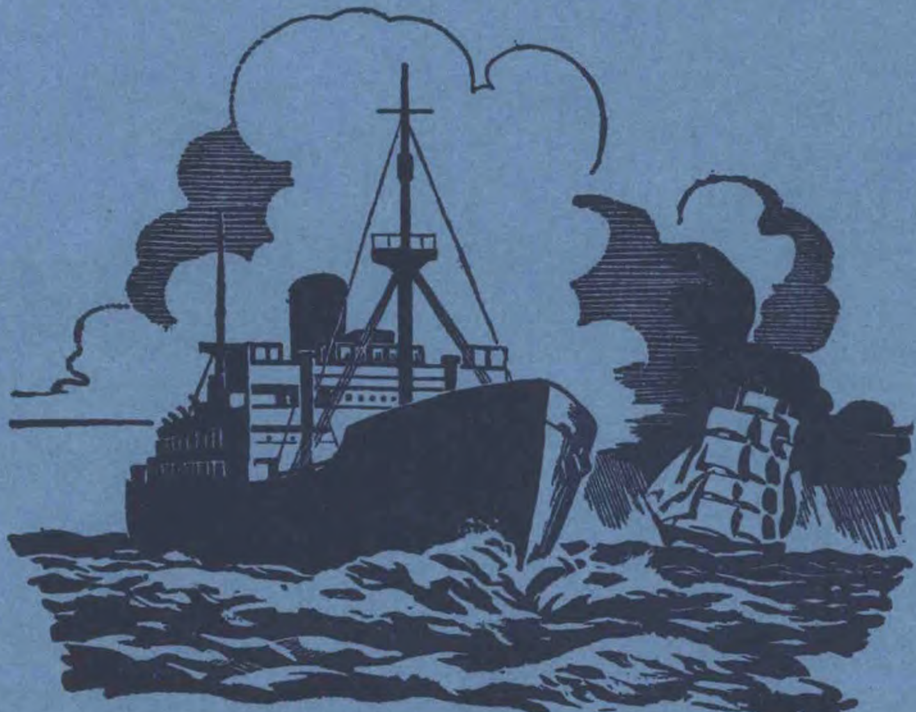
M.O. 736

# The Marine Observer

*A quarterly journal of Maritime Meteorology*



Volume XXXIII No. 199

January 1963

SIX SHILLINGS AND SIXPENCE NET

# THE
# MARINE OBSERVER

A Quarterly Journal of Maritime Meteorology
prepared by the Marine Division of the
Meteorological Office

Vol. XXXIII

1963

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

VOL. XXXIII No. 199 JANUARY 1963

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# Editorial

The second biennial report of the Advisory Committee on Cargo Claims of the United Kingdom Mutual Steam Ship Assurance Association has on its cover the words "Carefully to carry . . ." and the picture of a retriever carrying a dead pheasant in his mouth with loving care. Inside the cover is the quotation "The carrier shall properly and carefully load, handle, stow, carry, keep, care for and discharge the goods carried", from The Hague rules. Somewhat reminiscent of a part of the marriage service, this quotation might serve as a suitable motto for any shipmaster. The Oxford Dictionary tells us that a motto is, inter alia, a "maxim adopted as a rule of conduct"; the professional activities of the shipmaster are ultimately directed towards the care of his cargo—for after all, the sole purpose of the ship is to carry her cargo (or passengers) safely and in good order to her destination.

This Committee is surprisingly international; its members are all experts and come from Belgium, Netherlands, and Western Germany as well as from the United Kingdom. The foreword of the report tells us that one of the main objects of the Committee is to prevent damage occurring to cargo and so reduce the incidence of cargo claims. The report is brief and practical—in fact it is surprising how much 'horse sense' is packed into a few pages. It is, perhaps, not surprising that 25 per cent of the report is devoted to the question of ventilation of cargoes. Several articles on the general subject of meteorology in relation to care of cargo, (which obviously includes ventilation) have appeared in *The Marine Observer*; the Editor was inspired by personal recollections of cargo damaged by meteorological causes aboard ships in which he had served. This subject is also dealt with, though rather briefly, in *Meteorology for Mariners*.

The report of the Committee rightly points out that vigorous ventilation will not cure all ills, particularly with manufactured goods, and that with many iron and steel goods, because of the damage they sustain by moisture it is often better not to ventilate at all. Other cargoes—mostly those of an agricultural origin—are more inclined to require frequent or constant ventilation. For ships not fitted with 'drying' systems of ventilation, the report reminds us that the general guiding rule should be "ventilate only when the dew point of the air being admitted to the hold is lower than the temperature of the cargo surfaces." But this means that the ships' officers must be provided with a hygrometer or psychrometer to obtain the dew point of the outside air and have some means of estimating the temperature of the cargo surface. The first of these should be relatively easy—particularly in a Selected Ship—but the temperature of the cargo surface is not always easy. A rough-and-ready method would be to place a thermometer somewhere near the middle of the cargo; but just inside the cargo or lying on its surface would probably give a reasonable indication. In most cases a distant reading instrument seems to be essential because with a full cargo it would be difficult for an observer to get down into the hold. A portable electric thermometer with direct reading dial (balanced bridge thermometer indicator, with two resistance elements and operating on a small dry battery) would be light and easy to operate and the indicator could be hung up to a ring bolt at the mouth of one of the hold ventilators or at the top of an access hatch so that it could be read by one of the officers as and when necessary. It might cost anything between £30 and £60 complete. The advantage of having two elements would be that hold temperature as well as cargo temperature could be obtained and read off on the same dial. Another criterion as to whether to ventilate or not might be "only ventilate when the outside dew point is lower than the hold dew point"! But hold dew point is a difficult reading to obtain, unless the observer has direct access to the hold, in which case he could use an aspirated psychrometer. But the temperature of the cargo might still be an important factor. When making decisions about cargo ventilation, as with most jobs, it is experience that counts.

The report goes on to discuss the technicalities of relative humidity and dew point and the necessity of ensuring that cargoes of agricultural products being carried from a warm to a cold climate are given maximum ventilation "to get rid of heat and moisture" and so reduce the risk of ship sweat. Another interesting question which the report discusses is the possibility of other damage being caused to goods by ventilation at sea. The Committee reports "There is no doubt whatsoever that the air that is taken through a ship's hold is saturated with salt. The actual concentration can be as high as ·01 of sodium chloride and the corrosion of any type of metal is considerably enhanced in the presence of even minute quantities of chloride of any form whatsoever: for this reason ventilation should not be given on static goods. It should only be given on goods that are actually giving off moisture or capable of doing so". From this statement the Committee's report implies that damage described as sea water damage by reason of the salt content of the moisture which damaged the goods may in fact be sweat damage and that therefore "there seems little reason for ventilating ferrous cargoes such as steel, galvanised goods and canned goods, provided they are not stowed in the same holds as cargo which does require ventilation." One can imagine that this viewpoint might sound a bit heretical to mariners of the 'old school' but when one considers the difficulties that are experienced in avoiding moisture damage to ferrous cargoes, it seems that this advice is sensible and practicable.

The report reminds us of the other side of the picture—that cargoes of agricultural origin, being mostly of a hygroscopic nature, require quite a different treatment. "When being carried from a warm to a cold climate they require maximum ventilation to get rid of heat and moisture and so reduce ship sweat" but "bad weather may cause ventilation to be restricted". The ventilation complications that can arise with a mixed cargo are obvious.

There is intense international competition in the shipping industry nowadays and almost every country operates its own merchant fleet; and the shipping papers tell us how low freights are and how difficult it is for shipowners to pay their way. It seems reasonable to suppose that the ships which carry their cargoes in the best conditions will stand the best chance of surviving.

Once a cargo is properly stowed in the ship, the care of it during the voyage is largely a meteorological question, combined with seamanship and common sense. Outward cargoes from the U.K. are relatively straightforward for there is not much problem of mixing hygroscopic and ferrous goods. But on many other occasions, the ship's officer is often in a quandary as to how to avoid stowing the same hold with various cargoes which may be harmful to one another. And so his meteorological knowledge needs to be combined with experience, seamanship and a lot of common sense.

It seems that the officers serving in a Selected Ship should be in a fairly good position in this respect; at least they have no lack of instruments for indicating meteorological conditions on deck, and no lack of literature on the subject.

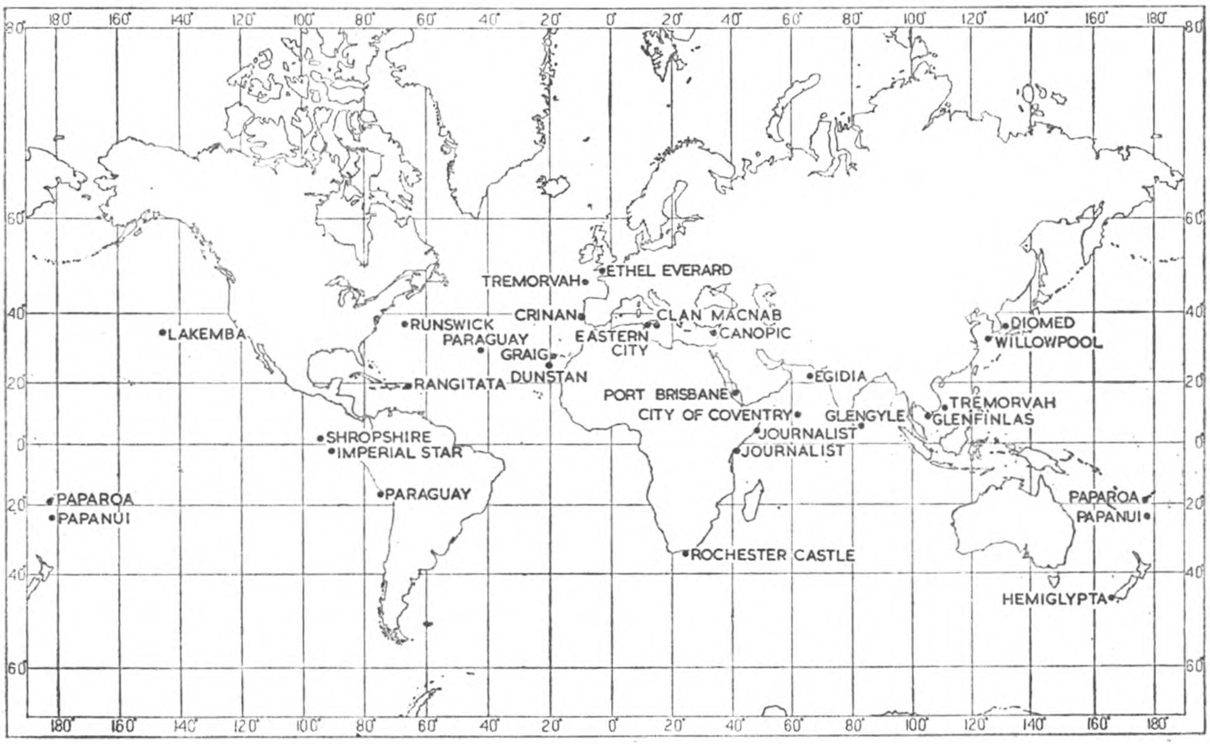
On behalf of the Director-General and Staff of the Meteorological Office, we send New Year greetings to all our readers afloat and ashore.

C. E. N. F.


# January, February, March

*The Marine Observers' Log* is a quarterly selection of observations of interest and value. The observations are derived from the logbooks of marine observers and from individual manuscripts. Responsibility for each observation rests with the contributor.

It sometimes happens that we are unable to offer an explanation for phenomena reported. In such cases we shall be very glad to hear from any reader who can put forward an authoritative or a possible explanation, which could be published in this journal. We should also be glad to hear from any reader who has witnessed a similar phenomenon in the past, but which has not previously been communicated to us.




Positions of ships whose observations are recorded in the "Marine Observers' Log".

## TROPICAL STORM

### South Pacific Ocean

s.s. *Papanui.* Captain R. E. Baker. Balboa to Brisbane.

28th February 1962.

Indications were of a sharp depression to the north and west of the ship and course was altered southward to pass it as quickly as possible and to avoid the worst of it. No reports of a tropical revolving storm were received from Fiji or elsewhere, but because of the steady fall in pressure, the increasing wind and sea, and the steep and confused swell already causing violent behaviour of the ship, it was decided to treat the disturbance as a newly-formed storm.

A warning was issued of a suspected tropical storm and course altered to the NE and then westward again as the disturbance moved SSE. (See diagram on page 8.)

The swell experienced between 1100 and 1430 GMT was very heavy, steep and confused.

| POSITION | GMT | WIND | PRESSURE | AIR °F | SEA °F | NARRATIVE |
|---|---|---|---|---|---|---|
| 23°01′S, 177°19′E | 0024 | 045°, force 4 | 1006·4 | 81 | 81 | |
| | 0424 | 060°, force 5 | 1003·6 | 74 | 81 | |
| | 0530 | 100°, force 5 | 1002·2 | 73 | 79 | Continuous heavy rain. |
| | 0550 | 105°, force 5 | | | | Rain ceased. Still overcast. Long moderate SE'ly swell. |
| | 0600 | 110°, force 6 | 1001·8 | 74 | — | Overcast. |
| | 0628 | | | | | Wind backed to 050°. |
| | 0630 | 360°, force 6 | 1001·6 | 76 | 79 | Wind backing then steady. Continuous heavy rain. |
| | 0642 | | | | | Wind backing and veering between approx. 345° and 010°. Squally. Rain clearing. Brighter to north. |
| | 0700 | 030°, force 5 | 1001·1 | 77 | 79 | Overcast, 3/8 scud, 5/8 Ac. Wind veering. Several insects flying around. |
| | 0709 | 035°, force 6 | | | | |
| | 0730 | 035°, force 6 | 1000·6 | 78 | 79 | Overcast, slight rain. Some Cb. Line squall to the east. Some light patches with stars. Heavy NNW'ly swell. |
| 23°23′S, 175°06′E | 0824 | 035°, force 7 | 999·9 | 79 | 79 | Overcast. Cb. |
| | 1024 | 035°, force 8 | 998·7 | | | Continuous light rain. Very heavy NW'ly swell. |
| 23°28′S, 174°34′E | 1100 | 035°, force 8 | 996·3 | 80 | — | Wind increasing. Continuous light rain. |
| | 1200 | 035°, force 9 | 993·1 | 79 | 80 | Very high sea; heavy NNW'ly swell. Overcast with frequent periods of moderate rain. |
| | 1400 | 340°, force 7 | 993·0 | | | Wind backed. Distant showers. |
| | 1448 | 350°, force 7 | 992·0 | | | High sea. Very heavy W'ly swell. Cloudy with showers. |
| | 1648 | 305°, force 8 | 991·1 | 79 | 81 | Wind backed. High sea. Very heavy NW'ly swell. Occasional showers. |
| | 1840 | 270°, force 8 | 994·3 | | | Wind backed. |
| 24°00′S, 173°33′E | 2048 | 270°, force 7 | 998·7 | 77 | 81 | Very rough sea; short heavy SE'ly swell. Frequent squalls and light rain. |

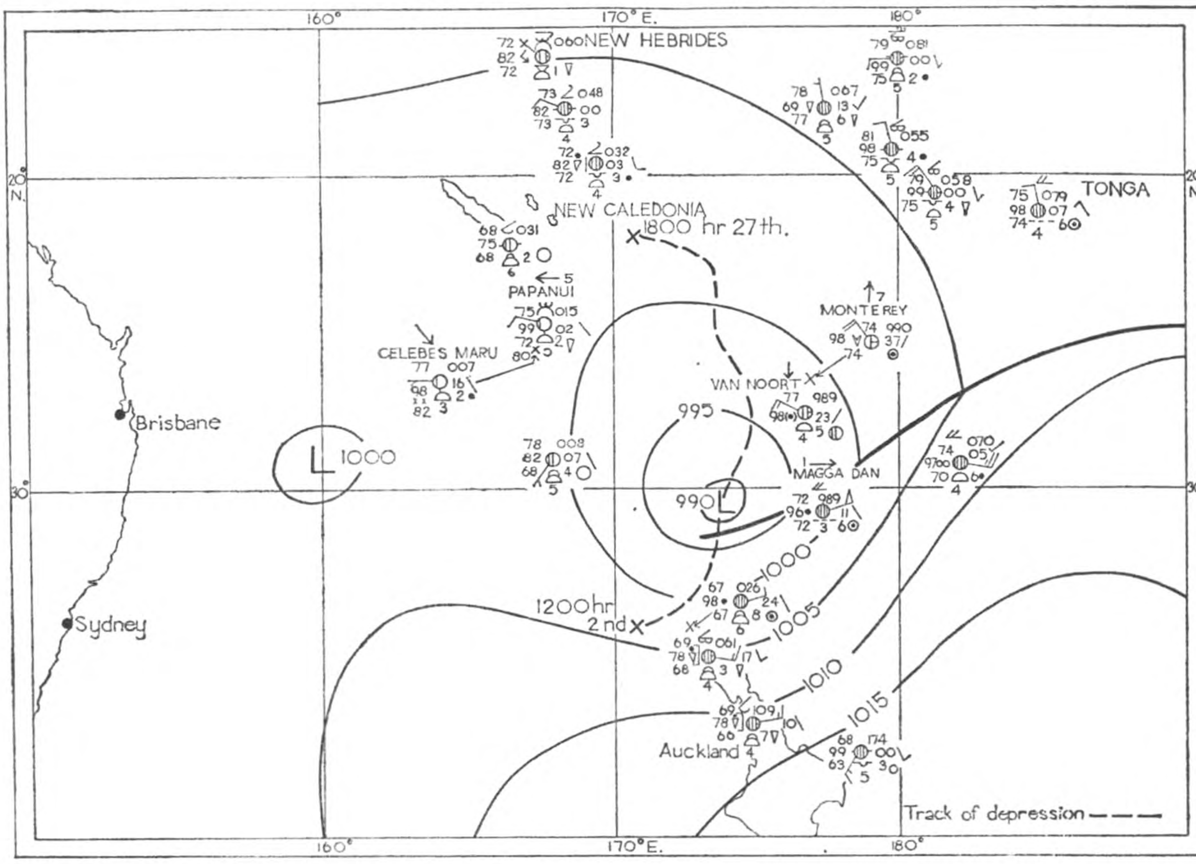
*Note.* Mr. R. G. Simmers, Director of the New Zealand Meteorological Service, comments:

"The sequence of events described is of considerable interest and illustrates how rapidly a storm can develop in this area during the summer months.

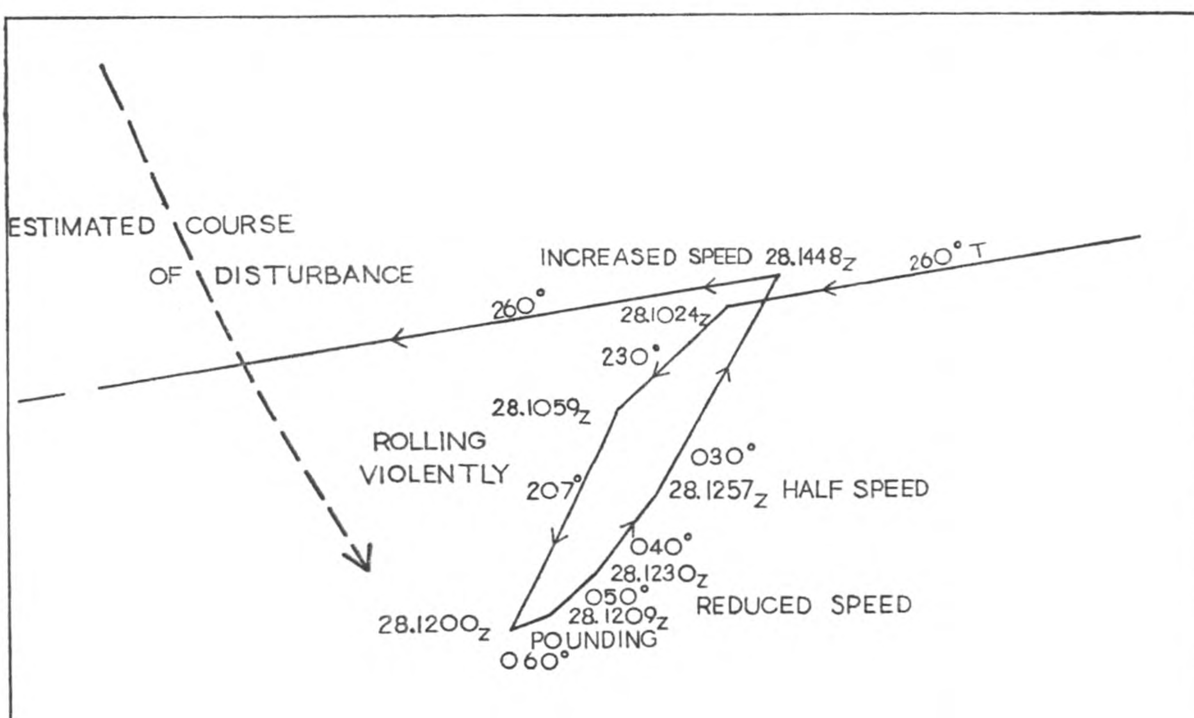
"On 26th and 27th February a broad trough of low pressure extended over the New Hebrides, New Caledonia and the area to the west. A convergence zone with a belt of rain ran through this area, extending from south of the Solomon Islands to the vicinity of the southern New Hebrides and then to the area south of Fiji. North of this convergence zone, winds were mainly light northerlies or north-westerlies and south of it there were light or moderate southerlies or easterlies.

"A report from the *City of Winchester* at 1800 GMT on 27th February at 22·7°S, 170·3°E with a pressure of 997·8 mb., a falling barometer and a 13 knot easterly wind indicated that a depression had formed south-east of the New Hebrides in the vicinity of 22°S, 171°E.

"The *Papanui* passed through the convergence zone between 0530 and 0630 on 28th with the rain and the change from easterlies to northerlies noted in the detailed report.




Synoptic chart for 1800 GMT 1st March 1962.




Movements of the *Papanui.*

"The first reports of strong winds in the area were the 1100, 1200 and 1400 reports from the *Papanui.* These indicated that the depression had deepened and moved east-south-east. The subsequent change to westerlies and later south-westerlies experienced by the *Papanui* together with reports from other ships showed that the storm was turning to a more southward direction. It continued to move south and later south-west preceded by a broad belt of strong easterlies (winds in excess of 40 knots were reported from the *Monterey* and *Magga Dan*). The depression centre passed close to North Cape eventually merging into a trough of low pressure over the Tasman Sea. It brought two to three inches of rain in some northern areas of New Zealand with winds of up to 50 knots on exposed parts of the eastern coast, north of Auckland.

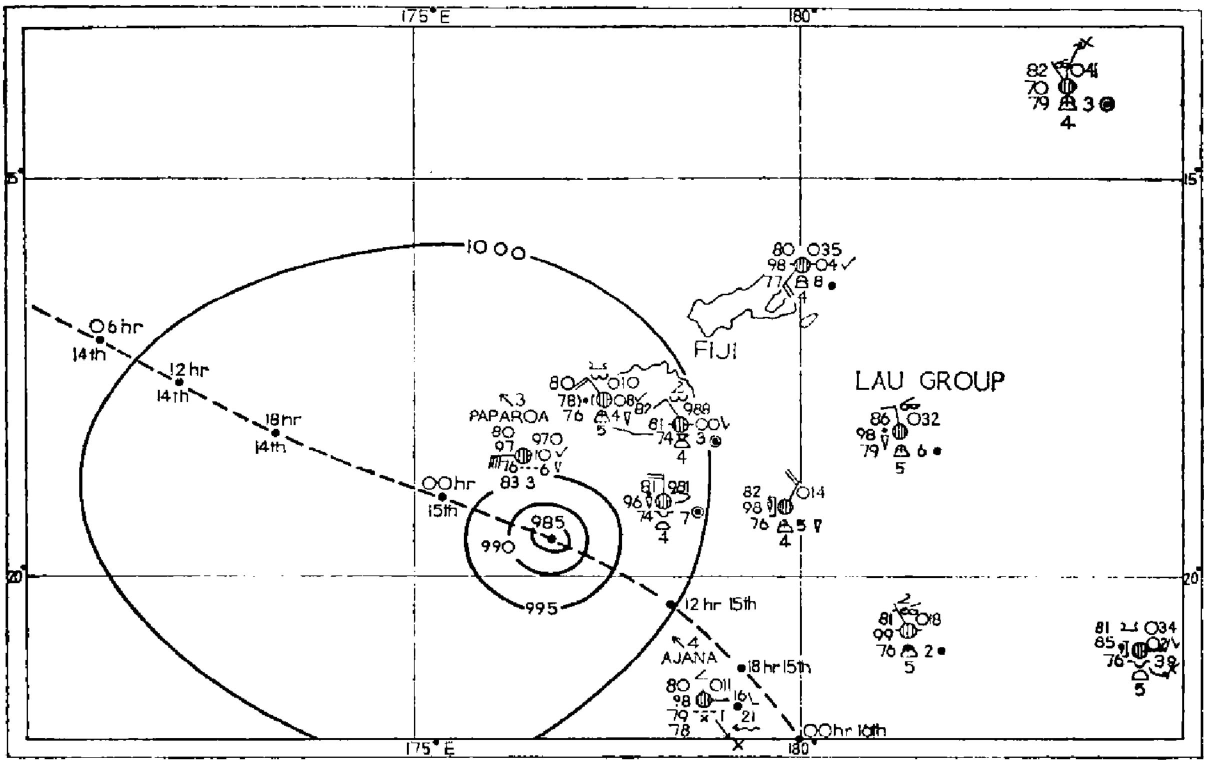
"Other ships in the area whose reports were of value were *Tarawera*, *Van Noort* and *Shropshire*.

"Although the existence of a disturbance south of the Solomons was recognised prior to 1800 27th February, and was mentioned in statements broadcast for shipping, it was not until the 0600 and 1100 reports on 28th were received from the *Papanui* that it was known to have become a storm. From then on, thanks to these reports from the *Papanui* and from other ships in the area good 'fixes' were possible and useful storm warnings were issued by this Service."

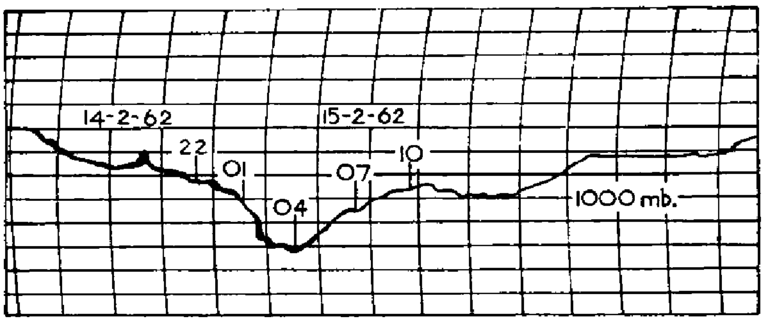
## Nandi waters (Fiji)

s.s. *Paparoa*. Captain P. R. Moulton. Lautoka to Lyttelton. Observer, Mr. H. G. Williams, 3rd Officer.

| GMT | WIND | PRESSURE | WEATHER | AIR °F | SEA °F | NARRATIVE |
|---|---|---|---|---|---|---|
| 14th February 1962 | | | | | | |
| 2200 | 350°, force 6 | 1000·9 | cpr | 83 | 83 | Vessel at anchor in Nandi waters awaiting pilot cutter, Navula Passage. |
| 2230 | 345°, force 6 | 1000·8 | | | | Sea increasing. |
| 2300 | 340°, force 6 | 1000·8 | cpr | 84 | 83 | Clear of Nandi waters and proceeding. |
| 2330 | 340°, force 6 | 1000·5 | | | | Set course 195. |
| 15th February | | | | | | |
| 0000 | 305°, force 7 | 1000·4 | cpr | 84 | 83 | Noon position 18°06'S, 177°04'E Commenced keeping meteorological logbook. |
| 0030 | 325°, force 7 | 999·5 | | | | Long heavy NW'ly swell suddenly encountered, no swell previously. |
| 0100 | 320°, force 8 | 998·3 | | 82 | 83 | |
| 0130 | 320°, force 9 | 996·7 | | | | At 0135 altered course to 270° to ease violent rolling. |
| 0200 | 320°, force 9 | 996·1 | or | 82 | 83 | DR position 18°14'S, 176°56'E. |
| 0230 | 320°, force 9 | 994·5 | | | | At 0235 altered course to 325° to avoid centre. |
| 0300 | 320°, force 9 | 993·7 | | | | 0245–0315 rolling and pitching very heavily and violently. Mountainous NW'ly swell. Storm centre reported at 19°00'S, 175°24'E, moving SE at 15 kt. |
| 0330 | 315°, force 10 | 993·6 | | | | Cloud predominantly Fs., though with some medium cloud. |
| 0400 | 315°, force 10 | 993·4 | cir | 82 | 83 | DR position 18°09'S, 176°50'E. Swell remaining NW'ly, very heavy and long. |
| 0430 | 305°, force 9 | 994·2 | | | | |
| 0500 | 290°, force 8 | 995·6 | | | | Swell moderating slightly. |
| 0530 | 270°, force 8 | 997·0 | | | | |
| 0600 | 270°, force 7 | 998·0 | | | | At 0610 increased speed. At 0630 resumed course 193°. Storm centre reported at 19°30'S, 176°42'E. Moving SE at 15 kt. |
| 0700 | 260°, force 6 | 998·1 | | | | 0700–1200 much sheet lightning at a distance on bearing of storm centre. |
| 0800 | 260°, force 6 | 999·0 | oir | 80 | 82 | 0730 S'ly swell first noted. At 0750 resumed full speed. |
| 1000 | 235°, force 5 | 1001·0 | bcl | 79 | 81 | DR position 18°46'S, 176°34'E. |
| 1200 | 225°, force 5 | 1001·2 | bcl | 78 | 80 | Moderate S'ly and confused swells. DR position 19°18'S, 176°18'E. Storm centre reported at 20°00'S, 177°48'E. Moving SE at 15 kt. S'ly swell remained until 0400 16th February. |




Synoptic chart for 0600 GMT 15th February 1962.




Barograph trace from *Paparoa*.

*Note.* Mr. R. G. Simmers, Director of the New Zealand Meteorological Service, comments as follows:

"This storm had its origin about 0000 GMT 14th February as a shallow depression some 150 miles east of the New Hebrides Islands, and moved in a south-easterly direction. The attached weather map of the area for 0600 on the 15th shows the positions of the centre as drawn on our weather charts at 6-hourly intervals from 0600 on the 14th to 0000 on the 16th.

"On the 15th, the storm was within 150 miles of the Fiji Islands, and the frequent and comprehensive reports sent in by *Paparoa* were of great assistance to the meteorological offices both in New Zealand and at Nandi Airport, Fiji, in obtaining an accurate fix of the storm centre, and its future movement. To illustrate this, part of *Paparoa*'s report for 0600 is plotted on the chart. The report for 0300 had given a 44 kt. gale from 320°, a pressure of 993·7 mbs. and a steep fall over the previous 3 hours of 5·2 mbs. The decrease and backing of the wind, and rising barometer, were good indications that the storm would not approach any closer to the Fiji Islands, but would continue its south-easterly movement.

"Regular reports were also received from the ship *Ajana* during this period and her report of 0600 on the 15th is also plotted on the chart, some 280 miles south-east of *Paparoa*.

"As the storm moved away into a region devoid of islands, subsequent reports from both ships were invaluable to this Service, and enabled the storm to be traced with reasonable accuracy to a position some 400 miles SSE of Fiji where it filled up about 1200 on the 17th.

"I wish to compliment Captain P. R. Moulton of s.s. *Paparoa*, also Captain T. Hastings of m.v. *Ajana*, and their officers for the splendid series of reports made of the weather experienced during this tropical storm."

## EXCEPTIONAL VISIBILITY

### Malta Channel

m.v. *Clan Macnab.* Captain T. A. Watkinson. Birkenhead to Port Said. Observers, Mr. M. B. Fowkes, 2nd Officer and Mr. C. F. I. Robinson, 3rd Officer.

20th February 1962. Exceptional visibility was experienced throughout the day and, while passing through the Malta Channel, Mount Etna (10,741 ft.) was clearly visible and used for bearings, up to a distance of 100 miles. At noon, air temp. 60°F, wet bulb 53°, sea 59°. Wind WNW, force 2. Cloud, traces of Ac.

Position of ship at noon: 36°24′N, 14°36′E.

*Note.* Mt. Etna, being about 2 miles high, can be seen when the atmosphere is sufficiently clear from a distance of more than 100 miles by a normal optical path. In this case, the sea temperature was below that of the air and the visibility might have been increased by refraction.

## WATERSPOUT

### Bay of Biscay

m.v. *Tremorvah.* Captain E. D. Stewart. Curaçao to London. Observer, Mr. J. Kalmins, 3rd Officer.

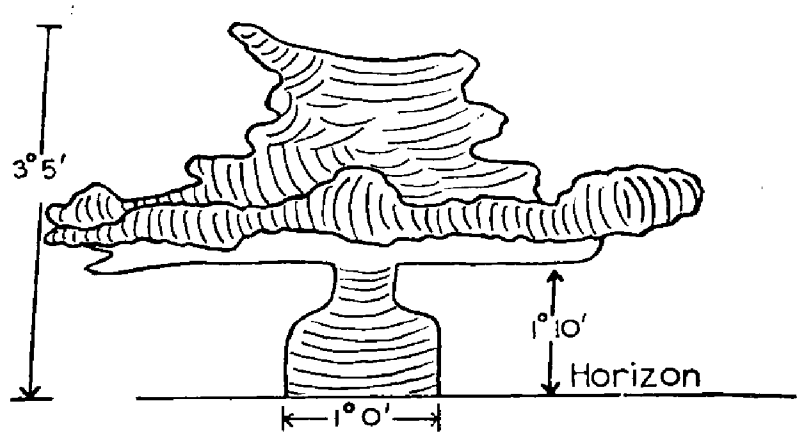
31st March 1962. At 0800 GMT a large Cb. cloud was seen travelling towards the ship with heavy precipitation falling from it. The cloud became heavier and darker and a small area of disturbed water was seen beneath it. When the cloud was within a mile of the ship a spout was seen to form on the sea surface and develop upwards, a slight whistling noise being heard. The spout passed within 100 ft. of the vessel and ahead of it. A definite white wake was seen and it was observed that the direction of rotation of the column was clockwise. As the spout passed, there was a heavy fall of hailstones which were approx. 1 cm. in diameter. At 0600: Air temp. 46·5°F, wet bulb 42·6°, sea 53°. Wind WNW, force 4.

Position of ship: 47°40′N, 8°10′W.

*Note.* This observation provides evidence of the close relation between the unstable atmosphere that produces cumulonimbus and that which produces waterspouts. The fall of large hailstones is evidence that an intense vortex in the lowest layers of the atmosphere was associated with intense vertical currents high up in the cumulonimbus.

### off Kenya

m.v. *Journalist.* Captain R. F. Longster. Aden to Mombasa. Observer, Mr. E. Maxwell, 2nd Officer.




13th March 1962. A large waterspout was observed about 15 miles away. It was still forming when sighted, so details of its origin are not available. The unusual features of the spout were its shape and size. When fully formed the spout was bell-shaped and it was connected to a heavy towering cumulus, which was visibly increasing in height. The spout was seen from 1035–1040 GMT. Dry bulb 83·5°F, wet bulb 77·1°, sea 84°. Wind SE, force 2.

Position of ship: 2°10′S, 41°49′E.

*Note.* This waterspout had a most unusual cross-section. It is possible that its appearance was due to rain falling from the cloud and appearing dark behind the spout. It may be that the flow into the cloud converged towards its base.

## SEA SMOKE

### North Atlantic Ocean

m.v. *Runswick.* Captain J. S. Pinkney, O.B.E. Rotterdam to Norfolk, Va.

7th February 1962. Between 1915 and 1950 GMT the vessel passed through an area extensively covered with sea smoke, which rose to a height of about 3 ft. The temperatures were constant throughout, the air temp. being 43·8°F, the wet bulb 42·0° and the sea 70·2°. Wind NW'N, force 4; 6/8 Cb. Visibility 8–10 miles.

Position of ship: 37°18'N, 67°46'W.

*Note.* This is an example of the formation of sea smoke over Gulf Stream water in Continental air from the North American continent.

### East China Sea

m.v. *Willowpool.* Captain F. D. Lloyd. Hsinkang to Hiroshima.

19th January 1962. Frequent heavy snow showers were experienced between 0000 and 0330 GMT, and during the heaviest of these, thick sea smoke was seen to rise from the sea surface. After the passing of the showers the sea smoke disappeared. At 0000 the sea temp. was 50·2°F and the air temp. 33·6°, but by 0600 both had risen and were 58·8° and 37·0° respectively. The wind was NW'N, force 7, at 0000 but it decreased to force 4 during the period.

Position of ship at 0000: 33°42'N, 126°06'E.

*Note.* See note concerning observation of m.v. *Diomed.*

### Japanese waters

m.v. *Diomed.* Captain W. J. Moore. Hsinkang to Otaru. Observer, Mr. J. M. E. Leese, 3rd Officer.

22nd January 1962. At 1200 SMT when the vessel was in the southern part of the Sea of Japan, sea smoke was seen which persisted for 20 min. It dissipated just as a sleet squall came over. The smoke which rose to a height of about 6 ft. appeared to drift from windward in waves. The air temp. was 37°F before, and during, the time the sea smoke was observed, but there was a fall of 2° when the sleet squall was passing. The sea temp. remained unchanged throughout, at 56°F, and the wind was NNW, force 4, increasing to force 5 in the squall.

Position of ship: 36°28'N, 131°29'E.

*Note.* Sea smoke forms when very cold air flows over a sea surface which is markedly warmer than the air above it and is the result of the turbulent mixing of this air with the relatively warm moist air in contact with the sea. The mixing process is often assisted by strong wind. The synoptic chart for 0000 GMT on 19th January shows that a large complex depression covered Japan and the adjacent sea areas and that the northerly air stream in the rear of the system had been flowing over Manchuria and Korea, causing it to be very cold and dry. The extra moisture added to the air during the showers, together with turbulence due to squalliness would assist the process of condensation. The disappearance of the sea smoke after the showers passed was probably due to the air having become drier and also to a decrease in turbulence as the wind became less squally.

## LINE OF DEMARCATION

### North Atlantic Ocean

m.v. *Crinan.* Captain K. Turner. Port Talbot to Bona. Observer, Mr. R. H. Barr, 2nd Officer.

16th February 1962. At 1400 GMT when the vessel was about 10 miles off Cabo da Roca, Portugal, a very pronounced change in the colour of the sea was noticed ahead. There was a very clearly defined line of demarcation running about 020°–

200°, on the north-west side of which the sea was a very dark green colour; on the other side of the line, towards the south-east, the water was a light, almost eau-de-nil green. The sea temperature rose immediately by 3°F on crossing into the water of lighter hue. No exceptional currents were experienced. The weather was cloudless with excellent visibility. Sea temp. at noon 56°F, rising to 59° at 1400.

Position of ship at noon: 39°12′N, 9°42′W.

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

"The sharp temperature change suggests that two distinct water masses of very difficult plankton content converged here. The cooler one was probably oceanic, the warmer predominantly coastal water, and the colour difference due to the difference in microplankton population."

### South China Sea

m.v. *Tremorvah*. Captain E. D. Stewart. Saigon to Vancouver. Observer, Mr. A. Washbourne, 2nd Officer.

17th January 1962. At 0600 GMT the vessel passed through a narrow line of discoloured water which stretched as far as the eye could see in the direction 030°–210°. The line was dark brown in colour and although narrow, being at the most 20 ft. wide, it was practically unbroken along its length. It was noticed that at infrequent intervals along the line there were small pieces of what appeared to be broken trees in a state of decay. There was no change in sea temp. which remained at 80°F. The wind was NE, force 5.

Position of ship: 11°30′N, 110°48′E.

*Note.* Dr. T. J. Hart, of the National Institute of Oceanography, remarks:

"The observation was made from a position far out in the west-going north equatorial current in the Pacific. The only comment I can make is that for coastal drift to have got so far off-shore presupposes a most unusual storm."

## CURRENT RIP

### North Pacific Ocean

m.v. *Shropshire*. Captain L. H. Sheldrake. Balboa to Papeete. Observers, Mr. M Wood, 2nd Officer, Mr. G. Tully, 3rd Officer and Mr. M. Reeves, 4th Officer.

10th February 1962. At 1800 GMT the vessel entered patches of calm water which stretched from horizon to horizon in a direction 350°–170°; waves were seen round the edges of the calm patches. The vessel, previously steering a steady course by automatic pilot, began to yaw violently up to 5° on each side of the course as it entered the areas of calm water. It steadied up between the patches. When the ship was passing through the waves surrounding the patches, the wind changed from SW'W, force 2, to NW'W, force 3. There was no change in sea temperature which remained constant at 82°F.

Position of ship: 2°18′N, 94°38′W.

*Note.* Dr. L. H. N. Cooper, of the Marine Biological Association of the United Kingdom, at Plymouth, states that this is probably associated with the newly discovered Cromwell current which is likely to prove of importance in meteorology. Dr. Cooper forwarded the observation to Dr. J. A. Knauss, who has been in charge of the investigation into this current at the Scripps Institution, California.

## DISCOLOURED WATER

### Arabian Sea

m.v. *Egidia*. Captain W. MacVicar, M.B.E. Karachi to Aden. Observer, Mr. D. B. Bisset, 2nd Officer.

14th February 1962. The vessel passed through an area where patches of the sea surface looked as though they had been sprayed with red lead powder. They were mainly lenticular in shape and sometimes the coloration was very intense. The distance traversed by the vessel through this area, on a course of 232°, was 66½ miles. During the previous 24 hours there had been no wind and the sea was calm. The sea temp. was 75°F. Marked phosphorescence was seen on the nights of 13th–14th and 14th–15th.

Position of ship: 21°52′N, 62°47′E.

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

"Although the sample from m.v. *Egidia* forwarded to me by Captain Jones at Cardiff was unpreserved, as some of the main constituents were diatoms I was able to make something of it, though the presence of living bacteria showed all too clearly how certain other main constituents had been partially decomposed.

"The commonest cause of reddish discoloration in these seas is *Trichodesmium,* but ciliates and dinoflagellates can give rise to similar colour effects. Diatom blooms commonly cause a yellow or greenish-khaki coloured effect.

" In this sample some of the decomposed remains looked like those of ciliates, but owing to their condition one could not be certain. There was evidently also a rich mixed phytoplankton of diatoms and dinoflagellates.

"The observation is interesting and another useful pointer for the work we are hoping to attempt in these regions from 1963 onwards."

### Gulf of Siam

m.v. *Glenfinlas.* Captain H. K. Martin. Bangkok to Hongkong. Observer, Mr. R. H. Plant, 4th Officer.

17th March 1962. Between 0700 and 0715 LMT when off Non Khoai the vessel passed through an area of thick brown scum covering roughly 6 sq. miles. Several other similar patches were seen at a distance on either side of the ship. The scum resembled fine sand and in it several small white objects which looked like cuttle fish bones were seen floating. Sea temp. 79°F. Wind variable, force 1.

Position of ship: 8°24′N, 104°19′E.

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

"This is almost certainly an algal bloom, most probably *Trichodesmium.*"

### Peruvian waters

m.v. *Paraguay.* Captain J. Allason-Jones. Matarani to Callao. Observer, Mr. P. A. Linacre, 3rd Officer.

4th March 1962. At 1800 GMT the vessel passed through a patch of water, some 200 × 150 ft. in extent, which was blood red in colour. The red was so deep a shade that it seemed the colouring matter responsible must have extended some distance below the surface. The surface of the water in these patches seemed to be smoother than it was elsewhere where the sea was the normal colour. Approximately twelve other generally similar patches were seen in the area, some of which were a lighter shade of red. Unfortunately there was not time to obtain a sample of the water, but the phenomenon was assumed to be that of aguaje. There were many sea birds in the vicinity. Sea temp. 62°F.

Position of ship: 15°27′S, 75°13′W.

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

"This is almost certainly the phenomenon known locally as aguaje, as suggested. Unfortunately we do not know the cause with certainty, since several very different types of micro-organisms may give a similar colour effect if the swarms are sufficiently dense. Aguaje is usually regarded as inimical to other forms of marine life. Certain dinoflagellate species or ciliate protozoa are the most probable cause. We need properly preserved samples from that area quite urgently, since, while some of the organisms concerned are toxic, others are harmless."

See also Note 2 under 'Organisms' observation by *Port Brisbane.*

## DISCOLOURED FOAM

### Galapagos Islands

m.v. *Imperial Star.* Captain G. L. Evans, O.B.E. Auckland to Balboa. Observer, Mr. R. J. Thake, 4th Officer.

10th March 1962. During the period 1500–1900 GMT while passing through the Galapagos Islands frequent extensive patches of scum and discoloured foam were observed from approx. 30 miles WSW of Santa Maria to 15 miles ENE of Santa Fe. The first of these were feathery looking streaks, light brown in colour, with isolated denser patches between them; they were dispersed easily by the bow and stern waves. However, as we approached Santa Maria the patches became larger and denser, measuring roughly 50–60 ft. across and 6–9 inches in depth. Eventually the scum became coffee-brown in colour, quite solid and always retaining a long, oval shape. It was made up of many concentric patterns in darker colours and having an almost honeycombed appearance round the edge. It was noticed that the many shoals of fish and the numerous sea birds were very wary of the scum but did not seem to be concerned about the streaks of foam. Stretching from the north-west shore line of Santa Maria, almost at right-angles to the ship's course line towards the Isla Isabella, were long unbroken streaks of white foam and bubbles about 3–6 in. wide and about 100 yd. apart, running almost parallel to each other for several miles. These lines of foam seemed to be boundaries of much smoother water in a rippled sea. Sea temp. fell from 84°F at 0600 to 77° at 1800.

Position of ship at 1500: 1°35′S, 91°00′W.

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

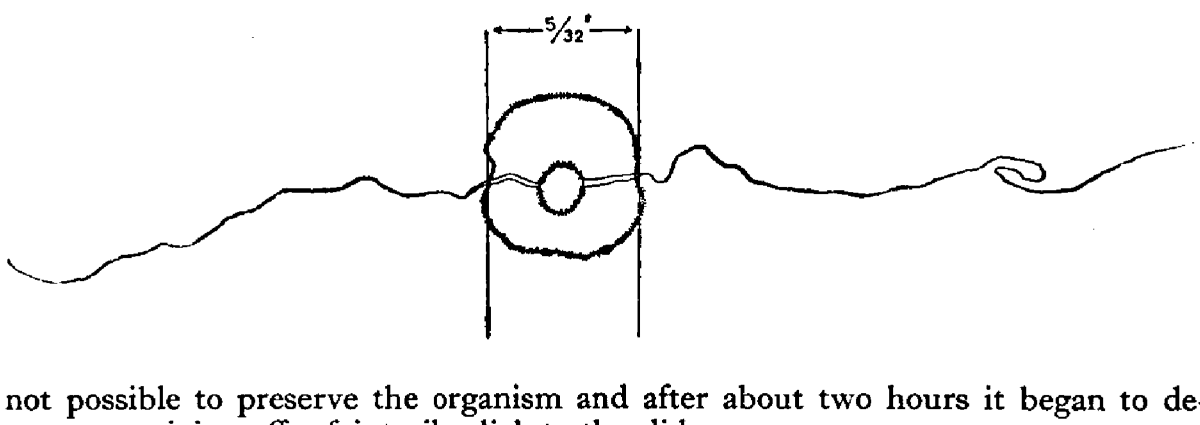
"The currents are known to be very variable around the Islands and may well encourage concentration of 'blooms' of microscopic algae such as the heavy discoloration suggests. Foam streaks may be due to purely physical causes. Organisms which I have seen in samples of discoloured water in that region include forms as diverse as Radiolaria and Coccolithophoridae among the dominant species present."

## ORGANISMS

### Red Sea

m.v. *Port Brisbane.* Captain E. E. Roswell. Aden to Suez. Observer, Mr. A. Rattray, 3rd Officer.

3rd February 1962. On several occasions sea water samples were taken when the vessel was passing through areas of pronounced phosphorescence. A few minute, transparent organisms were seen in the bucket and one of these was isolated on a microscope slide. It had the appearance shown in the sketch. At the time, it was




not possible to preserve the organism and after about two hours it began to decompose, giving off a faint oily slick to the slide.

Another small creature was observed resembling a water flea, which darted about the bucket with short bursts of speed. On being isolated in a bottle, the creature appeared to spawn another similar type of bug only about a quarter the size of the original and with a transparent body, whereas the 'parent' had a greenish coloured head with a light brown anterior. Sea temp. 79°–77°F.

Position of ship at 1800 GMT: 16°36′N, 41°12′E.

*Note* 1. Dr. T. J. Hart, of the National Institute of Oceanography, comments:

"Almost all the main groups of plants and animals in the sea include numerous examples of organisms possessing the power of luminescence, so that unless one can examine a sample oneself, and determine the relative abundance of the dominant form as well as getting it accurately identified down to a species, it remains quite uncertain whether it had anything to do with the phosphorescence or not.

"In the present instance, the 'water flea' would possibly, but not probably, be a copepod, one of the many species capable of emitting light. There are many hundreds of known species of copepods (no one man knows them all) and some scores of these are known to have some power of luminescence. Copepods of one kind or another are so widespread in all natural waters that almost any bucket sample taken anywhere would normally include a few.

"The sketch probably represents a ctenophore or a larval Medusa. Both these groups of animals include some 'phosphorescent' species. Ctenophores sometimes may be crowded together in dead and dying swarms in blooms of dense microplankton algae. They are therefore the best guess as to the cause of the display observed. But this can only be a guess in the absence of a preserved sample to enable us to identify the organism with confidence.

"Probably it was merely adhering to the copepod owing to the method of capture. Certainly no copepod ever 'spawned' anything like it. Ctenophores commonly create trouble in plankton net catches by adhering to any other creatures present. They are very slimy."

*Note* 2 (with reference to observations from m.v. *Paraguay* and m.v. *Port Brisbane,* above). Dr. Hart has often emphasised the need of a preserved sample to back up an observation. The harvesting of plankton and the systematic farming of the seas may some day be an important industry and a proper study of plankton now may well be the foundation for another world food supply in years to come. A preserved sample would materially assist in this study. Any Port Meteorological Officer in the United Kingdom will be only too pleased to supply bottles, preservative and instructions for this purpose.

## PHOSPHORESCENCE

### Arabian Sea

s.s. *City of Coventry*. Captain J. Ingoldsby. Colombo to Aden. Observer, Mr. H. E. Rowlands, 3rd Officer.

28th February 1962. At 2300 SMT large patches of phosphorescence began to be seen near the vessel. Each one first appeared as a small area of bright bluish light which quickly expanded to become a circular patch about 50 yd. in diameter, then faded away. The time taken was approximately 3 seconds, the area remaining a milky white for a further 2 seconds after the light had faded. Not more than one patch was seen at any particular moment and the time interval between them was irregular. While some apparently originated directly underneath the vessel, others were up to half a mile away on either side of it: they did not seem to follow any pattern. The phenomena continued until 2315, but specks of phosphorescence were seen for about half an hour both before and after, in the wave crests and along the ship's sides. The night was fairly dark with no moon but the sky was cloudless and the atmosphere very clear. Sea temp. 80°F. Wind NE, force 3. Slight NE'ly swell.

Position of ship: 9°58'N, 62°46'E.

### New Zealand Waters

s.s. *Hemiglypta*. Captain A. A. Nicol. Geelong to Lyttelton. Observers, Mr. D. J. Sloan, 3rd Officer and Apprentice G. Mount.

27th March 1962. At 0900 GMT the vessel passed through patches of phosphorescence, and in them phosphorescent 'sea slugs' about 2 inches long were seen, composed of a transparent jelly-like substance. When seas were shipped, carrying the 'slugs' aboard, they were brilliant enough to illuminate the deck. Sea temp. 58°F. Wind NW, force 4. Moderate sea and swell.

Position of ship: 34°30'N, 145°30'W.

### Indian Ocean

m.v. *Glengyle*. Captain R. Johnston. Penang to Aden. Observer, Mr. M. J. Steele, 2nd Officer.

8th February 1962. From 0130 SMT onwards, when the ship was about 90 miles east of Ceylon, the colour of the sea changed to a milky grey which gradually became a brilliant off-white, rather suggestive of a snow covered plain. During the period of greatest brightness it was possible to read a book on the wing of the bridge. Spots of bright red light were seen close to the ship when an Aldis lamp was directed on to the sea surface. As the sea was white and the ship and sky both very dark, the impression gained was that everything was being seen in negative. Some low, black-looking Cu. were visible in the north-west. The whole effect was rather ghostly and only once before, off the south coast of Japan, had I seen anything similar. On that occasion the phosphorescence was perhaps more brilliant, but it was not so complete in coverage as in the present instance. Wind, light and variable. Sea smooth with long low swell from NE.

Position of ship: 5°54′N, 83°10′E.

## SEALS

### North Pacific Ocean

s.s. *Lakemba*. Captain J. S. Stewart. Victoria, B.C. to Honolulu.

30th March 1962. During the 4 to 8 morning watch, two baby seals were sighted playing on the surface and passed 100 ft. away from the ship. This was accounted most unusual as the nearest land was 1600 miles away. There was no sign of accompanying adults.

Position of ship: 34°30′N, 145°30′W.

*Note.* Miss J. E. King, of the Department of Zoology at the Natural History Museum, comments:

"I think the animals seen were probably Pribilof fur seals, *Callorhinus ursinus*, on their southerly migration early in the year. Young animals are known to disperse more widely than the adults.

"Thank you for the record."

## ZODIACAL LIGHT

### North Atlantic Ocean

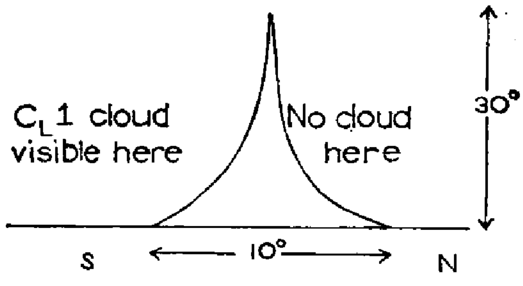
m.v. *Rangitata*. Captain A. Hocken. Madeira to Kingston. Observers, Mr. P. Snow, Senior 3rd Officer, Mr. P. Henderson, 3rd Officer and Mr. R. McNair, 4th Officer.

23rd January 1962, 2300 GMT. A cone of zodiacal light was observed, in the western sky, about 7° of arc in width at the base, the apex being at altitude 23°. There was no visible cloud.

Position of ship: 20°27′N, 58°52′W.

24th January, 2337. The zodiacal light was again seen: it had the same dimensions as on the previous night. Cloud was visible both to the northward and the southward of the cone of light.

Position of ship: 19°02′N, 65°40′W.



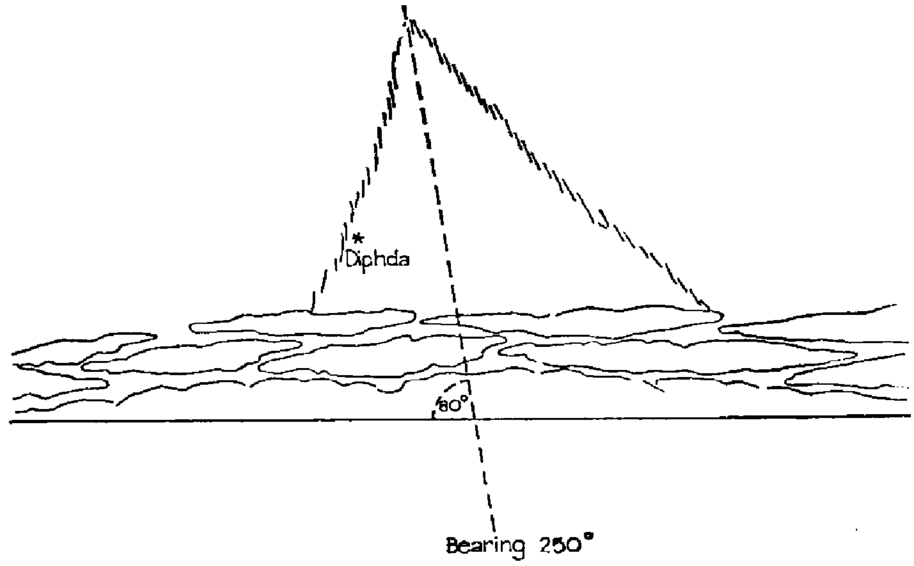

25th January, 2359. The cone of zodiacal light was observed to be more elongated and slightly wider at the base than on the two previous nights. It rose to 30° altitude and was 10° of arc in width along the horizon. Some fair weather Cu. were seen to the southward of the cone but none to the northward.

Position of ship: 17°27′N, 72°23′W.

### English Channel

m.v. *Ethel Everard*. Captain W. G. Hunt. London to Glasgow. Observers, the Master and Mr. H. T. Wells, Supernumerary 1st Officer.

2nd February 1962. At about 1830 GMT when twilight had gone, what was taken to be the Zodiacal Light—it was cone-shaped—was observed bearing 250°. The




base of the cone was obscured by Sc. cloud up to about 8° above the horizon, but the apex extended to an altitude of approx. 45°. It was estimated to be about twice as bright as the Milky Way, which lay in a 140°–320° direction and passed through the constellations of Orion and Cassiopeia. The axis of the cone was inclined towards the south at an angle of about 10° from the vertical, and the colour of the light was slightly greenish, compared with the Milky Way. After 1930 the light was obscured by increasing cloud. Visibility was excellent.

Position of ship: 50°15′N, 3°05′W.

*Note.* The luminosity, which is generally fainter than that of the Milky Way, is believed to be due to the scattering of sunlight by cosmic dust surrounding the sun. In the temperate latitudes of the Northern Hemisphere the evenings of January to March (just after the last traces of twilight have disappeared) are a very favourable time to observe this phenomenon.

## ABNORMAL REFRACTION

### North Atlantic Ocean

m.v. *Graig*. Captain S. Glyn-Woods. Kingston to Casablanca. Observer, Mr. L. Jarrett, Chief Officer.

24th February 1962. At 0042 GMT (25th February) the Fuencaliente Point Light, Palma Island, was seen at 63 miles, the dipping distance being 22¼ miles. The light was visible for about 20 sec. before disappearing completely. The outline of the island was barely visible and no other vessel was sighted in the moonlit waters before arriving abeam of the light at 0509 GMT. Air temp. 62°F, wet bulb 58·0°, sea 65°. Wind ENE'ly, force 1. Sea smooth; low swell.

Position of ship: 28°26′N, 19°04′W.

*Note.* Very great visibilities are usually associated with temperature inversions, and most often with sea surface temperature below air temperature. In this case the sea temperature is above that of the air. One must conclude that there were areas of colder sea surface water between m.v. *Graig* and Palma Island. Large variations in sea surface temperature are possible in this area.

## COMET

### North Atlantic Ocean

m.v. *Paraguay*. Captain J. Allason-Jones. Panama Canal to Liverpool. Observers, Mr. B. J. Hotter, 2nd Officer and Cadet R. D. Kelsall.

4th April 1962. At 2220 GMT a comet was sighted about 5° above Venus and about 5° to the right of it, bearing 290° and having an altitude of about 25°. The comet, which was quite faint, about magnitude 3·5, had a tail which was between 20° and 25° in length and 3° in maximum width. When examined through binoculars the comet had the colour of an ordinary star, and the tail was lying in a NE'ly direction from the head.

Position of ship: 30°30'N, 42°30'W.

### Indian Ocean

m.v. *Rochester Castle*. Captain R. H. Pape. Observers, the Master and most of the ship's officers.

26th March 1962. At 1715 GMT an object with a short tail, thought to be a comet, was sighted bearing 270° at an altitude of 15°. To the left of the object at a horizontal angle of 1°30' from it, there was a non-navigational and unidentified star of magnitude 3·0 approx. The sun had set at 1630, and both the object and the nearby star sank towards the western horizon together, the horizontal angle between them not changing—they appeared to be fixed bodies in outer space. It is completely certain that the object was not Venus, as at the time of sighting, it had already set below the horizon: no other planets were in the vicinity.

Observation was possible for a limited period only, due to haze on the horizon, extending to 5° in altitude, into which the object and the star both disappeared.

Position of ship: 34°36'S, 23°28'E.

*Note.* Mr. H. B. Ridley, Director of the Meteor Section of the British Astronomical Association, comments:

"These reports are very interesting, particularly as in the case of *Rochester Castle* the observer did not know the nature of the object—this kind of case gives a good check on the general reliability of such reports and in the present instance they certainly inspire confidence.

"This comet was discovered on 4th February 1962 by Tsutomo Seki of Kochi, Japan, and was independently detected a few hours earlier by R. D. Lines of Phoenix, Arizona; hence it is known as Comet Seki-Lines, 1962c, being the third comet to be discovered in the current year. At the time of its discovery the comet was a telescopic object of the ninth stellar magnitude but it soon brightened and eventually become easily visible to the naked eye, though it was not spectacular except in long-exposure photographs. Several ships logged this comet; some recognised it as such, but others simply recorded it as an unidentified object, and it is gratifying that these latter reports were sufficiently accurate and detailed to enable them to be related to the comet with certainty.

"The comet was well south of the celestial equator when it first became visible, and all the earlier reports are from southern or low northern latitudes, but after passing the sun at a distance of about 2·7 million miles on 1st April, it moved northwards and brightened rapidly. The writer first saw it from Rogate, Sussex, on 5th April, soon after sunset, when it was just above the horizon and of the second magnitude, with a tail some 3° long. A splendid view of the comet was obtained from Stockbridge, Hampshire, on the evening of 8th April when, in a very dark sky with a thin crescent moon, the comet was seen low in the west with a tail a good 10° long, almost vertical with a slight curve to westward. Although not of great brilliance the comet was of classical form and considerable beauty, as can be seen from the many excellent photographs which have been published. (See photo opposite page 45.)

"The comet is now (July 1962) a telescopic object again, and if it ever returns to the solar system it will not do so until many thousands of years have passed.

"It is quite possible that a ship's officer, seeing a previously unknown comet, may in fact be its discoverer, and it would be appropriate to communicate the observation immediately to the nearest astronomical observatory; a list of these observatories is given in the Astronomical Ephemeris."

## VISIBILITY IN MOONLIGHT

### Sicilian Channel

m.v. *Eastern City*. Captain F. J. Johns. Torrevieja to Japan. Observer, Mr. J. King, 3rd Officer.

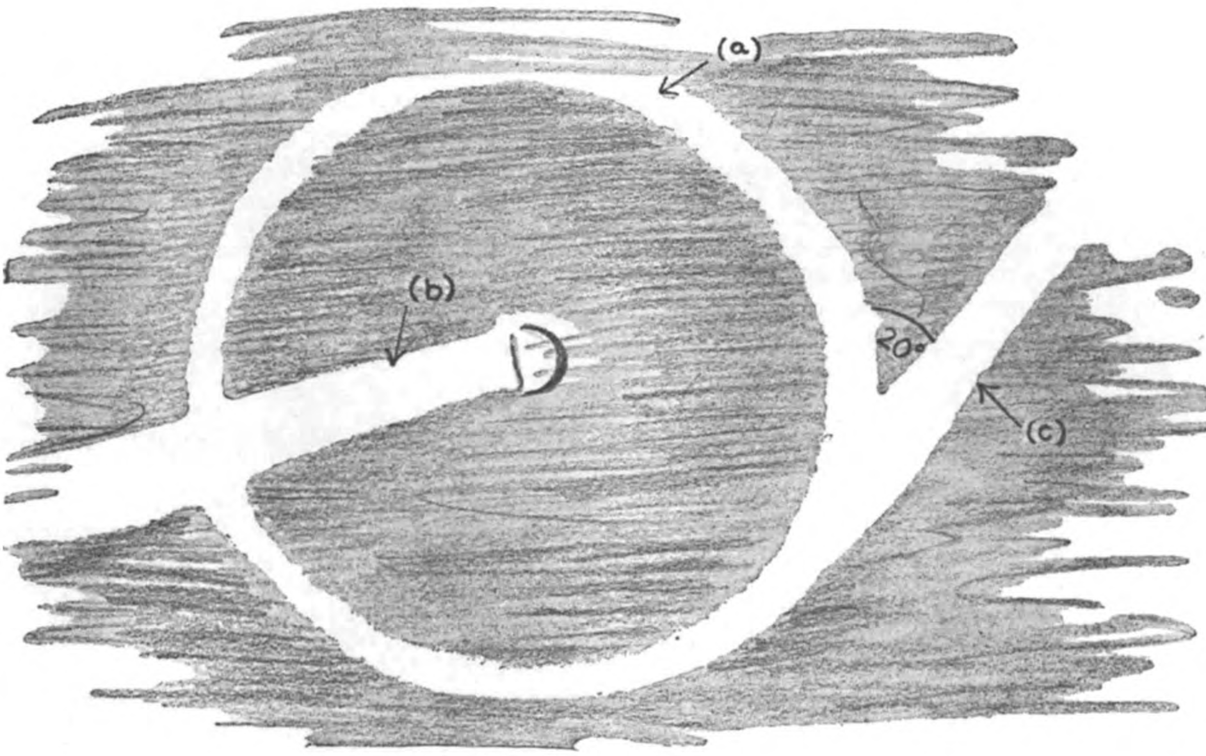
24th January 1962. At 2300 LMT the Island of Pantelleria was observed bearing 120° at 24 miles in bright moonlight, but Punta Spadillo Light (19 m.) on the island, was not then visible. The moon was at an altitude of approx. 30° and the sky appeared to be cloudless. Air temp. 56°F. Wind N, force 4.

Position of ship at 0000 on 25th: 36°54′N, 11°54′E.

## LUNAR HALO COMPLEX

### Mediterranean Sea

m.v. *Canopic*. Captain T. H. Davies. Famagusta to Genoa. Observers, the Master, Mr. L. G. Stewart, 3rd Officer and Cadet Rowe.




17th March 1962. When the vessel was south of Cyprus at 1845–1850 GMT, the lunar halo shown in the sketch was observed. A plain white halo of 46° radius had been surrounding the moon, which bore 150° and was at an altitude of about 69°. At 1845 a faint band of light was seen extending from the moon, in an easterly direction, and cutting across the halo to some distance beyond it. Five minutes later as this band was disappearing, another one became visible, this time making a tangent with the halo on the lower right-hand side. After a short time the second band faded away, leaving the halo which continued to be visible until 1930. 2/8 Cs. and 1/8 Cu. were present. Air temp. 59·8°F, wet bulb 57·9°.

Position of ship: 10 miles south of Limassol.

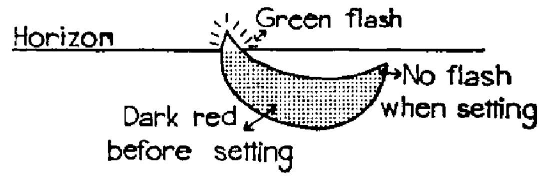
*Note.* m.v. *Canopic* observed three phenomena marked (a), (b) and (c) in the diagram. (a) is the 46° halo produced by refraction of light in the hexagonal, 'rodlike', ice crystals. This halo is less intense than the 22° halo which is produced by refraction through the crystal faces at right-angles, (b) is the horizontal, or parhelic, circle and was due to reflection in the side faces of ice crystal prisms while floating within the cirrus cloud with vertical axes. (c) is a rare phenomenon, and was produced by crystals each with its axis and a side face horizontal. The light from the moon was refracted through crystal faces at right angles.

## LUNAR GREEN FLASH

### off Somaliland

m.v. *Journalist*. Captain R. F. Longster. Aden to Mombasa. Observer, Mr. D. A. Browne, 3rd Officer.

11th March 1962. At 1947 GMT, the moon, which was crescent-shaped was seen




to be a dark red colour as it sank towards the horizon. When the left-hand cusp was disappearing below the horizon a pale green flash was seen through 7 × 50 binoculars. There was no flash when the right-hand cusp disappeared. Air temp. 81·2°F, wet bulb 77°, sea 81·8°. Wind SE'ly, force 2. Visibility excellent. Cloud 2/8 $C_L1$.

Position of ship: 4°00'N, 48°10'E.

*Note.* The fact that only one cusp produced the green flash confirms how transitory are the conditions favourable for its observation.

## DUST DEPOSIT

### North Atlantic Ocean

s.s. *Dunstan.* Captain G. G. Westhorp. St. Vincent, C.V.I. to Le Havre. Observer, Mr. E. Fernandes, 2nd Officer.

5th February 1962. The weather during the afternoon was hazy and next day the ship was found to be covered with a very fine reddish dust or sand. The wind had been ESE, force 5, and the vessel was some 280 miles from the African coast. Is it possible for the sand, a sample of which has been forwarded to the Natural History Museum, to have been carried all the way from Africa?

Position of ship at 1400 GMT: 25°04'N, 20°44'W.

*Note* 1. Mr. P. M. Game, of the Department of Mineralogy at the Natural History Museum, comments:

"The dust sample is somewhat coarser in grainsize than most dust from this area which has been examined. It is, for example, distinctly coarser than dust which fell on the *Pretoria Castle* off Madeira in August 1949, which it otherwise closely resembles.

"The following minerals were determined microscopically: 'aggregate' particles 32%: calcite 20%: quartz 18%: feldspar 4%: iron ore 3½%: amphibole 2%: biotite 2%: muscovite, tourmaline, zircon and apatite, together 1%: indeterminate particles (including organic matter and opaque grains) 17½%.

"In addition to its mineral content the dust contains various organisms and remains of organisms, including sponge spicules and, more rarely, diatoms (of fresh water origin).

"Chemical analysis showed that the dust consisted essentially of silica, calcium carbonate, alumina, iron oxide, soda and potash. The chemical evidence, taken in conjunction with an X-ray powder photograph, indicates that the 'aggregate' particles (which are too small to be determined optically) are probably composed mainly of quartz, mica and a clay.

"The surface wind indicates the coast of Spanish Sahara between Capes Bojador and Juby as a possible 'gathering ground' for the dust. This coastal strip with its varied rock formations and shallow depressions, in which the finer clay particles accumulate, would probably be capable of providing all the minerals found in the dust which fell on the *Dunstan.* There would seem to be no need to go further afield in the search. It is possible that the calcite, which is one of the major constituents, was formed by the evaporation of ground-water drawn to the surface by capillary action in limestone country. The distance of this gathering ground from the position of collection is 400–500 miles. There are many records of the transport of fine dusts over greater distances."

*Note* 2. Probably the furthest westward dust fall recorded was that on board the *Princess Louise* in May 1840 in 14°21'N, 35°24'W when 1030 miles from Cabo Verde, the nearest point of the African continent.

During the early nineteenth century the reduction of visibility near the coast due to dust during the Harmattan season (January to April) resulted in many strandings and Horsburgh's East India Directory recommended all vessels to avoid the passage between the Cabo Verde Islands and the mainland.

# AURORA

Auroral reports for the period 1st January–31st March 1962 are summarised briefly in the following list. These have been received at the Balfour Stewart Auroral Laboratory of the University of Edinburgh. They have been extracted from the meteorological logbooks by the Meteorological Office, or forwarded direct from the base in the case of the weather ships. We should like to thank again all observers and others concerned in sending these reports, for continuing to help in the work of recording all possible data on auroral appearances.

The shortness of the list and the number of 'glows' among the reports indicate that it was a quiet period for auroral observation (though we look forward to some interesting reports in the future after reading 'Ode to Phenomena', printed in the October issue of *The Marine Observer*).

The highest geomagnetic planetary index figure for the three months was 6 recorded on 10th January and 6th March, but on each occasion any associated auroral activity would probably be mainly during daylight hours in the Atlantic area.

Mr. Birkenshaw of m.v. *Bamburgh Castle* recently supplied some film he exposed on aurora on the night of 30th–31st August 1962. Photographs are valuable to us and we shall be glad to defray any costs of film, etc. Exposure times at F/2 using fast film like Ilford HPS vary from a few seconds for very bright features to about 20 seconds for less bright but quiet forms. Films can be developed here and prints will be sent to the photographer.

| Date (1962) | Ship | Geographic Position | | $\Lambda$ | $\Phi$ | I | Time | Forms |
|---|---|---|---|---|---|---|---|---|
| 5th Jan. | *Weather Surveyor* | 59°06′N | 19°06′W | 070 | 65 | +72 | 0445–0730 | HB, G |
| 10th | *Weather Surveyor* | 59°12′N | 19°06′W | 070 | 65 | +72 | 2040–2332 | RA, R, G |
| 12th | *Weather Surveyor* | 58°58′N | 18°20′W | 070 | 65 | +72 | 2348 | R |
| 14th | *Weather Surveyor* | 59°18′N | 18°12′W | 070 | 65 | +72 | 2150 | HB |
| 30th | *Weather Adviser* | 62°00′N | 32°50′W | 060 | 70 | +76 | 2145–2230 | G |
| 2nd Feb. | *Weather Adviser* | 62°11′N | 32°48′W | 060 | 70 | +76 | 0030–0230 | RA |
| | *Weather Adviser* | 61°50′N | 33°18′W | 050 | 70 | +76 | 2300–0245 | RA, RB, G |
| 4th | *Cairngowan* | 57°36′N | 19°42′W | 070 | 64 | +72 | 2100, 2300 | G |
| | *Weather Reporter* | 58°57′N | 19°06′W | 070 | 65 | +72 | 2305–0210 | G |
| | *Weather Adviser* | 61°55′N | 33°05′W | 050 | 70 | +76 | 2000–2030 | HB |
| 5th | *Weather Adviser* | 61°55′N | 33°05′W | 050 | 70 | +76 | 0230–0700 | HB, RA, RB |
| 6th | *Weather Reporter* | 59°10′N | 19°11′W | 070 | 65 | +72 | 2200–2400 | G |
| 23rd | *Weather Monitor* | 62°15′N | 32°55′W | 060 | 70 | +76 | 2135–2200 | RA |
| 26th | *Weather Surveyor* | 59°00′N | 19°00′W | 070 | 65 | +72 | 2105–2245 | HB, L |
| | *Cairngowan* | 57°24′N | 19°54′W | 070 | 64 | +72 | 0050–0053 | L |
| 27th | *Cairngowan* | 53°06′N | 39°00′W | 040 | 63 | +72 | 2230–2330 | HA |
| 1st Mar. | *Weather Surveyor* | 58°36′N | 19°48′W | 070 | 65 | +72 | 2345 | G |
| 2nd | *Weather Surveyor* | 58°42′N | 19°42′W | 070 | 65 | +72 | 0145–0445 | G |
| 3rd | *Weather Monitor* | 61°53′N | 33°10′W | 050 | 70 | +76 | 2130–2345 | HB, RB, DS, P |
| | *Weather Surveyor* | 59°00′N | 18°36′W | 070 | 65 | +72 | 2200–0500 | R, G |
| 4th | *Weather Surveyor* | 59°06′N | 18°36′W | 070 | 65 | +72 | 2130–2152 | G |
| 6th | *Weather Surveyor* | 59°06′N | 19°00′W | 070 | 65 | +72 | 0340–0555 | RA, DS, G |
| | *Explorer* | 57°02′N | 08°08′W | 080 | 61 | +70 | 0400–0410 | G |
| 7th | *Weather Surveyor* | 59°12′N | 19°12′W | 070 | 65 | +72 | 0300 | L |
| 10th | *Weather Surveyor* | 59°24′N | 18°18′W | 070 | 65 | +72 | 0248–0450 | G |
| | *Ethel Everard* | 54°00′N | 10°40′W | 080 | 59 | +69 | 2230–2250 | HA |
| | *Cairngowan* | 43°43′N | 66°20′W | 360 | 55 | +72 | 2000–2200 | HA, RB, DR, R |
| 11th | *Weather Surveyor* | 59°24′N | 18°18′W | 070 | 65 | +72 | 0150–0450 | G |
| 28th | *Alsatia* | 47°48′N | 32°42′W | 050 | 56 | +68 | 2330–0115 | G |

KEY: $\Lambda$ = geomagnetic longitude; $\Phi$ = geomagnetic latitude; I = inclination; G = glow; HA = homogeneous arc; HB = homogeneous band; RA = rayed arc; RB = rayed band; R = rays; C = corona; S = surfaces (DS = diffuse surfaces); DR = drapery or curtain; P = pulsating; F = flaming; L = auroral light seen but no other details available.

551.556.8: 551.466.33

# A Simple Method of Estimating Wave Height and Direction over the North Atlantic

By F. E. LUMB, M.SC.

(Climatological Services Department, Meteorological Office)

"Rise, winds!
Blow till ye burst the air and swell the seas,
That they may sink the stars."
Fletcher, *Double Marriage*, 1647

## Summary

Simple relations between the maximum wave height and the mean wind speed over the preceding 12 hours are derived. Their limitations are discussed, and a simple method of estimating or predicting the maximum wave height and dominant wave direction over the north-east part of the North Atlantic, whether or not swell predominates over sea, is explained by means of an example.

## Introduction

An investigation by the oceanographer J. Darbyshire[1] has demonstrated that if at any point the fetch is at least 200 nautical miles and the wind blows steadily in direction and speed over a period of 12 hours, in the absence of swell a fully developed sea will have arisen by the end of the period. Over the North Atlantic away from the coasts the fetch is usually greater than 200 miles, but winds which blow steadily in speed and direction for 12 hours are rarely experienced and swell is rarely negligible over the ocean. However, there are numerous occasions when the change of wind direction does not exceed 45°, and some allowance can be made for changes of wind speed by taking the mean speed over the 12 hours. For these occasions, provided the contribution of swell to the wave energy is relatively small, the wave height can be expected to increase as the mean wind speed increases.

## Data used

In order to ascertain whether there is any simple relationship between the maximum wave height ($H_{max}$) and surface wind speed averaged over 12 hours (V), data of surface winds and maximum wave height recorded aboard the O.W.S. *Weather Reporter** at 6-hour intervals during the following periods were examined:

| | |
|---|---|
| 18th February–14th March 1961 | (at station 'J') (52°30'N, 20°00'W) |
| 28th May–21st June 1961 | (at station 'I') (59°00'N, 19°00'W) |
| 15th July–8th August 1961 | (at station 'I') |
| 6th December–31st December 1961 | (at station 'I') |
| 23rd January–16th February 1962 | (at station 'I') |
| 9th March–19th March 1962 | (at station 'J') |

The maximum wave height (crest to adjacent trough) over a period of 15 minutes at the main synoptic hours was taken from the record of a Tucker shipborne wave recorder, and the wind speed and direction measured by a cup generator anemometer and remote-indicating wind vane at a height of 64 ft. above sea level were extracted from the ship's meteorological log-book. The sea-air temperature difference ($T_s$-$T_a$) was also noted since it has been established (e.g., by Roll[2]) that atmospheric stability has some influence on the wave height. The air temperature was measured at a height of 32 ft. above sea level.

* *Weather Reporter* was selected because she is the only British ship which has a wave recorder on board.

The mean wind speed ($\overline{V}$) was obtained by assuming a steady change between the 6-hourly reports, i.e.,

$$\overline{V} = \frac{V_1 + 2V_2 + V_3}{4}$$

where $V_1$ is the speed at the beginning of the 12-hour period, $V_2$ is the speed 6 hours later, $V_3$ the speed at the end of the period.

Occasions when the wind direction had not varied by more than 45° during the period of 12 hours were extracted, and by plotting the maximum wave height at the end of each 12-hour period against the mean wind speed during this period, it was found that the straight lines shown in Fig. 1 enabled a good estimate to be made of the maximum wave height on many occasions. The uppermost line (I) is applicable during the period September–April (inclusive) for cold air masses being heated from below, i.e., when the surface winds blow across the sea surface isotherms from colder to warmer water. Otherwise during the period September–April (inclusive) the middle line (II) should be used. The lowest line (III) is always applicable in summer (May to August inclusive).

It is important to note that the straight lines I and III are not extended to values of $\overline{V}$ less than 15 knots and line II is not valid when $\overline{V}$ is less than 20 knots. The reason is that with lighter winds swell often predominates over the sea and the simple relation between $H_{max}$ and $\overline{V}$ represented by the straight lines then breaks down. For example, the use of line II could lead to large errors for some hours after the passage of a warm front or warm occlusion when strong winds are replaced by a weak mild air flow.

## Example of 14th–15th March 1962

A good example of the replacement of strong winds by weak occurred during the period 14th–15th March 1962. The sequence of winds and maximum wave heights from 0600 GMT on the 14th to 1200 GMT on the 15th was as follows:

| Date | Time (GMT) | Wind Direction (deg) | Wind Speed (kt) | Max Wave Height (ft) |
|---|---|---|---|---|
| March 14 | 06 | 140 | 33 | 36 |
| | 12 | 230 | 17 | 30 |
| | 18 | 210 | 08 | 27 |
| March 15 | 00 | 260 | 10 | 24 |
| | 06 | 290 | 15 | 23 |
| | 12 | 270 | 13 | 20 |

Fig. 2 shows the synoptic situation at 1200 GMT on 14th March 1962. We see that a strong south-easterly air flow has just been replaced at station 'J' by a weak air flow from the south-west. The high waves generated by the south-easterly winds decayed only slowly under the influence of the weak south-westerly, $H_{max}$ being reduced by only 10 feet in 24 hours. The mean wind speed between 0000 and 1200 on the 15th March was 13 knots. If line II were extended downward to the point where $\overline{V}$ is 13 knots we find that the corresponding value of $H_{max}$ is 10 feet as against a recorded $H_{max}$ of 20 feet.

Provided the calculations are restricted to the range of values of $\overline{V}$ for which lines are drawn in Fig. 1 (e.g. 15–55 knots for line I), the standard of accuracy achieved is as given in Table 1.

## Application to area forecasts of wave heights and direction

The simple relationship between $H_{max}$ and $\overline{V}$ presented in Fig. 1 gives strong support to the opinion often expressed by shipmasters that if the surface wind

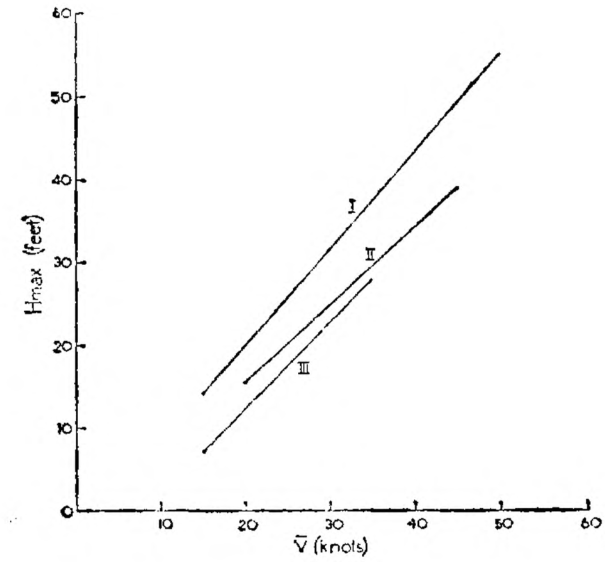



Fig. 1.

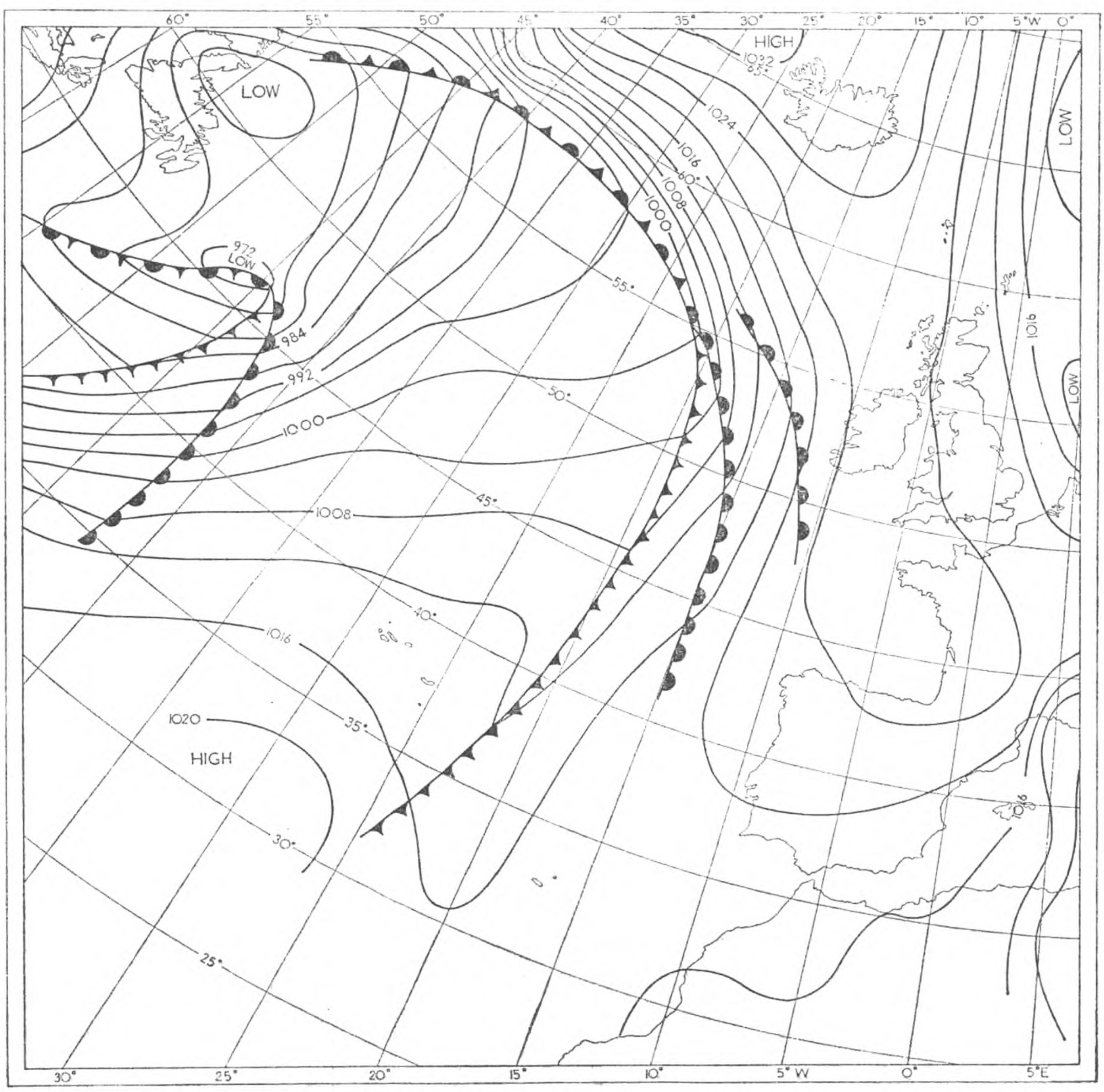



Fig. 2. Synoptic chart for 1200 GMT, 14th March 1962.

**Table 1**

| Straight Line | The error (in feet) will not exceed the given figure | |
|---|---|---|
| | on 2 occasions in 3 | on 19 occasions in 20 |
| I | 6 | 12 |
| II | 4 | 8 |
| III | 3 | 6 |

direction and speed are accurately forecast, long experience enables them to judge quite accurately what the sea conditions would be except in areas where swell predominates. In a forecasting office, the relationship can be applied to wave forecasting in the following manner:

Two synoptic charts, for the same sea area but differing in time by twelve hours, are laid, one on top of the other, on a 'light slope', i.e. a glass-topped table strongly illuminated from below. This device makes it easy to pick out the regions, usually quite extensive, within which the wind direction has not changed by more than 45°. Taking the mean of the wind speed at the beginning and end of the period as a good approximation to $\overline{V}$, Fig. 1 can be used to calculate $H_{max}$ at the end of the

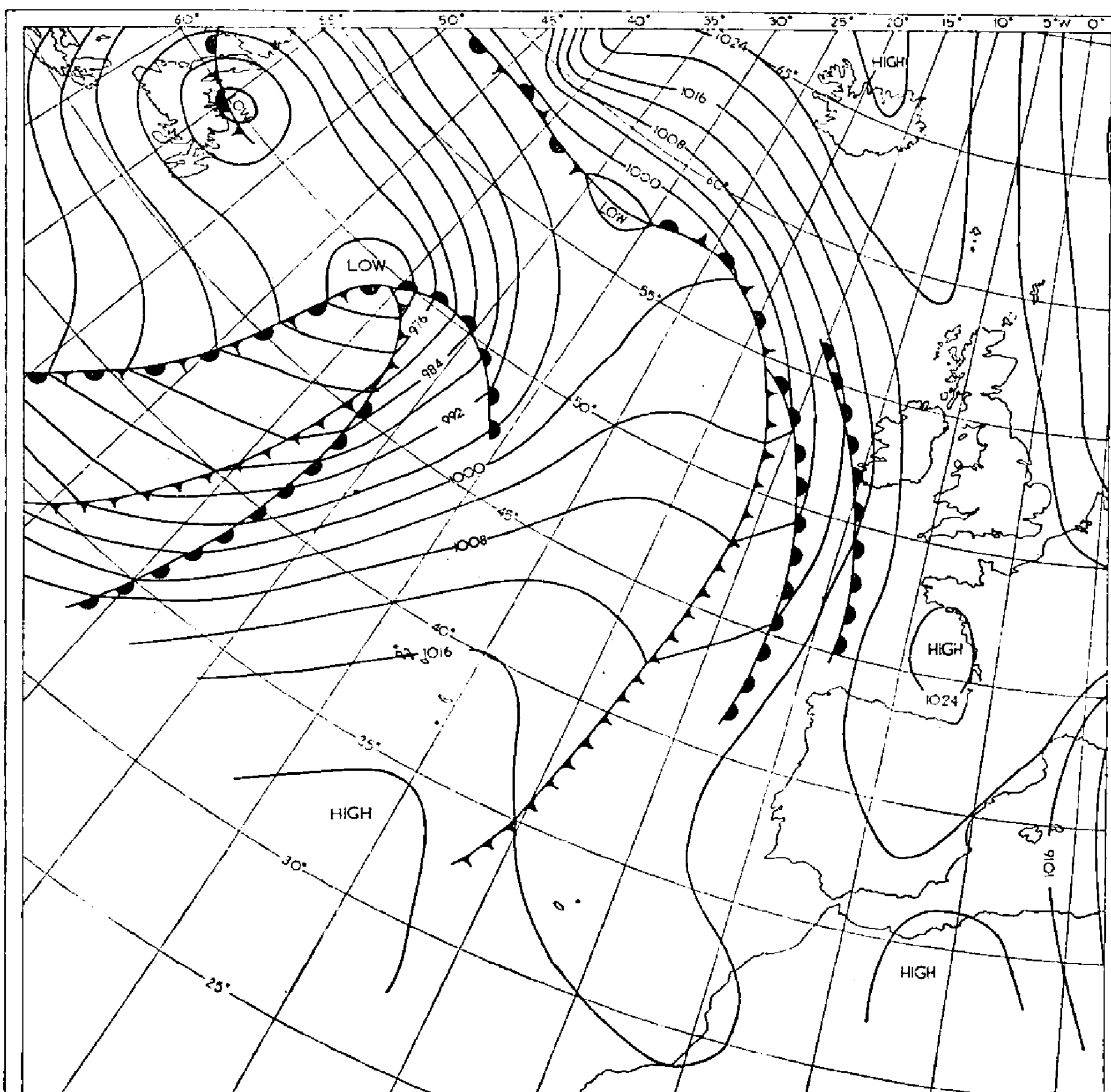


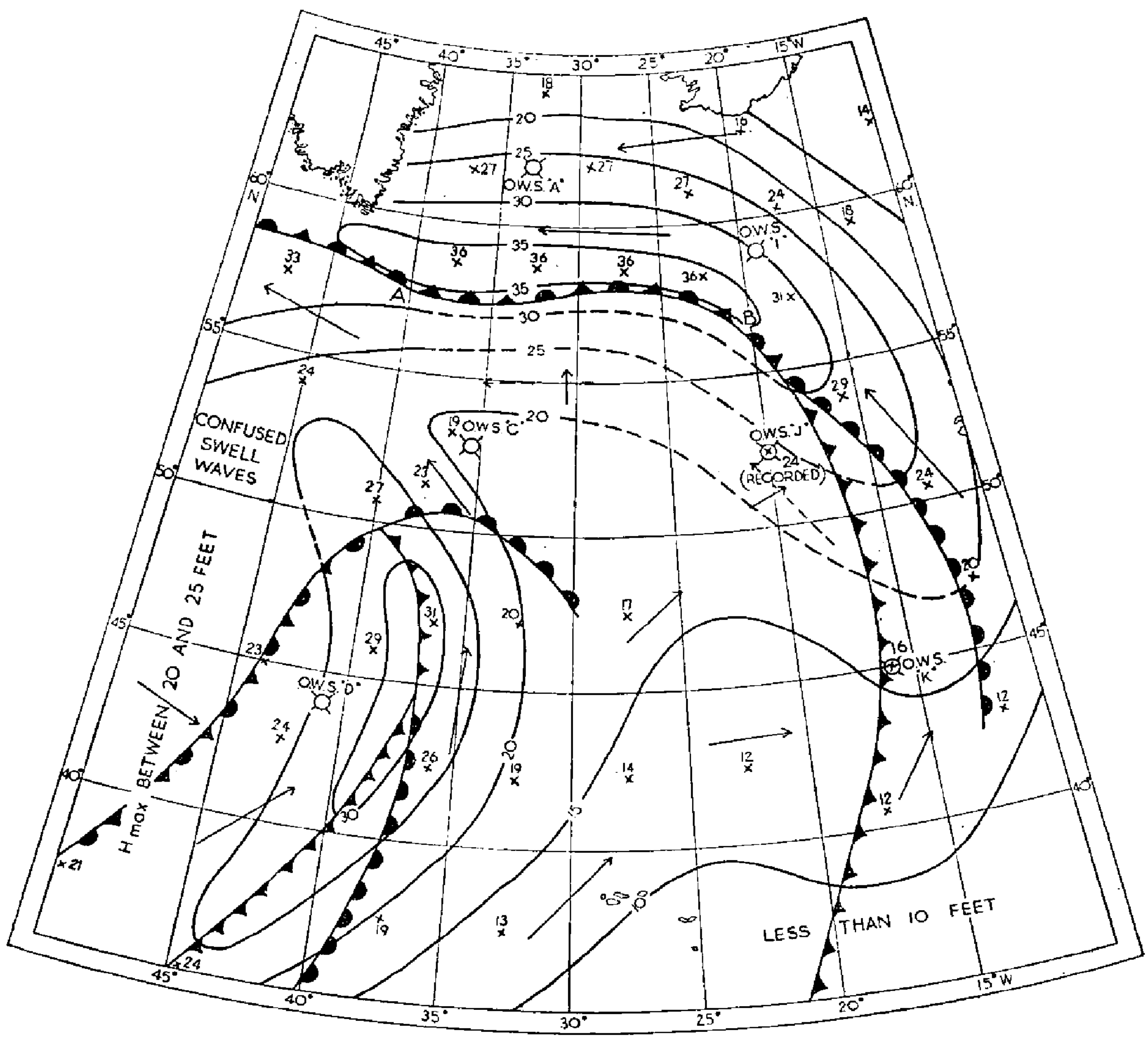

Fig. 3. Synoptic chart for 0000 GMT, 15th March 1962.

period. The awkward but very important areas of light wind where swell predominates can then be dealt with by drawing a rational pattern of the isopleths of $H_{max}$ over the whole area under consideration as will be shown in the following example.

The dominant direction of the sea and swell waves, taken to be the same as the mean direction of the surface winds which have generated them, can readily be found from a sequence of synoptic charts at 12-hour intervals. For determining the direction of sea waves, only the two latest charts are required.

## Estimation of maximum wave height and dominant wave direction at 0001 GMT 15th March 1962

Fig. 3 shows the synoptic situation at 0001 15th March 1962. With the aid of this chart and the one 12 hours earlier (see Fig. 2), using Fig. 1, $H_{max}$ was calculated at various points over the area 35°–65°N, 10°–50°W. The calculated values are entered on Fig. 4. Except in the north-east corner of the area, and to the rear of the cold




——→ Dominant direction of sea waves

– – – → Dominant direction of swell waves

Fig. 4. Chart of maximum wave height in feet, at 0000 GMT, 15th March 1962.

occlusion approaching Ocean Weather Station 'D', the surface air flow is from warmer to colder water. Straight line II has therefore been used to calculate $H_{max}$, and since the curvature of the isobars is generally small, the surface wind was taken to be 2/3 of the geostrophic. (The values of $H_{max}$ in the extreme north-east and the extreme west in polar air being warmed from below were calculated from line I taking the surface wind to be 3/4 of the geostrophic. In the region 50°–55°N, 40°–50°W the wind has backed 60° during the 12-hour period, but since the change was a gradual one line II will still be applicable without serious error.)

No attempt was made to calculate $H_{max}$ over any part of the area N of 45°N where $\bar{V}$ was less than 20 kt. However, isopleths of $H_{max}$ can be drawn over the area where swell is dominant, using the following aids:

(a) The isopleths must be continuous with those over the adjacent areas where $H_{max}$ can be calculated.
(b) In the rear of that part of the occlusion where the change of $H_{max}$ along the front is small (i.e., between points A and B in Fig. 4) the isopleths will be parallel to the occlusion.
(c) An investigation by J. Darbyshire[3] into the attenuation of ocean swell indicates that with light winds the change in the height of waves in a decay area is inversely proportional to the square root of the distance from the generating area.
(d) There is the recorded value of 24 ft. at station 'J'.

Isopleths, drawn over the whole area, are shown in Fig. 4; those in the area where swell predominates being given as broken lines. The dominant directions of sea and swell waves are indicated by arrows (broken for swell).

The same method can be used with forecast synoptic charts, thus enabling a prediction of wave height and direction to be made. In this particular example, if the synoptic charts had been forecast charts, no recorded value at station 'J' would have been available, but this would make little if any difference to the drawing of the isopleths, which is practically determined by aids (a), (b) and (c).

**Comparison with observations at Ocean Weather Stations**

A comparison of the dominant wave direction and maximum wave height deduced from Fig. 4 with the observed sea and swell waves at 0001 GMT 15th March 1962 at the North Atlantic ocean weather stations (except 'E' and 'M') is given in Table 2. (Since the observed wave heights are an approximation to the significant wave height they have been multiplied by 1½ in order to give an approximation to $H_{max}$.) Bearing in mind that the observations were made during the hours of darkness, in general the agreement between the reported values and those obtained from Fig. 4 is fairly satisfactory.

At station 'A' the reporting of two wave groups may account for the low values of $H_{max}$ in each case relative to the value deduced from Fig. 4. $H_{max}$ for the two groups combined would be $\sqrt{15^2 + 19^2} = 24$ ft.

There is a marked difference between the observed* and deduced figures at station 'J', but there is good agreement with the swell group (shown in brackets in Table 2) reported at this station at 1800 GMT on the 14th March 1962. It is unlikely that the heavy swell from the south-east would in fact have decayed as quickly as the 0001 GMT observation suggests since the surface wind remained light between 1800 and midnight, and the coded swell group 16452 was reported at every hour from 1800 up to and including 2300. At 0100 on the 15th March 1962 the coded swell group was reported as 149x9 (direction indeterminate, $H_{max} = 21$ ft.). The discrepancy between the observed and deduced values at 0001 on 15th March 1962 was therefore probably due to the difficulties of observing accurately an unusually complex sea surface during the hours of darkness.

It is also interesting to note that the waves at 1800 GMT on 14th March 1962 at station 'C' were reported as 10759 (direction 070°, $H_{max} = 21$ ft.). They were coded as sea waves, but they were undoubtedly swell waves since the surface wind was 180° 15 kt. It is clear that at this time station 'C' was affected by the heavy easterly swell which is shown to be just north of station 'C' 6 hours later (see Fig. 4).

* The wave recorder aboard the ship does not differentiate between sea and swell so that the assessment of the wave characteristics when both sea and swell groups are reported is dependent on the judgment of the observer.

**Table 2. Comparison Between Observed and Deduced Wave Characteristics at 0001 GMT. 15th March 1962**

| O.W. Station | Reported Sea Dir. | Reported Sea $H_{max}$ (ft) | Reported Swell Dir. | Reported Swell $H_{max}$ (ft) | Dominant Direction (deduced from Fig. 4) | $H_{max}$ (ft) |
|---|---|---|---|---|---|---|
| A | 080° | 15 | 120° | 19 | 090° | 27 |
| B | 060° | 38 | | | 060° | 33* |
| C | 170°<br>(070° | 12<br>21)† | | | 140° | 19 |
| D | 210° | 21 | | | 230° | 25 |
| I | 100° | 24 | | | 100° | 30 |
| J | 250°<br>(220° | 07<br>12)† | 220°<br>110°<br>(140° | 16<br>07<br>29)† | 140° | 24 |
| K | 180° | 15 | 230° | 10 | 210° | 16 |

* Calculated from winds reported at 1200, 1800, 0001 GMT 14th–15th March 1962.
† Observations made at 1800 GMT 14th March 1962.


## Acknowledgment

I wish to acknowledge the valuable help of Miss J. M. Oliver, who carried out the statistical calculations necessary to determine the position and slope of the straight lines in Fig. 1.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1 Darbyshire, J. 1961. Prediction of wave characteristics over the North Atlantic. *J. Inst. Nav.* Vol. 14, No. 3, p. 339. London.
2 Roll, H. U. 1952. Über Grössenunterschiede der Meereswellen bei Warm- und Kaltluft. *Dtsch. hydrogr. Z.* Vol. 5, p. 111. Hamburg.
3 Darbyshire, J. 1957. Attenuation of swell in the North Atlantic Ocean. *Quart. J. R. met. Soc.* Vol. 83, p. 351. London.


551.515.1 : 551.515.2

# Newfoundland and Tropical Storms


By B. F. Bulmer, M.A., B.Sc.

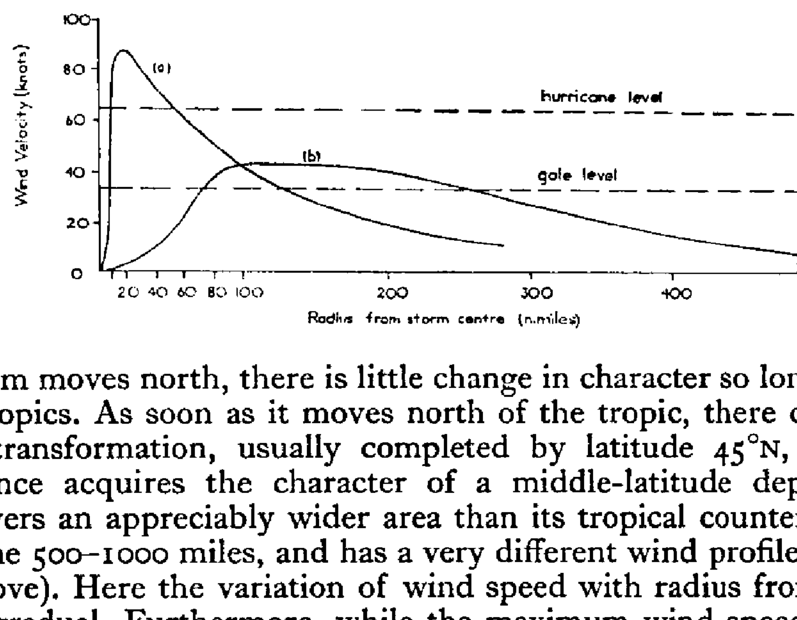
(Mr. Bulmer is in the Climatological Division of the Meteorological Office and is responsible for revising the meteorological section in the Admiralty Pilots.)


The question of the liability of Newfoundland to tropical storms was brought to the attention of the writer when engaged in describing the climate and weather around Newfoundland for the text of an Admiralty Pilot. Several references were found which implied that Newfoundland was affected by such storms, and this, in view of Newfoundland's latitude, seemed contrary to expectations. The search for a short answer to the question, "Is Newfoundland affected by tropical storms?" proved surprisingly difficult and revealed considerable vagueness as to the definition of a 'tropical storm'. Some writers used the term to denote the well-known violent vortex, with hurricane force winds, as found in tropical latitudes. Others applied the term more loosely to any disturbance which had originated in the tropics and had once had these characteristics.

Many charts have been published showing tracks of 'tropical storms', in which the tracks extend beyond Newfoundland and even as far as Iceland and Ireland. To the mariner, familiar with the 'tropical revolving storm' as described in the standard article in the 'Pilot', this may be confusing: for the disturbances which affect Iceland and Ireland are obviously very different from a 'tropical revolving storm' even though they may have started life as such.

To assist in reaching a conclusion about the extent to which Newfoundland is affected by tropical storms, and the sense in which it is so affected, let us consider how the tropical storm changes its character as it moves into higher latitudes.

Within the tropics a typical mature storm is a comparatively small affair, with an average radius of about 300 miles for the total circulation, and the violent winds (force 12—64 kt.) restricted to a relatively small annulus within 75 miles or so of the centre. Within about 5 or 10 miles of the centre, the wind decreases to light, and the sky becomes broken. This innermost region is the well-known 'eye' of the storm. Torrential rain is experienced in the inner part of the storm, outside the 'eye'. The rain area is disposed more or less symmetrically around the storm centre, and the whole circulation is composed of warm air; there is no sector wherein the air is markedly colder or warmer than elsewhere. Characteristic is the rapidity with which the wind increases and then decreases again as one approaches the centre. This typical wind profile is illustrated by curve (a) in the accompanying diagram. Another characteristic of a tropical storm is its small speed of movement—normally between 10 and 20 kt.




As the storm moves north, there is little change in character so long as it remains within the tropics. As soon as it moves north of the tropic, there commences the progressive transformation, usually completed by latitude 45°N, during which the disturbance acquires the character of a middle-latitude depression. This, typically, covers an appreciably wider area than its tropical counterpart, having a radius of some 500–1000 miles, and has a very different wind profile (illustrated by curve (b) above). Here the variation of wind speed with radius from the centre is much more gradual. Furthermore, while the maximum wind speed has declined, and the former small annulus of hurricane force winds has disappeared, the area covered by gale force (force 8—34 kt.) winds has expanded and commonly extends to a radius of about 300 miles from the depression centre. The shape of the wind profile can therefore be used as a criterion for deciding whether a storm has a 'tropical' or 'middle-latitude' character.

Another characteristic which differentiates the middle-latitude low from the tropical storm is its thermal structure. While the tropical storm, in the surface layers, is more or less uniformly warm on all sides, the middle-latitude low is characteristically asymmetric, having one sector markedly warmer than the others. This is tantamount to saying that the possession of well marked fronts characterises a depression as being non-tropical in character. As soon as the storm leaves the tropics it enters into a region of appreciable latitudinal temperature gradient. The effect of a vortex on such a gradient is to throw up warm air from low latitudes in advance of its path and to draw down cold air from higher latitudes in its rear, and this process ultimately leads to the formation of fronts.

As there is always a strong temperature gradient off the east coast of the United States of America between latitudes 35°N and 45°N, it is improbable that a storm could penetrate as far north as 45°N without acquiring a high degree of thermal asymmetry. In fact, most of them acquire fronts by this time.

Another factor which may assist in differentiating between tropical and middle-latitude storms is speed of movement. While in the tropics, the storm commonly has a speed of movement of about 10 to 20 kt. Having penetrated north of the tropic, there is commonly an acceleration, and its speed increases to between about 25 and 40 kt., which is the normal speed of many extra-tropical depressions in their early stages. Marked acceleration is therefore another pointer to a change in character of the one-time tropical storm.

While it is difficult to draw any hard and fast line between 'tropical' and 'extra-tropical' storms, a consideration of all the foregoing criteria will serve, in the majority of cases, to distinguish between the two categories.

While investigating the frequency with which former tropical storms affected Newfoundland and assessing their character in terms of the above criteria, considerable help was obtained from the recent *Technical Paper No. 36* of the U.S. Weather Bureau. This publication records the tracks of all observed tropical cyclones in the North Atlantic during the period 1886 to 1958, and uses different symbols to distinguish between the 'tropical storm' stage and 'extra-tropical' stage. The authors intentionally use the term tropical storm very loosely, applying it to storms of tropical origin until the extra-tropical characteristics are very well developed. Nevertheless, among all the storms which passed over or near Newfoundland in the years 1900–1958, there were only six the technical paper still classifies as 'tropical' when in the latitude of the island; and even these six, on re-examination, are found to have very evident extra-tropical characteristics including, in some cases, well-marked fronts.

The conclusion is therefore that 'tropical storms', in the sense of storms having the character of those in the tropics, do not normally affect Newfoundland, although the odd residual characteristic, such as the suggestion of an 'eye', may have been reported. It will be realised, of course, that this does not imply immunity from violent winds. Force 12 may well be reported on rare occasions. It is rather that the size, shape and character of the storms affecting Newfoundland conform with the middle-latitude pattern, rather than with the tropical.

551.5 (26): 681.177

# A New Punch-Card

By A. R. BELTON

(Meteorological Office Punch-Card Installation)

For preparing marine climatological summaries or atlases, and for scientific investigations in marine climatology, it is often necessary to collect and sort observations from ships of many countries.

A convenient medium for the exchange and sorting of these observations is the punch-card, especially since many countries now use punch-card electronic calculators and computers. The machines reduce the time spent in the enormous amount of computation often necessary in marine climatological work which in the past was a tedious manual operation.

As the observations will be made by ships of many nationalities, and in order to make the best possible use of punch-card machine methods, it is essential that the data be in an international code and punched on to an internationally agreed punch-card. For many years such a card was available but it had its disadvantages; for example, it did not cater for different units of measurement used by different countries, nor did it allow for the exchange of past data, often essential in long-term studies, which may have been punched in codes no longer used.

At a meeting of the Commission for Maritime Meteorology (C.M.M.) of the World Meteorological Organisation (W.M.O.) held at Utrecht in August 1960 a new International Maritime Meteorological Punch-Card was agreed and later ratified by a resolution of the W.M.O. Executive Committee (Geneva, May 1961). This card, the layout of which is shown in Fig. 1, came into use for the punching of all observations made from 1st January 1962 onwards.

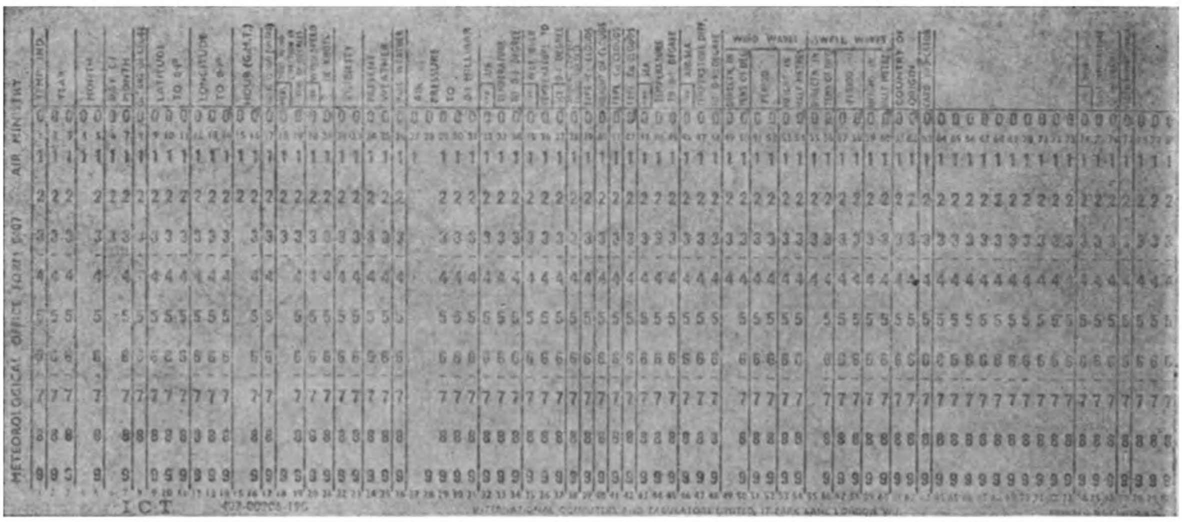


Fig. 1. The layout of the new International Maritime Meteorological Punch-Card.

The internationally agreed columns are those as shown on the card at Fig. 1, columns 64–73 and 78–80 being optional, although by the use of the 'Card Indicator', column 63, these columns may be used for the exchange of past data, thus overcoming one of the more serious disadvantages of the old International Punch-Card.

Columns 67–68 are used by the United Kingdom for series number, and columns 78–80 for recording the logbook number from which the observation is punched; this makes easier any back reference necessary in the case of queries, or perhaps for further study of extreme or unusual values. These columns, however, would be left blank if the card was reproduced for another Meteorological Service.

An example of a card actually punched is shown at Fig. 2 and is an observation made at 8·1°N, 83·9°W on 10th February 1962 at 1200 GMT. The information punched is, of course, taken from the usual ship's meteorological logbook with the exception of columns 1, 61–62 and 63. Column 1 is used to indicate the unit of measurement of temperature, e.g. in Fig. 2 the 2 punched in column 1 indicates

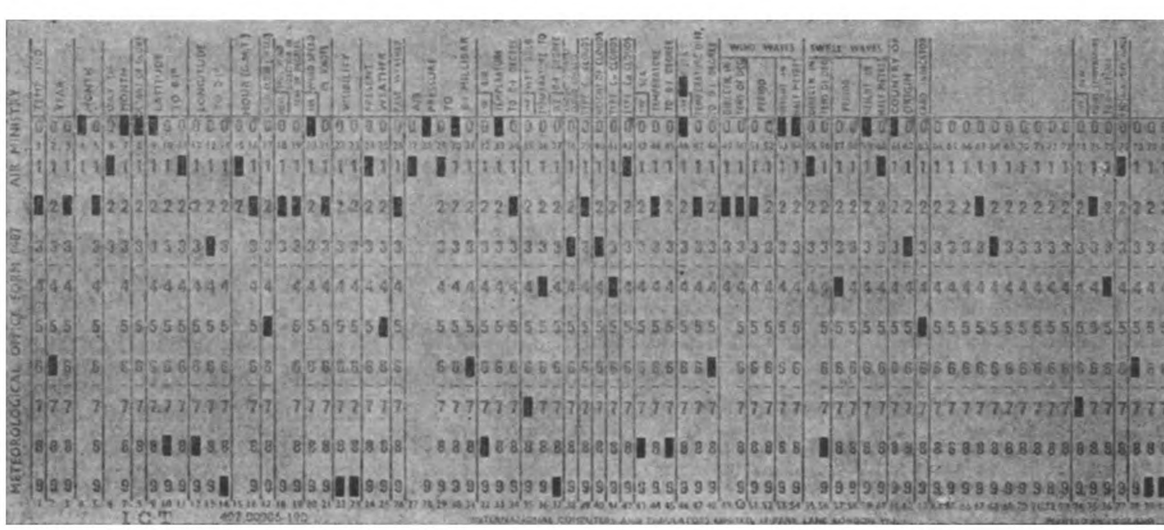
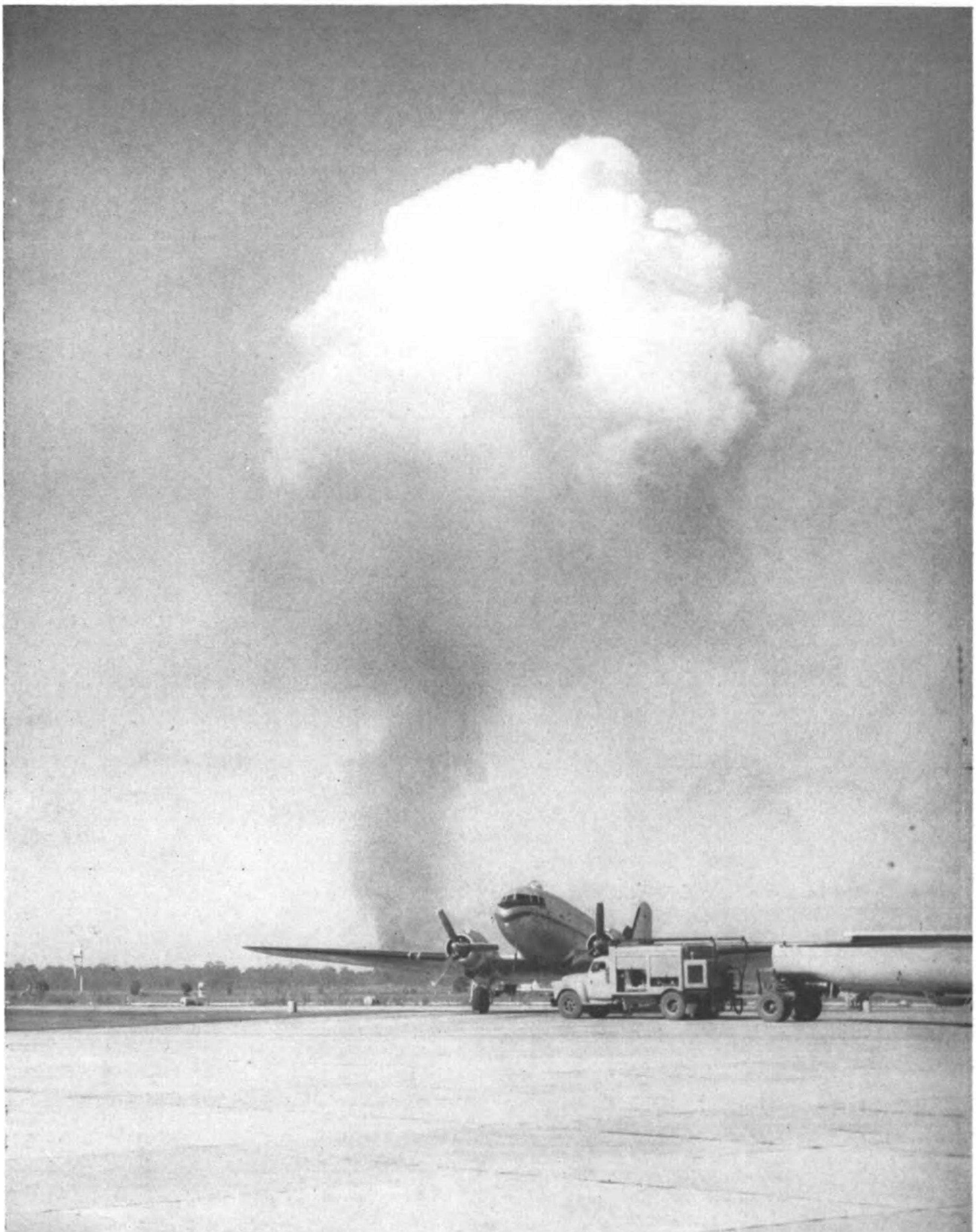


**Fig. 2. A card punched with an observation.**

Operators at work in the punched-card installation in the Meteorological Office at Bracknell (see opposite page).

(facing p. 32)



Artificially formed cumulus (see opposite page).

*Photo by K. J. Heffernan. Previously printed in* The Journal of Fluid Mechanics, *by Cambridge University Press*

*(facing p. 33)*

that the temperatures have been reported and punched in tenths of degrees Fahrenheit; columns 61–62 are used to punch the number, allocated by W.M.O., of the country which recruited the ship which made the observation. Column 63, as mentioned earlier, is used to indicate any code deviations which might occur. For present-day data this column will be punched as 5, indicating that the data punched on the card is in accordance with W.M.O. codes effective in the year as indicated in columns 2–3, except that temperatures are reported in Fahrenheit against the now accepted Celsius Scale. The punch above the 'o' in column 46 is called an X-overpunch and in this instance is used to indicate that the air-sea temperature difference is negative, i.e. sea temperature is greater than air temperature. These overpunches are used in many ways and are valuable from the point of view of economy in the number of columns used for the punching of certain elements.

Perhaps it is worth mentioning here that air-sea temperature difference (columns 46–48) and dew-point temperature (columns 74–76) will only be punched if calculated to a tenth of a degree. It is, therefore, important that dry bulb, wet bulb and sea temperatures be read and recorded in the logbook to tenths of a degree, facilitating the calculation of dew-point and air-sea difference after punching. In order to maintain accuracy, the necessity for reading temperatures to a tenth of a degree will be greater still when, as is envisaged, Celsius thermometers will be issued to all Selected Ships.

It will be noticed that two columns have been allocated for the punching of 'wave period', both in the wind and swell wave groups. This is intended to allow for possible modification to the present code for $P_w$ in order to enable the wave characteristics to be reported more accurately. In the meantime, the one-figure code for $P_w$ will be punched in columns 51 and 57 for wind and swell waves respectively, columns 52 and 58 being left blank.

The agreement and introduction of this new punch-card is a further example of the close international co-operation which exists in the fields of meteorology and climatology. Exchanging marine observations in this way will make possible scientific investigations into many aspects of marine climatology as well as more accurate preparation of marine climatological summaries for all the oceans and seas of the world.

# Artificial Cloud Formation Over Sea

By E. N. Lawrence, b.sc.

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Observations of 'ship-made' cumulus cloud, described during recent years in *The Marine Observer*[1–4] (see Table 1), illustrate some important and interesting aspects of the basic meteorological theory of atmospheric diffusion and cloud physics: that funnel exhaust does aid the formation and maintenance of the observed cloud is demonstrated by these repeated reports of the concurrence of such cloud over the ship with, and only with, an occasion when the ship's course and speed are similar to those of the wind (in other words, when there was zero wind shear relative to the heat source). The observed breaking away, dispersal and re-forming or growth of original cloud could be caused by small differences between the movement of ship and wind, due mainly to wind fluctuations, though these cloud changes may be related also to air currents in existing (natural) convection cells. The mutual assistance between artificial heat and natural convection is suggested by one of these observations[1] of smoke cloud rising only in the vicinity of natural tufts and merging with them. The same suggestion is contained also in another report[3, 5] of ship cumulus forming where and when the sea, viewed *in situ*, appeared chocolate-coloured and extremely opaque, due to marine organisms.[5] These may have been brought by up-welling cold water, caused by normal ocean current processes or occasional violent storms.[6] However, because the increased opacity of the water confines incoming solar radiation to a thinner surface layer, and because the organic matter may also produce certain significant changes in other physical properties of the surface layers (for example, thermal capacity, surface reflection, conductivity, viscosity—though lack of data prevents exact assessment of these changes), one might expect a locally increased sea surface temperature* which would, in turn, tend to increase local atmospheric convection.

Artificial cloud appeared to form either below the natural cloud formation[2] or lower than the level suggested by dry bulb (air) and dew point temperatures;[3,4] thus cloud base levels are influenced by the water content in exhaust gases, which contain about a gallon (10 pounds) of water for every 10 pounds of fuel oil burned.[7] This amount of water is about three times as much as that produced from the same weight of steam coal, but for the same rate of energy output or horsepower, oil produces only about twice as much water as coal.[7] In addition to the change-over from coal to fuel oil, more highly-powered vessels are being used, with the result that exhausts acquire greater thermal uplift and further increased water content. Hence, the earlier use of coal and lower power may explain the scarcity or absence of pre-war reports of ship cumulus: cloud base levels in Table 1 suggest that the additional moisture is more effective than the increased uplift in producing this type of cloud. However, the increased frequency of ship cumulus reports may be due merely to a larger number of marine observers.

The s.s. *Kenya* in East African waters (19°12′S, 36°12′E) on 27th August 1960 at 0630 GMT reported well-formed stationary cumulus over a vertically rising column of smoke on the shore.[8] Such cloud formation over land would be aided by little or no wind, while moderate or strong winds would tend to cause dispersal. Both artificial heat and additional moisture assist in the formation also of fire-cumulus over land. In his book on *Fogs, clouds and aviation*, Humphreys[9] states that in a forest fire, roughly a gallon of water is added to the air from every 15 pounds of fuel burned. Artificial (water) cloud may form more readily over sea than over land, on account of the greater tendency at sea for neutral stability, with adequate moisture, and because of the ship's ability to keep pace with the wind which may be maintaining these neutral conditions.

The current (1956) *International Atlas of Clouds*[10] contains a section on clouds from fires. It is stated therein that "In spite of the similarity of form between such fire clouds and cloud produced by ordinary convection (cumulus congestus and cumulonimbus), the former can easily be recognised by the rapidity of their development and by their dark colour". While this may be true of 'ship-made' cloud, stationary forest fire cumulus and the towering mushroom cloud from an atomic explosion or volcanic eruption, the intensity and direction of illumination and the type of background have considerable effects on cloud appearance (see for example, *The photography of air pollution*, by R. S. Scorer[11]), and identification is often inferred from the surrounding topography. When forest fire cumulus develops into massive cumulus or cumulonimbus and drifts far from its place of origin, it looks and behaves much like any other cumulus of similar stature.[10] In contrast, smoke cloud from forest fires in Newfoundland has been identified some 400 miles out to sea:[12] even the *smell* from the burning timber is known to have been strong at a distance of 600 miles from land (see ship reports[13,14]) and on one such occasion, it is said, the captain ordered a search of the ship. After travelling such long distances, smoke can retain its identity only under stable conditions, and particularly when light winds prevail. In very unstable conditions, and especially with strong winds, airborne particulate matter would be considerably diluted by turbulent diffusion. In general, with reference to fire cloud, neutral or slightly unstable conditions tend to be associated with cumulus (water) cloud, and stable conditions with stratified and predominantly smoke cloud (see, for example, the report from s.s. *British Dominion*[15]), but naturally smoke and water concentrations depend also on the type of fuel.

* In reference 5, the value quoted for sea temperature should read 67°F.

**Table 1. Ships' Observations of Artificial Cloud**

| Ship | Geographic Position | Date | Time (GMT) | Ship's Speed & Course | Wind: Speed & Direction | Air Temp. (°F) | Dew Point (°F) | Sea Temp. (°F) | Artificial Cloud (base in ft.) | Natural Cloud (base in ft.) | Remarks (artificial cloud) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| s.s. *Athelstane*[1] . | 35° 10′N 61° 12′W | 4.6.51 | 1400–1600 | 003° 11 kt. | 180° 11 kt. | 78 | | | Cu., 1500–2000 | Few small isolated tufts of Cu. | Not continuous; only in existing Cu. |
| s.s. *Himalaya*[2] . | 23° 31′S 104° 32′E | 4.1.59 | 0830–1005 | 320° 21 kt. | 140° 21 kt. | 80 | 64 | 75* | Small Cu., base rather lower than that of natural cloud | Some small Cu.† | Partial breakaways disappearing, and followed by continual regrowth of original cloud |
| m.v. *Rangitata*[3] . | 8° 45′S 79° 41′W | 15.5.60 | 1630 | 010° 16·3 kt. | 190° 16 kt. | 70·4 | 64 | 67·2 | Small Cu., 100–200 | 3/8 Small Cu., 1000–2000 | One temporary small cloud reported: (also sea discolortion[5]) |
| m.v. *Hertford*[4] . | 5° 50′S 67° 45′E | 24.5.61 | 0620 | 320° 17 kt. | 120° 18 kt. | 85·5 | 75 | 83·1 | Small Cu., 400 | 3/8 Mod./large Cu., 1000–2000 | Second cloud; third cloud at 0705 GMT |

* Interpolated value. † 3/8 small Cu., base 2000–3000 ft. at 1200 GMT.

Ship-made cloud may be compared also with contrails of aircraft; but although heat and water are added to the atmosphere by both vehicles, there are important differences in the physical processes of their formation. Long, persistent contrails tend to form almost immediately behind the engines, where cooling occurs partly by adiabatic expansion but mainly by very turbulent entrainment of cool, ambient air into the jet exhaust: whereas ship exhaust is cooled by more moderate mixing, and also by buoyant convection. However, deliberate formation of ship-made cloud to accentuate or to obscure a ship's position may be of greater practical application than corresponding aircraft manœuvres. Indeed, the aerial problem is rather to eliminate contrails.

One ship report[3] refers to the gradual variation from smoke to cumulus: it states that "the exhaust gases rising from the funnel were seen to change gradually from blue-grey to white, and after some minutes a small puff of what seemed to be fair weather cumulus formed over the vessel." The photograph opposite p. 33 shows a very similar transition in a smoke plume produced by a grass fire:[16] dark billowing smoke is merging up into a cloud with bulging light patches of condensation, which in turn merges into a white mass of normal cumulus above. These changes are illustrated, to some extent, in a photograph reproduced in *The Marine Observer*,[17] depicting cloud formation over the smoke trail of a moving vessel. In the regions of whitish cloud between the smoke and cumulus proper, limited condensation appears to occur in the smoke-laden atmosphere, in the same way that mist precedes fog formation by condensation on larger hygroscopic particles in a polluted environment, even though the relative humidity may be well below 100 per cent. The type of cloud in these whitish regions of limited condensation is sometimes referred to as fumulus (see, for example, *A course in elementary meteorology*[18]) but this term has not been used with consistent meaning, and was, in fact, originated in 1880 by Charles Ritter[19] to describe nascent cumulus cloud. The 'fumulus' controversy is more fully discussed elsewhere.[20]

The ships' observations of artificial cloud mentioned in this note were extracted from relevant issues of *The Marine Observer* from its first publication in 1924; though some references to artificial cloud over sea may have been missed, there certainly appears to be a dearth of photographs on this subject, particularly well annotated ones giving all relevant details, including, for example, time and location, ship and wind movements, temperatures and humidity, heights of base and top of artificial cloud (or corresponding distances and angles of elevation), height of base, etc., of any natural cloud, and the type and rate of consumption of fuel burned. Not the least of marine photographic difficulties is the restricted vantage area aboard ship, but a readily accessible camera may do much to overcome these disadvantages, at the same time providing, for the keen photographer, an interesting field of action in which he may help towards a better understanding of the physics of the lower atmosphere.

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# INTERNATIONAL ICE PATROL—1962

**from the Commander, U.S. Coast Guard**

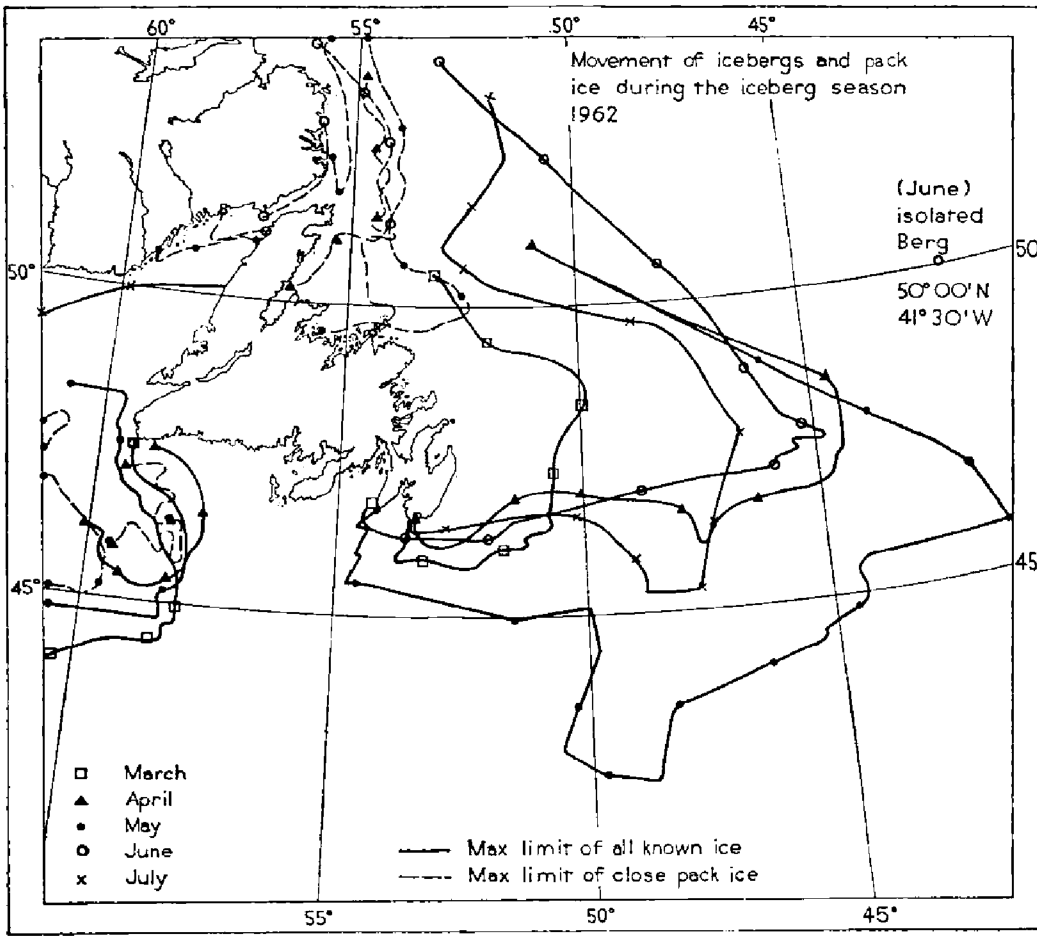
(The article below includes material summarised in our quarterly ice articles, but we are glad to have the authentic account of the 1962 season from the Commander of the International Ice Patrol, with local and operational details.)

Each year the International Ice Patrol operates from U.S. Naval Station, Argentia, Newfoundland during the period when ice is a threat to trans-Atlantic shipping. The date of the beginning of full operations varies from year to year, the average being about 1st March. Pre-season ice reconnaissance flights are made by the U.S. Coast Guard Air Detachment at Argentia and results reported to Commander, International Ice Patrol. On the basis of the ice conditions revealed by these flights, and by reports from ships, plans are made to start full services by the time ice appears on the north-east slope of the Grand Banks. Full services include regular aerial ice observation flights, the collection, analysis and plotting of pertinent ice information from several sources and informing shipping of the ice conditions.

In 1962, full services of the International Ice Patrol were begun on 5th March and continued until 22nd June. The first reports of ice in the Grand Banks region from merchant ships for 1962 were from the m.v. *Topdalsfjord* and the m.v. *Miami* on 27th February. Both reports indicated that strings of field ice had moved onto the Grand Banks east to 50°W and as far south as Cape Race. During the whole of March predominant north-easterly surface winds contained the pack ice and bergs close along shore and in the bays of Avalon Peninsula and north-east Newfoundland. Thus, there was no threat to shipping on the Grand Banks area except close along the east coast of Avalon Peninsula.

In April, a new pattern was established when the average surface winds became west-south-westerly driving the pack ice and many bergs from the bays and along the coast out to sea. In early April there were about 200 bergs in the area between Funk Island and Notre Dame Bay. Of the 170 bergs that were driven out to sea, it was expected that the majority would drift slowly to the south along Avalon Peninsula in the west branch of the Labrador Current. This was not the case as about half the bergs moved into the east branch of the Labrador Current drifting rapidly eastward between 48° and 49°N. The other half remained suspended between 48°30′N and 49°30′N from 52°W to the coast. By 18th April, there were 65 bergs to the east of 52°W, and by 25th April there were 85. As the bergs moved east along the north slope of the Grand Banks, the majority maintained easterly flow past 48°W and out of the Labrador Current which turned to the south-east and then south. Drifting into the warm waters north of Flemish Cap, the bergs rapidly melted. East of 48°W there were 42 bergs on 25th April, and only 14 five days later.

The feature of the year occurred on the last day of April and the first week in May when an intense stationary low developed east of Newfoundland causing 35 to 50 kt. northerly winds for six days on the Grand Banks, which drove the remaining offshore bergs to the south at a rate of 30 to 40 miles per day. The climax of the year was on 5th May when the southernmost and easternmost penetration of ice for 1962 occurred with a berg at 43°24′N, 49°14′W, and one at 45°45′N, 44°30′W. From this date until near the end of May the berg limits gradually retreated. Those bergs that had drifted east of the Grand Banks all melted by 11th May, and there were no bergs east of 51°30′W on that date. The bergs that




had drifted along the east coast of Avalon Peninsula and near Cape Race melted much more slowly in the cooler waters. By 20th May, only a few bergs remained south of 48°N and all were either aground or close along the east coast of Avalon Peninsula. A second movement of bergs eastward along the north slope of the Banks developed about this time and continued into June. The general movement of these bergs continued easterly and out of the main branch of the Labrador Current. These rapidly melted and none managed to drift south of 47°N. This second group of bergs were not necessarily another year group but were those bergs which normally would have arrived at the Grand Banks in April. Prior to this, the average winds in the vicinity of north-east Newfoundland were north-easterly, driving the bergs out of the axis of the south moving Labrador Current and retarding their trip to the south.

The field ice conditions on the Grand Banks were lighter than average. The close pack ice was generally confined north of 48°N and west of 52°W except for belts and patches occasionally drifting to the southern limit (which was 46°N on 7th March near Cape Race) and eastwards in the Labrador Current to the limit of 49°W on 20th April. The Grand Banks as far north as Funk Island was free of all field ice by 25th April although some scattered strings and loose patches drifted south-east to 48°30′N, 51°00′W near the end of May. Pack ice was slightly more difficult than usual in the Notre Dame/Belle Isle area. This was due to predominantly light northerly winds during May causing the supply to almost keep up with the melting. Usually the pack ice along the North Newfoundland and Labrador coasts drifts eastwards to warmer waters causing much disintegration; this did not occur in 1962.

The Gulf of St. Lawrence generally experienced a mild year except that Cabot Strait ice conditions were more severe than normal. By 28th March, Ice Central Halifax reported open water along the shipping track through Cabot Strait, the Gulf and into the River St. Lawrence as far as Quebec. By 20th May, the entire

Gulf was ice free except for Belle Isle Strait and some scattered bergs and growlers in Cabot Strait and along the west coast of Newfoundland. The consistent north-easterly winds during March and April drove an unusually large amount of bergs (estimated at about 100) into the Gulf by way of Belle Isle Strait. Some of these bergs eventually reached Cabot Strait and three were known to drift south through Cabot Strait into the Atlantic again before deterioration. Belle Isle Strait was not navigable until 14th June when the m.v. *Topdalsfjord* was the first merchant vessel to make passage for the season.

The main source of ice information is obtained from ice patrol flights. Meteorological conditions, however, do limit the use of aircraft for ice observation; there are many days when unsatisfactory ice observation conditions prevent effective aerial reconnaissance. During the past season, many valuable ice reports were received from surface vessels. Of primary concern to the International Ice Patrol are the bergs and growlers which are in the shipping tracks and/or near the eastern and southern limits of all known ice. These areas are searched by ice patrol aircraft as much as practicable, but with periods of low ceiling and poor visibility, satisfactory coverage is not obtainable. Much thought and effort by the Ice Patrol has been given to the problem of radar target identification without achieving the ability to identify radar targets as icebergs or as fishing vessels. Therefore, ice reports from surface vessels, especially during periods of ineffective aerial observation in the key areas, are most valuable and a very important part of the Ice Patrol in the relocation of dangerous ice and keeping the position of that ice up-to-date.

In addition to ice reports, all ships are urged to make regular four-hourly reports to Radio Station NIK during the ice season when between latitude 39°N and 49°N and longitude 42°W and 60°W, including ship's position, course, speed, visibility, sea temperature and weather condition. The visibility reports are valuable in planning ice observation flights. Visibility reports are also useful in deciding whether or not special warnings on ice conditions should be broadcast. Sea temperatures are used to construct isotherm charts employed in estimating ice deterioration and detecting shifts in the branches of the Labrador Current. Wind data are useful in estimating set and drift of ice and in forecasting weather for the purpose of planning ice observation flights. An up-to-date plot is maintained of all reporting ships. These ships can thus be warned directly when approaching dangerous ice.

Giving accurate and useful ice information to shipping depends not only on collecting and analysing pertinent ice information but also the ability to forecast the drift of ice as accurately as possible. The U.S. Coast Guard Cutter *Evergreen* conducts oceanographic surveys on the Grand Banks during the ice season, the main product of which is the sea surface current charts in the area. These current charts are valuable tools in forecasting ice drift. Also the wind effect must be calculated to determine resultant drift of ice. This year as in 1961, with the object of obtaining more accurate knowledge of water movement in the Grand Banks area, the *Evergreen* established three oceanographic deep-sea buoys on the Grand Banks; these are orange-coloured and show a flashing white light. Various oceanographic measurements were made including instantaneous current velocity and direction and sea temperature. The *Evergreen* made a special post-season oceanographic survey in Baffin Bay, Davis Strait and the Labrador Sea. The main purpose of this survey was to further knowledge on the water circulation and probable movement of bergs near their place of origin. Plans have been made for establishing seven oceanographic buoys on the Grand Banks from March to June 1963.

The International Ice Patrol will once again commence full services about 1st March 1963, depending on ice conditions at the time. Ice bulletins will be broadcast twice daily, at 0048 and 1248 GMT by U.S. Coast Guard Radio Argentia (NIK) on 155, 5320 and 8502 Kc/s. Each broadcast will be preceded by the general call CQ on 500 Kc/s with instructions to shift to receive on 155, 5320 and 8502 Kc/s. NIK will then transmit test signals and the International Ice Patrol radio call sign NIK for about two minutes to facilitate tuning. Transmission of the bulletin will then follow immediately at 15 words per minute and repeated at 25 words per minute. Prescribed radio silence periods will be observed. The format of the ice bulletin will generally be the limits of all known ice, the areas and limits of heavy concentrations, and the positions of individual bergs and growlers between the limits and heavy concentrations. The ice conditions broadcast will be as observed or reported during the date of the broadcast or estimated up to the broadcast time.

When deemed advisable, special ice bulletins may be broadcast in addition to those regularly scheduled. Such special ice bulletins will be preceded by the International safety signal TTT.

Ice conditions will be transmitted daily by facsimile at 1330Z on 5320 and 8502 Kc/s at a drum speed of 60 RPM. All ships receiving these transmissions are requested to post the facsimile chart copied, to the Commander, International Ice Patrol, Navy 103, FPO, New York, for evaluation purposes.

Merchant ships may call NIK on 500 Kc/s and 8M/c maritime calling band at any time; also 12 M/c band during daylight hours. Ships work 425, 448, 454, 468 or 480 Kc/s or their assigned working frequency. NIK will work 432 Kc/s, 8734 Kc/s or 12718·5 Kc/s. Duplex operation will be used. The surface patrol vessel, radio call sign NIDK, when on station will relay between NIK and ships when necessary. There is no charge for these services.

Throughout the ice season, U.S. Navy Radio Washington (NSS) will broadcast twice daily ice reports as furnished by Commander, International Ice Patrol at 0430 and 1630 GMT.

Until the International Ice Patrol services begin, all reports of ice sightings should be addressed to the U.S. Navy Hydrographic Office, Washington, D.C. and thereafter to Commander, International Ice Patrol (NIK).

Aerial ice reconnaissance and broadcasting of ice information for shipping is also done by the Canadian Department of Transport. This organisation, during the period from December 1962 to June 1963, will operate mainly in the Gulf of St. Lawrence and approaches and the coastal waters of Newfoundland to the entrance of Hudson Bay. Details of these services are available in "Guidance to Merchant Ships Navigating in the Gulf of St. Lawrence", published annually by the Marine Operations Branch, Department of Transport, Canada, and in "Radio Aids to Marine Navigation".

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## THE ICE AND SEA TEMPERATURE CHARTS OF THE MARINE DIVISION

By G. A. Tunnell, B.Sc.

(Marine Division, Meteorological Office)

To meet the needs of British trawlers, British naval and merchant ships and the Climatological Research Branch of the Meteorological Office and to give adequate replies to day-to-day enquiries, the Marine Division of the Meteorological Office produces at the end of each month a chart giving the distribution of sea ice, sea surface temperature and the vertical variation of sea temperature over sea areas in and around the North Atlantic Ocean.

The chart which has been produced with the help of the Cartographical Drawing Office of the Meteorological Office and the Photographic Reproduction Branch of the Air Ministry is in four colours, red, blue, green and brown. The front of the chart gives the distribution of pack-ice and icebergs plotted in code with two inserts giving a detailed analysis of the occurrence of ice over the Great Bank and in the Baltic Sea. On the reverse side of the chart, monthly averages and variability of sea temperature are plotted up to a depth of 1,000 feet, with two further diagrams giving the vertical and horizontal distribution of temperature observed by Weather Ships going to and from station.

## Sources of Ice Data

Information concerning the distribution of ice at the end of each month is obtained from many sources. These include the countries of the Baltic Sea, the Canadian Meteorological Service, the United States Hydrographic Office, the Norwegian Meteorological Service and the Meteorological Services of Denmark and Greenland. Reports are received by radio, facsimile chart, teleprinter and by post. Observations are made by naval and merchant ships, trawlers and land stations. Very detailed information is received during the ice season from the International Ice Patrol of the United States Coastguard and ships and aircraft of Canada and the United States now provide increasing amounts of very valuable data from Baffin Bay, the Canadian Arctic and Greenland. For some time we have been receiving ice reports from Spitzbergen and Bear Island from the Norwegian Meteorological Services station at Tromso and we hope in the near future to get Russian observations from the Barents Sea relayed from Murmansk Radio, which we are unable to receive direct.

## Plotting of Ice Data

The map is intended to show the ice situation at the end of each month, but data observed within a week either way of the last day of the month are included and plotted in green.

The code has been built up to fit the International Ice Nomenclature of the W.M.O. and follows procedures developed in Canada and the United States and the Baltic States of Europe. For completeness where actual observations are not available ice conditions are estimated from meteorological averages, climatic normals and ice atlases. Where earlier observations and adequate meteorological observations are available, these are entered in green without an outline or with an estimated limit if possible. Conditions in some areas are almost unknown and these are shown in blue. The latter are based almost completely on meteorological data and ice atlases. Two ice islands of the U.S.S.R. whose random day-to-day motions and resultant displacement are given, give an indication of the movement of ice within the polar basin.

Throughout the year we keep an iceberg count and note the movement of pack-ice on to the Great Bank. The occurrence of icebergs in each 1° latitude and longitude square over the Bank are shown on the inset map. These are based almost entirely on broadcasts from Washington and Halifax of North Atlantic ice observed by ships, augmented by facsimile maps of aerial reconnaissances of the Canadian Meteorological Service and United States Hydrographic Office, broadcast from Halifax. During the Atlantic ice season icebergs and pack-ice sightings are obtained via Washington and Halifax from the International Ice Patrol. Almost all our information is later confirmed by post.

We are able to follow the ice situation day by day and to enter on the inset map the limits of movements during the month of both icebergs and close pack, moving southwards from the Davis Strait. Manuscript reports, from British ships, of additional bergs received some months later, show that we are able to record only a fraction of the icebergs that exist, but by plotting those broadcast each day we endeavour to estimate somewhat subjectively iceberg tracks and speed of drift. These are also shown on the ice chart. Generalised tracks are given on the main chart and individual tracks on the inset maps.

We are endeavouring to find how representative of the whole distribution are our reports of icebergs. At present we believe they give an indication of the severity of the season and where dangerous concentrations of icebergs exist, but clearly they are functions of the most frequent shipping tracks as well as the distribution of ice. Squares from which there are no reports may often contain many icebergs.

The second inset map gives the distribution of ice in the Baltic Sea at the end of the month plotted in our own code. We receive data by teleprinter in the special local Baltic code which provide reports from land stations and sea areas. We have adapted our plotting code to make a representation of these reports possible and a fairly satisfactory map results.

### Sea Surface Temperature Observations

Our new combined Headquarters at Bracknell has provided us with easy access to a wonderful source of data whereby the fluctuations of the ice situation may be compared with the weather and sea temperature variations. Hundreds of sea temperature observations are received from ships by the Forecast Branch and we select ten days which correspond with two consecutive five-day periods, or pentades, near the end of the month (the year can be divided into 73 consecutive five-day periods called pentades) and compute average sea surface temperature over these periods for each 1° square of latitude and longitude. These values make it possible to draw isotherms (in red) on the ice map over the Atlantic and seas adjacent to the ice. We hope in the near future to give an indication of the difference from normal. The isotherms provide a good indication of warm and cold water masses and movements and developments of the ice.

### Bathythermograph Soundings

On the reverse side of the ice map are graphs of the vertical variation of monthly average sea temperature and its variability plotted on a grid with temperature and depth along respectively horizontal and vertical axes. It will be noted that each curve has its own temperature scale, enabling many curves to be plotted on the same graph. Data for these curves are provided by North Atlantic weather ships which take regular soundings by means of the Spilhaus Bathythermograph. Average values, at standard levels, for Weather Ship Stations A, I, J, B and C are included with variability. Where possible the deviation of the average from a short period normal is also given. Observations at stations A, I and J are made at 0900 to 1000 GMT and 2100 to 2200 GMT, while observations taken at 0000, 0600, 1200 and 1800 GMT are used to compute values for stations B and C. Spilhaus Bathythermographs are subject to zero errors and systematic errors which vary with depth. To eliminate the constant zero error the temperature recorded at each sounding at the surface is compared with a simultaneous bucket temperature reading and corrected. This may amount to several degrees. (When a bucket temperature is not available a condenser intake reading is used; aboard the British weather ships bucket temperatures are always available.) It has also been noted that two bathythermographs may differ at the bottom of a sounding by an additional plus or minus 1°C, after the bucket correction has been applied, when lowered together. In practice, when more than one instrument has been used this error affects both the average value and the variability. Maxima of variability usually indicate some significant phenomena but a systematic error in the bathythermograph can produce an erroneous increase in variability.

Average values, deviations from normal and standard deviations about the average are computed for every 50 ft. down to 500 ft. and then every hundred feet beyond this. It is usually possible to obtain values at fixed levels from stations A, I and J but from stations B and C and frequently from stations A, I and J observations are only available from depths where there is a significant change in the vertical rate of increase or decrease. Values for fixed levels are then interpolated. The difficulties described above arise because data are often only received, sufficiently early for publication, by signal.

Two further diagrams give a record of sea temperature soundings made by weather ships in passage to and from station. These make it possible to observe changes in the vertical and horizontal distribution of sea temperature over a fixed track.

### Weather Statistics

The Climatological Research Branch of the Meteorological Office provides maps of surface atmospheric temperature anomalies for successive five-day periods (pentades) based on a mean of day temperatures and covering a large part of the Atlantic side of the northern hemisphere. We have used these maps to compute the total of centigrade-degree-days for the period of sustained frost, i.e. the period over which the daily mean temperature remained permanently below 0°C. If, in any five-day period, the mean temperature is above 0°C, degree days are subtracted from the seasonal total as necessary. Should the total then become zero, the frost is considered not to be sustained and the total of degree days is terminated and resumed when the five-day mean falls more permanently below 0°C.

It has been found impossible to get daily averages of temperature for sufficient number of Baltic stations so that values given in the inset Baltic ice map are based on observations at 0600 GMT. Unfortunately, these do not always agree with the isopleths constructed from the maps of the Climatological Research Branch which contain a good deal of smoothing and are based on daily averages. The two sets of degree days must, therefore, be considered separately. Each, however, gives qualitative measures of first the probability of ice formation and later the rate of increase in ice thickness; they also indicate the severity of the season (isopleths of degree days are included in green). As the concept of degree days is somewhat complex and as they are the result of the total effect of the weather over a considerable period the 0°C isopleth of surface air temperature averaged over the same two pentades as the sea isotherms is included in red. This provides a measure of the distribution of atmospheric temperature towards the end of the month under consideration. To practical seamen it also reveals, in conjunction with sea temperature isotherms, the risk of deposition of ice upon a ship's upper-works.

The ice and sea temperature charts are published approximately one month after the month for which they provide information. However, large dyeline copies are available within a week of the end of the month and these are distributed to trawlers. Each edition is available for the cost of reproduction. The 1962 Charts have been given the publication numbers M.O. 733 (a to l).

## ROUTEING CHARTS

The Meteorological Office is co-operating with the Hydrographer of the Navy in the production of a new series of charts, to be known as 'Routeing Charts'. These have been specifically designed to meet the requirements of British Merchant Shipping and in particular of tanker fleets, the object being to give the mariner as much information as possible on one chart to assist in the planning of an ocean voyage. This is particularly important to tanker masters, who frequently get their orders at fairly short notice and are sometimes required to change their destinations at the last moment.

For the planning of an ocean voyage masters of merchant ships require to know not only the shortest routes but also the international load line zones and the meteorological conditions likely to be encountered in any particular month. These charts have therefore been designed to show the main great circle and steamship routes, with distances indicated, the relevant load line zones and meteorological information, based on data provided by the Meteorological Office, in the form of wind roses, ocean currents and limits of berg and pack ice, with insets showing mean sea and air temperatures, barometric pressure, dew point temperatures, percentage frequency of fog, low visibility and strong winds and tracks of some selected hurricanes. An important consideration nowadays for merchant ships is the agreement signed in 1954, with further recommendations in 1962, prohibiting the discharge of persistent oils in certain zones of the sea, and these zones have also been depicted on the chart to give visual guidance to ships' masters in interpreting this regulation.

Although all this information has been available hitherto it is contained in various publications and cannot easily be extracted when speed is essential in planning, or circumstances require an alteration in routeing. It is hoped therefore that the portrayal of the information on one chart will ease the lot of ships' masters.

The first series of Routeing Charts covers the North Atlantic Ocean from 67°N to 15°S and including the Mediterranean Sea, and it is the intention to publish one for each month. The chart for September is already available and the December one will be published early in November. These will be followed by charts for March and June and then the remaining months, which it is hoped will all be published within the next two years. Later it is intended to publish similar charts for the South Atlantic Ocean, the Indian Ocean and the North and South Pacific Oceans. If possible some of these will be brought out before the completion of the North Atlantic series, though no forecast can be given at present of the availability of charts of these areas. It is hoped, however, to publish the first of the South Atlantic series before the middle of 1963.

These charts are being prepared by the Hydrographic Office and are on sale at a cost of 10*s.* each at any of the Admiralty Chart Agents. M. H.

## CHAS. HILL & SONS, LTD.

For some years past we have endeavoured to publish annually in *The Marine Observer* photographs of three ships of the same name and ownership, each of which in her day has been a voluntary observing ship.

Though many owners have repeated names for their new construction, only in a few cases have three ships of one name carried our instruments. This series has now therefore had to be brought to an end.

In future years we intend to publish pictures of an owner's first observing ship, their latest observing ship and one in between. Where possible, the pictures will span a century of observing.

The new series starts opposite page 44 with three ships belonging to Messrs. Chas. Hill & Sons of Bristol, now known as the Bristol City Line. This is one of the oldest shipping companies on our registers, for it was as long ago as 25th June 1857 that our agent at Bristol lent a set of instruments to their full-rigged ship *Transit*, Captain I. M. Thompson. Meteorological logbooks were received from her from 1858 to 1861 when Captain Thompson appears to have taken the instruments to his next two commands in the company, the *Albion* and *British American*. This was a common practice in those days, when the supply of instruments was limited and the loan was rather more a personal one to a shipmaster than to a ship, rather similar to our present system with trawlers. Unfortunately no photographs of any of those three ships which observed for us in our earliest days can be traced and the first observing ship of the company of which a picture is available is their *Pride of Wales*. This is reproduced as our first picture. She was a full-rigged ship of 885 tons, built in Quebec in 1865.

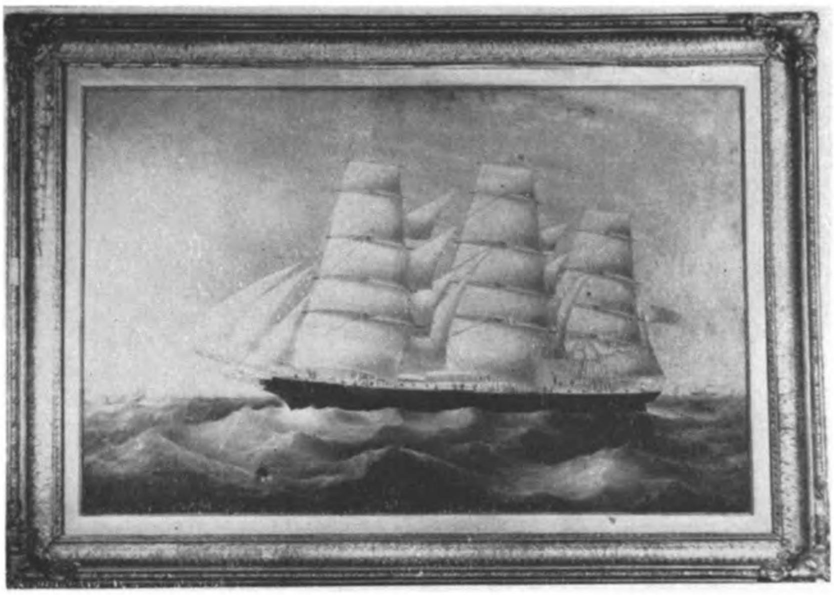
Her only meteorological logbook was received on 18th October 1871 and covered a year's voyage to Buenos Aires, Rangoon and home under the command of Captain E. J. Bolt.

Our second picture is of Chas. Hill's *Chicago City*. She was a steel steamer of 2,324 tons, built in Sunderland in 1898.

Her first meteorological logbook came to us on 28th November 1901 and, under the command of Captain W. M. Hunter, she remained as a voluntary observing ship for the next two years, all of which she spent on the North Atlantic run, the Bristol City Line's present trade.

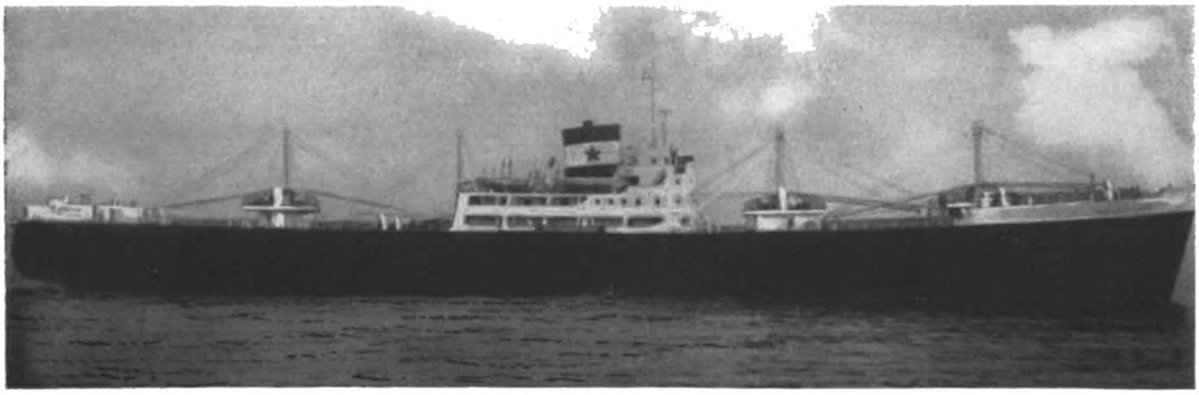
The third picture is of the company's newest observing ship, the *Bristol City*. Of 5,887 gross tons she was built at South Shields in 1959 and, under the command of Captain J. M. Ramsay, she joined the voluntary observing fleet after her second Western Ocean voyage. She has received excellent awards for two of her three years observing.

We take this opportunity of recording our gratitude to the masters and officers



*Pride of Wales*

*Chicago City*



*Bristol City*

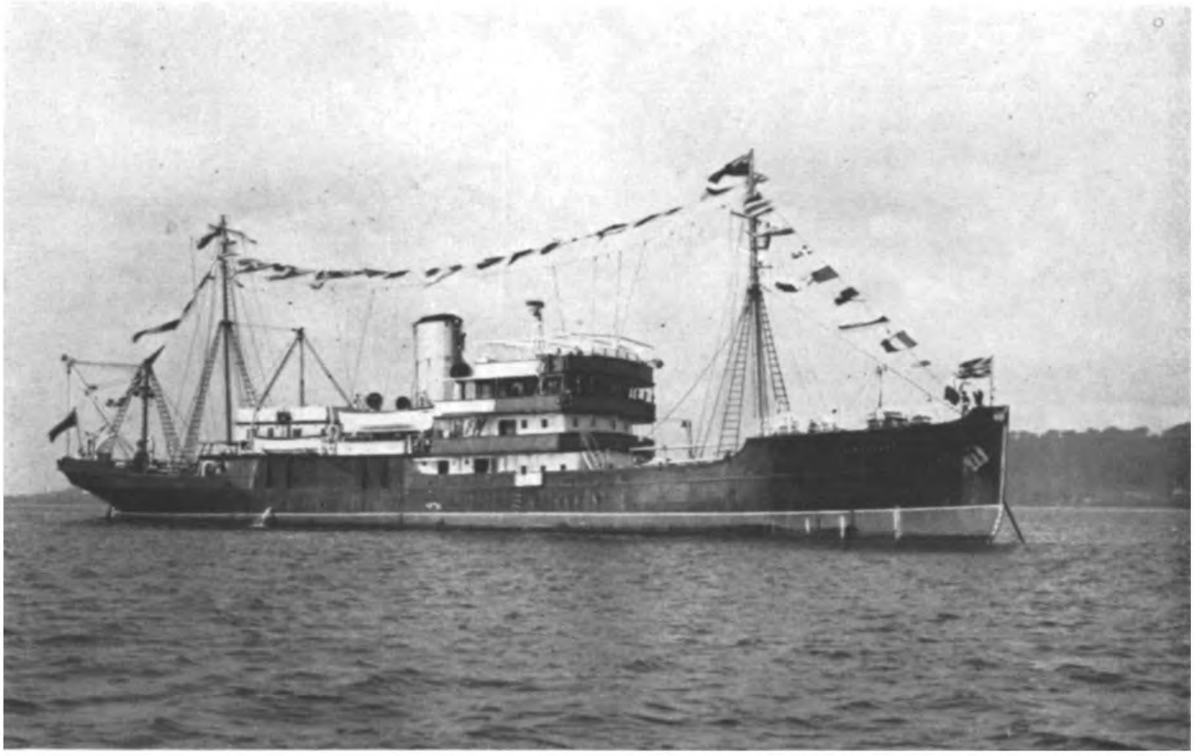
THREE SHIPS OWNED BY CHAS. HILL AND SONS (see opposite page).

(*facing p.* 44)

*By courtesy of Sky and Telescope*

Comet Seki-Lines, 1962c.

*Photo by Alan McClure*



*By courtesy of the National Institute of Oceanography*

RRS *Discovery II* (see opposite page).

of Chas. Hill's for their valuable voluntary work on our behalf for 105 years. Their contribution is admirably carried on today by the company's entire fleet of five vessels all of which are observing for us.

We are indebted to the company also for the pictures of the three ships, that of the *Pride of Wales* being, as will be seen, a photograph of an oil painting in their possession. L. B. P.

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# The Royal Research Ship "Discovery II"

By H. F. P. HERDMAN, D.SC.

On 12th September 1962 the *Discovery II* was finally paid-off from the service of the National Oceanographic Council, after an active life of almost 33 years. Originally built for the Discovery Committee, Colonial Office, by Ferguson Brothers, of Port Glasgow, as a research ship, and with Class I strengthening for navigation in ice, she was laid down early in 1929, was completed late in November the same year and within a few weeks (14th December) sailed on her first commission to Antarctic waters, where she was to examine the habitat of the whale.

This was to be the first of six such 2-year commissions, five of which were completed before the Second World War and, with the completion of the sixth in 1951, a major biological and physical survey of the Southern Ocean had been made. Outstanding problems still remain, of course, but these do not materially affect the overall picture now available in respect of the distribution of whale food, the configuration of the sea bed and the general circulation of the ocean. On all the cruises, the *Discovery II* was a Selected Ship for weather observations, in voluntary co-operation with the Marine Division of the Meteorological Office. Twice was the Antarctic continent circumnavigated in winter—in 1932 and 1951—and further winter observations on or near the ice-edge were obtained south of Cape Town during a series of repeated cruises in the winter months of 1938. It is probable that the meteorological logs kept during these periods form the greater part of the meteorological information even now available from such high southern latitudes in winter—in oceanic areas.

A further voyage close around Antarctica was made in the summer of 1938–39 and the meteorological observations then obtained must be of considerable value. The meteorological data from the logbooks has been punched onto Hollerith cards and is used as and when necessary for climatological purposes. Moreover, whenever the ship was within the zone appropriate to sending weather reports to Australia, New Zealand or South Africa, coded messages were sent. Since *Discovery II* was normally approaching from a westerly or south-westerly direction, and from areas from which incoming weather reports were virtually nil, the information was much appreciated by the meteorological offices concerned.

In 1938–39 meteorologists from the countries mentioned above accompanied the ship on the appropriate sectors of her summer circumpolar cruise and, in 1950–51 several research officers from New Zealand made a series of experimental observations between Dunedin and Macquarie Island.

During the six voyages made to the Southern Ocean in all seasons, and often in unpleasant weather, much data was collected on the subject of pack-ice, more especially with regard to its distribution, and the relation to meteorological conditions—particularly in winter. This information has been published separately by Mackintosh and Herdman,[1] and by Herdman,[2,3] but a brief mention can be made here.

Few ships cruise in the neighbourhood of the Antarctic pack-ice in winter from choice—or indeed in the course of their normal activities. Meteorological data from shore stations on Antarctica is, of course, now obtainable, but information on weather conditions to seaward of the pack-ice still is, as it was then, extremely scarce. For instance, wide variation was found in the conditions under which the sea freezes in winter although it is suspected that the sea surface temperature may affect formation more than very low air temperatures and the direction of the wind. Then there is the variable position of the ice edge not only from season to season but from month to month, and whether this derives from local conditions of weather, or from variations in the surface temperature, remains a matter of conjecture—and will remain so until much more data are available. It is interesting to note that the *Discovery II*'s observations on pack-ice and on the movement of the water masses of the Southern Ocean have confirmed the existence of a tongue of ice stretching out east from the Weddell Sea, which was first recorded by Captain Cook during his circumnavigation of Antarctica in 1772–75. It is virtually certain, however, that he was quite unaware of the significance of his discovery (Herdman[4]).

During the war *Discovery II* was requisitioned for service as an armed boarding vessel and was stationed to intercept ships on the northern route, via the Denmark Strait—a very suitable area for a ship built for the Antarctic—but life on board for a crew nearly four times the normal complement must have been a little trying. It must also have been difficult, in such a lively ship, to lower a boat and get a boarding party away. Released from this service in 1942, she was re-fitted for service with Trinity House and, during this period, she was for a time stationed in Iceland, laying buoys at a convoy anchorage. She also suffered damage from a 'near-miss' by a mine off the east coast of England. Later, she was transferred to the Irish Light Commissioners' service and, after returning to Trinity House, was eventually released for re-conversion to a research ship in 1948. To rebuild the *Discovery II* took nearly fifteen months; the accommodation being modernised and mechanical ventilation introduced, as far as space would permit. Unfortunately, it was not possible to increase the space occupied by laboratories and, for the next 12 years, it has been increasingly difficult to fit in all the scientific instruments now essential for our work.

As already mentioned, the last of *Discovery II*'s Antarctic cruises took place in 1950–51, and a circumnavigation of the continent in winter was successfully completed in generally unpleasant weather. Only the Master, the Senior Scientist and the Bo'sun had had previous experience of working under Antarctic conditions, which rather slowed down the work in the earlier stages of the cruise.

While the Institute of Oceanography was getting into its stride, the *Discovery II* was laid up for a year (1953–54), and on commissioning again was employed continuously in home and North Atlantic waters until paid-off finally in September of this year. She remained a voluntary observing ship during this period and in February–March 1955 she was chartered by the Meteorological Office and did a successful tour of duty as an emergency weather ship at Station 'K'.

In this more recent period of *Discovery II*'s career she was more often used for testing prototype instruments and equipment than for taking routine oceanographical observations. Among other new instruments tried out was the shipborne wave recorder, now an established instrument on a world basis (Deacon[5]), a precision deep echo-sounder, a new method of measuring deep ocean currents using a neutrally-buoyant float, a plastic reversing deep sea water-bottle (now in production), and a depth of net indicator. Experiments have also been made in the location of fish shoals, and the same transducer—which is stabilised against rolling—has also been used successfully to scan the bottom on the continental shelf. Much of this work has brought co-operation with scientists from outside the N.I.O. Admiralty research staff, staff and research students from the Universities, Fisheries Laboratories in England and Scotland and the marine research laboratories are among those in this country who have collaborated with the Institute. Other visitors included scientists from Australia, New Zealand, the United States of America, South Africa, France, India, Norway and Sweden.

Routine oceanographical surveys made by the *Discovery II* have included deep current measurements in the Gulf Stream, a number of major cruises in the North Atlantic, in collaboration with the Woods Hole Oceanographic Institution, as part of the oceanographic programme of the I.G.Y., and participation in the international Iceland–Faeroe ridge overflow expedition ('Operation Overflow').

It has been difficult shortly to encompass all that the *Discovery II*, and those who have manned her—both ship's company and scientists—have achieved in the thirty-three years of her life. Much of the work has been carried out under arduous conditions, both for ship and men, and it is a tribute to her designers, and to her builders, that she has served science for so long and so well. Many, especially those who served in her on the long pre-war cruises, will regret her passing. She was not, perhaps, the most comfortable of vehicles in which to travel or work; her design, while producing a 'safe' ship for ice navigation or work in stormy seas, did not, perhaps, lend itself to the provision of as stable a working 'platform' as modern oceanographical research demands. She was, however, able to keep the seas, and work efficiently, in weather which would have daunted most other research ships.

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## NOTES ON ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN FROM JULY TO SEPTEMBER 1962

### Relevant Weather Factors

*July.* Pressure was in general above normal over the Polar Basin during July. During the latter half of the month depressions moved eastward south of Iceland and from north-west Europe into the Polar Basin. Shallow depressions were experienced throughout the month over eastern Asia and the Pacific side of the Polar Basin, while weak anticyclones developed, to the west and north of Scandinavia, off eastern Greenland and over the Russian side of the Polar Basin. Atmospheric surface temperatures over western Europe and the Russian side of the Polar Basin were abnormally low but over northern Canada and Baffin Bay they were above normal. Several inches of precipitation above normal fell on the Pacific side of the Polar Basin; including over Alaska and north-east Russia. Sea temperatures in the Davis Strait and the eastern half of Baffin Bay continued above normal.

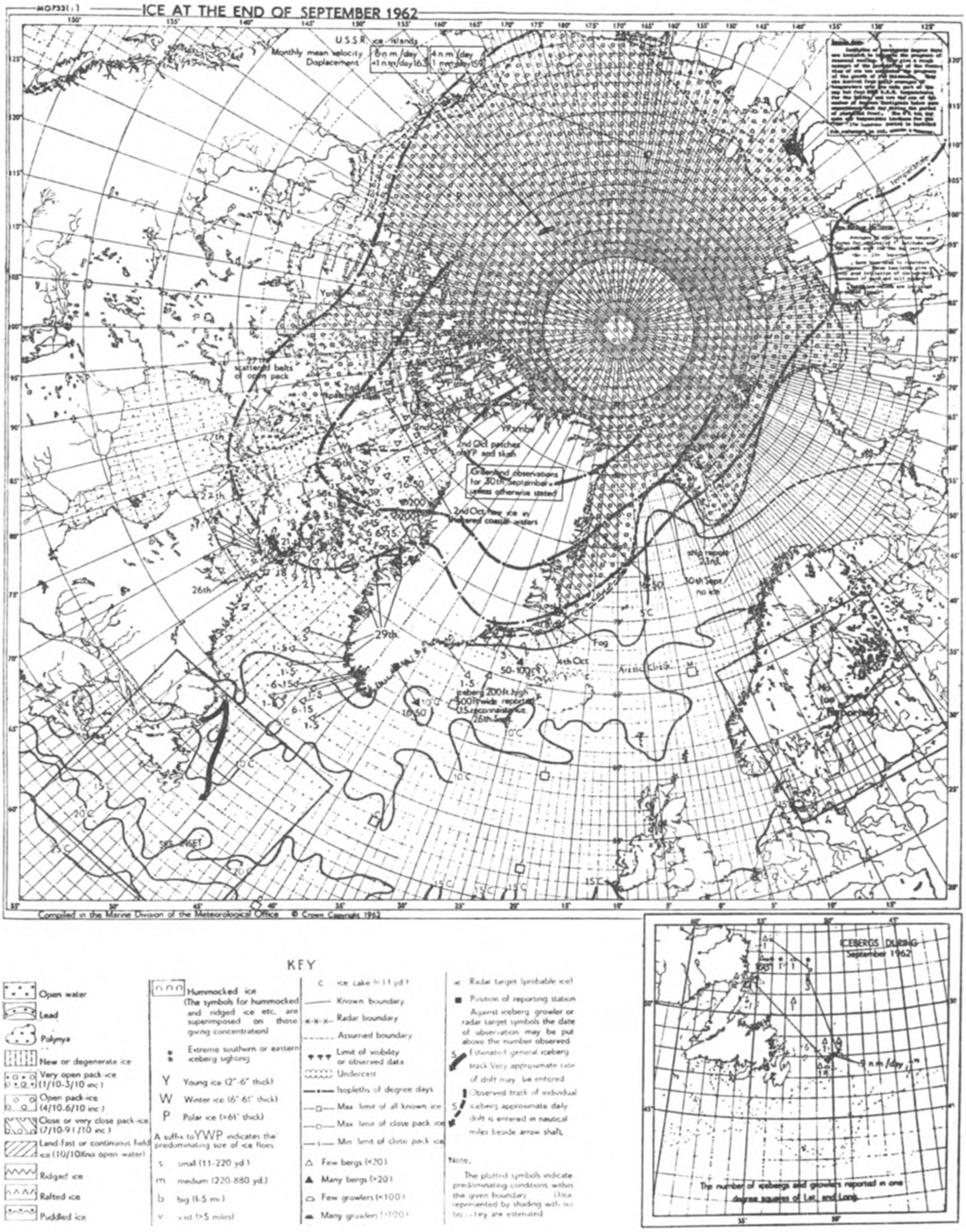
*August.* Shallow depressions tended to develop over the whole of the northern hemisphere north of 65°N but numerous cyclones followed a definite track from Hudson Bay south of Iceland thence to the Kara Sea and into the Polar Basin. Pressure over Greenland declined but remained high over north-east Russia. There were no material changes in the distribution of atmospheric temperature. The Russian side of the Polar Basin remained cold and northern Canada was warmer than normal. Abnormally large precipitation continued over Alaska and the adjacent Arctic Sea.

*September.* Pressure was low across northern Canada to Greenland and north-west Europe but was building up over north-east Asia and the adjacent Arctic Sea. The depression track described above moved northwards and towards the end of September depressions were moving north-eastwards towards the Polar Basin between Greenland and Scandinavia. There was a very great increase during September in the area whose 10 day average atmospheric surface temperature was below 32°F (0°C); this finally included the whole of the Polar Basin, north-east Canada, Baffin Bay and the northern half of Greenland.

### Canadian Arctic Archipelago including Baffin Bay and Hudson Bay and Strait

*July.* Over the whole area there was an abnormally rapid increase in open water. Continuous fast-ice remained over the continental shelf in the far north. Very little pack-ice remained in Hudson Bay but the amount of close and heavy pack-ice was almost normal in Foxe Basin and off the north-east coast of Baffin Island. Most of Baffin Bay, however, was open-water at the end of July. Individual land-stations reported up to 100 icebergs off the West Greenland coast but more than 200 were observed locally at the end of July near the glaciers towards 70°N. There were reports of large numbers of icebergs and growlers (more

*Note.*—The notes in this article are based on information plotted on ice charts each month, similar to the map below, but on a much larger scale (18 in. × 13 in.), and printed in four colours. They are available at the price of reproduction on application to the Director-General, Meteorological Office (M.O.1), London Road, Bracknell, Berks. Alternatively, they may be seen at any Port Meteorological Office or Merchant Navy Agency




—— o —— Air temperature: 0°C isotherm (mean for 18th–27th September).

—— · —— Air temperature: degree days, °C.

———— Sea temperature, °C, for 18th–27th September. These isopleths give an indication of the monthly movement of warm and cold water.

— — — Sea temperature, as above, but only estimated values.

than 20 icebergs at a sighting and more than 100 growlers) off Baffin Island but the number of icebergs circulating in Baffin Bay appeared to be below normal.

*August.* The very rapid clearance of pack-ice over the whole area continued even among the islands of the far north of the Arctic Archipelago. Considerable pack-ice remained at the end of August in Smith Sound and Kane Basin (i.e. the northern entrance to Baffin Bay). There was little change in the distribution of icebergs in Baffin Bay but large groups were reported in Hudson Strait south of Baffin Island at the end of the month.

*September.* Rapid seasonal changes occurred during September with the general fall of surface atmospheric temperature described above. Young ice developed rapidly round the islands of the Canadian Arctic Archipelago, in Smith Sound and Kane Basin but the amount of open-water in Baffin Bay, Hudson Bay and Foxe Basin remained well above normal. There was a general fall in sea temperature in Baffin Bay and Hudson Strait from the west but it continued above normal.

Much information is available concerning the iceberg populations at the end of September. Reconnaissances reported groups of up to 64 icebergs off the east coast of Baffin Island, although only isolated bergs were observed in Hudson Strait. Concentrations of icebergs were also observed in Jones Sound (north of Devon Island). Off the east coast of Greenland more than 200 bergs continued to be observed by land stations towards and north of 70°N (adjacent to the glaciers) but there were few reports of icebergs by individual land stations north of 75°N. It therefore appears that at the end of September the over-all number of bergs in Baffin Bay was probably less than that at the corresponding time in 1961.

### Davis Strait

*July–September.* The whole of Davis Strait was free of pack-ice during this period. This is somewhat abnormal and associated with high sea temperatures. This situation appeared to be changing towards the end of September. Up to 50 icebergs were observed off Greenland by individual land stations, and only isolated groups of icebergs (less than 5) moved southwards off the Labrador coast towards the edge of the Great Bank.

### Belle Isle Strait

*July–September.* Icebergs and growlers continued to move through the Strait; some penetrated into the north-east arm of the Gulf of St. Lawrence in July but there were no reports of this in August and September.

### Great Bank and East Newfoundland Coast

*July–September.* This area remained free of pack-ice although sea temperatures were below normal. Small numbers of icebergs moved south and south-eastwards from the Labrador coast towards the Great Bank. In July small groups of bergs (usually less than 5) penetrated over the northern half of the Great Bank to south of 46°N. The number moving south and their southward and eastward penetration decreased until at the end of September only isolated bergs approached the northern edge of the Great Bank. Both the numbers of bergs drifting southwards and eastwards, and the extent of their southward drift was well below normal.

### Greenland Sea

*July.* The area of fast-ice off eastern Greenland was below normal but the area of the polar pack moving southwards along the coast extended out to the Greenwich Meridian and almost to Jan Mayen and was considerably in excess of normal. Individual land stations of eastern Greenland observed up to 50 icebergs moving southwards within the pack-ice. Very small amounts of pack-ice and small icebergs were reported west of Spitzbergen.

*August.* By the end of August there was a small decrease in the area and mass of both the fast-ice and the polar pack, but the extent of the latter remained above normal. There were no reports of icebergs.

*September.* At the end of September the area of fast-ice had increased off eastern Greenland and the area of pack-ice increased slightly and remained above normal. Individual land stations reported up to 50 icebergs moving southwards within the polar pack.

### Denmark Strait

*July.* Abnormally warm water moved into the Straits from the south almost continuously. They were ice free south of 65°N but to the north, extensive polar pack containing icebergs extended half-way across the Strait from the Greenland coast.

*August.* Very little change from July but a general dispersal of polar pack occurred north of 65°N. Large individual groups of icebergs (more than 20) were observed from the air within and beyond the polar pack moving south-westwards towards Cape Farewell.

*September.* Warm water (several degrees above normal) continued to move into the Straits from the south. Individual land stations observed up to 100 icebergs moving south-westwards along the coast towards Cape Farewell. There appeared to be no material change in the area of pack-ice off eastern Greenland which continued somewhat in excess of normal north of 65°N.

BARENTS SEA

*July–September.* Most of the Barents Sea remained ice free but polar pack moved continuously south-westwards east of Spitzbergen. Isolated icebergs moved south within and beyond the pack. Meteorological reports suggest that in the north of the area the mass and extent of polar pack-ice between Spitzbergen and Franz Josef Land was in excess of, and extended further south generally than normal.

BALTIC SEA

*July–September.* No reports of ice received.

**Icebergs Sighted by Merchant Ships in the North Atlantic**

*(This does not include radar targets)*

| LIMITS OF LATITUDE AND LONGITUDE | | DEGREES NORTH AND WEST | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 58 | 56 | 54 | 52 | 50 | 48 | 46 | 44 | 42 |
| Number of bergs reported south of limit | JULY | * | > 279 | > 263 | > 263 | > 255 | 139 | 0 | 0 | 0 |
| | AUGUST | > 95 | > 95 | > 91 | > 44 | 3 | 0 | 0 | 0 | 0 |
| | SEPTEMBER | > 28 | > 28 | > 28 | > 11 | 4 | 1 | 0 | 0 | 0 |
| | Total | * | > 402 | > 382 | > 318 | > 262 | 140 | 0 | 0 | 0 |
| Number of bergs reports east of limit | JULY | > 279 | > 258 | > 258 | > 193 | 133 | 58 | 12 | 1 | 1 |
| | AUGUST | > 95 | > 92 | > 47 | 30 | 1 | 0 | 0 | 0 | 0 |
| | SEPTEMBER | > 28 | 26 | 5 | 4 | 2 | 0 | 0 | 0 | 0 |
| | Total | > 402 | > 376 | > 310 | > 227 | 136 | 58 | 12 | 1 | 1 |
| Extreme southern limit | JULY | 45° 20′N, 48° 45′W on 18.7.62 | | | | | | | | |
| | AUGUST | 49° 06′N, 50° 06′W on 30.8.62 | | | | | | | | |
| | SEPTEMBER | 47° 50′N, 50° 10′W on 11.9.62 | | | | | | | | |
| Extreme eastern limit | JULY | 47° 43′N, 46° 32′W on 1.7.62 | | | | | | | | |
| | AUGUST | 52° 00′N, 42° 07′W on 20.8.62 | | | | | | | | |
| | SEPTEMBER | 48° 10′N, 49° 43′W on 6.9.62 | | | | | | | | |

* Probably large numbers, but none sighted in excess of those reported in further south positions or in further east positions.

> ("greater than") has been inserted where there is some doubt as to the actual number of icebergs at some of the sightings, but the true value is probably greater than the value given.

# Book Reviews

*Sea Birds of the South Pacific*, by P. P. O. Harrison. 7½ in. × 5 in. pp. 140. *Illus.* Royal Naval Birdwatching Society, 1962. 15*s*.

Captain P. P. O. Harrison of the New Zealand Shipping Company, whom we had the pleasure of introducing to the R.N.B.W.S. some years ago when, as master of the *Kent*, he supplemented his meteorological logbook with several pages of scholarly ornithological observations, has produced this book with the object of giving "Seafarers an added interest to their already interesting life; and to other travellers an added pleasure to their Pacific crossing; and that it will enable all ocean wayfarers to appreciate more the wonders that may only be seen at sea".

There can be little doubt that the object will be achieved.

Basically, the book is the result of over 3,000 observations recorded in the sea-bird log of the author, a most meticulous observer and, it goes without saying, an experienced traveller on the route from Panama to New Zealand, augmented by information available to the R.N.B.W.S. and other observers.

The book is divided into eighteen chapters wherein the author first sets out to give general guidance on broad principles of distribution, recognition at sea, characteristics, plumage variations and flight patterns. He then divides the route into four sections covering Spring, Summer, Autumn and Winter. There follows a description of each bird followed by summaries for quick reference, one covering the shearwaters and petrels, another a distribution table entitled 'Look out for the Birds'.

It is copiously illustrated by close range photographs of many of the birds described, both in flight and also in the hands of a temporary captor, as well as by five plates of composite illustrations of shearwaters and petrels.

Much of the author's enthusiasm for birdwatching is communicated to the reader in his admirable preface wherein he reminds the watcher that when following the movements of a bird, he may see much else of interest, the green and red flashes, the purple twilights, the zodiacal light, rainbows, haloes, cloud formations and sea waves. Thus is birdwatching inseparable from meteorological observing and if for no other reason, for this alone we would welcome the appearance of Captain Harrison's book.

But in its own right it deserves to be carried by any enthusiast or even by any potential birdwatcher, for it will undoubtedly help the ship's officer to a fuller enjoyment of his watch on deck and watch below. We congratulate the Royal Naval Birdwatching Society on the appearance of this, their first publication for general sale. L. B. P.

*The Theory and Practice of Seamanship*, by G. L. Danton. 8¾ in. × 5¾ in. pp. 524. *Illus.* Routledge & Kegan Paul, London, 1962. 50*s.*

The author obviously has a wide knowledge of his subject. The book is well planned and the subject presented in an easily digested form, adequately covering in one volume the seamanship syllabus for all grades of Ministry of Transport Certificates of Competency, including the advanced knowledge required of candidates for the Extra Master's Certificate.

The text is well illustrated with photographic plates, and diagrams drawn by the author. To reduce production costs the use of colour has been avoided; a colour key is provided where necessary, and the author suggests that the reader do his own colouring.

A useful bibliography is provided at the beginning of the book which gives the titles of publications containing statutory rules and regulations of which a knowledge is required for the M.O.T. examinations.

The last chapter contains the syllabus of the oral examination in seamanship for each grade of Foreign-Going Certificate.

Particularly commendable are the chapters on navigation in ice (about which little information is contained in the popular seamanship manuals), damage control (including some well illustrated guidance on the construction and fitting of a jury rudder), practical ship handling, stranding and beaching, fire fighting and some excellent diagrams and practical advice on lifting gear.

Although, as the author says in his preface, the book is particularly intended for officers studying for the Ministry of Transport examinations for a Certificate of Competency, any mariner reading this book, which is very well indexed, will readily appreciate its value as a reliable and handy reference on any aspect of seamanship it contains.

The new approach given to much of the subject is a refreshing change from the familiar pattern known to the older generation of seamen. Although the price may seem rather high, it is excellent value. A. D. W.

*Solar Activity and the Ionosphere (for Radio Communications Specialists)*, by N. Ya. Bugoslavskaya. 8¾ in. × 5½ in. pp. 39. *Illus.* Pergamon Press, London, 1962. 12*s.* 6*d.*

This book, based on a lecture given, presumably at the Ministry of Communications of the U.S.S.R., does not claim to provide the radio communications expert with specific answers to the questions of the influence of solar activity on the state of the ionosphere and what radio communication paths are possible during various ionospheric conditions, but presents, in very readable fashion, the various forms of solar activity which give rise to ionospheric disturbances.

The subject matter ranges from the theory of ionisation by solar radiation and its effect on the earth's atmosphere to descriptions of the structure of the sun, its magnetic fields, its eruptions and their effect on the layers of the ionosphere. A chapter on the eleven-year cycle of solar phenomena is particularly interesting; a graph of the sunspot cycle for the years 1880–1957 is included in this chapter which further states that there is a correlation between the intensity and frequency of occurrence of flares and eruptions and the relative numbers of sunspots. The final chapter deals with the behaviour of the F.2 and E layers and their effect on M.U.F.s (maximum usable frequencies); absorption by the D layer is briefly discussed.

In his conclusion, the author maintains that the choice of operating frequencies is dependent upon a knowledge of the state of the ionosphere in which the oblique incidence of the F.2 layer, together with its diffuseness, the sporadic effects of the E layer, and the absorption of the lower layers, are the major factors.

Possibly there is nothing original in this little book but it has the merit of presenting the subject handily and compactly. To one who uses the prediction charts published in *Wireless World* to obtain M.U.F.s for radio communication, as a hobby, it appears that the book offers no *practical* guide to the radio communications specialist who is called upon to select, at short notice, a reliable frequency for long-distance communication; nevertheless, it provides interesting and enjoyable reading.

There are five first-class photographic illustrations of solar activity (four by the Royal Greenwich Observatory at Herstmonceux, the other by Sacramento Peak Observatory, New Mexico, U.S.A.) which, though denoted in the text, may not have appeared in the Russian edition of 1959. The cost of translation doubtless inflated the price.

J. C. R. O.

# Personalities

RETIREMENT.—CAPTAIN A. W. FORD, Master of the British Ocean Weather Ship *Weather Reporter*, retired because of ill health in October 1962.

Aubrey Winston Ford was born in Swansea in November 1908 and served his apprenticeship with the African Royal Mail Company. After completing his indentures, he served aboard ships of various companies and gained his Master's Certificate. In 1941 he was landed in Canada after surviving a torpedoing. When in Canada, he joined the Royal Canadian Navy as a Lieutenant; he served as navigating officer of destroyers and in command of three corvettes and one frigate and during the latter years of the war was Commodore of coastal convoys on the Canadian and United States Atlantic coasts. Thus, throughout the war, he was engaged on Atlantic convoy work. In July 1945 he was demobilised and placed on the retired list with the rank of Lieutenant Commander. After returning home he was employed on Admiralty salvage work for some time and was then Master of an L.S.T. on War Office duties.

Early in 1947 Captain Ford was appointed as one of the first Masters of the Meteorological Office Ocean Weather Ships, when he joined the 'Flower' class corvette *Genista* at Devonport dockyard where she was being converted for her new duties. Renamed *Weather Recorder* she was under Captain Ford's command for 81 successful voyages and he was then appointed Master of the first of the 'Castle' class vessels to be converted to an ocean weather ship, *Oakham Castle.* Renamed *Weather Reporter*, she sailed on her first voyage as a weather ship under Captain Ford's command in May 1958.

Altogether Captain Ford did 111 voyages in command of weather ships, and when one adds to this the strenuous voyages he did in corvettes and frigates during the war—all this work being in the North Atlantic—he can safely be considered an expert on the subject of rough weather in small ships.

We wish him happiness and better health in his retirement.

C. E. N. F.

# Notices to Marine Observers

## RAINFALL OBSERVATIONS IN THE INDIAN OCEAN

During the period of the International Oceanographical Expedition (1962–1964) all Selected and Supplementary ships when in the Indian Ocean within the area extending from 20°E to 145°E to latitude 55°S including the Bay of Bengal, Arabian Sea, Gulf of Aden, Red Sea and Persian Gulf, are urged to make a point of recording all rainfall in the Remarks column of the meteorological logbook using the Beaufort notation and giving the time rain begins and ends.

Beaufort notation:

R = Heavy rain
r = Rain (moderate)
$r_0$ = Slight rain

The prefix 'i' indicates 'intermittent', thus $ir_0$ = Intermittent slight rain. The prefix 'p' indicates 'shower of', thus pR = Shower of heavy rain. A solidus '/' is used in 'present weather' to distinguish present conditions from those in the past hour, thus $R/r_0$ = Heavy rain after slight rain in the past hour.

The energy of the Indian monsoon low is derived largely from the water vapour taken up by tropical air masses passing over the warm waters of the Indian Ocean. Detailed observations of precipitation can give a picture of the absorption and release of this energy over the wide expanse of the sea.

It may be possible over the two years of the investigation to examine in detail the history of the air masses that produce the great monsoon rains and the immense monsoon wind systems.

## PORT METEOROLOGICAL AGENT—SYDNEY

Captain R. W. Simmons resigned recently, due to ill health, as the Port Meteorological Agent for Sydney.

The Bureau of Meteorology has, however, been fortunate in engaging Captain John A. Doyle, who commenced his duties in July 1962.

Captain Doyle is a Master Mariner with 17 years' sea-going experience in the Mercantile Marine and 10 years with the Royal Australian Navy from which he retired as a Lieut. Commander. During his many years at sea he has served as observing officer in selected meteorological ships. Captain Doyle may be contacted through the Sydney Weather Bureau (Tel. 27–2191).

## FACSIMILE

The value aboard a ship at sea of the simple and speedy method provided by facsimile equipment of obtaining, by the turn of a switch, the latest weather charts —an exact copy of that drawn up by the forecaster at the meteorological centre ashore—is obvious (an article explaining this equipment appeared in the July 1961 number of this journal).

The latest information of times of some of the most useful transmissions of surface and analysis charts, with the times of the observations on which these charts are based, may interest readers likely to serve in ships fitted with this equipment. A manual giving full details of all facsimile transmissions throughout the world is provided by the makers with the equipment.

| Station | Time of Trans-mission | Time of Observa-tion | Area covered by Chart | Contents |
|---|---|---|---|---|
| AFRICA<br>Kenitra, Morocco | 1055 | 0600 | Western Mediterranean | Surface Analysis |
| | 1120 | 0600 | Eastern Mediterranean | Surface Analysis |
| | 1210 | | Mediterranean and N. Atlantic | 30 hr. Surface Prognosis |
| | 2255 | 1800 | Western Mediterranean | Surface Analysis |
| | 2320 | 1800 | Eastern Mediterranean | Surface Analysis |
| AUSTRALIA<br>Canberra | 0018 | 2000 | 5°S–50°S, 90°E–180°E | 24 hr. Surface Prognosis |
| | 0118 | 2300 | ,, | Surface Analysis |
| | 1018 | 0500 | ,, | 24 hr. Surface Prognosis |
| | 1918 | 1700 | ,, | Surface Analysis |
| CANADA,<br>Halifax | 0740 | 1800 | Western N. Atlantic | 36 hr. Surface Prognosis |
| | 1050 | 0600 | North Atlantic | Surface Analysis |
| | 1555 | 1200 | North Atlantic and Davis Str. | Wave Heights |
| | 2250 | 1800 | North Atlantic | Surface Analysis |
| ENGLAND,<br>Bracknell | 0030 | 2100 | 70°N–35°N, 65°W–45°E | Surface Analysis |
| | 1035 | 0600 | ,, | 24 hr. Surface Prognosis |
| | 1713 | 1200 | ,, | Surface Analysis |
| | 2235 | 1800 | ,, | 24 hr. Surface Prognosis |
| GERMANY,<br>Offenbach | 0353 | 0000 | N. Atl., Med. and Black Sea | Surface Analysis |
| | 1048 | 0600 | ,, | 24 hr. Surface Prognosis |
| | 1553 | 1200 | ,, | Surface Analysis |
| | 1800 | 1200 | ,, | 24 hr. Surface Prognosis |
| JAPAN, Tokyo | 0400 | 0000 | Western North Pacific | Surface Analysis |
| | 1000 | 0600 | ,, | ,, |
| | 2200 | 1800 | ,, | ,, |
| PACIFIC,<br>Pearl Harbour | 0446 | 0000 | Eastern North Pacific | Surface Analysis |
| | 0508 | 0000 | Western North Pacific | ,, |
| | 1228 | | Eastern North Pacific | 24 hr. Surface Prognosis |
| | 1250 | | Western North Pacific | ,, |
| | 1652 | 1200 | Eastern North Pacific | Surface Analysis |
| | 1714 | 1200 | Western North Pacific | ,, |
| PHILIPPINE IS.,<br>Manila | 0400 | 0000 | Bay of Bengal, S. China Sea | Surface Analysis |
| | 1136 | | ,, | 24 hr. Surface Prognosis |
| | 2159 | 1800 | ,, | Surface Analysis |
| | 2336 | | ,, | 24 hr. Surface Prognosis |
| U.S.A.,<br>Washington, D.C. (N.S.S.) | 0328 | 0000 | Western North Atlantic | Surface Analysis |
| | 1322 | | North Pacific, North Atlantic | 24 hr. Sea Condition |
| | 0624 | | Eastern U.S. and N. Atlantic | 30 hr. Surface Prognosis |
| | 1534 | 1200 | Western North Atlantic | Surface Analysis |
| | 2148 | 1800 | ,, | ,, |
| U.S.S.R., Moscow | 1000 | 0000 | | Surface Analysis |
| | 1925 | 1200 | | ,, |

Halifax (Nova Scotia) provides ice charts during the ice season showing ice reported in the region of the Gulf of St. Lawrence, Labrador, Hudson Strait and Eastern Arctic.

## ERRATA

*The Marine Observer*, April 1961. Page 60—
m.v. *Rangitata*'s observation, line 7: *for* 60°F. *read* 67°F.

*The Marine Observer*, July 1962. Page 100—
Line 3: *for* 'Weather Reporter' *read* 'Weather Recorder'.

*The Marine Observer*, October 1962. Page 205—
Paragraph headed GREAT BANK AND EAST NEWFOUNDLAND COAST, line 3: *for* west-south-westwards *read* east-south-eastwards.

# Fleet Lists

Corrections to the list published in the July 1962 number of *The Marine Observer*.

### INDIA (Information dated 16.10.62)

The following ships have been recruited as Supplementary ships:

*Bharat Kesari* (The Bharat Line Ltd.)
*Jalakirti* (Scindia Steam Navigation Co. Ltd.)
*State of Maharashtra* (Shipping Corporation of India Ltd.)
*State of Rajasthan* (Shipping Corporation of India Ltd.)

The following Supplementary ships have been deleted:

*Bharatdeepak, Bharatrani, Bharatvijaya.*

### HONG KONG (Information dated 9.10.62)

Recruited: *Eastern River* (Indo-China S.N. Co. Ltd.).
Deleted: *Sangola.*

### MALAYA (Information dated Oct. 1962)

Recruited: *Kelantan* (Malay Shipping Co. Ltd.).
Deleted: *Benveg.*

### GREAT BRITAIN (Information dated 12.10.62)

The following coasting vessels ('Marid Ships') have been recruited:

| Name of Vessel | Captain | Owner/Manager |
|---|---|---|
| *Cerdic Ferry* | C. Tanner | Atlantic S.N. Co., Ltd. |
| *Doric Ferry* | J. Cowie | Atlantic S.N. Co., Ltd. |
| *Fernhurst* | E. C. Ford | Stephenson Clark, Ltd. |
| *Forth* | H. G. Keilit | British Channel Island Shipping Co., Ltd. |
| *Mountstewart* | H. A. Matheson | Belfast S.S. Co., Ltd. |
| *Woodlark* | G. W. Lawrie | General S.N. Co., Ltd. |
| *Yewarch* | J. W. Russel | John Stewart & Co., Shipping, Ltd. |

The following skippers and radio operators have been added to the Trawler Fleet List:

| Skipper | Radio Operator | Trawler Owner/Manager |
|---|---|---|
| P. D. Abbey | T. B. Parkes | Thomas Hamling & Co., Ltd. |
| A. Clarkson | F. Scott | Kingston Steam Trawling Co., Ltd. |
| J. C. Lillery | E. J. Callicott | Hellyer Bros., Ltd. |
| P. J. May | K. C. Stone | Thomas Hamling & Co., Ltd. |
| C. A. Nielsen | W. B. Sayer | Kingston Steam Trawling Co., Ltd. |
| H. Parker | I. R. I. McCuaig | Hellyer Bros., Ltd. |
| H. Sloane | R. R. N. Laing | Charleson-Smith Trawlers, Ltd. |

The following ships have been deleted:

*Amber, Beaverlake, Belvedere, British Advocate, British Coast, British Endeavour, Cambridge, Canton, Carnarvon Castle, City of Durham, Clan Buchanan, Clan Chisholm, Clan Macaulay, Discovery II, Dominion Monarch, Domino, Durban Castle, Eastern City, Edward Wilshaw, Esso Poole, Graig, Harpalion, Hudson Firth, Iron Ore, John Holt, Lapwing, Macharda, Nestor, Norfolk, Parima, Port Dunedin, Rangitata, Rangitiki, Rochester Castle, Roscommon, Salween, Saxonia, Scottish Eagle, Silverdale, Silversand, South Africa Star, Southern Opal, Southern Venturer, Thelma, Trelawny, Trelevan, Trelyon, Trewellard, Trinculo, Wanstead, Warwick Castle, Willowpool.*

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We regret that, owing to increased costs, it has been necessary to increase the price of *The Marine Observer* from 6s. to 6s. 6d. The annual subscription will now be £1 7s. 8d. (including postage). Present subscriptions will continue at the old rate until renewal.

# GREAT BRITAIN (contd.)

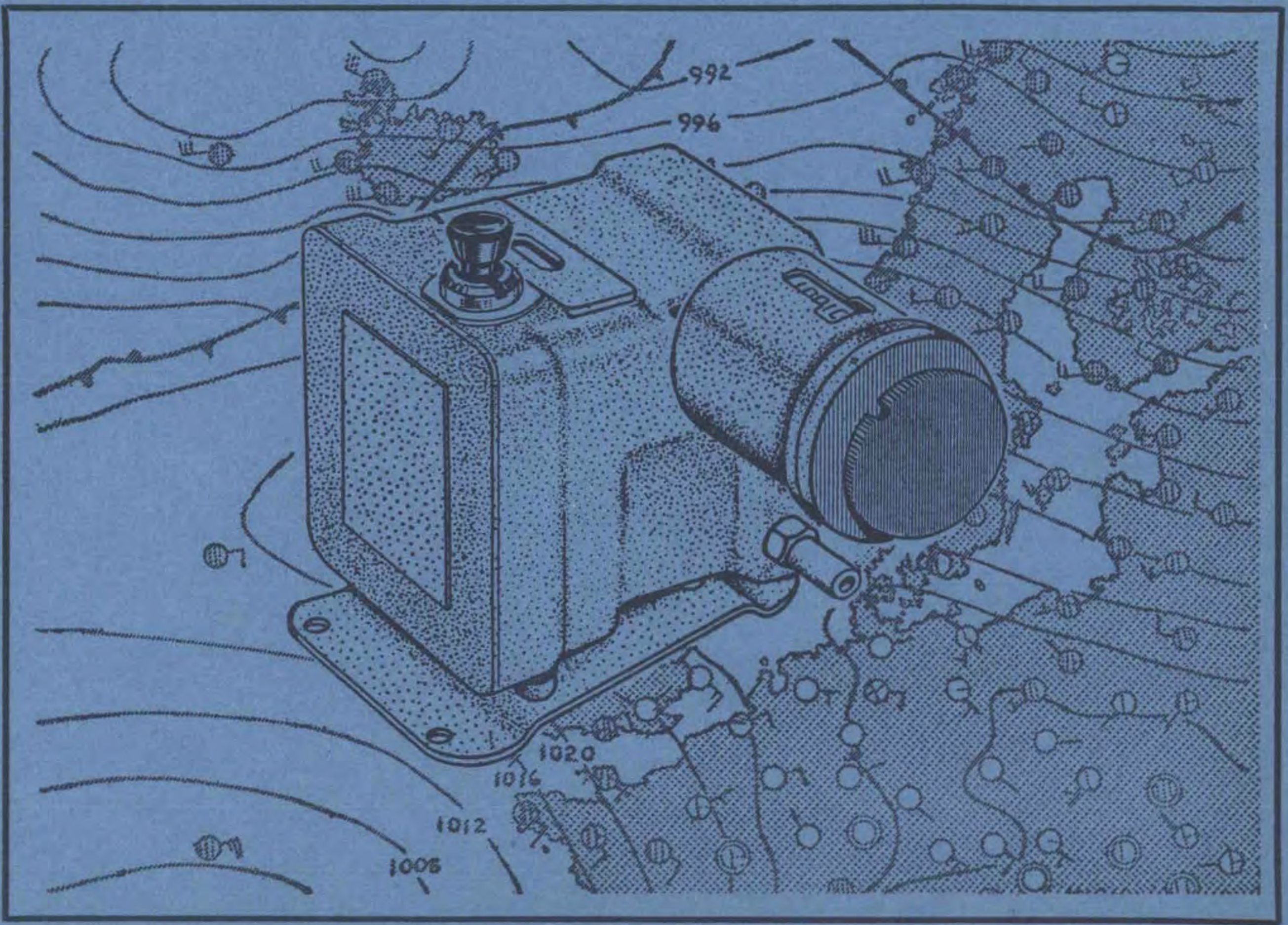
The following ships have been recruited as Selected Ships:

| Name of Vessel | Date of Recruitment | Captain | Observing Officers | Senior Radio Officer | Owner/Manager |
|---|---|---|---|---|---|
| *Aldersgate* | 21.5.62 | G. F. Chivers | N. J. Evans, W. N. Whitelaw, I. G. Ramsay | L. S. Kesson | Silver Line |
| *Athelcrest* | 11.4.62 | W. O. Williams | A. C. Wehner, J. Miles, R. J. Phillips | G. M. Robinson | Athel Line, Ltd. |
| *Benhope* | 29.8.62 | R. Cowie | J. Munroe, J. Stalling, A. Crombie | N. MacKenzie | Wm. Thomson & Co., Ltd. |
| *Bhamo* | 25.9.62 | E. Campbell | I. J. Louden, J. J. O'Brien, W. Fitzgerald | A. N. Gilbert | Henderson Line |
| *Breconshire* | 5.6.62 | K. B. Briggs | R. M. Swabey, J. N. Hood, D. Ellis | H. A. Cox | Glen Line |
| *British Trust* | 11.9.62 | B. S. Cartwright | R. McVeigh, G. Cook, B. Dingwell | P. J. Abday | B.P. Tanker Co., Ltd. |
| *Clan MacGillivray* | 14.9.62 | H. F. S. Hetherbridge | R. Harden, J. K. Currie, A. Ewin | D. A. P. Galbraith | Clan Line |
| *Devonia* | 16.4.62 | I. K. Bowerman | M. E. Davison, M. Ledger, P. Simms | R. Bennett | British India Line |
| *Esso Pembrokeshire* | 18.9.62 | C. L. Thomas | A. Fry, E. W. Christian, J. P. O'Sullivan, J. Richardson | W. N. Greene | Esso Petroleum Co., Ltd. |
| *Georgina V. Everard* | 15.6.62 | L. Anderson | A. D. O'Connor, G. Wilbughby, D. McPhail | W. Ascott | F. T. Everard & Sons, Ltd. |
| *Glanely* | 24.9.62 | F. I. Day | M. P. Salmon, G. C. Preston, N. Spurling | A. Thomson | W. J. Tatem, Ltd. |
| *Glenfruin* | 29.5.62 | G. W. Povey | R. S. Gruno, A. E. Longbottom, M. J. Kevan | C. Sargent | Glen Line |
| *Glengarry* | 20.6.62 | N. Willis | R. J. M. Hogg, P. Dodge, M. B. Lynskey | J. Morgan | Glen Line |
| *Illyric* | 31.8.62 | R. G. James | M. C. Sargeant, E. Irons, B. Kay, P. K. Murchison | H. Preen | Shaw Savill Line |
| *Iron Crown* | 25.7.62 | I. S. Taylor | A. Stathers, L. Cusiter, J. Pigott | D. Williams | Common Bros., Ltd. |
| *Isaac Carter* | 19.3.62 | W. J. Coull | T. Kennedy, A. MacFarlane, D. Lorimer | G. W. Burke | Runciman Line |
| *La Pampa* | 22.3.62 | T. H. Turner | R. Perera, W. Watterson, I. Haughton | S. Cowan | Buries Markes, Ltd. |
| *Leeds City* | 10.9.62 | J. Thornhill | C. I. MacIver, M. G. Thomas, L. Best | J. R. Mathews | Sir Wm. Reardon Smith & Sons |
| *Manchester Pioneer* | 17.4.62 | —. Fielding | J. Birkenhead, D. Mitten, —. Lehupu | | Manchester Liners |
| *Northern Star* | 6.7.62 | L. H. Edmeads | M. Collins, K. Newton, R. MacNamara | C. L. Carpenter | Shaw Savill Line |
| *Oakwood* | 27.7.62 | R. P. Openshaw | R. W. Boucher, G. Turnbull | | J. I. Jacobs & Co., Ltd. |
| *Piako* | 2.7.62 | I. Y. Batley | R. Burroughes, R. Jones, A. Doig | J. Russell | New Zealand Line |
| *Queen City* | 4.7.62 | J. Vaughan | D. R. McDarren, G. Ellerby | | Sir Wm. Reardon Smith & Sons |
| *Radnorshire* | 25.7.62 | G. Carney | J. Hanney, M. J. Beddington | | Glen Line |
| *Raphael* | 3.7.62 | C. E. Legg | M. R. Houghton, R. B. Jones, A. M. Murchie | F. Pender | Lamport & Holt Line |
| *Redcar* | 21.6.62 | B. Lillivick | S. Peters, M. Jessup, D. W. Parry | J. M. Murphy | Bolton S.S. Co., Ltd. |
| *Regent Eagle* | 6.7.62 | J. D. Pedersen | I. E. McVicar, B. Goodland, N. Brown | R. W. Jones | Regent Petroleum Tankship Co., Ltd. |
| *Remuera* | 24.8.62 | H. Lawson | P. B. Snow, C. H. T. Catwell | G. A. P. Parker | New Zealand Line |
| *San Fortunato* | 18.8.62 | J. Gay | R. Brown, G. Boyle, I. Morten | | Shell Tankers, Ltd. |
| *Silverfell* | 16.8.62 | W. E. Lewis | G. Hornnall, P. G. H. Vanner, D. Charles | A. J. Davy | Silver Line |
| *Silverforce* | 9.5.62 | H. H. Howie | J. D. Bean, C. Green | P. I. Walsh | Silver Line |
| *Tactician* | 24.7.62 | W. S. Eustace, O.B.E. | O. M. Owen, A. Gattiss, J. B. Dobbs | S. Broadbent | T. & J. Harrison, Ltd. |
| *Thistledowne* | 24.9.62 | C. Brown | C. A. Graham, W. T. Owen, M. Kearney | M. J. Freemantle | Albyn Line, Ltd. |
| *Trebartha* | 2.10.62 | W. Phillips | T. Hallatt, G. Smith, J. Darby | | Hain S.S. Co., Ltd. |
| *Volvatella* | 18.9.62 | R. Potter | R. M. Abbott, N. Coull, J. Cleveland | —. Taylor | Shell Tankers, Ltd. |
| *Warkworth* | 12.7.62 | W. Thompson, M.B.E. | D. Stewart, C. Harrow, W. Vaughan | J. Cotter | R. S. Dalgliesh, Ltd. |
| *Western Prince* | 20.9.62 | J. R. Stephens | P. J. Goodwin, —. Gray, —. M. Bowen | R. A. Straine | Prince Line |

The following ships have been recruited as Supplementary Ships:

| Name of Vessel | Date of Recruitment | Captain | Observing Officers | Senior Radio Officer | Owner/Manager |
|---|---|---|---|---|---|
| *Angularity* | 16.5.62 | R. H. Golding | E. J. Parker, F. Craske | | F. T. Everard & Sons, Ltd. |
| *Benmacdhui* | 10.10.62 | W. C. Watson | J. B. Lyall, I. F. MacKay, K. W. Soulsby | W. Duguid | Ben Line |
| *Benvorlich* | 10.4.62 | R. McPhee | B. Smith, A. Wilson, R. Shaw | A. Gordon | Ben Line |
| *British Oak* | 22.9.62 | C. K. Temple | J. Nash, W. Hare, D. Peters | | B.P. Tanker Co., Ltd. |
| *Esso Hampshire* | 27.6.62 | C. L. Thomas | T. Crompton, D. Smart, T. Sweeney, T. Ramsay, P. Smith, J. M. MacQuarrie | G. Barnes | Esso Petroleum Co., Ltd. |
| *Mawana* | 11.4.62 | L. E. Jeans | D. G. Wild, J. J. Redden, —. Lloyd | D. Butterworth | Brocklebank Line |
| *York* | 23.3.62 | J. W. Laverack | —. Periam, —. Boot, —. Garner | | Associated Humber Lines, Ltd. |

# MECHANISM PRECISION ANEROID BAROMETERS WITH DIGITAL READOUT FACILITATE WEATHER REPORTING

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*A large quantity of these instruments has been ordered by the* METEOROLOGICAL OFFICE *for use in ships responsible for making official weather reports where their* ROBUSTNESS, PORTABILITY, *and* ACCURACY *under adverse conditions make them the ideal choice.*

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RANGE: 900 to 1050 mb. DISCRIMINATION: 0·02 mb.

ACCURACY: At 20°C, ± 0·3 mb. At 5°C & 35°C, ± 0·5 mb. Max. change.

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