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*A quarterly journal of Maritime Meteorology*

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# THE MARINE OBSERVER

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# Editorial

" There is no new thing under the sun." These words, from an Old Testament preacher, are set down in the book of Ecclesiastes. Through the years, few words have been more quoted and few clichés more overworked, yet we were recently reminded of their truth by reading the proceedings of the Board of Enquiry into an air casualty. A cargo-carrying Viking aircraft took off from London Airport in September 1958 bound for Lod Airport, Israel. Her cargo was two aircraft engines, her crew numbered 3. Shortly after leaving London the aircraft crashed into some houses at Southall, Middlesex: the crew perished and 4 civilians, residents in the demolished houses, were killed.

The findings of the court which was set up to enquire into this disaster have recently been published. The court found that the condition of the aircraft was suspect and that it was overloaded; that the preliminary maintenance work on her was not done in accordance with approved schedules and that it was done by unqualified men; that the pilot was tired and not properly rested; that the Company's policy was to keep these aircraft flying at all costs regardless of the regulations; and that the staff was largely recruited from men who had lost jobs with larger organisations or from men who would scarcely have been employed by established companies.

These findings are an apt reminder of some of the maritime disasters of the early 19th century, when it was no unknown thing for a ship to sail, never to be heard of again. Had there then been courts of enquiry into these casualties, it would doubtless have been found that lack of maintenance, overloading and undermanning were contributory factors in a large number of them. Before the sea could become the comparatively safe place that it is today, the Merchant Shipping Acts, the International Convention for the Safety of Life at Sea, examinations for certificates of competency, a compulsory load-line and the collision regulations had to be introduced. The system of voluntary meteorological observing at sea, contemporary with the first Merchant Shipping Act, whereby one shipmaster could profit from the meteorological experiences of thousands of others, has also undoubtedly been a factor in the reduction of the loss of life and property at sea. To have played a part in this gives us no small satisfaction, but we could have done nothing had it not been for the thousands of observations which have come in from ships over the past 100 years, and the meteorologist would be seriously handicapped without the meteorological logbooks which continue to come in, or the radio weather messages which are daily received from ships at sea all over the world.

Many advances have been made in methods and instruments for the better navigation of ships and perhaps none has been more revolutionary than the use of radar—which is very much affected by meteorological conditions.

During the past 15 years reports of many courts of enquiry have remarked that reliance has been placed on radar in circumstances where an officer would have done better to trust his own eyes, ears and experience. These remarks were so widespread that, at one time, the unkind phrase " radar-assisted collisions " was frequently heard in shipping circles. Much advice has been given on the prudent use of radar, and the reports of radar performance in varying meteorological conditions which come to us in the " Additional Remarks " pages of ships' meteorological logbooks, and which we always forward to the Radio Advisory Service, are doing much to clarify the potentialities of this instrument. Radar is an aid to navigation and should not be regarded as an instrument of navigation in itself.

If we look back exactly 100 years, we find an earlier instance where undue reliance on a new invention could have been a contributory cause of a maritime tragedy. On 26th October, 1859, the ship *Royal Charter*, fitted with a comparatively new device known as the steam engine, stranded in Moelfre Bay, Anglesey, with the loss of over 400 lives. With 373 passengers and a valuable cargo, which included a large consignment of bar gold, she had made a fast passage from Melbourne, had landed 13 of her passengers at Queenstown and now, almost within sight of her destination, was to be cast ashore and lost. Gales of unprecedented violence and suddenness were sweeping all the coasts of the British Isles that week; on the east coast at Hartlepool alone the shipping papers reported that from 40 to 50 vessels of the collier type were found on the strand at daybreak. The *Royal Charter* passed Holyhead during the late afternoon with a wind at ENE., force 6, but at 10 p.m. this had backed to the NW. at hurricane strength and she found herself on a dead lee shore. She anchored and cut away her masts but her cables parted and she was driven ashore. The Court of Enquiry into the disaster commented on the " apparent want of preparedness to encounter stormy weather . . . it is true that the weather was fine in the morning but it is certain that in such a dangerous sea at that time of year, when storms may be expected, it would be prudent to make all snug aloft." It condemned as a dangerous practice the Master's action in steaming ahead to his anchors in a gale, pointing out that in the lulls between the squalls a vessel under steam would shoot ahead of her cable. " It is not impossible," the Court said, " that such may be the true explanation of the parting of the cables in the *Royal Charter*."

Neither the Master nor any officer survived the disaster, and it is not for us to say that the Master did not honestly believe that the possession of steam justified him in keeping a little closer inshore than would be prudent in a ship not so equipped, or that steam would enable him to ride out in safety a severe gale.

Much has been written and many opinions given on the use of the engines whilst at anchor in a gale. In a footnote on page 136 of *Meteorology for Mariners* can be found an instance of a British ship which used her engines very successfully whilst at anchor in the harbour of Kingston, Jamaica, during the hurricane of August 1951. A hundred years ago, however, no Master would have either his own or other people's experience to justify his implicit reliance on steam to keep him out of danger. Steam had to serve a long probationary period before it was allowed to supplant older and well-tried methods. So must radar.

Indeed, " there is no new thing under the sun ".

L.B.P.

# THE MARINE OBSERVERS' LOG


## October, November, December

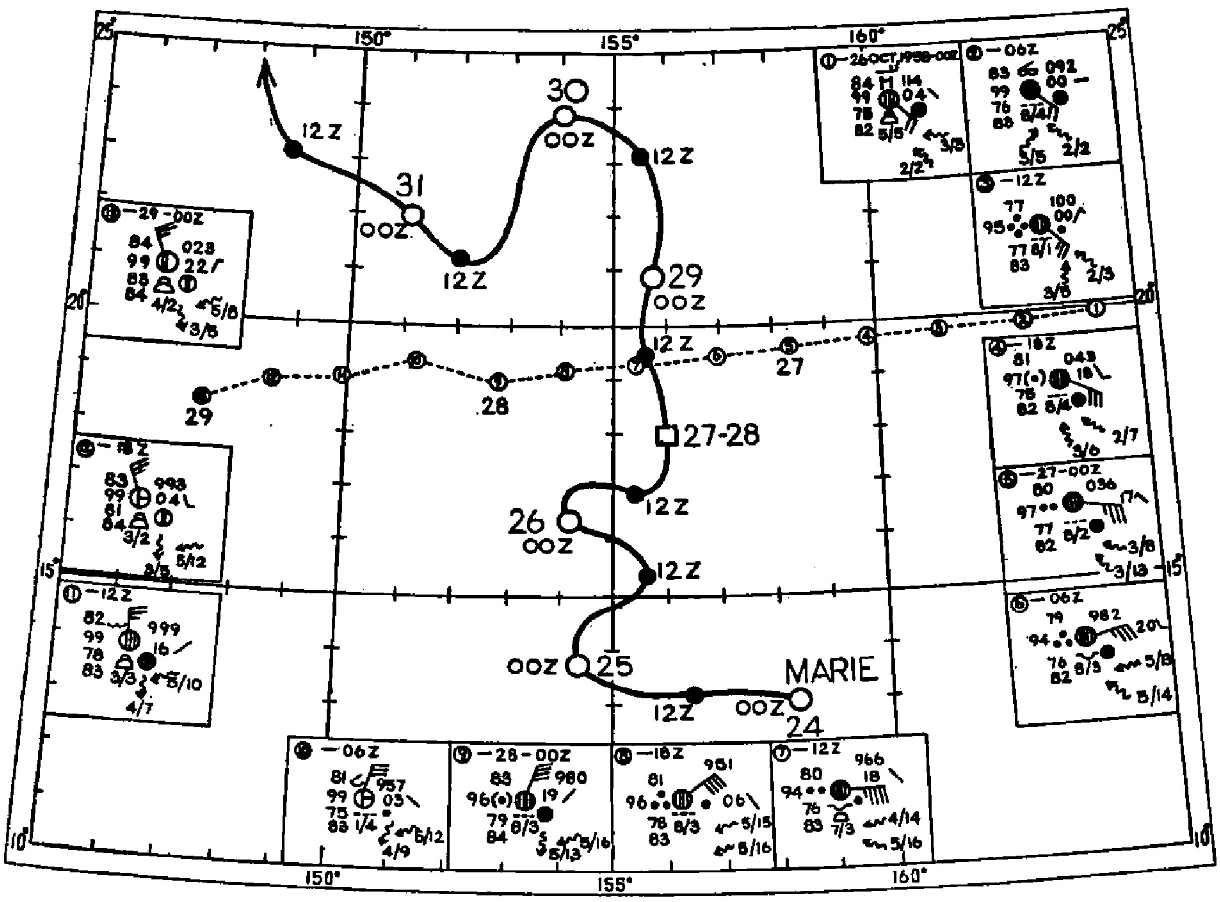
*The Marine Observers' Log* is a quarterly selection of observations of interest and value. The observations are derived from the logbooks of marine observers and from individual manuscripts. Responsibility for each observation rests with the contributor.

### TYPHOON MARIE

#### North Pacific Ocean

M.V. *Cingalese Prince*. Captain H. J. Pirie. Los Angeles to Manila.

26th October, 1958. At 1300 G.M.T., in approximate position 19° 36′N., 160° 54′E., the wind freshened to 23 kt from the SE. Barometer 1008·8 mb; visibility poor; sea and swell mounting, both SE'ly.




*Track of Typhoon Marie as in "Mariners Weather Log", May 1959*

Track of Typhoon Marie and weather experienced along track of M.V. *Cingalese Prince* (see *Note* 2).

At 1500: barometer 1007·2, falling; wind SE., increasing, 28 kt; sea conditions the same as before.

At 1600: barometer still falling; wind backed to SE'E, force 7 (30 kt).

At 1700: barometer 1005·0; wind SE'E, 32 kt; very heavy S'W swell, sea still mounting; visibility 4 miles; air temp. 81°F; sky overcast; intermittent rain, heavy in squalls.

At 1900: barometer 1005·3; wind SE'E, 32 kt, still in the SE. quadrant; sea conditions same as before.

At 2100: wind backed S'E, 32 kt; barometer 1005·5; sea and swell mountainous; visibility reduced to ½ mile or less in squalls.

At 2300: barometer 1004·0; wind E'S, 37 kt; air temp. 79°F.

27th October. At 0100: barometer 1002·6; wind E'S, 36 kt; very heavy rain; very heavy SE'E swell; visibility down to 200 yd at times.

At 0300: barometer 999·9; wind E'S, 36 kt; continuous rain, heavy in squalls.

At 0500: barometer 997·6; wind E'S, 36 kt.

At 0700: barometer 997·6; wind backed to E'N, 36 kt.

At 0900: barometer 997·6; wind E'N, 41 kt; sea and swell phenomenal.

At 1100: barometer 996·6; wind E'N, reaching 53 kt in squalls; visibility less than 200 yd.

At 1300: barometer 996·4; wind backed to NE'E; continuous rain; visibility improved to ½ mile.

At 1500: barometer 995·3; wind NE'E, 45 kt; sea conditions the same.

At 2100: barometer 996·1; wind NE'N, 40 kt; swell confused.

28th October. At 0100: barometer 996·9; wind N'E, 38 kt.

At 0133: barometer 996·9; wind N'E, 48 kt; very heavy squall; swell mountainous from the E. and ENE.; visibility in squall 100 yd, otherwise 1 mile.

During the next few hours the barometer began to rise and fall. The wind continued to back and gradually became less forceful. At 0500 the clouds began to break up and visibility greatly improved. At 1244 the barometer commenced to rise and wind was from N'W, 22 kt.

Lowest barometer recorded during this period was 994·5 mb, highest wind E'N, 53 kt. Air and sea temp. remained fairly constant in the low 80's; highest sea estimated at 33 ft; point of nearest approach approximately 110 miles due N. of the centre. The vessel maintained course and speed throughout and was found to have set 24 miles N. when sights were taken.

*Note* 1. This observation was forwarded to Dr. Reichelderfer, Chief of the U.S. Weather Bureau, who sends us the following comments from the National Hurricane Research Project:

" The narrative of the *Cingalese Prince* recorded during her encounter with typhoon ' Marie ' on 26th to 28th October, 1958, has been read with interest. Unfortunately not much information on this typhoon is available so that it is not possible to offer much comment on how her meteorological data fit with that obtained from other sources.

" Typhoon ' Marie ' formed in the vicinity of 13°N., 159°E. around 24th October, 1958. It moved very slowly—first towards the NW. and later towards a more N'ly direction so that, on 26th to 27th October it was drifting very slowly northward in the vicinity of 155°E. The data from the ship's meteorological logbook indicate that she went across the entire typhoon circulation passing westward some distance to the N. of the centre. Her observations do not depart significantly from what one would normally expect in such a situation. However, the recorded maximum winds of 53 kt and minimum pressure of around 994 mb suggests that the ship may either have come closer to the centre than 110 miles, as estimated by the Captain, or else the typhoon must have been very intense at the time.

" The comments on the constancy of the air and sea temp. and the height of the seas are very illuminating. The estimated height of 33 ft for the seas indicates, more than anything else, the great fury of the typhoon.

" The extract in general contains valuable information for further studies and should certainly be included in some climatological summary. A copy of it is being retained in the Library files of the National Hurricane Research Project."

*Note* 2. A very full set of observations was received from the M.V. *Cingalese Prince* which has been used in the diagram to illustrate conditions that occur when a ship passes across the track of a storm of typhoon intensity (but fortunately not one on a disastrous scale).

The data are plotted in the international code by the method given in *Meteorology for Mariners*, page 147. In addition, sea and swell are plotted. The plotted wave trains indicate the direction of movement of the waves while the number in front of the solidus (/) is the code figure for their period (Table XIX in M.O. 509, *Decode for use of Shipping*). The number following the solidus is the height of the waves in ft.

The observers are to be congratulated on the detailed observations of two trains of waves which they made. These clearly show that both sea, created by local wind, and swell, created by disturbed conditions elsewhere, were present.

The somewhat uneven pressure changes reflect the complex path and variations in development of the storm.

The typhoon " Marie " had very little motion from 27th to 28th and thus the *Cingalese Prince* was able to sail completely across the front half of the storm. In addition, the strength of the storm was not sufficient to make clear and accurate observations impossible.

## CURRENT RIPS

### Indian Ocean

M.V. *Canopic*. Captain T. H. Davies. Adelaide to Aden.

25th November, 1958. At 0030 G.M.T. the surface of the sea became disturbed and the ship's head swung to starboard on entering the rips, thus giving evidence of a strong E'ly set:

Position of ship: 5° 22'S., 74° 56'E.

27th November. At 0200 G.M.T. current rips were again experienced, though not as strongly as on 25th.

Position of ship 3° 10'N., 64° 12'E.

These appear to be the boundary rips of the Equatorial Countercurrent, which was experienced quite strongly this trip. Morning sights (sun) on 25th were taken too soon after the first rips were encountered to show much effect, but from noon to noon, 25th to 26th, a strong E'ly set was experienced and again until noon on 27th. As before, the morning sun sights on 27th followed too soon after observing the rips, but evening star sights showed that from noon, at least, the vessel had experienced a W'ly set. It seems fair to assume that this set began at the time the second lot of rips were encountered. Unfortunately, the evening star sights on 27th were the only ones available during the period, though all the sun sights were considered to be as reliable as they could be. No significant change in sea temperature occurred during the period.

Wind on 25th, light and variable, or calm.

Wind on 26th, light and variable, becoming WSW'ly, force 3.

Wind on 27th, light and variable then calm.

*Note.* The suggestion that these current rips indicate the limits of the Equatorial Countercurrent is confirmed by the evidence of the Current Atlas (M.O. 392). The report is therefore a useful oceanographical observation. The current rips were probably produced by the sheer of velocity between the two distinct water masses of the Equatorial Current and its Countercurrent.

## DISCOLOURED WATER

### Gulf of Aden

M.V. *Clan Maclean.* Captain H. Whitehead. Aden to Cochin. Observers, Mr. R. J. Easson, 3rd officer and Mrs. Whitehead.

30th October, 1958. At 0650 G.M.T. with Cape Guardafui just abaft the beam to starboard, a long line of what looked like sand and seaweed was seen to N. and S. of the vessel. The sand-like substance was deep yellow and about 2 to 3 ft in width, with the seaweed floating on either side. The band appeared to fade out about half a mile to the N. of the ship, but to the southward it continued as far as the eye could see. At 0730 several other bands were seen, but the lines were irregular on this occasion. It was ascertained by the Master that what seemed to be sand was fish spawn. Air temp. 76°F, sea 69°. Wind light and variable. Sea calm.

Position of ship at 0600: 12° 00'N., 51° 00'E.

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

"With all due respect, I think that Captain Whitehead is probably mistaken in thinking that the line of 'sand', running from Cape Guardafui, was fish spawn. A Dinoflagellate bloom or other algal bloom is so much more likely. The large *Dinoflagellate noctiluca* (½ mm spheres) could reasonably be confused with fish spawn if one was not familiar with it. Pelagic fish eggs rarely show much pigmentation and the largest concentration I have ever known barely exceeded 1000 per cubic metre, which were quite invisible as a general colourant. In spite of all the references to spawn as a cause of discoloration the only authenticated instance remains that of the palolo worm—very narrowly limited in time—in the Pacific."

### South Atlantic Ocean

M.V. *Regent Royal.* Captain J. A. Cresswell. Pointe-a-Pierre to Rio de Janeiro. Observers, the Master and Mr. R. J. Peters, 2nd officer.

26th December, 1958. At 1800 G.M.T. the vessel passed through a band of khaki-coloured water about 30 ft wide, extending between 065° and 245° as far as the eye could see. The discoloration appeared to be due to mud and there was a distinctly unpleasant odour reminiscent of the bottom of a dry dock. Sea temp. 81·5°F. Wind E'N, force 3.

Position of ship: 10° 00'S., 34° 54'W.

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

"I think some water bloom, most probably Trichodesmium, the most probable cause. The ship may have been close enough inshore for actual land run-off to justify the description of mud, but I note that she was N. of the only large river mouth in the neighbourhood, and the set is S. down that coast. There may of course be a countercurrent close inshore but I don't know of one, for I have sighted Rio only once myself.

"We have records of several actual samples now from that side of the S. Atlantic and nearly all have proved to be Trichodesmium thiebautii or the problematical Trichodesmium hildebrandtii atlantica of Reinch. That seems to me to be perhaps inseparable from the first-named species, in which case it will come down to one of those priority wrangles inevitable in that side of the trade.

"The smell at the bottom of dry docks emanates from the dead and dying remains of attached organisms, dried off plankton and barnacles and tube worms from the ships. I suppose Trichodesmium blooms do smell like that, but I would have said fainter, more sea-weedy and less objectionable, myself."

### Great Australian Bight

S.S. *Orcades.* Captain J. D. Birch, D.S.C., R.D. Melbourne to Fremantle. Observers, Mr. T. R. Williams, Senior 2nd officer and Mr. M. D. Rushan, Junior 3rd officer.

24th November, 1958. Throughout the afternoon it was observed that the sea surface, which had been smooth for a considerable time though affected by a long heavy sw'ly swell, foamed and took on a marked salmon pink colour on those occasions when it was much disturbed by the passage of the ship. The foam had the appearance of large soap bubbles. Sea temp. 60·5°F. Wind light and variable. Speed of vessel, 20 kt.

Position of ship at noon: 36° 39'S., 128° 36'E.

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

"This is an unusual sort of position for an algal bloom suggesting persistence of an unusually prolonged calm spell just before. I have seen *Trichodesmium* equally far S. in the S. Atlantic, and that Alga is perhaps the most probable in such a position, but the pink colour leaves Noctiluca or possibly other Dinoflagellates an equally good guess. What a pity we have no sample."

## MAINMAST STRUCK BY LIGHTNING

### Gulf of Mexico

S.S. *Settler.* Captain G. F. Penston. Brownsville to Manchester. Observers, the Master, Mr. D. N. R. Edmunds, 2nd officer and Mr. G. A. Livingston, 3rd officer.

23rd November, 1958. At 1730 G.M.T. banks of very dark grey cloud giving rain and lightning were seen ahead of the vessel: at about 1815 the ship passed under the edge of the cloud bank and entered the storm area. Lightning, accompanied by almost simultaneous sharp cracks of thunder, was flashing straight down to the sea all round the ship, at intervals of 10–15 sec. Little forking was seen, the lightning appearing as vertical, or slightly slanting, blue-white streaks which could be heard hissing through the rain. At 1832 a particularly violent thunder clap sounded overhead and lightning struck the mainmast, carrying away the truck. By this time the rain was torrential and, visibility being very poor, speed was reduced and the regulation sound signals made. On three occasions, when lightning flashed nearby, a slight electric shock was felt from the whistle lanyard handle. The ship ran out of the storm at 1842. There had been no appreciable effect on the compasses during the storm, and later, when observations were possible, the deviation was found to be unchanged. The chronometer rate was also unaffected. Air temp. 77°F, wet bulb 73°, sea 79°. Wind NE'ly, force 3.

Position of ship: 24° 48'N., 86° 06'W.

## WATERSPOUTS

### North Atlantic Ocean

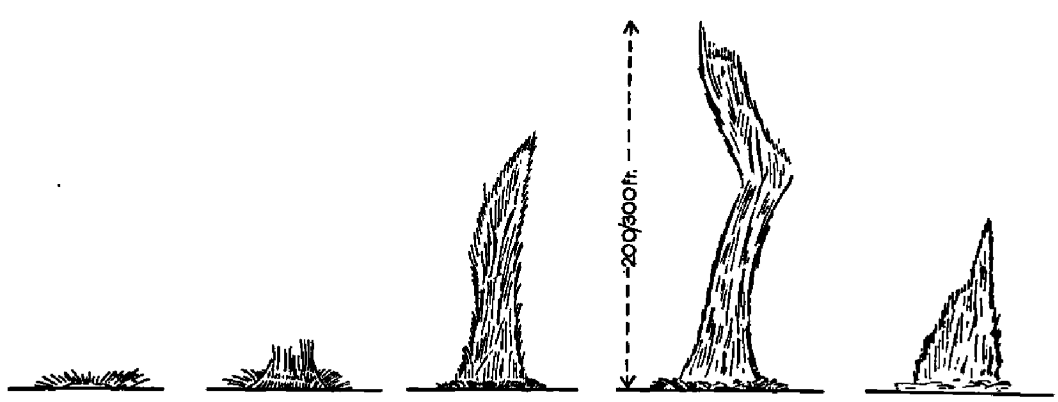
M.V. *London Pride.* Captain W. B. Blackmore. Mena-al-Ahmadi to Antwerp. Observer, Mr. R. E. Ambrose Jones, 2nd officer.

25th November, 1958. A waterspout was observed between 1610 and 1620 G.M.T., about 7 miles W. of Cape St. Vincent. It originated from cumulus cloud whose base was estimated at 1800 ft, and appeared to move in a S'ly direction. Seen at a distance of 2 miles, the sea surface was disturbed to a height of 20–30 ft, with spray showing a clearly spiral movement. At the top of the column, a hollow core was plainly visible. The centre section of the column became thinner and then disappeared, the upper part thickening as it retreated towards the cloud base. As this occurred, the disturbed water on the sea surface rapidly subsided. Air temp. 60°F, sea 64°. Wind NNW., force 1–2.

Position of ship at 1800: 37° 18'N., 9° 12'W.

M.V. *Tarantia.* Captain R. S. Paton. Norfolk Va. to Barry. Observer, Mr. I. K. Walker, 3rd officer.

26th December, 1958. At 1251 G.M.T. a waterspout was seen forming about 7




(1) (2) (3) (4) (5)

miles away, the first indication being a disturbance on the surface of the sea, causing spray to rise (Fig. 1). The subsequent stages of development are shown in Figs. 2 to 5: the maximum height of the column of disturbed water was between 200 and 300 ft. There was no corresponding funnel associated with the base of the cloud. By 1254 all signs of the waterspout had disappeared, but 25 min later another spout was seen forming in approximately the same position. This one did not reach the same height as the first, nor last as long. Air temp. 44°F, sea 72°. Wind NNW., force 4–5. Sea moderate to rough.

Position of ship: 37° 53'N., 67° 45'W.

M.V. *Tarkwa.* Captain E. Kingan. Freetown to Liverpool. Observers, the Master, Mr. J. Graber, 2nd officer, Mr. J. Moffat, 3rd officer and Mr. P. Kennedy, 4th officer.

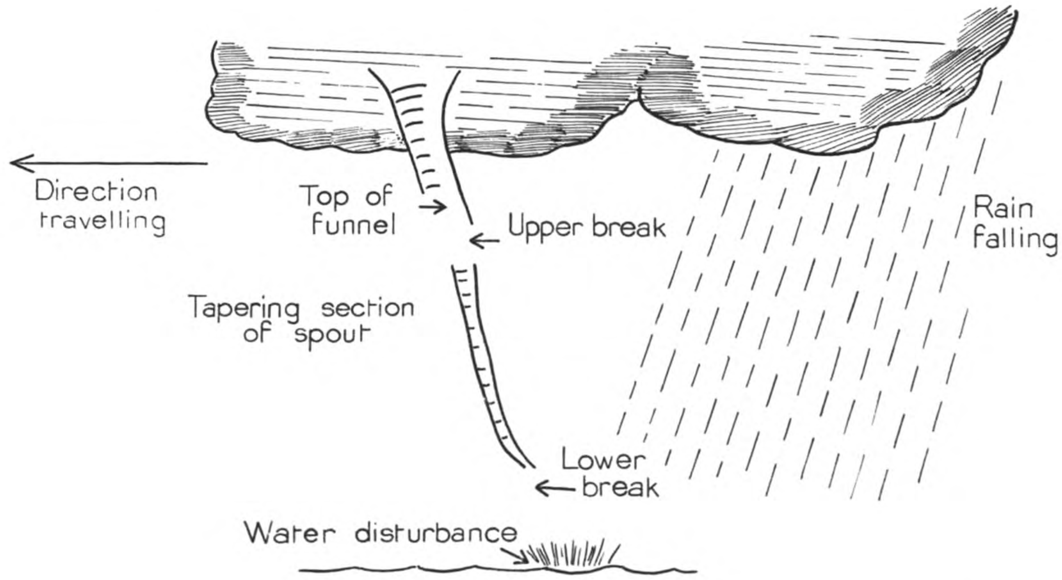
5th December, 1958. At 0929 a well-defined waterspout formed with almost explosive suddenness at a distance of 2·2 miles by radar, from the ship. The column was about 60 ft in diameter, the agitated water at the base being some 150 to 200 ft across. On either side of the spout, which originated from towering Cb, very heavy rain was falling, but at the ship the sun was shining. The activity gradually decreased until 0937, when the spout parted from the cloud base. The

*(Opposite page 172)*

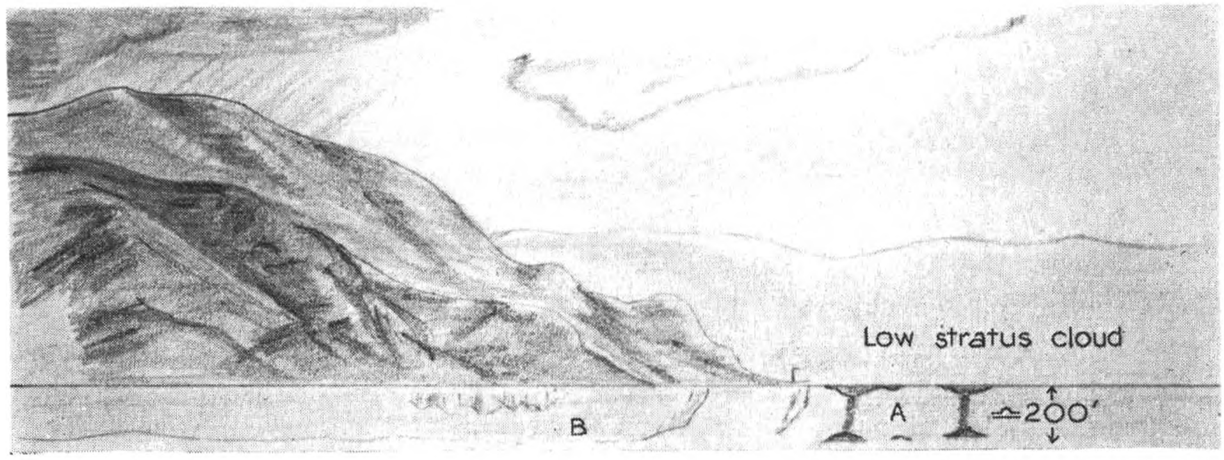
*Photo by courtesy of Météorologie Nationale, Paris*


Two views of *France I*, the new French Weather Ship (see page 197).

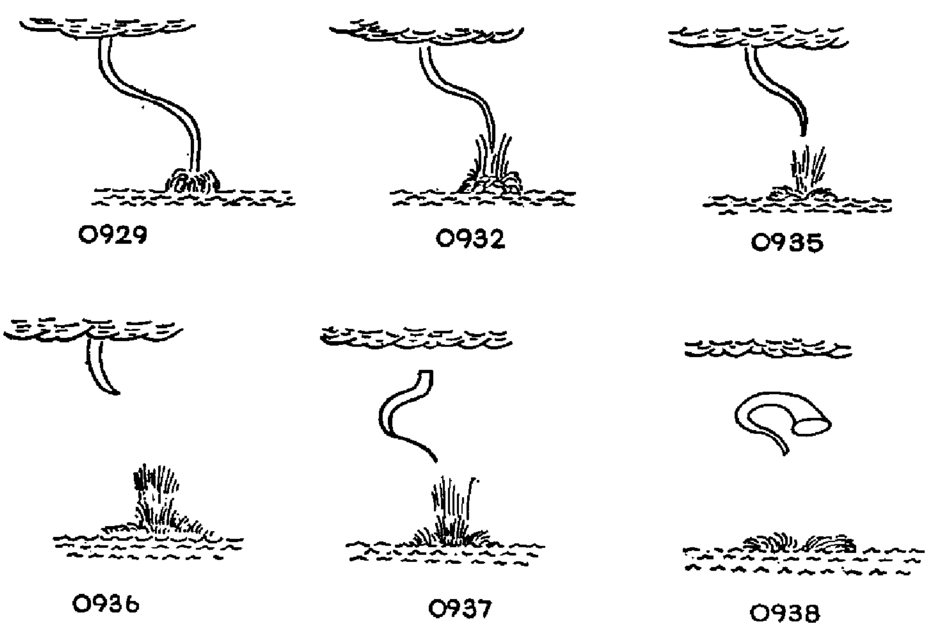
(*Opposite page 173*)




**Waterspout observed from M.V. *New Zealand Star* (see page 173).**




**Refraction effects observed from M.V. *Rangitata* (see page 178).**




various shapes taken by the column during the process of disintegration are shown in the sketches. Air temp. 60·5°F, wet bulb 56°, sea 60·5°. Wind S'E, force 2.
Position of ship: 40° 53'N., 10° 50'W.

## Mediterranean Sea

S.S. *Ayrshire*. Captain P. MacMillan. Aden to Suez. Observer, Mr. W. F. McCarthy, 2nd officer.

29th November, 1958. Between 1305 and 1310 a waterspout was seen 2·1 miles (by radar) from the ship. Sextant angles gave the height of the column as 665 ft and its diameter at the cloudbase as about 10 or 11 ft. The spout matured rapidly, achieving full development in a very few seconds. At sea level the spray rotated in a counter-clockwise direction (looking down) and seemed to have a period of rotation of about 12–14 sec but it is not possible to say if this applied to the funnel also. Running up the inside of the column were two very dark parallel lines which appeared to define the inner wall of the spout. There was apparently no lateral movement of the formation, but the great vertical disturbance was plainly seen. Temperatures at noon were: Air 63°F, wet bulb 60°, sea 66°. Wind E'ly, force 6.
Position of ship: 35° 27'N., 19° 57'E.

*Note.* This observation has been included because it gives interesting numerical values of the dimensions of the waterspout.

## Gulf of Darien

M.V. *New Zealand Star*. Captain E. L. Jermyn, O.B.E. Panama to New York. Observer, Mr. I. C. Wood, 3rd officer.

19th October, 1958. A small waterspout appeared suddenly about ¾ mile from the ship, at 2055 G.M.T., the first indication being a disturbance on the surface of the sea. It lasted 3 min. An interesting feature was the fact that the column was broken in two places simultaneously, the lower break occurring not far above the disturbed water and the upper one at some distance below the base of the clouds. The appearance of the waterspout is shown in the sketch on opposite page.
Air temp. 85°F, wet bulb 80°. Wind NE'E., force 3–4.
Position of ship: 10° 43'N., 78° 18'W.

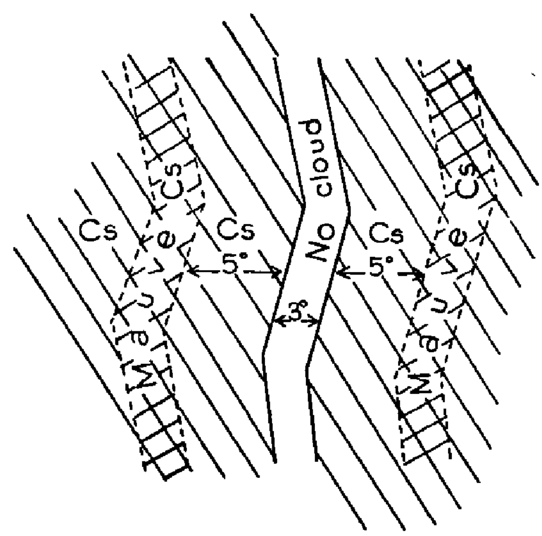
*Note.* This observation is of interest because of the two breaks in the column of the waterspout. It is unlikely that there were breaks in the rotating filament; the apparent " gaps " were probably where there was an absence of condensed water vapour. Estimates of the diameter of the column and its direction of rotation would have been of great interest.

## UNUSUAL CLOUD STRUCTURE

### South Pacific Ocean

S.S. *Gothic*. Captain L. J. Hopkins. Balboa to Auckland. Observers, Mr. T. Oliver, 3rd officer and Mr. R. Dyer, 4th officer.

7th November, 1958. At 0300 G.M.T. a large patch of Cs cloud, which was




divided by a perfectly clear cut lane about 3° wide, was seen overhead. On either side of this lane, and lying parallel to it at a distance of approximately 5°, were two mauve strips of Cs (see sketch). By 0310 the formation had dispersed, the original patch of cloud breaking up into several smaller ones: the mauve colouring also faded out. Other clouds present were 1/8 towering Cu and 1/8 Sc. Visibility excellent. Air temp. 69°F, wet bulb 67°, sea 74°.

Position of ship: 26° 02′S., 135° 16′W.

## LOCUSTS

### Vicinity of Canary Isles

M.V. *Richmond Castle*. Captain A. T. Underdown. Cape Town to Las Palmas. Observers, the Master, officers and crew.

17th October, 1958. At 0500 G.M.T. about 100 locusts landed on the ship, while many more were observed on the surface of the sea. They were mainly 3 in. long, ½ in. wide and " lobster pink " in colour. It was noticed that they were unable to jump, but could crawl. Four of them, on being catapulted into the air, were unable to fly. They were not interested in food, but one or two actually ate their neighbours. Those which were not immediately thrown overboard died after about 5 hours. Air temp. 74°F, wet bulb 70°. Wind N., force 3.

Position of ship: 26° 40′N., 15° 30′W.

*Note.* This observation has been referred to the Anti-Locust Research Centre.

## PHOSPHORESCENCE

### Off Liberia

S.S. *Calabar*. Captain P. M. Ralston. Takoradi to Freetown. Observer, Mr. B. P. Telfer, 2nd officer.

12th October, 1958. At 0230 G.M.T. a milky white glow was observed on the sea surface, in the form of a band about 200 ft across and stretching for approximately 3 miles in an E.–W. direction. When the ship cut across the band the sea did not break up into phosphorescence, nor did the light from an Aldis lamp have any effect when shone upon it. The echo sounder revealed no sign of any fish: the depth of the water was 48 fm.

Air temp. 74°F, sea 80°. Wind S., force 3. Overcast with rain showers. Sea slight.

Position of ship: 4°32′N., 8° 50′W.

*Note.* It is interesting to compare this report with that from M.V. *Port Vindex* below. In each case the phosphorescence was in a band-like pattern, but one gave a brilliant emission of light, while the other gave none when the ship crossed the band.

## North Atlantic Ocean

M.V. *Port Vindex.* Captain E. Young. Las Palmas to Durban. Observers, Mr. J. Burtt, 3rd officer and Mr. J. Whitcher, Junior 3rd officer.

4th December, 1958. From 0000 to 0200 G.M.T. numerous bands of unusually bright phosphorescence were seen lying in an approximately N.–S. direction: they were about 300–400 yd in length and 8 ft in width. When the ship passed through the bands, the resulting waves gave off a brilliant green light. Numerous shoals of fish about the size of small mackerel were seen at the time. Air temp. 67°F, sea 69°. Wind SW'ly, force 1. Rippled sea and low swell.

Position of ship: 21° 18′N., 17° 39′W.

## Persian Gulf

S.S. *British Sailor.* Captain R. C. D. Flamsteed. Mena-al-Ahmadi to Suez. Observer, Mr. F. A. Stolberger, 2nd officer.

11th October, 1958. At 0000 G.M.T. when off Ras-al-Mutaf in 25 fm, the vessel passed through a well-defined area, about 5 miles across, in which a rather unusual form of phosphorescence was observed. The surface of the sea was covered with scattered phosphorescent patches, estimated at about 1 ft in diameter and spaced approximately 5–10 ft apart, which glowed fairly brightly and persisted for a few seconds. The night was completely dark and quite clear and the general effect resembled sequins glittering on a dark background. There was no resemblance either to the normal type of phosphorescence or to a " milky sea ". Air temp. 84°F, sea 88°. Wind NW'ly, force 2–3. Sea slight, not breaking.

Position of ship: 27° 24′N., 51° 40′E.

## Arabian Sea

S.S. *Tribulus.* Captain J. Carr. Bandar Mashur to Eastham. Observer, Mr. J. E. Tinney, 2nd officer.

7th November, 1958. At 2200 G.M.T. the bow wave was seen to be luminous though not actually showing any marked phosphorescence: a number of phosphorescent patches were also observed, the largest of which was estimated to be 30 ft by 6 ft. These appeared to be slowly changing shape and on one occasion, when a patch met the vessel's bow wave, it seemed to disperse as though millions of tiny fish had scattered in all directions. The depth of water by echo sounder was 70 fm. Air temp. 79°F, sea 80°. Wind W'ly, force 1. Sea smooth.

Position of ship: 21° 40′N., 59° 40′E.

S.S. *City of Lichfield.* Captain G. Stewart. Aden to Karachi. Observer, Mr. P. G. Pike, 3rd officer.

14th November, 1958. Long bands of milky phosphorescence were observed between 1630 and 1700 G.M.T. As the first of them appeared, the rather bright phosphorescent glow on the sea, which had been present since twilight, disappeared. The vessel passed through six bands at 2032, 2037, 2042½, 2051, 2057 and 2102 G.M.T. respectively. Each was between 50 and 70 ft wide and, as they passed, small, twinkling spots, rather like stars, were seen. The bands seemed to be quite straight to the northward, but to the S. they were wavy looking and, near the horizon they curved towards the W. They were estimated to extend about 5 or 6 miles on either side of the ship. Air temp. 78°F, sea 80°. Wind, light airs. Slight E'ly swell. Speed of vessel 10·7 kt.

Position of ship at 1630: 16° 33′N., 54° 25′E.

### South African waters

S.S. *Clan Davidson.* Captain G. W. Spiller. Cape Town to Port Elizabeth. Observer, Mr. G. R. Stokes, 2nd officer.

8th November, 1958. Bright circular patches of phosphorescence were seen from 2300 G.M.T. until 0100 on 9th November, varying from 50 to 100 ft in diameter. The greenish glow given off was so bright at times that the foredeck fittings, etc., could be seen clearly from the bridge. Out of these patches quite a number of what seemed to be porpoises could be seen swimming towards the ship's bow, around which they played for some time. When they left they darted back again into patches of phosphorescence. By 0100 the ship had left the larger patches behind, but the crests of the waves were still very bright until about 0200. Air temp. 62°F, sea 63°. Moderate sea and swell. Wind S., force 4.

Position of ship: 34° 34′S., 22° 18′E.

### Strait of Malacca

M.V. *Graig.* Captain R. Dodds. Antwerp to Shanghai. Observers, Mr. L. Jarrett, Chief officer and Mr. T. Jackson, 2nd officer.

10th October, 1958. At 2020 G.M.T. successive waves of what appeared at first to be light spindrift blown from the surface of the sea, were seen approaching from NE. Since the wind at this time was SE., force 2–3 only, the idea of spindrift being present had to be ruled out, and on further examination it was found that the "spindrift" was in reality belts, or "waves", of phosphorescence. At 2034 the "waves" disappeared but phosphorescent particles, which glowed frequently in a manner similar to sea clutter on a radar PPI, were seen in the sea near the vessel. By 2035 the sea assumed a normal appearance. Air temp. 78°F, sea 85°. Thunder and lightning with moderate rainfall. Visibility 5–6 miles. Sea smooth.

Position of ship: 3° 17′N., 100° 23′E.

### New Zealand waters

M.V. *Port Brisbane.* Captain F. W. Bailey, M.B.E. Observers, Mr. J. D. Hitchmough, 3rd officer and Mr. C. H. Boyd, Apprentice.

21st December, 1958, 0030 to 0300 G.M.T. After rounding Cape Reinga, vivid green phosphorescence was observed in the bow wave, culminating, after 2 hours, in an area of milky sea about 1 mile in diameter. Stronger lines of phosphorescence, each about 4 ft wide, ran E.–W. across the area. A nauseating stench filled the air. A sample of the sea water was examined and the following contents found:

(1) Two identical globules, each 8 mm long by 4 mm broad, lemon-shaped and of a transparent gelatine-like texture. A grey-brown elongated spot decorated one end, with a tiny black spot beneath. When laid on a piece of paper a rhythmic twitch, or beat, was seen, at the rate of 44 per min: some 8 min later this was still being consistently maintained.

(2) An amorphous gelatine mass (approximately twice the volume of the globule) containing seven specks.

(3) Numerous organisms, all less than 1 mm long, darting about close to the surface (approximately 50 in 20 cc of the sample).

One, larger than average and shaped like an extremely small, acute-angled cone, when removed from the water was seen to have an orange head, and an orange spot on the tail, the remainder of the organism being transparent.

(4) A shrimp-like creature, 1½ mm long, with semi-transparent body, two black spots at the head and two minute fins. In the general aquatic activity it appeared to be frequently attacked by lesser members which would adhere for a short time, before the shrimp, normally docile, shook them off.

Air temp. 66°F, sea 70°. Wind variable, force 1.
Position of ship: 34° 44′S., 172° 35′E.

*Note.* Dr. W. J. Rees, of the Natural History Museum, comments:
" With reference to the above,

(1) these appear to be salps;
(2) a chain of salps;
(3) the organisms might have been, questionably, Dinoflagellates. Dr. J. P. Harding suggests small copepods or their larvae.
(4) this seems to be a larval ommastrephid squid."

## ABNORMAL REFRACTION

### Mediterranean Sea

S.S. *Esso Cambridge*. Captain J. B. Elliott. Southampton to Port Said. Observer, Mr. J. Hickson, 3rd officer.

12th November, 1958. Between 1900 and 2200 G.M.T. the glare of Alexandria's lights were visible, the distance at the beginning of the period being approximately 106 miles. The weather was overcast with low, thick stratiform cloud. Visibility very good. Air temp. 68°F, sea 72°. Wind W., force 3.
Position of ship at 1900: 32° 34′N., 28° 32′E.

### Red Sea

S.S. *Orontes*. Captain S. Ayles, R.D. Port Said to Aden. Observers, Mr. G. K. Harrison, 1st officer and Mr. J. M. Boyde, Senior 3rd officer.

6th December, 1958. The Brothers islets were observed to undergo the changes

0839 0839½ 0840 0841 0842 0842½

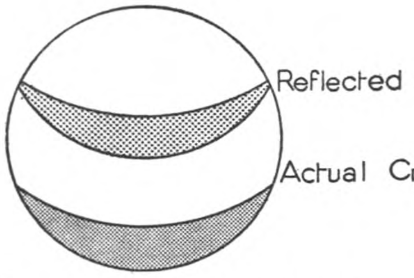
in appearance shown in the diagrams, around 0840 S.M.T. The most striking aspect of the phenomenon was the change between 0842 and 0842½, when the image of the islet and lighthouse suddenly became upright. At the same time, parts of the coast of Saudi Arabia were seen, although 80 miles distant: the masts and funnels of ships " hull down " were also seen very clearly. Air temp. 74°F, wet bulb 65°, sea 79°. Wind, calm. Cloud: 7/8 Ac and As, 1/8 Sc.
Position of ship: 26° 30′N., 34° 39′E.

*Note.* The fluctuations of abnormal refraction between 0842 and 0842½ are probably due to the ship's experiencing a change of air mass, either by its own movement or by the flow of a different air mass over and around it. This would cause a change in the vertical distribution of temperature and humidity over large areas in specific directions away from the ship causing corresponding variations in the abnormal visibility.

### South Atlantic Ocean

M.V. *Winchester Castle*. Captain G. W. B. Lloyd. Cape Town to Las Palmas.

19th July, 1958, 1800 G.M.T. The moon, which was 3 days old, presented the




appearance shown in the accompanying sketch. The disc was feebly illuminated by " earth shine " and superimposed upon it was a reflected image of the crescent (see sketch). The night was fine and there was no mist or haze.

Air temp. 60°F, wet bulb 58°, sea 62°. Wind SE., force 3.

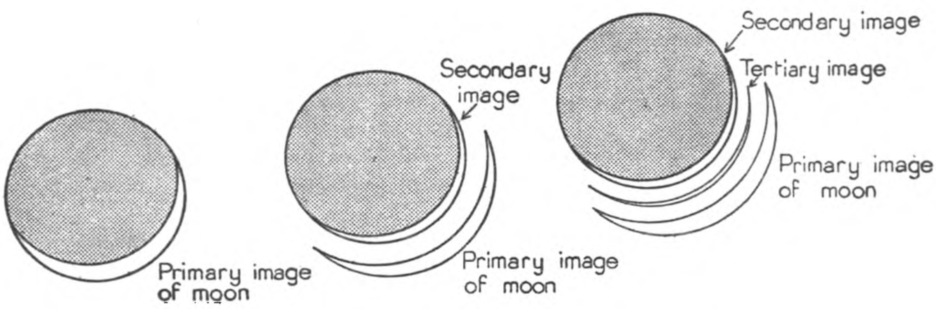
Position of ship: 27° 20′S., 11° 40′E.

*Note.* Although the date of this observation falls outside this *Marine Observers' Log*, it is published here because of its interest. It occurred at night and was therefore not influenced by solar radiation and probably indicates some deep air mass changes.

## South Pacific Ocean

M.V. *Port Auckland*. Captain C. R. Townshend. Cristobal to Suva. Observer, Mr. L. G. Williamson, 3rd officer.

7th December, 1958. At 1000 G.M.T., when at an altitude of 35°, the whole of




(1) (2) (3)

the moon's disc was very faintly visible, due to " earth shine ", in addition to the crescent which was of normal brilliance (Fig. 1).

At 1007, the crescent appeared to become detached, and occupied a separate position, a small distance away from the moon's disc. At the same time, another crescent, slightly thinner than the original one, took its place: it was just as distinct and had the same colour (Fig. 2). At 1010 the separation between the two crescents increased further and at 1012 a third narrow crescent appeared between the other two. It was just as clearly defined and of the same colour as those which preceded it (Fig. 3). At 1014, low cloud covered the moon and no further observations were possible. Air temp. 71·7°F, wet bulb 67·1°, sea 72·8°. Wind E'ly, force 3.

Position of ship: 4° 06′S., 109° 52′W.

*Note.* This is of interest because it occurred at night and it can be compared with the report from M.V. *Winchester Castle* (above).

## New Zealand waters

M.V. *Rangitata*. Captain E. H. Hopkins. Wellington to Balboa. Observers, the Master and Mr. I. C. S. Rankin, 3rd officer.

18th October, 1958. At about 0000 G.M.T. when approaching Cape Palliser from Wellington, with the lighthouse bearing 130° at a distance of 15 miles, the refraction effects shown in the sketch were observed. The headland below the lighthouse and the rocks off the Cape appeared to be completely inverted (A); the houses to the W. were likewise inverted and slightly distorted (B). When

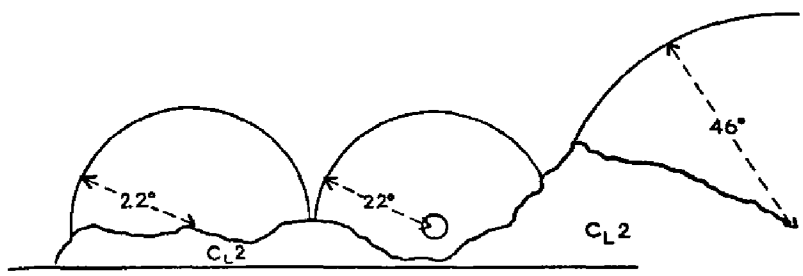
refraction was occurring the rocks were joined, as shown. Rain showers had been falling and low St lay behind the Cape to the E. The refractive layer was estimated to be about 200 ft thick. Air temp. 57°F, wet bulb 55°, sea 55°.
Position of ship: 41° 27'S., 175° 03'E.

## LUNAR HALOS

### South Pacific Ocean

M.V. *Port Napier*. Captain P. S. Ball. Port Chalmers to Balboa. Observer, Mr. R. J. Gollogly, 3rd officer.

5th October, 1958. At 1115 G.M.T. lunar halos, as in the sketch, were observed




when the moon bore 040°, altitude 29° 40', the lower segments being obscured by a bank of large Cu. The parts visible were predominantly white in colour. To the E. of the two 22° halos there was part of the arc of a 46° halo: of this halo, 95° of arc was seen. At the time of observation the sky was covered with a thin layer of Cs. Air temp. 74°F, wet bulb 71°, sea 76°. Wind NNE., force 3.
Position of ship: 21° 44'S., 128° 10'W.

## SCINTILLATION

### North Atlantic Ocean

M.V. *Imperial Star*. Captain G. L. Evans. Curaçao to Dunkirk. Observer, Mr. A. Fordham, 3rd officer.

11th December, 1958. At 0005 G.M.T. the sky was clear of cloud except for two patches of lenticular Ac which lay between Sirius and the horizon. It was noticed that Sirius was exceptionally bright and showing marked scintillation, the predominant colours being red and green, though frequent flashes of blue and purple were also seen. This condition persisted with variations in brilliance until 0030, when the cloud patches passed across Sirius, obscuring it temporarily. After the passage of the cloud, Sirius was seen to show its normal brilliance and colour. This was the only star which appeared to be affected in this manner. Air temp. 69°F, wet bulb 68°, sea 71°. Wind SE., force 2. Visibility excellent.
Position of ship: 33° 39'N., 46° 16'W.

*Note.* Reports of scintillation abnormalities are rare, which makes this observation of particular value.

## AURORAE

*Note.* Observations have been received from 22 ships, in addition to those published below. All have been forwarded in full to the Aurora Survey, towards which ships' observations are making a very valuable contribution.

### Northern North Sea

F.R.S. *Explorer*. Captain E. A. Bruce.

20th October, 1958. At 1845 G.M.T. pale auroral light was observed bearing 010°, altitude 30°. At 1850 aurora having no definite coloration appeared in the W., resembling a sector of a catherine-wheel undergoing rapid changes: at 1854 it disappeared. At 1858 the aurora reappeared in the form of rapidly changing patches of light which showed through the cloud at altitudes ranging from about 15° to the zenith. It extended around almost the whole horizon. By 2000 it was becoming difficult to distinguish the aurora from moonlight.

Position of ship: 57° 00′N., 3° 06′E.

## North Atlantic Ocean

M.V. *Richard de Larrinaga*. Captain J. Meade. Port Churchill to Manchester. Observer, Mr. F. Waring, 3rd officer.

8th October, 1958. At about 2400 G.M.T. a brilliant auroral glow appeared on the SE. and W. horizons: it was most brilliant towards the E. and W. Rays similar to searchlight beams crossed the sky from NW. to SE. and NE. to SW., the whole display being light green in colour. After a few min the glow extended over all the northern horizon but it still remained brightest in the E. and W. The colour changed to a brilliant emerald green in the NE. and from this point a broad arc traversed the sky to the SW. The rest of the sky was only faintly illuminated by a grey-green light. For the next 3 hours the aurora remained brightest to the NE. and SW. with an occasional arc between them. No more observations were made owing to cloud.

Position of ship: 58° 36′N., 32° 38′W.

M.V. *Britannic*. Captain J. D. Armstrong, D.S.C., R.D. Cobh to New York. Observers, Mr. R. O. Venn and Mr. R. J. Ogilvy, Senior 3rd officer.

22nd October, 1958. Aurora without any outstanding features was seen during most of the night. At 0530 an area of red coloration was observed in the N.: faint at first, it intensified slowly. At 0540 the coloured area was rather more to the W. of N. and intensifying somewhat: a single bright, white beam being to the N. At 0550 the red area was still brightening and lying more to the W., but with little change in the extent of the sky covered. The white beam in the N. still persisted but becoming less bright. To the W. of the coloured area several white beams appeared which on the whole were continually changing, though two of them were fairly constant. The more westward of the two was the brighter but neither was as brilliant as the beam bearing N. At 0600 cloud obscured most of the aurora but this was still seen at the edges of the cloud sheet. Visibility was very good and cloud amount variable.

Position of ship: 46° 50′N., 41° 55′W.

S.S. *Manchester Spinner*. Captain F. L. Osborne. Manchester to Quebec. Observer, Mr. A. O. Copeland, 2nd officer.

23rd October, 1958, from 0305 to 0700 G.M.T. Observed a diffuse glow of aurora in large patches across the northern sky, which was half clouded. At 0520 the aurora rays rose from all parts of the horizon between W. and E. culminating in a corona at the observer's zenith. Rays extended beyond the zenith, across the southern sky, to within 23° of the horizon. The aurora filled the sky with a bright white light through which the stars were clearly visible.

Position of ship: 55° 56′N., 35° 08′W.

## New Zealand waters

M.V. *Port Macquarie*. Captain E. W. Dingle, M.B.E. Balboa to Wellington. Observers, the Master and Mr. W. Cole, 4th officer.

24th October, 1958. At 0910 G.M.T. a bright red glow, which lasted until 0945, was seen towards the S. At 1045 aurora was observed again, altitude 18° to 45°, and appeared to cover a large area of the southern sky. Several white pillars of light were observed, each lasting only 5 min approx. As a pillar disappeared it would leave an extremely bright glow which merged in 2 or 3 min with the bright red of the surrounding sky. By 1130 the sky had assumed its normal appearance.

Position of ship: 40° 21′S., 177° 08′E.

## North Pacific Ocean

S.S. *Orcades.* Captain J. D. Birch, D.S.C., R.D. Honolulu to Vancouver. Observer, Mr. M. D. Rushan, Junior 3rd officer.

22nd October, 1958. Between 0810 and 0840 G.M.T. faint reddish auroral glow was visible bearing N., altitude between 15° and 25°. A small patch only was seen.

Position of ship: approximately 41° 18′N., 137° 12′W.

23rd October, 1958. Between 1100 and 1150 G.M.T. at moonset, a diffuse white auroral light was observed reaching a height of 5° and extending in azimuth from 330° to 030°. There was a brighter nucleus bearing N. and this gradually extended, the whole aurora increasing in brilliance. Rays of light, reaching an altitude of 15°, were then observed at each extremity, which gradually spread to the centre: at the same time a faint red glow was observed for 4 min above the western end of the aurora. Activity then slowly diminished until by 1150 G.M.T. there was only a very faint white light in the northern sky. The sky was almost cloudless and visibility was excellent.

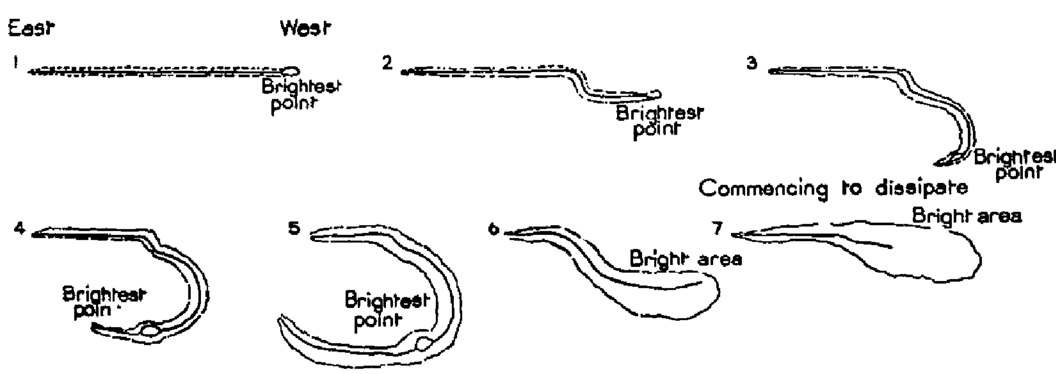
Position of ship: approximately 46° 54′N., 127° 54′W.

# METEORS

## Arabian Sea

M.V. *London Pride.* Captain W. B. Blackmore. Mena-al-Ahmadi to Antwerp. Observer, Mr. R. E. Ambrose Jones, 2nd officer.

9th November, 1958. At approximately 2145 G.M.T. a bright flash occurred




and a meteor, of magnitude comparable to that of Mars, or possibly brighter, was seen emitting a white trail. It was travelling in a W'ly direction at an elevation of about 43°. The trail, which was approximately 5° long, remained visible for 6 or 7 min and during that time assumed the shapes indicated in the accompanying sketch. It lay about 39° 30′ from the star Schedar, towards Rigel. At the time of observation the sky was cloudless and the visibility excellent.

Position of ship: 21° 18′N., 59° 30′E.

## South Atlantic Ocean

M.V. *Richmond Castle.* Captain A. T. Underdown. St. Helena to Lourenço Marques. Observers, Mr. S. Cazalet, 3rd officer and Able Seaman Tipper.

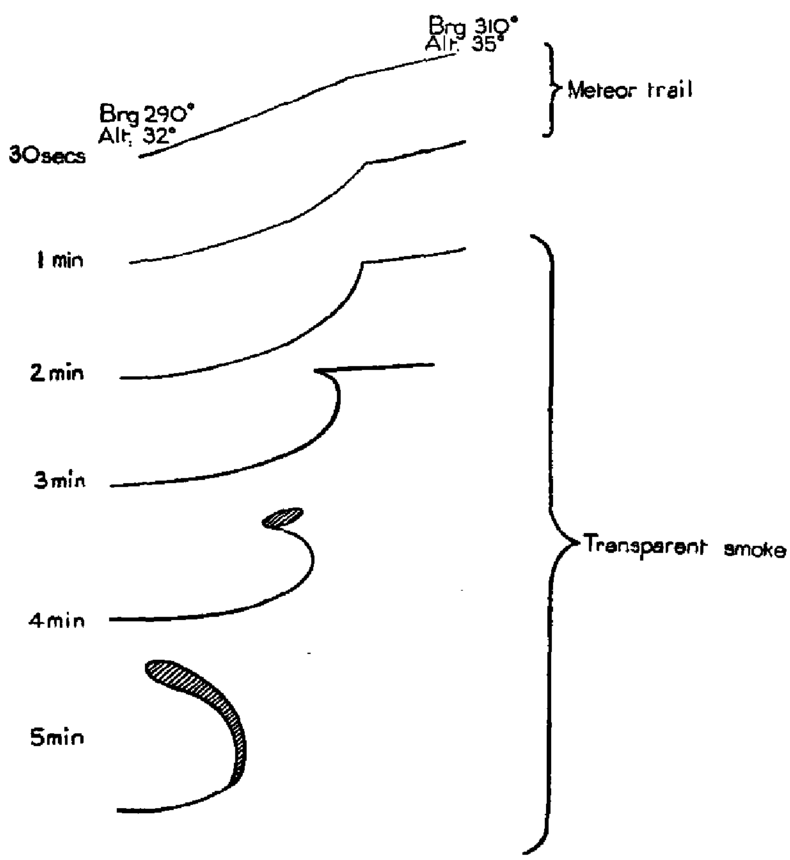
6th October, 1958. At 2050 G.M.T. a meteor, bearing 325°, alt 35°, was observed to be travelling in a NE.–SW. direction until it disappeared behind cloud, on a bearing of 283°, alt 5°, after a flight of 5 sec. A very intense greenish white light was emitted and the meteor seemed to be either very large or very close. For a fraction of a second a long tail was visible after the meteor itself had disappeared. Cloud: 6/8 Cb at 4000 ft. Visibility very good.

Position of ship: 28° 20′S., 12° 55′E.

## North Pacific Ocean

S.S. *Oronsay*. Captain R. W. Roberts, O.B.E., D.S.C. Los Angeles to Honolulu. Observers, Mr. B. H. Pickering, Senior 2nd officer and Mr. W. M. Cowles, Junior 3rd officer.

6th December, 1958. At 1316 G.M.T. a brilliant meteor was seen bearing 310°,




alt 35°; it disappeared with a flash similar to lightning, on a bearing of 290°, alt 32°, and left behind a bright ice-blue trail which remained visible for 6½ min. During the first min it seemed to be luminous, but for the rest of the time it had the appearance of thin smoke through which faint stars could be clearly seen. The trail underwent the changes of shape shown in the sketches: its position showed little change relative to the stars. Visibility excellent. Cloud: 2/8 Cu and 3/8 As.

Position of ship: 25° 30′N., 148° 02′W.

# METEORS COLLIDE

## Indian Ocean

M.V. *Benvannock*. Captain J. P. Robertson. Penang to Aden. Observer, Mr. A. H. Grant, 3rd officer.

6th November, 1958. Two meteors were seen to collide in the southern sky at 1606 G.M.T. The brighter one was travelling in a NE'ly direction while the other one moved towards the W. When the collision occurred a brilliant white flash, with a bluish tinge, was observed. From first to last the time elapsed was about 4½ sec. Sky almost cloudless and visibility excellent.

Position of ship: 8° 25′N., 70° 55′E.

*Note.* Mr. E. W. Barlow comments:

" This is a very remarkable observation and I know of no previous case of the apparent collision of two meteors. The chance of two very small bodies coming in from outer space independently, in different directions and almost certainly at different speeds, meeting in the great expanse of the upper atmosphere, seems to be incredibly small. It is not, however, impossible, though, if it occurred, it would be an event of the most extreme rarity. An alternative explanation is that the meteors did not collide, their paths intersecting at some distance from one another in the line of sight. This would not be an event of any great rarity, but in the case of the above observation, it involves another extraordinary coincidence, viz. that one meteor should have flashed at the instant the path of the other apparently crossed it. Even if this occurred, the meteor which did not flash would have been expected to have been seen continuing its original path after the flash and there is no indication of this in the observation. If the continued path was very short in distance and time it might, however, have been masked by the flash of the other meteor.

" While I cannot state with certainty what actually happened on this occasion, it is a most interesting observation to put on record."

# A Winter Storm in the Sub-tropical South Pacific

The meteorological logbooks of S.S. *Devon* and M.V. *Surrey* covering the period 15–18th July, 1958, contained narratives of meteorological conditions in the South Pacific familiar in summer but somewhat unexpected in the southern winter. Extracts from these logbooks are given below:

(1) S.S. *Devon*. Captain S. W. Lambrick, Balboa to Brisbane.

| | | |
|---|---|---|
| 15th July, 1958. | 1200 G.M.T. | In 23°S., 164° 54′W. Barometer began to fall after rising steadily for the previous 24 hours; wind SE., force 4, increasing; sky 8/8 clouded. |
| | 1520 ,, | Light rain commenced; barometer still falling. |
| | 1530 ,, | Rain intensified; wind increased to force 6. |
| | 1620 ,, | Barometer levelled off slightly, then resumed falling; wind E., force 7; heavy continuous rain. |
| | 1723 ,, | Barometer commenced rising; wind SE., force 7; SE'ly swell increasing. |
| | 1800 ,, | Barometer 1010·1 rising; wind E., force 7; overcast with heavy continuous rain. |
| | 1900 ,, | Barometer rose 0·2 mb in last hour; wind 150°, force 7; heavy continuous rain; sea very rough with very heavy SE'E swell. |
| | 2018 ,, | Barometer risen 2·2 mb since 1900 and commenced falling; rain eased off; wind 110°, force 8. |
| | 2023 ,, | Barometer down 2·0 mb since 2018. |
| | 2030 ,, | Barometer down 2·0 mb since 2023; wind 110°, force 8. |
| | 2035 ,, | Rain ceased; barometer steady. |
| | 2100 ,, | Commenced sending 3-hourly weather reports. Barometer 1010·5, steady since 2030; wind 110°, force 8; low cloud dispersing and revealing 8/8 cirrus cloud. |
| | 2155 ,, | Barometer commenced falling steadily; wind 100°, force 9. |
| | 2330 ,, | Barometer rose and fell 1·0 mb in 5 min, then commenced falling unsteadily. Swell very heavy, SE'E'ly; wind 100°, force 9. |
| | 0000 ,, | Barometer 1007·6 mb. |
| 16th July, 1958. and | Between 0000 0300 G.M.T. | Intermittent very heavy rain squalls, very poor visibility; barometer falling unsteadily; cloud always 8/8 of medium and low cloud; wind E's, force 7. |
| | 0300 ,, | Barometer 1005·2 mb. |
| to | 0400 ,, 0430 | Wind 160°, force 4; barometer 1006·6, rising. |
| | 0500 ,, | Rain ceased; wind 120°, force 9. |
| | 0530 ,, | Barometer rising unsteadily since 0300 then fell 6·0 mb |

| | | | |
|---|---|---|---|
| 16th July, 1958—*contd.* | | | in next 5 min and resumed rising unsteadily; wind 150°, force 8. |
| | 0600 | ,, | Barometer 1004·2 mb, rising slowly; wind 150°, force 8; raining. |
| | 0618 | ,, | Wind 100°, force 8; barometer 1004·2; swell very steep and heavy, still increasing. |
| | 0800 | ,, | Drizzle commenced; wind varied between 100° and 140°, force 7–9; barometer rising slowly. |
| | 0900 | ,, | Wind 110°, force 9; intermittent drizzle; barometer 1005·3, rising. |
| | 1010 to 1030 | ,, | Wind veered to 130°, force 9. |
| | 1120 | ,, | Drizzle intensified to rain. |
| | 1130 | ,, | Vessel altered course to avoid very heavy rolling. |
| | 1200 | ,, | Wind 130°, force 8; barometer 1007·6 mb, rising; overcast with heavy continuous rain. |
| | 1200 to 1400 | ,, | Wind 140°, force 8; overcast with heavy continuous rain. Rain ceased at 1400. |
| | 1400 to 1745 | ,, | Barometer rising slowly; wind 140°, force 8. |
| | 1745 | ,, | Rain commenced. |
| | 1800 | ,, | Barometer 1010·6, rising; wind 150°, force 8; swell moderating; slightly overcast with heavy continuous rain. |
| | 1930 | ,, | Rain ceased. |
| | 2000 | ,, | Wind 160°, force 8; barometer 1012·5, rising; swell still moderating; sky cleared rapidly to 4/8 low cloud. |
| | 2200 | ,, | Wind 150°, force 7; barometer 1014·5 mb, rising; course resumed in considerably moderating swell. |
| 17th July, 1958. | 0000 | ,, | Wind 140°, force 8; barometer 1014·8 mb; swell moderate, SE'ly. Position 25° 02'S., 173° 44'W. |

(2) M.V. *Surrey*, Captain H. J. D. Sladen, Balboa to Auckland.

| | | | |
|---|---|---|---|
| 16th July, 1958. | 2142 | G.M.T. | Ship's position 22° 03'S., 143° 47'W. Received warning of tropical revolving storm in vicinity of 22° 30'S., 168° 00'W., moving 090° at 15 kt. Wind at ship NE., force 4. Barometer 1018·9 mb, falling; air temperature 73°F. Altered course 11° to the southward to avoid storm. |
| 17th July, 1958. | 0030 | ,, | Cirrus clouds began to appear. |
| | 0300 | ,, | Barometer very unsteady; overcast with stratocumulus. Storm now moving 110° according to analysis. |
| | 0900 | ,, | Altered course a further 27° to the southward. Fractonimbus forming; wind freshening and veered to 070°; continuous drizzle. |
| | 2200 | ,, | Altered course to the W. to pass to the southward. |
| | 2300 | ,, | Wind backed to 345°, force 3. |
| 18th July, 1958. | 0400 | ,, | Wind veered to 110°, force 4; passed through frontal rain belt, vivid lightning, no thunder. |
| | 0600 | ,, | Altered course to the NW.; wind backed to 010°, force 4–5; presumed to be under influence of tropical revolving storm. |
| | 1200 | ,, | Wind decreasing. |
| | 1300 | ,, | Light airs, occasional rain; barometer 1009·2, steady; resumed normal course. |

These observations were forwarded to the Director of the New Zealand Meteorological Service, who sends us the following narrative together with the diagrams reproduced on pages 185, 186 and 187.

"During the period 14th–16th July, 1958, the synoptic charts for the S.W. Pacific presented features which are more familiar in the southern hemisphere summer than in the winter. A trough of low pressure extended from west to east

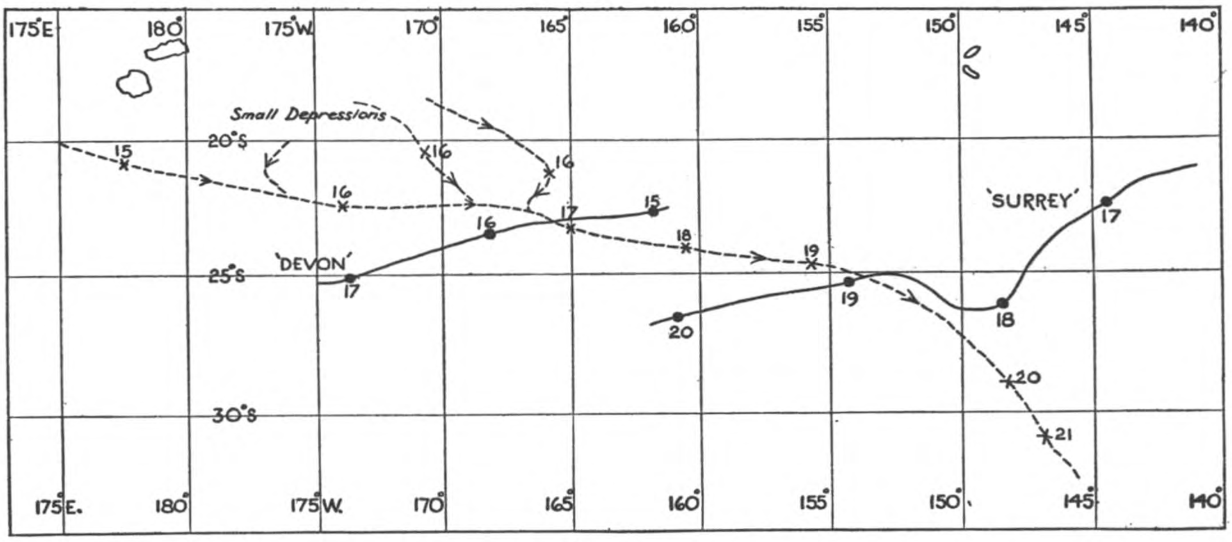



Fig. 1.

Tracks of Ships and Storm Centres. Positions of ships at 0000 G.M.T. are shown by solid circle and positions of depression centres at 0000 G.M.T. by a cross.

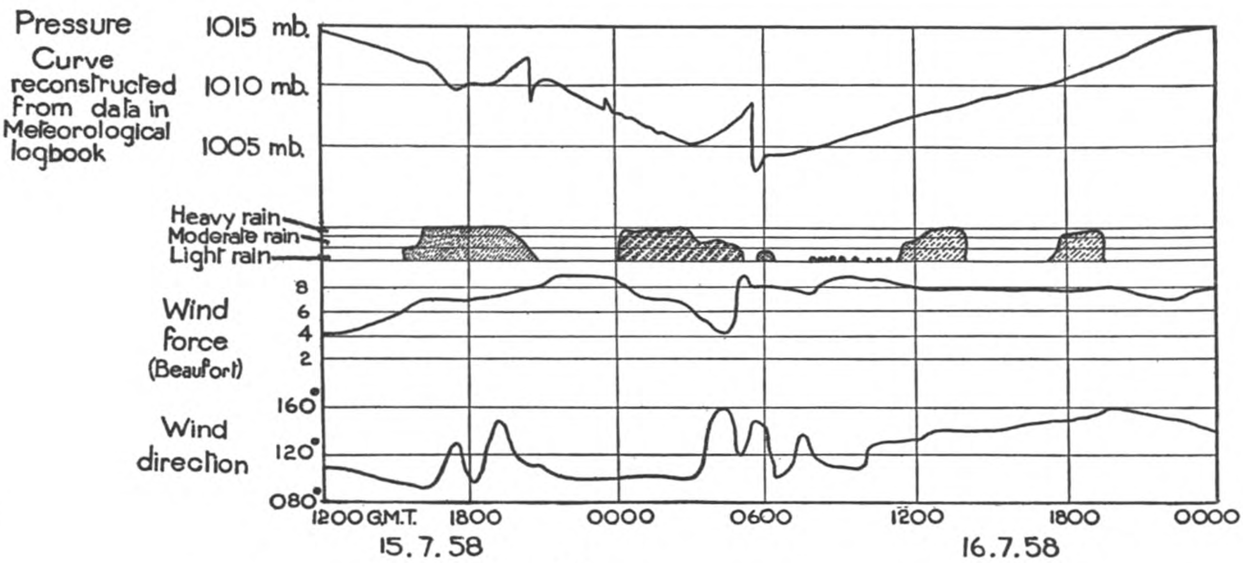



Fig. 2.

Pressure, Wind and Rain experienced by S.S. *Devon* on 15th–16th July, 1958.

for some 1500 miles, lying just south of Fiji, Tonga and the Cook Islands. To the north, a broad northwesterly airstream was accompanied by dull, humid unsettled weather. South of the trough was an easterly airstream with markedly lower dew points, evidently recently arrived from higher latitudes.

" It is clear that several centres of low pressure developed within the trough. In this early stage their movements were erratic and very difficult to establish with certainty, but the broad features of the weather and pressure sequences experienced by the S.S. *Devon* may be explained by supposing that two of these centres passed nearby at about 1800 G.M.T. on 15th July, and 0600 on 16th July. The first had developed near Niue, passed southeastwards about 150 miles north of the *Devon*, and must have been very close to the *Clydebank*, which experienced a wind change from NE. 30 knots to SW. 50 knots between 1800 and 2100 at 21°S., 166°W. This centre then became almost stationary for about 12 hours. The second centre passed eastwards 100 to 200 miles north of the *Devon*, and amalgamated with the first. This second centre probably developed southwest of Samoa and finally became the main centre, absorbing what was originally the main centre further to the west, as well as the one to the east. From 1200 G.M.T. on 16th July, there appeared to be only a single, fairly extensive depression, which moved steadily away to the east and later southeast at about 15 knots, while the *Devon* moved away to the west.

"About 0000 G.M.T. on 19th, the centre of the depression passed close to M.V. *Surrey*. The winds in the neighbourhood of the centre had decreased considerably, and central pressures were only about 1005 mb, but easterly gales were still reported by vessels 300 miles south of the centre. The depression sub-

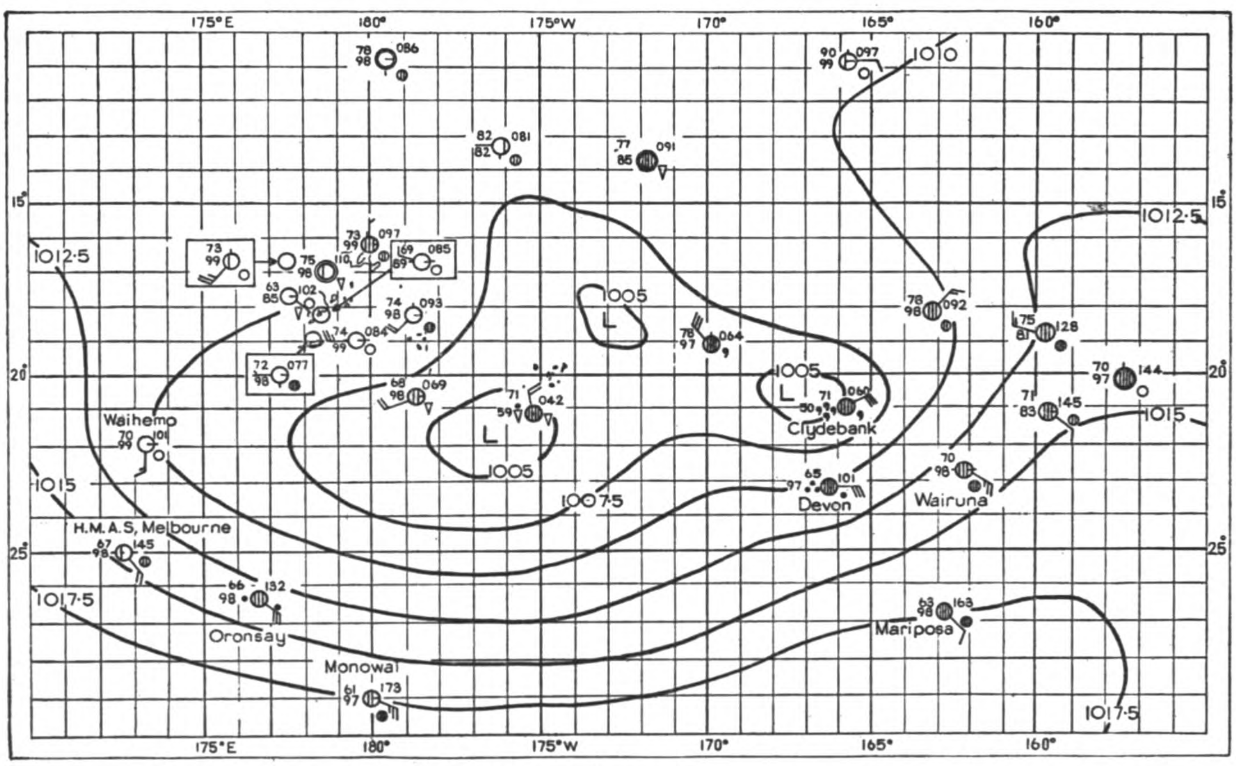



Fig. 3.
Synoptic chart for 1800 G.M.T. on 15th July, 1958.

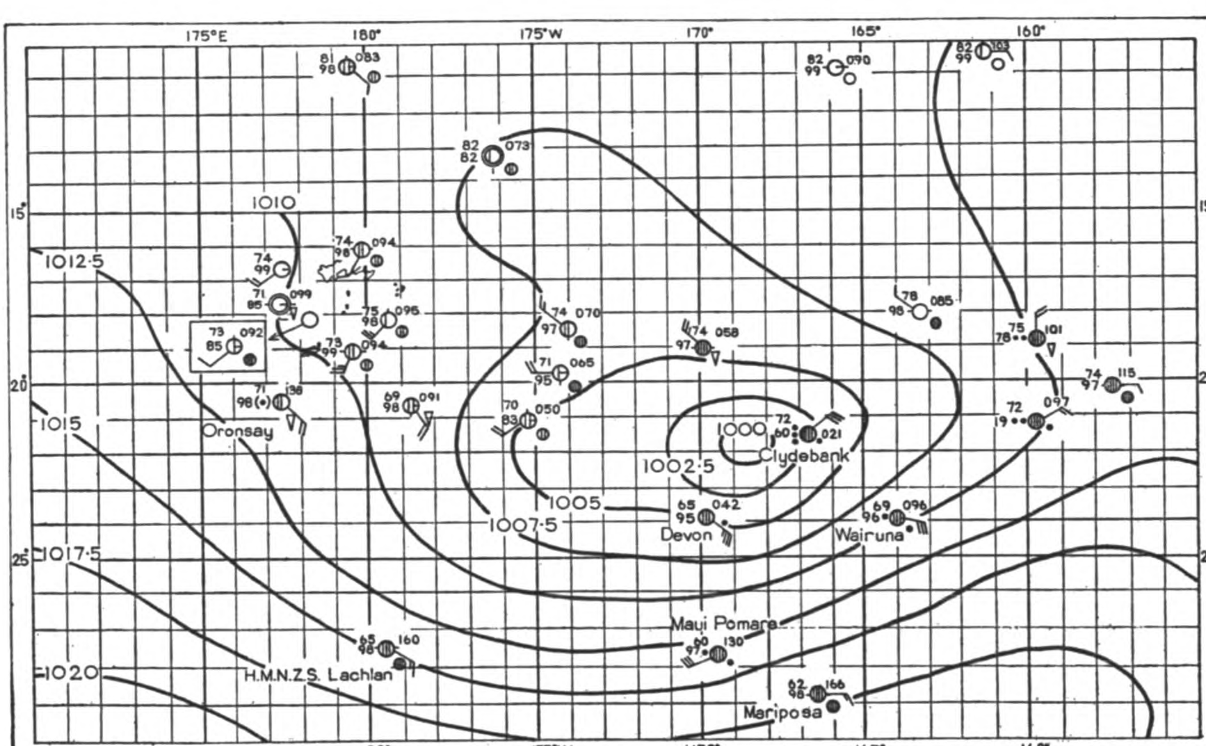



Fig. 4.
Synoptic chart for 0600 G.M.T. on 16th July, 1958.

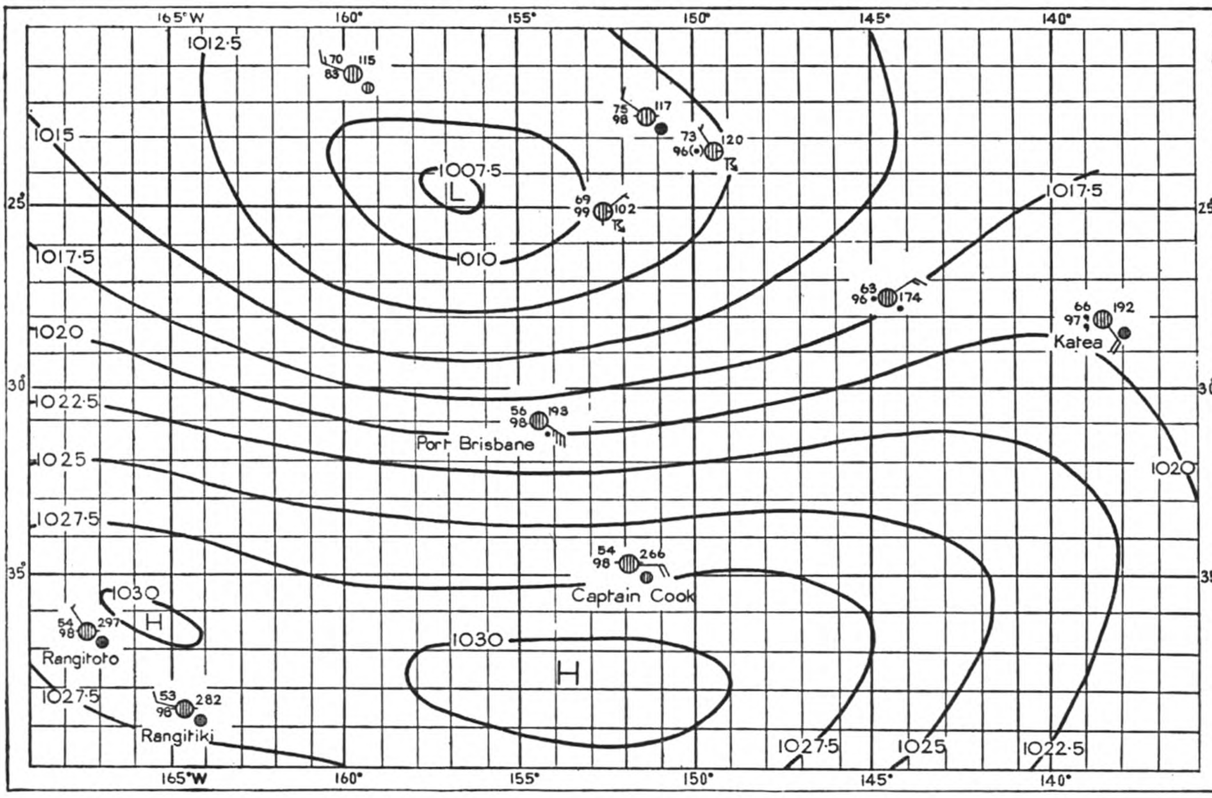



Fig. 5.
Synoptic chart for 1800 G.M.T. on 18th July, 1958.

sequently moved away to the southeast, deepening again, and during the next few days gales were experienced by at least five other vessels.

" Referring to the extracts from the meteorological logbook of the M.V. *Surrey*, it will be seen that the ship sought to avoid the storm by twice altering course to the southward. However, the movement of the storm centre itself acquired a southward component and, when it became clear that the ship could not pass to the south of the centre, course was again altered to the northwest in the hope of passing to the north. In fact the *Surrey* passed through the central low pressure area. As it happens, this was preferable to a passage some distance to the south of the centre because, as was mentioned in the last paragraph, the wind in the vicinity of the flat, central low pressure area was much lighter than it was in a two or three hundred mile wide belt to the south.

" It is well known that tropical hurricanes may be encountered in these waters during the southern hemisphere summer, but the existence of less severe winter depressions in sub-tropical latitudes of the southwest Pacific is perhaps not so widely recognised. They are more common in areas further to the west, between New Caledonia and Australia, and do not often attain the severity of the storm encountered by S.S. *Devon*. The lowest pressures in this storm were not much below 1000 mb, whereas they would be well below this figure in a summer hurricane. It is possible to distinguish two air-masses involved in this storm, but they are separated by a transition zone rather than a sharp front. It would be difficult to analyse all the various centres as waves on a frontal surface.

" The copious entries in the meteorological logbooks of the S.S. *Devon* and the M.V. *Surrey* were invaluable for the analysis of the storm. Other ships in the vicinity whose reports were most useful were the *Clydebank*, *Maui Pomare*, *Mariposa*, *Monowai*, *Wairuna*, *Southern Cross*, *Port Brisbane*, *Katea*, *Aramaic*, *Port Townsville*, *Rangitiki*, *Waihemo*, *Oronsay*, *Captain Cook*, *Rangitoto* and H.M.A.S. *Melbourne*."

Fig. 1 shows the tracks of *Devon* and *Surrey* and the track of the main storm together with its three subsidiaries. Fig. 2 shows graphically the weather and pressure sequences experienced by *Devon* as she passed close to the two depressions, about 1800 on 15th July and about 0600 on 16th July. Figs. 3 and 4 show the synoptic situation at those times. *Surrey* was concerned only with the main depression after the secondaries had been absorbed. Fig. 5 shows the synoptic situation at 1800 on 18th July at the time when she was seeking to avoid the centre.

Of the other British observing ships mentioned in New Zealand's narrative only *Clydebank*, Captain F. S. Langton, Panama to Brisbane (Figs. 3 and 4) was seriously involved. Her meteorological logbook does not contain any narrative but it records that at 1800 on 15th July the wind was 070°, 30 knots. At 2030 it freshened to a moderate gale from the northeast. At 2045 it veered rapidly to WSW., force 10, with torrential rain. At 0000 on July 16th she was slowed down to 5 knots in a confused sea with wave heights of up to 30 feet.

*Port Brisbane*, Commodore F. W. Bailey, M.B.E., Wellington to Balboa, was involved to a lesser degree when, at 1800 on 18th July, she experienced a wind of 120°, 37 kt (Fig. 5).

The other seven ships, *Rangitoto* (Fig. 5) Captain L. W. Fulcher, Balboa to Wellington; *Oronsay* (Fig. 3) Captain R. W. Roberts, O.B.E., D.S.C., Auckland to Honolulu; *Aramaic*, Captain G. Connolly, Balboa to Auckland; *Port Townsville*, Captain J. S. Moate, Balboa to Auckland; *Rangitiki* (Fig. 5) Captain A. E. Lettington, O.B.E., D.F.C., Wellington to Balboa, and *Southern Cross*, Captain L. H. Edmeads, Suva to Papeete, passed too far away from the disturbance to be affected by it and their meteorological logbooks show nothing of unusual occurrence. No meteorological logbook for this period has yet been received from the *Captain Cook* (Fig. 5).

This, however, is a very good example of the value of ship's observations in tracking a storm, even when it may appear to those aboard the ship that there is nothing of unusual significance in their own observations. L. B. P.

# United States National Hurricane Research Project

This note has been compiled from information kindly supplied by Dr. F. Reichelderfer, Chief of the U.S. Weather Bureau, and is primarily based upon a report prepared for the World Meteorological Organisation. It is published here because of the effect of tropical storms on safety at sea and the consequent value to the mariner of any practical steps that can be taken by meteorologists to improve hurricane warning services. Successful research into hurricane behaviour in the Caribbean may prove valuable to meteorological services in other tropical storm areas of the world.

## Introduction

The hurricane catastrophes of 1954 and 1955 aroused public opinion in the U.S.A. to the need for research into the hurricane problem which would lead to improved accuracy of hurricane forecasts. In the spring of 1955, the Congress of the United States of America appropriated funds specifically for special investigations of severe storms including hurricanes. As a result the National Hurricane Research Project was started.

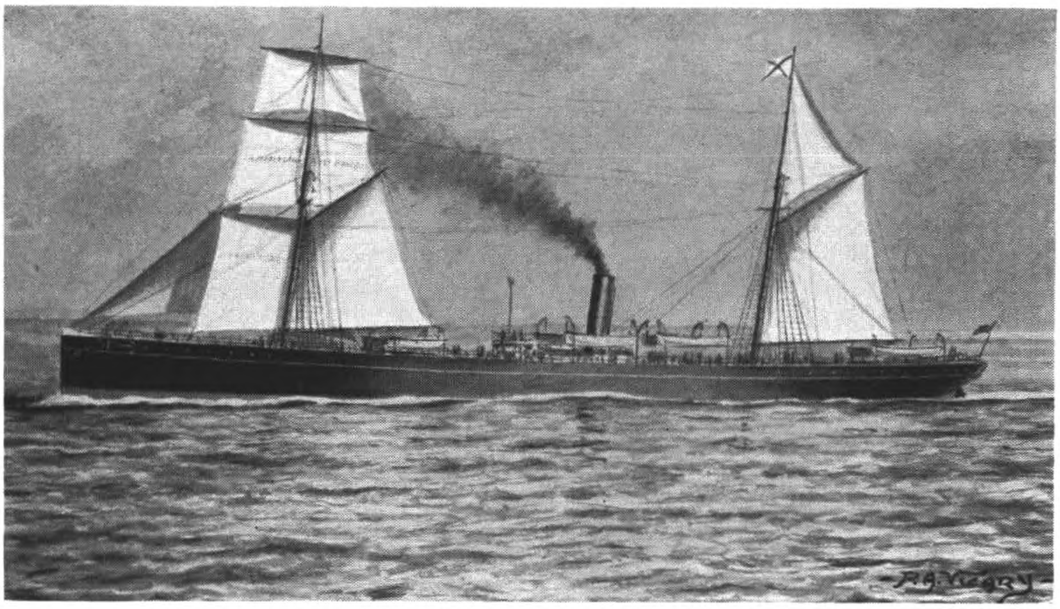
The programme includes the active co-operation of the governments of the countries having territory in the hurricane area. They are assisting with the gathering of the large amounts of data needed as a basis for the research programme. Also participating are outstanding authorities on tropical meteorology from many parts of the world, several of the leading universities in the United States and a number of other agencies of the U.S. government.

## Plan of attack on the hurricane problem

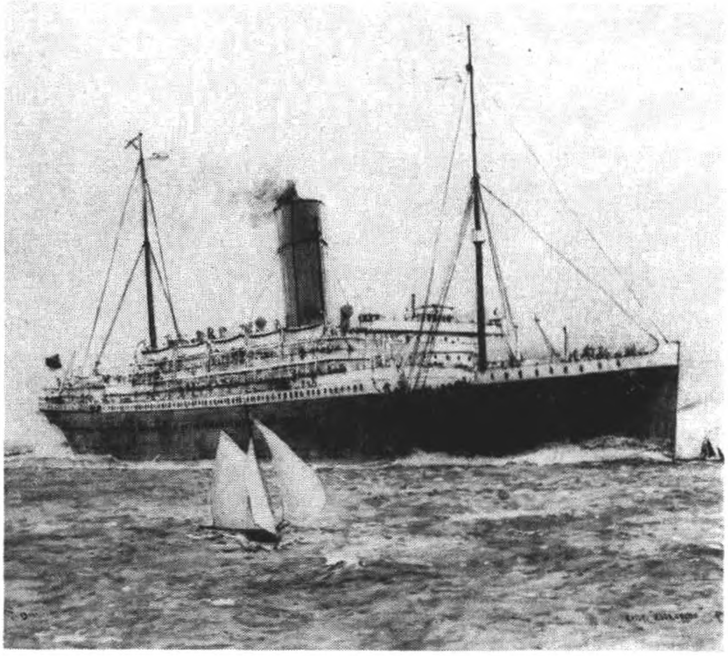
The efforts of the Project have been concentrated in three rather well-defined categories.

1. Collection of detailed data from the hurricane core and surrounding environment in order to test and improve hypotheses.
2. Theoretical studies of the hurricane and its development.
3. Application of the information already at hand to the immediate task of improving forecasts of the development and movement of hurricanes.

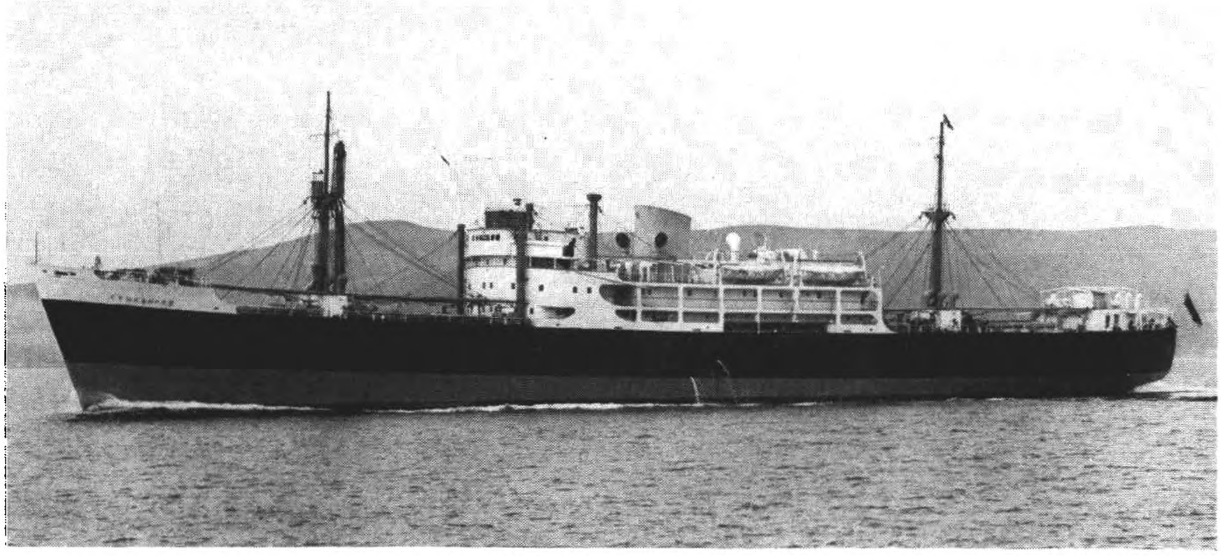
(*Opposite page 188*)



First *Essequibo*.



Second *Essequibo*.



Third *Essequibo*.

THREE OBSERVING SHIPS OF THE SAME NAME (see page 200).

(*Opposite page 189*)

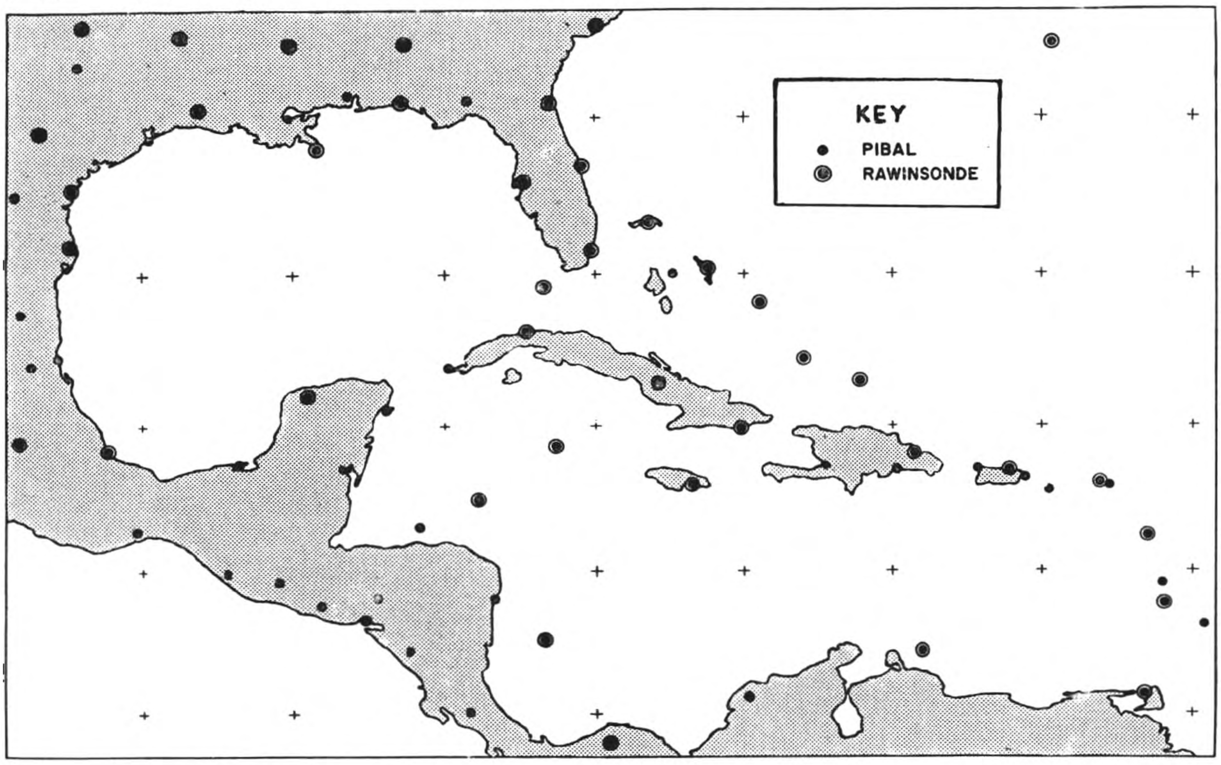



Fig. 1.
West Indies Upper Air Station Network, 1957 (see page 189).
(Over the land the Rawinsonde symbols appear as enlarged Pibal symbols.)

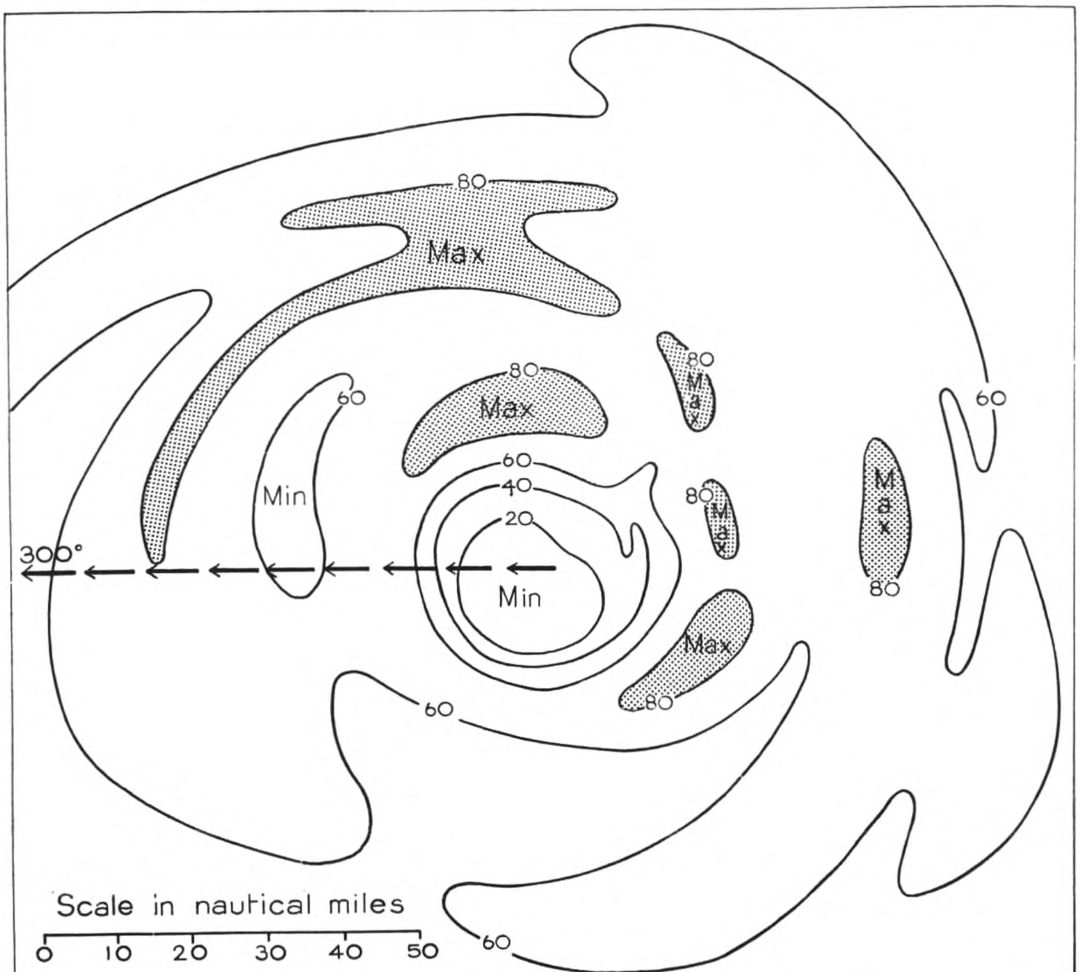



*Diagram from* Business/Commercial Aviation Magazine, *August 1958.*

Fig. 2.
Hurricane Carrie—15th September, 1957. The isopleths are of wind velocity, in knots, at 14,000 ft (see page 190).

To obtain the data essential to this research, it was necessary to establish a network of radiosonde stations in the West Indies of sufficient density to permit a detailed, three dimensional analysis of the atmosphere over the Caribbean area to be made twice daily. This network, which is shown in Fig. 1 (on opposite page), makes use of all the existing upper air observing stations, supplementing them as necessary with new ones.

To obtain data from the storm core, it was necessary to use specially instrumented aircraft which could fly into the storms and gather the information needed. Three aircraft (two conventional piston driven T.B.-50 and one jet B.47) were provided by the Department of Defence and operated by the U.S. Air Force Air Weather Service to collect information from the hurricane core. Each aircraft is equipped with instruments that measure temperature, pressure and humidity of the outside air. Automatic navigational equipment gives a direct measurement of wind and computes the aircraft's position. A camera mounted in the plane's nose takes time-lapse cloud pictures. A digital recording system places the more important data on punch cards in order to facilitate rapid processing of the observations after the aircraft returns to base.

**Résumé of storms**

Hurricane Carrie of 6th–21st September, 1957, was the most important hurricane in the two years of research operations 1956–1957. Carrie was tracked for over 4,000 miles and remained at full hurricane intensity throughout this course. At no time did the storm threaten land areas, but its existence presented a serious hazard to shipping. During its final days it was responsible for the tragic sinking of the German ship *Pamir* with the loss of most of the 86 persons aboard.

Carrie provided the Project with its first opportunity for simultaneous reconnaissance of a mature hurricane by all three of the Project aircraft. This took place on 15th September and two days later two of the aircraft again penetrated the storm. Data gathered during these flights have proved very useful in helping to verify some current theories regarding storm structure, and have led to revision of others.

During 1958 the research flying was favoured with a larger number of tropical storms than in either of the two previous years. Of the 1958 tropical storms, Helene and Daisy were the most notable. The most intensive investigations ever made of the detailed structure of a hurricane were carried out in hurricane Daisy, involving a total of eight flights into the storm.

**Preliminary results of research**

1. Forecasts of Hurricane Movement

Data collected from research flights suggest that the distribution of wind near the hurricane core provides a good indication of the future movement of the storm. This relationship between the hurricane circulation and its movement appears to hold equally well for a storm rapidly changing its direction as it does for a storm moving along a uniform path. If these results are verified, it may become possible for a reconnaissance aircraft not only to locate the centre of the storm but to collect information which will permit immediate computations of forecast positions of the centre.

Techniques are also being developed for forecasting the movement of hurricanes by numerical prediction (using an electronic computer) and by statistical methods (using regression equations for forecasting hurricane positions 24 hours in advance). The results so far are encouraging.

Another study, relating the frequency of hurricanes to the broad-scale features of the atmosphere, has been undertaken in the Extended Forecast Section of the Weather Bureau. Seasonal mean flow patterns for years with many hurricanes differ markedly from those for years with a few hurricanes. Thus to the extent that forecasters can predict the mean flow for a month or a season, the probability of hurricane occurrence can be forecast.

2. The Storm Surge

The analysis of hurricane records in relation to tide height data obtained from the U.S. Army Corps of Engineers, the U.S. Coast and Geodetic Survey and many local agencies has revealed a simple relation between the central pressure of a hurricane and its extreme tide-producing effect. This relation provides a useful way of estimating storm tide rises since the central pressure of a hurricane can be measured by aircraft before the storm reaches the coast.

The effect of a hurricane upon the tide may be clearly evident at coastal points from one to six hours before the waters begin to rise in inland estuaries and endanger evacuation routes. To take advantage of this fact, remote recorders of tide height measured at 12 coastal tide gauges have been installed in neighbouring Weather Bureau offices making possible continual watch for dangerous rises in water level. At least another 20 similar installations are planned.

3. Physical Structure of the Hurricane

The textbook model of the hurricane envisages a spiral influx of air in the lower layers of the storm causing rising motions within a radius of 100–150 nautical miles of the storm centre, and ultimately filling the entire volume of the storm with air originating in the surface layers. However, research flights through hurricanes have indicated that the rising motions are concentrated within a few miles of the centre, like a gigantic smoke stack around the eye of the storm.

In the middle layers of the troposphere the hurricane circulation is not one of pure rotation as described in numerous textbook models. Air in many of the storms spirals in towards the centre of the storm from the forward quadrants, and out from the centre in the rear quadrants. The introduction of relatively cool, dry air into the energy releasing portions of the storm acts as a damper on its intensity.

4. Detection and Reconnaissance

It appears quite possible that a constant-level balloon launched in the eye of a hurricane at the proper height might remain at the hurricane centre for some time. A radio transmitter attached to such a balloon might thus provide a means of tracking the storm through the use of radio direction finders outside a storm area. A device of this type has been developed jointly by the Hurricane Project and the Air Force Cambridge Research Centre. Tests in hurricane Helene were very encouraging and further refinement and testing of the apparatus is planned.

Radar has proved very useful in detecting and tracking hurricanes when the storm centre is within range. The University of Miami is conducting studies designed to improve the usefulness of radar so that the storm centre and its movement may be identified by radar observation of the spiral rain bands which surround the storm.

Peaks of maximum wind separated by areas of somewhat lighter wind have been found in hurricanes by research aircraft. These patterns seem to be the same at different levels. If further investigation proves this to be the case, it may be possible to determine from wind patterns at flight level the maximum winds at the surface and the area covered by hurricane force winds. The wind structure of hurricane Carrie, 15th September, 1957, at 14,000 ft, is shown in Fig. 2 (opposite page 189).

Future Plans

The collection of data by aircraft for a further period of several years may be required in order to test and establish the findings and hypotheses of recent years. The programme under which the U.S. Air Force operated the three research planes in support of the Project ended with the close of the 1958 flight season. In lieu of these planes, however, two DC-6 and one B-57 aircraft are being instrumented and will be used for continued investigation of tropical storms. The B-57 is being furnished by the U.S. Air Force, and all three aircraft will be operated for the

Weather Bureau by a civilian contractor. These aircraft, particularly the DC-6's, are easier to maintain than the former research planes, which should permit much more flexible operations. In particular, it will permit operating from many more airports and thus will greatly expand the area that can be covered by research reconnaissance.

Other methods of securing data will include the use of rockets and satellite vehicles for photographing successive positions of the cloud system of the hurricane.

In April 1959 the research operations base of the National Hurricane Research Project moved from West Palm Beach to combine with the hurricane warning centre at Miami. The combined unit will be known as the National Hurricane Centre. From this location further experimental work on the hurricane problem will be directed and expanded in order that results may be put into operational use as soon as possible.

### Value of Observations from Ships

For any investigation into tropical storms, weather reports from selected ships must play a vital role, since the meteorologist must rely on ships' reports for the first indication of the storm's existence or development. On the research side there is reason to believe that there is a close relationship between the upper winds and surface winds in mature hurricanes. To confirm this, ships' reports within the intense circulation of the hurricane are of great value. The observing officer of a ship caught in the violent winds and mountainous seas of a hurricane should be fortified by the knowledge that his observations are of crucial importance both for immediate forecasting purposes and for basic research.

F. E. L.

# A Possible Correlation between Weather Conditions and Discoloured Water Phenomena in the Eastern Central Basin of the Caribbean Sea

By T. J. Hart, D.Sc.

(National Institute of Oceanography)

One of the many difficulties in understanding the establishment of *Trichodesmium* blooms in the open seas of the tropics, and sub-tropics (as distinct from the more spectacular blooms, sometimes of Dinoflagellates, nearer land) lies in the great scarcity of phosphate and other nutrient materials, essential for plant life in the surface waters. These are usually sharply marked off from the richer waters below by a thermocline (a sharp temperature gradient) at depths of some 140–40 m, which presents a considerable barrier to enrichment by vertical mixing (turbulence). Winds of normal trade-wind strength, rarely exceeding force 6 and averaging force 4 Beaufort, do not establish a " mixing layer " deep enough to disturb the thermocline; and the comparative scarcity of phytoplankton in such waters and their consequent deep blue colour is in accordance with this. For a bloom to develop there must first be some enrichment of the surface layers, and subsequent calm conditions favouring rapid proliferation* of the algae, though even then their subsequent concentration into patches thick enough to cause visible discolouration may depend on other factors as yet but little understood. Chief among these may be the shallow eddies and " wind-lanes " invoked by Bary,[1] Ryther[2] and others.

* Proliferation is the gross increase of these primitive plants resulting from multiplication and growth of individuals.

The sequence could be: first, enrichment by turbulence during occasional violent storms and then rapid proliferation and aggregation* by surface eddies during mainly calm weather.

The eastern central basin of the Caribbean presents conditions similar to those of the larger oceanic areas in comparable latitudes throughout most of the year, if we except local turbulence close in to the Antillean islands and reefs. The reports of discoloured water phenomena in this area, received from the Marine Division of the Meteorological Office or through the U.S. Hydrographic Office during the last six years, are as follows:

S.S. *Akaroa*, Capt. J. W. Hart. 11.X.53, at 1635 G.M.T., in 14° 04′N., 67° 10′W. Passed several patches of light brown discolouration extending about 3 miles along the direction of the wind. Wind 090°, force 2–3. Air temp. 87°F, sea 84°.

M.V. *Dorset*, Capt. K. Barnett, R.D.

(*a*) 13.VI.54, at 1830 G.M.T., in 17° 00′N., 64° 40′W. Observed a few streaks of yellow confervae floating along the direction of the wind.

(*b*) 13.VI.54, at 1930 G.M.T., in 16° 49′N., 64° 51′W. Observed a large patch of discoloured water, varying from sandy yellow to turquoise and having the appearance of a shoal. Proved to be a dense patch of confervae lying across the wind, about half a mile in width.

Canadian S.S. *Pinnacles*, Capt. T. Lotvedt. Observers, the Master and Mr. M. C. Lever, 2nd officer. 3.V.55, at 1520 G.M.T., in 11° 07′N., 64° 43′W. Passed through a large area of discoloured water, a dirty red in colour, with the sun's rays penetrating to a depth of about 10 ft. Many large and small patches were observed in a line 357° and 177°. Total area of the patches was 4 miles E. and W. and 9 miles N. and S. No indication of an oil slick, and the waves were observed to be the same as those outside the area.

S.S. *Sundial*, Capt. H. Burke. Observer, Mr. A. W. Caulderwood, 2nd officer. 11.V.55, at 2000 G.M.T., in 11° 18′N., 64° 20′W. The vessel passed through an extensive area of discoloured water extending in an 015°–195° direction. The discolouration, a dark brown in colour, extended as far as could be seen in both directions and was about three quarters of a mile in width. Wind E., force 3, sky clear. Air temp. 82°F.

M.V. *Thaumastus*, Capt. B. G. Stanley. 5.IX.55, at 2100 G.M.T., in 12° 25′N., 68° 27′W. Vessel passed through a stream of very badly discoloured water. Stream about 50 ft wide and visible up to approximately 5 miles either way in more or less a straight line. Discolouration apparently caused by suspended sand particles as colour of stream was yellow to light brown. Particles visible up to about 5 ft below the surface. Stream was in a 110° to 290° direction.

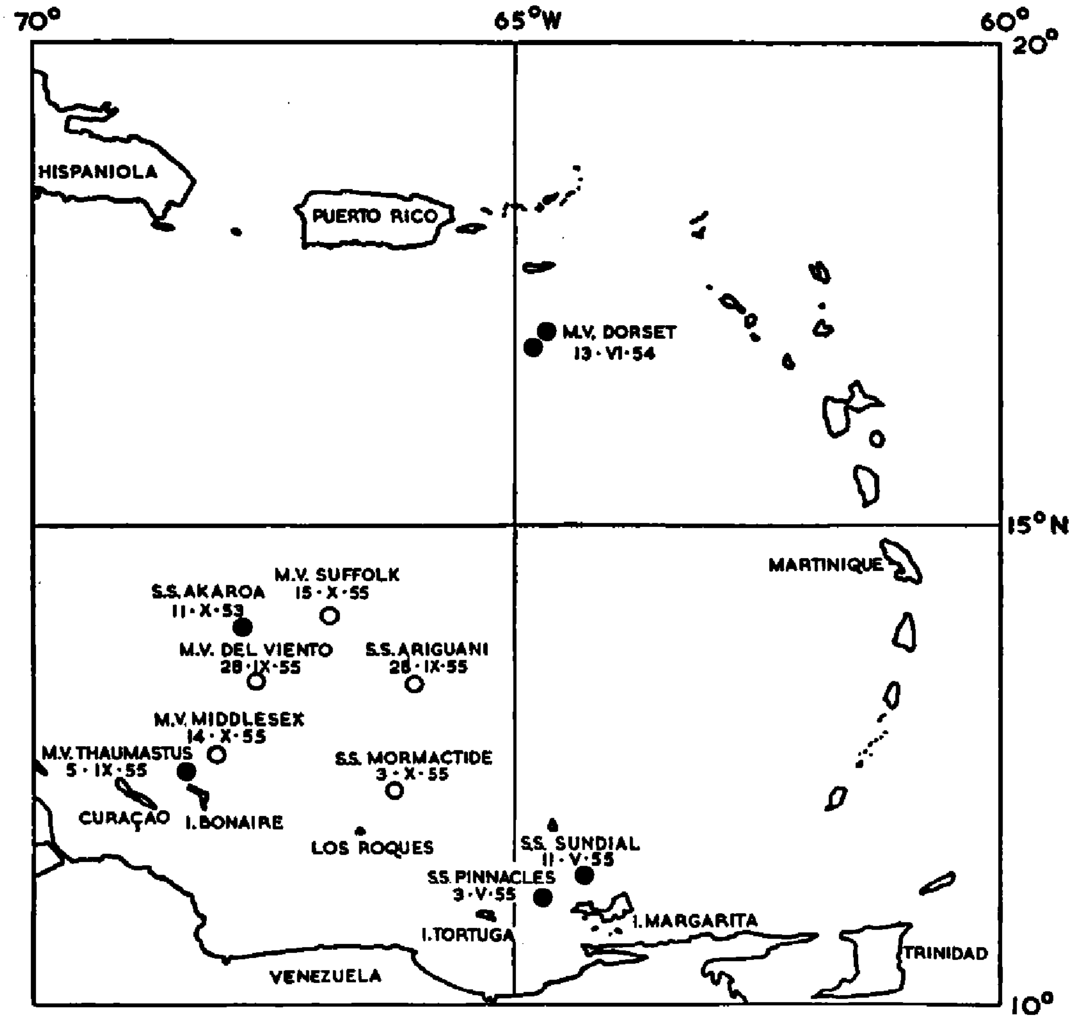
American M.V. *Del Viento*, Capt. R. W. Hudson. Observer, Mr. J. R. Kuhns, 4th officer. 28.IX.55, at 1406 G.M.T., in 13° 21′N., 67° 43′W. Vessel passed a large patch of bright yellow-coloured water, about ½ mile wide and extending about 3 miles in a 115°–295° direction. Wind E., force 3. E'ly sea. Air temp. 87°F, sea 83°.

S.S. *Ariguani*, Capt. R. W. Lundy. 28.IX.55, at 1515 G.M.T., in 13° 20′S., 66° 05′W. The ship entered a large patch of discoloured water. It extended over an area of about a quarter of a square mile, and appeared like fine grains of golden sand suspended on the surface of the water. Interspersed with the discoloured water were small isolated pieces of seaweed. A sample of this water was obtained in the canvas bucket and what had appeared to be sand was found to be what were probably minute pieces of pulverized seaweed. Lack of a microscope on board prevented a more detailed examination of the specimens. The sea surface temperature from the canvas bucket was 82·5°F. Sky lightly clouded. Wind E., 12 kt. Ship's course 296°, speed 14 kt. Further discolouration in patches less extensive and less dense was noticed within this area. There had been a severe hurricane (" Janet ") in this area three days previously.

American S.S. *Mormactide*, Capt. J. Ottesen. Observer, Mr. C. Jarosik, 3rd officer. 3.X.55, at 1805 G.M.T., in 12° 12′N., 66° 16′W. Copper-coloured water was encountered. The discolouration covered an area approximately 2 miles by ½ mile, extending ESE.–WNW.

M.V. *Middlesex*, Capt. T. J. Alderman. 14.X.55, in 12° 45′N., 68° 06′W. From 1450–

* Aggregation implies their crowding together by some external means such as the eddies and " wind lanes ".




Position of the observations discussed. Observations during the three weeks following Hurricane Janet are shown by open circles, others by solid circles.

1850 G.M.T. the vessel passed through large areas of discoloured water. The average size of a patch was about ½ mile long and 30–40 ft wide. They consisted of bands of discolouration, light green at edges and opaque fawnish yellow at centre, travelling in parallel lines to the direction of the wind. Two bottled samples were taken and preserved. It was seen that the water was full of minute specks similar in shape and colour to grass seed. Wind E'S, force 3. Air temp. 87°F, sea 84°.

M.V. *Suffolk*, Capt. H. C. R. Dell. 15.X.55, at noon ship's time, in 14° 03'N., 66° 56'W. Observed lines of thick yellow plankton, some patches up to 4 ft in width stretching to the horizon in lines approximately 140°–320°. They continued for 15–20 min and were occasionally observed up to an hour after noon this day. Speed of ship 15 kt.

It will be seen that only 11 reports of discoloured water have come in from this area during the past six years. Five of the reports, in June 1954, May 1955 and early September 1955, were too near the islands for all possibility of local turbulence, due to the bottom topography, to be ruled out. The remaining six were from farther offshore, and all but one of them followed within three weeks of Hurricane Janet, that passed through the area about 25th September, 1955 (see map above). We have had no reports from the area since the mid-October of that year, although many observing ships continue to make passages through it. It may be noted further that seven out of the 11 records fell within the hurricane season (August to October).*

* Since the above was written, one further report from just outside the area specifically dealt with has come in. It is from M.V. *Cambridge*, Capt. P. P. O. Harrison, Curaçao to Cristobal, and reads: "20th November, 1958, at 1630 G.M.T., in 12° 02'N., 73° 28'W. Olive green strips of discoloured water about a mile long and up to 100 yards wide were observed lying in a SW.–NE. direction."

M.V. *Middlesex* was able to collect a bucket sample of the discoloured water observed on 14.X.55, and when some of this was centrifuged and examined microscopically it was found to contain the bloom-forming alga *Trichodesmium thiebautii*, characteristic of the central Atlantic, though sometimes found elsewhere. Some were still aggregated into rafts just visible to the naked eye, but most occurred as individual filaments. (The rafts tend to break up in preservatives.) Some 30 filaments were present in each raft and not less than 220 filaments in each ml of water. Each filament consists of several scores of cells and is considerably larger than the unicellular micro-organisms that usually predominate in offshore microplankton. Many of the latter were also present: Diatoms, Dinoflagellates and Coccosphaeriales; but only in numbers such that (considering also their minuteness) they can have made but a small addition to the over-all visual effect.

In other areas, usually close to land, where Dinoflagellates of other unicellular microplankton have been observed to form discolourations, far higher numbers of individual organisms per unit volume of water have been reported, but we have to consider firstly that in bucket-sampling under way it is often impossible to sample the thickest part of a patch, and secondly the relatively large size of *Trichodesmium* filaments. This sample sufficed to establish alga as the main cause of the discolouration discussed here beyond all reasonable doubt and is accordingly of particular value.

The hypothesis, that in deep sea areas of the tropics and sub-tropics, where the surface waters are normally impoverished and sharply separated from the richer sub-surface layers by a strong thermocline, the turbulence caused by storms of exceptional violence may be a necessary precursor of certain discoloured water phenomena, seems well supported by the reports of observing ships in the eastern part of the central basin of the Caribbean (Marsden square 43).

Here the writer would like to explain to long-suffering observing officers why reports of discoloured water are still desirable, and samples even more so.* There is a huge body of literature on the subject that has grown from some 20 published observations in Darwin's day to several hundreds; but for every instance where the identity of the plankton organism concerned has been established, we get 20 or more reports that leave us guessing. Two of the best general accounts of the phenomena are those given by Steuer[3] and Hayes and Austin,[4] which are quoted as examples of the writer's indebtedness to many other authors.

Discolouration may be due to several different natural causes: windborne inorganic particles, land run-off, the presence of shoal water, and a large variety of plants and animals of the plankton (mostly microscopic ones). With all or any of these the over-all visual effect is modified by the quality and direction of the incident light (sun's altitude) and prevailing weather conditions (cloud, state of sea surface).

Originally reports were requested because discolouration was often the first indication of uncharted shoal-water. Although this led to the investigation of an exasperating number of vigias, the authorities of most maritime nations including our own Admiralty Hydrographic Department, continued to advise reporting for this particular purpose until the increasing excellence of surveys and the development of echo-sounding combined to show up the biological cause of most of the deep-sea discolouration. Even so, this visual aspect of shoal-water is still of some moment in pilotage, especially in coral-reef areas.

In the last 50 years it has become evident that some of the algal blooms produce disastrous effects on other forms of marine life (mortalities of fishes and guano birds) and may even affect human affairs more directly (shell fish poisoning of men and farm animals, fouling of Florida bathing beaches). Other blooms, that may occur in the same sea areas, are harmless in themselves, but may be involved in the development of harmful ones later. It therefore becomes necessary for marine

* The best way to obtain a sample is with a clean bucket, rinsing the sample bottle with some of the catch before filling, pickling and labelling it.

biologists to gain all possible information regarding their distribution, and the individual species of algae or other plankton, that give rise to them.

Another aspect is the effect of these exceptional concentrations of microplankton on underwater visibility, which may directly influence the scope of underwater photography and television in certain areas where they are common. Yet again, in these areas, the phenomenon could complicate air-sea rescue operations.

These blooms are of great interest to marine biologists because they are the only naturally occurring examples of marine microplankton organisms attaining population densities as great as those of laboratory cultures, and their study may therefore help to show how far results obtained in culture experiments can be applied to conditions " in the field ". This aspect is of mainly academic interest at present, but may be found to have wide economic implications before long, and it is hoped that the examples quoted earlier show that discoloured water reports, and above all samples, from observing ships are even now of some practical value.

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## SPECIAL LONG-SERVICE AWARDS

For the twelfth consecutive year, the Director-General of the Meteorological Office is making special awards to the four voluntary marine observers whose long and meritorious work on behalf of the Meteorological Office is considered as deserving special recognition.

The basic qualification is 15 years as a voluntary marine observer, i.e. to qualify for a place, an officer must have sent us records in 15 separate years. These years are not necessarily continuous, in fact, so far they never have been, e.g. the two world wars caused gaps of 4 and 6 years respectively, and are often spread over 30 or more years. The place of an officer in the list of those basically qualified for the award is mathematically calculated from his personal record card in the Meteorological Office, taking into consideration the number of years observing, and the number of records classed " excellent ", " very good " or " good " in relation to the number of records received from him. Considerable care is taken to check all aspects of an officers' record to ensure that the award is made fairly.

This year the Director-General is pleased to make the special awards to the following masters of Selected Ships:

1. CAPTAIN F. POVER of the New Zealand Shipping Co., whose first meteorological log was received here in 1925. During 17 years as a voluntary observer he has sent us 25 records, of which 20 have been classed excellent.

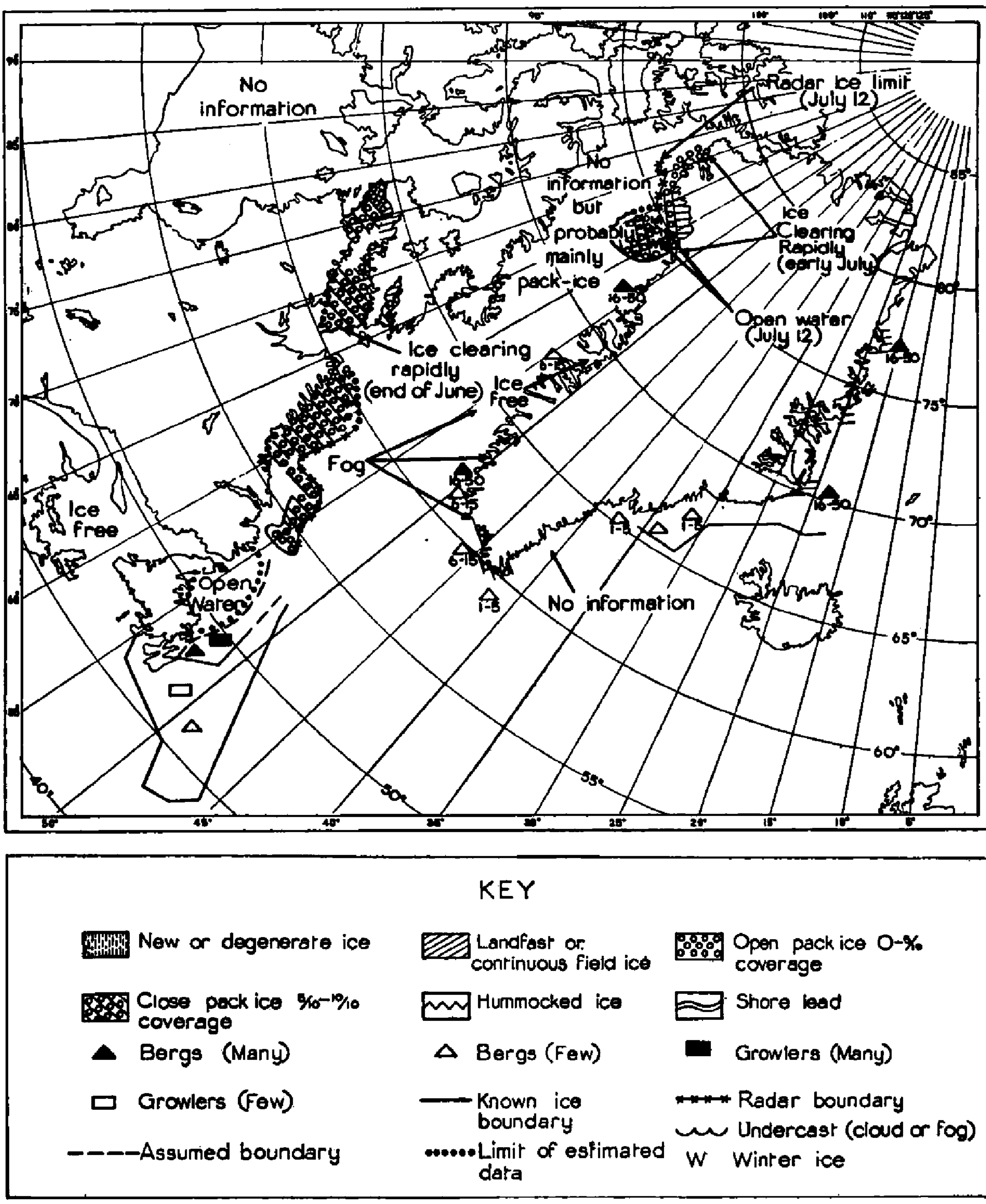
2. CAPTAIN H. N. LAWSON, R.D., of the New Zealand Shipping Co. A voluntary observer since 1927, he has in 17 years of actual observing sent us 30 records, 21 of them being classed excellent.

3. CAPTAIN L. J. HOPKINS of the Shaw Savill Lines. Since his first meteorological logbook was received in 1923, he has during 17 years of voluntary observing sent in 36 books, 23 of them being classed excellent.

4. CAPTAIN N. A. THOMAS of the New Zealand Shipping Co. During 17 years' service as a voluntary observer since his first logbook was received in 1931, he has sent in 34 records, 22 of which have been classed excellent.

The award will, as in past years, be in the form of a suitably inscribed barograph. We congratulate these captains on this recognition of many years' voluntary meteorological work at sea. They will be personally notified of the award and of the arrangements which will be made for its presentation.

## DISTRIBUTION OF NORTH AMERICAN AND GREENLAND ICE AT THE END OF JUNE 1959




Map showing ice conditions in sea areas around North America and Greenland at the end of June 1959.

During the present ice season, while the southward movement of icebergs endangers shipping in the Atlantic shipping lane approaches to North America, aircraft and ships of the International Ice Patrol of the United States Coastguard and many merchant ships continuously report the occurrence of ice. An effort has been made in the Marine Division of the Meteorological Office to plot the occurrence and distribution of ice floes and icebergs from these reports. This has been done to provide information for shipping and for meteorological investigations.

The main sources of data are broadcasts by the Canadian Meteorological Service from Halifax (CFH) Nova Scotia, broadcasts from the United States Navy Hydrographic Office, Washington, from the International Ice Patrol and from the Danish meteorological authorities via the radio station Angmagssalik (OZL). Unfortunately, very little information is available from the important areas Greenland Sea, Norwegian Sea, Barents Sea, Kara Sea and land areas in proximity to the Arctic Sea (e.g. Spitzbergen and Bear Island). We hope to improve this by obtaining more ice reports from our own British trawlers and from the countries of Europe near to the areas where ice occurs.

The above map gives conditions at the end of June 1959 and gives interesting details of the break-up of field ice and the movement of pack ice in the Davis Strait, Baffin Bay and approaches to Hudson Bay. We are greatly in debt to the United States Navy and to the Canadian Meteorological Service who provide, by means of facsimile chart broadcasts, the results of reconnaissance in the far north of Greenland and the Canadian arctic, which can be picked up at Dunstable.

The present ice season has been remarkable because of the very late date at which the approaches to the St. Lawrence became free of ice. Cabot Strait was not free until the end of April, while the Belle Isle Strait remained obstructed until early in June, after which there remained dangerous ice in the approaches to this Strait throughout June and July.

Late in May and early in June, icebergs moved southward almost to 40°N. and Atlantic track " A " came into use.

Ice and oceanographical observations indicate that the field ice in Baffin Bay and approaches to Hudson Bay appear to have broken up extensively and the movement south of ice floes into the North Atlantic is probably more extensive than usual.

G. A. T.

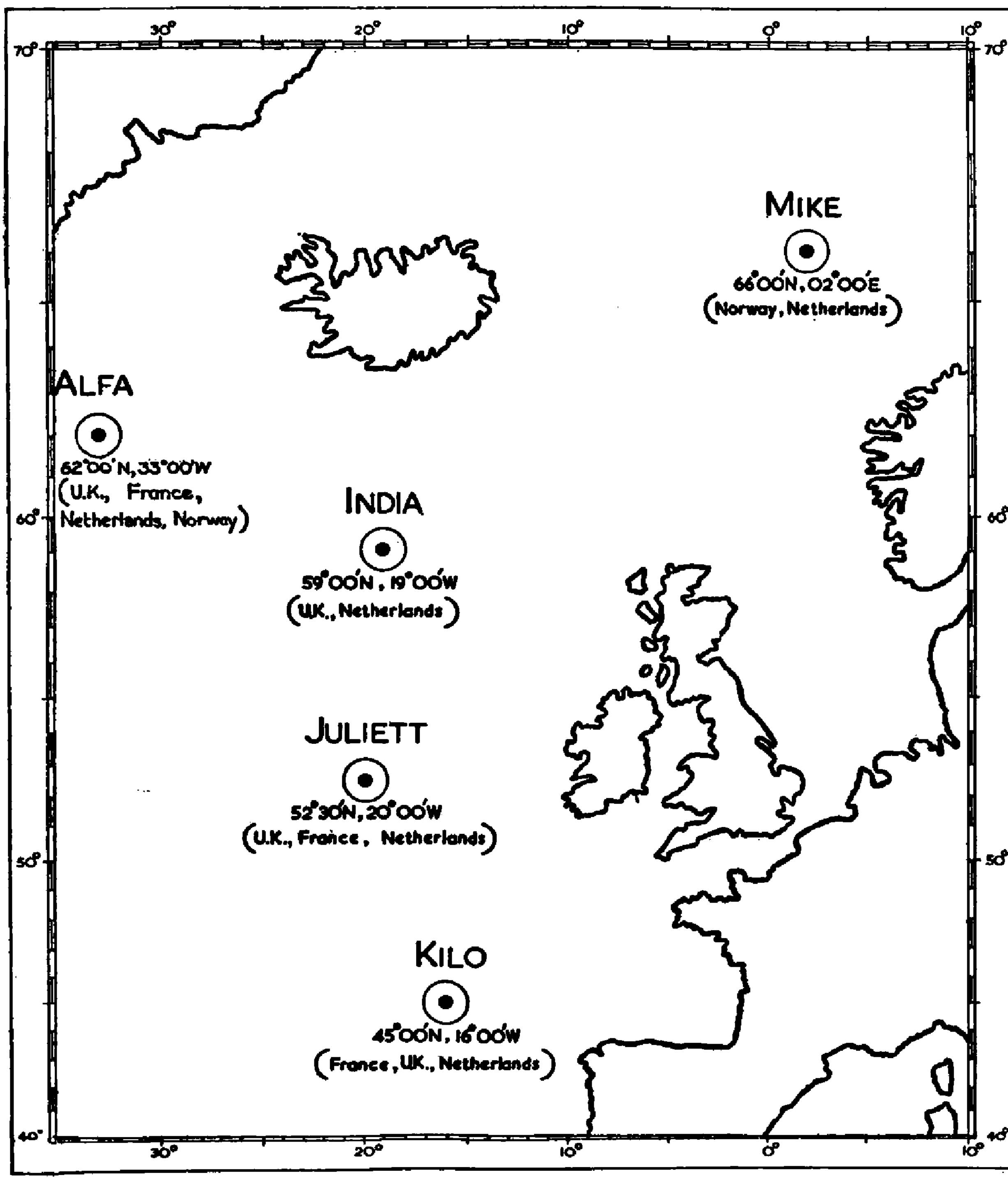
# A New French Weather Ship

In accordance with the North Atlantic Ocean Station Agreement (Paris 1954), Ocean Stations A, I, J and K in the eastern Atlantic are jointly operated, on a rotation basis, by British, French and Netherlands weather ships. Normally the Norwegian weather ships operate at Ocean Station M, but during a period of 6 months every 2 years these ships transfer to Station A, while the Netherlands vessels operate at M, the British vessels remaining at I and J and the French at K. All this sounds rather complicated, but in effect it gives a fair division of labour, bearing in mind the distance that the various stations are from the ports in the countries concerned, see the map on page 198.

When the North Atlantic Ocean Station scheme was started in 1947, the British and Norwegian authorities used " Flower " class corvettes for the job, whereas the Netherlands and French authorities used frigates formerly employed by the U.S. Navy.

Having had a strenuous wartime career, followed by 12 years' service as a North Atlantic weather ship, some of these vessels are now due for replacement. In the October 1958 number of *The Marine Observer* mention was made of the entry into service of the new British weather ship *Weather Reporter* (formerly the " Castle " class frigate *Oakham Castle*) in replacement of the former " Flower " class vessel *Weather Explorer*.

Two very welcome recent newcomers to the European fleet of weather ships are the new French vessels *France I* and *France II* which came into service in February and May 1959, respectively, in replacement of the two earlier French weather ships *Mermoz* and *Le Verrier*.




Weather ship stations in the eastern North Atlantic.

These two identical new ships were built at the Forges & Chantiers de la Mediterranee/Graville/Le Havre and they have the distinction of being the first ocean weather ships to be specially built for the job. The French weather ships are based at La Pallice/Rochelle. *France I* and *France II* have an overall length of about 243 ft, a breadth of 40 ft and a depth of 16 ft. They have twin screws and their motive power is diesel electric, maximum speed being 15 kt. The electrical current on board is provided by three alternators coupled to the above mentioned generators. For the exceptional occasions when full power is needed for propulsion, as, for example, if an air/sea rescue incident occurs, an emergency generator is provided to furnish essential electrical services aboard the ship.

The ship has two continuous decks and a long superstructure, a raked bow and a cruiser stern (see photographs opposite page 172). Comfortable accommodation is provided for the ship's company of 53, including 18 technicians (meteorologists and radio staff). The officers, technicians and some of the ratings are in single cabins, the remainder of the crew being in double cabins. Comfortable public rooms are provided as necessary. Quarters are also provided for the reception of 16 survivors.

The vessel is equipped with modern navigational appliances, including Loran and Consol; meteorological equipment for radio sonde and radar wind observations as well as for surface observations; and with very comprehensive radio equipment (M.F., H.F., V.H.F., and U.H.F.) all of which are essential aboard an ocean weather ship.

In the photograph, the shelter used for filling the meteorological balloons for upper air observations can be seen on the after part of the superstructure, with a smaller shelter on either side thereof for stowage of hydrogen cylinders. The meteorological office is situated immediately below the balloon shelter, with the radio receiving room alongside it. The radar used for upper wind observation is seen on top of the goal-post mainmast, the radar office being immediately below it. A radar for surface navigation is seen on top of the balloon shelter and there is an anemometer each side of the goal-post foremast.

The French weather ships *Mermoz* and *Le Verrier* did an excellent job during their 12 years of service in the Atlantic and these names now pass into history. The photographs indicate that *France I* and *France II*, the newcomers to this unique international fleet, are attractive and unusual vessels and it seems that having been built for the job and having the relatively small machinery spaces associated with diesel engines and such an extensive superstructure, they should be roomy and comfortable. It is hoped that they will have a long and successful career.

C. E. N. F.

## CANADIAN EXCELLENT AWARDS, 1958

The names of the officers and ships in the Canadian Weather Observing Fleet who have won Excellent Awards for marine weather observing carried out in the year 1958 are printed below.

| Name of Vessel | Observing Officer(s) | Radio Officer(s) | Company |
|---|---|---|---|
| *Baffin* | | C. P. Short | Government of Canada |
| *Bluenose* | D. Rush | H. Whitehead | Government of Canada |
| *Esso San Juan* | | F. A. Domina | Imperial Oil, Ltd. |
| *Imperial St. Lawrence* | J. A. Hunt<br>E. J. Samson | M. C. O'Leary<br>M. N. Kelly | Imperial Oil, Ltd. |
| *Irvingbrook* | | –. Clement | Kent Lines, Ltd. |
| *Irving Glen* | | R. Schmidt | Kent Lines, Ltd. |
| *John W. Mackay* | N. Crowe | | Commercial Cable Co. |
| *Lakemba* | K. W. Hewitt | F. Hanson | B.C. Ship Chartering Co. |
| *Lakonia* | J. W. Brewster | J. Cox | Donaldson Lines, Ltd. |
| *Lord Kelvin* | P. M. Brick | | Western Union Telegraph Co. |
| *Montcalm* | | | Government of Canada |
| *Paloma Hills* | M. Wagner | J. Weir | Shell Canadian Tankers, Ltd. |
| *Pinnacles* | A. M. Crawford | A. W. Horwill | Shell Canadian Tankers, Ltd. |
| *Princess Helene* | W. J. Goodwin | C. F. MacMillan | Canadian Pacific Railway Co. |
| *Rincon Hills* | C. A. Bradshaw | | Shell Canadian Tankers, Ltd. |
| *Suva* | | N. J. Nelson | B.C. Ship Chartering Co. |
| *Waihemo* | | J. Ward | Union Steamship Co. of New Zealand |

Dr. Andrew Thomson, Director of the Canadian Meteorological Branch, states:

" This is the eleventh in our annual Marine Award series. A total of 40 awards, which take the form of books, will be presented to captains, principal observing officers, and radio officers who have made an especially noteworthy contribution to the Canadian Ship weather program.

" A copy of the book *The Crossing of Antarctica* by Sir Vivian Fuchs and Sir Edmund Hillary will be presented to the masters of the 15 ships in our observing fleet which have done the best overall work during the year. Fourteen awards will be made to the radio officers on the awards-winning ships who have transmitted 250 or more reports to shore receiving stations. The book selected for this award was *Aku Aku* by Thor Heyerdahl. The remaining 11 awards will be presented to the Principal Observing Officers whose weather records were judged to be the best during the year. These officers will receive a copy of *Mathematics for the Million*, by Lancelot Hogben.

" Fifty-eight ships were engaged in weather reporting last year, and made a total of approximately 17,000 observations. In choosing the recipients of the annual awards, both the number of observations made in the previous year, and their quality are considered, but more emphasis is placed on quality."

## " ESSEQUIBO "

Each year, in the October number, we publish photographs of three ships of the same name and ownership, each of which has, at some time in her career, been a voluntary observing ship.

The series is continued opposite page 188 with photographs of three ships named *Essequibo*, belonging to the Royal Mail Lines, formerly the Royal Mail Steam Packet Co., Ltd.

The first ship of this name was a schooner-rigged steamer of 1831 gross tons, built at Stockton-on-Tees in 1871 for Messrs. Brownlow & Lumsden of Hull. She was originally named *Bladworth*. In 1873 she was bought by the Royal Mail Steam Packet Co. who renamed her *Essequibo*. She was the first ship of the Company to observe for us and her first meteorological logbook, which covered a round voyage to the West Indies, was received here in May 1888. Her Master, Captain F. W. Powles, wrote up the logbook himself but stated in a letter:

> " Mr. le Cras, the Chief Officer, has certainly been most careful in making the observations. Indeed, except the writing out and an occasional interference on my part, you owe the greater part of the observations to his attention and constant watchfulness."

This ship continued to observe for us until April 1893 and she was sold in 1900.

The second *Essequibo*, 8489 tons gross, was built for the Company in Belfast in 1914. She made her maiden voyage to the West Indies in the early part of the first World War and in 1915 she was requisitioned by the Admiralty for use as a hospital ship. Returning to the Company's service after the war, in 1921 she commenced to keep the old meteorological form 121a under Captain C. P. Green and continued with this when she was transferred to the Pacific Steam Navigation Co., retaining her name, in 1922. In 1936 she was sold to the U.S.S.R.

The modern *Essequibo*, 7785 gross tons, was launched at Govan in 1952. She was recruited to the Voluntary Observing Fleet in January 1953 when she was commanded by Captain T. W. F. Bolland, and has been observing for us ever since.

We are indebted to the Royal Mail Lines for the pictures of the second and third *Essequibo* and to Mr. P. A. Vicary for the loan of his drawing, from a contemporary painting, of the first *Essequibo*.

We take this opportunity of recording our appreciation of the voluntary services of the Masters and officers of the Royal Mail Lines for over 70 years. At present, of their fleet of 36 ships, 27 are observing for us. L. B. P.

# Book Reviews

*The Atlantic*, by Leonard Outhwaite. 8¾ in. × 5¾ in. pp. 479. *Illus.* Coward-McCann, Inc., New York; Constable and Co., Ltd., London, 1957. 30s.

This is a story in which history, geography, oceanography, meteorology and sociology have been combined to make a continuously interesting and readable book about the ocean that has played such a key role in the development of the western world from the earliest times until the present day.

The book is divided into four parts, comprising twenty-six chapters. Part 1, aptly called " Portrait of an Ocean ", contains an introductory chapter, " About this Book ". Herein the author sets out the broad aims of the book: "... that attempts to gather within its covers the main facts about this ocean, its place in the world of nature and of man; how it was discovered and used by earlier adventurers and explorers; who sailed upon it in times past; what were their purposes; what ships did they use; where did they mean to go and where did they actually land; how did the ocean itself affect their travels; how did trade develop and conflicts of interest arise about all this broad water; what societies have grown up around the Atlantic shores; what nations have arisen; what are their present prospects and their future hopes." This part is completed by chapters on the physical structure of the Atlantic, its behaviour and meaning.

Part 2, entitled " Discovery and Early History ", takes us through eight chapters of fascinating reading—the legends of Homer, the fabulous story of Atlantis, the exploits of the barbaric tribes of northern Europe (who, whatever their methods of warfare and conquest, were essentially seamen), the voyages of the great discoverers, the extraordinary expansion of Spain and Portugal, to the western migration of many peoples of diverse tongues and creeds and the ships which carried them.

Part 3, divided into nine chapters, deals with modern history, the whalers, slavers, packets and clippers; the development of fore and aft rigged ships and the coming of steam. This part contains also a chapter on the origin and laying of the trans-Atlantic cable and another on small boat voyages across the ocean.

Part 4 is called " The Atlantic, Today and Tomorrow " and its five chapters tell of the speed, elegance and luxury of modern ocean travel; flying the Atlantic; ocean warfare; and finally of the ocean's potentialities still to be exploited for the human good.

In the story of an ocean it is inevitable that meteorology will play a very large part, indeed little can be written or said on the subject from which it can be omitted. The author recognises this fact right from the first chapter: " I have been on my feet for days while my ship fought through hurricane winds, I have seen the northern seas grey with ice, shaken in the grip of a winter gale and seen the ocean a sheet of molten gold under a tropic moon. These are all aspects of the same ocean and they are things never to be forgotten." The wind and ocean current circulation of the Atlantic are well described in the earlier chapters and the impact which they have made on discovery, settlement, migration and culture are frequently referred to throughout the book.

In recognising the importance of the place occupied by the twin sciences of meteorology and oceanography, the author pays tribute to Lt. M. F. Maury, U.S. Navy, to whose life and work he devotes a whole chapter. Maury, whose name will be familiar to all readers of *The Marine Observer*, may well be said to be the father of the voluntary observing system, and the reviewer is glad to see his work given such prominence.

Though this is a wholly readable and instructive book, it has certain points which warrant modification and amendment. On the map opposite page 192, which shows the principal Atlantic shipping routes, certain areas in high latitudes are described as being " not open to all year traffic ". From this map one gets the impression that Iceland is ice-bound during the winter and that Cape Horn is impassable except fairly close to the land during this season. Memories of winter passages around the Horn or of Atlantic convoys during the war will prompt many a seaman to quarrel with this map.

Many readers will know that on the U.S. charts and in the U.S. Sailing Directions the British territory of Graham Land is known as the Palmer Peninsula but the British seaman with a just pride in his forebears will be disappointed to find that, whilst there are many references to the exploratory work of Captain N. H. Palmer, a Connecticut whaling captain, in and around the Weddell Sea in the early part of the 19th century, there is little mention of British exploration in that sea, and none of the phenomenal drift of Shackleton and his expedition on an ice floe after the loss of the *Endurance* some 45 years ago.

It is remarkable that the author has made no reference to the tropical revolving storm—the West Indian hurricane. Such storms deserve their place in the history of an ocean and of the nations who have settled its shores. They may even have changed the course of the latter. For instance, at the time of the Spanish-American War, President McKinley is quoted elsewhere as having said that more warships had gone to the bottom of the sea in storms than under the fire of enemy fleets. One would have thought that a book, written and produced in the United States, would have made at least some passing reference to a phenomenon over which, even today, their maritime communities are so much concerned.

Some reference to the International Ice Patrol might also have been included with advantage. The tragic story of the *Titanic* is outlined, but somehow the unenlightened reader is left with the impression that, beyond certain improvements being made in the life-saving equipment of ships, nothing was done to prevent a recurrence.

If, however, the reader is prepared to accept these deficiencies, the book can be recommended as one to be read with pleasure and profit. In an appendix, moreover, the author, without attempting a full bibliography, makes various helpful suggestions for the further study of this ocean. L. B. P.

*Climatology and Weather Services of the St. Lawrence Seaway and Great Lakes*, prepared by The Marine Area Section, Office of Climatology. $10\frac{1}{4}$ in. × $7\frac{3}{4}$ in. pp. 75. Technical Paper No. 35, U.S. Department of Commerce and Weather Bureau, Washington, 1959. 45 cents.

With the opening of the St. Lawrence Seaway in which three major canal and lock systems raise ships the 602 ft that Lake Superior is above the Atlantic, the Great Lakes are now open to ocean-going vessels for the first time. This should lead to a considerably expanded interest in weather conditions and weather services over the whole area which includes the St. Lawrence River from Quebec to Lake Ontario and all the Great Lakes.

This paper gives a very comprehensive survey of climatology of the Seaway and the Great Lakes. It deals with cyclones, winds, fog, air temperature, humidity, precipitation, clouds, ice, lake levels, currents, lake temperatures, and the climatological data for a number of stations distributed along the shore of the Lakes and the St. Lawrence River are clearly presented, mainly in pictorial form on a background map. Detailed numerical tables are conveniently given as an appendix.

It is unfortunate that no scale of distances is entered on any of the maps, because it is so important when considering the influence of the Great Lakes on the weather constantly to bear in mind their immense size. North or south winds over Lake Michigan have a fetch of about 300 nautical miles which is the same as for east or west winds crossing the North Sea between N.E. England and Denmark. East or west winds over Lake Superior also have a fetch of about 300 nautical miles. Gales from a suitable direction can therefore build up a considerable sea on any of the Great Lakes. Wind roses for approximately 20 shore stations are given for each month of the year, but apart from a list of the highest 1-minute winds recorded each year from 1941 to 1957 on Lakes Erie, Huron, Michigan and Superior by vessels equipped with anemometers, no information is given for the Great Lakes themselves. For shipping, a series of maps showing the monthly frequency of gales over the Great Lakes would probably be more useful than the wind roses for shore stations. Also the mixed use of m.p.h. and knots in the section on winds is to be deprecated.

The presence of the Great Lakes favours the formation of advection fog in spring and summer and of steam fog in autumn. Some figures are given of the number of days with visibility less than 2 nautical miles at a number of shore stations, but this information seems to be of very little value for shipping. The map of mean monthly number of days with heavy fog* is more to the point, but this too is of limited value for shipping since it refers only to stations on land. No data for the frequency of thick or dense fog over the Lakes themselves are given.

There is a short but clearly written section on cargo care. Protection of cargoes from sweat is an important consideration owing to the relatively high humidity and big variations of temperature encountered on the Great Lakes.

The section on ice is important, since it gives a reminder that ice limits the navigation season to approximately 8 months of the year. Navigation from Montreal inland to the Lakes usually begins around the middle of April and continues until the middle of December. This period of navigation includes the autumn and early winter, during which some of the most severe storms over the Great Lakes are liable to occur. Forecasting and warning services to shipping are broadcast both by the U.S. Weather Bureau and the Canadian Meteorological Service, and full details are given in the last section of the paper. They include Great Lakes weather forecasts (LAFOTS), Great Lakes weather bulletins (LAWEBS), and St. Lawrence River forecasts; also warnings of gales.

An interesting example of statistical forecasting is mentioned—the prediction of the date of opening of navigation. This date (expressed as the number of days after 1st January) is found to have a significant correlation with the mean temperature of February. For example, a regression line calculated for Duluth enables the opening date at this port to be predicted with a tolerance of $\pm 13$ days.

F. E. L.

*The Gulf Stream—A Physical and Dynamical Description*, by Henry Stommel. 9¼ in. × 6¼ in. pp. 202. *Illus.* University of California Press, California; Cambridge University Press, London, 1958. 45s.

This book is the result of very careful study of the Gulf Stream by an eminent oceanographer. While describing numerous researches the author gives a great deal of basic oceanographical knowledge which should be of interest to students of an allied science like meteorology. However, the more theoretical and mathematical chapters 8–11 are likely to be too difficult for those with an inadequate mathematical background. Nevertheless, the earlier parts of the book are full of interest to sailors, scientists and laymen who are interested in the role played by the Gulf Stream in the formation of western European climate. This book apparently discounts many of the conventional views of the nature and role in climate of the Gulf Stream.

The book begins by giving a history of Gulf Stream investigations. Famous people like Bernoulli, John Harrison (the inventor of the chronometer), Maury, Bjerknes and Ekman, and famous ships like the *Challenger*, are given their places in the history of oceanographical research carried out in the North Atlantic. This is followed by a necessarily short account of the methods of taking physical measurements in and over the oceans, followed by a discussion of the geostrophic relationship and the resulting practical method of estimating mean ocean current velocities

* Visibility ¼ mile or less.

from average distributions of sea water density. The author emphasises the fundamental difficulty of establishing a level of reference in the oceans.

Chapter 4 is devoted to a description of the large-scale features of the North Atlantic ocean current circulation with accounts of horizontal and vertical temperature distribution. The North Atlantic water masses are discussed by means of temperature and salinity diagrams. Chapter 5 gives an account of temperature soundings made by ships crossing the Gulf Stream between Chesapeake Bay and Bermuda. There is a sharp rise in temperatures encountered at specific locations at all levels as one passes southward out of the fresher cold water into warmer and more saline water. (There is no corresponding fall marking the southern limit of the Gulf Stream, i.e. there is really only one temperature and velocity discontinuity as one passes southward.) Difficulties in defining the Gulf Stream are also discussed with accounts of its meanders and eddies.

The general wind circulation over the North Atlantic Ocean is described in Chapter 6; the variations of this system are given and there is finally an account of the force that is exerted by these winds on the sea. These are, of course, very important because a great deal of the general and random ocean flow are produced by the action of the wind. It is unfortunately apparent from this somewhat unsatisfying account that much work is required on investigating the interaction between wind and sea. Chapter 7 is devoted to mathematical analyses deducing the current circulation likely to be caused by the mean surface wind circulation. It shows that the latitudinal variation of the Coriolis force is largely responsible for the concentrated jet-like Gulf Stream flow off the United States coast with the broader and less definite flow in the eastern North Atlantic. Chapter 8 is mainly concerned with the principle of conservation of potential vorticity (potential vorticity is a simple mathematical function of vorticity or inherent spin in the movement of the sea water). This principle is shown to hold over the intense sections of the Gulf Stream and is used to map it; the end of the chapter is devoted to theories of ocean currents by Charney and Morgan.

Random and periodic fluctuations of the Gulf Stream flow are described in Chapters 9 and 10, and serve mainly to emphasise the complexity of the relationship between ocean currents and weather.

In Chapter 11, flows associated with density variation due to thermal and salinity gradients are considered, and elaborate theories of currents are combined with much observational material to give a picture of transports of water in the Atlantic at upper and very deep levels. Fig. 82, for example, gives an interesting glimpse of the exchanges of water between the North and South Atlantic driven by thermal and salinity differences.

In Chapter 12, the author concludes by reviewing philosophically results and concepts given in earlier chapters of the book; he again emphasises the falseness of the layman's concept of the Gulf Stream as a very wide warm river flowing towards Europe. The author's appeal for more testing of hypotheses will produce many statistical problems. Meteorologists have long been aware of the special difficulties associated with data in which consecutive observations are grouped together, i.e. high values with high values and low with low.

This is a very valuable book for those interested in sciences allied to the sea, because it contains so much basic oceanographical theory. I found it at times difficult because of the many mathematical devices used in conjunction with drastic physical assumptions. The speed and direction of movement of the oceans fluctuates greatly and it is surprising that statistical reasoning is almost absent in all the theories of ocean currents given by the author. The book is well produced and the diagrams are helpful and clear. I cannot recommend the book strongly to the layman, but it is an excellent account of modern work on the Gulf Stream for all serious students of nautical matters. G. A. T.

# Letter to the Editor

## DRIFT BOTTLE

SIR,—While travelling to West Africa last autumn by the Elder Dempster mail vessel *Apapa* (Captain W. E. Humphreys), I threw a wine bottle, containing a souvenir menu of the carnival dinner and including my name and address, out of the porthole. This was on the evening of the 23rd October, 1958, at approximately 9 p.m., and I understand from the Elder Dempster Company that the ship's position was 16° 40′N., 17° 42′W.—approximately 100 miles north of Dakar.

I imagined that the bottle would probably drift on to the African coast nearby and gave very little thought to the incident until the end of May this year. I then received a friendly letter from one George Chang, from Erin, Trinidad, enclosing the souvenir menu. The letter was dated the 20th May, and Mr. Chang said he had found the bottle the previous week-end while bathing on the Erin beach.

Although I imagine that similar incidents are not infrequent, I understand the information may be of interest to you.

DOREEN G. SEAR

50, Orpington Road,
Winchmore Hill,
London, N.21
13th July, 1959

*Note.* Floating bottles are no longer used extensively for the scientific investigation of ocean currents; however, specially designed bottles are still used in oceanographical and fisheries research. The drifts of plastic envelopes in the sea approaches to the British Isles were observed in the investigation of the pollution of our coastal areas, and it is said that an American manufacturer plans to use the Gulf Stream to send samples of perfume to Europe.

The above report is of interest because of the unusual but happy circumstances under which the bottle was put into the sea. It was carried to Trinidad entirely by the North Atlantic Equatorial current in a time consistent with the expected current strengths given in *Quarterly Surface Current Charts of the Atlantic Ocean* (M.O. 466).

The report is, therefore, an unusual indirect confirmation of the atlas.

# Personalities

RETIREMENT.—In July 1959, COMMODORE F. W. BAILEY, M.B.E., retired after 48 years at sea, 44 of them in the service of the Port Line.

Francis William Bailey was born in 1897, the son of a chief engineer in the L.C.C. fleet, well known on the London River. He went to sea in 1911, serving his time in the full-rigged ship *Westgate*, belonging to John Stewart & Co. of London.

In 1915 he passed for 2nd mate and joined the Commonwealth and Dominion Line, later to be known as the Port Line, Ltd., as 3rd mate of their *Indrabarah*.

He passed for master in 1920. Bailey became chief officer in 1924 in the early days of the great shipping depression of the inter war years, which brought promotion almost to a standstill, and spent no fewer than 16 years in that capacity.

In 1940 he was chief officer of the *Port Wellington* when she was engaged and sunk in the South Indian Ocean by the German raider *Penguin*. His captain was killed in that action, and he was taken with his crew from the boats, aboard the raider.

Transferred to a captured Norwegian tanker, in use as a prison ship, Captain Bailey was landed at Bordeaux and spent the rest of the war in the German prison camp, Marlag und Milag Nord.

Released at the end of April 1945, Bailey returned to England and subsequently was appointed Marine Superintendent for the Allied Control Commission at Flensburg, Germany.

For his war service he was appointed M.B.E.

In 1946 he rejoined the Port Line as staff captain of the *Port Hobart*. After one voyage in her he was appointed to command the *Samleven*, which Port Line were then managing for the Ministry of Transport. Subsequently he commanded the *Port Jackson*, *Port Pirie* and *Port Brisbane*, all of which were selected ships, and was appointed Commodore of the Port Line in July 1958.

Commodore Bailey's active association with the Meteorological Office is mostly of the post-war period, and though he served in many observing ships between the wars as chief officer, we have only one pre-war logbook bearing his name, from the *Port Hunter* in 1934. In the 12 years of his observing he sent us 22 logbooks, a large proportion of which were classed "excellent". He received Excellent Awards in 1951, 1952, 1953, 1954, 1956, 1958 and 1959. In July 1956 a photograph of his ship, the *Port Brisbane*, was published in *The Marine Observer* as being one of the three best observing ships in the previous year.

As 4th and 3rd officer, the writer made many voyages with Bailey when he was chief officer, and has always been grateful for the many lessons learned, most of them the hard way, at the hands of this rugged seaman of the old school.

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

RETIREMENT.—CAPTAIN ALEXANDER BANKIER retired from the service of the Donaldson Line at the end of June 1959 after 45 years' service with the Company.

He first went to sea in September 1914, joining the *Cassandra* as an apprentice.

He passed through the usual grades and was appointed to his first command, the *Vardulia*, in April 1929. He later commanded the *Parthenia*, *Gregalia*, *Delilian*, *Salacia*, *Laurentia* and *Captain Cook*. For his last four years as master of the *Captain Cook*, he was engaged in carrying emigrants to New Zealand.

During the First World War, he served mainly aboard transports and troopships, and for the greater part of the Second World War he commanded the *Salacia* in North Atlantic convoys. In this ship he took part in the first landing in North Africa in November 1942.

Captain Bankier's first meteorological logbook was received here in 1928, when he was in the *Concordia*.

Since then he has in 11 years sent us 20 logbooks, 16 of which have been classed "excellent". He received Excellent Awards in 1953 and 1955.

We wish him health and happiness in his retirement. R. R.

RETIREMENT.—CAPTAIN A. E. LETTINGTON, O.B.E., D.F.C., retired recently from the sea after 39 years with the New Zealand Shipping Company. Since 1956 he has been Commodore of the company in the *Rangitiki*.

Arthur Edward Lettington first went to sea at the early age of 14½ in May 1911, serving his apprenticeship in the full-rigged ship *Glenholm*, owned by William Price & Co. of Liverpool. This ship was sunk by an enemy submarine in August 1915 and the crew was picked up by a British destroyer.

On his return to London Captain Lettington passed for second mate in sail and then joined the Royal Naval Air Service as a flight sub-lieutenant, where he won the D.F.C. and Bar " for acts of gallantry in active operations against the enemy ". Captain Lettington later served as a flight officer in Russia where he received the Order of St. Ann from the late Czar. On his return to the United Kingdom he received a permanent commission with the R.A.F. that had been formed by the merger of the R.N.A.S. and Royal Flying Corps. He was transferred from the Navy " under protest " and in six months he relinquished his commission to return to sea. In 1920 Captain Lettington passed for master and joined the New Zealand Shipping Company's *Cornwall* as fourth officer. He continued to serve in this company and was appointed to his first command, the *Surrey*, in 1930 and thereafter commanded a number of ships of the combined N.Z.S. Co. and Federal Line fleets until he became Commodore in 1956 when in command of the *Rangitiki*. In 1950 he was awarded the O.B.E.

Captain Lettington has an admirable record with the Meteorological Office dating back to 1926 when he was in the *Ruapehu*, and in 22 years he has sent in 42 logbooks, 30 of which were classed as "excellent". He received Excellent Awards in 1931, 1932, 1935, 1936, 1937, 1954, 1955, 1956, and 1957 and in November 1954 he was presented with a barograph in recognition of the long period during which he carried out particularly good meteorological work at sea.

We wish him health and happiness in his retirement. J. C. M.

RETIREMENT.—Mr. S. G. SHARMAN recently retired from the *Royal Sovereign* light-vessel. In a letter to the Marine Superintendent of the Meteorological Office he wrote:

> "I shall not be returning to the ship as I am due for retirement before the next major relief. I have served ten years in the *Royal Sovereign* and have really been most interested in the meteorological observations, as these have tied up with the reports I have made on bird migration for some Ornithological Societies and especially for the insect migration authorities at Rothamsted Experimental Department of Agriculture, so my migration records have carried the correct weather situation for this speciality. The Societies mentioned are especially pleased. I have served 39 years in the Trinity House Service, and I know I shall miss the unique opportunity of witnessing the wonderful phenomena and various aspects of nature, but also as a good miss. I shall not particularly pine for the vigorous depressions that come sweeping up the Channel that are seemingly so exuberantly announced by the B.B.C. weather announcer! So I must bid the Meteorological Office farewell and please accept my honest and sincere gratitude for the always unfailing courtesy we have received from your Office and would request you to convey this appreciation to the staff concerned with the light-vessel department."

Over many years the unspectacular service which the Trinity House light-vessels render us has been a great help in formulating the forecasts for sea areas and many shipmasters will have been glad of the actual observations from the *Royal Sovereign* light-vessel which now figure in the shipping forecasts broadcast in the B.B.C. Light Programme. We are particularly pleased to have this note from Mr. Sharman and take this opportunity of wishing him health and happiness in his retirement. L. B. P.

## IN LIGHTER VEIN

We enjoyed reading the two definitions given below. We are indebted to the Principal Examiner of Masters and Mates for sending them to us.

"The aneroid barometer consists of a series of levers and chains made fast to a corrugated vacuum."

"Standard temperature is the ideal temperature at which the barometer should read correctly at 57°F."

# Notices to Marine Observers

## M.O. 477, MARINE OBSERVER'S GUIDE

A new edition (3rd edition) of the above was published last May. Port Meteorological Officers and Merchant Navy Agents are issuing copies to Selected and Supplementary Ships when they inspect them. Captains of ships away on protracted voyages, who have not yet received a copy of the new edition, are invited to request one from their usual Port Meteorological Officer or Merchant Navy Agent, or direct from the Marine Division of the Meteorological Office at Harrow (addresses are given below). The copy of M.O. 509, *Decode for Use of Shipping*, should be extracted from the old edition of M.O. 477 before the latter is disposed of (the following Notice refers).

## M.O. 509, DECODE FOR USE OF SHIPPING

M.O. 509, which was previously supplied as an inset to M.O. 477, *Marine Observer's Guide*, is now issued separately. It is hoped that this will be a more satisfactory arrangement, as we have been informed by Port Meteorological Officers that most ships have been in the practice of extracting M.O. 509 from M.O. 477 since these two publications are used separately. Also, it makes things simpler for us to have the two issued separately.

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

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**Humber.**—Lieut.-Commander W. H. Carr, R.N.R., c/o Principal Officer, Ministry of Transport, Trinity House Yard, Hull. (Telephone: Hull 36813.)

**Tyne.**—Captain P. R. Legg, c/o F. B. West & Co., Custom House Chambers, Quayside, Newcastle upon Tyne. (Telephone: Newcastle 23203.)

## SHIPS' CODES—GROUP $N_hC_LhC_MC_H$

The attention of all observing officers is invited to Group 6 ($N_hC_LhC_MC_H$) of the Selected and Supplementary Ships' codes, in which a number of ships' meteorological logbooks have recently shown errors. In this group $N_h$ and h normally refer to the amount of low cloud, but when no low cloud is present they should refer to the amount of medium cloud.

Thus, in a sky which is overcast by medium cloud but which has no low cloud present, $N_h$ will read 8, not 0.

The figure 0 which will appear under $C_L$ in all circumstances where no low cloud is present is sufficient information to the forecaster, or other person receiving the radio weather message, that $N_h$ and h refer to the amount of medium cloud and not to the amount of low.

It will thus be seen that $N_h$ should only be coded as 0 when there is neither low nor medium cloud.

## CORRECTION TO M.O. 593, METEOROLOGY FOR MARINERS

Page 147.

(f) Ship: the first group should read 62735 instead of 62730.

The above correction will be incorporated in Amendment List No. 1 to M.O. 593 in due course.

## PHOTOGRAPHS AND DRAWINGS

We ask all observers who insert photographs and drawings in the meteorological logbooks to make sure that their name is given on them. In the event of any of these photographs or drawings being published in *The Marine Observer*, we shall then be in no doubt as to whom should be given credit for them.

## INDEX TO VOLUME XXIX, 1959

# Meteorological Office (Marine Division) Atlases

The following are published by the Marine Division of the Meteorological Office and may be purchased from the bookshops of Her Majesty's Stationery Office at any of the addresses on the title page. Copies are available for reference by shipmasters and shipowners in the offices of Port Meteorological Officers.

## Meteorological Atlases

**Monthly Meteorological Charts of the Atlantic Ocean.** M.O.483, 1948. (60°S–70°N, 80°W–40°E) *In the press*

**Monthly Meteorological Charts of the Western Pacific.** M.O.484, 1956. (60°S–60°N, 100°E–155°W) (16¾″ × 23¾″) 105*s.* (post 2*s.* 9*d.*)

**Monthly Meteorological Charts of the Eastern Pacific.** M.O.518, 1956. (60°S–60°N, 160°W–60°W) (17½″ × 24½″) 147*s.* (post 3*s.* 3*d.*)

**Monthly Meteorological Charts of the Indian Ocean.** M.O.519, 1952. (50°S–30°N, 20°W–120°W) (16½″ × 22½″) *Reprinting*

The above four atlases contain monthly charts of wind, barometric pressure, air and sea temperature, and all meteorological elements including some typical tracks of tropical revolving storms.

**Monthly Sea Surface Temperatures and Surface Current Circulation of the Japan Sea and Adjacent Waters.** M.O.M.447, 1944. (20°N–47°N, 110°E–150°E) (20″ × 17″) 7*s.* 6*d.* (post 9*d.*)

**Monthly Sea Surface Temperatures of Australian and New Zealand Waters.** M.O.516, 1949. (50°S–10°S, 100°E–180°) (19¾″ × 12¼″) 10*s.* (post 7*d.*)

**Monthly Sea Surface Temperature of the North Atlantic.** M.O.527, 1949. (30°N–68°N, 80°W–15°E) (19¾″ × 12¼″) 10*s.* (post 7*d.*)

**Monthly Meteorological Charts and Sea Surface Current Chart of the Greenland and Barents Seas.** M.O.575. (60°N–80°N, 30°W–120°E) *In the press*
This atlas contains a generalised surface current chart for the area and monthly charts of wind, barometric pressure, air and sea temperature, and all meteorological elements.

## Current Atlases

**Currents of the Indian Ocean.** M.O.392, 1939. (50°S–30°N, 20°E–140°E) (30″ × 20″) 10*s.* (post 7*d.*)

**South Pacific Ocean Currents.** M.O.435, 1938. (60°S–0°, 140°E–70°W) (22″ × 34″) 12*s.* 6*d.* (post 1*s.*)

The above two atlases contain quarterly "current arrow" and "current rose" charts.

**Quarterly Surface Current Charts of the Atlantic Ocean.** M.O.466, 1957. (60°S–70°N, 80°W–20°E) (22½″ × 18″) 32*s.* 6*d.* (post 1*s.* 6*d.*)

**Quarterly Surface Current Charts of the Western North Pacific Ocean with monthly chartlets of the China Seas.** M.O.485, 1949. (0°–60°N, 98°E–160°W) (21″ × 16″) 25*s.* (post 11*d.*)
The above two atlases contain current rose charts, predominant current charts, and vector mean current charts.

## Ice Atlases

**Monthly Ice Charts of the Arctic Seas.** M.O.M.390a, 1944. (60°N–80°N, 80°W–110°E) (12″ × 7″) 3*s.* 6*d.* (post 5*d.*)
Polar ice, mean limits of sea ice, extreme limits of sea ice, extreme limits of bergs.

**Monthly Ice Charts of Western North Atlantic.** M.O.478, 1944. (37°N–53°N, 72°W–35°W) (12″ × 7½″) 4*s.* (post 7*d.*)
Mean limits of pack, extreme limits of pack, mean limits of bergs, extreme limits of bergs.

**Her Majesty's Stationery Office**

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