position: Latitude	Position: Longitude	Description	Remarks	Name of Ship Reporting
		° ′	° ′			
1946	1	61 06S	47 24W	Pack and growlers.	Loose pack from NNW to SE through NE. Few small growlers around.	*Southern Venturer.*
	3	From 61 18S To 61 36S	44 30W 44 00W	Growlers.	Few small growlers. No pack visible.	
	4	61 54S	45 00W	Pack and bergs.	Heavy pack to S. Many large and small bergs.	
	5	61 30S	45 06W	Pack and bergs.	Pack to S approx. 10 miles off. Few large and small bergs.	
	6	60 42S	42 12W	Bergs.	Many large and small bergs. No pack.	
	1	61 28S	47 03W	Bergs and pack.	Some bergs. Pack 8 miles to S.	*Empire Venture.*
	2	61 23S	47 24W	Bergs and pack.	Some bergs. Pack 8 miles to S.	
	3	61 19S	47 14W	Bergs and pack.	Some bergs. Pack 8–9 miles to S.	
	4	61 15S	47 12W	Bergs and pack.	Pack 6 miles to S.	
	5	60 49S	48 04W	Bergs and pack.	Pack 6 miles to S.	
	6	60 50S	48 30W	No ice.	No ice in sight.	
	7	61 11S	48 32W	No ice.	No ice in sight.	
	8	61 08S	48 47W	Bergs and pack.	Few bergs. Pack just in sight.	
	9	60 38S	47 37W	Bergs.	Few bergs. No other ice.	
	10	60 23S	47 23W	Bergs.	Few scattered bergs.	
	11	60 28S	47 05W	Bergs.	Numerous bergs, all sizes.	
	12	60 19S	46 47W	Bergs.	Some bergs.	
	13	59 52S	47 06W	Bergs.	Few bergs.	
	14	60 48S	47 18W	No ice.	No ice in sight.	
	15	60 49S	47 09W	Bergs.	Few bergs.	
	16	60 18S	47 00W	Bergs.	Few bergs.	
	17	59 50S	46 19W	Bergs.	Few bergs. Left for South Georgia—clear water the whole way.	
1947	1	61 50S	85 45E	Drift-ice and bergs.	Small amounts of drift ice and a good many small bergs with overturned appearances and one showing a dark green layer all through, as a band around its surface.	*Balaena.*
	2	61 36S	85 13E	Drift-ice and bergs.	Patches of drift-ice of various sizes, mostly small, with a tendency to become firmer through binding medium of sludge. Isolated bergs.	
	3	From 61 42S To 62 18S	85 00E 83 36E	Pack, bergs and drift-ice.	Extensive pack a mile or so SE of ship all day extending to horizon or beyond. A good many bergs of all shapes seen. Also much drift-ice or re-setting pack.	
	4	63 00S	84 08E	Pack, bergs and drift-ice.	Extensive pack a mile or so SE of ship all day extending to horizon or beyond. A good many bergs of all shapes seen. Also much drift-ice or re-setting pack.	

Year	Day	Position: Latitude	Position: Longitude	Description	Remarks	Name of Ship Reporting
		° ′				
	5	63 07S	84 11E	Pack, bergs and drift-ice.	Extensive pack a mile or so SE of ship all day extending to horizon or beyond. A good many bergs of all shapes seen. Also much drift-ice or re-setting pack.	
	6	63 07S	84 11E	New ice.	Entire sea surface speckled with plates of new ice which grew in size from 2–3 ins. diameter early to nearly a foot by afternoon.	
	7	63 12S	83 49E	Pack.	Pack dimly seen on S horizon (10 miles).	
	8	63 14S	82 15E	Bergs.	Isolated small bergs. Little other ice.	
	9	63 13S	72 20E	Bergs.	Only a few small bergs seen this day, but suspect main pack not very far S because of (*a*) low air temperature, (*b*) detour needed by S.S. *Empire Catcher II* near here.	
	10	From 63 13S To 63 13S	70 00E 63 00E	Bergs.	A few small bergs. No other ice seen. Water very cold, freezing in bucket as soon as hauled in; must have been kept open by windiness.	
	11	From 63 54S To 63 42S	57 30E 49 18E	Bergs.	Little ice seen. One berg, much worn, seen from factory. Water temp. ranging from 29·8 to 30·4°F, but the notorious storms off Enderby Land keep the water open almost to the coast in this season.	
	12 13	From 63 24S To 62 00S From 60 12S To 59 18S	46 30E 42 30E 39 06E 37 54E	No ice seen.	An air party observer reports having seen one small berg.	
	14	56 48S	34 41E	Berg.	One medium-sized tabular berg 4 miles W of ship. One small berg or bergy bit reported by an independent observer earlier in day, i.e. further SE. No other ice.	
	17	45 09S	22 23E	Berg.	One small berg or bergy bit, the size of a Nissen hut, a mile E of ship. No ice seen on 15th and 16th.	
	1	62 30S	48 00W	Bergs and pack.	6 tabular bergs toward horizon. Thick pack S to SE.	
	4	62 30S	48 00W	New ice.	Lying in sea of newly formed ice-pads.	*Southern Harvester.*

May and June, 1946. No reports received. May and June, 1947: No reports received.

Reports of ice previous to April, May and June, 1946, will be found in *The Marine Observer*, Vol. XVI, No. 134, page 64.



" A Breezy Day. Sea Reach," by R. H. Penton

FLEET LIST (Great Britain)

VOLUNTARY OBSERVING SHIPS

The following is a list of British ships, voluntarily co-operating with the Marine Branch of the Meteorological Office.

The names of the Captains, Observing Officers, and Senior Radio Officers are given as ascertained from the last written return received. The date of receipt of the last return received is given in the sixth column.

All returns received from observing ships will be acknowledged, direct to the ship, by the Marine Superintendent.

The Port Meteorological Officers and Merchant Navy Agents at the ports will make personal calls on the Captains and Observing Officers as opportunity offers, or on notification from the ship at any time when their services are desired. (See under Notices to Marine Observers.)

Excellent awards are made at the end of each financial year. The names of the Captains, Principal Observing Officers and Senior Radio Officers gaining these awards are published in a special list in the *Marine Observer.*

It is requested that prior notification of changes of service, probable periods of lay up, transfer of Captains, or other circumstances which may prevent the continuance of voluntary meteorological service at sea, may be made to the appropriate Port Meteorological Officer or Merchant Navy Agent.

Captains are requested to point out any errors or omissions which may occur in the list.

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Accra	C. C. Cave	C. N. Morrison, G. Reed, P. W. Lillie	J. A. Stuart	Elder Dempster Lines, Ltd.	20.12.47
Admiral Sir John Lawford	W. B. Hicks			Iago Steam Trawler Co., Ltd.	
Afghanistan	W. Robertson	J. Linton, R. L. Cain, H. Wales	F. Dibble	Strick Line, Ltd.	3.1.48
Ajax	C. H. Whitehouse	I. McK. Jackson, D. L. Emery, C. M. Best	F. G. Short	Ocean S.S. Co., Ltd.	5.12.47
Akaroa	W. J. Williams	J. Tierney, J. Scott, M. Brown	J. W. Soulsby	Shaw, Savill & Albion Co., Ltd.	10.12.47
Alpha Zambesi	J. Forsythe			Alpha S.A. S.S. Co., Ltd.	
Amastra	A. K. Bamberry	F. R. Pretty, J. McKay, J. Weatherley	J. Evans	Anglo-Saxon Petroleum Co., Ltd.	9.10.47
Amersham	A. Spence	E. T. Ward, W. P. Tait	W. C. Sheard	Thompson S.S. Co., Ltd.	11.8.47
Andes	H. F. Way, Cdre., R.N.R.	C. Robertson		Royal Mail Lines, Ltd.	
Aquitania	J. D. Snow, R.D., R.N.R.	D. Robertson, J. H. W. Locke, F. G. Boize	G. M. Parsons	Cunard White Star Line, Ltd.	7.1.48
Arabistan	J. H. Metcalfe	W. G. Smith, J. B. Clemenson	N. W. Hodgson	Strick Line, Ltd.	27.9.47
Araby	G. H. Taggart	G. A. Keen		Royal Mail Lines, Ltd.	
Arakaka	D. R. C. Onslow	J. A. Carter, S. Armitage, E. G. Price	R. G. Taylor	Arakaka S.S. Co., Ltd.	29.12.47
Argentina Star	D. R. Macfarlane, O.B.E., D.S.O.	B. Baillie		F. Leyland & Co., Ltd.	
Argyll	J. Dodds			B. J. Sutherland & Co., Ltd.	
Ariguani	S. Browne	J. Beatson, R. D. Philpott	A. N. Taylor	Elders & Fyffes, Ltd.	13.12.47
Artisan	H. Coates	C. A. V. Daly, R. W. Baldwin, A. Ryan	H. Hall	Charente S.S. Co., Ltd.	7.1.48
Arundel Castle	C. C. Page	J. Taylor, M. Kenshole	P. P. Williams	Union Castle Mail S.S. Co., Ltd.	13.12.47
Ascania	G. N. Jones, O.B.E.	H. Huntley, J. Boyce, G. H. Drinkwater	S. K. Alston	Cunard White Star Line, Ltd.	17.10.47
Asia	J. A. Myles, R.D., Cdr., R.N.R.	E. A. Irvine		Cunard White Star Line, Ltd.	
Asturias	J. W. Carr	F. Williams, G. H. Emerton, K. J. Colombo	A. Banberry	Royal Mail Lines, Ltd. (Managers)	3.11.47
Athelchief	J. D. Donovan	R. C. Stone, J. P. Coffey, B. Jarrett	G. Clarke	Tankers, Ltd.	29.10.47
Athelprince	H. J. Hill	C. C. Billsom, R. McGregor, W. S. Boyd	A. E. Morton	Athel Line, Ltd.	26.11.47
Athelregent	W. Meneight	A. Sugden	N. B. Martin	Athel Line, Ltd.	22.8.47

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Athenic	D. Aithison	A. Warren		Shaw, Savill & Albion Co., Ltd.	
Athlone Castle	W. D. Roach	N. A. Rigg, G. B. Murray, C. E. Walker	J. H. Summers	Union Castle Mail S.S. Co., Ltd.	
Atlantis	D. R. Lee	C. J. Gulliford, D. R. Moody, N. D. Carlson	L. G. Hoskings	Royal Mail Lines, Ltd. (Managers)	11.6.47
Auricula	H. Sangster	A. Phillips, N. Douglas, R. Shaw	W. Phelan	Anglo-Saxon Petroleum Co., Ltd.	12.11.47
Australia Star	T. F. Williams, O.B.E., D.S.O.	D. Carstairs, L. Tessier, F. Bale	W. Rollason	F. Leyland & Co., Ltd.	26.1.48
Australind	J. F. Woods	R. Thomson, D. R. G. Stephan, N. H. Smith	S. Hall	Australind S.S. Co., Ltd.	11.8.47
Balaena	P. Verik	B. Christensen		United Whalers, Ltd.	
Balantia	F. A. C. Thacker	R. Box, G. Fraser, R. Newbury	R. Lewis	Royal Mail Lines, Ltd.	13.12.47
Baltara	G. E. Thomas	S. Bayliss		United Baltic Corporation, Ltd.	
Banff Park	E. Bursby	T. Burke, G. Dunn, R. Rutherford	J. Spicer	Sir Eric Ohlson, Bt. (Manager)	
Baron Belhaven	H. Moore	G. J. McIntosh		Hogarth S.S. Co., Ltd.	
Baron Napier	J. H. Anderson	W. C. Casson, J. E. York, K. Krutainis	A. D. Carter	Hogarth S.S. Co. Ltd.	27.11.47
Basinghall	J. Hall	G. Baxter, J. R. Foster	J. Peacock	Bulk Storage Co., Ltd.	20.10.47
Baskerville	E. Pugh, O.B.E.	J. F. Thompson, R. J. Lungley, D. Henderson	P. Kelly	Barberry's S.S. Co., Ltd.	5.11.47
Bassano	G. Hodgson	P. R. Skelton, B. W. Waldie, N. O. Cook	G. H. Shilson	Ellerman's Wilson Line, Ltd.	10.12.47
Beaconsfield	W. D. Shields	R. King		Britain S.S. Co., Ltd.	
Beaverburn	J. B. Smith, O.B.E.	A. Aikman, J. B. Laflin, M. D. Atkins	T. Ainsworth	Canadian Pacific Railway Co.	28.1.48
Beavercove	B. B. Grant, R.D., R.N.R.	R. D. P. Gillett, G. Palmer, J. Bezant, B. Q. Dunham	J. A. McAskill	Canadian Pacific Railway Co.	22.12.47
Beaverdell	C. E. Duggan, R.D., Capt., R.N.R.	L. E. McDowell, W. E. Williams, G. W. Bateman	L. Norton	Canadian Pacific Railway Co.	13.11.47
Beaverford	R. A. Leicester, O.B.E.	G. W. R. Graves, E. R. Connorton, E. R. Shaw	W. Poingdestre	Canadian Pacific Railway Co.	20.12.47
Beaverglen	S. W. Keay	M. Bates, D. Blois, D. J. Jeavons	J. S. Skinner	Canadian Pacific Railway Co.	13.12.47
Beaverlake	C. L. deH. Bell, D.S.C., R.D., R.N.R.	M. Hurd-Wood, R. Walgate, R. Rawlings	A. R. Humphries	Canadian Pacific Railway Co.	9.1.48
Beckenham	F. W. Grist	H. Blair		Britain S.S. Co., Ltd.	
Bendoran	J. Cringle	F. Hamilton		Pen Line Steamers, Ltd.	
Benedict	S. Pollock	D. Lear, L. Sayers, J. Wood	J. Adamson	Booth S.S. Co., Ltd.	13.1.48
Benledi	A. P. Paterson	G. Spears, G. Miller	A. Saltwell	Ben Line Steamers, Ltd.	3.7.47
Benreoch	J. B. Hastie	G. Pirie, S. Murray, R. D. Robb	I. M. Fraser	Ben Line Steamers, Ltd.	3.1.48
Benvrackie	W. C. Wilson			Ben Line Steamers, Ltd.	
Bibury	A. Roche	A. Jones		Alexander S.S. Co., Ltd.	
Black Prince	P. F. Owens	J. C. Giles, P. M. Giles, B. S. Biggs	E. H. Pickering	Rio Cape Line, Ltd.	5.12.47
Brasil Star	G. Duff, G.M.	D. S. Gilmour		F. Leyland & Co., Ltd.	
Bravo	E. Tyler	C. I. W. Fox, C. Everingham, P. Hudson	E. C. Bates	Ellerman's Wilson Line, Ltd.	
Brisbane Star	F. N. Riley, D.S.O.	M. R. Bremberg, R. H. Stark, G. Munro	D. J. Eastwood	F. Leyland & Co., Ltd.	5.12.47
British Colonel	E. L. Miller	W. S. Jaeger	R. A. MacLeod	British Tanker Co., Ltd.	16.4.47
British Commodore	N. Pinkney	R. Maybourn	J. Sheehan	British Tanker Co., Ltd.	19.12.47
British Endurance	W. Watkin-Thomas	S. H. Falconer, A. D. Millar, P. C. Coyne	A. E. Adams	British Tanker Co., Ltd.	29.12.47
British Energy	J. G. Hill	L. V. Potts		British Tanker Co., Ltd.	
British Escort	D. F. Ward	A. E. Marshall, H. Evans, G. Barber	P. Dwyer	British Tanker Co., Ltd.	7.1.48
British Hussar	T. J. Picken			British Tanker Co., Ltd.	
British Lancer	W. S. Vittle	J. A. Picken, W. R. Symon, D. H. Ferrett	C. O'Mahony	British Tanker Co., Ltd.	18.12.47
British Marquis	J. C. Lea, O.B.E.	H. Scott, A. Gordon, G. Lawson	D. Golden	British Tanker Co., Ltd.	5.12.47
British Patience	G. A. Dickson	J. H. Jones	L. Cooper	British Tanker Co., Ltd.	20.2.47

British Pilot	R. O. Cash	J. R. Lumley, N. Steadman, B. Peck	A. Noblett	British Tanker Co., Ltd.	8.11.47
British Piper	M. W. Good	H. White, A. Brading, J. Milburn	J. Pearcey	British Tanker Co., Ltd.	19.4.47
* *British Power*	C. A. Colburn	L. Leybourne, F. Randison, H. Tunnell, A. Mitchell	M. Thompson	British Tanker Co., Ltd.	20.12.47
British Prestige	W. Hill	M. Sydenham, W. Budge	H. Holdridge	British Tanker Co., Ltd.	
British Resolution	J. Bolger	T. Giffard, D. Battel	K. Morris	British Tanker Co., Ltd.	2.10.47
British Statesman	W. P. Booth	J. B. Hunter, C. V. Harrison, F. A. Lapper	G. W. Bayliss	British Tanker Co., Ltd.	29.12.47
British Swordfish				British Tanker Co., Ltd.	
Brittany	H. A. Wright	M. H. Blackman, J. Fox, W. Morton	J. Downie	Royal Mail Lines, Ltd.	27.10.47
Brockleymoor	D. J. Jones	F. W. Gant, J. H. Looker	J. S. Don	Moor Line, Ltd.	25.8.47
Brontes	E. Drinkall			Henriksen & Co.	
Bulby	G. Bull			Seddon Fishing Co., Ltd.	
Cairnavon	A. Henderson	S. W. Taylor, G. Percy, J. E. Holland	F. L. Roberts	Cairn Line of Steamships, Ltd.	16.1.48
Cairnesk	I. G. Foster	R. Preston, G. R. Norvell	R. J. Howard	Cairn Line of Steamships, Ltd.	27.10.47
Canton	G. Stable	T. Hopkins, J. S. G. Christian, P. G. Pattinson, J. M. Donkin	Johnson	P. & O. Steam Nav. Co.	2.1.48
Cape Barfleur				Hudson Brothers Trawlers, Ltd.	
Cape Gloucester	C. Agerscow	J. A. Hamilton	J. A. Hamilton	Hudson Brothers Trawlers, Ltd.	
Cape Mariato	W. E. Woodall	W. E. Woodall, R. N. Dixon	R. N. Dixon	Hudson Brothers Trawlers, Ltd.	13.2.47
Cape Trafalgar	R. A. Cook			Hudson Brothers Trawlers, Ltd.	
Cape York	H. C. Hunter	G. O. Lambert, D. E. Cormack, R. Brewster	J. D. MacKinnon	Cape York M.S. Co., Ltd.	2.11.47
Capetown Castle	J. C. Brown, C.B.E., R.D., Cdre., R.N.R.	F. Tudor, R. Lofts, J. Beytagh	J. Gilbart	Union Castle Mail S.S. Co., Ltd.	5.12.47
Carella	J. Crewdson	H. Butler	H. Butler	J. Marr & Son, Ltd.	
Carnarvon Castle	T. W. McAllen	J. C. Whadcoat, T. R. Kendra, R. E. Johnston	W. A. Brown	Union Castle Mail S.S. Co., Ltd.	21.1.48
Cavina	S. A. Sapsworth	D. Clark		Elders & Fyffes, Ltd.	
Celtic Monarch	J. H. Keir	E. A. Muir		Monarch S.S. Co., Ltd.	22.11.47
Cerinthus	J. F. Auld			Hadley S.S. Co., Ltd.	
Cheshire	F. C. Brooks	R. D. Fielder, P. Saunders, R. Sly	J. E. Unsworth	Bibby Line, Ltd.	13.1.48
Chinese Prince	F. S. Thornton, O.B.E.	H. E. Jennings, P. J. Brenthall, P. B. Eccles	E. Wearmouth	Prince Line, Ltd.	11.9.47
Chupra	M. C. Williams	W. L. Hillcoat, C. W. Allerton, J. E. Wills	R. C. Whiting	British India Steam Nav. Co., Ltd.	27.1.48
Cilicia	R. W. Smart	G. Hamilton		Anchor Line, Ltd.	
City of Barcelona	H. G. Williams, O.B.E.	R. G. Lewis, A. M. Bowman, A. J. Preston	J. E. Martlieu	Ellerman Hall Line, Ltd.	30.9.47
City of Bristol	T. F. Labey	R. J. Windsor, J. B. Somerville, D. McLean	W. G. Fitzgerald	Ellerman City Line, Ltd.	11.10.47
City of Calcutta	W. H. Matheson, O.B.E.	T. Lovell, I. McDermid, J. Henderson	D. O'Leary	Ellerman City Lines, Ltd.	13.10.47
City of Canberra	F. Tibbetts	W. H. Wilson, E. G. A. Smith, F. E. Pollitt	C. C. Northcote	Ellerman Lines, Ltd.	13.12.47
City of Capetown	W. S. Coughlan, O.B.E.	H. Lewis, J. L. Robertson, A. H. Davey	D. R. Crombie	Ellerman Hall Line, Ltd.	21.8.47
City of Carlisle	L. E. Smith, M.B.E.	E. J. Beaumont, J. Irvin, B. Pickering	B. G. Magennis	Ellerman & Bucknall S.S. Co., Ltd.	19.12.47
City of Chester	R. Longstaff, D.S.O.	J. B. Lister	J. A. Vallance	Ellerman Hall Line, Ltd.	15.9.47
City of Derby	A. G. Melville	K. Dobson		Ellerman & Bucknall S.S. Co., Ltd.	
City of Dieppe	E. G. Chapman	A. G. Willa, R. J. Tyrell, D. J. Lloyd	R. Lennox	Ellerman Lines, Ltd.	7.10.47
City of Durham	T. H. Speakman	H. McL. Farquhar, F. A. Dickson, J. W. Terris	A. R. Evans	Ellerman City Line, Ltd.	6.12.47
City of Exeter	G. E. Roberts, O.B.E.	R. Miller, W. Lowe, D. H. Wardlaw, J. W. Morrison	G. S. Creighton	Ellerman City Line, Ltd.	
City of Hong Kong	H. Percival, O.B.E.	L. R. Keith		Ellerman City Line, Ltd.	
City of Johannesburg	D. L. Lloyd, O.B.E.	H. Routledge		Ellerman Hall Line, Ltd.	
City of Khartoum	J. A. Beynon	D. B. Martin, R. Frame, R. Wakefield	S. Gracie	Ellerman Hall Line, Ltd.	
City of Lyons	R. L. Stewart	J. Kendall, A. R. Horam, C. B. Powell	W. Roberts	Ellerman Hall Line, Ltd.	5.6.47
City of Paris				Ellerman City Line, Ltd.	
City of Pretoria	T. F. Labey			Ellerman & Bucknall S.S. Co., Ltd.	
City of Swansea	F. C. Dashley	T. Dickinson, P. Appleton, K. Haslam	J. Mann	Ellerman Hall Line, Ltd.	20.5.47
City of Sydney	J. B. MacLaren	L. G. Powell, I. M. Williams, J. L. Blanch	R. Pickering	Ellerman Hall Line, Ltd.	20.10.47

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
City of Windsor	T. G. Mathias	M. Graham, T. Rigg, E. F. Brick	A. C. Macaulay	Ellerman & Bucknall S.S. Co., Ltd.	27.10.47
Clan Brodie	B. Vernon-Browne	E. J. E. Owen, W. Kendall, J. Baxter, W. Burgess	R. J. Jones	Clan Line Steamers, Ltd.	5.11.47
Clan Buchanan	T. W. Inman	F. H. Thornton		Clan Line Steamers, Ltd.	
Clan Campbell	J. A. Foster	S. F. Nicholson, A. G. Beynon, S. K. Young	R. F. Cole	Clan Line Steamers, Ltd.	23.8.47
Clan Chattan	H. C. Simpson	F. Turton, J. W. Ward, P. W. Howells	J. Shillabeer	Clan Line Steamers, Ltd.	16.9.47
Clan Chisholm	J. H. Crellin	R. S. Russell, A. M. Vaughan, A. G. Allson	J. A. Gray	Clan Line Steamers, Ltd.	27.10.47
Clan Farquhar	P. MacMillan	E. R. Thorpe, W. Graham, D. Busserreau	H. O. Francis	Clan Line Steamers, Ltd.	
Clan Forbes	H. S. Pengelly	C. Stonehouse, J. West, A. T. Campbell, W. T. Maltman	W. H. Saville	Clan Line Steamers, Ltd.	27.10 47
Clan Macaulay	A. G. Storkey	T. R. Halliday, C. G. Smeaton, R. G. Hallewell	R. G. Gooseman	Clan Line Steamers, Ltd.	6.9.47
Clan Macdonald	H. Cater	J. P. Dunphy, J. Law, D. Milner, T. R. Parsons	G. Martyn	Clan Line Steamers, Ltd.	6.12.47
Clan Macdougall	R. P. Galer, C.B.E., R.D., R.N.R.	G. Bagnall, J. A. Baxter, R. C. Pearce	C. E. C. Crew	Clan Line Steamers, Ltd.	30.12.47
Clan Maclaren	W. R. Woodriffe	A. Mair, R. Helme, J. Duff	R. M. Moore	Clan Line Steamers, Ltd.	4.10.47
Clan Macnair	R. F. Buckley	P. L. Leslie, W. J. Freestone, N. W. Wallace	D. C. Munro	Clan Line Steamers, Ltd.	15.11.47
Clan Macneil	S. J. Carter	L. W. Gibbins, S. F. Nicholson, M. T. Morton	G. McCubbing	Clan Line Steamers, Ltd.	13.6.47
Clan Macrae	A. G. Macpherson	G. S. Gann, T. O. Marr, P. C. W. Hoblyn	R. W. Mortimore	Clan Line Steamers, Ltd.	3.9.47
Clan Urquhart	C. C. Parfitt	W. C. Rodger, M. N. Ure, T. N. Geesin	A. F. MacIntyre	Clan Line Steamers, Ltd.	20 10.47
Clydebank	A. S. Reed	W. Fromant, L. B. Witheridge, H. Chambers	E. O'Neill	Bank Line, Ltd.	15.4.47
Clydefield	H. Vaughan-Jones	G. S. Barker	J. M. Coates	Northern Petroleum Tank S.S. Co., Ltd.	14.11.47
Columbia Star	C. J. W. Jones	C. G. Lea, Smith, Harkness	A. E. Clark	Union Cold Storage Co., Ltd.	10 3.47
Comanchee	T. Potts	A. E. Hughes, M. Rutherford, R. Tasker	C. Barrett	Anglo-American Oil Co., Ltd.	23.10.47
Comedian	R. L. Williams	E. D. Ashdown, D. O. Percy, R. E. Gerrard	B. B. Haw	Charente S.S. Co., Ltd.	14.11.47
Comliebank	W. Mendus	A. J. Whiston, R. Clark, S.J East	A. H. Elde	Bank Line, Ltd.	21.4.47
Condesa	R. Smiles, O.B.E.	E. G. J. Roberts, R. F. Martin, A. Byers	M. McDougall	Furness-Houlder Argentine Line, Ltd.	1.11.47
Consuelo	D. B. Ramsbottom	F. Fletcher, H. Edwards, R. C. Neesham	R. J. H. Carew	Ellerman's Wilson Line, Ltd.	7.6.47
Corinthic	G. M. Robertson, D.S.C.			Shaw, Savill & Albion Co., Ltd.	
Cornwall	J. W. C. Pring	J. M. James		Federal Steam Nav. Co., Ltd.	
Coulgorm	G. Robison	T. F. Tuomey, W. F. Kelly, D. Betteridge	R. Andrews	Dornoch S.S. Co., Ltd.	13.1.48
Custodian	A. H. Thompson	C. S. S. Boam, A. P. Sandford	A. J. Long	Charente S.S. Co., Ltd.	22.4.47
Darro	T. Davies	R. Finch, D. Buckle, J. Sutherland	C. T. Ball	Royal Mail Lines, Ltd.	23.1.47
Deebank	B. Rivett	I. McKay, D. Campbell, T. Ridgeway	J. Freeman	Bank Line, Ltd.	27.1.48
Defoe	W. C. Blake	W. Carslaw, P. Casey, H. Smith	W. Auden	Lamport & Holt Line, Ltd.	2.10.47
Delilian	R. McNie	R. S. Macaulay, A. K. McFarlane, S. F. Bryce	F. P. Lawton	Donaldson Line, Ltd.	26.1.48
Delius	H. W. Underhill	R. H. Turner, W. Jones, H. Jones	R. Pryer	Lamport & Holt Line, Ltd.	29.7.47
Denbighshire	W. F. Dark	J. Main, W. S. Hargrave, E. G. Painter, D. Stanley	H. A. Cox	Glen Line, Ltd.	16.10.47
Derryclare	G. Smith	A. M. Livingstone		McCowan & Gross, Ltd.	
Deseado	B. C. Dobbs, O.B.E.	J. H. Napper, W. B. Avison, J. Holt	A. W. Allen	Royal Mail Lines, Ltd.	6.9.47
Devis	A. Bibby, O.B.E.	H. M. Bunker	L. Brazill	Lamport & Holt Line, Ltd.	29.7.47
Devon	A. Hocken	S. G. Robinson, J. Bayley, N. A. Dennis	A. Williams	Federal Steam Nav. Co., Ltd.	

Devonshire	J. E. Cullen, O.B.E.	D. Hine, J. Farrow, L. E. Mallon	G. Nutter, M.B.E.	Bibby Line, Ltd.	10.12.47
Dilwara	F. L. Sampson, D.S.C.	J. W. Walker, H. B. Cray, J. A. G. Bridgeman	S. J. Taylor	British India Steam Nav. Co., Ltd.	13.1.48
Doris Clunies	J. G. Stevenson	J. B. Whyte, R. L. Edwards, P. P. Bracewell	C. M. Hargreaves	Doris S.S. Ltd.	11.12.47
Drina	W. H. Roberts	D. N. G. East, J. Rutter, E. O'Keefe	D. B. Douglas	Royal Mail Lines, Ltd.	27.6.47
Dryden	C. L. Legg	K. Quirk, J. S. Peterkin, J. L. Radcliffe	S. J. Hardman	Lamport & Holt Line, Ltd.	17.7.47
Dunnottar Castle	J. Trayner	N. Upham, D. A. Bird	E. H. Pitt	Union Castle Mail S.S. Co., Ltd.	14.11.47
Dunster Grange	S. Christie	R. W. Macfarlane, H. Neal, C. Mullings	P. B. McNab	Houlder Line, Ltd.	7.1.48
Durango	W. H. Roberts	J. G. Brennand, M. W. M. Weekes, M. J. Dean, J. T. Jones	F. Portess	Royal Mail Lines, Ltd.	18.1.48
Durban Castle	C. C. Gorringe	L. M. Cairns, M. R. H. Oates	H. G. Higgins	Union Castle Mail S.S. Co., Ltd.	
Durham	R. J. Dunning	R. W. Merry, J. E. Bury, R. D. Parkin	E. R. Saunders	Federal Steam Nav. Co., Ltd.	26.1.48
Eastern	T. J. Mills	D. C. Elkington, C. D. Dykes, S. W. Mort	E. C. Bouel	Eastern & Australian S.S. Co., Ltd.	23.11.47
El Gallo	E. H. Richardson	T. Yates		Lobitos Oilfields, Ltd.	12.9.47
Empire Brent	J. Cook	J. Short	L. Hooper	Donaldson Bros. & Black, Ltd. (Managers)	
Empire Halladale	E. Stormont, M.B.E.	T. Moodie, D. Lamont, D. McLeod	W. Waddell	Anchor Line, Ltd. (Managers)	21.8.47
Empire Kinsman	A. Richardson			Bullard, King & Co., Ltd. (Managers)	
Empire MacDermott	O. L. John, O.B.E.	F. H. Leigh, A. C. E. Green, H. Ashforth	L. G. Hills	Buries Markes, Ltd.	16.10.47
Empire Martaban	E. Longster	G. McGowan, D. B. Butler	T. M. Keddie	Bolton S.S. Co., Ltd. (Managers)	19.6.47
Empire Pride	A. Beharrel	F. M. Hughes, J. F. Carr, R. Hammond	T. Preston	Bibby Line, Ltd. (Managers)	5.12.47
Empire Star	S. J. C. Phillips, C.B.E.	R. H. Hall-Soloman, Lt., R.N.R., J. T. Brown, F. P. McGuckin	A. Morris	F. Leyland & Co., Ltd.	27.10.47
Empire Viceroy	M. D. Mackenzie	D. L. Jardine, A. C. Cable, A. Purvis	R. Porter	Counties Ship Management Co., Ltd. (Managers)	4.11.47
Empress of Australia	H. H. Davies	R. W. Savage, E. Bennett	W. Campbell	Canadian Pacific Railway Co.	18.6.47
Empress of Canada	E. A. Shergold	R. W. Savage, A. Morrison, H. L. Kinns	J. M. Butterworth	Canadian Pacific Railway Co.	25.11.47
Empress of Scotland	J. W. Thomas, O.B.E.	G. E. Warburton, L. Thompson, D. Seward	H. W. Turner	Canadian Pacific Railway Co.	29.12.47
Epsom	R. W. Fletcher	G. T. Sharpe, E. Curling, J. F. Tutvill	H. M. S. Williams	Britain S.S. Co., Ltd.	20.11.47
Eros	R. C. Vigurs	V. Irving, C. P. Turquand, T. Lenton	P. McBride	Elders & Fyffes, Ltd. (Managers)	7.1.48
Esperance Bay	T. V. Roberts, R.D., R.N.R.	D. T. Mouldey, K. Murray-Brown, J. H. Moore	P. Moloney	Aberdeen & Commonwealth Line, Ltd.	2.2.48
Esso Glasgow	A. C. Burge	L. Mitchell, J. Arthur, S. Robinson	C. C. H. Weeks	Anglo-American Oil Co., Ltd.	6.9.47
Ettrickbank	T. Watkins			Inver Transport & Trading Co., Ltd.	
Explorer	W. Moore	F. Allen, R. Ledger, P. A. Leighton	W. Murray	Charente S.S. Co., Ltd.	30.12.47
Fanad Head	E. W. Black	W. L. Nelson		Ulster S.S. Co., Ltd.	27.2.47
Fantee	A. M. Scobbie, O.B.E.	G. H. Griffiths	H. O'Gorman	Elder Dempster Lines, Ltd.	13.11.47
Fenja	J. W. Leask	I. C. McDonald	J. W. Leask	South Georgia Co., Ltd.	5.12.47
Ficus	S. Thompson	B. T. Tallack, G. D. Davidson, J. R. Johnson	J. Moss	Anglo-Saxon Petroleum Co., Ltd.	1.8.47
Finland	A. Wilson	A. Wilson		Currie Line, Ltd.	
Folda	E. Tulloch	J. F. Cooper, H. Watson		South Georgia Co., Ltd.	
Fordsdale	R. G. Ireland	R. Welch, H. G. B. Moss, G. Lewis	H. S. Knight	Shaw, Savill & Albion Co., Ltd.	2.2.48
Fort Assiniboine	A. H. Downes	J. Beerman		Brown, Atkinson & Co., Ltd. (Managers)	
Fort Augustus	R. D. Griffiths	W. S. Dockeray, T. Hylsop	F. W. Divers	Watts, Watts & Co., Ltd. (Managers)	
Fort Brandon	A. D. Seybold, M.B.E.	V. J. Owen, J. Trautman, D. Chandler	R. Leatham	Houlder Bros. & Co., Ltd. (Managers)	1.1.48
Fort Cadotte	A. MacKellar, R.D., R.N.R.	G. Mitchell, K. Lamb, L. Coltham	J. F. Reilly	Cunard White Star, Ltd. (Managers)	13.8.47
Fort Caribou	W. T. Evans			Goulandris Bros., Ltd. (Managers)	
Fort Musquarro	J. Francis Drake, O.B.E., R.D., R.N.R.	M. Hehir, P. Jackson, J. C. Nicholson	J. Shehan	Cunard White Star, Ltd. (Managers)	
Fort Nakasley	A. Cromarty, O.B.E.	M. MacPhee, A. McFie-Allen, A. S. Kelly	J. F. Norwood	J. & J. Denholme, Ltd. (Managers)	5.12.47

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Fort Steele	J. S. Binnie	K. Montgomery, L. Jamieson, J. Horne	W. Steele	Lyle S.S. Co., Ltd. (Managers)	
Fort Ticonderoga	J. L. Croasdaile, R.D., R.N.R.	J. K. Finlay, T. W. Marshall, J. W. Killan	J. E. Conway	Cunard White Star, Ltd. (Managers)	28.2.47
Franconia	C. I. Thompson	A. M. Thomson, J. Locke, E. L'Estrange		Cunard White Star, Ltd.	
Georgic	H. Grattidge, O.B.E., R.D., R.N.R.	E. E. Willis, K. Nelson, D. Wicksteed	A. G. Hill	Cunard White Star, Ltd. (Managers)	20.11.47
Glaucus	W. T. Spencer	J. Lloyd-Jones, G. McInnes, P. Pratt	J. M. Lewis	Ocean S.S. Co., Ltd.	31.12.47
Glenartney	W. E. Coates	R. Webb, C. Lorimer, P. Goldie	Collier	Glen Line, Ltd.	10.6.47
Glenbank	T. Fraser	M. Murphy, J. J. Reed, J. R. Roe	C. H. Ball	Bank Line, Ltd.	4.11.47
Gloucester	A. J. Angell	B. E. Applegate, G. E. Holland, T. G. Fuller	R. J. Devlin	Federal Steam Nav. Co., Ltd.	16.9.47
Goth	T. Barcock			Wyre Steam Trawling Co., Ltd.	
Gothland	D. Sinclair	A. Miller, J. Laing	D. Sinclair	Currie Line, Ltd.	1.2.47
Granpond	P. F. Ewart	H. Smallwood, A. V. James, J. Woodworth	R. A. Bristy	Mediterranean & Atlantic Lines, Ltd.	14.5.47
Guinean	H. Coffey, R.D., R.N.R.	A. E. Pearson		United Africa Co., Ltd.	
Haparangi	C. R. Pilcher, O.B.E.	N. J. Collett		New Zealand S.S. Co., Ltd.	
Helicina	F. T. Vine	P. S. Sharer, G. E. Bennison	T. W. Corbett	Anglo-Saxon Petroleum Co., Ltd.	12.9.47
Herefordshire	T. J. A. Thomson	E. Hodgson, T. Cooper, W. Thomas	E. Greaves	Bibby Line, Ltd.	22.10.47
Highland Brigade	H. D. Hooper, O.B.E.	R. M. Tysol		Royal Mail Lines, Ltd.	
Highland Chieftain	G. A. Bannister	A. N. Brook W. R. Brooks, C. B. Lambert	T. Desboro'	Royal Mail Lines, Ltd.	29.10 47
Highland Monarch	D. A. Casey, D.S.O., D.S.C., R.D., Cdr., R.N.R.	A. Ferguson, F. Dickenson, M. Hawkins, E. Pearce	F. Dunk	Royal Mail Lines, Ltd.	27.11.47
Highland Princess	D. R. Lee	A. J. Field, J. C. Cotton	F. Goodall	Royal Mail Lines, Ltd.	19.5.47
Highwear	J. S. Mallaby			High Hook S.S. Co., Ltd.	
Hilary	A. Elliott, O.B.E.	A. S. Frith, M.B.E., P. J. Wahlberg, W. T. Pitcher	J. Houghney	Booth S.S. Co., Ltd.	17.11.47
Historian	C. C. Heaton	G. Davies, D. Jones, W. D. Aitken	W. Watt	Charente S.S. Co., Ltd.	8.7.47
Hopecrown	T. Georgeson	N. Hanson	W. Thomas	Clive S.S. Co., Ltd.	22.4.47
Hopepeak	G. Grindrod	J. C. Jackson, C. E. Pain, F. Rowe	A. Buchanan	Hopemount S.S. Co., Ltd.	5.6.47
Hopestar	F. H. Dufton	G. J. Outen, W. D. Tullock	C. J. Rees	Wallsend S.S. Co., Ltd.	20.11.47
Hororata	A. E. Taylor	R. Webster, B. K. Price, P. Jeanes	C. L. Lambe	New Zealand S.S. Co., Ltd.	28.8.47
Horsa	D. Dickson	W. Urquhart, A. Wotherspoon	None carried	Currie Line, Ltd.	8.3.47
Inishowen Head	G. A. Moore	J. Smythe, N. C. Stark, R. McKeague	F. J. Murray	Ulster S.S. Co., Ltd.	11.8.47
Inverbank	A. M. Williamson	J. A. Jones, J. Mitchell	W. Chalmers	Bank Line, Ltd.	25.11.47
Jamaica Producer	G. E. M. Jenkins	G. J. Tedd, W. E. Brett, D. G. Clarke, W. Hendry	K. Hartley	Jamaica Banana Producers S.S. Co., Ltd.	19.1.48
Jersey City	J. M. Cox	F. J. Johns, A. W. J. Justen, R. Briton	S. Whitmore	Reardon Smith Line, Ltd.	9.10.47
Jessmore	A. C. Bailey	S. N. Coe, D. G. Waters, K. Rowland	F. Murray	Johnston Warren Lines, Ltd.	29.9.47
John Biscoe	A. F. MacFie, O.B.E., R.D., Lt.-Cdr., R.N.R.	W. Heatley, T. Miller, R. V. Cox	J. O'Hare	Falkland Islands Dependencies Government	
John Holt	J. Shaw	W. L. Harrison, P. Bathurst, J. Spilman	E. A. Heard	John Holt & Co. (Liverpool), Ltd.	15.9.47
Kaipaki	T. Fenwick	A. E. Searle		New Zealand S.S. Co., Ltd.	7.1.48
Kaipara	T. R. Windus	N. Fraser, D. Ewan, G. Thomson	S. H. Devereux	New Zealand S.S. Co., Ltd.	18.8.47
Kaituna	R. F. Hellings	J. Blake, C. F. Turner, W. Howgego	M. Garrett	New Zealand S.S. Co., Ltd.	21.1.48
Kallada	S. Hazard	R. H. Wakeford		J. Nourse, Ltd.	

Kelmscott	R. E. Richardson	P. F. Carnochan, J. F. Thompson, J. Hepplewhite	G. Williams	Pachesham S.S. Co., Ltd.	3.9.47
Kenilworth Castle	G. H. Mayhew	J. C. Forster, W. Anson, F. Rossouw, B. Blackburn	J. Gillespie	Union-Castle Mail S.S. Co., Ltd.	22.10.47
Kent	E. H. Hopkins	D. L. Willmott, G. C. Simpson, C. Masson	E. Dove	Federal Steam Navigation Co., Ltd.	30.9.47
Ketos	G. J. Gjertsen	H. Johansen, J. F. Jarvis	J. Murphy	United Whalers, Ltd.	
King Robert	G. Craze	G. Griffiths, W. Keith, P. Kidd	W. Fielding	King Line, Ltd.	10.10.47
King William	A. B. Drever	M. Nelson, J. Gittings	W. A. Wareing	King Line, Ltd.	2.2.48
Kingston Pearl	A. R. Cornish	A. R. Cornish	W. Weaver	Kingston Steam Trawling Co.	3.11.47
Kohistan	W. A. Chappel	C. O. Jones, A. Baird, J. B. Peto	R. R. Gill	Shahristan S.S. Co., Ltd.	18.11.47
Lacklan	W. H. Willcox	J. I. W. Reid	H. E. Morrison	Socony-Vacuum Transportation Co., Ltd.	19.3.47
Laguna	R. C. Skillorn	J. H. Allenby, W. P. Goldie, P. H. Grant	J. Heenay	Pacific Steam Navigation Co.	
Lambrook	H. F. McInnes	J. Orr, R. L. Snaith, H. P. Winkle	A. Leader	Austin Friars S.S. Co., Ltd.	18.2.47
Lanarkshire	C. E. O'Byrne	J. S. Catterall, C. McCullach, D. Crawford	P. Budge	Scottish Shire Line, Ltd.	25.9.47
Lancashire	A. Kerbyson	W. H. Malley, R. K. Mason, J. W. Q.-K. Harwood	A. Jones	Bibby Line, Ltd.	25.11.47
Largs Bay	A. V. Richardson	P. Williams, F. Packman, A. Childs	D. Macrae	Aberdeen & Commonwealth Line, Ltd.	27.10.47
Latia	P. G. G. Dove	R. K. Nicholls		Anglo-Saxon Petroleum Co., Ltd.	
Leeds City	J. D. Lloyd	H. O. Parry, J. R. Patterson, G. J. R. Hayes	R. G. Lee	Reardon Smith Line, Ltd.	8.12.47
Leicester	J. Holwood	J. T. Andrews		Federal Steam Navigation Co., Ltd.	
Levernbank	D. Gillies	C. G. Watterson, C. R. Eaddy, D. A. Kiddell	W. C. Doyle	Bank Line, Ltd.	
Livorno	E. S. Green	D. H. Hill, A. W. Wilks, G. Dineley	S. G. Gracie	Ellerman's Wilson Line, Ltd.	13.11.47
Llangibby Castle	J. B. McReynolds	W. J. Damerell, R. Wright, C. M. Hart	F. W. Saxey-Santelli	Union Castle Mail S.S. Co., Ltd.	1.1.48
Lloydcrest	T. Walker	D. W. Verniers		Junecrest S.S. Co., Ltd.	
Lobos	R. H. Sissons	R. T. Riley, P. H. Ray, J. Norman	N. P. Sherin	Pacific Steam Navigation Co.	15.1.48
Loch Avon	W. W. Lowe	R. G. Driver		Royal Mail Lines, Ltd.	
Loch Garth	H. G. Whittle, O.B.E.	D. B. Keefe		Royal Mail Lines, Ltd.	
Loch Ryan	W. H. Grimshaw	C. Hartley, N. F. Seaton, M. Dean, R. D. Stirling	D. Douglas	Royal Mail Lines, Ltd.	9.10.47
Lochmonar	H. H. Treweeks	G. B. Medleycott, J. E. Robson, Lt., R.N.R., P. C. T. Davies	J. Coutts	Royal Mail Lines, Ltd.	15.12.47
Lord Gladstone	J. Abuelo	M. M. Osman, W. T. Davies, S. L. Edwards	W. Phelan	Norwood S.S. Co., Ltd.	
Lord Glentoran	W. J. Leinster	S. Templeton, R. M. Hall, A. Brines	S. G. D. Wessels	Ulster S.S. Co., Ltd.	10.11.47
Lord O'Neill	R. A. Ferguson	R. G. Pass, W. R. Nelson	A. H. Campbell	Ulster S.S. Co., Ltd.	11.12.47
Loriga	G. B. Wardale	W. E. Molloy, K. Thomas, A. Hudson	J. Sheen	Pacific Steam Navigation Co.	2.12.47
Losada	P. L. Hockey	G. E. Turner, J. Galston, M. Plewes	F. K. Cowley	Pacific Steam Navigation Co.	13.11.47
Lulworth Hill	J. Reed	J. S. Henderson, R. W. Curd	R. Penrose	Dorset S.S. Co., Ltd.	4.2.48
Luminous	S. J. Smith	J. Billett		Aral S.S. Co., Ltd.	
Machaon	J. L. W. Johnston	D. H. Stewart, C. C. Reeder, J. R. Wells, A. C. Farquhar	A. Akhurst	Ocean S.S. Co., Ltd.	28.1.48
Macharda	R. A. Penstone	J. F. Baker, T. H. Wardle, L. J. S. Saxty	G. Caddy	T. & J. Brocklebank, Ltd.	22.12.47
Magdapur	A. Hill, O.B.E.	S. Baxter, A. Davies, P. A. Litherland	E. Halton	T. & J. Brocklebank, Ltd.	2.12.47
Mahanada	J. W. B. Robertson, R.D. R.N.R.	P. A. Gunson, J. Brand, J. C. Long	T. Williams	T. & J. Brocklebank, Ltd.	30.12.47
Mahia	J. W. Hart	T. deM. Ogier, C.C.D. Gough	J. J. Nolan	Shaw, Savill & Albion Co., Ltd.	8.10.47
Mahout	T. C. Eddy	O. Pritchard, G. Sinclair, P. Greenhall	A. E. Weston	T. & J. Brocklebank, Ltd.	29.7.47
Mahsud	R. Humble	A. P. Briggs, F. J. Watts	H. Fisher	T. & J. Brocklebank, Ltd.	20.12.47
Maihar	J. R. Paisley	J. P. Pembridge, M. H. Taylor, D. L. des Landes	K. P. Kinderman	T. & J. Brocklebank, Ltd.	18.12.47
Makalla	J. B. Newman	A. H. Fawcett, J. Clarke, J. H. Moore	A. N. Orum	T. & J. Brocklebank, Ltd.	16.10.47
Malakand	J. Owen	B. T. Dey, H. Defty, E. G. Anderson	J. Caddy	T. & J. Brocklebank, Ltd.	30.10.47

NAME OF VESSEL	CAPTAIN	OBSERVING OFFICERS	SENIOR RADIO OFFICER	OWNERS	LAST RETURN RECEIVED
Malancha	H. MacGregor	D. S. Carter, W. Gibson, J. Kemp	B J. Smith	T. & J. Brocklebank, Ltd.	13.1.48
Malayan Prince	J. D. Fraser	H. Gates, G. Wilkinson, E. Knaggs	L. Andrews	Rio Cape Line, Ltd.	
Malmo	J. W. Calvert			Ellerman's Wilson Line, Ltd.	
Manchester City	F. L. Osborne	W. P. Lowthian, W. Hine, M. Bewley, B. S. Roberts, R. Wadsworth	W. H. Critchley	Manchester Liners, Ltd.	9.6.47
Manchester Commerce	H. Hancock	A. C. Caird, W. E. Quirk, J. E. Askew	J. D. Dempster	Manchester Liners, Ltd.	
Manchester Division	E. W. Espley	H. Nielsen, F. Robinson, D. Thomas	T. Parker	Manchester Liners, Ltd.	2 2.48
Manchester Progress	W. H. Downing	A. Cookson, F. Lewis, N. Davies	J. Coates	Manchester Liners, Ltd.	2.2.48
Manchester Regiment	F. D. Struss, O.B.E., D.S.C.	E. J. Eccles, J. L. McLaren, D. S. Millard	W. Critchley	Manchester Liners, Ltd.	11.12.47
Manchester Shipper	J. Barclay	T. H. Lynn, F. Lewis, D. Heaton	E. Ambler	Manchester Liners, Ltd.	14.1.47
Manchester Trader	E. W. Raper	C. T. Marchant, D. S. Millard, P. Fielding	A. C. Gavin	Manchester Liners, Ltd.	12.9.47
Mandasor	C. W. C. Parry	D. J. Evans, J. G. Nuttall, F. P. Attwood	B. Banks	T. & J. Brocklebank, Ltd.	21.8.47
Maplebank	N. P. McLeod	N. P. McLeod	J. B. Anderson	Bank Line, Ltd.	
Marengo	F. Ellison	H. Riley		Ellerman's Wilson Line, Ltd.	
Margay	E. A. Prentice	M. G. Stevens, W. Forster, J. Bloomfield	M. Lynch	"K" S.S. Co., Ltd.	30.12.47
Marinda	A. Crewdson	H. C. Coplin	H. C. Coplin	Seddon Fishing Co., Ltd.	
Markhor	W. Hill, O.B.E.	I. A. Maclaren, R. N. Bonnry	J. Schofield	T. & J. Brocklebank, Ltd.	
Marna	R. J. Hume			South Georgia Co., Ltd.	
Marquita	F. C. Jennings	D. Hughes		Coolham S.S. Co., Ltd.	
Marsdale	M. Ferguson	H. Jones, J. Tiere, L. Mansell		"K" S.S. Co., Ltd.	
Martand	T. Fox-Lloyd	E. Watkins, E. L. Jones, G. J. Kenyon	G. W. Hazel	T. & J. Brocklebank, Ltd.	5.12.47
Martita	H. Bunn	R. V. G. Check, E. Prest, C. Ferguson	J. J. Hynes	"K" S.S. Co., Ltd.	
Matheran	A. B. Bannatyne, O.B.E.	H. Simpson, J. A. Miller, A. W. Wiltshire	P. Neeson	T. & J. Brocklebank, Ltd.	21.1.48
Matina	R. A. Thorburn	J. Mayo, T. C. Crane, E. M. Harvey	A. C. Knight	Elders & Fyffes, Ltd.	8.12.47
Mauretania	H. Grattidge, O.B.E.	T. R. Buckingham, K. Milburn, J. R. Lidgey			
Media	R. G. Thelwell, O.B.E., R.D., Capt., R.N.R., A.D.C.	A. G. Hustwayte, A. D. Hunt, M. T. Dodds	F. Clark	Cunard White Star, Ltd.	
Memling	D. C. Roberts	G. J. Piper, L. A. Ankers, W. Sparks	L. M. MacDonald	Cunard White Star, Ltd.	1.1.48
Millais	J. F. Byrne	R. H. Turner, B. G. C. Salisbury, A. Corlett	F. E. L. Hall	Lamport & Holt Line, Ltd.	16.10.47
Mirror	S. A. Gammon	R. E. Small, P. B. Henderson, C. E. Burrill	A. Hutchinson	Lamport & Holt Line, Ltd.	18.8.47
Monarch	J. P. F. Betson	K. H. Joy, A. Hoar, Black-Tuckwell	J. Crouch	Cable & Wireless, Ltd.	5.12.47
Moveria	J. L. McQueen	A. D. McCallum, M. Todd, J. C. Young	E. Robinson	Postmaster-General	18.7.47
Mulbera	T. J. Murphy	T. A. Robinson, D. C. Morrison, J. S. Davies	R. H. Hallam	Donaldson Line, Ltd.	25.6.47
Myrtlebank	F. Hale	G. G. Hodgson, J. T. Duncan, F. J. Adamson	T. McMinn	British India Steam Nav. Co., Ltd.	27.8.47
Nab Wyke	P. E. Bedford		N. Kehoe	Bank Line, Ltd.	11.11.47
Nairnbank	C. S. Holbrooke	B. Arnstad, E. Reed, J. Appleby		Wyre Steam Trawling Co., Ltd.	
Napier Star	E. N. Rhodes	S. Harvey, J. Bain	J. Adamson	Bank Line, Ltd.	8.11.47
Naringa	R. Stone	Hutton	W. Lay	Union Cold Storage Co., Ltd.	18.12.47
Naticina	W. D. Speakman	C. Palmer, J. E. Gill, C. B. Davidson		British India Steam Nav. Co., Ltd.	
Nestor	E. W. Powell	W. A. Clark, J. G. Wilson, J. R. McCarthy	C. D. Grimster	Anglo-Saxon Petroleum Co., Ltd.	29.8.47
New Zealand Star	G. Owen, O.B.E., R.D., Cdr., R.N.R.		L. Booth	Ocean S.S. Co., Ltd.	16.6.47
		D. Thomas, R. Stewart, D. van der Merwe	C. J. Carter	F. Leyland & Co., Ltd.	10.12.47

Norfolk	A. T. Robertson, R.D., Capt., R.N.R.	R. S. Luly, H. C. MacP. Douglas, A. B. Moss	J. Heath	Federal Steam Nav. Co., Ltd.	2.2.48
Northumberland	F. Longheed	R. G. Anderson, C. B. Hewitt	A. H. Lugar	Federal Steam Nav. Co., Ltd.	11.8.47
Norwegian	J. Pollock	H. Wylie		Donaldson Line, Ltd.	
Nova Scotia	J. E. Wilson, O.B.E.	A. Pearson, J. D. P. Williamson, R. I. Heys	W. C. Brock	Johnston Warren Lines, Ltd.	17.12.47
Novelist	T. E. Steel	W. G. Jackson	G. Mitchell	Charente S.S. Co., Ltd.	
Ocean Valley	W. MacMellin	J. S. Dalgarno, T. Shields, W. Hodgson	H. Holdridge	Houlder Bros. & Co., Ltd. (Managers)	11.8.47
Ocean Wanderer	D. E. Norie	A. Mathieson, J. T. Hibbert		Bolton S.S. Co., Ltd.	
Orari	F. Pover	F. M. Williamson, L. Ambrose, C. S. Single	G. A. Parker	New Zealand S.S. Co., Ltd.	2.2.48
Orbita	J. Sutherland	J. Greenwood, J. Kelly, W. Singleton	W. McCormick	Pacific Steam Nav. Co.	26.8.47
Orduña	W. A. Hearle	J. B. Olsson, B. A. King, N. Owen	J. R. Kidson	Pacific Steam Nav. Co.	17.12.47
Orion	C. Fox, C.B.E., L.M.	C. K. Knight, W. Thompson, B. Noble	N. Boon	Orient Steam Nav. Co., Ltd.	20.12.47
Ormonde	T. L. Shurrock, O.B.E.	C. F. Williams, A. M. Murray, D. K. H. Kinlock	R. Oakley	Orient Steam Nav. Co., Ltd.	9.4.47
Otranto	I. E. G. Goldsworthy	L. C. Kingswood, E. V. Harris, Thomas	C. T. Seaton	Orient Steam Nav. Co., Ltd.	13.12.47
Pacific Enterprise	M. E. Cogle, O.B.E.	D. M. Morris, Crosthwaite, Cameron	I. A. Waddell	Norfolk & North American S.S. Co., Ltd.	15.12.47
Pacific Exporter	R. E. L. Holland	H. M. Head, B. A. Gouldstone, G. K. Williams	R. P. McEwan	Norfolk & North American S.S. Co., Ltd.	29.9.47
Pacific Shipper	E. V. Richards	W. E. Thomas, R. Hughes, S. G. Edwards	T. E. Stronge	Furness, Withy & Co., Ltd.	13.11.47
Pakeha	H. C. Smith	A. R. Stephenson		Shaw, Savill & Albion Co., Ltd.	
Palacio	M. H. Atkinson	C. A. Ellis, R. M. Lidgate	P. McCarthy	MacAndrews & Co., Ltd.	
Palana	F. R. Spurr	P. J. Passmore, M. A. Frenfield, W. B. Vickers	H. Olding	P. & O. Steam Nav. Co.	3.11.47
Palomares	D. L. Thomas, M.B.E.	F. Szanage		MacAndrews & Co., Ltd.	
Pampas	T. Powell	C. D. Williams		Royal Mail Lines, Ltd.	
Papanui	E. A. Burton	G. R. Naylor, G. Rennie, R. Tomlinson	P. Broome	New Zealand S.S. Co., Ltd.	17.9.47
Paparoa	E. A. J. Williams	C. B. Hewett, H. A. Owen, A. P. Robinson	L. P. Rayner	New Zealand S.S. Co., Ltd.	22.12.47
Paraguay	P. M. Burrell	L. Gibson, G. A. Gibbons, W. K. West	T. G. Twistleton	Royal Mail Lines, Ltd.	22.11.47
Pardo	R. N. Fletcher	R. Kilby-Leonard, J. Green, S. D. Gibson	J. Whitfield	Royal Mail Lines, Ltd.	5.11.47
Parima	J. N. Duncan	R. C. Hunnisett	D. Field	Royal Mail Lines, Ltd.	8.11.47
Paringa	C. E. Pollitt	G. P. Blyth, W. N. Eade, J. S. Anderson	A. MacBeth	P. & O. Steam Nav. Co.	16.1.48
Pegu	S. Thomson	I. S. MacColl		British & Burmese Steam Nav. Co., Ltd.	
Perim	J. C. Mellonie	R. M. Parnell		P. & O. Steam Nav. Co.	
Perthshire	A. J. Hogg	J. Browne, J. G. Smith, I. W. Bennet	F. Rayner	Scottish Shire Line, Ltd.	13.10.47
Pilcomayo	J. S. Wrake, Lt.-Cdr., R.N.R.	D. P. Warren, P. Anthony, J. Upton	A. R. Beynon	Royal Mail Lines, Ltd.	17.11.47
Pipiriki	R. G. Rees	M. J. Heron, J. Bryant, J. Laidlaw	L. Wittingdon	New Zealand S.S. Co., Ltd.	25.11.47
Planter	J. J. Wallis	J. L. Cule		Charente S.S. Co., Ltd.	
Polar Chief	A. Goodlad			South Georgia Co., Ltd.	
Polar Maid	H. Leask	E. Smith, J. Gilman		Polar Whaling Co., Ltd.	
Port Chalmers	E. J. Syvret	C. M. Watkins, P. A. N. Thomas, M. L. Mitchell	M. J. Sheehan	Port Line, Ltd.	29.12.47
Port Fairy	D. G. H. Bradley	P. L. Hollings, J. Rose, H. S. Cran	E. G. Gunner	Port Line, Ltd.	29.12.47
Port Hobart	T. F. Kippins, O.B.E., D.S.C.	A. J. Braund, J. D. Aitchison, J. A. Ashburner	B. Morley-Evans	Port Line, Ltd.	29.12.47
Port Jackson	T. H. Rigden	D. M. MacKeith, C. Guest, D. Sinclair	A. B. Chiffers	Port Line, Ltd.	18.12.47
Port Lincoln	H. H. Smith, O.B.E.	C. Rhodes, R. Silvester, D. Robinson	F. Griffiths	Port Line, Ltd.	29.7.47
Port Macquarie	E. T. N. Lawrey	A. W. Kinsett, T. S. Paton, P. M. Hudson	H. J. Griffiths	Port Line, Ltd.	30.10.47
Port Philip	J. G. Lewis, O.B.E.	F. M. Barton, E. W. Dalton	J. Macpherson	Port Line, Ltd.	2.2.47

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Port Pirie	W. J. Enright, O.B.E., R.D., Cdr., R.N.R.	H. F. Lunn, R. C. Matthews, A. S. Baird	W. Miller	Port Line, Ltd.	17.12.47
Port Wellington	W. G. Higgs, O.B.E.	J. M. Bedwell, R. J. Harris, L. P. H. Sayles	J. S. MacPhearson	Port Line, Ltd.	30.12.47
Port Wyndham	H. Steele	W. H. Hopwood, Lawrence, Bell	P. Hobbs	Port Line, Ltd.	18.12.47
Potaro	S. J. G. Hill	T. A. Evans, W. A. Tresidder, W. K. West	C. B. Townley	Royal Mail Lines, Ltd.	13.8.47
Priam	L. W. Kersley	I. Webster, R. A. Hansel, C. H. Jolly	F. Fish	Ocean S.S. Co., Ltd.	5.11.47
Princesa	R. Owen	D. A. Dear		Furness-Houlder Argentine Lines, Ltd.	
Rakaia	J. S. Oxnard	M. Holden, T. Gibbon, J. Budgell, A. Rollinson	A. Lugar	New Zealand S.S. Co., Ltd.	22.10.47
Rangitata	G. Kinnell, O.B.E.	H. P. Lunn, M. Drake, W. Peto	E. Stride	New Zealand S.S. Co., Ltd.	5.12.47
Recorder	R. F. Longster	G. W. Sigsworth		Charente S.S. Co., Ltd.	22.10.47
Red Charger	R. Nash	C. Noble		Iago Steam Trawler Co., Ltd.	
Red Crusader	B. Rogerson			Iago Steam Trawler Co., Ltd.	
Red Knight	E. Littler		R. Green	Iago Steam Trawler Co., Ltd.	
Red Lancer	M. Wright			Iago Steam Trawler Co., Ltd.	
Red Sword	J. Tomlinson			Iago Steam Trawler Co., Ltd.	
Regent Hawk	J. Ward	J. Ward, G. R. Arthur, H. G. Cresswell, T. S. Farrar	J. R. Twidell	Trinidad Leaseholds, Ltd.	6.1.48
Reighton Wyke	C. Whiting		R. Bell	West Dock Steam Fishing Co.	29.3.47
Rembrandt	J. J. Grugan	R. Thompson		Bolton S.S. Co., Ltd.	
Repton	D. Cownie	F. L. James, D. M. Muir, D. Meardon	W. Keogh	Basra S.S. Co., Ltd.	5.12.47
Richmond Castle	Pettitt	E. H. F. Hall	R. Santillo	Union Castle Mail S.S. Co., Ltd.	3.2.47
Richmond Hill	M. O'Neill	S. Sloan, A. Shafy, L. Gellie	R. White	Putney Hill S.S. Co., Ltd.	6.1.48
Riebeeck Castle	J. E. R. Wilford, R.N.R.	J. C. Whadcoat, R. Fancourt	D. G. Bristow	Union Castle Mail S.S. Co., Ltd.	11 10.47
Rimutaka	W. Wilson, O.B.E.	B. Linklater, I. Cubitt, D. Dickens, J. van der Straaten	A. Stenning	P. & O. Steam Nav. Co.	5.11.47
Rippingham Grange	L. Bearbank	R. Tinmouth, H. Butler, E. A. Prothero	J. Connelly	Houlder Line, Ltd.	1.10.47
Robert F. Hand	E. J. Instone, O.B.E.	A. Cresswell, R. Phillips, J. Rochford	A. W. Toor	Anglo-American Oil Co., Ltd.	29.3.47
Robert Hewett	G. Elliott	H. Willcock		Great Northern Fishing Co., Ltd.	
Rochester Castle	D. D. Mackenzie	P. G. Eckford, G. E. Matthews, E. H. Pickles	K. N. G. Ashfold	Union Castle Mail S.S. Co., Ltd.	14.11.47
Rockside				Andros S.S. Co., Ltd.	
Roslin Castle	H. L. Holland	R. H. Hudson	F. J. Smith	Union Castle Mail S.S. Co., Ltd.	1.1.48
Rowallan Castle	A. C. M. Black, O.B.E.	R. G. Patterson, K. M. Knight, A. D. Sincock	T. M. K. Knowles	Union Castle Mail S.S. Co., Ltd.	26.1.48
Roxburgh Castle	J. M. Rayner, R.D., R.N.R.	J. K. Mumford, K. Grant	J. H. Hillyer	Union Castle Mail S.S. Co., Ltd.	17.7.47
Royal Star	R. White, D.S.C.	T. G. Hughes, L. Thompson, T. Brewster	T. G. Hills	Union Cold Storage Co., Ltd.	
Ruahine	A. E. Lettington, D.F.C.	I. Y. Batley, J. D. Guyler, J. Massy	J. Poyner	New Zealand S.S. Co., Ltd.	4.2.48
Rutland	W. Thom	J. Pryde	J. Macfarlane	Currie Lines, Ltd.	8.1.47
Sacramento	J. Robinson, M.B.E.	A. C. Dick, W. White, A. D. Robinson	W. Parratt	Ellerman's Wilson Line, Ltd.	17.9.47
St. Crispin	R. A. Cook	L. Hought	L. Hought	West Hartlepool Steam Nav. Co., Ltd.	10.12.47
St. Just	V. A. Buschini	V. A. Buschini		Heward Trawlers, Ltd.	
St. Loman	A. Robinson	A. Robinson	G. Schofield	T. Hamling & Co., Ltd.	12.9.47
St. Zeno	J. H. Ellis	J. H. Ellis, A. G. Phillips	A. G. Phillips	T. Hamling & Co., Ltd.	15.12.47
Salaverry	A. G. Litherland	T. Hiatt, P. D. O'Driscoll, W. A. E. Johnston	P. E. Everett	Pacific Steam Nav. Co.	29.10.47
Salinas	J. Williams			Pacific Steam Nav. Co.	
Salmonier	J. D. Wilson			W. Thomson & Co.	
Saluta	A. Torgerson	R. L. Wood	P. Curson	South Georgia Co., Ltd.	

Samanco	J. H. Lyle	C. Stewart, A. Lang, E. Sleeman	R. M. Evans	Pacific Steam Nav. Co.	29.3.47
Samaria	D. W. Sorrell	J. Ormerod, J. Hughes, W. Marshall	E. P. Bishop	Cunard White Star, Ltd.	11.2.47
San Adolfo	E. J. Osborne, M.B.E.	D. L. Newton, J. H. Gay, C. F. Hudson	R. H. Charlton	Eagle Oil & Shipping Co., Ltd.	22.1.48
San Cirilo	T. L. Pearson	M. H. Jones, J. Pratt, B. T. Orange	P. S. Henderson	Eagle Oil & Shipping Co., Ltd.	21.1.48
San Felix	A. E. Gumbleton	J. B. Hunter, J. D. Nash, J. Mulligan	W. L. Radcliffe	Eagle Oil & Shipping Co., Ltd.	10.12.47
San Velino	H. C. Archer, O.B.E.	J. Dixon, J. Munday, W. D. Hepworth	J. Clark	Eagle Oil & Shipping Co., Ltd.	18.8.47
San Veronico	R. M. Atkinson	J. J. Greener, R. Auric, R. Purvis	C. L. Carpenter	Eagle Oil & Shipping Co., Ltd.	26.1.48
San Vulfrano	W. Wigham	N. P. Macfarlane, T. O. Davies	N. G. Maclean	Eagle Oil & Shipping Co., Ltd.	28.4.47
Santander	T. J. Naylor	H. Russell, F. Leicester, D. T. Beamish	E. Early	Pacific Steam Nav. Co.	11.12.47
Sarmiento	J. D. Richards	O. A. Baker, A. B. Powell, F. Nuttall	J. Hammond	Pacific Steam Nav. Co.	16.10.47
Saxon Star	D. J. Stralta	H. Tompsett, M. McClymont, A. G. Smith	H. J. Camp	F. Leyland & Co., Ltd.	7.1.48
Scythia	H. Dixon	F. A. M. Pain, D. P. Johnstone, W. MacDougall	L. Varmen	Cunard White Star, Ltd.	27.10.47
Silvercedar	F. E. Godley	B. Stark, D. R. Tillstone, G. K. Harrison	J. Lord	Silver Line, Ltd.	
Silverguava	J. Duncan	N. C. Jones, J. M. Evans, D. M. Lamont	R. Burrow	Silver Line, Ltd.	22.12.47
Silveroak	R. H. Woodrow, O.B.E.	K. A. Wise, P. Whitaker, J. H. Crane	R. L. Sinclair	Silver Line, Ltd.	26.9.47
Silversandal	E. Stark	J. McK. Batchen, R. O. Darby, P. Hildred	F. J. Stubbs	Silver Line, Ltd.	8.10.47
Silverteak	C. J. Metcalf	W. L. N. Fisken, C. A. Felgate, J. W. Ellis	J. Dunnett	Silver Line, Ltd.	23.10.47
Silverwalnut				Silver Line, Ltd.	
Sneaton	W. Armstrong	E. Wilson		Rowland & Marwoods S.S. Co., Ltd.	
Socotra	E. R. Bodley, D.S.O., R.D., R.N.R.	E. Snowden		P. & O. Steam Nav. Co.	10.3.47
Southern Collins	D. Hunter	R. Cramb, J. McNaughton, T. Johnstone	W. S. Hayes	South Georgia Co., Ltd.	9.9.47
Southern Harvester	C. Cranoe	J. T. P.		South Georgia Co., Ltd.	
Southern Opal	J. O. Bowie	G. A. D. Govan, J. Banna	J. Edmond	South Georgia Co., Ltd.	18.9.47
Southern Venturer	Haga	W. P. Jamieson, F. B. Stewart	D. W. Miller	Sevilla Whaling Co., Ltd.	30.5.47
Sovac	S. F. Living	J. D. Nutter, J. McLellan, A. W. Kelly	D. V. McMurdo	Socony-Vacuum Transportation Co., Ltd.	29.10.47
Staffordshire	Potter	J. C. Priest, J. F. Carr, A. G. Thompson	A. Rodger	Bibby Line, Ltd.	10.7.47
Stancourt	F. H. Wainford	R. F. Eckersall	N. Crossley	Stanhope S.S. Co., Ltd.	10.11.47
Stanhall	S. G. Lerard	J. R. Sims, L. M. Davies	R. Malpin	Stanhope S.S. Co., Ltd.	20.10.47
Stanthorpe	R. G. Roberts	E. L. Davies, R. S. Drew, J. H. Buck	J. M. Bannerman	Stanhope S.S. Co., Ltd.	8.11.47
Stirling Castle	W. A. Pace, O.B.E.	W. B. Fletcher, E. Hall, J. McAuley	H. Oliver	Union Castle Mail S.S. Co., Ltd.	20.1.48
Stirlingshire	J. McCrone	A. S. Palethorpe-May, G. A. Winter, A. J. Rutherford	P. Goss	Scottish Shire Line, Ltd.	28.1.48
Strathaird	H. S. Allen, R.D., R.N.R.	D. Parsons		P. & O. Steam Nav. Co.	
Stratheden	S. W. S. Dickson	R. B. Webster, P. M. Jones, R. N. Firth, J. Hamilton	H. S. Horn	P. & O. Steam Nav. Co.	22.12.47
Strathmore	D. M. Stuart, D.S.C.	D. M. Noble	J. Carey	P. & O. Steam Nav. Co.	1.1.48
Strathnaver	E. Lee	J. Wacker, N. Jenner, G. Eates	G. Ormiston	P. & O. Steam Nav. Co.	28.1.48
Suffolk	H. E. Reilly, D.S.C., R.D., R.N.R.	B. E. Evans, A. McKenzie, F. C. D. Bevis	J. Hasson	Federal Steam Nav. Co., Ltd.	14.8.47
Suncrest	L. G. Barwell	J. Johnson, J. Collins, P. Tate	G. W. Morris	Junecrest S.S. Co., Ltd.	26.3.47
Sutherland	R. W. Nicholson	R. Thwaites, A. L. Clemmet, A. Gardner	G. Rich	B. J. Sutherland & Co., Ltd.	2.7.47
Sutherland	J. McClure	R. McNeil		Currie Line, Ltd.	
Swainby	J. E. Roddam	K. Jackson, R. Dunn, W. M. Fallon	T. J. Melville	Ropner S.S. Co., Ltd.	21.8.47
Sydney Star	T. S. Horn, O.B.E.	J. C. Davies, J. G. King, J. G. Reeve	H. W. Dunning	F. Leyland & Co., Ltd.	22.1.48
Tactician	A. Robertson	D. Bloom, D. A. Hancock	W. Bryce	Charente S.S. Co., Ltd.	6.12.47
Talca	A. Lyall	R. A. Mumford, D. I. Jones, J. Peters	P. J. Sanfey	Pacific Steam Nav. Co.	15.10.47
Tamele	J. J. Smith	P. J. Finan, R. E. Foster	F. Broomfield	Elder Dempster Lines, Ltd.	14.5.47
Taranaki	F. A. Smith	H. P. M. Lawrence, N. E. Wood, J. L. Harrison	L. Cottell	Shaw, Savill & Albion Co., Ltd.	10.10.47
Tarkwa	W. C. Baxter	J. White, C. St. H. Webber, G. H. Griffiths, J. Fraser	C. Forbes	Elder Dempster Lines, Ltd.	12.9.47
Tasso	H. Scarbrough	E. Laverack, K. Allen	L. Richardson	Ellerman's Wilson Line, Ltd.	

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Tekoura	F. Sutton	D. E. Edmonds	D. E. Edmonds	Heward Trawlers, Ltd.	26.2.47
Telemachus	J. F. Webster	A. Rankin, R. H. Masters, P. T. Power, J. D. Murphy	J. C. Wilson	Ocean S.S. Co., Ltd.	21.8.47
Thamesfield	D. A. Law	A. D. Lombard, H. Shaw, T. Shanks	G. Middleton	Northern Petroleum Tank S.S. Co., Ltd.	19.3.47
Tinto	S. H. Bennett, M.B.E.	A. Ledger		Ellerman's Wilson Line, Ltd.	
Tongariro	A. E. Williams	S. W. Lambrick, D. MacDonald, B. A. Kelly	K. H. Brooks	New Zealand S.S. Co., Ltd.	16.10.47
Torr Head	M. Kennedy	A. Fee, E. L. Seaton, J. K. McMorran	G. Penketh	Ulster S.S. Co., Ltd.	6.2.47
Tower Grange	E. Fox	J. A. Burnhape	W. Butcher	Tower S.S. Co., Ltd.	20.11.47
Tresillian	C. L. Collings, O.B.E.	W. Winter, W. Bulmar, E. L. Cussons	W. Baldwin	Hain S.S. Co., Ltd.	25.11.47
Trevaylor	D. I. Spencer	J. G. Sleight		Hain S.S. Co., Ltd.	
Umtali	F. E. J. O'Hea	J. McDermott, A. Gibson, K. Wilson	S. Hewitt	Bullard, King & Co., Ltd.	30.1.47
Umtata	J. W. Miles	H. J. Thorn, H. K. Underwood, P. A. Scott	A. H. Coxhead	Bullard, King & Co., Ltd.	8.1.47
Valacia	C. B. Osborne	J. D. Smythe, N. Jones, A. Hoyle	P. A. Hayes	Cunard White Star, Ltd.	13.12.47
Vancouver City	B. Carnaffan	J. King, M. J. Cleary, O. J. Lindsay	J. J. Dean	Reardon Smith Line, Ltd.	29.4.47
Vardulia	F. E. Patchett	L. O. Pound, J. Hughes, R. Conway	M. Doran	Cunard White Star, Ltd.	
Vasconia	G. S. Evans	R. H. Arnott, A. L. Davies, P. J. Lawley	C. Lea	Cunard White Star, Ltd.	26.1.48
Vestra	D. S. Archibald	I. MacAlpine		J. T. Salvesen & Co.	
Victrix	E. Garnett	C. F. Lawrence		Henriksen & Co.	
Vienna	A. P. Sutton	J. A. Tully, W. V. Adams, E. Atkinson	F. Howell	British Railways (Harwich) (Managers)	
Vivien Louise	G. McLeod	R. E. Garisch		British Oil Shipping Co.	28.2.47
Volo	A. Morrill	P. Shallcross, F. Briggs, O.B.E., J. Harbord	W. Ellison	Ellerman's Wilson Line, Ltd.	26.6.47
Waimana	T. T. Oliver	K. C. Davis, J. W. Paine, A. S. Masters	G. F. Cocksedge	Shaw, Savill & Albion Co., Ltd.	28 1.48
Waipawa	W. G. West	G. Watkins, C. Carroll, R. Hamilton, A. Griffith	W. Charlton	Shaw, Savill & Albion Co., Ltd.	16.9.47
Wairangi	D. Aitchison	C. H. Saddington		Shaw, Savill & Albion Co., Ltd.	7 5 47
Waiwera	B. Forbes-Moffatt	J. L. Carroll, J. G. Fairgrieve, A. H. Baber	W. N. Holmes	Shaw, Savill & Albion Co., Ltd.	16.10.47
Warwick Castle	R. Wren, D.S.O.	B. W. Mitton, A. M. McLean	R. Brew	Union-Castle Mail S.S. Co., Ltd.	4.2.48
Welsbach	J. Bywater			Wyre Steam Trawling Co., Ltd.	
Winchester Castle	L. P. Wilkie	I. M. Snelgar	J. Hodgeson	Union-Castle Mail S.S. Co., Ltd.	30.12.47
Zent	C. R. Hodder	A. Bruce	T. Richardson	Elders & Fyffes, Ltd.	28.1.48

FLEET LIST (Canada)
VOLUNTARY OBSERVING SHIPS

The following is a list of observing ships, co-operating with the Meteorological Service of Canada.

NAME OF VESSEL	OWNERS
Fort Amherst	Furness Withy & Co.
Fort Townshend	Furness Withy & Co.
Imperial Edmonton	Imperial Oil, Ltd. (Marine Department).
Imperial Quebec	Imperial Oil, Ltd. (Marine Department).
Imperial Toronto	Imperial Oil, Ltd. (Marine Department)
Imperial Winnipeg	Imperial Oil, Ltd. (Marine Department).
Lady Nelson	" Lady Nelson ", Ltd. (Canadian National Steamships).
Lady Rodney	" Lady Rodney ", Ltd. (Canadian National Steamships).
Victoria County	Acadia Overseas Freighters, Ltd.
Waihemo	Canadian Union Line, Ltd.
Waikawa	Canadian Union Line, Ltd.
Wairuna	Canadian Union Line, Ltd.
Waitomo	Canadian Union Line, Ltd.

FLEET LIST (New Zealand)
VOLUNTARY OBSERVING SHIPS

The following is a list of observing ships, co-operating with the Meteorological Service of New Zealand.

NAME OF VESSEL	CAPTAIN	OBSERVER	RADIO OFFICER	OWNERS
Huia	A. J. Matheson			Nobel (Australasia) Proprietary Ltd.
Kaikorai				Union S.S. Co. of New Zealand, Ltd.
Kairanga	G. S. Beaton	B. R. Druce	G. M. Gormlie	Union S.S. Co. of New Zealand, Ltd.
Karetu	T. S. Nicol	A. Mackay	B. G. Hart	Union S.S. Co. of New Zealand, Ltd.
Karitane	W. E. Jones	E. W. Robb	L. M. Harvey	Union S.S. Co. of New Zealand, Ltd.
Kauri	G. Evans	D. H. Turnbull	A. E. Whalley	Union S.S. Co. of New Zealand, Ltd.
Komata	A. T. Adam	J. C. Young	G. M. Throp	Union S.S. Co. of New Zealand, Ltd.
Kopua	F. Chapman	E. Clark		Union S.S. Co. of New Zealand, Ltd.
Kurow	A. F. Inman	B. E. Avery	W. A. Hawkins	Union S.S. Co. of New Zealand, Ltd.
Manuka	J. Holm	E. R. Warner		Capt. J. Holm and crew.
Matua	A. R. Russel	G. H. Edwards	E. H. Ward	Union S.S. Co. of New Zealand, Ltd.
Maui Pomare	L. C. Boulton	J. Hare	W. A. Taylor	Government of New Zealand (Pacific Islands Admin.)
Pamir	H. S. Collier	A. F. Jenkins	A. J. Stanton	Government of New Zealand.
Port Waikato	J. Keith	E. Anderson		A. F. Watchlin.
Ranui	N. Worth			Public Works Department.
Wahine	W. Grey	K. Mitchell	J. G. Rea	Union S.S. Co. of New Zealand, Ltd.
Waipori	C. Burgess	D. S. Brayshay	S. J. Waters	Union S.S. Co. of New Zealand, Ltd.
Waitaki	F. W. Gibson	J. K. West	C. V. Hayes	Union S.S. Co. of New Zealand, Ltd.
Waitemata	W. Whitfield	J. W. Keyworth	E. L. Hulme	Union S.S. Co. of New Zealand, Ltd.
Whakakura	F. A. Barrett			Tasman S.S. Co.

MARID SHIPS

The following is a list of ships voluntarily observing and reporting sea temperatures from coastal waters of Great Britain.

Captains are requested to point out any errors or omissions in the list.

Name of Vessel	Captain	Owners
Accrington	R. Good	British Railways (Harwich).
Actuality	J. Lewis	F. T. Everard & Sons, Ltd.
Adjutant	K. R. Nichols	General Steam Nav. Co., Ltd.
Alouette	L. G. Horsham	General Steam Nav. Co., Ltd.
Antwerp	R. V. Adams	British Railways (Harwich).
Ariosto	— Reeves, O.B.E., D.S.C.	Ellerman's Wilson Line, Ltd.
Atlantic Coast	F. Mara	Coast Lines, Ltd.
Baltraffic	F. Waldron	United Baltic Corporation, Ltd.
Belvina	J. Phillip	London & Edinburgh S.S. Co., Ltd.
Bucklaw	W. Dunnet	G. Gilbson & Co., Ltd.
Bury	J. L. Davison	British Railways (Harwich).
Cambria	A. Marsh	British Railways (Holyhead).
Clyde Coast	D. Cowan	Coast Lines, Ltd.
Coldharbour	G. L. Hetherington	Coastwise Colliers, Ltd.
Coldridge		Coastwise Colliers, Ltd.
Corfen	E. Allen	Cory Colliers, Ltd.
Corfleet	R. J. Barrow	Cory Maritime, Ltd.
Corfoss	A. Greiffenhagen, M.B.E.	Cory Colliers, Ltd.
Cormist	H. H. Horley	Cory Colliers, Ltd.
Cormoat	R. B. Armstrong	Cory Colliers, Ltd.
Crane	E. C. Paynter, D.S.C.	General Steam Nav. Co., Ltd.
Denbigh Coast	E. C. Maddrell	Coast Lines, Ltd.
Drake	K. Carmalt	General Steam Nav. Co., Ltd.
Duke of Argyll	W. Thompson	British Railways (Heysham).
Duke of Lancaster	J. Irwin, R.D., Cdr. R.N.R.	British Railways (Heysham).
Duke of Rothesay	F. Ardern, D.S.C.	British Railways (Heysham).
Duke of York		British Railways (Heysham).
Eastern Coast	R. E. Holt	Coast Lines, Ltd.
Edina	W. Inglis	Dundee, Perth & London S.S. Co., Ltd.
Eildon	W. Jeffrey	G. Gibson & Co., Ltd.
Falcon	Kelly	General Steam Nav. Co., Ltd.
Goldfinch	W. Lockhart	General Steam Nav. Co., Ltd.
Granta	D. A. Hunter	Granta S.S. Co., Ltd.
Guernsey Coast	F. Lucas, M.B.E.	British Channel Islands S.S. Co., Ltd.
Harrogate	C. H. Tully	Wilson's & N.E. Railway S.S. Co., Ltd.
Highwood	J. Coupland	High Hook S.S. Co., Ltd.
Hirondelle	— Klamp	General Steam Nav. Co., Ltd.
Isle of Guernsey	F. Front	British Railways (Southampton).
Isle of Jersey	A. L. Light	British Railways (Southampton).
Isle of Sark	W. F. Mason, O.B.E.	British Railways (Southampton).
Lairdsburn	J. McColl	Burns & Laird Lines, Ltd.
Lairdswood	I. McGuggan	Burns & Laird Lines, Ltd.
Lancashire Coast	J. B. Clarke	Coast Lines, Ltd.
Lapwing	K. R. Nicholls	General Steam Nav. Co., Ltd.
London Merchant	C. A. Piper	London Scottish Lines.
Mallard	H. Clayton	General Steam Nav. Co., Ltd.
Medway Coast	E. A. Jones	Coast Lines, Ltd.
Melrose Abbey	J. Laverack	Hull & Netherlands S.S. Co., Ltd.
Minna	T. Mather	Scottish Home Department (Fishery Division).
Moray Coast	E. Griffiths	Coast Lines, Ltd.
Northern Coast		Coast Lines, Ltd.
Ocean Coast	J. Webber	Coast Lines, Ltd.
Otterhound	A. M. Kennedy	Coastal Tankers, Ltd.
Pass of Ballater	R. Reid	Bulk Oil S.S. Co., Ltd.
Persian Coast	T. Taylor	Tyne, Tees S.S. Co., Ltd.
Petrel	Tomlin	General Steam Nav. Co., Ltd.
Plover	J. F. Casey	General Steam Nav. Co., Ltd.
Princess Maud		British Railways (Stranraer).
Royal Daffodil	A. Paterson, D.S.C.	General Steam Nav. Co., Ltd.
St. Andrew		Fishguard & Rosslare Railway & Harbour Co.
St. Julien	L. J. Richardson	British Railways (Cardiff).
Salerno	A. Morrill	Ellerman's Wilson Line, Ltd.
Scottish Co-operator	T. Robertson	Scottish Co-operative Wholesale Society.
Selby	A. W. Johnson	Wilson's & N.E. Railway S.S. Co., Ltd.
Slieve Bawn	J. Hughes	British Railways (Heysham).
Slieve Bearnagh	A. E. Willmott, D.S.C., R.D., Cdr. R.N.R.	British Railways (Heysham).
Slieve Bloom		
Slieve League	V. S. Phillips	British Railways (Heysham).
Slieve More	E. G. J. Manning	British Railways (Heysham).
Southern Coast	W. Quirk	Coast Lines, Ltd.
Stork	C. Carr	General Steam Nav. Co., Ltd.
Supremity	S. F. Wilson	F. T. Everard & Sons, Ltd.
Tern	G. Thain	General Steam Nav. Co., Ltd.
Wandle	T. W. Corney, M.B.E.	Wandsworth & District Gas Co.
Welsh Coast	M. Fleming	Coast Lines, Ltd.

LIGHT VESSELS

The following Light Vessels voluntarily observe and report from coastal waters of Great Britain.

Name of Vessel	Master
East Goodwin	A. Giblin
Humber	
Newarp	
Royal Sovereign	
Shipwash	H. L. Neale

NOTICES TO MARINE OBSERVERS

Postal Arrangements

The quarterly numbers of the *Marine Observer* are published on the last Wednesdays of December, March, June and September.

The Marine Observer is addressed to the Captain, S.S./M.V......................., c/o the owners, and captains are requested to make their own arrangements for forwarding.

Shipowners, Marine Superintendents, and all concerned in the despatch of mails to ships abroad are asked to kindly facilitate the despatch and delivery of postal matter, received at their offices from the Meteorological Office and Air Publications and Forms Stores, to their ships abroad.

This matter, addressed to the captains of ships, contains information which is required for the conduct of meteorological work at sea, and is most effective if received by the captains at the earliest possible date.

Much of the information referred to is published in the *Marine Observer* and is of a seasonal nature. This journal also contains advice to observing ships which enables them to perform voluntary service by wireless communication for the benefit of all shipping.

Ice Observation

Drifting ice, derelicts, and other floating dangers to navigation are reported by all means of communication at the disposal of the master.

See Appendix III, pages 106-108 of the *Marine Observer's Handbook*, Sixth Edition.

It is also desirable that more detailed information than can be given in a TTT wireless message should be available to the Meteorological Office for the purpose of research, and for the Admiralty Charts and Sailing Directions.

Marine observers will greatly assist by noting the conditions of ice, either drifting or fast.

For this purpose Form 912 is supplied direct to all observing ships plying in regions where ice may be encountered, and this form may be supplied to the captain of any British ship on application to a Port Meteorological Officer or Merchant Navy Agent.

Regular observing ships using the Trans-North Atlantic tracks are requested to send in these forms, not only when ice is encountered, but also when they have passed through the ice region during the ice season without encountering ice. In this case a " nil " report should be returned, since it is desirable as far as possible to determine when tracks have been clear of ice.

Return of Logbooks

Owing to the need for strict economy in the use of paper, observing officers should endeavour to fill up their logbooks (Forms 911), before returning them to the appropriate Meteorological Service, except when insufficient space remains for the recording of observations during a further complete passage.

Great Britain

Transmission of Routine Wireless Weather Messages

When in the reporting area " Great Britain " and transmitting weather messages through British shore stations, observing ships are requested, forthwith, to address their reports to " Weather Wire London " instead of to " Weather Telex Dunstable " as previously.

Hong Kong

Transmission of Routine Wireless Weather Messages

When in the reporting area " Hong Kong " and unable to contact the detailed radio station Cape D'Aguilar (VPS), observing ships transmitting their messages via Singapore (GYL) are requested to address them to " Royal Observatory, Hong Kong " to ensure that they are forwarded to Hong Kong.

Meteorological Services for Shipping

Captains of British ships are requested to notify the Marine Branch of the Meteorological Office of areas in which meteorological services for shipping appear inadequate. Suggestions for the improvement of these services are always welcome.

Excellent Awards

Prior to the war, it was the practice of the British Meteorological Office to make awards to Captains and principal Observing Officers of those Voluntary Observing Ships recruited within the United Kingdom whose work had been " excellent " for not less than a certain period during each year. The award took the form of a suitably inscribed bound copy of *The Marine Observer*.

In future, instead of bound copies of *The Marine Observer* it has been decided to award books on meteorological or other suitable professional subjects each year. Occasionally, meteorological or navigational instruments may be substituted for books. Senior Radio Officers will also share in these awards.

The above awards will be presented on work performed between 1st April and 31st March each year, commencing with the year ended 31st March, 1948.

TRANSMISSION OF WEATHER MESSAGES THROUGH DETAILED STATIONS

When transmitting routine weather messages to Meteorological Services, observing ships are specially requested to transmit only through the radio stations detailed in Part II of the " Marine Observer's Guide."

When in a reporting area, messages should be transmitted *only through the radio stations appropriate to that area* (except when using Area Stations for short-wave transmissions).

Transmission of reports through stations other than those detailed, or through stations outside the appropriate reporting area may involve complications in the payment of telegraphic charges.

MARINE METEOROLOGY

Co-operation of British Shipowners, Masters and Mates

Captains and officers of ships registered in Great Britain and Northern Ireland, who wish to co-operate regularly with the Meteorological Office, should apply to the appropriate Port Meteorological Officer or Agent.

In accordance with the International Convention for Safety of Life at Sea, the Meteorological Office arranges for a number of ships to record meteorological observations at specified hours, throughout their voyage, and to transmit coded observations, by wireless telegraphy, for the benefit of other ships and the various meteorological services.

Ships performing these voluntary duties are known as Observing Ships—the whole as the Voluntary Observing Fleet—and the captains and officers of these ships as the Corps of Voluntary Marine Observers.

The list of observing ships is published in *The Marine Observer*.

The quarterly *Marine Observer* is sent regularly to the captain of every observing ship, for the information and guidance of his observing and radio officers. The captains of observing ships are also supplied on request with charts and atlases, according to trade, as meteorological equipment.

To ensure the accuracy of data collected for the purpose of research and for weather forecasting, ashore and afloat, and to provide a pattern, which may be copied with advantage to all concerned for general use in merchant ships, sufficient tested instruments are lent by the Meteorological Office to the captains of observing ships.

Captains of observing ships are requested to return their Fair Logbooks (Form 911) when full, or when insufficient space remains for the recording of observations during a further complete passage, to the Meteorological Office.

Pages from the Coded Messages Record (Form 911A), when filled, or at the end of each voyage, should be detached, folded, and returned to the Meteorological Office.

The Port Meteorological Officers and Merchant Navy Agents inspect instruments quarterly, when possible, and they will replace, as necessary, any gear lent by the Meteorological Office. These officers will also check the accuracy of ship's barometers.

GREAT BRITAIN—LOCAL WEATHER FORECASTS

Masters of ships and others interested in the movements of shipping and in the loading and discharging of cargo can obtain local weather forecasts from the forecast centre nearest to the port, free of charge.

The addresses and telephone numbers of the forecast centres nearest to the main ports of Great Britain are given below.

PORT	ADDRESS OF NEAREST FORECAST CENTRE	TELEPHONE NO.
Aberdeen	The Meteorological Officer, Dyce Airport, Aberdeenshire	Dyce 332. Ex. 70
Bristol	The Meteorological Officer, Bristol Airport, Whitchurch, Bristol	Bristol 26451. Ex. 22
Cardiff	The Senior Meteorological Officer, Overseas Aircraft Control, Royal Air Force, Eastern Avenue, Barnwood, Gloucester	Gloucester 4465/6/7. Ex. 110/1.
Dundee	The Meteorological Officer, Royal Air Force, Leuchars, Fife	Leuchars 271. Ex. 21 and 106.
Falmouth	The Senior Meteorological Officer, H.Q. 19 Group, Royal Air Force, Mount Wise, Plymouth, Devon	Plymouth 61201 or 61101. Ex. 109/110.
Glasgow	The Meteorological Officer, Renfrew Airport, Renfrewshire	Renfrew 2352. Ex. 21/3.
Hartlepool	The Senior Meteorological Officer, Royal Air Force, Watnall, Nottingham	Nottingham 45731/5. Ex. 230/1.
Hull	The Senior Meteorological Officer, H.Q. No. 1 Group Royal Air Force, Bawtry, Doncaster, Yorkshire	Bawtry 363/7. Ex. 6 and 100.
Inverness	The Senior Meteorological Officer, Royal Air Force, Raigmore, Inverness	Inverness 1853/8. Ex. 61/2.
Leith	The Meteorological Officer, Edinburgh (Turnhouse) Airport, Edinburgh, 12	Edinburgh 66635. Ex. 76.
London	The Director, Meteorological Office, Air Ministry, Kingsway, London, W.C.2	Holborn 3434. Ex. 629.
Liverpool	The Senior Meteorological Officer, Speke Airport, Liverpool, 19	Garston 1240. Ex. 14.
Milford Haven	The Senior Meteorological Officer, H.Q. No. 19 Group Royal Air Force, Mount Wise, Plymouth, Devon	Plymouth 61201 or 61101. Ex. 109/110.
Newcastle	The Senior Meteorological Officer, Royal Air Force, Watnall, Nottingham	Nottingham 45731. Ex. 230/1.
Plymouth	The Senior Meteorological Officer, H.Q. No. 19 Group Royal Air Force, Mount Wise, Plymouth, Devon	Plymouth 61201 or 61101. Ex. 109/110.
Southampton	The Senior Meteorological Officer, Southampton Airport	Eastleigh 87228. Ex. 10.
Swansea	The Senior Meteorological Officer, Overseas Aircraft Control, Royal Air Force, Eastern Avenue, Barnwood, Gloucester	Gloucester 4465/6/7. Ex. 110/1.

NAUTICAL OFFICERS AND AGENTS OF THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE, GREAT BRITAIN

Captains and observing officers of the Voluntary Corps of Marine Observers will always be welcomed at headquarters, where the Marine Superintendent will be pleased to show them how their observations are utilised in meteorological research and weather forecasting.

Headquarters

Commander C. E. N. Frankcom, O.B.E., R.D., R.N.R., Marine Superintendent, Meteorological Office, Air Ministry, Headstone Drive, Harrow, Middlesex. (Telephone : Harrow 4331, Ext. 324).

Commander J. Hennessy, R.D., R.N.R., Deputy Marine Superintendent. (Telephone : Harrow 4331, Ext. 323).

Mersey

Commander M. Cresswell, R.N.R., Port Meteorological Officer, Room 617, Royal Liver Building, Liverpool, 3. (Telephone : Central 6565).

Thames

Commander C. H. Williams, R.D., R.N.R., Port Meteorological Officer, Room 4, Ibex House, Minories, London, E.C.3. (Telephone : Royal 1721).

AGENTS

Bristol Channel

Captain E. Hall, Room 120, Exchange, Mount Stuart Square, Cardiff Dock.

Clyde

Captain W. W. Elliott, c/o Thomas Hastie & Son, 2–4, Tullis Street, Bridgeton, Glasgow. (Telephone : Bridgeton 3219).

Forth

Captain G. More, " Craigneuk ", Dechmont, West Lothian. (Telephone : Dechmont 19).

Humber

Captain R. E. Dunn, c/o Principal Officer, Ministry of Transport, Trinity House Yard, Hull.

Southampton

Captain Sir Benjamin Chave, K.B.E., Royal Mail House, Southampton.

Tyne

Captain F. B. West, Custom House Chambers, Quayside, Newcastle-on-Tyne. (Telephone : Newcastle 23203).

OFFICERS OF THE METEOROLOGICAL SERVICE OF CANADA

Headquarters

Controller, Meteorological Division, Department of Transport, 315 Bloor Street W., Toronto 5.

Halifax

O.I.C. Dominion Public Weather Office, Room 111, 8 Harvey Street, Halifax, N.S. (Telephone: 3–8314).

Saint John

Mr. Francis N. Barnes, The Observatory, Saint John, N.B. (Telephone: 3–3500).

Vancouver

Mr. E. B. Shearman, 815 Bower Building, 543 Granville Street, Vancouver, B.C. (Telephone: PAcific 3032).

590. Wt. 46. M2312. 4/48. S.P. & S. G9/8/8.