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The Marine Observer

*A quarterly journal of Maritime
Meteorology*



Volume XXII

No. 158

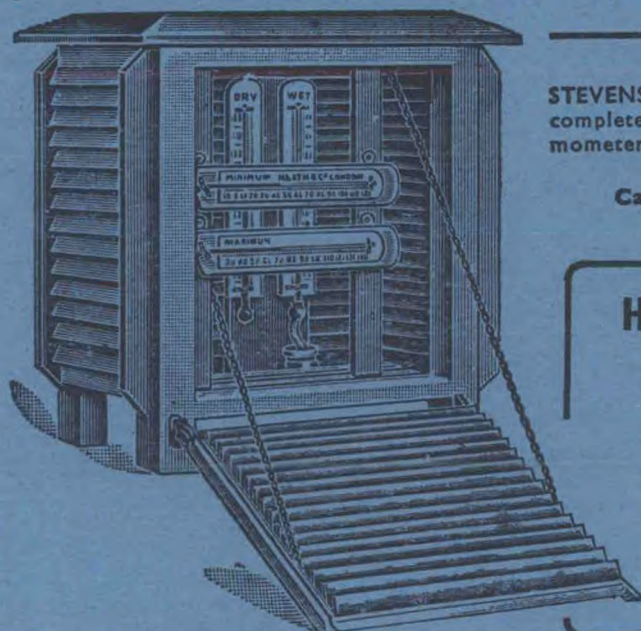
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METEOROLOGY PREPARED BY THE MARINE
BRANCH OF THE METEOROLOGICAL OFFICE

VOL. XXII

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*Letters to the editor, and books for review, should be sent to The Editor, "The Marine Observer,"
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Editorial

The Ministry of Transport's return of shipping casualties in 1950* makes interesting reading. The main causes of serious casualties to merchant ships were "accidents to machinery" and "damage caused by stranding"—33 vessels in each case out of a total of 109 vessels. Eight formal investigations into serious casualties were held during the year. A detailed analysis of the main causes of serious casualties including total losses during the year shows that 20 per cent were due to weather conditions, the term "weather conditions" including heavy weather, fog and abnormal tides or currents. During 1949, 18 per cent of all serious casualties were due to weather conditions. Statistics of minor casualties show that in 1949 and 1950, 24 per cent were directly due to weather conditions. There is little doubt, however, that weather conditions were a contributory cause of many other casualties such as those due to losses of propellers, spontaneous combustion, navigation, stowage, etc. A generalised statement about total losses shows that, in 1938 and 1950, the gross tonnage lost as a percentage of the corresponding total tonnage was the same in both years, namely 0.27 per cent. No corresponding comparative figures about minor casualties are given.

These figures emphasise the economic effect of weather on the shipping industry and on the marine insurance market. If the total casualty figures of 1938 compared with 1950 are any guide, they seem to indicate that modern invention and improved navigational facilities have not done a great deal to reduce casualties, but it may be that other factors, e.g. condition and average age of ships, wartime construction or repair work, etc., have had some effect on the 1950 statistics. It is reasonable to suppose, however, that bearing in mind these figures and the improved navigational facilities which are available to ship masters, there is justification for doing all that is possible to improve whatever meteorological advice and information can be given to shipping; under the heading of meteorology one can include forecasts, climatology and information about currents and tides. It is true that the mere issue of an absolutely accurate forecast would not necessarily save a ship from weather damage, but there are many cases, for example in tropical revolving storms and on some occasions of temperate latitude storms, when an alteration of course or speed on the strength of a forecast can keep the ship out of the worst of the heavy weather. Similarly an accurate forecast received before sailing may cause a beneficial postponement of the sailing. A timely fog forecast may prevent wastage of fuel caused by increasing speed in order to catch a certain tide at a fog-bound port. The contribution which the Selected Ship makes towards the provision of accurate information about the weather is enormous; in fact the meteorologists of the world would find it extremely difficult to provide such information at all, if it were not for reports from Selected Ships.

There is quite a lot of evidence now that ship owners themselves are becoming weather conscious; an outstanding example of this is shown in a paper written by Mr. E. H. Watts, entitled "A new cargo liner design", which gives interesting details of the S.S. *Wanstead* and her sister ships. The author shows that in planning the somewhat revolutionary accommodation, mooring arrangements and winch siting, weather conditions were a major consideration. These ships are engaged on the Eastern Canada and Continental Cargo Service, and the intention of the design is to meet the worst conditions at sea and the most difficult berthing in any of the ports visited; on this route the importance of weather in this problem is fairly obvious. Weather in relation to cargo receives a lot of attention by enlightened ship-owners nowadays, as is seen by the number of ships which are fitted with mechanical ventilation and special air drying apparatus for their holds. The introduction of the radio telephone aboard ship also has its meteorological value.

**Return of Shipping Casualties and Deaths (1950). Vessels registered in the United Kingdom.* Ministry of Transport. London: H.M. Stationery Office, 1952.

It is possible nowadays for a Marine Superintendent of a shipping company to discuss with the Master by telephone while the ship is in the vicinity of the United Kingdom, the present and probable future weather situation and the likelihood of the vessel berthing on a particular tide. There is nothing to prevent the Master of a ship at sea fitted with radio telephony calling the Meteorological Office and having a direct consultation with the duty forecaster about the future weather on his particular route. This constant telephone contact between ship and shore may disturb the serenity of life aboard a ship at sea, but nevertheless, it undoubtedly has its economic advantages.

MARINE SUPERINTENDENT.



October, November and December

The Marine Observers' Log is a quarterly record of the most unusual and significant observations made by mariners.

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

Responsibility for each observation rests with the contributor.

BIRD OF PREY AT SEA

North Atlantic Ocean

M.V. *Port Pirie*. Captain F. W. Bailey, M.B.E. Curaçao to Dunkirk. Observers, Mr. T. A. Fairbairn, 2nd Officer, Mr. H. R. Long, 3rd Officer, and Mr. C. Lancaster, 4th Officer.

21st October, 1951, 1800 G.M.T. A hawk or falcon was observed on board in $27^{\circ} 26'N$, $54^{\circ} 24'W$, some 600 miles E of Bermuda. The bird was 9 or 10 in. long from beak to tip of tail and 4 to 6 in. tall when in a sitting position. The head was black with a "hood", the breast a dirty yellow with black spots, the rest of the body being covered with white, brown and black feathers; it had a curved beak and talon feet typical of a bird of prey. On the same afternoon it caught and ate a small bird which had joined the ship while passing through the West Indies *via* Sombrero Passage. The falcon eventually perched on the foremast table, where it remained all night in spite of continued interruptions by lookouts coming and going from the nest. It left at 1800 on the 22nd in $31^{\circ} 52'N$, $48^{\circ} 53'W$, some 760 miles from Bermuda. The weather was mainly cloudy with occasional showers and good visibility. The wind was sw force 2 to 3, veering N'ly force 3 to 4. Air temp. 75° to $77^{\circ}F$, sea 79° . Course of ship 047° to 049° .

Note. The above observation was sent to the Edward Grey Institute of Field Ornithology, who sent us the following comments:

"The description is not sufficiently exact for certain determination of the species but the black hood on the head seems to indicate a small falcon. Of these, the American Sparrowhawk and the Merlin seem the only likely ones, but neither has normally any white feathers

in its plumage. The American Sparrowhawk has a strong tinge of red in its upper plumage and a reddish spot in the black crown which would probably have been mentioned; the bird therefore was probably a Merlin.

"The American race of this bird (called the Pigeon Hawk) is believed to visit Bermuda fairly regularly on its autumn migration from its breeding quarters in northern North America to its winter quarters in the West Indies and northern South America. Its occurrence 600 miles further east with westerly winds would not therefore be very surprising."

DISTURBED WATER

Atlantic Equatorial Waters

S.S. Tasmania Star. Captain G. Owen, O.B.E., R.D., R.N.R. Cape Town to Tenerife. Observer, Mr. D. Gilmour, 2nd Officer.

11th December, 1951, 1700 G.M.T. Bands of alternate calm and rough waters running parallel to course were observed. Each band was approximately two cables wide and apparently stretched from horizon to horizon. In the rough bands, waves were white-topped, while in the smooth bands small whirlpools were seen; the whole moved from starboard to port in a sw'y direction. The gyro-pilot course was irregular and at one period was running 10° to starboard. This condition of the sea lasted for three-quarters of an hour and the area affected was estimated to be 12 miles. Sea temp. 85°F . Wind NE, force 2. Course 322° , 16.5 knots.

By 1815 the course was normal and the sea smooth with low swell. Sea temp. 84.5° .

Position of ship at 1700: $8^{\circ} 07' \text{N}$, $15^{\circ} 18' \text{W}$.

TIDE RIPS

Indian Ocean

M.V. Worcestershire. Captain F. C. Brooks. Aden to Colombo. Observers, Mr. J. S. Morris, Jnr. 3rd Officer, and Mr. D. C. Monteith, Senr. 3rd Officer.

5th December, 1951. At 8.25 a.m. a distinct unbroken line of breakers, with the appearance of strong tide rips, was seen stretching in a NW-SE direction. The ship shortly afterwards crossed this line. To the westward the wind was NE force 3 and to the eastward was NW'W force 1-2, veering within 10 minutes to N. Weed was seen floating nearby.

At 8.40 the line, which was now lying in an E-W direction, was again crossed and the wind veered to NE force 3. During the next 50 minutes the line was crossed two or three times, generally maintaining an E-W direction until 9.30 when it changed to ENE and disappeared from sight. Over this period, the sea temperature was observed frequently. To the north of the line it was 86°F and to the south 85° . Considerable helm was required to keep on a course of 100° . Sounding, 47 fathoms.

Position of ship: $7^{\circ} 35' \text{N}$, $77^{\circ} 05' \text{E}$.

CURRENT RIPS

North Atlantic Ocean

M.V. British Endurance. Captain R. Wright. Curaçao to Lobito.

6th October, 1951. During the day and early evening a light swell was in evidence with a calm water surface almost throughout. From about 2.00 a.m. local time, however, on several occasions, waves formed without apparent cause, the sea criterion being in accordance with a wind of 17 to 20 knots. Without any gradual subsidence of these waves, the vessel immediately passed into calm water again. Throughout this period no wind was experienced. The sensation of seeing the white crests and hearing the noise of the waves buffeting the ship's side whilst

feeling only the breath of air from the ship's motion through the water was almost uncanny. The ship was making about 11 knots and was 400 miles from land in over 2,000 fathoms.

Position of ship : $5^{\circ} 26'N$, $44^{\circ} 12'W$.

Note. A number of observations of current rips in this region of the South Equatorial Current have been published in previous issues of *The Marine Observer*, and a preliminary investigation of the distribution of current rips over the oceans shows that this is a particularly favourable locality for their occurrence. The region in which M.V. *British Endurance* made this observation is on or near the boundary between the north-west going South Equatorial Current and the east-going Equatorial Countercurrent at this time of the year, and the rips may have occurred through meeting of easterly and westerly current. Alternatively it is probable that eddies of current are formed within the region of a strong flow of current such as the South Equatorial Current, in which case bodies of water moving in different directions might sometimes converge and form current rips. Most of the observations referred to above seem to be too far from the mouth of the Amazon to be produced by the meeting of the river outflow and the South Equatorial Current.

LINE OF DEMARCATION Caribbean Sea

S.S. *Mataroa*. Captain R. G. James, R.D., R.N.R., Curaçao to Panama. Observer, Mr. W. J. Denly, 3rd Officer.

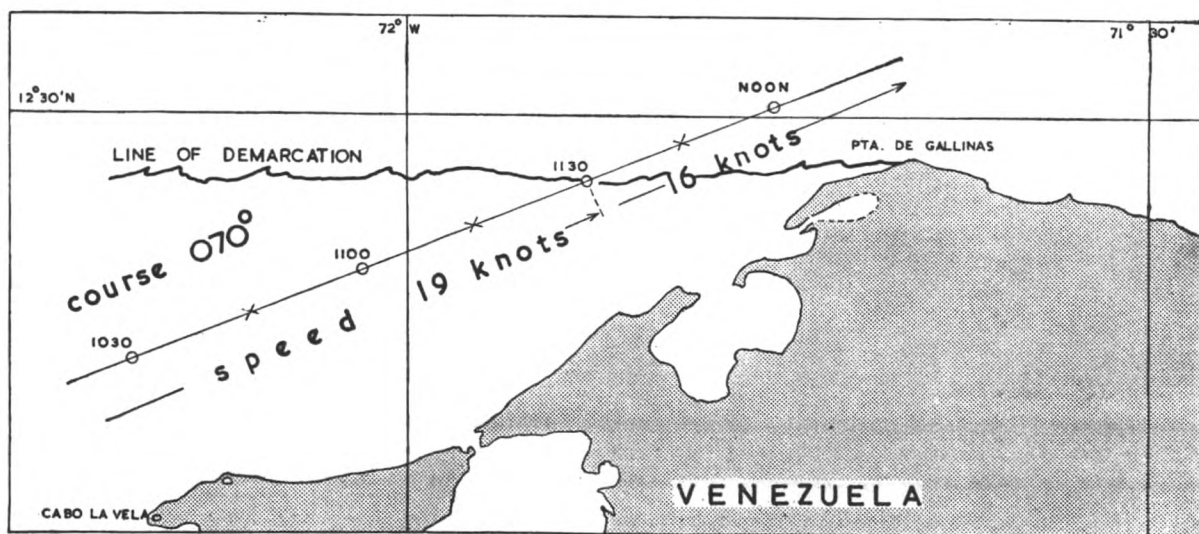
5th October, 1951, 1615 G.M.T. In a position 21 miles NNW of the mouth of the Rio Magdalena, the vessel crossed a strongly-defined line of dead branches, weeds, etc., which separated light-green from dark-blue water, the green water being to the south. The line ran in a W'N direction. Density readings gave an average of 1017.0 and the sea temperature was $86^{\circ}F$, i.e. 2° higher than immediately before or after passing through the green water.

At 1700, in a position 25 miles NW'W of the river mouth, the ship re-entered blue water, the line of demarcation running in a SW'ly direction.

Position of ship : $11^{\circ} 25'N$, $75^{\circ} 01'W$.

M.V. *Rangitoto*. Captain C. R. Pilcher, O.B.E. Auckland to Southampton. Observer, Mr. R. E. Baker, 3rd Officer.

27th October, 1951, 1615 G.M.T. The ship passed from cloudy greenish to dark-blue water, over a straight line running E-W as shown in the diagram. The line was



marked by breakers, but the difference between the two bodies of water was rather in the appearance of the surface than in the colour of the water. On the southern side of the line the surface showed closely-spaced small ripples, while on the

northern side were large wavelets frequently breaking, though the wind was SW force 1 throughout. The ship's speed, accurately found by visual and radar bearings, fell abruptly from 19 knots to 16 knots on crossing the line.

Note. The observation of S.S. *Mataroa* was made in almost exactly the same position as that recorded by M.V. *Hurunui* on 3rd May, 1950, which was published in *The Marine Observer*, April, 1951. In both cases the green colour of the water was produced by the outflow of the Rio Magdalena, which had carried down the tree trunks and other debris referred to in both observations.

The observation of M.V. *Rangitoto* is similar to one made by M.V. *Port Chalmers* in the same region (off Punta de Gallinas). In these cases a different explanation of the green water must be sought, since the region of the observations is about 200 miles eastward of the river mouth. The dark-blue water is in all cases the water of the open part of the Caribbean Sea brought by the west-going North and South Equatorial Currents of the Atlantic. There are two ways in which the greenish water near the coast could be produced, apart from the local region affected by the river outflow. Along much of the coasts of Venezuela and Colombia there is some degree of upwelling of cooler sub-surface water due to the easterly trade wind tending to drive the surface water away from the coast. This results in a belt of cooler water along the coast, which can be seen from the isotherms of sea temperature, notably in the winter half of the year. M.V. *Port Chalmers* observed that the green water was 7°F cooler than the blue water. The other factor tending to make the coastal water different to that of the open sea is the easterly flow of the Caribbean Countercurrent along the coasts of the Gulf of Panama, including the western part of the coast of Colombia. Through lack of sufficient current observations it is not known exactly how far eastward this current reaches, but it probably does not extend beyond Punta de Gallinas. The reduction of 3 knots in the speed of M.V. *Rangitoto* on passing the line of demarcation was due primarily to the vessel then encountering the adverse westerly current of the Caribbean, but as this current does not normally attain the rate of 3 knots, there was probably a previous favourable current in the green water region.

DISCOLOURED WATER

Gulf of Aden

T.E.S. *Theliconus*. Captain W. R. Main. Mena-al-Ahmadi to Antwerp. Observer Mr. P. J. E. Marshall, 3rd Officer.

17th November, 1951, 0900 G.M.T. The sea was seen to be a bright orange colour, extending as far as the eye could see in all directions. The colour was emphasised by the bow wave and seemed as if it were caused by a reddish dye. The sea was smooth with a long, low westerly swell. The phenomenon disappeared at 1000.

Position of ship: 14° 16'N, 49° 59'E.

Note. The reddish coloration was probably caused by a free-floating alga of thread-like appearance, known as *Trichodesmium*. Though classed as one of the blue-green algae, this plant has a red accessory pigment which masks the blue-green colour. *Trichodesmium* frequently appears in more or less large quantities in the Red Sea and it is from the resulting coloration that this sea derived its name. "Red water" in other parts of the world may be due to different kinds of plants, the microscopic dinoflagellates or diatoms, both of which groups consists of unicellular organisms. Dinoflagellates are the usual cause of the red coloration of the Gulf of California, known in Spanish as the "Vermilion Sea".

PHOSPHORESCENCE

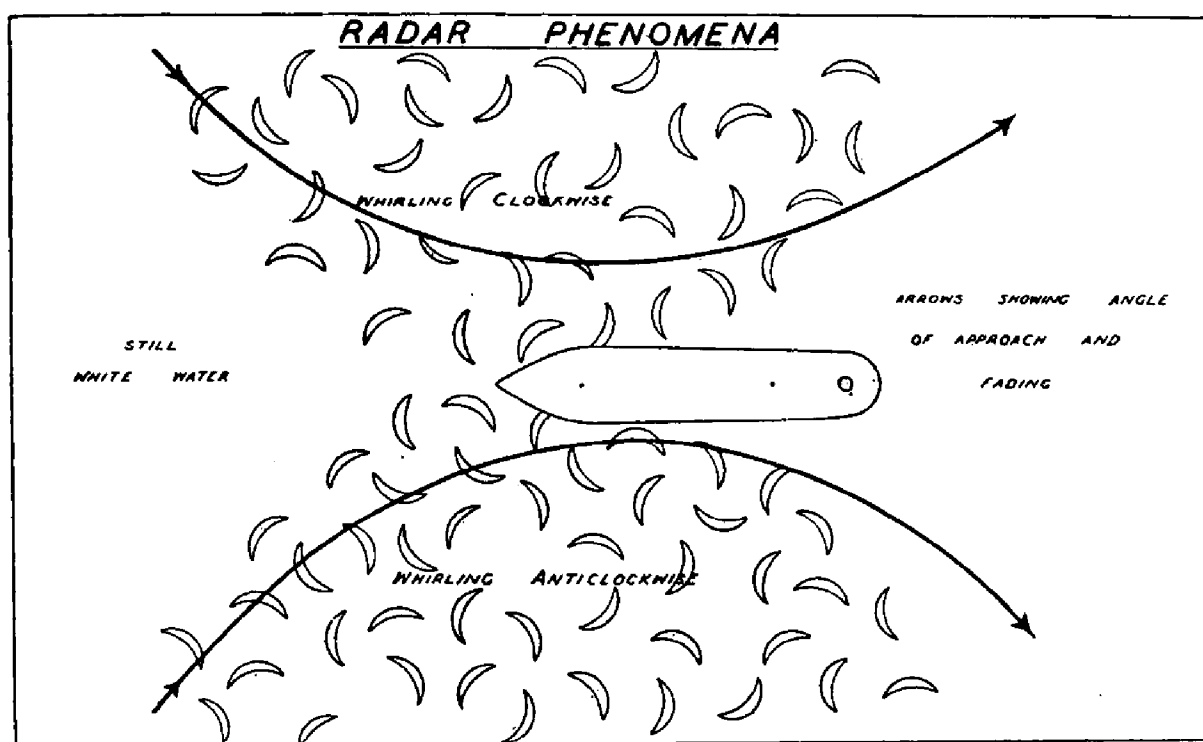
Gulf of Oman

M.V. *British Premier*. Captain F. G. Baker. Observer, the Master.

30th November, 1951, 1800 G.M.T. The ship's radar apparatus had been switched on with a view to checking her position, when, in the same instant that this gear became operative, most brilliant boomerang-shaped arcs of phosphorescent light appeared in the sea, gyrating in a clockwise direction to starboard and anticlockwise to port, but all sweeping inwards towards the ship from points situated from five to six points on either bow and some two miles distant, and conveying the impression

that they ricocheted from each other on meeting at the ship's bows and then turned and travelled away astern to similar points which were equidistant on either side and about four points on each quarter.

Having read with considerable interest the paragraph "Luminosity of the sea"—which is given on page 18 of the *West Coast of India Pilot*—I do not suggest there is any definite connection between this phenomenon and the operation of radar, but it certainly appears peculiar that it should have been coincident with the switching on of the gear and only lasting during the period of its operation; this I suggest gives room for the thought that the ultra-high frequency radiation from the ship might possibly have had some effect upon some submarine substance that led to this result, especially as the whole aspect can best be described as flashes of fluorescent green light of such brilliance that the whole ship was illuminated as though by deliberate floodlighting, each one being separate in itself and having the size and shape of a "Cossor Radar Scanner" and revolving in the water as though synchronised with that unit, and all travelling to or from the ship as described and as I have attempted to portray in the accompanying sketch.



The sky was cloudless, visibility was good and the sea was calm. The whole incident lasted some 15 minutes during which the ship was proceeding on a course of 141° at 11.5 knots.

Position of ship: $26^{\circ} 02'N$, $56^{\circ} 53'E$.

Note. This observation was sent to the Ministry of Agriculture and Fisheries and to the Ministry of Transport whose comments are as follows:

From the Ministry of Agriculture and Fisheries

The phenomenon described by Captain Baker must certainly be a form of animal luminescence. This takes place in the warmer seas at all seasons, and around our own coasts and in colder seas in summer time. It may be produced by fishes or squids in the deep ocean or it may be produced by microscopic organisms (dinoflagellates) in both the ocean and in shallow seas. The light produced by the dinoflagellates is a response to a small agitation of the water, like the breaking of the surface with an oar, but the light produced by the higher animals like the fish or squids is part of more complex behaviour; for example, the squid *Heteroteuthis* instead of emitting an inky cloud to baffle its pursuers, as other squids do, throws up a fiery cloud of luminescence.

The Gulf of Oman is shallow and the most probable organisms causing luminescence are

the dinoflagellates. Captain Baker says that the intensity of luminescence was strong. This would mean either that dinoflagellates were in high concentration or that larger organisms were swimming in circles flashing very strong lights. Of these two possibilities the presence of dinoflagellates in high concentration is most likely; these organisms can occur in the sea in thousands or tens of thousands per litre. The detailed interpretation of the phenomenon, however, is most difficult. If one imagines that the radar beam is like a searchlight, the beam is spread somewhat near its base because of the shape of the polar diagram. As the beam is turned, its movement might describe the type of patterns that Captain Baker saw; this depends upon the shape of the radar polar diagram. This interpretation assumes that part of the energy of the radar beam strikes the water fairly close to the ship and that this causes luminescence. This can only be a general luminescence by dinoflagellates because of the regularity of the pattern; fish or other larger animals would, if disturbed, move irregularly. It might be said that fish were made to move in patterns beside the moving ship and that their movement agitated the dinoflagellates, but this is unlikely.

If the right interpretation is something like this one, then it is a new observation. Dinoflagellates respond by luminescence to agitation and to low frequency noise like tapping the culture vessel with a pebble. Their possible response to wavelengths of radar frequency is a remarkable phenomenon and opens up a new field of enquiry.

From the Radar Examiner, Ministry of Transport

It is not unusual to see peculiar effects due to phosphorescence and floating spawn in the Gulf of Oman, the effects are more pronounced on clear, dark nights. In the same area I have seen a luminous sea with the appearance of a sea of milk when it was possible to read the headlines of a paper on a moonless night. When such phosphorescence appears and there is a slight breeze to ripple the surface of the water, the phosphorescence takes the shape of boomerangs.

When looking into the wake of a ship on a dark night, revolving discs of phosphorescence are seen, the discs will be revolving clockwise on starboard side and anti-clockwise on port side, as indicated in the report. This movement is due to the whirlpools caused by the movement of the ship through the water.

It is possible that the *British Premier* was steaming through a phosphorescent patch in the wake of another ship. This could have happened if the *British Premier* was following another vessel or had just passed close to another vessel.

I do not know whether or not floating spawn would be fluorescent under the influence of a R.F. beam, if it would, then the light would be flashing in synchronism with the rotation of the scanner and would appear as a rotating beam of light.

The reverse direction of rotation could only be due to the movement of a large body through the water but I do not think that it would be visible at two miles.

I suggest that this is a combination of unusual phosphorescence, slight breeze, movement of ship through water and coincidence.

DETECTION OF RAIN BY RADAR

South Pacific Ocean

M.V. *Kaipaki*. Captain N. Fraser. Panama to Brisbane. Observer, J. B. Ricketts, 2nd Officer.

28th October, 1951. From 1000 to 1400 G.M.T. the radar was in use and small patches of rain (about $\frac{1}{2}$ to $\frac{3}{4}$ sq. mile) were observed up to 18 miles from the ship. At each observation 3 to 5 of these patches were seen on the radar screen, forming and dispersing in 5 to 10 min. Their distance apart varied from 10 miles to about 30 miles. No visual rain-patches were seen except clouds which were probably above the rain-patches observed by radar. During the four hours, 12 observations were taken by radar. Wind NE force 4-5. Air temp. 81°F. Bar. 1010.4 mb, falling. Occasional patches of Sc and Cb.

Position of ship at 1200: 13° 57'S, 140° 18'W.

Note. A copy of this observation was sent to the Operational Research Group, Ministry of Transport, who sent us the following comments:

The fact that intense rain can be observed at such great ranges by radar, when land at the same distance may give poor echoes or none at all, calls for some comment. The explanation would appear to lie in the comparatively great vertical height occupied by the rain, which enables it not only to be seen well over the "radar horizon", but to present a large reflecting

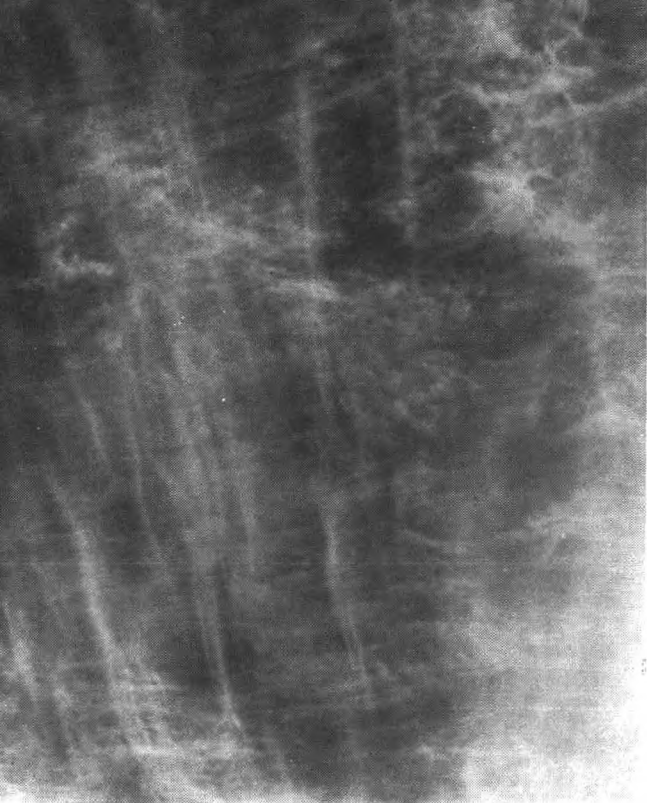


Fig. 2. Looking towards S, at low angle.

Fig. 1. Looking towards SE, at low angle.

CLOUD PHOTOGRAPHS

Fremantle, Australia

M.V. *Ajana*, Captain F. W. Mould. At anchor, Fremantle, Western Australia. 9th November, 1951, 1500 local time (0700 G.M.T.).

The above photographs of cirriform clouds were taken as near simultaneously as possible.

Less than an hour previously the sky had been cloudless. The Ci cloud formed in the SW quadrant of the sky in long and remarkably uniform rolls lying roughly N-S. Soon cirriform cloud developed independently all over the sky. Of the many diverse types, the one shown in Fig. 1 was the most prevalent and eventually connected all the various types that were present. No low or middle clouds were observed.

Photographs are by Mr. D. G. Billing, 3rd Officer, who supplied the following details. Film, Kodak Plus X. Exposure 1/500 sec. at *f*7 (Figs. 1 and 2) and *f*9 (Figs. 3 and 4). Filter $\times 2$.

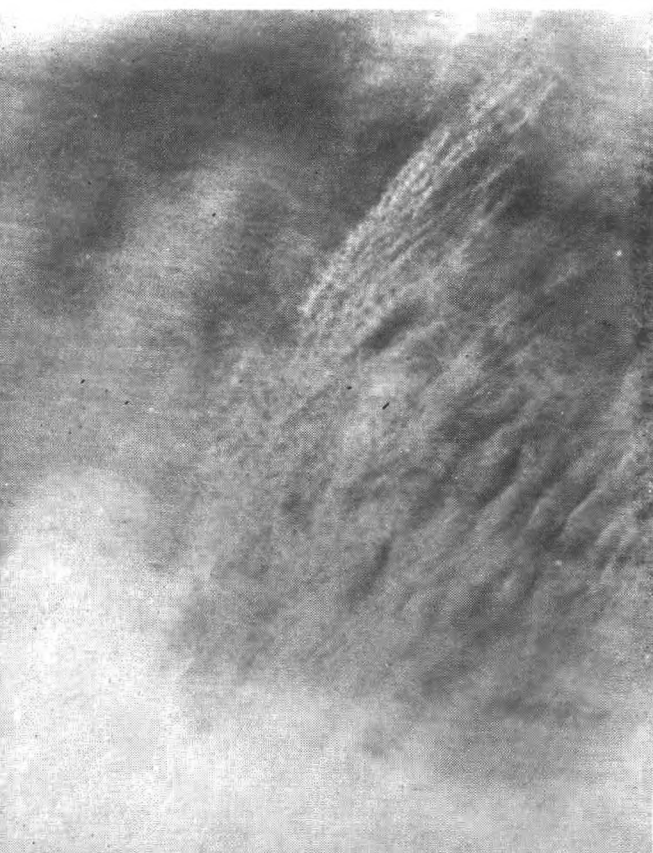


Fig. 3. Looking towards NNW, at high angle.

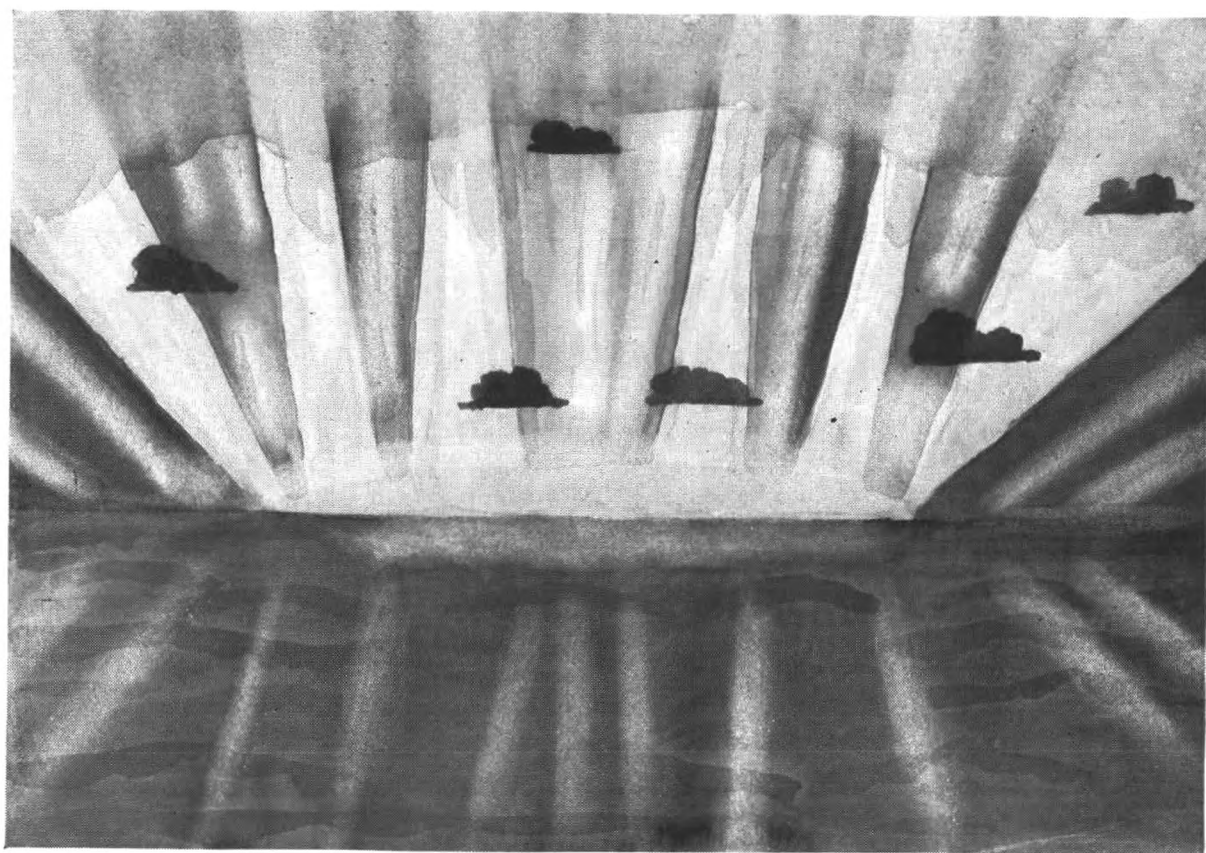
Fig. 4. Looking towards NNE, at high angle.





Photo by A. Halliday

Arch squall, Australian waters, 25th December, 1951
(see report from M.V. *Port Jackson* on page 195).



Aurora, Australian waters, 28th October, 1951
(see report from M.V. *Trelewan* on page 199).

or scattering area which is yet well inside the radar beam. The echoing characteristics of this area probably resemble a steep cliff face rather than a mountain, in the respect that the cliff is more likely to reflect radar energy back to the scanner than are the gradually sloping sides of a mountain. Thus the echo received from such rain may be expected to be fairly strong. This explanation is perhaps over simplified but may serve to explain these long ranges.

WATERSPOUTS

English Channel

S.S. *Dinard*. Captain W. Scott. Boulogne to Dover. Observers, the Master and Mr. M. H. Moore, 2nd Officer.

31st October, 1951, 1505 G.M.T. A vortex formed twice in quick succession accompanied by a large waterspout, in each case to a height of about 1,500 ft. The cloud consisted of 8/10 Cu and the weather was squally with hail showers. The wind was WSW force 3. Barometer, 29.43 in. Position: $50^{\circ} 50' \text{N}$, $1^{\circ} 17' \text{E}$.

At 1510 two smaller spouts were seen in positions (a) $50^{\circ} 51\frac{1}{2}' \text{N}$, $1^{\circ} 32' \text{E}$, (b) $50^{\circ} 48\frac{1}{2}' \text{N}$, $1^{\circ} 33' \text{E}$.

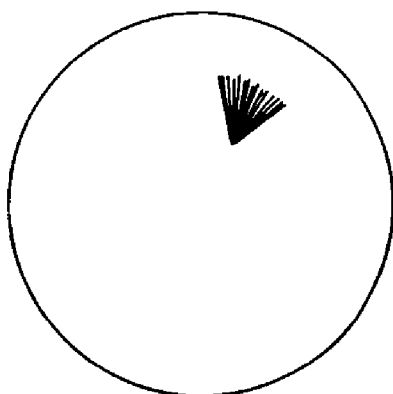
The wind veered to WNW force 5. Barometer, 29.40 in.

WATERSPOUT ON RADAR

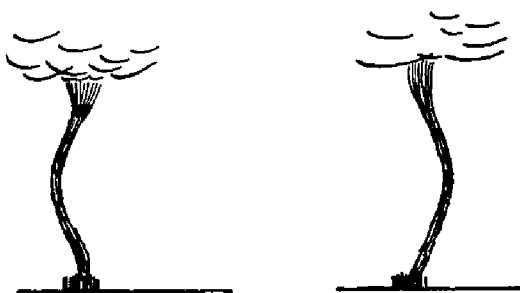
Indian Ocean

S.S. *New Australia*. Captain K. D. G. Fisher. Colombo to Fremantle. Observers, Mr. B. E. Mahy, 1st Officer, and Mr. M. D. Johnstone, 4th Officer.

6th December, 1951. 0640 S.A.T. a waterspout was observed silhouetted against a heavy rain squall. The radar (Marconi Radiolocator III) was switched on and the squall showed clearly on the screen as shown in the figure, painting quite heavily



Squall on radar screen. 10 mile range.



with the apex at a range of $4\frac{1}{2}$ miles and the squall about 2 miles deep. The spout was judged to be at the top of the apex, but could not be distinguished from the squall on the screen. The spout was not sufficiently close to see the direction of rotation, but the spiral form was observed to writhe slowly and the sea surface around the base appeared to be disturbed by a myriad of splashes.

After 10 or 12 minutes, during which time the bearing remained practically constant, the range closed to $3\frac{1}{2}$ miles, the spout was noticed to have broken, only the lower half remaining; this quickly diminished, became indistinct and merged into the squall which was becoming less heavy and starting to break up.

Air temp. 83°F , wet bulb 78° , sea 84° . Barometer, 1010.5 mb, steady; wind NNW force 3; cloud 6/8 Cu and Cb. Course $138^{\circ}(\text{T})$, $18\frac{1}{4}$ knots.

Position of ship: $03^{\circ} 14' \text{N}$, $82^{\circ} 34' \text{E}$.

Note. This observation was forwarded to the Operational Research Group of the Ministry of Transport, who suggested that the value of such interesting observations would be increased if photographs of the radar images could be obtained.

RARE FORM OF LIGHTNING

Arabian Sea

M.V. *Ajax*. Captain H. S. Wood. Colombo to Aden. Observer, the Master.
19th November, 1951, 1520 G.M.T. A brilliant greenish explosion, bearing $015^{\circ}(T)$, seemed to occur behind a large Cu, lighting it up and in particular illuminating its outer edges for about two seconds; at the same time a fiery shaft, similar



to a brilliant rocket, shot up to a height of about 18° . This was visible for about one second and then seemed to extinguish itself in a downward direction.

Position of ship: $10^{\circ} 30'N$, $59^{\circ} 50'E$.

Note. This is another very interesting observation of essentially the same character as that recorded by M.V. *Kaipaki*, which was published in the July, 1952, number of *The Marine Observer*. In a note which followed the observation, this form of lightning was stated to be very rare and probably confined to the tropics.

SEVERE SQUALL

Red Sea

S.T. *Nyati* towing two barges, *Anita* and *Mercedes*. Captain J. McK. Warner. Suez to Aden. Observer, the Master.

13th November, 1951. In the early hours of the morning, the ship was struck by a storm of phenomenal intensity in the nature of a cyclone of small area, or a tornado. It had been visible from 4 p.m. on the 12th as a small white-topped cloud overtaking the ship from the NW. At dusk it was seen to be lit up inside by lightning, not flashing, but in one long flicker. The rate of advance was estimated as 20 knots i.e. overtaking the ship at 15 knots. At 0030 on the 13th it was a few miles distant whilst the ship was in clear starry weather with a light s'ly breeze. I had everything, even engine-room skylights, closed and then turned to S. Just before 0100 it struck. Both clocks on the ship stopped and the chronometer was put ahead 10 sec but has since recovered to the normal rate of 2 sec per day. There was a loud hissing noise like steam as it came on and the surface of the sea seemed to be going

upwards. The water went past the bridge horizontally and it was salt. Visibility was zero. The second mate was pulling the whistle cord but it was impossible to hear it or to see the whistle to know if steam was coming out. The lightning made a noise like a sharp crack as it came down. The tug would not answer the helm but blew straight before the wind, the lighters acting as a sea anchor. She made a perfect course and maintained a heavy but even strain on the tow, so I let her go like that until the wind shifted to the opposite direction (SSE) at about 0230, when the strain on the tow eased and she steered normally.

I have been in several cyclones and hurricanes but have never experienced a wind of such velocity or heard so many different noises. At about 0300, with a clear sky and calm sea, we watched it passing on ahead exactly as it had come. The master of an American Liberty ship, whom I subsequently met at Aden, stated that it was the most terrifying experience of his career. He should have been on this tug!

Note. Copies of this observation were sent to various authorities and the following comments received:

From the Meteorological Office

The theory that this phenomenon was a waterspout can be discountenanced primarily on the ground of its long duration. It is unusual for a waterspout to last for more than a few minutes. In the description, moreover, there is no mention of a funnel such as would normally be associated with a waterspout and we have no knowledge of such being illuminated from within by flickering lightning.

The storm described was probably a severe squall associated with the movement of the inter-tropical convergence zone. Although the main position of this zone in November is near the Equator and it runs in an east-west direction where the air from the Southern Hemisphere meets air from the Northern, there is in this month, nevertheless, a well-defined localised zone in the Red Sea where incoming air from the Arabian Sea meets the southcoming air from the Mediterranean.

The main position of this localised zone in November in the Red Sea is about latitude 20°N , the region of the tug's position at the time of the occurrence.

In his *Geophysical Memoir* No. 28, C. S. Durst mentions the "small white-topped cloud" such as that reported by the master of the *Nyati*, and has the following observations on these squalls. "They are seen as gigantic towering cumulonimbus clouds, from the base of which torrential rain falls. The squalls may move in any direction and the wind in their neighbourhood is variable, though it may attain to such force as to cause loss of canvas to a sailing ship. In these squalls both wind and rain are not always present, some being rainless, others windless. They differ essentially from the line squall of extra-tropical regions in that the cloud, as seen from a distance, is more similar to snow-capped mountain peaks than to a horizontal cylinder."

From the Institute of Navigation

The report from the *Nyati* is precisely that of an exceptionally violent convectional storm of the type described by C. S. Durst, though the normal position of the inter-tropical convergence zone is a long way to the southward and passes somewhere near east and west through the vicinity of Mombasa.

ARCH SQUALL

Australian Waters

M.V. *Port Jackson*. Captain P. S. Ball. Sydney to Aden. Observer, Mr. M. Jones, 4th Officer.

25th December, 1951. 0820 S.A.T. (2423 G.M.T.) observed arch squall having very distinct extremities, almost pure white in colour, and stretching from horizon to horizon in a NNW-SSE direction at an estimated height of 1,000 ft. The wind was NE force 3, air temp. 62°F , barometer 1013.6 mb. During the time taken for the squall to pass over the ship, about one minute, the air temp. fell 4° and the wind backed to NW force 5. There was no precipitation and no change in barometric

pressure. Two further squalls followed, which were much less sharply defined and which had no further effect on wind or temperature. The wind continued to back and freshen after the passages of the squalls and by 1100 S.A.T. was W force 4.

A photograph of the squall is shown facing page 193.

Position of ship: $37^{\circ} 45'S$, $133^{\circ} 55'E$.

UNUSUAL SKY PHENOMENON

South Atlantic Ocean

M.V. *Sussex*. Captain F. Loughheed. Montevideo to London. Observer, Mr. D. Nicolson, 3rd Officer.

13th October, 1951. Between sunset at 1954 G.M.T. and 2040, a reddish glare spread from the western horizon until it covered the sky half-way to the zenith over an arc of 90° . The glare was reflected on the sea surface and combined with the silvery light from the moon gave an eerie effect which was most unusual. It also had the effect of dimming the stars, the brilliancy of Vega and Antares being much reduced. The only clouds consisted of tufts of Cu low on the horizon. Air temp. $77^{\circ}F$, sea 78° . Wind 110° , force 4.

Position of ship: $6^{\circ} 18'S$, $30^{\circ} 14'W$.

Note. The position of M.V. *Sussex* at the time was approximately 300 miles eastward of the Brazilian coast in the region of Natal.

LUNAR RAINBOW

North Atlantic Ocean

R.M.S. *Pretoria Castle*. Captain R. Wren, D.S.O. Madeira to Southampton. Observer, Mr. D. B. Ross, 3rd Officer.

20th November, 1951, 0025 G.M.T. Observed lunar rainbow to the west after light rain showers. The rainbow lasted for about three minutes, and was a perfect arc from N-S (approx.); at least two colours were visible, the rest being grey above and below the colours. Clouds, Fc to the W and Sc to the E.

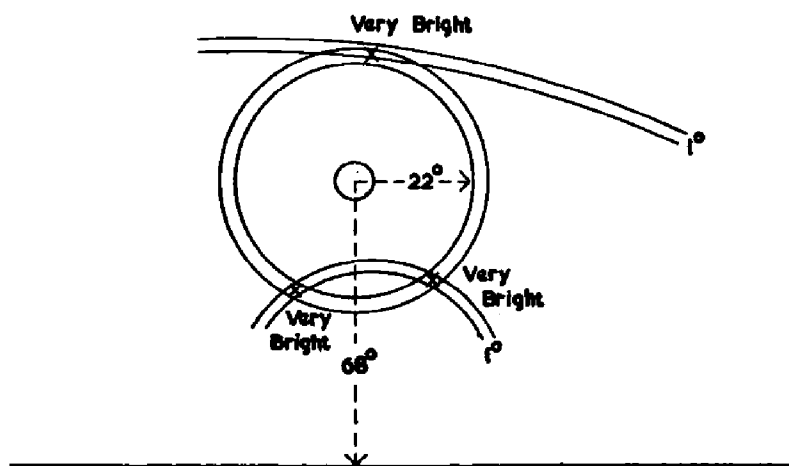
Position of ship: $33^{\circ} 52'N$, $15^{\circ} 45'W$.

RARE LUNAR HALO PHENOMENA

North Atlantic Ocean

S.S. *Balantia*. Captain H. Davies. Santos to Liverpool. Observer, Mr. J. H. Brown, 3rd Officer.

13th November, 1951, 2345 G.M.T. Observed white lunar halo of radius 22° . At 2400 a bright white arc appeared tangent to the halo, the point of contact being very bright. Shortly afterwards another arc appeared as shown in the figure; this



arc was not so bright as the former. At 0130 the halo and arcs faded. Cloud, Cs with wisps of Ci.

Position of ship: $19^{\circ} 30' \text{N}$, $19^{\circ} 54' \text{W}$.

Note. This is a very interesting observation, since neither of the two arcs shown are recognised halo phenomena. The upper one appears at first sight to be the ordinary upper tangent arc to the 22° halo, but there are two reasons why it cannot be: (a) with a lunar altitude of 68° the tangent arc bends downward so much as to be practically coincident with the upper part of the 22° halo, (b) the point of contact of the arc and the 22° halo, as shown in the sketch, is not vertically above the moon.

The arc shown intersecting the halo below the moon is not the lower tangent arc since the latter touches the halo at a point vertically below the moon and never intersects it. Furthermore, with a lunar altitude of 68° the lower tangent arc bends upward so much as to be practically coincident with the lower part of the halo. It will be noted that the points of intersection, of which no measurements are given, are not symmetrical with respect to the vertical line through the moon.

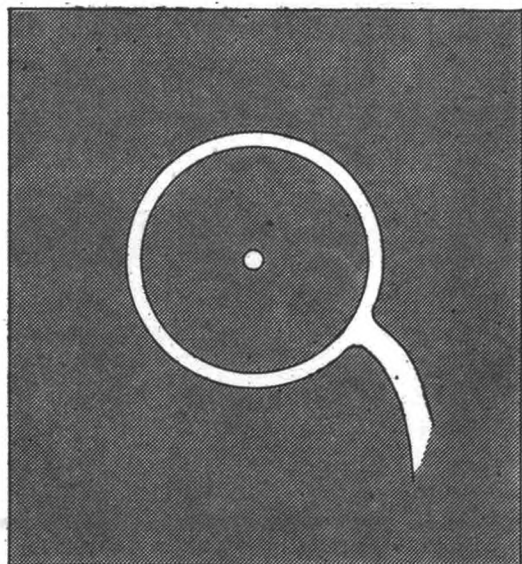
R.M.S. *Pretoria Castle*. Captain R. Wren, D.S.O. Madeira to Cape Town. Observer, Mr. D. B. Ross, 3rd Officer.

9th December, 1951, 2230 G.M.T. Observed lunar halo of 26° radius. It was in the form of a perfect ring around the moon, which showed clearly through very thin As, about $5/8$.

Position of ship: $31^{\circ} 05' \text{N}$, $17^{\circ} 00' \text{W}$.

Note. It is not possible to say what halo this was without fuller knowledge of how the radius was measured, see remarks in the note to the observation of S.S. *Regent Hawk* below. No halo of 26° radius is definitely known but one of radius $24\frac{1}{2}^{\circ}$ has been measured. It is possible, however, that other halos do occur at times either previously unrecorded or, at any rate, previously unmeasured.

S.S. *Regent Hawk*. Captain G. H. Hobson. Pointe à Pierre to Avonmouth. Observer, Mr. T. M. Hemingway, 2nd Officer.



19th December, 1951, 0600 G.M.T. A lunar halo of 18° radius and an accompanying arc were observed as shown in the figure. The halo and arc were plain white, the point of contact however being indistinct. Cloud $7/8$, Cu and thin Ac.

Position of ship: $29^{\circ} 00' \text{N}$, $45^{\circ} 42' \text{W}$.

Note. An observation of the halo of 17° by M.V. *Condesa* was published in *The Marine Observer* for April, 1952. In a note it was stated that several halos other than those of radii 22° and 46° have been very occasionally observed. Among these are the halos of 17° and 19° radii. The few recorded observations of these two rare halos differ slightly as regards the measurement of the radii, being a little more or a little less than 17° and 19° respectively. In the present observation it cannot be said which of these halos was seen since it is not stated whether the radius was measured to the

interior or exterior edge of the halo. All halo radii should be measured from the centre of the sun or moon, not from the outer edges of the disc, to the interior edge of the halo, which is better defined than the outer one.

The arc shown is not among the recognised halo phenomena and it is possible that it may have been a luminous band of cirrus cloud.

GREEN FLASH

Pacific Equatorial Waters

M.V. Haparangi. Captain R. G. Rees. Wellington to Balboa. Observer, Mr. N. D. Selwood, 4th Officer.

9th November, 1951, 0021 G.M.T. (1808 S.A.T.). The sun was observed to set (bearing 254°T) behind the top of massive Cu just showing over the horizon. As the upper quarter disappeared behind the cloud, the outer right-hand edge of the upper limb was observed through binoculars to become "fuzzy" and take on a bright watery green tinge which spread along the top edge at the instant of disappearance. Visibility was exceptionally good with a sharply defined horizon. Air temp. 72°F , wet bulb 66° , sea 73° . Cloud 6/8 Sc, 1,500–2,000 ft.

Position of ship: $8^{\circ} 52'\text{S}$, $95^{\circ} 53'\text{W}$.

9th November, 1951, 2338 G.M.T. (1802 S.A.T.). A double observation of the green flash was observed through binoculars. The sun sank (bearing 254°T) behind a layer of Sc low down but not in contact with the horizon. As the extremity of the upper limb disappeared behind the top of the cloud it underwent a colour transition, commencing with light green which seemed to change suddenly to a very light blue at the instant of dipping. At 1804½ the upper limb dipped below the horizon, and once again the upper limb was seen to turn green, the colour this time being less bright and lasting only half the period of the first observation, also no change of colour was seen.

Position of ship: $4^{\circ} 31'\text{S}$, $91^{\circ} 08'\text{W}$.

Note. These are interesting cases of the more unusual kinds of green flash observations. In theory, the green flash should be seen at the upper edge of a cloud as well as at the horizon, providing that the edge is sufficiently hard and is not very far above the horizon. The green flash seen in this way has sometimes been seen without the use of binoculars but it is usually fainter than the one at the horizon because the sky background is brighter. On the other hand there is a somewhat better chance of seeing the flash as blue or even violet, because at a little distance above the horizon some light of these very short wavelengths may be transmitted by the atmosphere, whereas on the horizon it is usually completely absorbed. The writer of this note has similarly seen the blue flash at a cloud edge.

The rarest thing in the observations of *M.V. Haparangi* is the change of colour from green to blue and this has very seldom been recorded. In *The Marine Observer*, October, 1949, an observation from *M.V. Port Wyndham* made on 30th December, 1948, was published which is, as far as we know, the only other instance of a succession of colours being seen. In that observation the colour changed from blue-green to very bright apple-green and back to blue-green again.

AURORA

North Atlantic Ocean

M.V. Esso Plymouth. Captain E. Orr. New York to United Kingdom. Observers, Mr. H. Johnson, Chief Officer, Mr. J. Doyle, 2nd Officer, and Mr. A. Brown, 3rd Officer.

28th October, 1951, 1930 G.M.T. A distinct red glow was observed extending from 280° to 360° reaching an altitude of 50° (approx.). The sun had set at 1830. The glow lasted for about 10 minutes and then changed to white. Cloud, 3 oktas Cb, frequent heavy rain showers.

Position of ship: $44^{\circ} 30'\text{N}$, $23^{\circ} 00'\text{W}$.

S.S. Martand. Captain T. Fox Lloyd. London to Port Said. Observer, Mr. J. H. Coles, Chief Officer.

28th October, 1951, 1945 G.M.T. Aurora appeared in the form of vertical bands of a reddish colour rising to an altitude of 20° and covering all stars in the constellation of Ursa Major. The display was brilliant at first, dying away to a red glow by 2000.

Position of ship: $40^{\circ} 10'\text{N}$, $9^{\circ} 35'\text{W}$.

S.S. *Pacific Fortune*. Captain F. H. Perry. Manchester to Kingston. Observer, Mr. G. M. Willoughby, 3rd Officer.

28th October, 1951, 1930 G.M.T. A reddish glow was observed in the western sky from whence emanated white rays which shimmered and flashed from horizon to horizon, sometimes showing the colours of the rainbow. The eastern sky also began to show a red glow, of less intensity, from whence emanated similar white rays which merged with those from the west. Pale white rays, which as time passed became brighter and took on a reddish hue, appeared to the N. The rays met in a focal point in the zenith and none were seen S of the E-W line. The ending of the rays was quite abrupt. The phenomenon then slowly dispersed until at 2000 it had disappeared. Around this period, radio reception was very poor and at times was nil.

Position of ship: $49^{\circ} 47' \text{N}$, $20^{\circ} 50' \text{W}$.

Mediterranean Sea

S.S. *New Australia*. Captain K. D. G. Fisher. Sydney to Southampton. Observer, Mr. W. Newport, 3rd Officer.

28th October, 1951, 1940 G.M.T. Off Cape Tenez, a red glow, bearing 330° , appeared suddenly in the sky over a low-lying bank of Sc. It rose to a height of 5° above the horizon over an arc of 10° , appearing to fluctuate until it suddenly disappeared at 1945. Its appearance was similar to that caused by bush fires. The nearest land to the NW was the east coast of Spain at a distance of about 120 miles. The weather was fine with good visibility and the wind was SSE force 2. Air temp. 66°F , wet bulb 61° .

Position of ship: $36^{\circ} 57' \text{N}$, $01^{\circ} 47' \text{E}$.

South Indian Ocean

M.V. *Ajana*, Captain F. W. Mould. Cape Town to Fremantle. Observer, Mr. R. Brewster, 2nd Officer.

28th October, 1951, 1916 G.M.T. The sky to the S above a bank of low cloud became very light. The effect was that of diffused light, covering the sky from an altitude of 10° to 70° and between 125° and 200° . The area of greatest intensity was in the region of 181° , between 10° and 30° altitude.

At 1936 the sky became fairly overcast to the S, the light still being visible in the openings. The sky then cleared to the S and the phenomena still covered the same area, now being most intense about 160° . The edges appeared to be faintly yellow, otherwise the display was milky in colour.

At 2016 the light faded completely and then returned as pencils of light slightly inclined to the vertical, moving slowly along the horizon. Shortly after this the pencils faded.

Position of ship: $35^{\circ} 00' \text{S}$, $78^{\circ} 36' \text{E}$.

Australian Waters

M.V. *Treleven*. Captain S. K. Hawken. Melbourne to Geraldton. Observer, Mr. J. Roberts, 2nd Officer.

28th October, 1951, 1900 G.M.T. A brilliant display of aurora began with a sharply-defined ribbon of light bearing 120° and other ribbons and diffused pulsating patches gradually spreading fanwise over the horizon to a bearing of 260° . The highest altitude attained was about 35° . The ribbons were white whilst the patches were red in the higher altitudes and pale green in the lower. A fine display of curtains formed just before the phenomena disappeared at 1945. The cloud consisted of small Cu, widely scattered, and visibility was good.

Position of ship: $35^{\circ} 08' \text{S}$, $115^{\circ} 52' \text{E}$.

Note. These observations show that the aurora of 28th October, 1951, was observed simultaneously in both hemispheres. Observations of aurora in the Mediterranean are rare. The

occurrence of aurora visible in relatively low latitudes has been declining in recent years in conformity with the decrease in general solar activity. The sun was at its maximum of activity in 1947 and the next minimum of activity in the 11-year solar cycle is expected about 1955.

METEORS

North Atlantic Ocean

M.V. *Ajana*. Captain F. W. Mould. Las Palmas to Cape Town. Observer, Mr. D. G. Billing, 3rd Officer.

4th October, 1951, 0024 G.M.T. A meteor was observed bearing 240° , altitude 20° , and travelling diagonally across the sky. At the end of its flight it was bearing 180° , altitude 10° . The meteor had a brilliance of -4 or more, was orange in colour with a trail of 3° in length and had a duration of 3 or 4 sec.

Position of ship: $23^\circ 17'N$, $17^\circ 26'W$.

Takoradi Harbour

M.V. *Scottish Prince*. Captain A. L. Wiles. Observer, Mr. M. C. L. Palmer, 3rd Officer.

12th November, 1951, 2010 G.M.T. A meteor of great brilliance appeared bearing 025° , altitude 40° , travelling in a descending arc to 30° altitude. It left a trail of sparks behind it, the colour of both the body and the trail being yellowish-green. The duration of flight was about 3 sec, but the trail was visible several seconds after the body had disappeared. The brilliance of the meteor exceeded that of the full moon, although the sky was covered by thin cloud.

Position of ship: $5^\circ 00'N$, $2^\circ 30'W$.

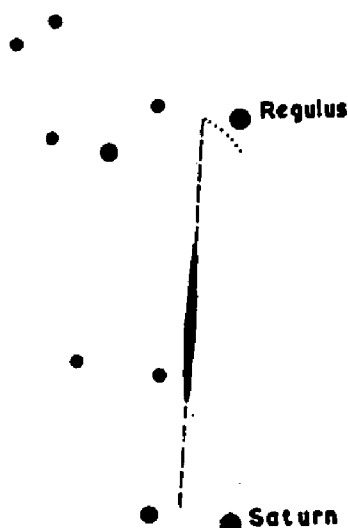
North Pacific Ocean

S.S. *Margay*. Captain E. A. Prentice. Port Alberni, B.C., to Panama.

8th November, 1951, 1449 G.M.T. In a cloudless sky, a meteor appeared near Regulus and disappeared near Denebola, having travelled in a straight line. It first had the appearance of a rocket bursting with a fragment flying off as indicated in the sketch. The colour was orange, which changed to red, then to brilliant green and finally faded to orange. The magnitude at greatest brilliancy was about twice that of Venus. At the point of disappearance the meteor seemed to burst into half a dozen pieces.

A faint trail was apparent during the green period and the estimated time of flight was 3 sec.

Position of ship: $26^\circ 49'N$, $115^\circ 52'W$.



Australian Waters

M.V. *Ajana*. Captain F. W. Mould. Fremantle to Adelaide. Observer, Mr. D. G. Billing, 3rd Officer.

22nd November, 1951, 1418 G.M.T. A meteor was observed bearing 010° close to Algol (β Persei) at an approx. altitude of 10° . It made a practically vertical flight, about 2 sec duration, down to the horizon. White in colour, it was of exceptional brilliance, comparable with a flash of lightning and appeared to fluctuate considerably in intensity.

Position of ship: $35^\circ 21'S$, $130^\circ 00'E$.

PHENOMENAL RADIO RECEPTION

North Atlantic Ocean

S.S. *Regent Hawk*. Captain G. H. Hobson. United Kingdom to Trinidad. Observer, the Master.

1st to 8th December, 1951. Extraordinary radio reception was experienced on medium frequency (particularly between 800 kc/s and 1500 kc/s) and poor reception on higher frequencies (particularly between 8 Mc/s and 10 Mc/s).

The M.F. reception of the B.B.C. Home Service stations lasted throughout the week and at distances of from 1,300 miles and 3,600 miles respectively, in daylight. At this latter distance we were within 300 to 400 miles of the island of Barbados.

The stations usually came in fairly suddenly (that is to say, the reception steadily improved over about half an hour), at times between 3 or 2½ hours before local sunset. As soon as the sun had set, these results would deteriorate rapidly as interference from stations in the U.S.A. would increase. Northern Ireland on 1151 kc/s was usually the best, with the 1088 kc/s and 1052 kc/s transmitters very good. Luxembourg on 1439 kc/s and one or two French M.F. stations were also heard, but none so consistently as the B.B.C. transmitters.

It is probable that these conditions had prevailed before the 1st December, but that was the date that the unusual reception was noticed.

Position of ship at 0000 G.M.T. on 1st: 39° 51'N, 25° 47'W; at 0000 on 8th: 18° 00'N, 54° 00'W.

Note. The above observation was sent to the Post Office Engineering Department, Radio Branch, who sent us the following comments:

We have found nothing in the data recorded by American ionospheric sounding stations during December that would account for these unusual reception conditions. Similar conditions to those reported by the *Regent Hawk* were however experienced during the previous sunspot minimum period in 1943-44, and it may be that the conditions reported last December are associated with the approaching minimum of the present sunspot cycle.

Special Long Service Awards to Marine Observers

Each year since 1948 the Director of the Meteorological Office has made a special award to four voluntary marine observers whose long and meritorious work at sea on behalf of the Meteorological Office is considered as deserving special recognition. Each individual who qualifies for this award has carried out a minimum of 15 years' service as a voluntary observer and considerable care is taken to check the records and ensure that the award is made fairly. This year the Director is pleased to make the special award to the following captains:

CAPTAIN E. A. BURTON (New Zealand Shipping Co.), a voluntary observer since 1920. Of 33 logs received from him 61 per cent have been classed excellent.

CAPTAIN J. V. LOCKE (Cunard Steamship Co. Ltd.). Since he started observing in 1924 we have received 123 logs from him of which 76 have been classed excellent.

CAPTAIN J. V. ROBERTS (Shaw Savill Lines). Has been observing for us since 1922. A total of 47 logs has been received from him of which 11 have been classed excellent.

CAPTAIN E. A. SHERGOLD (Canadian Pacific Steamships). First commenced to observe in 1920, since when he has submitted 74 logs of which 19 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 the recognition of their voluntary work over many years. They will be personally notified of the award and of the arrangements which will be made for its presentation.

MARINE SUPERINTENDENT.

Annual Report of the National Oceanographic Council 1950-1951

The above report, published by the Cambridge University Press, gives an outline of some of the work carried out for the year by the National Institute of Oceanography. In view of the relationship between maritime meteorology and oceanography, it seems reasonable to suppose that some extracts from the report may be of interest to our readers. The National Institute of Oceanography was formed in the winter of 1950 and is under the directorship of G. E. R. Deacon, D.Sc., F.R.S.

Waves and Swell

Continued analysis of wave records has suggested that limiting wave steepness is an important factor in governing the distribution of energy between short and long waves. The short waves that dominate the wave pattern when the wind is light grow higher till they reach a limiting steepness in which the ratio of height to length is of the order of 1 : 13, at which they lose energy as fast as they gain it. As the wind grows stronger the energy tends to pass into longer waves on which the shorter waves are superimposed. Observations which have been made suggest that the equilibrium steepness decreases with increasing wind strength.

Using available information about the tangential stress of the wind and its pressure on waves, an estimate has been made of the energy associated with waves of all lengths which occur under specified wind conditions. The results are in reasonable agreement with theoretical expectations.

Preliminary measurements have been made of the oscillatory movements beneath the waves in shallow water, using an instrument which records the varying deflections of a small can mounted on a vertical flexible rod fixed to a stand on the sea bottom. The records broadly confirm that the character of the waves changes from the sine-wave type in deep water to the solitary wave type when the water is so shallow that the velocity of the wave depends mainly on the depth. In such depths there was a sharp forward movement below the crests and a slow backward movement in the troughs.

Exchange of Energy between Atmosphere and Ocean

The climatic atlases prepared by the Marine Branch of the Meteorological Office are being used to compute the magnitude of the major terms in the energy balance equation for typical areas in the Southern Ocean. A knowledge of the relative importance of heating and cooling processes and wind stress in controlling the circulation of large masses of water is important in meteorology and oceanography. The Southern Ocean was chosen because the main features of the water circulation there appear less complicated, and therefore more capable of theoretical analysis, than those of other oceans.

The main difficulty in these studies appears to lie in lack of knowledge about the drag of the wind on the sea surface. Such knowledge would be very valuable in the theory of wave generation, and attempts are being made to obtain more detailed information. The drag of the wind over the sea has been studied in co-operation with the Department of Meteorology at Imperial College, using measurements made near the Scilly Isles. Hydrogen-filled balloons with a small rate of ascent were followed with two or more theodolites, and detailed observations made on more than 100 ascents. A preliminary analysis of the results indicates that the variation of wind with height in the lowest 1,500 ft. of air over the sea is much less than is generally supposed, and the drag is probably correspondingly small.

Measurements of wind profiles in the first 30 ft. above the water made on Lough Neagh appear inconclusive, and attempts are therefore being made to confirm them by measurements on a large reservoir at Staines. It is also hoped to measure the

stress by a more sophisticated method which involves measuring the correlation between vertical and horizontal gusts of wind.

Among the new instruments which have been developed for wave measurement is a beach gradient recorder which makes rapid measurements of beach contours to facilitate the study of small changes of depth on waves and beach currents. It records the angular movements of a damped pendulum, and measures the changes in slope of the beach as it is pulled or pushed like a perambulator.

The sea sledge is an extension of American experiments to produce a carriage to carry instruments into and beyond the zone of breaking waves. It runs on an articulated track, and can be moved out and in by pulling one way or the other on an endless rope.

Improvements have also been made in the design of the harmonic analyser used for waves and microseisms.

R.R.S. *William Scoresby*

The *William Scoresby* sailed from London on 11th January, 1950, and completed her commission in November, 1950. The principal object of her voyage was to mark whales during their winter migration and to carry out other oceanographical work in warm waters, especially in the region of the Benguela current. Fishery experiments off East London were also carried out. It is well known that the Agulhas Current in this region reaches a speed of 4-5 knots at the surface near the Continental Slope, and the *William Scoresby* found evidence that below the surface its velocity is considerably greater. It was hoped to find considerable numbers of humpbacks near the south of Madagascar, and though few could at first be found, a number of sperm whales were marked. Two oceanographical surveys of the Benguela Current were made, the first in the late summer in abnormal conditions and the second in late winter in normal conditions, that is, with extensive areas of cold surface water, marked upwelling, predominant southerly winds, etc. Taken as a whole, these two surveys should go far towards a more accurate measurement or delineation of the phenomena specially associated with the current and should help to clarify the factors which cause them. It is well known that upwelling water in this region, very rich in nutrients, supports a dense animal and plant population. Although the present work is in an early stage, it seems to show that the upwelling area is closely correlated with the width of the Continental Shelf and brings water from a depth of about 100 fathoms to the surface. Decomposition of the plankton greatly reduces the dissolved oxygen in the water and the extent of this reduction shows a marked seasonal variation. In summer there is practically no oxygen in the inshore region and it is not impossible that this lack of oxygen is the primary cause of the mass mortalities of fish which occur near Walvis Bay. The surveys have shown that the azoic mud (which is attributed to the flourishing of sulphur-reducing bacteria in the anaerobic conditions of the sea bed) extends for some 400 miles along the coast and is thus spread over a much greater distance than previous observations had indicated.

R.R.S. *Discovery II*

The report covers approximately the period from the sailing of the *Discovery II* in May, 1950, to the time of her refit in Sydney in March-April, 1951. The principal object of the voyage was to round off the broad oceanographical survey of the Southern Ocean. The specific application of the survey will become clearer as the analysis of the data proceeds, but a few examples of the many probable or possible results of the observations may be mentioned. It should be possible to estimate the dimensions and limits of the area in which whales find the conditions they seek in the summer; to demonstrate the circulation and circumpolar continuity of the pelagic fauna and flora; to compare roughly the total volumes of the main water masses with those of other oceans; to measure approximately the seasonal expansion and contraction of the area covered by pack-ice; and perhaps to estimate the total

exchange of energy between sea and atmosphere in the Southern Ocean as a whole.

Some years will of course be needed for examination of the data and material obtained, but the work done so far in this commission may be summarised as follows:

PRINCIPAL ITEMS: (a) A line of full stations in 90°E through the little-known central Indian Ocean from the Equator to the pack-ice in 58°S in winter. This provides a vertical section about 3,500 miles long in which the distribution of physical and chemical phenomena and of the plankton can be shown in their main outlines. Preliminary inspection of the data shows the Antarctic intermediate layer as a conspicuous feature of the section extending northwards to about 10°S. (b) A repetition in summer of the Subantarctic and Antarctic part of this line. This fills another gap in earlier observations and is valuable for comparison with the winter line. (c) A similar line in 150°W in spring, also closing an important gap. (d) Other useful lines of stations across the Tasman Sea and from the ice-edge to Dunedin.

OTHER BIOLOGICAL WORK: (a) Further data collected on the distribution of plankton, whales' food, etc., along the ice-edge in the Pacific sector in winter and West Australian longitudes in summer. (b) Observations on the relative densities of the population of whales in the Antarctic regions visited. (c) Collection of a variety of biological material from various nets. (d) A large body of data on the distribution of oceanic birds, especially in relation to zones they inhabit and seasonal changes in such zones. (e) Limited collections of material for presentation.

SPECIAL PHYSICAL INVESTIGATIONS: (a) Vertical sections through the Straits of Gibraltar and Gulf of Aden which may add to what is known of the flow of currents at different levels into and out of the Mediterranean and Red Seas. (b) Data on the distribution of water layers at the Antarctic Convergence. (c) Further data on the seasonal positions of the convergences and pack-ice edge. (d) Further data for comparing the form of ice-floes at the ice-edge in summer and winter. (e) Records of surface temperature throughout the ship's voyage. (f) New information on echo-reflecting layers in the water.

SOUNDINGS AND BOTTOM DEPOSITS: (a) Numerous soundings both in deep water and on continental slopes, etc., including some continuous sounding records covering several hundred miles. Taken with existing soundings these should add substantially to what is known of the bottom topography of the Southern Ocean. (b) A number of seismic soundings of bottom deposits. (c) Material collected with the Kullenberg core sampler; this instrument has been little used as yet, mainly on account of adverse weather, and no full-length core has so far been obtained, but some of the material appears to be of special interest.

CO-OPERATION WITH AUSTRALIAN AND NEW ZEALAND AUTHORITIES: (a) Local oceanographical work including lines of full stations and special soundings and bottom sampling. (b) Accommodation in the ship for visiting scientists from Australia and New Zealand to gain experience and make special observations. (c) Assistance to the Australian expedition established at Macquarie Island.

MISCELLANEOUS INVESTIGATIONS: (a) Line of stations west of English Channel in co-operation with the Marine Biological Association. (b) Swings for measuring magnetic variation for the Hydrographer of the Navy. (c) Collection of routine meteorological data for the Meteorological Office. (d) Observations on basal metabolic rates by the Surgeon for the R.N. Personnel Research Committee of the Medical Research Council.

P. R. B.

Hints on Observing

1. THE THERMOMETER SCREEN

By CDR. C. H. WILLIAMS, R.D., R.N.R., and CAPT. J. R. RADLEY

(Cdr. Williams and Capt. Radley are the Port Meteorological Officers
at London and Southampton respectively)

This is the first of a series of short articles intended to assist ships' officers with their meteorological observations. Two heads are reputed to be better than one and so certain points which were not generally appreciated before may possibly be gathered from these hints. In this number we propose dealing with the readings as taken from the screen thermometers, on which three important observations depend: TT (air temperature), $T_s T_a$ (air temperature minus sea temperature) and $T_d T_a$ (dew point).

Most ships' officers are familiar with the portable thermometer screen in use at sea, as it forms part of the Meteorological Office outfit supplied on loan to all Selected Ships. The screen contains two thermometers mounted vertically side by side, one being a "dry bulb" and the other a "wet bulb" thermometer, which together form what is known as a hygrometer (Greek *hygros* = wet), or alternatively a psychrometer (Greek *psychros* = cold), and is used for determining the humidity or moisture content of the air. The two thermometers are identical, but that known as the "wet bulb" has its bulb covered with a single layer of thin muslin, which is kept moist by means of a wick dipping in a small vessel of water.

The process of water turning into water vapour is termed evaporation. The opposite process which turns water vapour into water is called condensation. When the air is not saturated, evaporation takes place from the wetted surface of the muslin on the wet bulb, and the drier the air the more rapid will be this evaporation. The rate of evaporation also increases with the speed of the wind past the evaporation surface, and with an increase in the air temperature. The process of evaporation requires heat, which is taken from the water left on the muslin, the mercury in the wet bulb and from the air flowing past it, thus reducing the temperature of the bulb. The reading of the wet bulb thermometer is therefore usually lower than that of the dry bulb. Using this same principle of evaporation, sailors used to keep drinking water cool in hot climates by keeping it in a porous canvas bottle hung in a draught of air. The small beads of water on the canvas evaporated and the outside surface temperature of the bottle was thus lowered, cooling the water inside. The "chatti", made of porous earthenware and used in the East, is a similar device.

From the difference in the dry and wet bulb readings can be calculated what is known as the "dew point"; that is to say, the temperature at which the air, if it were cooled sufficiently, would become saturated and evaporation would cease. The calculation of the dew point is not simple and it is usual to obtain it by reference to special tables. These tables are given in the *Marine Observer's Handbook* and similar publications. The dew point, as well as being of value in meteorological observations and reports, can be an important factor in relation to the efficient ventilation of cargoes, as will be shown later. There are also tables for obtaining, by means of the dry and wet bulb readings, the relative humidity; this is defined as the amount of water vapour actually present in the air, expressed as a percentage of the amount the air could contain at that temperature if it were saturated.

The "screen hygrometer", although it appears simple, requires care and attention if the results obtained are to be really satisfactory. Two conditions are essential: (a) cleanliness, (b) good exposure. Cleanliness does not merely mean freedom from obvious dirt such as coal dust, etc.; the thermometers must be kept free from the effects of the less noticeable fouling by salt from spray, and deposits on the wet bulb from impure water. Both bulbs should be kept bright. The water

container should be kept full of clean, fresh water; distilled water is best, but condenser water from the engine-room may be used. Do not take a reading immediately after replenishment of the water container before the wet bulb thermometer has had time to regain an equilibrium temperature: this will take about five minutes. The muslin should be damp but should not drip; if it does, the supply of water to the bulb should be reduced by removing one or more threads from the wick. If there is any water on the dry bulb or the thermometer stems, wipe it off and wait a few minutes before reading. The muslin and wick should be changed or washed frequently (at least once a week). The wick should be just long enough to lead water from the container to the muslin; if it is too long it may hang in a bight and water will drip from the lowest part and soon drain the container dry. It should be of just sufficient thickness to keep the muslin damp. It is of course advisable for one officer to make himself responsible for the care and efficiency of the screen.

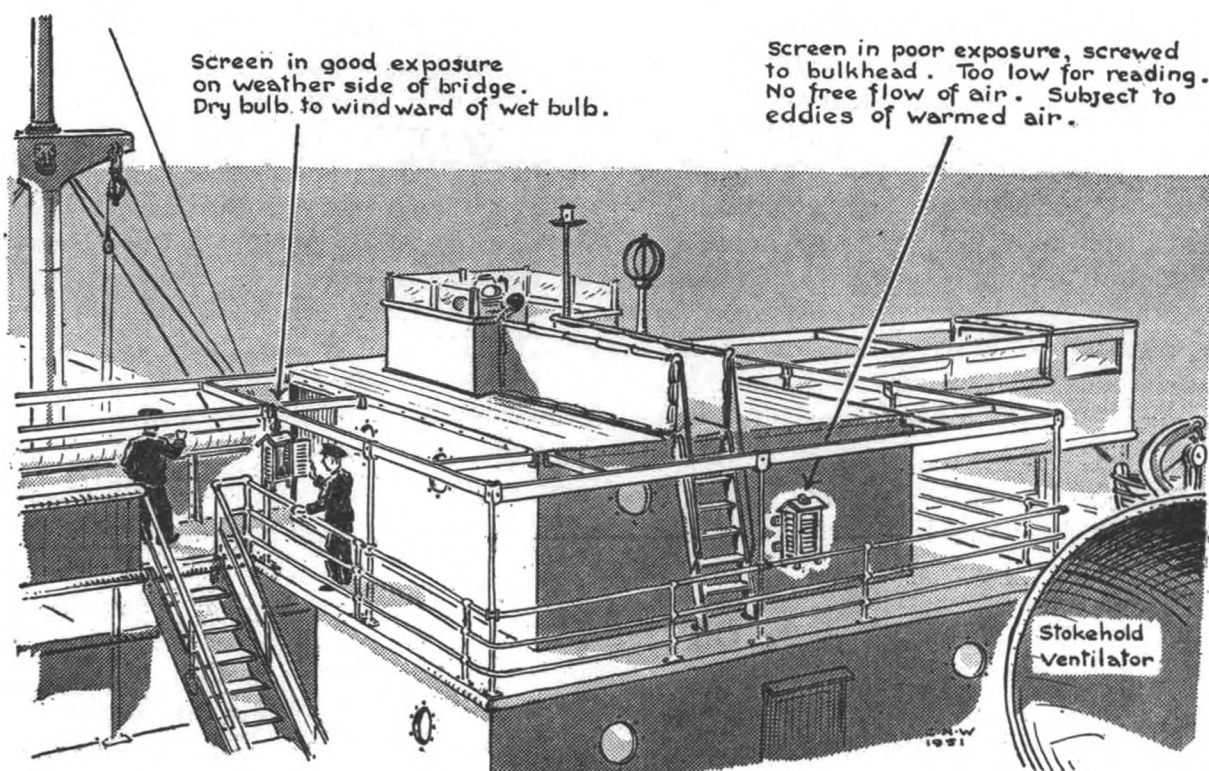
The second condition, good exposure, is not always easy to attain in a ship at sea, because there are invariably a number of sources of heat likely to affect the readings. The aim is to measure, as accurately as possible under the circumstances the dry and wet bulb temperatures of a sample of air which is uninfluenced by any warming effect of the ship. The screen should therefore be hung in such a position that the air from the sea blows straight through it, hence the notice now attached to the tops of screens, "Hang to windward before reading". It is preferable that the dry bulb should be to windward of the wet bulb, though this may sometimes be difficult to arrange.

The importance of ensuring a flow of air through the screen cannot be too strongly emphasised; the whole principle of the screen and its relevant tables depends on a current of air flowing freely through the screen. Hanging the screen on a bulkhead, even on the weather side, must be avoided, as in effect this turns the screen into a solid-backed one and thus prevents proper ventilation.

In theory, in perfectly still air, whatever the actual humidity, the two thermometers would have practically the same reading, because once the air adjacent to the wet bulb became saturated, without any replacement of drier air, no further evaporation would take place. An example of this can be judged by the effect of an electric fan in a warm cabin. It does not lower the temperature of the air at all, but by continually replacing the air next to the damp skin of the occupant with drier air, it reduces his temperature in the same manner as in the case of the wet bulb thermometer. At sea, with a following wind of exactly the same speed as the ship, there will of course be no flow of air through the screen wherever it is exposed, and under these circumstances the dew point as obtained from the tables will not be correct. Fortunately this is not of very frequent occurrence.

It is because of the difficulty of ensuring adequate ventilation for thermometers in screens aboard ships that the International Meteorological Organisation, at its meetings in Washington in 1947, recommended that thermometer screens should, when possible, be replaced by some form of aspirated, that is to say, mechanically ventilated, instrument. In order to carry out this idea experiments are being made with a hand aspirated psychrometer in the British Meteorological Office with a view to its use in Selected Ships at some future date. Meanwhile officers must use their discretion to ensure adequate ventilation, knowing the purpose of the readings and the need for accuracy. When the relative wind is nil it would be a good idea to make a note of this in the remarks column of the logbook against the observations. The captain may be willing to make a slight alteration of course; this will often produce a slight relative breeze and enable an accurate reading to be taken.

In some ships, hooks are fitted to an awning spar on either side of the navigating bridge, so that the screen can be readily shifted to a suitable position well to windward a few minutes before reading. Although it is the usual practice of seamen to lash all moveable articles securely, the thermometer screen must be shifted from



time to time to ensure its efficiency. It is not possible to lay down hard and fast rules as to the most suitable position, as the arrangement of ships' bridges varies considerably. The "Monkey Island" is often a good place, except with a following wind, in which case the screen will be in a flow of air which has been warmed in its passage over the ship from aft.

The screen when issued is painted white and it should be kept so, as in this way the heating effect of the sun on its outer surface is minimised. A white surface reflects the heat from the sun and a dark surface absorbs heat—hence the use of white material for tropical clothing. Most ships have white painted superstructures, but in some cases, where it is other than white, there is a tendency to paint the screen the same colour when painting ship, a temptation that should be resisted.

When reading the thermometers, look out for possible errors. For instance, if the wet bulb reads higher than the dry there is obviously something wrong. Similarly if the two thermometers read within 1°F of each other when the air is obviously not saturated, the observer should have another look; it may be that the muslin is dry, or the water become salty, or that moisture has collected on the dry bulb making it, in effect, a wet bulb, or one of the thermometers may perhaps have become defective through an accidental knock. The screen should not, of course, be hung too high because of the risk of parallax error in reading the thermometers.

When the air temperature is below freezing point, the muslin will be ice-coated. Evaporation will go on from the ice surface as from water, and the readings should be taken as usual. If the muslin has no ice on it, wet it with cold water, allow this to freeze, and wait until the mercury has steadied before making the observation.

At sea the difference between the dry and wet bulb readings is seldom more than 10°F . It is advisable to read the thermometer fairly quickly, so that heat from the observer's body does not have time to affect the readings. Thermometers should not be handled whilst being read.

It is of value if a note is made about changes in the dry and wet bulb temperatures, (a) with the passage of squalls, (b) when in the vicinity of ice, and (c) particularly when mirage or excessive refraction or "freak" radar results are evident. Cases of this sort should be entered in the "Remarks" column of the meteorological log.

The air temperature and the dew point, which are both transmitted in the ships' weather message, have a particular use for meteorologists ashore in assisting them to forecast cloud, fog or frost and in locating the position of "fronts". These observations are also of considerable value for climatology, for example, in compiling atlases showing the mean and extreme temperatures and humidities in the various oceans, or for special investigations or specific shipping enquiries. To be fully useful, the observations must be accurate. The Meteorological Office thermometers are good ones, the rest depends on the man on the spot. The value of accuracy in temperature reports was well brought out in an article, "The importance of ships' observations to the forecaster", published in the October, 1947, number of *The Marine Observer*, where temperatures read by the ships *Empire Kendrick* and *Eros* were shown to have materially helped in the plotting of the line of separation between tropical air and polar maritime air and the consequent frontal system associated with a secondary depression approaching the British Isles.

To the ship herself the dry and wet bulb readings can at times be of considerable value. For instance, if the sea surface temperature is below that of the dew point of the air, fog is probable when the air, by contact with the sea, becomes cooled below its dew point and condensation occurs. One of the most valuable uses of good hygrometric observations is in connection with the ventilation of cargo. Cargo is often damaged through "sweating", that is, the precipitation of moisture from the air on to the inside of the hold or the cargo surface. The two factors governing this are (a) the dew point of the air in the hold, (b) the temperature of the cargo or of the sides and deckheads of the hold. Thus if the air in the hold is of a lower temperature than the dew point of the air outside, it may be best not to ventilate, otherwise sweating would almost certainly occur. If practicable, it is desirable that observations of temperature and humidity should be taken at representative positions in the holds.*

Sea air is usually moist and salt laden, and the moisture and minute particles of salt can cause corrosion if deposited on iron in the cargo. Some years ago recommendations were made as to restricting the ventilation of cargo holds when conditions indicated the likelihood of sweating. Briefly these were:

- (a) To take dew point readings of the air on deck each watch.
- (b) To take temperature of the holds once a day.
- (c) To plot these readings on a graph.
- (d) To ventilate when the dew point on deck is below the temperature of the air in the hold.
- (e) To cease ventilating when the temperature of air in the hold is below the dew point of the air on deck.

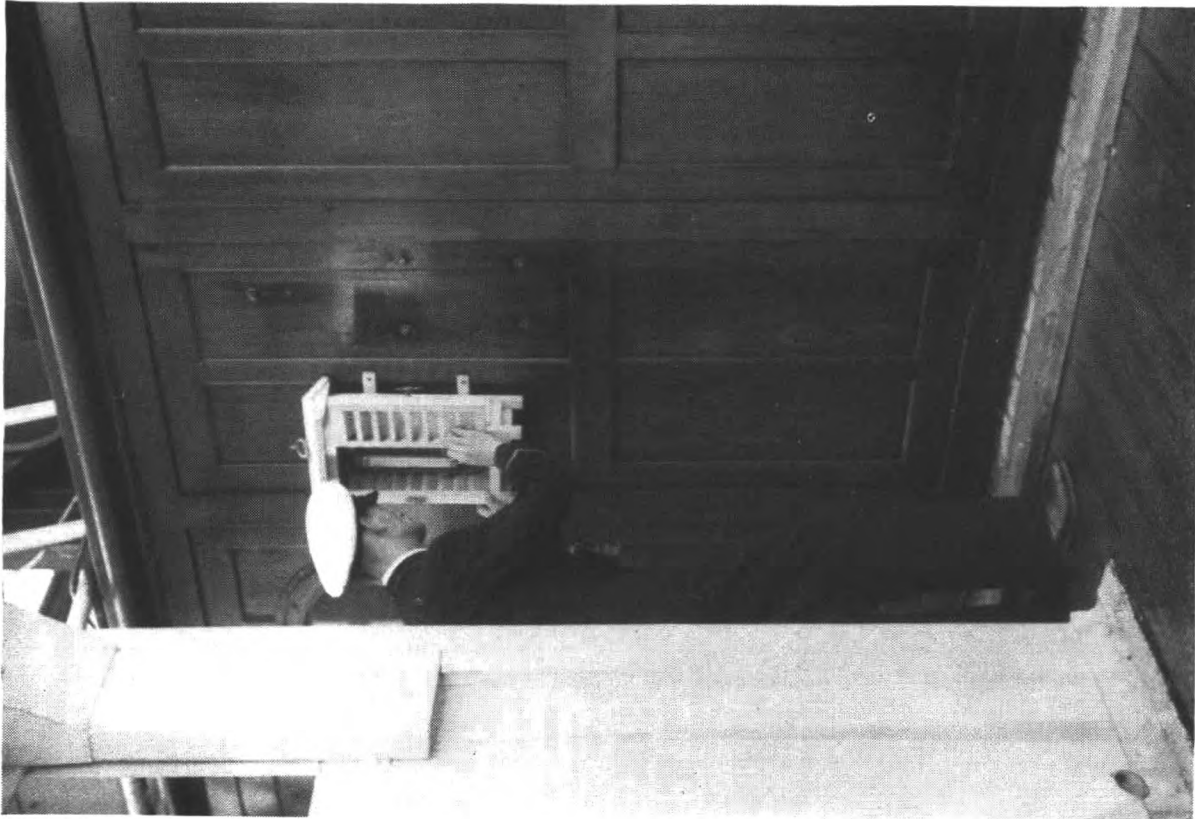
This problem of preventing damage done to cargo by the "sweating" of ships' holds has also been tackled of late years in certain ships by the installation of mechanical ventilating and air-drying equipment.

It will be seen by these remarks that a hygrometer is a valuable instrument both for the meteorologist ashore, and for practical daily use in the ship.

It is of course realised in the Marine Branch of the Meteorological Office that, at sea, there are often certain difficulties in carrying out all this careful observing. On a dark night, raining, blowing a gale, and perhaps with the ship rolling heavily, it is no easy matter to read the screen thermometers accurately. Nevertheless most officers with a proper realisation of the usefulness of these temperature readings do take pains to get the correct readings. Being accustomed to care and accuracy in their use of such instruments as sextants and compasses, navigating officers can readily see the need for similar care in the use of meteorological instruments.

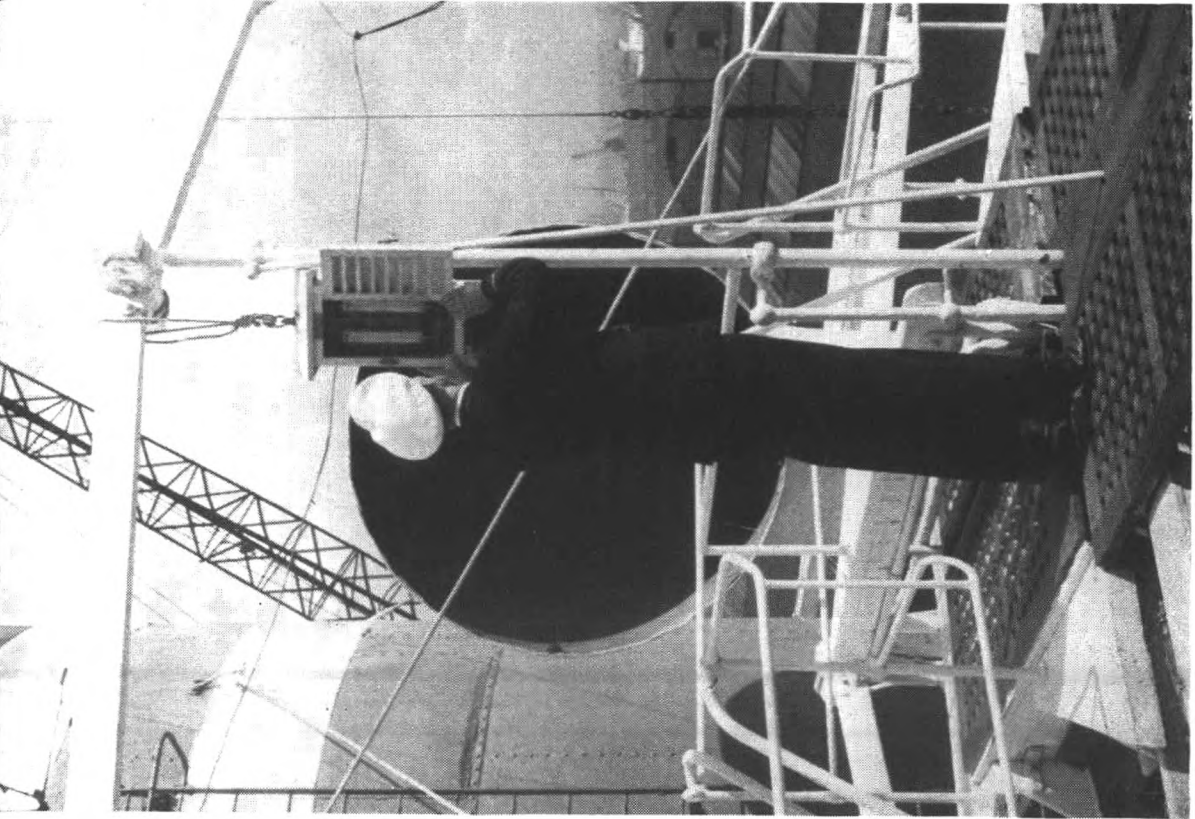
"A blank space is preferable to a doubtful observation."

*More detail about this subject is given in the article "Meteorology in relation to the carriage of goods by sea" in *The Marine Observer* for April, 1952.



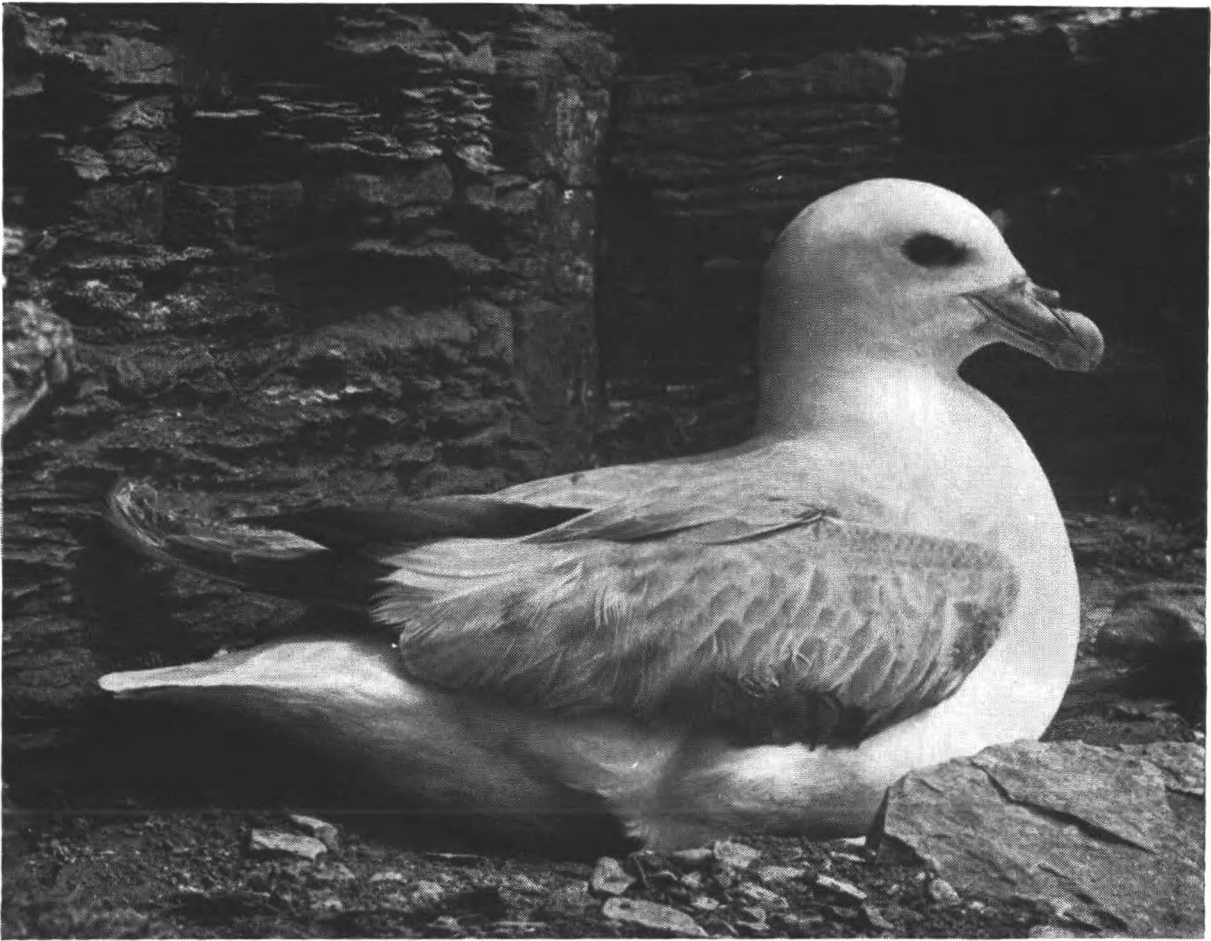
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Another example of poor exposure. The screen is fixed to the side of the chart room, thus preventing the free flow of air necessary for an accurate determination of temperature and humidity (see page 206).



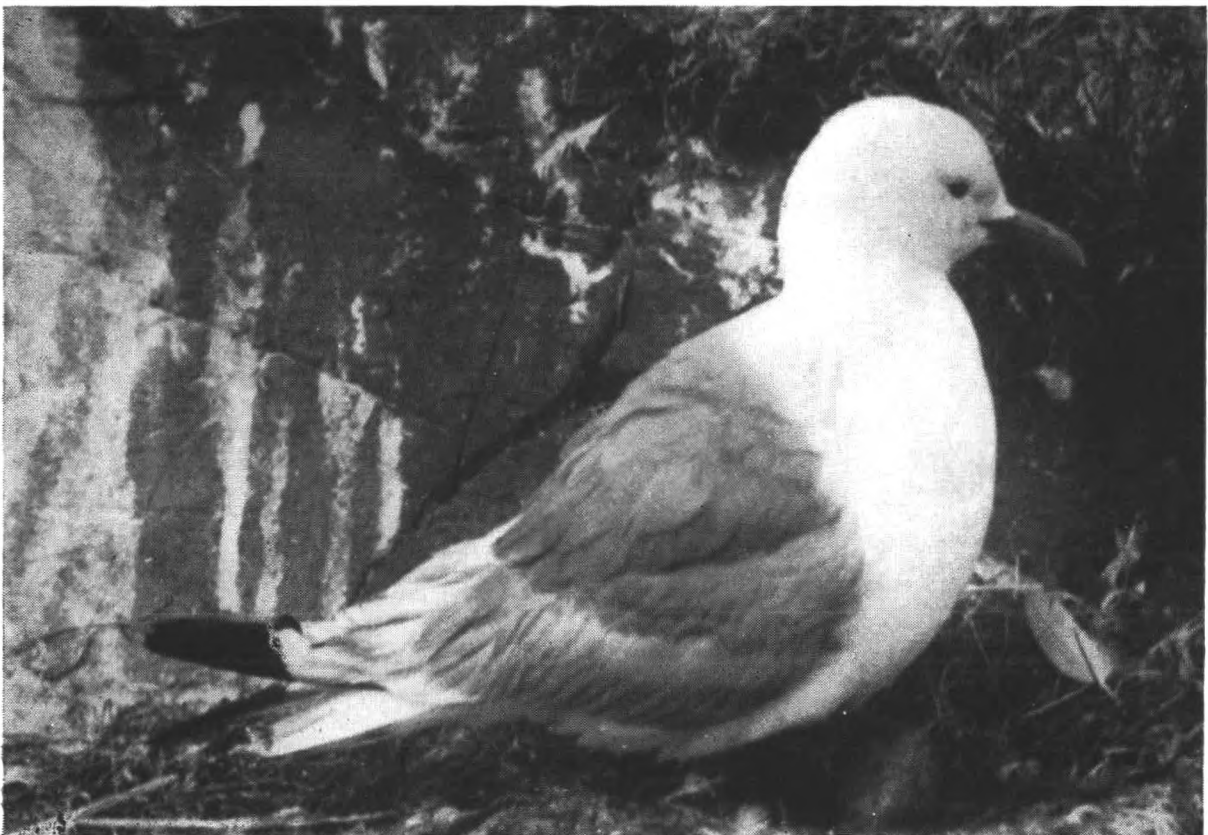
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Example of poor exposure of thermometer screen. The heat radiated from the funnel and the warm air from the stokehold ventilator will combine to raise the temperature of the screen by perhaps several degrees. The screen is also hung too high, giving rise to possible parallax errors when reading the thermometers (see page 206).



A nesting fulmar.

Photo by A. Gilpin



A nesting kittiwake.

Photo by A. Gilpin

Fulmars Around an Ocean Weather Ship

By F. R. ALLISON

In July, 1950, I was one of the four members of the British Trust for Ornithology who, by the kindness of the Director of the Meteorological Office, were allowed to make trips on Ocean Weather Ships. As there was little migration going on at the time I chose for my trip, I was able to devote some time to the observation of the behaviour of sea birds.

I decided to study the daily activities of the fulmar, as this species was the most numerous and was nearly always present about the ship.

Identification

The casual observer could mistake the fulmar, with its whitish plumage, for a gull. Comparison with the kittiwake, which is a gull and commonly seen from ships, shows that it differs in several respects.

The fulmar is a plump and heavily-built bird with a thick neck and peaked head, rather pigeon-like in shape, whilst the kittiwake is more lightly built and has a better defined neck and a flatter head. The kittiwake flies with much wing-flapping and with angled wings. The fulmar in flight holds its wings straight out and glides much more than gulls. The kittiwake has a longer tail and well-marked black tips to its wings (but not all species of gull have black-tipped wings) compared with fulmar's ill-defined dusky tips. A close view shows the fulmar has a bill made up of several plates and tubular nostrils; this is a diagnostic feature of the petrels, shearwaters and albatrosses, which is the group of birds to which the fulmar, or more strictly fulmar petrel, belongs. The kittiwake has the upper and lower mandibles each covered by a single plate like the more usual types of birds.

The photographs which are printed opposite of a nesting fulmar and a nesting kittiwake give a very good idea of their appearance and show the important identification features mentioned above. The appearance of the two species in flight and their differences are shown in J. Barlee's photographs illustrating the article "Bird Observations on Ocean Weather Ships in 1950" in *The Marine Observer*, January, 1952, pages 29 and 31.

Breeding

The fulmar breeds in colonies, usually on cliffs, in Iceland, the Faeroes, Scotland and England amongst other places. A single egg is laid and incubated for 40-44 days by both parents, each spending a few days at a time with the egg whilst the other bird is away feeding. The chick flies 48-56 days after hatching and during this time is fed and brooded by both parents at irregular intervals, usually being fed about once a day.

The fulmar does not breed when young and possibly only every second or third year when adult, and so in addition to the breeding birds out foraging whilst their mates tend the egg or chick there are always fulmars in the non-breeding phase of their breeding cycle out at sea. In July non-breeding birds can be picked out because they are moulting some of their wing feathers, which makes a slight notch in the trailing edges of their wings, whilst the wings of breeding birds have smooth outlines at this time as they moult later in the year. No differences could be detected in the behaviour of the two types when near the ship.

Identifying Features of Individual Fulmars

In addition to being able to distinguish between breeding and non-breeding birds, individual birds can easily be followed, thanks to the variations of shade of the upper surface of the wing and differences in the shape and colour of the light patches at the base of the primaries, which is a useful asset in studying birds.

There are also occasional fulmars which are an even dusky grey all over, called "dark phase" birds. The percentage of these "dark phase" fulmars varies in different parts of the ocean (1.5 to 3 per cent where observations were made). Observations on "dark phase" birds suggested, but this is not certain, that the fulmar population around the weather-ship was constantly changing—which shows one of the ways in which being able to identify individual birds can be useful.

Observational Routine

Using 7×50 bloomed fixed-focus binoculars (designed for marine work), I studied the fulmar's daily activities by making counts of the number near the ship and the numbers flying, feeding on scraps from the ship, preening and sleeping during the day and night. In the evening when the sun was low and was reflected off the water, making observation difficult, I fitted "polarised filters" and was able to pick out birds previously invisible owing to the glare. The form of their silhouettes indicated the activities in which they were engaged. Fortunately, it was never dark enough at night to cut down seriously my range of vision.

I got counts like: 32 fulmars present of which 3 were flying, 5 feeding, 3 preening and 4 sleeping. All the times of the counts were corrected to Local Mean Time and the averages found for each activity for each hour, hour 1 being from 0030–0130 hrs. and so on. The counts had to be corrected from B.S.T. to L.M.T., so that I could compare the readings taken at 59°N 19°W with those taken at 61°N 11° 52'W, and so that Solar Noon was at 1200 hrs. at both positions.

The behaviour of the fulmars differed when the ship was moving compared with when it was drifting.

Ship Drifting

NUMBERS

The numbers when the ship was drifting averaged 0.25 fulmars per count for hour 1 and increased steadily to an average of 84 about noon and then decreased steadily to give an average of 0.75 for hour 24.

This midday peak and low averages at night can be explained by the feeding habits of the fulmar. The food of the fulmar is mostly plankton, minute floating animals, which has a vertical diurnal migration, moving up into the surface waters at night-time and moving down deeper during the daylight hours. As the fulmar feeds whilst sitting on the surface and does not often dive, it can only capture its food when this is near the surface and so has to feed at night-time. Even at night the plankton is very sparsely distributed in the surface waters, so that fulmar has to cover a large area of ocean in order to obtain sufficient food. The birds therefore have to leave the ship during the hours of darkness, thus giving the low counts observed.

PERCENTAGE FLYING

This night-time dispersal for feeding is also reflected in the high percentage of fulmars seen flying at night and the low percentages recorded flying during the day.

FEEDING ON SCRAPS

That the weather ship was important as a source of food for fulmars was shown by their sitting on the starboard side of the ship where the galley-shute was situated. Most waste food was thrown overboard during the preparation of meals and just after the meals, and the feeding of fulmars on scraps shows peaks about ship's meal-times as a result of this.

PREENING

Peaks in preening activity followed peaks in the fulmar's feeding activity, suggesting that after feeding they clean themselves up. Also there was some preening early in the morning when they had returned from the night's feeding.

SLEEPING AND RESTING

I classed as sleeping all the fulmars on the water with their bills tucked into their scapulars (shoulder feathers). This method of estimation indicated that fulmars spent only 3 per cent (or about 45 min.) of their day in sleep. This figure is rather low, and as fulmars may rest without actually sleeping (a recent study of the daily activities of cattle showed they do not sleep but only rest) or sleep without tucking their bills into their feathers, I calculated the number resting by subtracting the numbers of those engaged in all activities except sleeping from the total count. In the sample count given earlier 21 would be regarded as resting. This estimation suggests that 25 per cent (or six hours) of the day was spent resting, which appears to be a more reasonable estimate compared with only 45 minutes. But all birds just swimming are classed as resting so the estimate is still not accurate. The average number resting showed a peak about noon.

SUMMARY

Thus the daily cycle of fulmars' activities are influenced by the movement of plankton to and from the surface waters (these movements are probably influenced by light intensity) which appears to affect the numbers of fulmars near the ship and the percentage flying in each hour. The ship's meal-times, or rather when scrap food is thrown overboard, influences their times of feeding on scraps. This also influences the times of preening, as feeding appears to be followed by preening. Resting takes place when there is nothing else to do, which is during the day.

Ship moving

NUMBERS

When the ship was moving the fulmars followed, but the numbers seen varied in a different manner compared with the counts taken from the ship when stationary. Though I did not make counts equivalent to a whole day, my observations bore out a statement by E. Duffey (quoted in *B.T.O. Bull.* No. 36, Jan., 1950) that the numbers of fulmars following a ship show a daily cycle with peaks in the morning and afternoon in the summer.

This cycle with two peaks can be explained on the basis of observations from a drifting ship. Like the fulmars around a drifting ship, those following a moving ship will have to disperse at night-time to feed on plankton, explaining the night-time minimum. The noon minimum is probably associated with the fulmars' resting about this time, for when they settle on the water to rest they will get left behind and so give a minimum about noon. The peaks in the morning and afternoon are possibly due to those fulmars not engaged in feeding or resting following the ship to take advantage of the extra supply of food and possibly shelter or air-currents provided by the ship. As most birds are not otherwise engaged in mid-morning and mid-afternoon, the peaks occur at these times.

The average numbers seen following a moving ship was usually less than the average number seen from a drifting ship in a given hour. As would be expected, the average number flying and the percentage flying were greater with the ship moving than when it was still. I did not make enough observations on feeding, preening or sleeping whilst the ship was moving to come to any conclusions from them.

SPEED OF FLIGHT

Amongst other aspects of my study of fulmars, I carried out some estimations of the speed of their flight by watching until one landed on the water just aft of the ship when she was moving, timing how long it was before it took off and how long it took to get back to the ship again. Knowing these times, the speed and course of the ship and the force and direction of the wind, it is possible to calculate the air-speed of the fulmar.

I recorded the following speeds:

SHIP'S SPEED (knots)	WIND	FULMAR'S AIR-SPEED (knots)
$\left. \begin{array}{c} 9 \\ 2.5 \\ 2 \end{array} \right\}$	Beam wind of 15 knots Headwind of 18 knots	$\left\{ \begin{array}{c} 34-44 \\ 18-24 \\ 35-40 \end{array} \right.$

Acknowledgments

I should like to thank the Director of the Meteorological Office and the Marine Superintendent and the British Trust for Ornithology for the opportunity to make the voyage, and Commander H. R. Wilkinson and his officers and crew of O.W.S. *Weather Explorer* for assistance with my work during the trip. I should also like to thank those people who have helped me with this work by their criticisms, comments and discussions, and Mr. A. Gilpin for the photographs used to illustrate this article.

Moisture Damage to Cargoes

A paper on this subject* was read before the North-East Coast Institution of Engineers and Shipbuilders by W. McClimont, B.Sc., on 7th March, 1952. In his evaluation of the nature and extent of this problem, to which we have often referred in these pages and most recently in *The Marine Observer*, April, 1952, page 75, the author stressed the importance of ships' officers taking an intelligent interest in the meteorological factors connected with the care of cargo. We ourselves feel that the same might be said to apply to ship owners, shippers, consignees and indeed to all concerned with the carriage of goods by sea. Though meteorology has, for a good many years, featured in the examinations for masters and mates, one wonders sometimes if the practical importance of this subject, not only for the safety and comfort of the ship herself but for the care of her cargo, is fully realised.

The synopsis of the paper is illuminating and is quoted herewith in full.

This paper examines the extent and prevalence of moisture damage to cargoes and indicates that damage is either insignificant or of very small value in relation to the value of the cargoes carried. It seems probable that considerations of goodwill and prestige, however, may increase the use of mechanical ventilation and drying systems.

The provision of general, all-embracing standards of ventilation is not feasible since the standard of ventilation to be installed must be related to the trade on which the particular ship is to be engaged.

Data are presented on the properties of a number of representative commodities of a hygroscopic nature with particular reference to the requirements necessary for efficient sea carriage. The use of data of this type should be helpful in tackling moisture damage in cases where it is considered to be of significant magnitude.

The outstanding conclusion is that the standard of cargo out-turns appears to be in direct proportion to the care and knowledge shown by the ships' officers of the factors involved in ventilation.

In the research necessary for the production of his paper, Mr. McClimont found that the ship owners, surveyors and protection and indemnity associations whom he consulted held the view that the care and knowledge shown by ships' officers is the biggest factor in eliminating sweat damage.

* MCCLIMONT, W.; Moisture damage to cargoes. *Trans. NE Coast Inst. of Engineers and Shipbuilders.* 68, p. 249-270, D107-D120. Newcastle-upon-Tyne: 1952.

The main source of damage is moisture, and excessive moisture may be present on or in a cargo for a variety of reasons. The original moisture content of a cargo may be too high, either generally or in local pockets; this may result in deterioration in cargoes of animal or vegetable origin by bacterial action or by premature ripening or rotting. Cargo sweat, the moisture which condenses directly on to a cargo when its temperature is lower than that of the dew point of the air in contact with it, may form or ship sweat, the condensation on the steelwork of the holds if the temperature of the steel is below the dewpoint of the holds, may form and drip on to the cargo. Appreciation of dew point and its relation to surface temperature is therefore probably the most important single factor in the carriage of goods by sea. Damage to cargo may also result from direct heating from the sun, hot bulkheads and the like, and the stowing together of cargoes whose moisture contents are incompatible. It is the temperature and humidity of the hold equally with that of the outside which must be considered in relation to the properties of the commodities.

The temperature changes of cargoes are obviously slower than those of the outside, but very little information on the rate of heat and moisture transference through cargoes is available. A cargo of steel products about 40°F colder than the sea temperature will warm up to the sea temperature in about 10 days. Canned goods warm up more slowly, and for bulk grain and lumber the changes are smaller still. Timber stowed in a frozen condition in lower holds has been known to remain frozen for several weeks.

The author gives some very interesting examples to illustrate the care that is needed with special types of hygroscopic cargoes such as rice, textile-fibres, fresh fruits, soya beans and tobacco. As an appendix to the paper are some extremely useful and practical graphs. The author concludes by reiterating the two most significant points. Firstly, the factors involved are peculiar to each trade and do not permit of an all-embracing standard; secondly, any form of ventilation will only produce effective results if the ships' officers concerned know just what they are doing and are ready to apply their knowledge of the subject.

It would be undoubtedly worth the while of any ship's officer to get hold of a copy of this paper from the North-East Coast Institution of Engineers and Ship-builders at Newcastle-upon-Tyne.

Royal Observatory, Hong Kong

Radio weather reports received from British Selected Ships

The Director of the Royal Observatory has recently sent us some notes on the number of weather reports which British Selected Ships have been transmitting to Hong Kong.

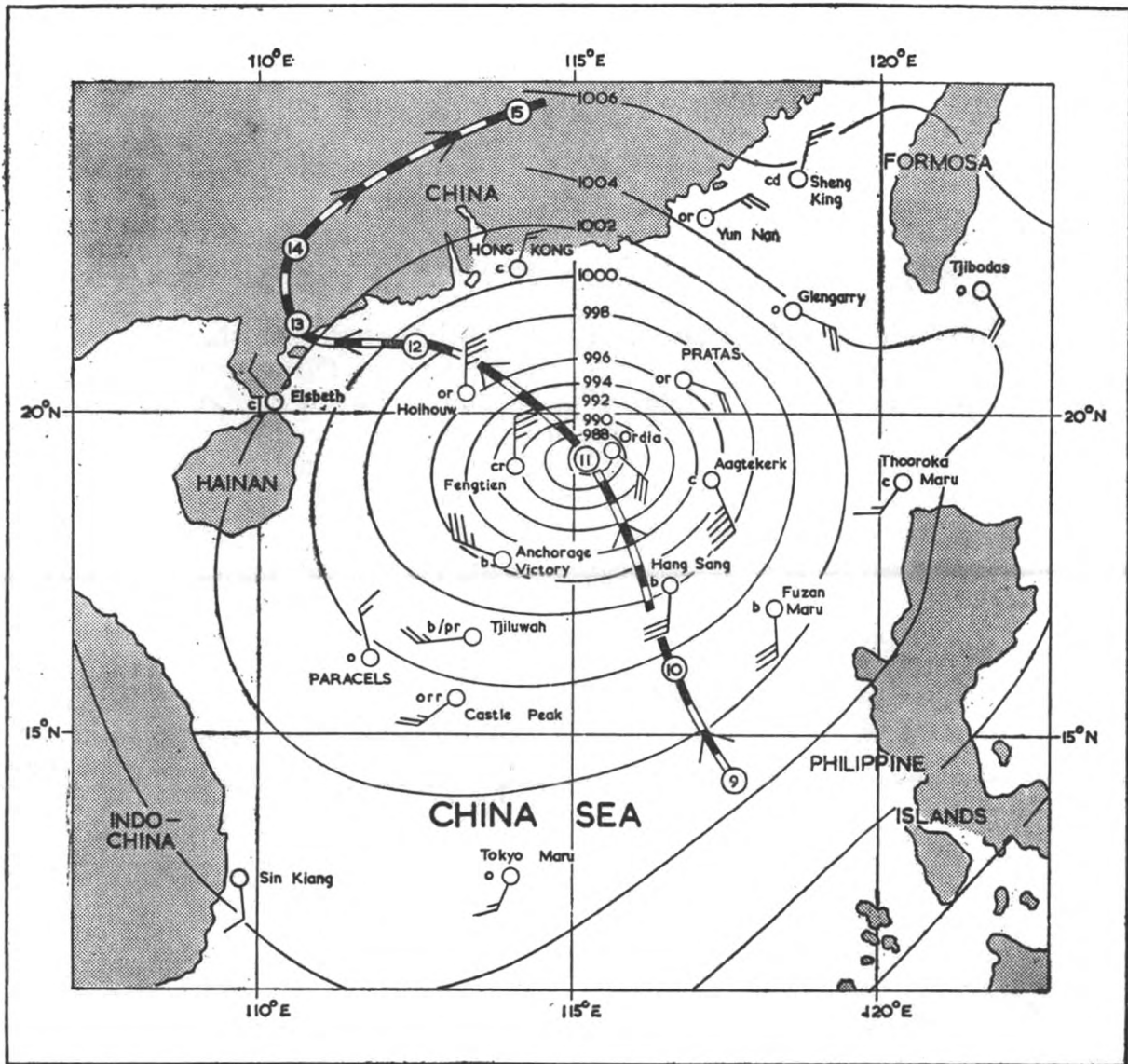
During the year between 1st April, 1951, and 31st March, 1952, a total of 20,297 radio weather reports were received, of which 798 were from British Selected Ships. The ships *Corfu*, *Glenorchy* and *Glenartney* provided 198 reports between them.

The following table gives similar information for the past four years.

Year	1948-49	1949-50	1950-51	1951-52
Total reports	—	23,907	19,935	20,297
Reports from British Selected Ships	1,012	1,008	667	798

From about 9th to 15th June, 1952, the Royal Observatory experienced a

typhoon which, while being nothing exceptional in the way of tropical revolving storms, did happen to be the occasion of a record-breaking number of radio weather messages from ships. The figure shows the synoptic chart for 0000 G.M.T. on the



Synoptic chart of the China Sea, 0000 G.M.T. 11th June, 1952.

11th. On that day no fewer than 162 weather reports were received, the numbers for the previous and following days being almost as good. As a result the Royal Observatory was able to issue storm positions at three-hourly intervals, sometimes within one hour after the time of observation. This achievement was due largely to the magnificent co-operation of ships.

We would remind ships trading in the area that their reports are always welcome at the Royal Observatory, and that the Marine Liaison Officer at Hong Kong, Mr. Goodfellow, is always available for meteorological advice.

Errors of Aneroid Barometers

By H. JAMESON, D.Sc.

(Formerly on the scientific staff of the Marine Branch, Meteorological Office)

Aneroid barometers are used aboard many ships, either to supplement mercurial barometers or as the only means of determining barometric pressures or pressure changes. It seems desirable, therefore, to obtain data as to the behaviour of these aneroids. Port Meteorological Officers and Merchant Navy Agents were asked by the Marine Superintendent to obtain as much information as possible about the errors of the aneroids on board ships visited in the course of duty. A considerable amount of information on the errors of aneroids, and the manner in which these errors vary, was thus amassed.

Unfortunately it was not usually noted whether or not the aneroid was marked as compensated for temperature. One officer, however, gave this information. He stated that out of 135 ships' aneroids examined, only 14 were marked "Compensated" on the dial. It is probable, therefore, that few of the aneroids used on merchant vessels are compensated for temperature.

Another defect in the data was that, except in two cases, no information was given as to when, or if, aneroids had been reset. It was necessary, therefore, to assume, as a working hypothesis, that the aneroids under discussion had not been reset over the period of the comparisons, and, when discussing the summarised data, to allow for the possibility that some resetting of the instruments had occurred. Nautical officers in the Branch are of the opinion that such resetting would be infrequent.

In the majority of cases pressures were given in inches, but in all such cases the errors of the aneroids have been converted to millibars in this note.

The information obtained was of two kinds: (a) for a number of Selected Ships, supplied with Meteorological Office mercurial barometers, the aneroid was compared with the mercurial barometer at short intervals throughout a voyage, and the differences tabulated; (b) for a large number of ships the aneroid was compared with a standard barometer, usually at a British port by the Port Meteorological Officer but occasionally at sea or in a foreign port, at intervals usually of weeks or months. In this group, the number of comparisons per aneroid varied from one to eight or nine.

The former group of data were the first to be studied. They were from nine ships, and for three of those for two voyages, making 12 groups of data in all. A cursory inspection showed that the index correction varied quite markedly with the temperature. The mean errors for groups of temperatures over ranges of 5°F (e.g. 60°–64°, 65°–69° and so on) were plotted against the mean temperatures, and

Table 1

SHIP	VOYAGE	See below*
	Southampton to:	
A	Hong Kong and return	+0.15
B	Cape Town and return	+0.16
C	Cape Town and return	—0.27
D	Cape Town	—0.17
D	Cape Town and return	—0.11
E	River Plate and return	—0.20
E	River Plate	—0.17
F	Cape Town and return	Irregular
G	West Indies and return	Irregular
G	Port of Spain and return	Irregular
H	Cape Town and return	—0.16
J	Tripoli and return	+0.10

*Variation of error (aneroid reading minus mercury barometer reading) with temperature. Expressed in mb per 1°F rise in temperature.

in most cases it was possible to represent the relation between temperature and index error by a straight line, without too great a scatter of the mean points from this line. The slopes of these lines might be expected to give the variation of the error of the aneroid with temperature, in millibars per degree Fahrenheit. Although, as will be shown below, these results may be fallacious, they are given, as a matter of interest, in Table 1. In none of these cases was it mentioned whether or not the aneroid was marked "compensated".

The aneroids on ships A, B and J show positive changes with increase of temperature, while those on C, D, E and H show negative changes. The reaction of an uncompensated aneroid to temperature may depend on the construction of the instrument, or even on defects, such as the presence of air in the vacuum box.

However, there is a further complication, which illustrates the difficulty of studying the behaviour of an aneroid under ordinary working conditions, without facilities for varying temperature and pressure under laboratory conditions. The changes in temperature are for the most part due to changes in the latitude of the ship as it proceeds on its voyage, and it happens therefore that the temperature usually shows some correlation with the pressure. The changes in the index error that generally appear to follow temperature changes fairly closely might therefore be due, wholly or partly, to systematic errors in the pressure scale. An attempt was made to test this by picking out, for each set of data, pairs or groups of observations that showed considerable changes in pressure at the same, or nearly the same, temperature. The results obtained were not very satisfactory, though in some cases they certainly suggested systematic scale errors. If these results were accepted, in some cases they would tend to reduce the computed variation with temperature, in others to increase it but in no case were they sufficient to cut out the temperature effect altogether.

We may conclude, therefore, that seven out of the nine aneroids show definite temperature effects, and that some may show systematic scale errors as well.

For the usual aneroid aboard a ship, it seems difficult to allow for changes in the index error with changes in temperature and pressure. If comparisons are taken over several voyages, it might be possible to disentangle errors due to temperature changes from scale errors, but the longer the period over which comparisons are taken, the more likely it is that other errors will creep in, due to imperfect elasticity of the metal, porosity of the vacuum chamber or other causes.

Table 2

	A	B	C	D	D	E	E	F	G	G	H	J
<i>Comparisons made during voyages</i>												
Period in months*	3	1	1	0	1	1	0	1	1	1	1	1
Range of error (mb)	4.8	5.2	5.8	5.0	4.6	6.5	8.7	7.8	4.6	5.6	5.2	5.4
Range of temperature (°F)	27	30	33	32	40	25	34	46	29	42	31	26
Range of pressure (mb)	19.0	16.4	21.7	26.4	20.7	15.6	29.3	21.0	27.3	22.0	33.4	15.7
<i>Comparisons made at Southampton</i>												
Period in months*	7	11	13	9		8		7	10			
Range of error (mb)	0.8	5.1	2.2	2.4		5.2		15.8	3.8			
Range of temperature (°F)	11	22	16	21		16		13	20			
Range of pressure (mb)	5.6	20.3	7.6	26.5		17.9		28.5	13.7			

*To nearest month.

Table 3

Range of error(mb) { From To		0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	15.0	19.0	Total
		0.9	1.9	2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9	10.9	15.9	19.9	cases
No. of cases	<i>Comparisons at British ports</i>	6	15	11	15	7	5	1	4	3	0	1	3	1	72
	<i>Comparisons during voyages</i>					3	6	1	1	1					12

The Barometer Correction Card for use with aneroid barometers, as issued by the Meteorological Office, makes provision for recording different pressure readings over ranges of temperature and pressure, and is reproduced below. This card can be supplied to any British ship on request, and if filled in over a sufficient range of temperatures and pressures, will serve to give some idea of the errors to which a reading of pressure is liable, when no correction is made for temperature and the scale reading.

Date and Port	Temp. °F.	Range of Readings		Actual Reading	Error	P.M.O. or Agent
		ins	mb.			
		28.00	948			
		28.50	965			
		29.00	982			
		29.50	999			
		30.00	1016			
		30.50	1033			
		31.00	1050			

Record card for error of aneroid barometer.

The question of the accuracy with which pressure can be obtained, when no allowance is made for these errors, was the next point considered in this investigation. Table 2 gives the total range of error, temperature and recorded pressure (corrected for height) and the time taken on the voyage, to the nearest month, for each of the voyages specified in Table 1. In the same table are shown, for the same aneroids, similar figures for the comparisons made by the Port Meteorological Officer at Southampton, but only for cases when at least three comparisons are available.

Table 3 shows the distribution of ranges of error, as determined at British ports, for all the aneroids for which at least three comparisons have been taken. These figures include those shown in the lower part of Table 2. The number of comparisons varies from three to nine, and the mean temperature range for all cases in which temperatures are given (58 out of 72 sets of comparisons) is 16°F. The mean range of recorded pressure is 24·7 mb. In the same table is also given, for comparison, the distribution of error ranges for the voyages shown in Table 1. The mean temperature range over these voyages was 33°F and the mean range of recorded pressure was 17·2 mb.

From Table 2, the error range of an aneroid over a voyage is appreciably greater, in 8 cases out of 10, than the error range of the same aneroid from comparisons at a British port, although the period of time over which these comparisons extend is very much greater than the duration of a voyage, which is usually between a fortnight and six weeks. The temperature range for a voyage is always greater, and sometimes much greater, than the temperature range experienced at a British port.

The pressure range for a voyage is also greater on the whole than that shown at the British ports, though the difference is not so marked as in the case of the temperature.

Although a mercurial barometer cannot be read as accurately at sea as when in harbour, such errors at sea should not usually be more than a few tenths of a millibar, and can hardly suffice to explain these differences in the range of error of the aneroids.

From Table 3, the comparisons at British ports would suggest that practically two-thirds of the aneroids in use on ships have an error range of less than 4 mb, while not one of those nine aneroids tested on 12 voyages shows, on any voyage, a range of less than 4 mb. The chance of this happening fortuitously is almost infinitesimal.

The discrepancy may be due to resetting of the aneroids between the comparisons made at British ports, as the internal evidence given by the readings taken on voyages does not suggest that there could have been much, if any, resetting of the aneroids on these voyages. It seems more likely, however, that it is due to the much greater ranges of temperature experienced by the aneroids on the voyages.

If the latter is the explanation, it appears clear that the consistency of the errors of an aneroid, as shown by comparisons at a home port, may be very misleading as a guide to its behaviour in other parts of the world, and masters of ships are advised to take every opportunity of checking their aneroids under as great a variety of temperatures and pressures as possible.

A list of Port Meteorological Officers and Merchant Navy Agents at various ports in the United Kingdom, who will be prepared to check the aneroid barometer of any ship on request, is given on pages 227 and 228 of this number of *The Marine Observer*. At most of the larger overseas ports Port Meteorological Offices have also been established, and there is little doubt that they will also be very willing to give to the master of any ship a correct pressure reading on application.

This investigation suggests that those aneroid barometers which are at present used aboard certain British merchant ships cannot be regarded as really satisfactory for obtaining absolute pressures, although there is no doubt that they are of service in indicating pressure changes over short periods of time, particularly if they are not subject to sudden changes of temperature. It is because of the known liability of aneroid barometers to error that the Meteorological Office has for many years supplied marine mercurial barometers to Selected Ships. It is when one wishes to compare pressure readings with those of other ships for synoptic purposes that accuracy in absolute pressure is desirable; an inaccurate aneroid reading may give a totally erroneous impression of the ship's position relative to a particular storm centre for example, and in some cases this might have serious consequences to the ship.

Unless a really satisfactory precision aneroid is available it seems desirable that merchant ships should, as far as possible, be supplied with mercurial barometers in preference to aneroids. The disadvantages of the mercurial barometer are that it takes up more room than an aneroid, and is somewhat more difficult to read because the mercury is so much affected by "pumping".

Shipping Operations in the Hudson Bay

By the time this number of *The Marine Observer* comes out, another season during which merchant ships operate in the Hudson Bay area will have come to an end.

The potential importance of Port Churchill to the Dominion of Canada for the export of grain is fairly obvious if one studies the map. Situated as it is about 900 miles from the open sea, Churchill is by far the nearest port to the great grain provinces of Manitoba, Saskatchewan and Alberta, but the Hudson Bay is inaccessible to shipping for about nine months of the year. As was shown in the review of a paper read before the Royal Meteorological Society,* published in this magazine in April, 1952, there is evidence that during much of the year the Bay is not only filled with drift ice but is practically frozen over.

The importance that the British Commonwealth attaches to the operation of merchant shipping in Hudson Bay is shown by the fact that the Commonwealth Shipping Committee publishes periodical reports on Hudson Bay marine insurance rates. The first of these reports was published in 1930, and the latest report came out in 1951.† These reports have much useful statistical information about the number of ships which operate on this route each season, and also about ice and weather conditions, and practical difficulties experienced by the navigator.

As the report points out, Port Churchill is only about 180 miles further from Liverpool than is Montreal. The use of the Hudson Bay route is almost entirely governed by physical conditions, the principal hazards, of course, being fog and ice. Until 1933 the navigation season was from 10th August to 30th September, but the closing date was extended in 1933 to 7th October, whilst between 1936 and 1949, 5th August was set as the opening date. In 1950 the season was extended to 26th July to 10th October and a British steamer arrived at Port Churchill as early as 31st July. This year, 1952, the opening date was altered to 23rd July. There is nothing to prevent a ship starting through the Bay as early as 5th August if weather conditions permit, but on any date previous to 10th August the underwriters require that advice be sought of the Canadian Government vessel *N. B. McLean*, which is stationed off Cape Chidley early in the season to give advice to ships as to the best route through the Gulf.

The number of ships which have loaded at Port Churchill during years for which statistics are available is as follows:

1931	2	1936	15	1946	9
1932	10	1937	2	1947	16
1933	10	1938	3	1948	15
1934	15	1939	6	1949	16
1935	8			1950	20

It is interesting to note that during the period that the route has been officially open to shipping only two vessels have been lost, one in 1932 and another in 1936, the years following the opening of the route.

There is no doubt that improved aids to navigation, with particular reference to the gyro compass and radar, combined with increased knowledge of conditions on the route, have rendered the hazards to shipping considerably less than they were in the early days. The report reminds us, incidentally, that although radar can pick up bergs at considerable range, nevertheless, on occasions, small bergs and growlers may not be picked up on a radar screen until they are extremely close to the ship. The Canadian Government has done a valuable amount of work in

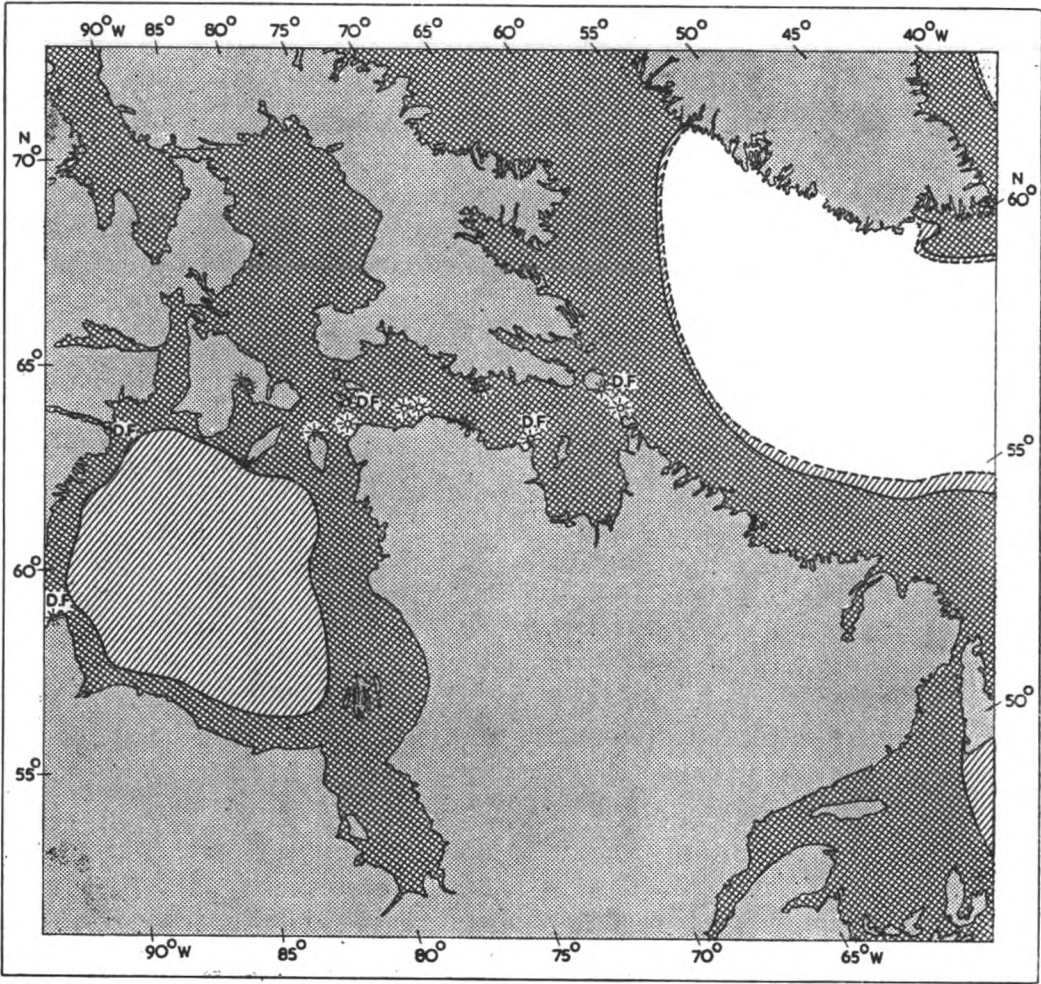
*BURBIDGE, F. E.; The modification of continental polar air over Hudson Bay. *Quart. J. R. Met. Soc.*, London, 77, July, 1951, p. 365.

†Tenth report on Hudson Bay marine insurance rates 1951. London: H.M. Stationery Office, 1951.

improving navigational facilities on the route, by providing D/F stations, lights and buoys. The assistance and advice provided by the Canadian Government vessels in the area, combined with the meteorological information which the authorities issue by radio, does much to ease the problem of the navigator in this area. The two maps give an indication of the ice cover in the vicinity of Hudson Bay in February and August of an average year.

Perhaps the best indication of improved conditions is shown by the following figures concerning additional insurance premiums payable on ships trading to Hudson Bay:

Date	Per Ton G.R.T.	Percentage on Insured Value	
		With Gyro per cent	Without Gyro per cent
12th March, 1931	s. d. 2 0	s. d. 50 0	s. d. 50 0
1st May, 1950	1 0	10 0	
Without Gyro	2 0		40 0



Average ice conditions in the Hudson Bay area—February.

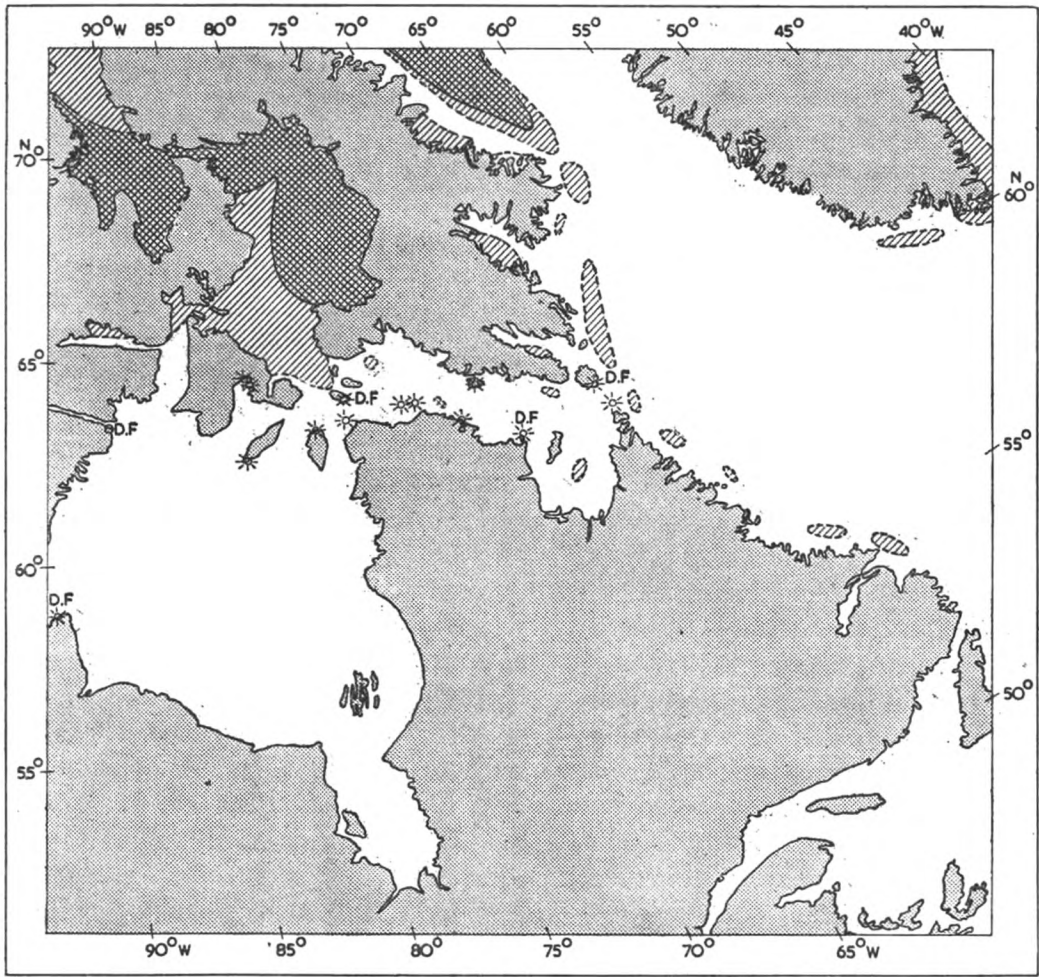
- Unshaded: Unnavigable or generally unnavigable ice.
- Diagonal lines: Ice navigable by heavily built vessels. Parts of these areas are also navigable by unreinforced vessels.

The advantage which is rightly attached to the use of a gyro compass in this area, where the directive force of a magnetic compass is so notoriously bad, is brought out in these figures; this was again emphasised when in June, 1952, the additional premiums for vessels fitted with gyro compass were reduced by a further 25 per cent (for extensions up to 10th October the rates were increased by 25 per cent).



The physical hazards of ice and fog are always present, however, and the navigator who sails into Hudson Bay has to have all his wits about him, with the realisation that electronic devices are only aids to navigation and that his personal skill and seamanship are always liable to be called upon. As the report points out, one important hazard from the underwriters viewpoint is the difficulty of salvaging a vessel which becomes damaged in the Bay late in the season.

The report contains many very interesting comments by masters of the ships trading in the Hudson Bay. These comments of the masters emphasise the prominent part that the meteorology of the area plays and the great value of radar to a ship navigating in these waters.

Although considerable advance has been made in the provision of navigational aids in the Hudson Bay, there is still an enormous amount to learn from the meteorological viewpoint. Our present state of knowledge leads to the belief that winds between N and W are the most common during the navigation season and



Average ice conditions in the Hudson Bay area—August.

-  Unnavigable or generally unnavigable ice.
-  Ice navigable by heavily built vessels. Parts of these areas are also navigable by unreinforced vessels.

that gales are frequent from these directions, although gales from between S and E are not unusual. Calms are rare and usually of short duration and are frequently accompanied by fog, while effects upon the wind due to the "lie of the land" are much in evidence, especially in the hilliest and most indented parts of the coast. Fogs are most frequent in late spring and early summer, especially July and August, when they may occur on 8 to 16 days a month over the eastern half of the Bay. As is common on this coast, down as far as Cape Race, visibility is often very good with winds from between W and N except when snow is falling; winds from most other directions bring poor visibility, mist or fog.

Up to the present, insufficient data has been collected from shipping in this region for the preparation of climatic atlases such as have been published for other sea areas of the world. Even the ice atlases for this area which have been published by the United States and Germany respectively, differ quite considerably about the information they give. Meteorological observations from ships using this route are, therefore, of very great value, for it is mainly from them that our knowledge about the weather in this important area can be built up.

C. E. N. F.

Canadian Meteorological Service

AWARD TO MR. ANDREW THOMSON

Mr. Andrew Thomson, O.B.E., M.A., F.R.S.C., of Toronto, Controller of the Canadian Meteorological Service, has been awarded the 1952 Gold Medal of the Professional Institute of the Public Service of Canada, for his outstanding contribution to national or world well-being. The panel of judges unanimously awarded the 1952 Institute Medal to Mr. Thomson, saying that he "carries high the banner of Canadian science", and that "the medal of the Professional Institute of the Public Service of Canada is a fitting tribute".

The Institute's citation reads:

"One of the most striking developments in the meteorological service under Mr. Andrew Thomson's direction has been the work in the polar areas. With the rapid development of aerial service in the far north, and with the increasing importance of that area from the standpoint of defence, the need for meteorological knowledge, day by day, has become urgent. The weather stations extending to the furthest tip of Canadian soil provide a thrilling phase of northern adventure, in which Canada and the United States are happily co-operating. Mr. Thomson has shown foresight and vigour in developing this important service.

"The scientific progress in meteorology, both in ground level and upper air altitudes, for which Canadian meteorological officers have been responsible, is being widely recognised. The Controller of the Service, Mr. Andrew Thomson, has acquired for himself an enviable position in world meteorological council.

"Mr. Andrew Thomson has brought credit and distinction to himself, the Meteorological Division and the professional Civil Service in Canada. He has also earned for himself and the Division a position of esteem and respect in international meteorological circles. In addition to his many activities in scientific fields he has played a major role in the creation of the World Meteorological Organisation as a specialised agency of the United Nations. This organisation endeavours to promote human welfare by the application of meteorology to human activities."

Mr. Thomson has had an interesting and varied scientific career. In 1919 he was physicist on a solar eclipse expedition to the interior of Brazil. This was followed by being placed in charge of investigations on atmospheric electricity on a 26-month round-the-world cruise aboard the research ship *Carnegie*. In 1922 he was appointed scientific adviser to the Apia Observatory, in Samoa. In 1929 he was appointed Aerologist for the Dominion of New Zealand. This was followed

by a year in advanced studies in meteorology at leading European research institutions. Returning to Canada in 1931, he was appointed Chief of the Research Division of the Meteorological Service of Canada and was appointed Controller in 1946.

The Canadian Meteorological Service has always displayed great interest in maritime meteorology, as is well known to all seamen who trade to Canada; its meteorological services for shipping in Canadian waters are always very comprehensive. There are also 30 Canadian Selected Ships. We feel sure that readers of *The Marine Observer* will join us in congratulating Mr. Thomson on receiving this award.

Thames Tidal Model

In a cargo shed at the Royal Victoria Dock, London, a large tidal model of the River Thames has been made. It is 400 ft long and is one of the largest models of the kind in the world. Housed with it is a smaller pilot model which supplied useful data for constructing the main model, and which is still used for certain investigations. The models were constructed for the Port of London Authority and the work was carried out under the direction of Sir Claude Inglis, C.I.E., Director of Hydraulic Research in the Department of Scientific and Industrial Research.

The large model has been moulded to represent the river as it is shown on the P.L.A. surveys made between 1939 and 1949. Where the slopes are of 40° or less the moulding is in a natural silica sand; where the slopes exceed 40° it is done in cement mortar. The seaward limit in the model is a line 600 ft east of Southend Pier, and the upstream limit is Westminster Bridge. Above Westminster Bridge to the tidal limit at Teddington Weir the water is contained in a labyrinth.

The main object in the use of these models is to study the problems of dredging in the river. Each year something like 3,000,000 cubic yards of silt have to be removed from the river and docks, a job that costs about £500,000. Obviously a number of important problems confront the engineers and scientists using the model. They will be able to study the flow patterns of the water, the movement of the river bed material and the behaviour of the silt. The most important problem is, of course, the possible reduction of silt and its expensive dredging. Problems connected with the pollution of the river can also be studied in the model. Coloured liquids, representing the impurities which pollute the river, are discharged into the model at various places and states of the tide. From the behaviour of these colours in the model, the period of the retention of impurities in the river can be deduced.

By an ingenious device the model is able to simulate any required type of tide. The ordinary tidal period of 12 hours 25 minutes is reduced to 9 minutes 36 seconds in the model. A tide to be reproduced is drawn in the form of a graph on a roll of paper; the graph is scanned by an electronic follower which controls the air pressure in a pneumatic displacer at the seaward end, and hence the ebb and flow of the water in the model. The amount of upland water entering the river is controlled at the Teddington end of the model, and in the small tributaries lower down. Thus the effects of different types of tide corresponding to actual winter and summer conditions and to various upland freshwater flows, can be reproduced.

The meteorological effects of wind and atmospheric pressure on the tides will not normally be studied in the model as these effects will already have shown on the records of the tide gauges from which the controlling graph will have been made. It would no doubt be possible to reproduce a special tide, such as an abnormal case when flood water from up-country together with a NE gale happen to coincide with a spring tide, with the result that there is danger of flooding in London, but this would only be done after such a tide had actually occurred and the relevant information had been shown on the tide gauges. The model is primarily intended for the study of the effects on the river bed of a large number of ordinary tides; in the

course of a few days a whole year's actual tides can be simulated in the model and the results measured.

To anyone who is familiar with the London River the operation of the tidal model is a fascinating thing to watch. In half an hour one can see three complete tides ebb and flow. Some of the small creeks that empty into the Thames will be drained of water and the mud showing; then in a few minutes they are filled again with the rising tide.

C. H. W.

Reviews

“The Trade Wind Circulation of the World” and “The Seasonal Variation in the Strength of the Trades”, by P. R. Crowe. *Transactions and Papers of the Institute of British Geographers*, 1949-1950, No. 16, pp. 37-56 and No. 17, pp. 25-47 respectively.

In the first of the above-mentioned papers an attempt is made to define the limits of the trade winds in terms of the constancy of the predominant winds. This constancy is defined as the proportion of winds of Beaufort force 3 or more within a quadrant (90°) centred about the predominant wind direction, to the total number of wind observations (including those of Beaufort force 0-2). The data used were drawn from the records of the Marine Branch of the Meteorological Office at a time when only observations made on British ships were held. Dr. Crowe pays a tribute to British marine observers when he adds: “Although this restriction is regrettable, it does carry with it some guarantee that the record is the work of qualified observers and that the processes of screening and analysis have been carried out on a uniform system”. All available wind observations for the oceans were analysed and isopleths drawn for constancies of 50, 60 and 70 per cent for each month. There is a discussion on the lowest value of the constancy which can be regarded as the limit of the trades and 50 per cent is taken as reasonable for this value.

Having drawn up these monthly charts, Dr. Crowe examines them for information as to the movement of the areas governed by the Trades. He finds that, apart from a northward bulge some 800 miles off eastern coasts (African and Californian), there is little north-south movement of the limits but a considerable east-west pulsation. The movement, however, of the inter-tropical front is greater and more complex, and the front itself is often contained within the 50 per cent isopleth of constancy of wind direction.

The area covered by each of the trade wind systems is from 50 to 100 per cent greater at the period of maximum development than at the minimum.

In his second paper Dr. Crowe plots monthly cross sections across the trade wind belts, showing the variation of mean wind speed in knots with latitude across the centre of each system. The Atlantic trades show an annual rhythm which is weakest at the respective autumn equinoxes and strongest in the spring. The mean wind speed is normally greater than 10 knots. Data is not so adequate for the Pacific. The south-east trades of the Southern Pacific are very similar to those of the South Atlantic, but the similarity is not so marked for the north-east trades.

The Indian Ocean trades are again similar in many respects apart from their speed. From June to August they blow at 20 knots and are then the most powerful trades in the world, and at their minimum they blow with the same speed as the other trades at their maximum. The paper also contains a brief discussion of the Chinese monsoon and Coral Sea trades.

Both papers are of interest not only to geographers and meteorologists but also to mariners.

P. R. B.

Lloyd's Survey Handbook. Demy octavo, 5 $\frac{1}{4}$ in. \times 8 $\frac{1}{2}$ in., pp. 112. The Corporation of Lloyd's, London. First Edition, 1952. £3 3s. od.

This little book is no doubt primarily of value to a cargo surveyor, but it contains such a wealth of information about cargo damage that it would undoubtedly be a valuable book of reference aboard any ship. Despite the comprehensive nature of its contents and the care which must have been taken in its preparation, its price of £3 3s. od. is somewhat surprising, particularly in view of the fact that the book has no drawings, photographs or diagrams.

The book is arranged in four sections: Section I concerns the general principles to be observed when surveying damaged goods and gives useful hints about the sort of trouble to look for; Section II gives in alphabetical order an extremely comprehensive list of commodities, particularly their peculiar properties, inherent vices and liability to damage; Section III, which is almost solely of interest to the cargo surveyor, concerns treatment of damaged goods; Section IV gives a glossary on the less commonly known commodities referred to in the earlier sections of the book.

Reading through this book one is constantly reminded of the important part that meteorology plays in this question of damage to cargo. This is perhaps fairly obvious when one remembers that variations in temperature and humidity are the chief elements, apart from the entry of sea water to the ship, which cause damage to most cargoes once they are stored in the ship. In Section I the author points out the difficulty in differentiating between "country" (i.e. pre-shipment) damage, damage due to sweat, damage due to salt water, and damage due to rain. It is mentioned that packages may absorb salt from the atmosphere while they are awaiting shipment or while in the ship's hold.

Among the items enumerated, it is to be expected that the hygroscopic cargoes such as beans, grain, coffee, copra, cotton, jute, and wool occupy a prominent place; mention is rightly made of the importance of care in ventilation and of the fact that certain hygroscopic cargoes are liable to induce such a high humidity value into the atmosphere of a hold as may damage other cargo. The controversy about the liability of jute to spontaneous combustion is discussed and it is stated that "it is now thought in the trade that there is no such thing as spontaneous combustion where jute is concerned. In fact, it is believed that in many cases, fires were due to human agency, the most common method being to put inside a bale a mixture containing cow-dung and sulphur. According to the experts it is difficult to say how long this will take to set fire to the jute, but sooner or later it ignites. There have been fires on ships attributed to spontaneous combustion, but it is thought that in these cases the bales work loose in stow, fire eventually being caused by the consequent friction".

With reference to cotton, it is emphasised that water damage does not make it liable to spontaneous combustion but that contact with oil is what must be avoided. Motor cars have become an important cargo lately, and it is pointed out that rust or mould damage with these is often due not only to humid conditions of stowage, but also to climatological conditions prior to and at time of packing. The possible use of silica gel to minimise liability of damage due to moisture in unventilated cases of machinery is mentioned and emphasis is rightly placed upon the liability of canned goods to moisture damage. The number of commodities which are subject to "loss of weight due to drying out" seems to be almost astronomical.

The reader can scarcely fail to be impressed with the fact that a cargo surveyor needs considerable versatility, judgment and practical knowledge, and it would seem that some practical acquaintance with meteorological principles is necessary for him to discharge his duties successfully.

It is obvious that considerable care and much research has gone into the preparation of this book.

C. E. N. F.

Personalities

RETIREMENT.—CAPTAIN R. P. GALER, C.B.E., R.D., R.N.R., has recently retired from the Clan Line after 44 years' service with that company.

Richard Percy Galer was born in London and began his sea career as an apprentice in the four-masted barque Lawhill, owned by the Anglo-American Oil Co. Ltd. After obtaining his second mate's certificate he joined the Clan Line, and in 1912 obtained a commission in the Royal Naval Reserve. He served in the Royal Navy throughout World War I and on demobilisation returned to the Clan Line, passing through the officer grades until appointed to his first command, the *Sinaloa*, in 1931. At the outbreak of the Second World War he was again mobilised and after a period of service as commodore of coastal convoys he served as commodore of ocean convoys until the middle of 1942, when he was appointed to command H.M.S. *Mersey*, the Liverpool Naval Depot. He was awarded the C.B.E. in 1941. On his return to the Clan Line service, Captain Galer commanded the *Clan Macdougall*, then in January, 1950, he was appointed commodore of the company's fleet and master of the new *Clan Shaw*, in which ship he recently completed his last voyage.

A member of the Voluntary Marine Observers since 1933, Captain Galer has contributed a total of 29 logbooks, of which nine were classified as "Excellent". His keen interest in Marine Meteorology was rewarded in November, 1948, when the Director of the Meteorological Office presented him with an inscribed barograph for meritorious service.

Captain Galer is a member of the Court of the Honourable Company of Master Mariners.

We wish him good health and happiness in his retirement.

M. C.

APPOINTMENT.—Captain Galer has been succeeded as Commodore of the Clan Line by CAPTAIN A. R. COSSAR, who has already been a member of the Corps of Voluntary Marine Observers for a number of years.

Southern Ice Reports

November, 1950

R.R.S. *Discovery II*

DATE	POSITION		DESCRIPTION
	LAT.	LONG.	
15	56 04s	151 29w	Medium berg.
	56 52s	151 20w	Medium berg.
16	57 42s	150 28w	1 large tabular berg, 5 medium tabular bergs, 3 medium pinnacled bergs, 3 medium bergs, numerous growlers and bergy bits.
	59 33s to	150 48w }	
17	59 40s	150 50w	1 large tabular berg, 2 largish bergs, 7 medium bergs, 1 castellated berg, 1 small berg.
	60 08s to	150 51w }	
	60 46s	150 42w	In pack. Numerous bergs.
	60 18s	150 30w	Edge of pack. Many bergs.
	60 10s	151 28w	Numerous bergs.
18	60 06s	152 00w	13 large tabular bergs, 1 medium tabular berg, 1 medium pinnacled berg, 1 small berg, numerous bergy bits and growlers.
	59 22s to	155 32w }	
19	59 35s	156 35w	Radar target.
20	58 53s	160 46w	Small berg.
22	61 18s	170 00w	1 large tabular berg, numerous bergs, bergy bits, growlers and pieces.
	62 04s to	171 42w }	
	62 12s	172 00w	Pack ice, numerous small bergs.
	61 52s	172 12w	2 large tabular bergs, 1 medium berg (radar),
23	61 38s	172 56w	3 large tabular bergs, 2 medium bergs (radar), 1 small berg (radar).
	61 15s to	178 10w }	
24	61 26s	179 00w	1 large tabular berg (6½ to 7 miles large).
25	63 00s	175 05E	Pack ice.

Further reports of southern ice for October, November and December, 1950, can be found in *The Marine Observer*, Vol. XXI, No. 154, October, 1951, p. 255.

No reports have yet been received of southern ice for October, November and December, 1951.

NOTICES TO MARINE OBSERVERS

Postal Arrangements

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

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

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

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

Ice Observation

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

See Chapter 12, pages 96-98 of the *Marine Observer's Handbook*, Seventh Edition.

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

Marine observers will greatly assist by noting the conditions of ice, either drifting or fast, in the pages provided at the end of the logbook (Form 911), or on Form 912, which may be supplied to the captain of any British ship on application to a Port Meteorological Officer or Merchant Navy Agent.

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

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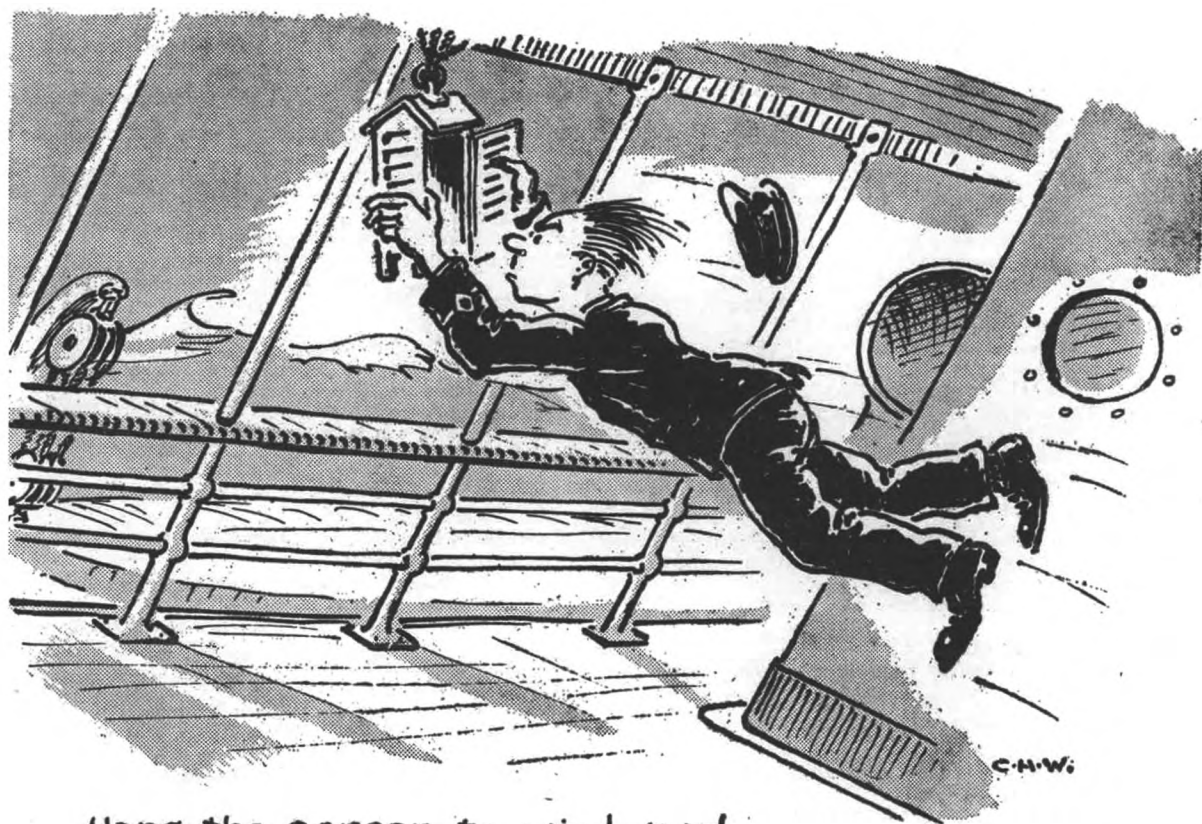
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Hang the screen to windward.

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