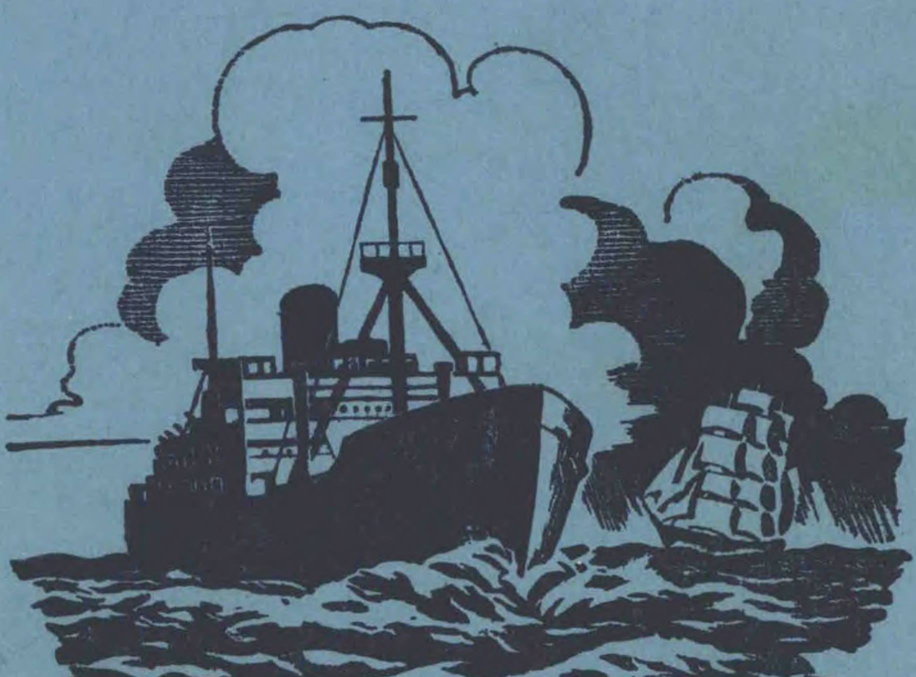
M.O. 656

The Marine Observer

A quarterly journal of Maritime Meteorology



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THE MARINE OBSERVER

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

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Editorial

In the days of the sailing ship and indeed in the early days of steam the mariner, to all intents and purposes, was not given any meteorological information. It was not till 1858 that, due to the inspiration of Maury, an American naval officer who had already started a system of observation aboard American ships, an international scheme was agreed whereby officers aboard merchant ships of all nations should make meteorological observations on a voluntary basis, with the object of preparing atlases of the climatology and currents of the oceans. As we mentioned in an earlier edition of *The Marine Observer*, marine casualties involving enormous loss of life and ships were alarmingly high during the latter part of the nineteenth century; nearly 3,500 lives (passengers and crew) were lost during 1882, and the average figure between 1880 and 1900 was about 1,500.

There were various reasons for these high rates of casualties; not only were the ships propelled by sail or (latterly) by relatively inefficient machinery, but there were no "loadline survey" regulations and many of the ships were badly maintained. Some of the masters and officers of British ships in those days were of notoriously drunken habits and largely uneducated; it was for the latter reason that masters' and mates' examinations were established in 1845. A large proportion of the casualties was undoubtedly caused by bad weather in some form or another, directly or indirectly, and it is interesting to conjecture what decrease in casualties there would have been if, in those days, radio weather information had been available to the masters of ships. Whatever their faults these men were seamen, and had they been given warnings in good time, for example, about the risk of being caught on a lee shore with unfavourable wind, they might in many cases have been able to take precautions accordingly—or in some cases they might usefully have delayed sailing when a very unfavourable forecast was issued.

We have advanced a long way in the cause of marine safety since the advent of radio. Nowadays, the ships and the men who man them are generally efficient, and the comfort and convenience and the aids to navigation which the mariner has at his disposal must seem almost unbelievable to those like Captain Heseltine (see page 80 of this number) who were at sea in 1900. But storms, ice and fog can still cause damage or loss to the largest and most modern ship and her cargo—and there seems little doubt that the issue of timely warnings of bad weather conditions plays a useful part in safety at sea. During the years 1952 to 1957 inclusive, the average number of lives lost per year aboard British ships due to shipwreck was only 59 and during 1952 it was only 8.

Nowadays, as a result of arrangements made by the World Meteorological Organization, supported by the relevant regulations of the International Convention for Safety of Life at Sea, there is hardly any part of the world where a seaman can rightly complain of a lack of meteorological information. Most oceanic areas have been divided into convenient sections, responsibility for the meteorological coverage of which has been allotted on a geographical basis to the meteorological services of the various countries bordering the oceans. Thus it is the responsibility of each meteorological service concerned to issue weather information by radio, in a more or less standard form, for the benefit of shipping in a specified area. Arrangements for the issue of radio information to shipping in coastal waters are left to the discretion of the nation concerned but, here again, the general outline of the information and the frequency at which it is issued more or less follows a standard pattern. There is often consultation on a regional basis between the various countries in certain areas, so as to ensure that the best service possible is provided and that confusing information is not issued.

The information which is provided for coastal areas usually consists of a general statement of the existing weather and a forecast for the whole area followed by particular forecasts of wind, weather and visibility conditions in smaller areas around the coast concerned. In some cases, as is done in the "5-minute" bulletins to shipping in British coastal waters broadcast by the B.B.C., actual readings of pressure, temperature and wind at selected coast stations and light-vessels are included.

For the oceanic areas it has been agreed internationally (at a conference of the World Meteorological Organization at Washington in 1947) that in addition to the issue of a statement in the form of a " word picture " of the existing weather in the area and a forecast for various sections of that area, the mariner should also be provided with sufficient information to enable him to prepare his own weather map—in other words, a coded analysis is to be included in the message. In many cases this is supplemented by a selection of actual observations from ships at sea and from certain shore stations.

A realisation of the big part that weather plays in affecting marine safety has led to the inclusion of the decoding of the analysis and plotting of weather maps in the master mariner's examination. The object of encouraging mariners to plot weather maps is certainly not to make them into forecasters but is to enable them to get a more complete picture of any given weather situation. Forecasting the weather is a complicated and expert job—and needs detailed study of a series of surface synoptic maps, and also of the various upper air charts. Bearing in mind the need for reasonable economy in length of message and indeed the time available for transmitting weather messages, it will be understood that it is often very difficult for the meteorologist to give a comprehensive word picture of a complicated weather system and to give a detailed forecast for an oceanic area; the weather " picture " in the Atlantic is often very complicated! Various methods are used to delineate areas. In general, the use of lettered or numbered areas, although very convenient in many respects, is not acceptable for international purposes because it would mean that every mariner would need to have aboard the relevant publication in order to identify the area and this is not always practicable. According to the international regulations " Positions should be given and areas delineated in terms of latitude and longitude, or with reference to well-known land marks ". (An exception to this will be necessary in the case of forecasts issued in the new " MAFOR " code by authorities which find it impracticable to issue them in English as well as in their own language—as laid down in W.M.O. regulations.) To overcome this difficulty, in the eastern North Atlantic north of 35°N. for example, the area is arbitrarily divided into four sections; and wording such as " northern part of the area " is used to describe a particular location in any section under discussion. In the western Atlantic, no arbitrary division of the area is attempted, which means that the actual message in that area has to be somewhat longer in order to describe what is happening. In each case the bulletin contrives to give as much information to the mariner as possible. When the bulletin is considered alongside the weather map which has been plotted aboard the ship, the mariner is better able to visualise from the analysis what was in the mind of the meteorologist responsible for the bulletin. Sometimes, if a very intense depression is seen on the weather map, the master of the ship can alter course, ease down or take some other action to avoid the worst of the weather. Aboard certain ocean liners nowadays the weather maps are plotted as a routine and early steps can be taken to avoid injury to passengers and loss of crockery and galley utensils when bad weather is thus anticipated.

In the North Atlantic the United Kingdom is responsible for the area east of 40°W., whereas the United States and Canadian authorities are responsible for their respective areas west of 35°W. There is thus an overlap between these areas which should tend to assist the mariner who has need to plot a map based upon more than one analysis.

When the composition of these bulletins was agreed by the Commission for Maritime Meteorology of the W.M.O., many of whose members have had maritime experience, the object was to provide the most comprehensive information possible for the benefit of shipping. The wording and detailed composition of the bulletins obviously has to depend upon various circumstances but each meteorological service does its part to provide information which is as useful and intelligible as possible.

The bulletin issued from the G.P.O. Station at Portishead is deliberately divided into two sections for the convenience of the mariner. That portion of the bulletin which is issued at 0930 and 2130 G.M.T. contains a general statement of the weather in the various Atlantic areas, a forecast, and actual weather reports from Selected Ships and land stations. These bulletins are based upon a chart plotted at midnight or twelve o'clock G.M.T. respectively, supplemented by whatever observations for 0600 and 1800 G.M.T. are available at the time of issue. The broadcast is made at a time when the radio operators of all ships are on watch in the eastern Atlantic. On the other hand, the analysis part of the message is issued only once a day, at 1130 G.M.T., and it is based upon observations made at 0600. It is issued only once a day because it is considered that, aboard the average merchant ship, the officers would not find time to plot more than one weather map a day. The reason it is issued at 1130 is that there would not be time to include it in the 0930 bulletin, even if it could be made available by that time, and 1130 is the earliest possible time at which it can be certain of being available. It is unfortunate that this time happens to fall outside the hours of watch of the operator aboard a " single operator ship " but this is unavoidable.

Whatever the contents of these bulletins may be and whatever the areas they cover it is almost certain that they will not satisfy everybody. It is of course, the desire of every meteorological service to have satisfied " customers ", and as a step towards this it is necessary to know the wishes of those who use the service. Constructive criticism is always helpful and any suggestions for improvements in the radio weather bulletins are welcome; they can be given verbally, or in writing, to a Port Meteorological Officer when he visits the ship, or can be addressed direct to the Director-General, Meteorological Office (M.O.1) at Harrow. All such suggestions will be carefully studied and action will be taken upon them if considered desirable after consultation with representative shipping interests. If the suggestion concerns a bulletin issued by some other meteorological service then it will be promptly forwarded to the director of that service for consideration.

There have been a few occasions when criticisms have been made by masters or officers of ships about the inadequacy of the services provided by the Meteorological Office, without a proper appreciation of what is in fact available. In other words the individuals concerned had failed to consult the relevant publications. Every ship should have on board at least one copy of *The Admiralty List of Radio Signals*, Volume III, which gives details of all the weather bulletins that are in fact available. Deck officers, as well as radio officers, are advised to study this book so that they are fully " in the picture ". It is realised that with the numerous papers with which the modern ship's master is burdened and the number of instructions and other documents he has to carry, it is sometimes difficult to know where to look for the relevant information. In addition to the detailed information in *The Admiralty List of Radio Signals*, advice about available meteorological information is summarised in Brown's and Reed's Nautical Almanacs and in Lloyd's Calendar. It is unlikely that there is any foreign-going ship, no matter how small, that does not carry at least one of these publications. Detailed information about services to shipping in coastal waters is giving in M.O. 509 (*Decode for the use of shipping*), H.M.S.O., price 2s. 9d., which is issued free to all Selected Ships and in M.O. Leaflet No. 3 (*Weather Bulletins and Gale Warnings for Coastwise Shipping and Fishing Vessels*) which is obtainable gratis on application to the Director-General of the Meteorological Office (M.O.1, Harrow).

MARINE SUPERINTENDENT.

THE MARINE OBSERVERS' LOG

April, May, June

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

CURRENT RIP
Indian Ocean

M.V. *Dartmoor.* Captain F. Bradfield. Durban to Dairen. Observers, the Master and Mr. D. Nicholas, 2nd Officer.

12th May, 1958. At 0845 G.M.T. the vessel passed through an area of disturbed water, 1 cable wide and about 2 miles long, lying 080°–260°. The waves were much longer and higher in this patch than they were outside it, and they had foam crests similar to breakers. No sign of oil was seen on the surface and the echo sounder (max. scale 600 fm) showed no trace. Wind SE., force 5–6.

Position of ship: 22° 20′S., 60° 45′E.

LINE OF DEMARCATION
Caribbean Sea

M.V. *Port Hardy.* Captain A. N. Williamson. Cristobal to Curaçao. Observers, Mr. D. F. T. Downard, Senior 3rd Officer and Cadet G. Tully.

7th May, 1958. At 2035 G.M.T. a well-defined line of demarcation was observed approximately 24 miles off the mouth of the River Magdalena, the temperatures of the blue and muddy waters being 81·6° and 83° F. respectively. No noticeable offshore set was experienced, but a 1 kt favourable current had been experienced before the line of demarcation was met. A large number of sharks were apparently feeding along the line, but no fish or other food was actually seen. Wind W'ly, force 2. Sea slight.

Position of ship: 11° 32′N., 74° 38′W.

New Zealand Waters

M.V. *Cambridge.* Captain P. P. O. Harrison. Auckland to Lyttelton. Observers, the Master, Mr. L. E. Howell, 2nd Officer and Mr. R. N. Jordan, 3rd Officer.

30th April, 1958. At about 0030 G.M.T. when 35 miles east of Kaikoura Peninsula, the ship passed through a sharply defined line of demarcation, running in a 320°–140° direction as far as it could be seen, on either side of the vessel. It had the appearance of a narrow oil slick. On the NE. side the colour was dark blue and the sea temperature 58°: on the SW. side the sea was a light green and the temperature fell to 54°. Although there was no sign of a rip the ship swung 10° to starboard as it crossed the line.

Position of ship: 42° 30′S., 174° 25′E.

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

" The fall in temperature strongly suggests a convergence of water masses with sufficient physical differences to lead to a totally different plankton population in each such as could in turn help to account for the apparent difference in colour."

DISCOLOURED WATER

Red Sea

M.V. *Essex*. Captain S. W. Andrews. Aden to Suez. Observers, the Master and all Officers.

26th June, 1958. Between 0630 and 1145 G.M.T. considerable areas of sand were seen continuously, floating on the surface of the sea. Sometimes there was only a thin film of sand; at other times the layer was thicker and " cracked " when disturbed by the bow wave. Wind WNW., force 1–2. Low swell.

Position of ship: 14° 44′N., 42° 15′E., to 15° 52′N., 41° 30′E.

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

" Mineral sand is very dense and sinks rapidly except under most extraordinary surface tension effects and an algal bloom of *Trichodesmium* would seem to me a far more probable explanation.

" But sand and dust storms *do* precipitate large amounts of mineral particles into the Red Sea quite frequently, so that one cannot rule out the sand explanation altogether, though sand so deposited would normally sink nearly as fast as it settled. It is just possible that sand, or more probably fine dust, settling in an area where a dense algal bloom had already given rise to peculiar surface conditions, might render both explanations correct."

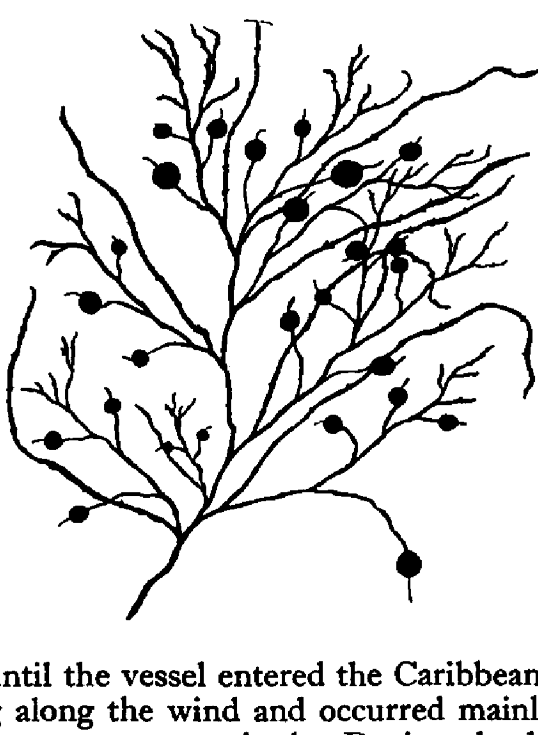
Note 2. The extreme salinity of the Red Sea would cause the deposits to float more easily. Page 223 of *Meteorology for Mariners* states: " in the surface layers of the open oceans the salinity varies between 32 and 37·5°/₀₀, 35 being the average. Higher surface salinities occur in partly enclosed waters in low latitudes, where evaporation is excessive; the greatest occur in the Red Sea (up to 41°/₀₀) and the Persian Gulf."

GULF WEED

North Atlantic Ocean

M.V. *Nottingham*. Captain F. G. Bevis. London to Curaçao. Observers, the Master and all Deck Officers.

15th May, 1958. Gulf weed was first seen around 1430 G.M.T. and it was



continually observed until the vessel entered the Caribbean via Sombrero Passage. It lay in lines running along the wind and occurred mainly in small patches, but frequently fairly large areas were noticed. During the last two days the weed thinned out but it still occurred in patches of irregular size. None of the ships' officers had previously seen the weed so far E., and no E'ly currents had been encountered. A sample was taken on board on 17th May, from which the photograph (opposite page 52) and sketch above were made. Noon to noon set and drift from 15th to 16th May, 346°, 4 miles. Wind SE., force 4.

Position of ship: 33° 15′N′, 37° 11′W.

Note 1. Mrs. Y. M. Butler, of the Natural History Museum, comments:

"The photographs and very nice silhouette are of the gulf weed. "Gulf weed" is a general term for the brown seaweed *Sargassum*, several species of which are commonly found floating on the oceans far from land. The area where most of this floating weed is found is the Sargasso Sea off the American coast between about 20° and 35°N., but it is known to occur all over the tropical Atlantic Ocean and in the Caribbean Sea as observed by M.V. *Nottingham*. The exact distribution of floating masses like this must be constantly changing with the weather conditions and it seems quite feasible that it should be blown along the surface by wind.

"I am afraid that it is impossible to say what species of *Sargassum* is pictured in the silhouette; even when actual specimens are available, identification is not always possible since these floating plants are always sterile and reproductive bodies are usually necessary for naming. It used to be thought that these floating masses consisted entirely of plants torn off rocks and carried out by ocean currents. However, it has been shown that these masses grow and multiply vegetatively while they are floating. The origins of these masses therefore, are probably a few attached plants each of which has multiplied enormously since it became detached and carried out into the ocean."

Note 2. This weed appears to have moved contrary to the predominating ocean currents, although currents are very variable in the position of observation. If the weed had been moving for several months it could have moved to its reported position in the general North Atlantic current circulation. If the weed moved in the surface layers of the sea whose flow is greatly influenced by the surface wind, its E'ly movement and dispersion could be fairly rapid.

SEALS

Mediterranean Sea

M.V. *Socotra*. Captain W. H. Waghorn. Port Said to Casablanca. Observers, the Master and Mr. J. W. Slee, 2nd Officer.

25th May, 1958. At 0600 G.M.T. two seals, grey brown in colour and about 10–12 ft long, were seen heading SSE. Sea temp. 61°F.

Position of ship: 36° 00′N., 15° 37′E.

Note. Miss J. E. King, of the Natural History Museum, comments:

"These animals would be Monk seals (*Monachus monachus*), the only seals found in the Mediterranean and it is interesting to hear of them on what must be quite a busy shipping route. I am very grateful to Captain Waghorn for making this observation and I would be interested to hear of other seals seen in this area."

VIOLENT THUNDERSTORM

Australian waters

S.S. *Captain Cook*. Captain A. Bankier. Wellington to Fremantle.

14th April, 1958. At 1015 G.M.T., when a violent electric storm with vivid lightning and deafening thunder passed overhead, two flashes of lightning struck the vessel, causing damage in the wireless cabin and affecting the compasses. The deviation of the standard compass was unchanged at 1½°E. (course 262° magnetic), but that of the steering compass jumped from 2½°E. to 11°E. and continued increasing until a maximum of 19°E. was reached 6 hours later. Ten hours after the storm had passed over, the deviation had decreased to 11°E. During the storm there was violent rain accompanied by severe gale force winds, but the barometer continued to rise without fluctuations.

The Master commented upon the incident as follows:

"In the wireless room, the aerial connecting link in the change-over switch box, a stranded copper wire about $\frac{1}{16}$ in. in diameter and approximately 8 in. in length, was fused. The fusing of this link, which should stand a load of between 30 and 40 amps, saved the main receivers from serious damage.

"When course was altered to 331° (magnetic) off Cape Leeuwin the deviation on the standard compass altered to 13°W. and on the steering compass to 37½°W. On course 006° (magnetic) off Cape Naturaliste, the deviations found were 10°W. on the standard compass and 34°W. on the steering compass. On course 031° (magnetic), the deviations were: standard, 10½W.—steering, 22½°W. Approaching Fremantle on a course of 090° (magnetic) the deviations on both compasses returned to nil.

"Between Fremantle and Sunda Straits on a magnetic course of 340°, the deviations found were approximately 11°W. on the standard compass and 25°W. on the steering compass. Good observations were difficult to obtain as the compasses were unsteady. When the vessel was swung to a W. magnetic heading, the compasses steadied up and no deviations were found. It was apparent that the physical condition of the ship had been affected. On a N. magnetic heading the athwartship magnets in both compasses were reversed and deviations were reduced to nil. During the remainder of the voyage to Glasgow the compasses behaved in a normal manner. My conclusion is that the polarity of the athwartship beams must have been completely reversed."

Position of ship at 1000 G.M.T.: 39° 20'S., 150° 13°E.

Note. This observation was referred to the Admiralty Compass Observatory, where it was read with great interest. It was remarked there that the age-old, rough and ready rule that, if the compasses are badly affected as a result of a ship having been struck by lightning then the athwartship magnets should be reversed, seems to have received a measure of substantiation in this instance.

The Director of Navigation and Direction at the Admiralty, will be referring to this observation in the *N.D. Bulletin*, a restricted quarterly publication issued for the benefit of navigating officers in H.M. ships.

LIGHTNING
Off Colombo

S.S. *Leicestershire.* Captain E. D. Brand. Aden to Colombo.

19th April, 1958. Lightning was seen between NE. and SE. from about 1 hour after civil twilight until 2330 G.M.T., the photograph (opposite page 52) being taken at 2215. Although the flashes were very bright at times, no thunder was heard.

Position of ship: 6° 48'N., 79° 42'E.

Note. Dr. B. F. J. Schonland, who is a well-known authority on lightning, comments:

"Thank you very much for sending me the interesting photograph of lightning taken by the Master of the S.S. *Leicestershire.* As a photograph it has one very interesting feature in the upward branching, which is most unusual, and in the fact that it is a photograph of a discharge which is in the main inside the cloud and certainly does not reach the earth. In the extract from the logbook of Captain Brand there is no indication of the distance of the flash and this is something which I hoped would be remedied by any other observers of lightning even though the distance may be a very rough estimate.

"Much attention is now being given to discharges within thunderclouds and photographs like this are likely to build up a body of observed facts which can supplement the many observations which are now being made by radar and electrical equipment. I hope, therefore, that Captain Brand's beautiful photograph may encourage others to take photographs of discharges within the clouds."

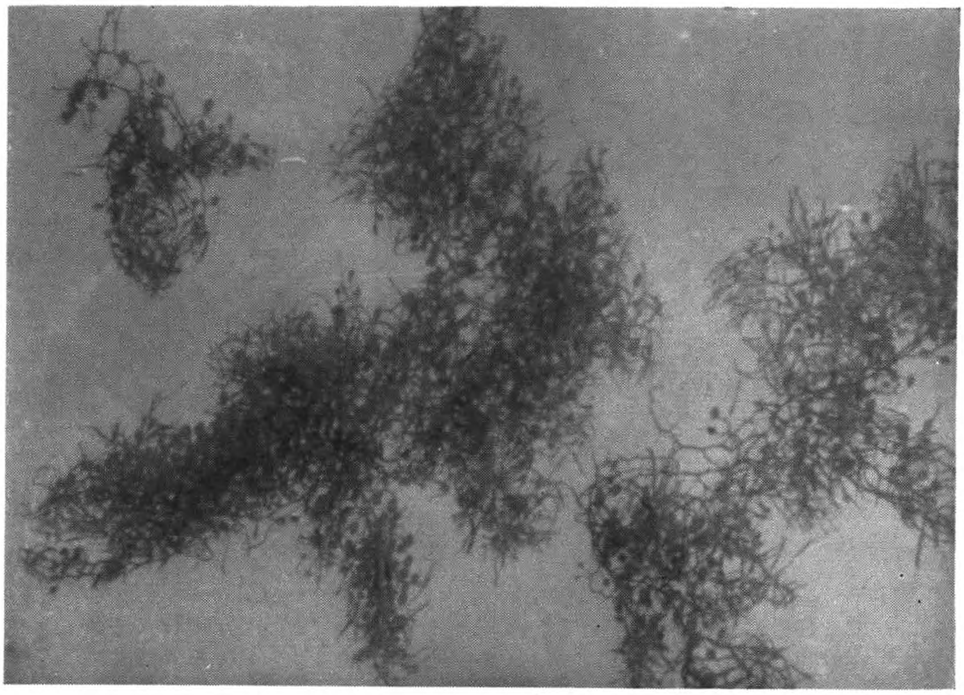
WATERSPOUT
Strait of Malacca

S.S. *Oxfordshire.* Captain N. F. Fitch, O.B.E., Hong Kong to Liverpool. Observer, Mr. D. N. B. Nutman, 3rd Officer.

See opposite page 53.

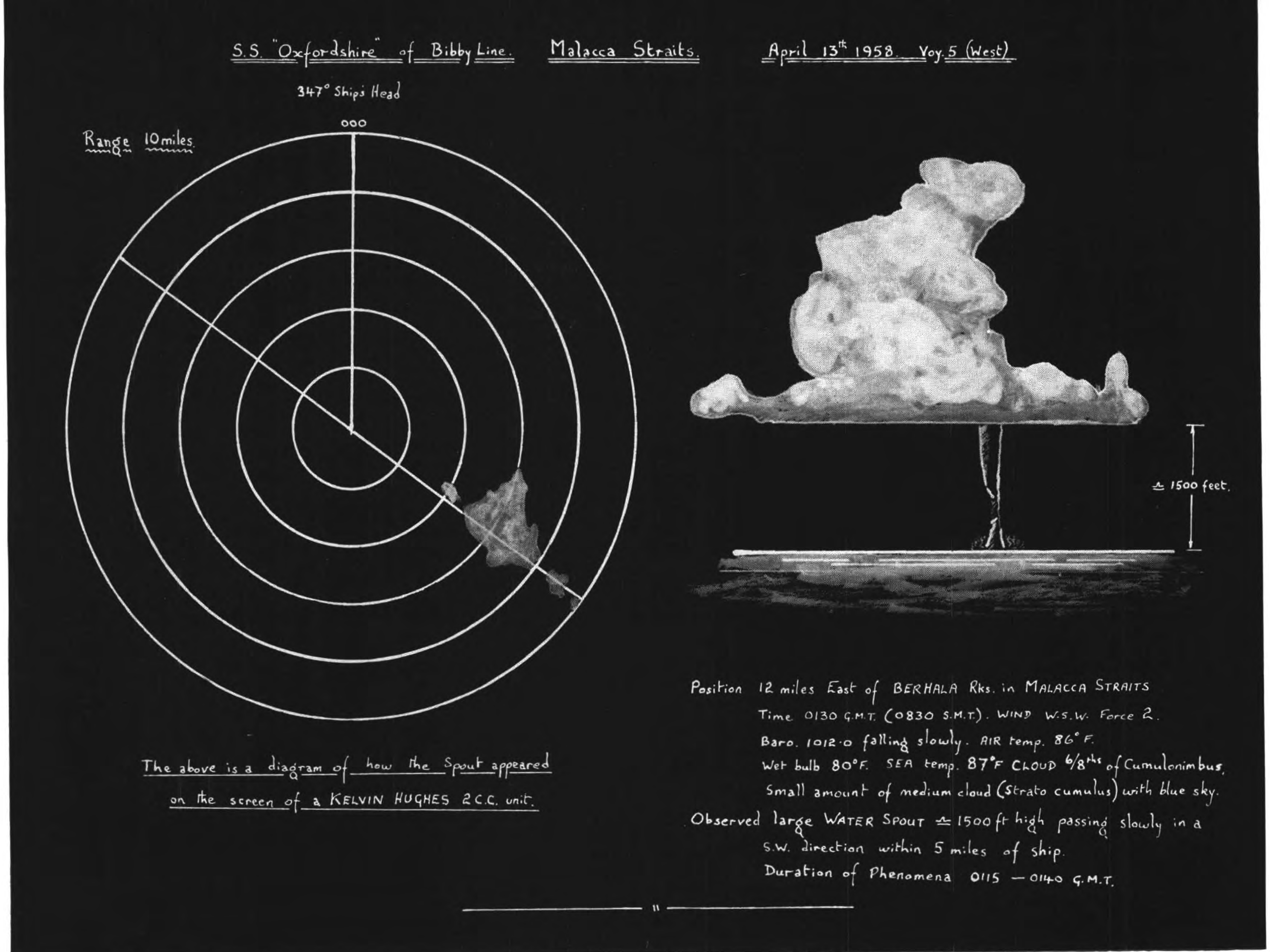
Note 1. This observation was sent to the Radio Advisory Service.

Note 2. Most of the illustrations published in *The Marine Observers' Log* were originally drawn in the meteorological logbook, and so have to be copied on to white paper or linen for reproduction purposes. The present observation, however (opposite page 53) was excellently



Gulf weed observed from M.V. *Nottingham* (see page 50)

Lightning observed from S.S. *Leicestershire* (see page 52)



Waterspout observed from S.S. *Oxfordshire* (see page 52).

drawn in white ink on black paper, and so has been reproduced directly. As a direct reproduction is more accurate, we ask other observers to draw their line-diagrams either in black ink on white paper or in white ink on black paper. Where it is desired to show light and shade, a pencil drawing should be made on white paper, for reproduction on art paper.

In the present number, the drawing of gulf weed on page 50 is also a direct reproduction.

PHOSPHORESCENCE

Off Land's End

M.V. *Imperial Star*. Captain G. L. Evans, O.B.E. Curaçao to Dunkirk.

5th June, 1958. On approaching the Lizard at 2300 G.M.T., brilliant balls of phosphorescence were observed around the ship. There were high seas at the time and spray was carried on to the foredeck and bridge. The phosphorescence in the spray which landed on deck kept its original green colour for a period of about 2 min. One spot of spray which was examined was a brilliant green; this persisted for about a minute. The colour then faded and all that remained resembled a particle of dust. Air temp. 56°F, sea 59°.

Position of ship: 49° 55′N., 5° 50′W.

Note. This observation is of particular interest because of its unusual place of occurrence. A similar observation made in British waters near Beachy Head on 28th June, 1957, was reported by S.S. *Beaverglen*. An account of this was given on page 70 of the April 1958 number of this journal.

North Atlantic Ocean

M.V. *Rochester Castle*. Captain G. D. Fowler, R.D. London to Las Palmas. Observer, Mr. G. C. H. Wearing, 3rd Officer.

20th April, 1958. At 2335 G.M.T. eight stationary patches of phosphorescence were seen in the water ahead of the vessel. On passing among them, some appeared to be circular and about 50 ft in diameter: others were in bands lying in a direction 110°–290°, approximately 100–150 ft long and 20 ft wide. The phosphorescent areas shone clearly and appeared to be composed of plankton, certainly not of fish, because previous to this observation, between 2153 and 2230, the vessel had passed through many shoals of fish which were clearly recognised as such in the phosphorescent light their movement caused. The patches kept appearing at fairly frequent intervals until 0330 on 21st. Air temp. 54°F, sea 61°. Wind S'W., force 3–4. Speed of vessel 16½ kt.

Position of ship: 36° 55′N., 12° 05′W.

M.V. *City of Swansea*. Captain J. Vizer. Beira to Glasgow. Observers, Mr. J. A. Jones, 3rd Officer, Mr. C. W. Davies, 4th Officer and Mr. K. Beverley, Apprentice.

20th May, 1958. Vivid phosphorescence was seen at 1950 G.M.T., particularly in the disturbed water around the vessel, where a criss-cross pattern appeared. This was caused by the motion of what seemed to be a school of porpoises. The brilliance gradually diminished and the phosphorescence disappeared about 2100. Two hours later, however, it suddenly reappeared and increased in extent and brilliance. Large shapes 10–20 ft in length, believed to be porpoises, were seen through binoculars. They were moving under the patches of phosphorescence and keeping up with the ship at a distance of 50 yd. The bodies had a greenish tinge, which became particularly noticeable when they broke the surface. Air temp. 78°F, sea 75°. Wind light and variable. Sea rippled with slight swell.

Position of ship: 4° 31′N., 11° 57′W.

M.V. *Napier Star*. Captain W. L. Murphy. Tenerife to Santos.

22nd May, 1958. From 2230 G.M.T. onwards pieces of glowing phosphorescence, estimated at about 3 in. to 6 in. in size, were seen in increasing numbers. Between 2315 and 2335 whole patches of the sea surface glowed and long phosphorescent lines appeared downwind, visibile for about 2 cables. Sea temp. 82°F. Wind SE's., force 3. Sea slight with low swell.

Position of ship: 4° 40'N., 26° 50'W.

Note. These appear to be pyrosoma, described by Dr. H. W. Parker on pages 204 and 205 of the October 1957 number of this journal.

Indian Ocean

M.V. *Queensland Star.* Captain R. White, D.S.C. Aden to Adelaide. Observer, Mr. E. G. Bee, 3rd Officer.

13th May, 1958. From 1300 to 1600 G.M.T., while continuous moderate to heavy rain was falling, much bright phosphorescence was seen in the bow wave and in the disturbed water up to 50–60 ft from the sides of the ship. Other patches of light, which appeared to come to the surface and burst into a bright phosphorescent glow, were seen all around to a distance of about 2 miles. Those patches near the vessel were about 12 in. to 15 in. across.

Position of ship: 35° 30'S., 118° 10'E.

Australian Waters

S.S. *Marabank.* Captain C. G. Watterson. Sydney to Port Lincoln. Observer, Mr. W. Mottram, Chief Officer.

18th June, 1958. At 0500 S.M.T. the vessel passed through an area studded with glowing phosphorescent shapes. Some were globular, about 10 to 12 in. in diameter and approximately 2 to 3 ft. below the surface: their outline was fuzzy, an effect probably due to depth. Other pieces were sausage-shaped, approximately 6 to 8 in. long, by about 2 in. wide, and apparently floating right on the surface. One of the latter appeared to break into two portions, each part thereafter glowing with undiminished intensity.

The various shapes, which emitted a distinctly greenish light, were visible for a distance of some 30 ft on each side of the vessel. Along the whole length of the ship's sides the slipwash glowed with a whitish light, giving the illusion of the vessel steaming through a sea of milk. Although the display—which lasted 8 min—began suddenly, it faded gradually until finally only a very occasional globule was seen. Air temp. 55°F, sea 62°. Wind WSW., force 2. Rippled sea with slight S'ly swell.

Position of ship: 10 miles NE. of Montague Island.

PHOSPHORESCENT WHEELS

Persian Gulf

M.V. *British Resource.* Captain E. E. Bradley. Colombo to Bandar Mashur.

10th April, 1958. When approaching Jazirat Tunb at 1800 G.M.T. a bright patch of light was seen on the starboard bow at a distance of a mile. Three minutes later the vessel entered an area of brilliant phosphorescence, in the form of rotating wheels, which extended along the starboard side and outwards to starboard for approximately a mile. The wheels were rotating rapidly in a clockwise direction and resembled the blades of a revolving electric fan: at the same time they also had the appearance of waves about 3 ft. high. After the wheels passed the stern of the ship they were no longer seen.

On the port side there was only slight phosphorescence, in the shape of elongated bands beneath the surface. The whole display lasted about 10 min. The radar was not in use at the time. Wind WSW., force 2. Sea calm.

Position of ship: 26° 20°N., 55° 30'E.

M.V. *British Commerce.* Captain G. R. Armstrong. Abadan to Kandla. Observer, Mr. K. B. Youngs, Navigating Apprentice.

14th April, 1958. At 2140 S.M.T., while travelling E. through the Persian Gulf, patches of phosphorescence were seen. They were stationary and flashing irregularly, giving the sea, which was covered with breaking waves about 3 ft in height, a dappled appearance over a distance of several miles around the ship. This passive phase soon gave way to a very active one, when the patches brightened considerably and began to move through the water extremely rapidly, mainly in straight lines, though at times with a rotary movement. The lateral speed of movement was far in excess of anything that could have been achieved by a mass of organisms, being estimated to be of the order of a mile in under 5 sec, i.e. they moved much faster than the waves. There was no regularity in the direction of movement of the patches: a series would pass the ship on one course, then a minute later they would fade away to be replaced by another series moving in quite a different direction. Phosphorescent wheels were numerous but sometimes indistinct, no centre of rotation being discernible—phosphorescent patches apparently travelling in arcs rather than in straight lines. These never lasted long and, on fading, were replaced by others occupying slightly different positions, or became absorbed in the straight line type. Frequently, different formations overlapped at the edges, but there appeared to be no interaction. A curious feature of the affair was the part illusion played in the apparent direction of movement since, by looking away and then back again, the direction of rotation of the wheels could be made to change, although the patches themselves seemed to move along straight lines in one direction only. During the active phase there would frequently be a near return to the original passive state, but this condition would soon give way and the fast movement would be resumed. The whole display lasted for rather less than half an hour. It was much less impressive than the one the observer witnessed on 3rd April, 1956 [published in the April 1957 number of this journal].

A sample of the sea water was taken in a bucket, amounting to about 4 in. in depth. The light was turned off and the water examined in the dark. Small particles of phosphorescence glowed momentarily, each for not more than a second, and were then extinguished. During this time the water in the bucket was perfectly still and unruffled. When the bucket was lightly flicked with a finger, at the level of the water, countless flashes were seen simultaneously for a very brief period, then there was darkness. After a few seconds the test was repeated, but the brilliance was less. With each successive flick, given at regular intervals, the brilliance continued to diminish steadily until eventually, after tapping seven or eight times, there was scarcely any response. The sample was allowed to rest for some minutes, then on the tapping being repeated the phosphorescence flashed brilliantly again. Even tapping the table on which the bucket rested, produced the same result. It was found that although tapping provided a stimulus, blowing hard on the water had comparatively little effect. Air temp. 72°F, sea 78° (condenser intake). Wind w'ly, force 4. Speed of vessel, 10 kt.

Position of ship: 26° 22'N., 55° 43'E.

Note. This report is of great interest because of the thoroughness with which the phenomena are described, and for the valuable experiments on the stimulation and propagation of the phosphorescent phenomena, which appear in this case to be by mechanical vibration. A preserved sample of the organisms emitting the light would have added to the value of the observation.

ABNORMAL REFRACTION

North Atlantic Ocean

S.S. *City of Pretoria.* Captain A. G. Freeman. Las Palmas to London.

1st May, 1958. At 1155 G.M.T. two ships were sighted bearing 023° and 060°,

some 7 miles away. Owing to refraction both vessels appeared to have short masts and very deep hulls, so that at one period one of the ships looked as if it were in a

floating dry-dock. At a distance of 4 to 5 miles both vessels assumed a normal appearance. Air temp. 65°F, dew point 56°, sea 61°. Wind ENE., force 1–2.
Position of ship: 41° 23′N., 10° 19′W.

Persian Gulf

M.V. *British Consul.* Captain W. L. Pugh. Abadan to Mombasa. Observer, Mr. P. Waller, 3rd Officer.

27th April, 1958. At 1500 G.M.T., ships approximately 20 miles away were observed to undergo rapid changes in appearance, appearing upright one minute and inverted the next (height of eye, 36 ft). After sunset, the oil tanks at Mena-al-Ahmadi, at an elevation of 435 ft, were clearly visible from a distance of 60 miles. From 1900 onwards, the lights of vessels more than 8 miles away often appeared double, and occasionally triple. Air temp. 80°F, dew point (at 1800) 68°, sea 75°. Wind NW'ly, force 1–2. Sea calm or slight.
Position of ship: 29° 28′N., 49° 02′E.

South African waters

S.S. *Clan Davidson.* Captain T. A. Watkinson. Cape Town to Port Elizabeth. Observers, Mr. D. Paterson, 2nd Officer, Mr. W. Marshall, 3rd Officer and Mr. J. E. Whitworth, Radio Officer.

25th June, 1958. Abnormal refraction affected both the coast line and a vessel 6–8 miles away, between 1000 and 1220 G.M.T. The coast appeared as a sandy strip raised slightly above the horizon, with bearings varying between 020° and 090°, while the upperworks of the vessel appeared elongated. Throughout the period, the high land could be seen plainly in the background. The radar showed clearly a picture similar to that of a sandy coastal strip, bearing 040° to 090° at a distance of 9·6 miles (on 10 mile range), although the true coastline, over 15 miles away, did not show on the radar when switched to the 30 mile range. This condition persisted from 1030 to 1045 when the radar was switched off. It was not seen again when the radar was used at 1200, but a similar picture was seen on the radar at 1430, when the coastline moved in quickly from 10 miles to 2 miles. It then disappeared. A vessel which was approaching returned a clear echo during the whole time, even though the "land" passed over it. At 1200: Air. temp. 67°F, dew point 53°, sea 63°, wind NE'E., force 2. Course 081°, speed 12 kt.
Position of ship: 34° 33′S., 23° 10′E.

Note 1. Captain F. J. Wylie, Director of the Radio Advisory Service, states:

"This vessel is fitted with the original production model of a radar set installed in 1949. This radar has a high pulse-repetition frequency, which makes it prone to the reception of second-trace echoes from targets at between 54 and 84 miles.

"In connection with the echo reported as 'similar to that of a sandy coastal strip' at 9·6 miles on the 10 miles range, it seems likely that what was observed was a second-trace echo of the Zitzikama Mountains, between Cape Seal and Klippen Point—range 63·6 miles.

"The phenomenon of multiple-trace echoes is explained in Chapter 7 of *The Use of Radar at Sea* and this report does not appear unexpected or unusual."

Note 2. In the October 1950 number of this journal an article was published on the subject of unusual radar performance, based on reports from this same ship. *The Use of Radar at Sea* was reviewed in the January 1953 number of *The Mariner Observer.*

New Zealand waters

M.V. *Cambridge.* Captain P. P. O. Harrison. Timaru to Auckland. Observer, Mr. R. N. Jordan, 3rd Officer.

12th June, 1958. At 2000 S.M.T. the loom of Cuvier Island light, 390 ft above high water, was clearly seen at a distance of 70 miles, bearing 294°, from a height of about 20 ft. In clear weather it is normally seen at 26 miles. Air temp. 56°F, dew point 46°, sea 63°. Sea calm. A little high cloud near horizon.
Position of ship: 36° 53′S., 177° 04′E.

FOG BOW

Mediterranean Sea

S.S. *Velletia.* Captain J. C. Nettleship. Le Havre to Mena al Ahmadi. Observers, the Master, Mr. S. W. Dean, Chief Officer and Mr. P. J. Wearing, 4th Officer.

9th June, 1958. At 0600 G.M.T. when the vessel was in thick fog, but with the sun and sky visible, a fog bow was seen which reached 15° in altitude. The inside of the bow was a whitish grey while the outside was rather darker and more of a brownish grey colour.

Position of ship: 36° 34′N., 13° 19′E.

HALO

Strait of Formosa

M.V. *Chengtu.* Captain V. R. Woolfe. Japan to Hong Kong. Observer, Mr. J. A. McDonald, Chief Officer.

20th May, 1958. At 0840 G.M.T., when the sun was at an approximate altitude of 26° 10′, a halo was seen which had a measured radius of 16° 10′. The colours of the spectrum were faintly visible in a band about 1° wide, the predominant colours, seen through sun glasses, being purple and white. By 0920 the halo had disappeared.

Position of ship: 23° 03′N., 117° 21′E.

LUNAR HALO

Australian Bight

M.V. *Brisbane Star.* Captain S. Foulkes. Beira to Napier. Observer, Mr. C. R. Spencer, 3rd Officer.

10th April, 1958. Between 1600 and 2000 G.M.T. a lunar halo was observed, having an almost constant radius of 18° throughout the period. For much of the time the sky was covered with a 6/8 veil of Cs, but occasionally the cloud amount was small.

Position of ship at 1800: 38° 15′S., 138° 20′E.

IRIDESCENT CLOUD

South Pacific Ocean

M.V. *Rangitane.* Captain R. G. Rees. Wellington to Southampton. Observers, Mr. J. Withington, 3rd Officer and Mr. J. D. Thomson, Supernumerary 3rd Officer.

17th May, 1958. At 2315 G.M.T. the edges of Cc cloud within a radius of 10° of the sun were seen to be tinged with pink and green, resembling mother of pearl. The colours varied in intensity and were in no fixed order or pattern. When the cloud thinned, the colours became more vivid, showing blue, violet and orange. The altitude of the sun was 28½° approx. and the bearing 320°.

Position of ship: 24° 01′S., 127° 48′W.

DOUBLE GREEN FLASH

North Atlantic Ocean

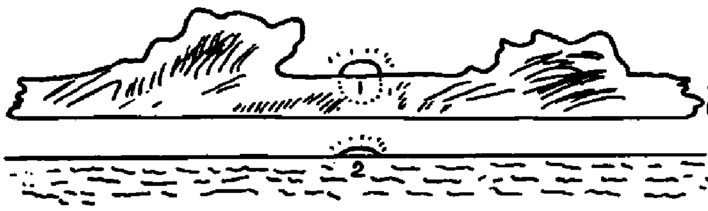
S.S. *Arabia.* Captain W. B. Tanner, R.D. Montreal to Liverpool. Observer, Mr. I. K. Grindrod, 3rd Officer.

11th June, 1958. At 2300 G.M.T. the sun was on the point of setting on the NW. horizon. As the upper limb sank below the horizon there was a distinct green flash lasting ½ sec: the top of the sun's disc then reappeared for approximately 6 sec and set again, when there was a second well-defined green flash. At 2400: vis. over 10 miles, no cloud. Very heavy sw'ly swell.

Position of ship: 55° 46′N., 32° 56′W.

M.V. *Brisbane Star*. Captain S. Foulkes. Beira to Napier. Observers, the Master and Mr. J. B. Kirkham, 2nd Officer.

13th April, 1958. As the upper limb of the sun vanished behind the top of a



cloud bank approximately 5° above the horizon, a green flash occurred lasting about 1 sec. The sun emerged from beneath the cloud bank and as it disappeared below the horizon a second green flash was seen. Cloud, 2/8 Sc. Vis. over 10 n.m.

Position of ship: 40° 42'S., 159° 54'E.

AURORAE

Note. Fewer aurora observations than usual have been received, and they are all published below. Copies have been sent to the Aurora Survey in Edinburgh.

In addition, since the beginning of June 1958, 107 logbooks have been received containing auroral information entered in the columns provided. This information is periodically extracted by the Aurora Survey.

North Atlantic Ocean

M.V. *Interpreter*. Captain W. Weatherall. Houston (Texas) to Liverpool. Observer, Mr. R. Potts, 3rd Officer.

15th April, 1958, 0010 G.M.T. A vivid display of aurora was seen extending to an altitude of 27°. It began as a single ball of red light, which became very bright and gradually spread to the horizon. The sky to the N. exhibited various shades of red, crossed by white rays similar to searchlight rays. The display lasted about 30 min.

Position of ship: 47° 56'N., 23° 36'W.

S.S. *Bassano*. Captain G. Goodman. Montreal to Aberdeen. Observer, Mr. S. C. Cook, 3rd Officer.

13th May, 1958. At 0030 G.M.T. the clouds to the N. dispersed and a bright arc extending from 260° to 045° was seen. At first this was thought to be some twilight effect, the sun having set about two hours previously, but shortly after rays were noticed and at 0040 they were shooting up to near the zenith. They came mainly from two very bright patches on the arc, bearing about 285° and 020° respectively. The maximum altitude of the arc was about 25°. At 0045 it was hidden by cloud.

Position of ship: 53° 20'N., 31° 00'W.

M.V. *Trevince*. Captain F. G. Bolton. Three Rivers to Gibraltar.

9th June, 1958, at 0500 G.M.T. A bright band of light was seen stretching from horizon to horizon, one end bearing 270°, the other 060°.

The band was composed of separate lines, almost vertical, merging together towards the eastern end. Gradually the band broadened, sending shoots both up and down till by 0530 the sky was about half covered with lines which appeared to be converging on Vega, bearing about 260°, altitude about 68°. The lines were pulsating, becoming intensely brilliant and then fading rapidly to almost zero.

By 0600 the sky was about 5/8 covered with these lines which, though still pulsating, were fusing together and in places appearing as patches and twisted bunches rather than definite lines.

With the coming of daylight, they gradually faded.

Position of ship: 49° 07'N., 64° 22'W.

10th June, 1958, at 0130 G.M.T. The sky developed into lines as was seen last night; they extended all round the horizon but were more definite and detailed in the N. At 0200 the lines had become more vivid and taken on a faint greenish hue pulsating all the time. Short wave radio reception was noticed to be very poor around this time.

At 0215 the effect began to fade and by 0300 had all but disappeared except to the N.

From 0400 to 0430 broken segments of the lines were visible at various altitudes and points around the compass. They were brightest and most dense on an arc from W. through N. to ENE., and were as bright or slightly brighter than normal moonlight.

At about 0430 the moon rose and the effects gradually dimmed until they were concentrated on an arc from W. to ENE. They still pulsated in waves travelling from the horizon to the zenith but the green tinge faded and became silvery.

By 0530 the lines had completely merged together and shrunk into a band with ends bearing 055° and 270°. The main band was very broad rising to an approximate altitude of 9°, the lower edge being clearly defined while the upper edge was very faint and variable, the whole being silvery with the very faintest tinge of green. With the coming of dawn the band faded rapidly.

Position of ship at 0530: 46° 55′N., 58° 38′W.

11th June, 1958, at 0103 G.M.T. The band effect reported the last two nights again began to appear with its ends bearing 160° and 030°. Its highest altitude was approximately 50° on a bearing of 090°. At 0330 lines began to shoot up from the horizon to N., reaching an approximate altitude of 40°, becoming bright and then fading almost to zero, the whole effect gradually fading.

By 0430 the main band was visible only as a glow above the horizon which had brightened during the previous hour, although it was visible as a partial arc in the sky from 300° to 030°.

By 0500 the main band had disappeared or become eclipsed by the moonlight, but a secondary band remained just barely visible until daylight.

Position of ship: 45° 10′N., 54° 30′W.

Gulf of St. Lawrence

S.S. *Arabia*. Captain W. B. Tanner, R.D. Liverpool to Montreal. Observers, Mr. P. B. Watson, 2nd Officer and Mr. J. K. Rudgard, Apprentice.

18th April, 1958. A fine display of aurora was observed from 0500 to 0520 G.M.T., the whole of the sky to the N. being traversed by undulating bands of white light which originated all round the northern horizon, apparently at an elevation of about 30°. The bands reached almost to the zenith and frequently assumed a pinkish shade when overhead, before disappearing. Although the display faded at 0520 it continued with diminished intensity for the rest of the night.

Position of ship: Off Cape Ray.

Australian waters

M.V. *Queensland Star*. Captain R. White, D.S.C. Geelong to Sydney. Observers, Mr. D. Greenland, 2nd Officer and Mr. C. Roger-Jones, Cadet.

26th May, 1958, between 1430 and 1500 G.M.T. The southern sky turned a very deep red colour which reached from the horizon to an altitude of approximately 20°. The whole display lasted for a period of 30 min then slowly faded and disappeared.

Position of ship: 35° 06′S., 150° 59′E. (6 miles E. of Perpendicular Point, New South Wales).

New Zealand waters

M.V. *Gothic*. Captain L. J. Hopkins. Wellington to Lyttelton. Observers, the Master, Mr. T. T. Salmon, 3rd Officer and Mr. J. M. Bain, Apprentice.

7th June, 1958. At 0810 G.M.T. the vessel was in fog. At 0915 when the fog began to clear and the sky became visible it was observed to be a dull red in the S. At 1000 the sky became covered with a layer of Sc but, nevertheless, from then until 1050 aurora was clearly observed over the sky to the S. The clouds became tinged with red as at sunset but the strength of the colouring varied continuously. By 1100 all signs of aurora had disappeared.

Position of ship: 41° 46′S., 174° 37′E.

South Pacific Ocean

M.V. *Port Macquarie*. Captain R. A. Holmes. Wellington to Balboa. Observer, Mr. D. R. Gunn, 4th Officer.

7th June, 1958, 0900 G.M.T. Aurora was observed as a pink glow covering most of the southern sky, accompanied by vertical beams of green light which varied in intensity during the 20 min duration of the display. The aurora appeared to originate about 5° above the horizon.

Position of ship: 42° 19′S., 171° 10′W.

UNIDENTIFIED PHENOMENON

Indian Ocean

M.V. *Dartmoor*. Captain F. Bradfield. Durban to Dairen. Observer, Mr. D. Nicholas, 2nd Officer.

20th May, 1958. At 0230 S.M.T. there was no moon, but the whole sky showed a certain amount of luminosity, there being a definite increase in brightness towards both the N. and S., but more especially towards N. Against this luminous background the clouds showed up plainly. The bearings of maximum luminosity were approximately 010° and 210°, the luminous patches apparently being related to something below the horizon. They appeared to be in approximately the same plane as the Milky Way and as light as the brightest part of it then visible. The general appearance was suggestive of a full moon about to rise, the light being a uniform pearly white, diminishing with altitude and azimuth. Due to the rapidly changing amounts of Cu and Cb and the occasional flashes of sheet lightning, it was rather difficult to determine the extent of the luminous patches, but the northern glow stretched, on the horizon, very approximately from 340° to 040° and attained an altitude of 30°. The southern glow was less extensive and may have been just a part of the Milky Way, on the horizon, though it appeared too uniform for that. Nautical twilight began at 2300 G.M.T. and the moon was new.

Position of ship: 10° 00′S., 93° 10′E.

Note. This observation was forwarded to Mr. B. McInnes, of the Balfour Stewart Auroral Laboratory, who also referred it to Mr. J. Paton. Their comments are as follows:

Mr. McInnes: " I am sorry that I cannot really say anything very helpful about the observation of unusual night sky light seen from M.V. *Dartmoor* on 20th May, 1958. The geomagnetic latitude of the ship at the time was about 20°S. Aurora australis has been observed from such low latitudes but only during great geomagnetic disturbance. As the level of geomagnetic activity on that date was lower than average, the possibility of aurora australis can be ruled out. With that goes the ruling out of aurora borealis for the northern horizon light. As you know, there is no record of simultaneous observation of northern and southern aurora. When this is observed (as I expect it will be some day) it is almost certain to be from a place within a few degrees of the geomagnetic equator."

Mr. Paton: " This is certainly not zodiacal light and if magnetic disturbance was slight could not be aurora. I would not think that airglow would be visible to the eye in patches like those described. In a sky with scattered cumulus, there actually occur variations in brightness of the clear sky in daylight, caused by the fact that the cumulus clouds are strong sources of scattered light. Whether this occurs perceptibly at night I do not know. Even on the darkest clear night there is, of course, an increase in sky brightness towards the horizon all round, again arising from scattering. Perhaps it could be that this effect is enchanced when viewed through scattered cumulus."

METEORS

Mediterranean Sea

S.S. *Hemiglypta.* Captain S. A. Greenaway. Cardiff to Persian Gulf. Observers, Mr. W. R. Smith, 3rd Officer and Apprentice Soper.

20th June, 1958. At 2021 G.M.T. an unusually bright meteor, white in colour, bearing 130° at an altitude of 25°, fell at an angle of 45° towards the horizon. It had a conspicuous tail, reddish in colour, which remained clearly visible until it was about 5°–10° above the horizon, when it vanished. The meteor itself was still bright as it disappeared below the horizon.

Position of ship: 32° 28′N., 28° 45′E.

Arabian Sea

M.V. *Socotra.* Captain W. H. Waghorn. Colombo to Aden. Observer, Mr. I. Gibb, 4th Officer.

13th May, 1958. At 1747 G.M.T. a brilliant meteor of magnitude −4 was seen for 3 to 4 sec. It appeared from a point midway between Dubhe and Polaris, bearing 352° at an altitude of about 18°. The colour was a greenish white which faded and brightened rhythmically until it disappeared with a very bright flash at an altitude of 5° on a bearing of 340°. There was a trail about 4° in length.

Position of ship: 10° 40′N., 56° 32′E.

The Development of a Hold Climate and of Sweating in the Hold and of its Cargo

By H.-J. Bullig

(Marine Weather Bureau of the German Meteorological Service)

As mentioned in the previous number of *The Marine Observer*, we now publish extracts from another paper read at the conference on " The Meteorology of Cargo Holds ", held at Hamburg on 20th June, 1956, under the auspices of the Seewetteramt, Deutscher Wetterdienst (the Marine Weather Bureau of the German Meteorological Service).

1. Statement of problem

The deposition of moisture on the sides or deckhead, or on the surface of or inside the cargo in a ship's hold, causing damage to the cargo, is the result of condensation of water vapour; this vapour coming chiefly from the air where it is in the form of an invisible gas; or from the moisture content, for example, of vegetable cargoes. The problem of the occurrence of condensation phenomena is primarily a physical one and is affected by the meteorological conditions; and it seems appropriate that research on sweating in holds of ocean-going ships should be carried out from the meteorological standpoint.

The problem of sweating in ships' holds has existed for hundreds of years, and even in the shipboard regulations and maritime law of the Hanseatic towns for the year 1614 it was laid down, regarding the transport of grain, that corn was to be ventilated during voyages when wind and water conditions permitted, and that if the corn was not kept properly cooled, the captain was to be held responsible.

By using the most suitable ventilation system based on their own experience and on that acquired over the centuries, ships' officers try to do all they can to avoid sweat damage, and ship-owners, by installing, for instance, mechanical ventilation devices and all-weather cowls, have tried, particularly during the last few years, to make ventilation of the holds as effective as possible and to provide ventilation even in the worst weather.

The fact that in spite of every care, sweating and sweat damage occur again and again on a scale with which all sea-faring nations are familiar, is not due—certainly not in the case of German shipping—to insufficient care on the part of either ship-owners or ships' officers, but is largely due to the fact that:

(*a*) ships' officers follow a careful routine for the correct handling of cargo and its ventilation, but they are not (and cannot be) familiar with the fundamental physical principles necessary for deciding upon the ventilation measures required,

(*b*) ships' officers are still unacquainted with facts of a climatological nature which in the form of danger zones—and their variations in intensity particularly—may lead to unexpected sweating;

(*c*) ventilation systems are still, generally speaking, not capable of dealing effectively with all the dangers arising from the meteorological angle. I am not referring here to the few ships with air-conditioning plant. Moreover, I do not want to be so optimistic as to think that normal ventilation systems could be devised to prevent all dangers, and the question is quite rightly bound to arise here from the financial side as to whether too high an investment in ventilation systems would be justified for a few cases of extreme meteorological conditions.

In order to judge the possibilities of preventing damage due to sweating, it is first and foremost necessary to understand how the deposition of moisture occurs and the causes of the development of a hold climate. The factors which influence a hold climate are, briefly, as follows:

The temperature and moisture content of the cargo;
The weather at the time of loading;
The water temperature (essential for lower hold);
The air temperature, insolation and radiation (essential for between decks);
The type of ventilation installed, particularly the way it is handled;
The biological reaction of the vegetable cargoes;
The stowage of the cargo, dunnage and packing, etc.

2. Some meteorological conceptions

The atmosphere always contains a certain amount of water in the invisible form of gas. The air can contain in invisible form only a certain quantity of moisture for a given temperature, and the higher the temperature of the air, the greater the quantity of moisture, e.g.

1 cubic metre of air at 0°C (32°F) can absorb, in invisible form as gas, up to 4·9 grams water;

1 cubic metre of air at 30°C (86°F) can absorb, in invisible form as gas, up to 30·3 grams water.

If the air contains the maximum quantity of water possible for a given temperature, we speak of saturated air or of a relative humidity of 100 per cent. If, for example, we have saturated air of 30°C and cool it down to 0°C then $30{\cdot}3 - 4{\cdot}9 = 25{\cdot}4$ grams per cubic metre are precipitated as water. Now surface air is not, generally speaking, saturated with water vapour (except in the case of fog). Over the sea, the most frequent values of relative humidity are between 70 and 90 per cent.

The dew-point is the temperature to which air containing a given amount of water vapour must be cooled down before it becomes saturated, i.e. has a relative humidity of 100 per cent. Deposition of moisture takes place when further cooling below this critical point occurs.

The dew-point of the air over the ocean usually lies between 2 to 5°C (3·6 to 9°F) below the air temperature (the most frequent values of relative humidity being between 90 and 70 per cent as stated above). The dew-point has the characteristic of remaining constant as long as moisture is not added in any form or lost by condensation.

Just as the dew-point does not vary so long as water is not deposited by sweating or humidity introduced from a source of moisture, the vapour pressure also remains unchanged under the given conditions.

What is vapour pressure? Every gas present in the atmosphere exerts a certain pressure, therefore the water vapour invisible as gas exerts a vapour pressure which —like the dew-point—depends essentially on the temperature and the relative humidity of the air.

But the air over the surface of each cargo, particularly vegetable cargoes, takes up its own vapour pressure, which for its part depends upon the temperature and moisture content of the cargo. The interaction between these two vapour pressure values will be referred to later.

The vapour pressure of the open air in the hold, on the one hand, and the vapour pressure near and inside the cargo, on the other, are essential forces in the hold (we are for the moment leaving out of account outside conditions) as regards the development of a hold climate. We should bear in mind that moisture in the form of vapour always flows from the higher to the lower vapour pressure.

3. Condensation phenomena

There are, according to their origin, two basic kinds of condensation, or forms of sweating, and these can be most simply described by known phenomena in everyday life:

Case 1. Cold spectacles become dimmed in winter when their wearer enters a warm, moist room from out-of-doors, because the temperature of the air coming into contact with the cold spectacles falls below its dew-point. The parallel case to this is the ventilation with warm outside air of a cold cargo coming from a cold climate.

Case 2. In warm rooms in our houses where the air is moist, such as the kitchen, the insides of the windows become misted when the outside temperatures are low, because the air in contact with the cold window-panes is cooled down to a temperature below that corresponding to the dew-point of the air in the room. The parallel case to this is a cargo hold filled with moist and warm goods of a ship travelling into a region with a colder climate; the ship-side temperature falls below the dew-point of the hold air and the excess moisture is deposited as sweat on the interior of the ship's side or on the deckhead.

4. Behaviour of closed holds

CASE 1. Voyage from a cold to a warmer climate.

Let us take the case of a ship outward-bound to the West Indies which has in winter taken on a cargo of hardware and machine parts in Hamburg in foggy conditions, the temperature being 0°C (32°F). Owing to bad weather and heavy seas the hatches and ventilators were kept closed. The temperature in the hold to begin with is therefore 0°C, relative humidity reaching 100 per cent, owing to the fog; the dew-point is also 0°C. Not far from the Azores, at roughly lat. 40°N. the stormy westerly weather, which has thus far prevailed, improves. The sun comes out, the temperature of the air rises to 18°C (64°F); relative humidity is only 65 per cent. The crew feel more and more at ease, and it is natural for a conscientious crew to think that they should now get rid of the wet, cold Hamburg air in the hold so as to provide the same improved conditions for the cargo. The hold is ventilated, even vigorously ventilated, as mechanical ventilation is installed. But the well-meant intentions result badly for the cargo; rusting occurs, and in fact the greater the ventilation, the worse it is.

And why? As the water temperature has risen over 7°C (12·6°F) during the passage through the North Sea and up to 15°C (27°F) by the time the ship was in the neighbourhood of the Azores, the sides of the ship have made the air inside the lower hold warmer and warmer. As all the ventilators were closed, this caused the relative humidity of the hold to decrease steadily (the dew-point remains constant at 0°C). The air, which was still saturated in Hamburg, has long ceased to be so. The cargo is in no danger. But if I now ventilate at the Azores with air of 18°C (64°F) and with a relatively low humidity at 65 per cent, the dew-point reaches

11·2°C (52·2°F). This ventilation air now comes into contact with the hardware, which is only warming up slowly, and which may still have a temperature of about 4°C (39°F). The ventilating air, with a dew-point of 11·2°C, playing around the metal thus cools down below its dew-point and deposits all the excess humidity on the metal products. It is merely a question of the intensity of ventilation, whether just a few drops or decilitres* of water form on the cargo and start corrosion.

The type of ventilation shaft at present in general use does not help matters; it concentrates the flow of air almost entirely on one spot so that cargoes stacked high are particularly affected.

Main issue

The following remarks apply to a voyage from a cold to a warmer climate:

(1) There are situations in which the rough-and-ready rule of ventilating as vigorously as possible whenever the weather permits can be disastrous under present-day ventilation systems.

(2) The condition of a vegetable cargo can be adversely affected owing to the cargo's giving up heat, carbonic acid and water. In this case ventilation must be carried out on biological grounds despite meteorological objections. For the above-mentioned reasons, efforts should, however, be made to ventilate carefully; hatch ventilation, which acts over wide areas, still proving the most satisfactory method.

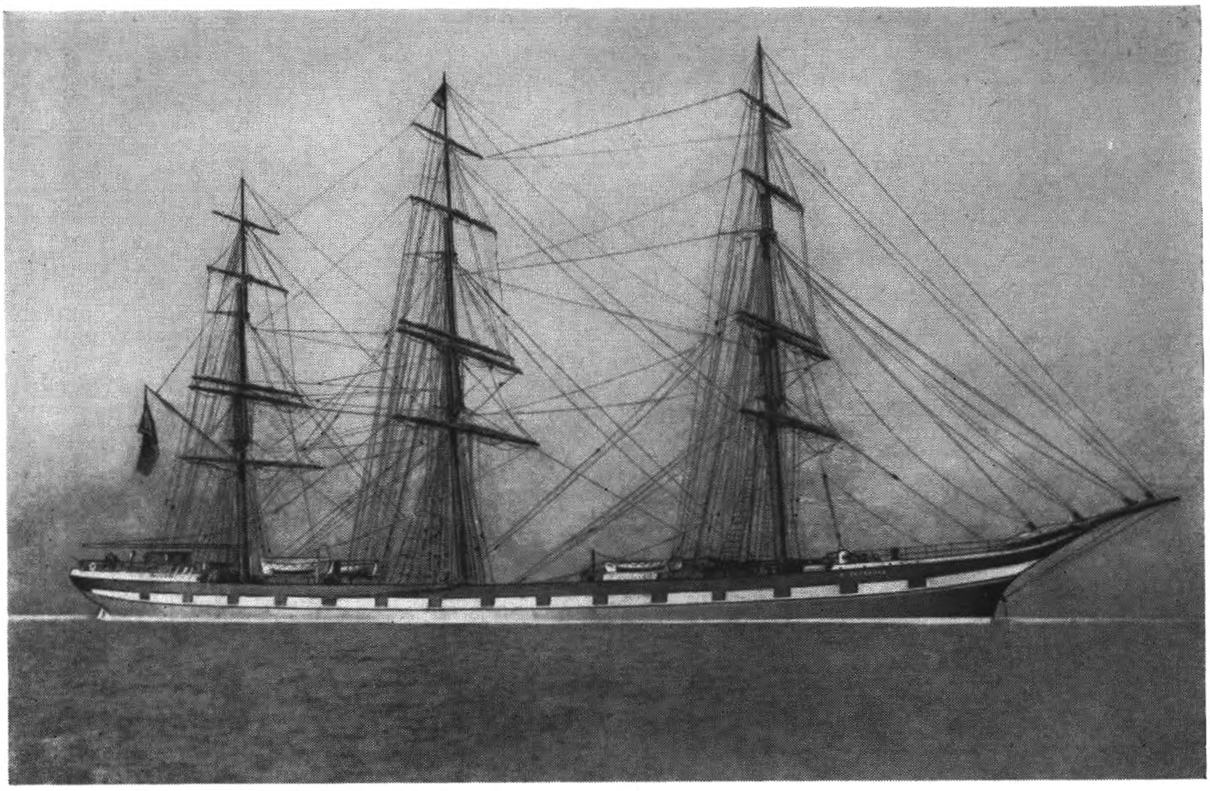
(3) Only when ventilation of the whole hold can be assured, should ventilation be carried out vigorously, i.e. when the flow of air penetrating everywhere drives away rapidly any moisture which may have been present originally. To make sure this happens, shafts different from those commonly in use are needed, namely, air supply ducts extending to the bottom of the compartment and provided, moreover, with horizontal connecting pipes; this system making area ventilation possible both horizontally and vertically.

CASE 2. Voyage from a warm to a colder climate.

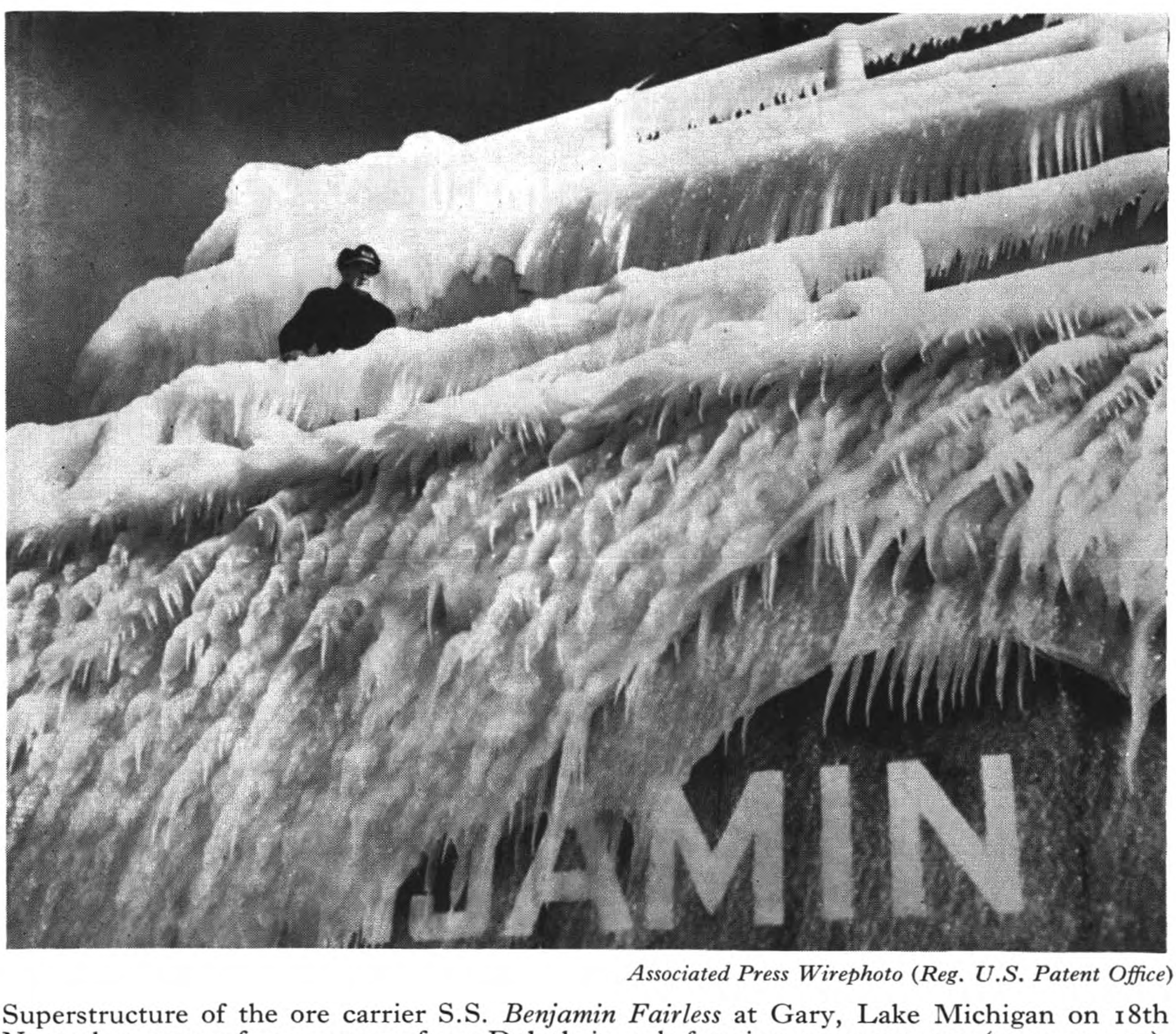
A ship with a warm vegetable cargo is northward bound from the tropics, say from Africa. The temperature in the hold is 30°C (86°F), relative humidity is 80 per cent, thus the dew-point is 26·2°C (79·2°F), i.e. if the air cools down to below this temperature, sweating will occur. If in such a case, the hatches and ventilators are tightly closed, it will be found that when the ship moves into climatic regions with lower water and air temperatures, the sides of the ship will become cooler and with them the air in the hold, particularly near the ship's sides and the deckhead. If the temperature of the hold air near the ship's side falls below the dew-point, in our case by more than 3·8°C (6·8°F), sweating will start on the inside of the ship's sides and on the deckhead and in fact it will occur on an increasing scale as the outside temperature becomes lower, whether it be that of the water, which largely influences the climate of the lower hold, or that of the air, which largely influences the climate between-decks. The condensation water formed runs mainly into the bilge, dropping, however, from the deckhead on to the cargo which, in very serious cases, may also come in contact with moisture from below. In order to prevent damage to the cargo by sweat dropping on to it from the deckhead, the sailor takes the precaution of carefully arranging dunnage and covering the cargo as far as possible. In spite of this care, however, the moisture is able in many cases to penetrate to the cargo, causing it to rot or leading to the risk of fire, as, for example, in the case of a cargo of cotton.

The only remedy against the possible occurrence of damage of this kind is vigorous and timely ventilation to get rid of the humid and warm air in the hold, on the one hand, and to reduce the temperature of the cargo, on the other. But here again there arises the earlier mentioned disadvantages of ventilation shafts, i.e. the concentration of the supply of air on one point. By getting rid of the warm and

* 1 decilitre is equal to about 6 cubic inches.



Blackbraes (see page 80).



Associated Press Wirephoto (Reg. U.S. Patent Office)

Superstructure of the ore carrier S.S. *Benjamin Fairless* at Gary, Lake Michigan on 18th November, 1955 after a voyage from Duluth in sub-freezing temperatures (see page 75).

(*Opposite* *page* 65)

Mr. W. B. Newman, State Deputy Director of Meteorology, presenting Australian "Excellence Award" to Captain F. N. Curphy of M.V. *Idomeneus* (see page 79).

Clayton Photos, Ltd.

Presentation of barograph to Captain Watts (see page 78).

From left to right: Captain E. Gleave, Commander C. E. N. Frankcom, Dr. J. M. Stagg, Mr. A. J. Hutcheson and Mr. A. M. Thomson (Senior 3rd and Senior 1st Officers of *Sylvania*), Captain F. G. Watts, Mr. D. A. Davies (2nd Officer, *Sylvania*), Captain J. R. Radley, Mr. D. E. James (Chief Officer, *Sylvania*), Mr. A. Honey.

humid air, deposition of moisture on the ship's sides is certainly prevented, but now the zone of condensation is transferred from the ship's side on to the surface of the cargo and, owing to the cooling of the surface of the cargo, it possibly even penetrates inside it. The danger of this is particularly great at precisely those points where cooling takes place too spontaneously, i.e. in the neighbourhood of the ventilation shafts, and surface or interior sweating may lead to heating of the cargo near the ventilation shafts.

Too often there are times when the forces all conspire against the sailor; for instance, there may be no wind so that natural ventilation is simply not possible, or in northern latitudes the weather may be so bad and the seas so high that even mechanical ventilation is not possible because the ventilators have to be kept closed.

All-weather cowls, as they are called, have already been installed on many vessels and these are intended to allow continuous ventilation in good or bad weather. I have, however, heard of cases in which those with experience of these cowls have found that further improvement is needed before they are fully capable of serving their purpose.

Main issue

The following remarks apply to a voyage from the tropics to higher latitudes:

1. Generally speaking, it is necessary to have thorough ventilation of the whole hold introduced as early in the voyage as possible, and so as to make ventilation effective everywhere, such ventilation should include hatch ventilation when the weather permits.

2. In order to avoid dangers arising when outside ventilation is not possible, owing to absence of wind, mechanical ventilation should be provided.

3. So as to make ventilation possible whatever the weather, it is necessary that all-weather cowls should be installed; the design of cowls needs to be improved.

4. The ventilation system should be constructed so that a horizontal and vertical flow of air round the cargo is ensured, for it is no good driving the humid and warm air away from the more exposed surfaces of the cargo and leaving it to stagnate in the many "dead" spaces in the interior of the hold, where it will give rise to sweating.

5. Main climatological danger zones

Cargoes, and this is especially so in the case of vegetable cargoes, are liable to become damaged on a voyage from the tropics. The Seewetteramt has made a special climatological study of the main danger zones on the chief shipping routes. Danger zones are, for example, sections of routes in which the water temperature, which influences conditions in the lower hold, suddenly falls, or varies completely in magnitude in different years. The study of these zones and their variations in magnitude was made possible by the fact that for nearly a century German shipping has been keeping meteorological records; the Seewetteramt thus has over ten million sets of observations available on punched cards.

The Seewetteramt studied in particular the water temperature, the temperature and humidity of the air, and also the effect of weather situations on the climate of holds. The results are to be given in the publication *Science of Ventilation* (*Lüftungslehre*).

This special study of climatic conditions will direct the attention of ships' officers to the main danger zones for cargoes. The first danger zone for vessels homeward bound from Africa, for example, occurs before even the Bissagos Islands are reached. Off the coast of West Africa lies the region of cold upwelling water, well-known to ships' officers, the existence of which is due to the effect of the north-east trade-winds. This cold-water area moves during the seasons with the Atlantic high-pressure region and reaches its most northerly position in August and its most southerly in February. Whereas a northward bound ship passing

Cape Palmas in February at 12 knots reaches the cold-water area only one day afterwards, in summer the area is often not reached by such a ship until after the third day, the decrease in temperature in two days averaging about 8°C (14·4°F).

Now the intensity of the cooling down of the water varies considerably in the same month in different years; in many years the cold-water region is restricted to a more or less coastal zone, in others it reaches far out to sea.

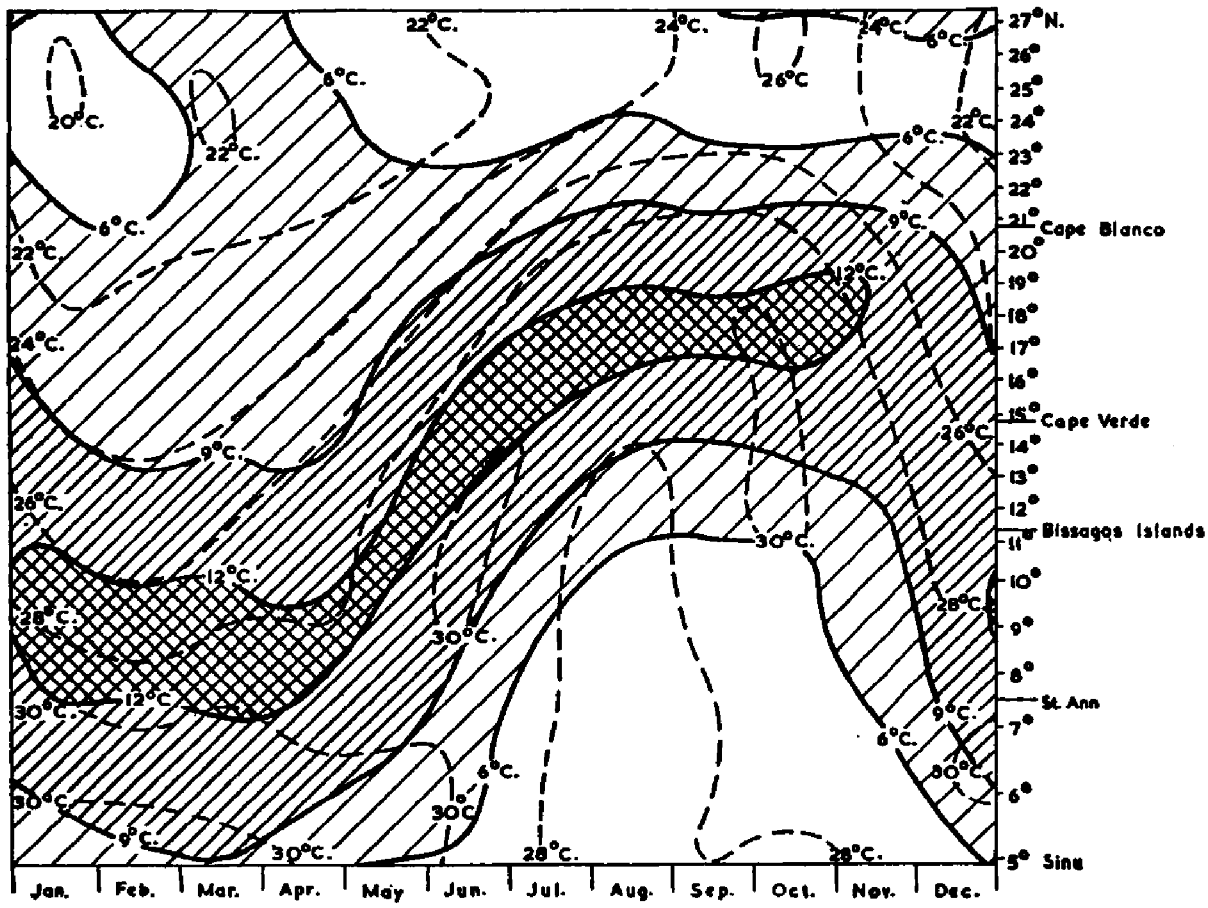


Fig. 1.

Diagram for homeward-bound ships from West Africa showing extreme drops of sea temperature possible in the individual months, thus illustrating the risk of danger to cargoes through sweating due to the conditions.

The solid isolines given in Fig. 1 show the fall in temperature possibly in the following 24 hours for a 12-knot ship. Whereas the drop in temperature in mid-March for a ship in 7°N. averages 6°C (10·8°F), in many years it may be as little as 3 to 4°C (5·4 to 7·2°F)—a drop of no harm to the cargo, or it may, as the diagram shows, reach over 12°C (21·6°F) in 24 hours in many years. In such a case very intensive ventilation together with hatch ventilation can at best prevent damage to the cargo.

If ships' officers hitherto knew nothing of such fluctuations of intensity of the cold-water regions, it is not surprising that with the same careful treatment of a cargo of the same quality, i.e. with the same water content, the cargo in March one year remained in good condition, whereas in March another year severe sweating occurred. We still do not know enough about the causes of the varying development of the region of upwelling water. They are most likely to be found in the large-scale atmospheric circulation.

Fig. 2 shows danger zones for May. The danger zones shown are those with drops in water temperature lasting at least 24 hours and occurring over a distance of 300 sea-miles, i.e. about the day's run of a 12-knot ship; the danger is graded according to the intensity of the drop in temperature (indicated by differently drawn arrows). It will be seen how extensive and intensive the development of danger zones in the oceans may be.

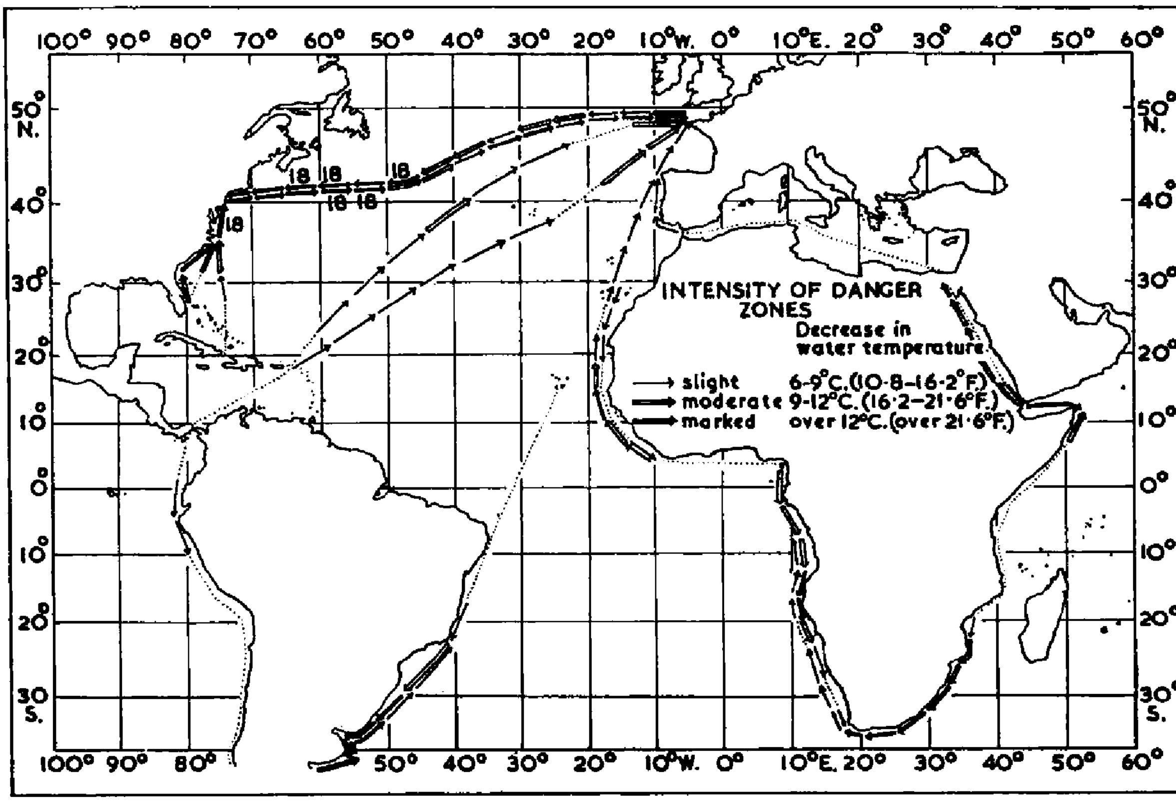


Fig. 2.
Extreme drops in sea temperature in May.

Cargoes in ships passing quickly through extensive zones of this kind are exposed to greater danger than those travelling slowly, since in the latter case the drop in temperature, and thus sweating too, takes place much more gradually.

Main issue (climatological danger zones)

(1) Measurement of the water temperature should be carried out regularly before reaching and whilst passing through all danger zones. This is the only safe way of obtaining information about the intensity of the drop in temperature.

(2) Early ventilation before the danger zones are reached.

(3) In particularly serious cases of drops in temperature and in the case of enclosed danger zones, e.g. the zone off the African coast, ships can travel round the region without much time being lost.

A drop in *air* temperature caused, for instance, by an outbreak of polar air on the North Atlantic route, of course exposes the hold between decks to the same dangers as those which threaten the lower hold when a drop in water temperature occurs (*see* Fig. 3).

The inclusion of warnings of outbreaks of cold air in wirelessed ocean-weather reports would be of great help here. It would then be possible for those concerned to take suitable measures as regards ventilation before the arrival of the cold air.

6. A cargo creates its own climate

So far we have discussed the case of a voyage into a warmer climate with industrial and vegetable goods, and the case of a voyage into a colder climate with the main danger zones. We should now consider another important factor.

The following points should be remembered:

(*a*) the vapour pressure of the free air in the hold depends upon the temperature and relative humidity of the air;

(*b*) the vapour pressure in and just above the cargo is, on the other hand, dependent upon the temperature and moisture content of the cargo, and

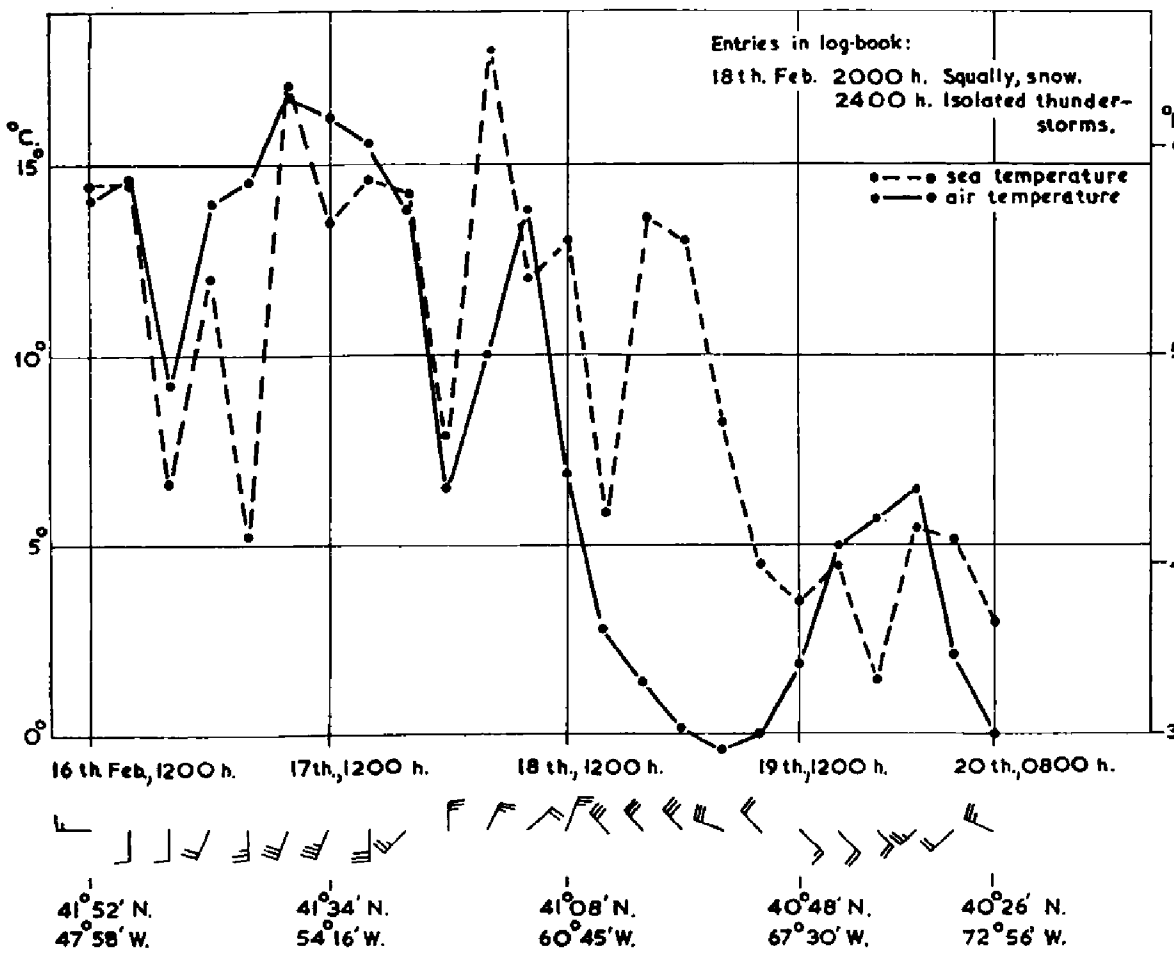


Fig. 3.
S.S. *Rhein*, 16th-20th February 1908, Bremerhaven to New York.

(*c*) when these two vapour pressure values are not the same, moisture always flows from the higher to the lower vapour pressure.

Every cargo, particularly a vegetable cargo, can only adapt itself slowly to the meteorological conditions of the air in the hold. Very thorough ventilation must be carried out before the climate of the cargo as a whole, e.g. its temperature, responds to it.

If, for example, we have a bulk cargo of wheat with a temperature of 30°C (86°F) and we ventilate intensively and constantly with outside air of 20°C (68°F) which is thus 10°C (18°F), lower than the wheat, then 10 days later the temperature of the shipment of wheat will have dropped as follows:

at a depth of 5 cm, 8·5°C (15·3°F)
at a depth of 10 cm, 7°C (12·6°F)
at a depth of 20 cm, 4·5°C (8·1°F)
but at a depth of 50 cm, only 0·5°C (0·9°F).

These values have, however, to be amended and supplemented by series of measurements taken on moving ships, but they show how slowly the climate of the cargo reacts to an outside influence.

Every vegetable cargo creates, according to its character, temperature and moisture content, a vapour pressure inside and close to its surface. If the vapour pressure of the surrounding air is the same, the moisture content of the cargo and hold air are the same (the ideal state).

If the vapour pressure of the air in the hold is higher than that over the cargo, the cargo absorbs moisture from the hold air; if conditions are reversed, i.e. if the vapour pressure over the cargo is higher than the vapour pressure of the air in the hold, or, moreover, higher than that of the ventilation air, the cargo acts as a source of moisture and it gives off moisture to the surrounding air.

In a closed hold a vapour pressure balance between the cargo and the hold air is quickly established, and as the moisture and heat content of the cargo is incomparably higher than that of the hold air, the cargo to all intents and purposes dictates the temperature and also, via the vapour pressure, the relative humidity of the air in the hold.

Whereas, for example, in a hold of 90,000 cubic feet which is to be half-filled with wheat having the moisture content usual in trade of 12 per cent, the free air in the hold at a temperature of 25°C (77°F) contains only 20 litres of water in invisible form, the shipment of wheat contains 100,000 litres of water. In this example, the vapour pressure is such that we have a dew-point of 19°C (66°F). If the temperature of the ship's side falls below this 19°C owing to a decrease in water or air temperature, the air in contact with the ship's sides will also cool down to below this critical point, the dew-point, and sweating will occur on the ship's sides. Whereas in the extreme case the condensation of the 20 litres of moisture in the hold air would cause no damage, since the water would flow off straight into the bilge, the first appearance of moisture on the ship's sides through sweating means the starting up of the " humidity engine " in regard to the wheat: with the deposition of moisture on the ship's sides, the vapour pressure drops, also the dew-point of at least the air near the ship's sides; the shipment of wheat for its part tries to re-establish moisture equilibrium by giving off moisture from its reservoir of water content, but, however—*ceteris paribus*—does not succeed, since in addition moisture from the wheat is evaporating into the hold air and condensing on the cold ship's side or ceiling of the hold. That is to say, if the process of sweating is once started, the only way to put a stop to it is by vigorous ventilation of the hold. Calculating on the basis of the moisture content of 100 tons of wheat, one can find out how much water may be liberated from the wheat by this slow but constant flow of moisture.

The lower the temperature of the ship's sides drops below the dew-point of the hold air, the more intensive will be the flow of moisture; moreover, the higher the hold is stacked with cargo, the greater the flow, for the nearer the surface of the cargo is to the cold ship's sides or the ceiling, the greater will be the drop in vapour pressure.

A further point: the higher the temperature of a cargo, the higher will be its equilibrium dew-point at its surface with the surrounding air; and, in particular, the higher the moisture content of the cargo, the higher will be this dew-point. If, for example, we have a cargo of cotton which has a temperature of 30°C (86°F) and the moisture content usual in trade of 8·5 per cent, the equilibrium dew-point with the surrounding air is about 23°C (73°F). If our cotton, on the other hand, has a moisture content of 12 per cent, the equilibrium dew-point is 27·5°C (81°F), i.e. 4·5°C (8·1°F) higher. Whereas in the latter case the temperature of the ship's sides need drop no farther than 2·5°C (4·5°F) before sweating occurs, we have a margin of 7°C (12·6°F) in the case of the cargo with the moisture content usual in trade. It is obvious how much more difficult it is to transport into colder climates cargoes with a higher moisture content than those with the moisture content usual in trade.

Fig. 4 shows the ventilation advisable for cotton with a moisture content of 7·5 per cent, on the one hand, and of 12 per cent on the other. Whereas in the case of voyages into colder climates (and with an initial temperature of 30°C (86°F) relative humidity of the outside air being 90 per cent), cotton with the moisture content usual in the trade must not be ventilated until the outside temperature has dropped to 24°C (75°F) so that the cargo does not absorb extra moisture from the ventilation air, ventilation must begin at once in the case of cotton with the higher moisture content, and it is hoped in this way to succeed in keeping the cargo in good condition during the voyage.

The same applies to all vegetable products, whether cocoa or coffee, wheat or barley, or fruit; a knowledge of the moisture content of a cargo is thus of decisive importance in determining the proper course to follow in regard to ventilation.

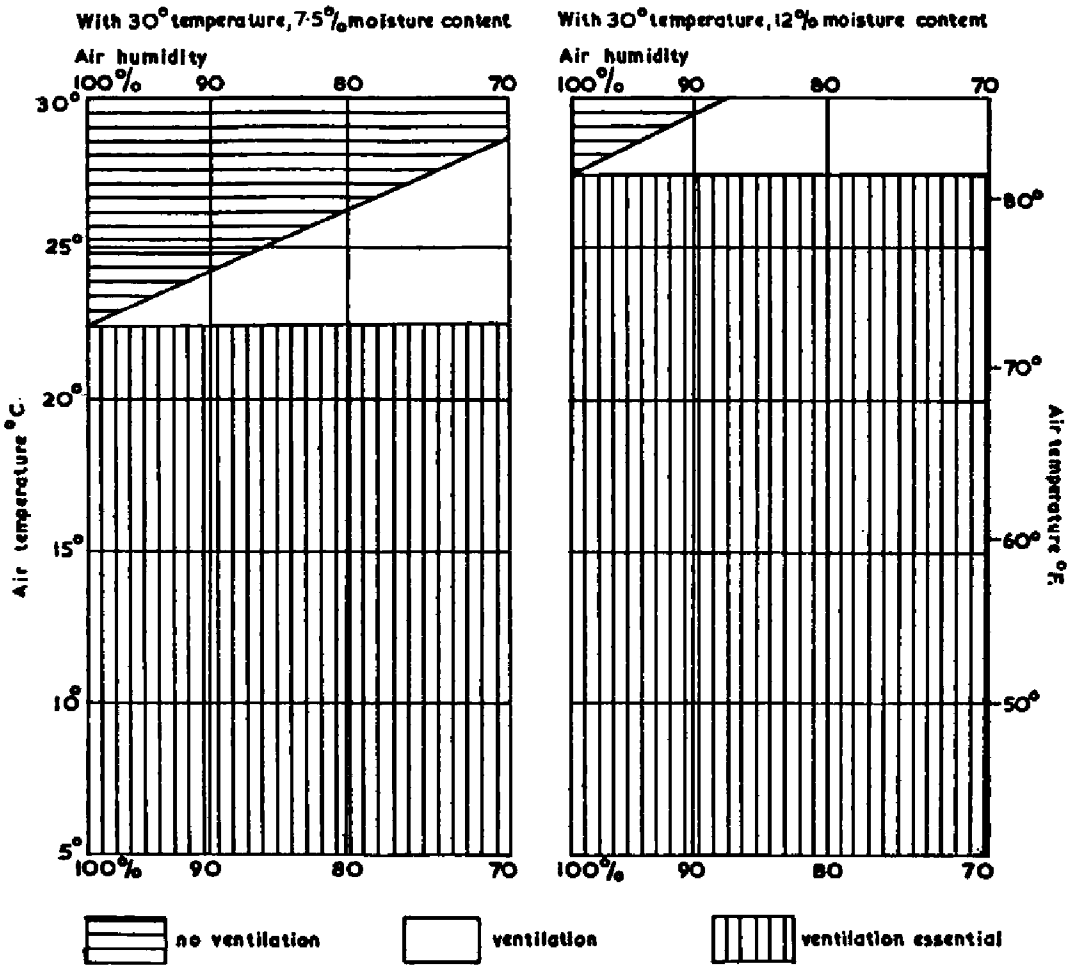


Fig. 4.
Recommendations for the ventilation of cotton.

So far as I know, they get over the difficulty in North America by largely predrying vegetable cargoes to the moisture content usual in trade. How much easier it is to deal with dry goods in the case of a voyage into a cold climate is shown by Fig. 5, which illustrates the ventilation measures recommended by the Seewetteramt to a building firm wanting to ship valuable wooden boards which had been predried to 8 per cent. During transport the timber was on no account to be allowed to absorb moisture. On the basis of our humidity equilibrium diagram and the climatological conditions on the route we were able to advise the firm not to ventilate at all, even in winter in the northern hemisphere, until at least abreast of the Canaries (although in this case the ship would have to pass through the danger zone off the coast of West Africa.)

The author is firmly of the opinion that much of the damage to cargoes is to be attributed simply to too high a water content of the cargo. Matters are further aggravated by the biological component in that in the case of vegetable products, the higher the moisture content of the product, the greater is the liberation through respiration of moisture, carbonic acid and heat.

Main issue (climate of the cargo)

(1) A moisture content of a cargo higher than that usual in trade makes it far more difficult to keep the cargo in good condition during the voyage.

(2) Correct handling of ventilation is difficult when the moisture content of a cargo is not known. The experience of ships' officers is based upon cargoes with the moisture content usual in trade.

(3) In the case of a cargo with a higher moisture content than that usual in trade, the danger of sweating increases when the hold is full.

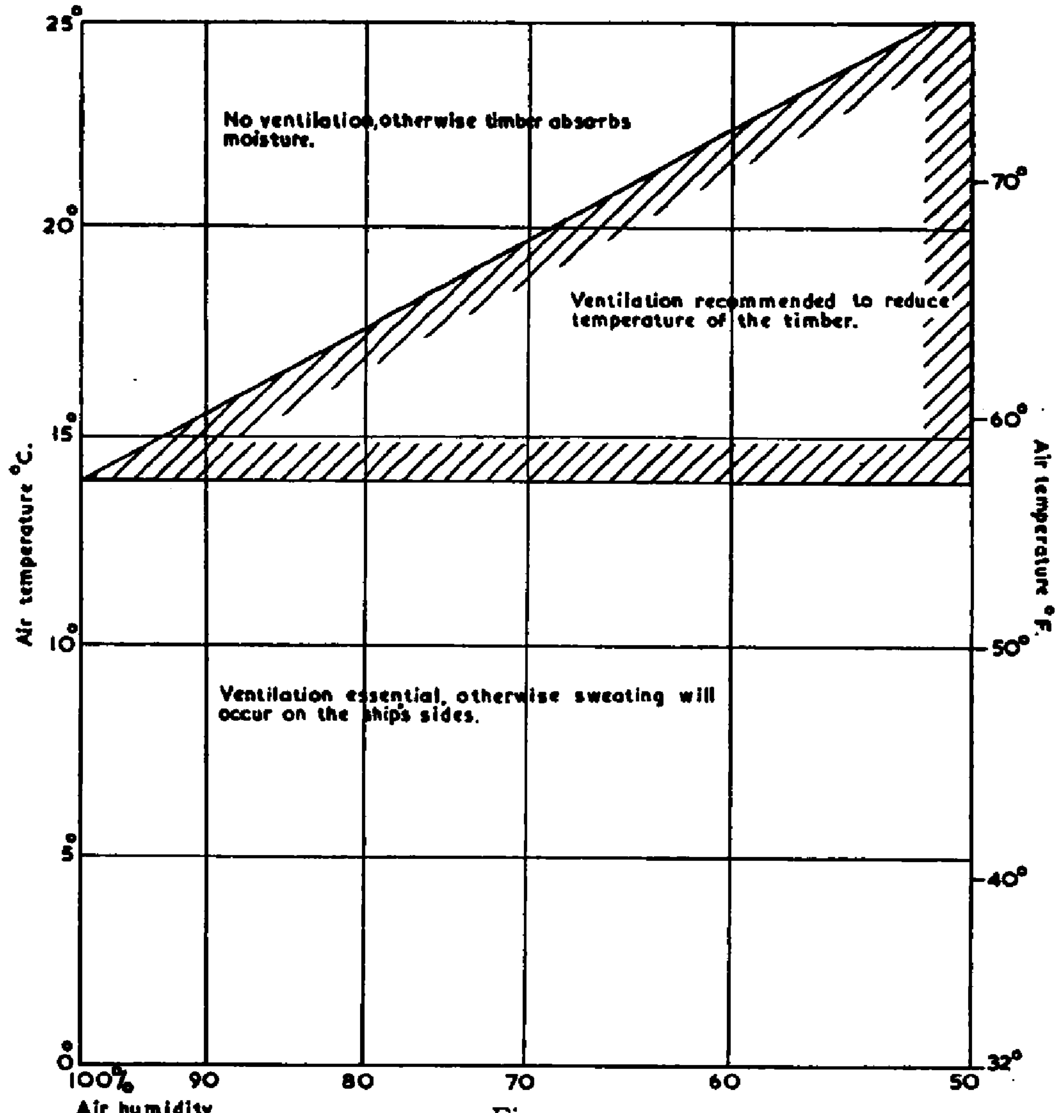


Fig. 5.

Humidity equilibrium for timber of temperature 27·5°C and 8 per cent moisture content.

(4) It should be made possible for ships' officers to check simply and quickly the moisture content of a cargo to be taken on board.

There is not space in this article to examine the question of the interchange of moisture amongst different types of cargo in a hold. Uncontrollable circulation of moisture from shipment to shipment develops in the interior of the hold if there is not vapour-pressure equilibrium between the shipments, which is particularly the case when one of the shipments has too high a moisture content. These small-scale circulations inside the hold may also lead to an immense amount of damage low down in the hold, and this damage in its turn may mean the sparking off of further damage in the whole hold. The only remedy here is again the installation of a piped ventilation system extending vertically and, if possible, horizontally over the whole hold.

Summary

The cargo and surrounding air endeavour to establish a moisture equilibrium; the cargo, owing to its high heat and moisture content, largely determining the climate in the closed hold.

The outside world with its water and air temperatures and insolation and other radiation, modifies, via the heat-conducting sides of the ship and under deck of the hold, the climate inside the hold, particularly at these contact surfaces, which are the main danger zones in the hold, and when they cool down to below the dew-point of the hold air, condensation occurs on these contact surfaces. The ensuing

ventilation should not occur too spontaneously, as otherwise the danger zone near the ship's sides where sweating is liable to occur, may be transferred artificially to the surface of the cargo, or may even be transferred into the interior, since the cargo itself, particularly inside it, only responds very sluggishly to ventilation, and thus moisture may accumulate not far below the surface.

Thus, generally speaking, what matters is not vigorous, but thorough ventilation. This does not mean ventilation which, although vigorous, only renews the air in the hold from the surface of the cargo to the deckheads, so that serious damage may still occur inside the cargo or anywhere in a dead zone low down in the hold—but a ventilation system which is effective over wide areas (this can often be ideally achieved by hatch ventilation) and which extends in the vertical plane to the floor of the hold. With thorough ventilation there is absolutely no need for an intensive flow producing considerable movement of air in the hold, for the rate of evaporation of the moisture content of the goods into the hold is not at all high. The important thing is that there should at least be circulation of the air both horizontally and vertically from all sides in the case of those goods not already within range of the ventilation air. This can be achieved by extending the ventilation shafts to the floor of the hold, which would not take up much room, and by placing the air-discharge openings at a different height.

The capacity of the ventilation motors should certainly be great enough to deal with any eventuality, but their full power need not, by a long way, always be used for ventilation. Careful ventilation leads in general to much better results.

Ventilation should be no more than absolutely necessary in many cases, so as to prevent the cargo from absorbing moisture from the ventilation air, or—and this is practically always applicable—when industrial goods which are cold when loaded are transported to the tropics.

Vegetable cargoes should never be placed too near the ship's sides or deckhead of a hold, so as to prevent too great a drop in the dew-point between the last named and the cargo, since the intensity of the flow of moisture also depends upon this drop. The air between the cargo and sides of the hold provides, moreover, excellent insulation. Apart from these considerations, a cargo stacked too high impedes ventilation.

Ventilation carried out at the discretion of those concerned occurs mainly in the case of goods with the moisture content usual in trade and in normal climatic conditions.

A moisture content higher than is usual exposes the goods—if one knows nothing about it—to very great danger.

In the case of climatologically dangerous zones, regular water-temperature measurements should be taken in the vicinity of and whilst passing through these zones in order to obtain a picture of the intensity of the drop in temperature. Besides correctly timed ventilation and cooling of the goods, navigational measures sometimes help.

Warnings in wirelessed ocean weather reports of marked outbreaks of cold air would enable ships' officers to ventilate holds suitably and in good time.

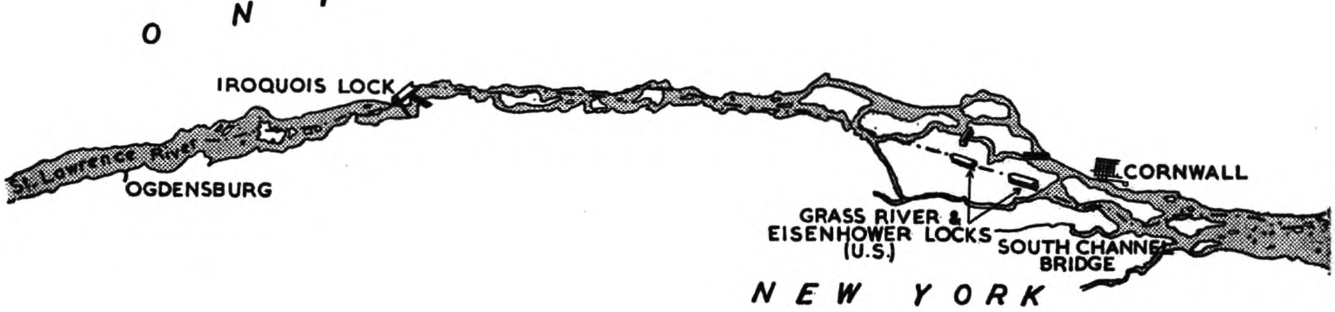


Fig. 1. Locks of the

The St. Lawrence Seaway and Climate of the Great Lakes Region of Canada

By Captain F. G. C. Jones

(Port Meteorological Officer, Cardiff)

The waterways of Canada are one of the most vital elements of its national existence, and the Great Lakes, together with their outlet to the sea through the St. Lawrence river, form the most important system of waterways on the continent and are the most notable fresh water transport system in the world.

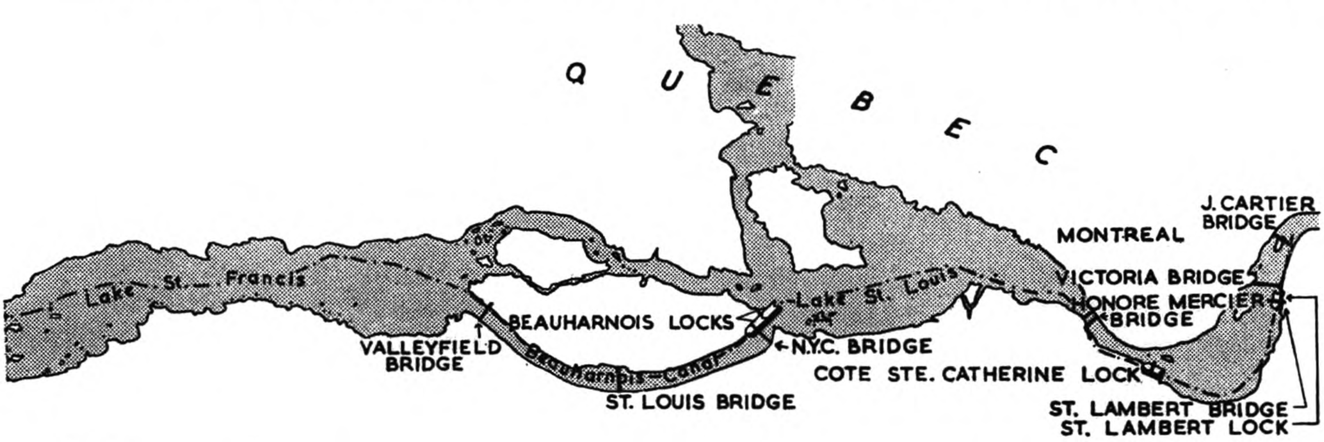
The history of water transport in Canada may be said to date back to the year 1535 when Jacques Cartier was turned back by the Lachine rapids from his attempt to find a North-West passage from France to the Far East. Exploration, settlement and finally the commercial development of Canada followed the course of the rivers and waterways, and in order to provide deep channels and avoid the many rapids encountered, a great system of canals and locks has been gradually developed. The culmination of these works will be seen when the new St. Lawrence Seaway comes into operation in the spring of 1959.

The Seaway will provide navigation for vessels of 27 feet draft from Montreal to the main Lake ports of Canada and the U.S.A. (*see* Figs. 1 and 2). A system of dredged channels, locks, canals and natural waterways will extend from the sea for 2,200 miles into the interior of North America, rising from sea level to a height of 602 feet at Lake Superior (*see* Fig. 3). Incorporated in the design of the Seaway are new hydro-electric schemes which will develop over 2,000,000 horse power of energy for the further development of this great industrial area.

The first recorded improvement for the benefit of water transport in this instance was in the year 1700 when a $1\frac{1}{2}$-foot canal was constructed at the Little River St. Pierre near Lachine. Further short canals having depths of 2–3 feet were afterwards constructed at the edge of the Lachine rapids, and in 1821 the first Lachine canal proper was constructed, giving a depth of 5 feet. This canal has been successively improved, and now has a length of $8\frac{3}{4}$ miles, a depth of 14 feet, and a total rise of 50 feet, leading from Montreal harbour to Lake St. Louis.

The history of navigation from Lake St. Louis to deep water at the head of Lake Ontario is very similar to that of the Lachine section of the river, successive short canals and locks were built to by-pass the rapids, and as the demands for transportation increased these canals were enlarged and deepened until by the year 1908 a system for 14-foot navigation existed from Lake Ontario to Montreal. The water level of Lake Ontario is 225 feet above that of Montreal and until the inauguration of the new Seaway this has been overcome by a series of 21 locks. The new Seaway will accomplish this lift with seven locks.

The next barrier to navigation between the lakes is the 326 feet difference in level between Lake Erie and Lake Ontario at the Niagara peninsula. Here a canal



St. Lawrence Seaway.

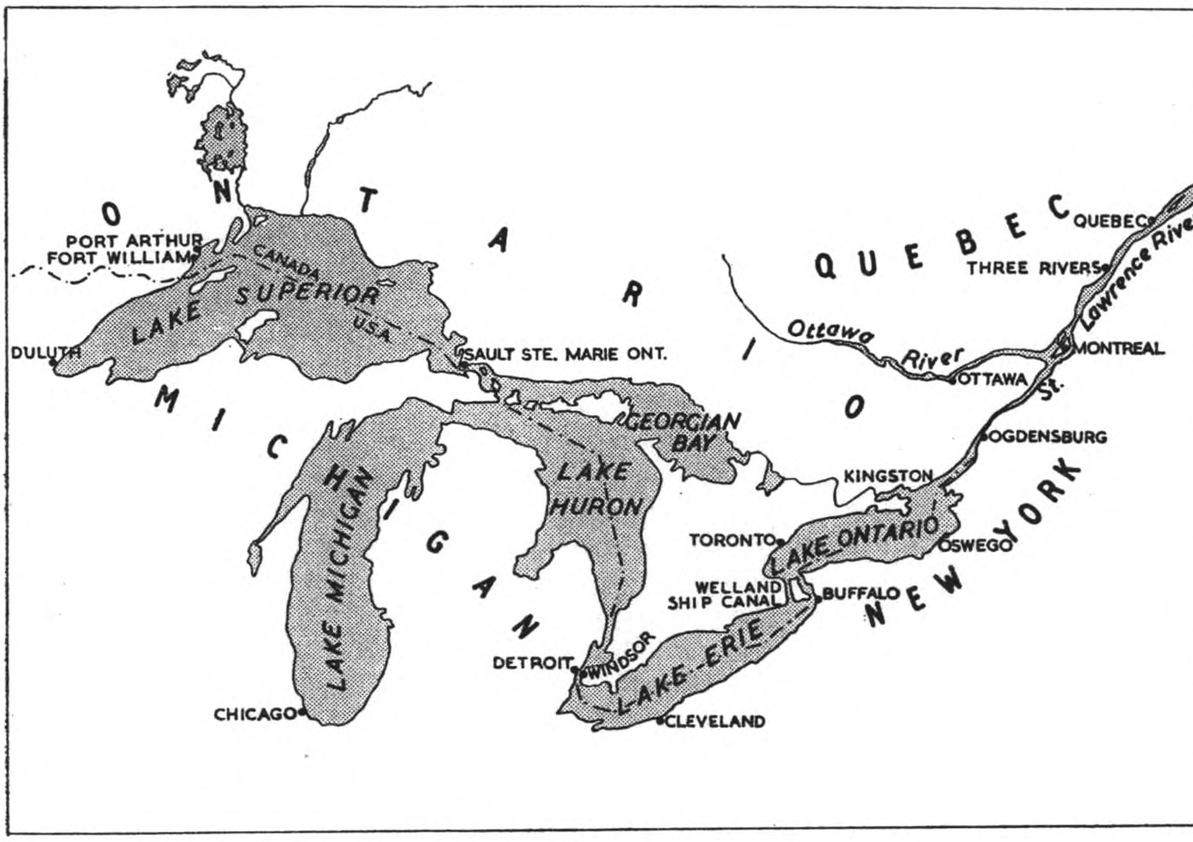


Fig. 2.
Map showing the whole length of the Seaway.

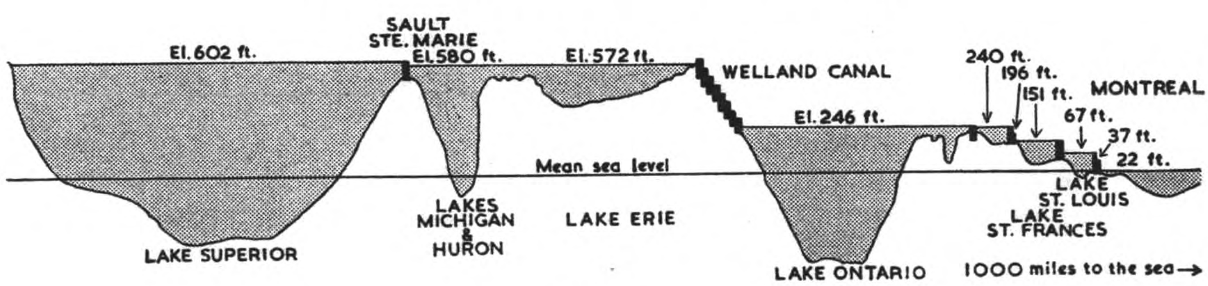


Fig. 3.
Water level profile.

was first constructed between 1824 and 1833, which has been successively improved until in 1887 it provided passage for vessels of 14-feet draft. The present Welland canal was commenced in 1913. Construction was halted during the First World War and this canal was completed in 1932, the lift of 326 feet is accomplished through eight locks, and the channel will be dredged to 27 feet to coincide with the opening of the Seaway in 1959. The Welland canal opens communication from the sea to the great industrial cities of Detroit and Chicago.

A further short canal and locks at Sault Ste. Marie between Lake Huron and Lake Superior complete the chain and open communication to the Canadian Lakehead ports of Port Arthur and Fort William. From these ports much of the wheat produced in the prairie of Canada is shipped.

The navigation of the Great Lakes by deep sea shipping is no new event; regular services have been maintained from the Lake Michigan ports to Europe during the navigation season since 1933, and since the Second World War this trade has greatly increased, although the 14-feet draft limitation has confined the trade to vessels of about 2,000 tons deadweight.

Upon the lakes, great bulk carriers of up to 20,000 tons deadweight ply between the inland ports. These vessels are not suitable for deep sea service but the deepening of the Seaway will give them access to the St. Lawrence river ports and also to the iron ore supplies of Labrador through Seven Islands; these supplies of ore are urgently needed by the expanding industrial areas of Canada.

This brief description of the St. Lawrence system leads one to ask " What of the weather conditions likely to be experienced in this area? "

The great land mass of Canada has many varieties of climate. The western seaboard has a temperate climate, the principal source of air being from the Pacific Ocean where the North Pacific current plays its part in providing a supply of warm, moist air to the southern coast of British Columbia, as does the Gulf Stream North Atlantic drift to our own islands and northern Europe. Unlike Europe, however, the main area of Canada is cut off from the western seaboard by high ranges of mountains which hinder eastward movement of the warm and moisture laden air from the Pacific. East of the Rockies therefore the climate is far more extreme, hotter in the summer and far colder in the winter, and since the prevailing winds are from the west and the eastern seaboard of Canada is surrounded by the cold waters of the Labrador current, the climate of the eastern maritime provinces is also extreme.

To the northward lie the desolate regions of the North and North-West territories which stretch to within 490 miles of the Pole. Even under the extreme conditions of this region life is found in the sheltered valleys; the musk ox, caribou and abundant bird life find sustenance on lichens, mosses and other plants which are able to maintain growth in a cold soil that attains a temperature of only about 43°F in midsummer for a short period.

The climate of the Great Lakes and St. Lawrence basin lies between these two extremes. The lakes have a tempering effect on the climate, especially since they are seldom completely frozen over in the winter months owing to the great depth of water they contain. In rough weather in the colder months, however, heavy icing of shipping on the lakes can occur, as can be seen from the photograph opposite page 64. One can trace the influence of the Great Lakes on the temperature gradient: they cause a slight northward swing of the isotherms in October by their retention of summer heat, and this bend becomes more and more pronounced until January, after which the effect diminishes and after March they cease to provide warmth. This is a region subject to drastic changes of temperature and prevailing weather with the changes of air mass from day to day or week to week.

The region is traversed by:

(*a*) Dry continental polar air from the north.

(*b*) Milder Pacific polar air from the west.

(*c*) Continental polar air on recurving tracks from the south and intermediate in character to (*a*) and (*b*).

(*d*) Subtropical air carrying much water vapour and generally warm for the season.

The frequent changes of air mass are commonly accompanied by precipitation. Rain may be expected on 10 to 14 days each month from May to October, and rain or snow on 14 days for each of the winter months. The most characteristic feature of the climate is the passage of a constant succession of depressions through the region. The main tracks of depressions from the northwest, west and south all converge in this area, with the result that the weather experienced at all times of the year is the most variable in the American continent. Strong winds are frequently experienced and there is much fog and rain to obscure visibility on the Lakes.* It is even not quite unknown for the region to be affected in the late

**Editor's Note.* In view of the vast size of these lakes of the North American continent, it seems obvious that during gale or storm conditions heavy seas will be encountered. This is borne out by a recent report in Lloyd's List of a 10,000 ton turbo-electric steamer in ballast which " broke in two and founded during heavy weather in Lake Michigan with a loss of 37 lives ".

summer months by tropical storms passing inland from the Gulf of Mexico or Atlantic seaboard.

It is interesting to note that not only do we in Great Britain import vast quantities of foodstuffs and minerals from this region of Canada, but also much of our weather as well. One of the major problems in extended forecasting of the weather in the British Isles is connected with the behaviour of depressions which pass through the maritime provinces of Canada. In the year 1950, of 106 " major " depressions which were significant enough to have formed at least one closed isobar and which passed through the area between 40 and 60 degrees North latitude and 50 to 80 degrees West Longitude, 65 had originated to the westward and passed over or near the Great Lakes area, and of these 65 depressions 25 moved out into the North Atlantic.

The major hindrance to navigation in the St. Lawrence area is the formation of ice of sufficient thickness to impede navigation. The Great Lakes seldom if ever freeze over completely, but shore fast ice is formed in the shallow waters at the edge of the lakes and although icebreakers are used to clear the channels and assist vessels which might otherwise become fast, most of the harbours are frozen over and navigation only possible from the beginning of April to mid-December. At the end of the season there is always the danger that an early winter may freeze the canals and locks, trapping vessels in the lakes even while the channel from Montreal to the sea is still open. It is noted that on 16th December, 1958, ocean going ships were still held by ice in the Lachine canal, and that 17 ocean going vessels were berthed in Montreal harbour waiting for icebreakers to clear a path to open water.

The date of freezing of lakes and rivers will depend on the daily mean temperature, the depth of water, and the strength of the current. Ice will begin to form in the shallow water near the shore almost immediately after the daily mean temperature has fallen below 32°F, but in deeper water there will be a considerable lag in the formation of ice, since during the summer months a great volume of water has been heated to a considerable depth.

The break up of ice in the spring will depend not only on the temperature and wind, but on the depth of insulating snow cover which has formed on top of the ice. The first break will usually form at the shore, where the run-off of warmer water from the land melts the snow and ice. After the first break the ice gradually becomes porous, is broken up by the action of wind and current and finally melts.

The navigation season in the river approaches to Montreal usually commences in the second or third week of April and ends in the first or second week of December. Occasionally, entry into the Gulf of St. Lawrence from the Atlantic through Cabot Strait may be impeded by the rafting of ice floes forming a " bridge " across the strait until early in May.

In view of the great mining and industrial development which has taken place in recent years on the North shore of the Gulf of St. Lawrence, much attention is now being paid to the problem of winter navigation in the Gulf and St. Lawrence river estuary up to Quebec.

Survey of conditions over many years have indicated that, with the assistance of modern technological aids, ships strengthened for navigation in ice should be able to navigate the area with reasonable safety throughout the winter months. In the Gulf a system of air reconnaisance, with radio-telephonic communication and the assistance of icebreakers when necessary, would enable vessels to navigate through the open channels between the ice floes.

The river estuary presents rather a different problem, as the obstacle here consists mainly of broken up drifting ice, but the authorities are hoping that with the assistance of ice breakers, air reconnaissance, ice reporting and forecasting, navigation up to the harbour of Quebec will be possible throughout the winter. The economic advantages of extending the navigation season in the area is considerable.

The dates of arrival of the first ship from overseas at Montreal, and the sailing of the last ship of the season for the last 10 years, are given below.

Year	First Arrival Montreal	Last Departure Montreal
1949	7th April	15th December
1950	18th April	7th December
1951	13th April	13th December
1952	13th April	10th December
1953	2nd April	20th December
1954	30th March	15th December
1955	5th April	16th December
1956	2nd April	17th December
1957	3rd April	18th December
1958	30th March	*

* The season 1958-59 was exceptional and many ships were beset before the normal closing date. The last one of these was released with icebreaker assistance on 14th January, 1959.

In conclusion, the following climatological data may be of interest to the reader.

Place	Temperatures (°F)				Total Precipitation				
	Mean		On record		Average (inches)			Average number of days	
	Jan.	July	Highest	Lowest	Jan.	July	Annual	Rain	Snow
Vancouver ..	36·2	63·7	92	+2	8·57	1·22	57·38	168	12
Craig Harbour.. N.W. Territory	—22·0	41·0	61	—49	0·38	0·93	9·05	17	40
Fredericton, N.B. ..	13·5	66·1	101	—35	3·87	3·53	42·80	108	55
Toronto ..	22·7	68·9	105	—26	2·71	2·95	32·18	107	49

INTERNATIONAL GEOPHYSICAL CO-OPERATION

The International Geophysical Year, which officially began on 1st July, 1957, terminated on 31st December, 1958. During that " Year ", as mentioned in earlier numbers of *The Marine Observer*, voluntary observers aboard British ships have contributed a large number of " routine " meteorological observations as well as a gratifying number of special observations of aurora, which is one of the phenomena which are being specially studied by scientists as part of the I.G.Y. programme. In addition to the observations from our Selected and Supplementary ships, over 70 observations have so far been received from " Auxiliary " Ships, which were specially recruited to make observations in oceanic areas where shipping is relatively sparse. These ships are not supplied with officially tested instruments, but are asked to make pressure and temperature observations with the ships' own instruments and to make their reports in a special "abbreviated " code form in which the sixth group (which is optional) reads PPXTT. This " X " is by way of an indicator. The accuracy of these ships' instruments is tested by a Port Meteorological Officer. Details of this are given in *Decode for use of Shipping* (M.O. 509).

The results of the I.G.Y. programme are considered to be so successful for scientific purposes that it has been agreed internationally that the programme will continue in a somewhat modified form throughout 1959. This prolongation of the programme will be known as " International Geophysical Co-operation 1959 ". As is customary with so many activities, this rather ponderous title is given a short title of " I.G.C.".

As far as voluntary observing ships are concerned during the I.G.C., it is requested that whilst continuing to do their routine meteorological observations carefully and accurately, they make a special effort to make observations at all four "standard synoptic hours" (0000, 0600, 1200 and 1800 G.M.T.) even if there is no opportunity of transmitting the message by radio. A special effort should also be made to make aurora observations. The recruitment of "Auxiliary" ships for augmenting the number of observations in "sparse" areas of the oceans will be continued.

PRESENTATION OF BAROGRAPHS

In the October 1958 number of *The Marine Observer* the names were published of the masters of four British Selected Ships who had been awarded barographs in recognition of more than 15 years voluntary observing work at sea on behalf of the Meteorological Office.

This is the tenth year in which such awards have been made.

On 12th November, 1958, Mr. R. G. Veryard, Deputy Director, Central Services of the Meteorological Office, made the presentations on behalf of Sir Graham Sutton, the Director-General, aboard the *Wellington*, headquarters ship of the Honourable Company of Master Mariners. The date of the presentation was chosen to coincide with a meeting of the Technical Committee of the Company and was followed by an informal technical discussion, so there was quite a good audience to witness the presentations. The three recipients of these awards were: Captain G. G. Langford (Port Line) recently in command of the *Port Pirie* but now retired, Captain C. R. Townshend (also of the Port Line), in command of the *Port Auckland*, and Captain H. A. Wright (Royal Mail Lines) recently in command of the *Highland Princess*, but now retired.

Captain G. C. Saul, Senior Warden, presided, in the unavoidable absence of Sir Frederick Bowhill, Master of the Company.

Mr. Veryard paid tribute to the value, both to synoptic meteorology and to climatology, of the observations provided by British Selected Ships and referred to the high proportion of these to the total number of Selected Ships in the world. As a practical and unusual example of the usefulness of such voluntary work at sea he referred to the effect that variations in sea temperatures were considered to have in relation to climatic change, and in this connection he stressed the need for accuracy in making the observations. In referring to the work carried out by the individual recipients of these awards he drew attention to the fact that six awards have now been presented to masters of the Port Line and two to masters in the Royal Mail Line. The first meteorological logbook we had received from the ships of these two companies respectively were from the *Port Pirie* in 1886 and *Essequibo* in 1888; both these old logbooks were on show. It was an interesting coincidence that two ships of the name *Port Pirie* should thus have figured in the proceedings.

Thanking Mr. Veryard for making the presentation, the recipients acknowledged that, although they had done quite a lot of this work themselves in the past, it was largely their junior officers who had done it under their direction while they had been in command; they all agreed that it was useful and interesting work to do.

Captain F. G. Watts, R.D. (Cunard Line), the fourth recipient, was unable to attend the presentation in London, as he was at sea at the time. Dr. J. M. Stagg, Director of Services of the Meteorological Office, made the presentation to him aboard the *Sylvania*, of which Captain Watts is in command, at Liverpool on 27th November. The presentation was made informally, and it was appropriate that some of the deck officers of the ship were able to be present to witness the little ceremony. Mr. A. Honey (Assistant Manager, Cunard Line) and Captain E. Gleave (Assistant Marine Superintendent) were also present.

Dr. Stagg remarked about the long association that the Meteorological Office had had with the Cunard Line—since 1868 when we received our first meteorological logbook from one of their ships—and said there was little doubt that much of our knowledge of the weather in the North Atlantic ocean could be attributed to voluntary observations received from those ships. He mentioned that this was the ninth presentation which had been made to the master of a Cunard ship since 1948. Mr. Honey and Captain Watts spoke about the value of accurate meteorological information in so far as their ships were concerned and of their realisation that the accuracy of the information they received depended very much upon the quality of observations sent in by the ships. Dr. Stagg was accompanied by Commander Frankcom, Marine Superintendent, and Captain Radley, Port Meteorological Officer in Liverpool, and they were later entertained to luncheon aboard the ship. A photograph of those present is opposite page 65. C. E. N. F.

INDIAN EXCELLENT AWARDS, 1957-58

We have been informed by the Director of the India Meteorological Department that the officers of seven ships have been selected for Excellent Awards for outstanding work during the year 1957-58.

The awards, which are in the form of books, are made to captains, observing officers and radio officers who have been on the ships concerned for six months or more during the award year. The Director says that the useful work put in by the other officers who served on these ships for lesser periods than six months is also very much appreciated.

The officers who will be receiving the awards are named in the list below.

Name of Vessel	Captain	Observing Officer (s)	Radio Officer (s)	Company
Kampala ..	C. L. Broadhurst	R. Baker	P. McCarthy L. H. Lewis	British India Steam Navigation Co., Ltd.
Jalayamuna ..	N. E. Wickham	J. K. Chaudhury	V. Mathias	Scindia Steam Naviation Co., Ltd.
State of Bombay	M. S. Patel	M. M. Tare J. N. Kapoor	C. D. Joshi S. M. Viliat	Eastern Shipping Corporation Ltd.
Karanja ..	R. Weatherseed	G. Merchant R. Ralph	A. Cockett R. Lynch	British India Steam Navigation Co., Ltd.
Indian Exporter	R. C. Pitt	D. J. Antia E. B. Bertelsen	P. M. Panthaki	India Steamship Co., Ltd.
Sirdhana ..	F. J. Flinders	A. K. Ambegavkar	C. Jones H. Randall	British India Steam Navigation Co., Ltd.
Islami	I. A. H. Glen	E. G. Dawes J. N. Correa A. A. Nazareth A. D. Divekar	J. F. Cullen S. G. Chaudhury	Mogul Line, Ltd.

AUSTRALIAN EXCELLENCE AWARD

Mr. L. J. Dwyer, Director of Meteorology for Australia, states in a letter dated 26th November, 1958:

" I wish to advise that following the practice of previous years the Australian Bureau of Meteorology has this year awarded an " Excellence Award " to M.V. *Idomeneus* in recognition of the excellent standard, quality and regularity of reports made by this ship.

" The form of award again consisted of a suitably inscribed print of a typical Australian scene together with a framed citation and a congratulatory letter to the Captain from the Honourable, The Minister of the Interior.

" It is a matter of considerable gratification to this Bureau that the co-operation accorded by the various Selected Ships of all nationalities is shown by statistics to greatly outweigh the general increase of such vessels. This is borne out by the fact that although the amount of shipping trading to and from Australia varies to a very small degree and therefore the Selected Ship fleets vary little, figures over a four-year period reveal that the world selected fleets have increased by approximately 25 per cent over this period. The reception of weather reports received in Australia have increased by some 125 per cent. This evidences an increasing interest by all reporting ships and the officers concerned."

BLACKBRAES—67 DAYS ROUND THE HORN

In the October 1958 number of *The Marine Observer* we published some extracts from the meteorological logbook of the barque *Hermine*, together with a track chart of her beat of 40 days westward round Cape Horn in 1880.

Commander C. L. A. Woollard, R.N., a former voluntary marine observer in the Cunard and Royal Lines, as a result of seeing the above article, has sent us a copy of the track chart of the iron ship *Blackbraes* which was, in all, 67 days beating round the Horn in 1899-1900. We publish this on next page. Unfortunately, our records show that *Blackbraes* was never an observing ship, so there is no meteorological logbook but the original of this chart was drawn by Captain Heseltine, now living at Barton-on-Sea, who was an Apprentice in the ship at the time. Captain Heseltine writes:

> The *Blackbraes* battled against mountainous seas and continual gales from September 1st—October 15th, 1899, when, due to shortage of fresh water and food, loss of sails, and sickness among the crew, the Captain decided it was useless to try to round the Horn and set course for the Falkland Islands to refit, arriving at Port William on October 23rd.
>
> The journey to San Francisco was continued on 15th February, 1900, and the *Blackbraes* cleared Cape Horn by March 5th, after sighting the Horn four times.
>
> In the November 1953 issue of *Sea Breezes* I wrote an account of that voyage and I have in my possession the original chart which, as a lad of 16, I made day by day throughout the voyage round Cape Horn. The chart itself is plotted on the cardboard cover of an old ship's biscuit box!

We are indebted also to Captain Heseltine for the photograph reproduced opposite page 64 of the *Blackbraes* on her arrival in San Francisco at the end of that momentous passage of 355 days from South Shields.

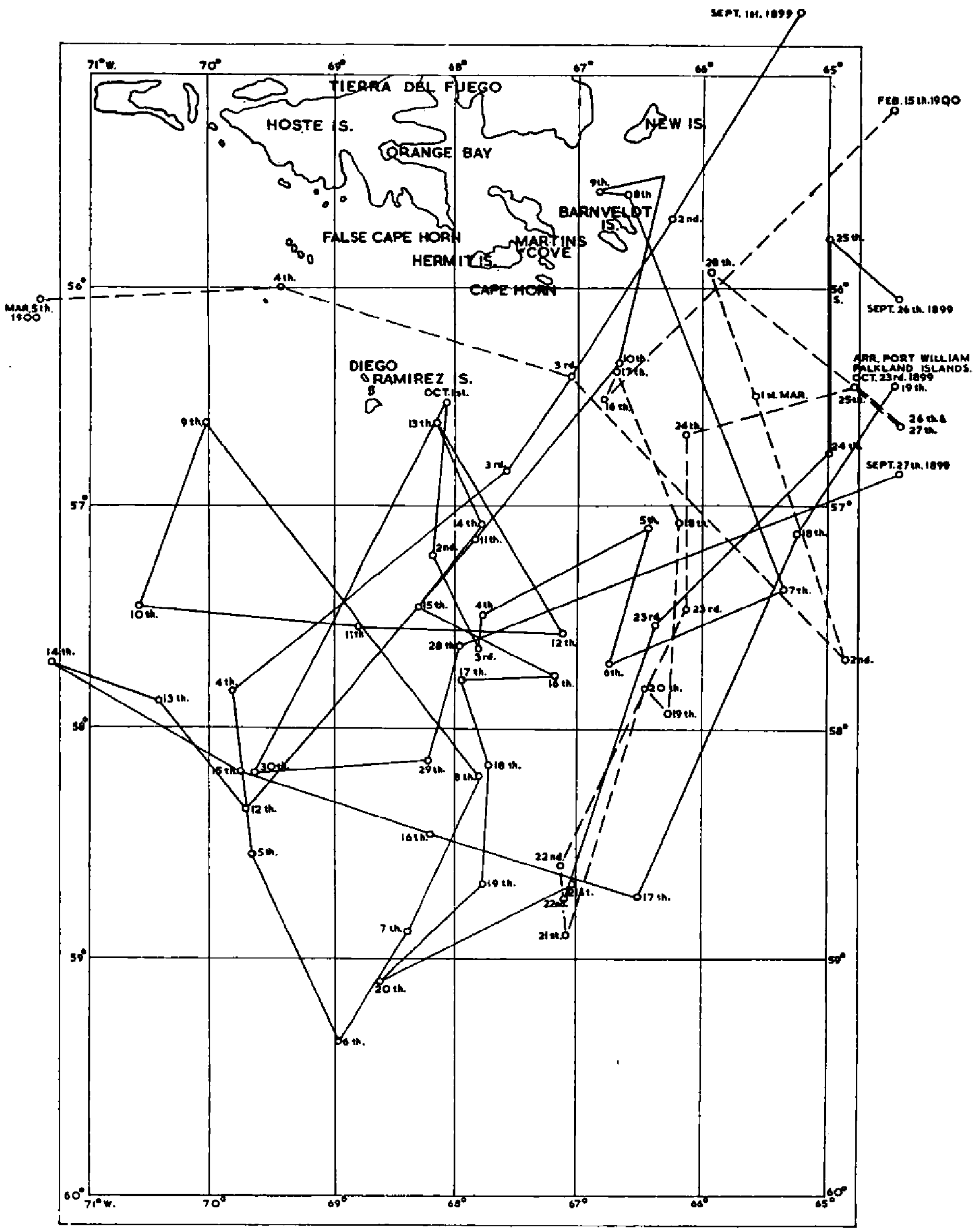
In the *Sea Breezes* article, from which we quote by kind permission of the Editor, Captain Heseltine states that when the ship arrived at Falkland Islands after her first attempt to round the Horn, "the harbour was full of sailing vessels taking shelter for repairs and refitting, all of them having put back from Cape Horn. Some had lost masts, some had deck and hull damage and some were short of sails, food and water. From the newspapers obtainable we first heard of the outbreak of the Boer War. . . . and it was learned that *Blackbraes* had been posted at Lloyd's as overdue and probably lost."

When she eventually arrived in San Francisco in June 1900 she found in port the ship *Musselcraig* which had taken 334 days on a similar passage. In her case, however, the Master, despairing of ever weathering Cape Horn, had turned and completed the voyage eastbound.

Blackbraes must have been a very happy ship for during her stay in San Francisco, despite the hardships of such a long passage, the scurvy, shortage of food, water and tobacco and the notorious activities of the boarding house masters, she lost only one man by desertion—surely an unusual circumstance in those days.

The following details of the ship have been supplied by the Trustees of the National Maritime Museum from notes made by the late Captain Daniel who was for many years Marine Superintendent for Houlder Bros. in Montevideo.

She was an iron ship of 2,207 gross tons, built in 1892 by Hamiltons of Port Glasgow. In 1899 she was owned by Potter Bros. of London. In 1910 she was



Track chart of the *Blackbraes*

bought by J. Stewart of London who sold her the same year to a German firm who renamed her *Luna.* Shortly afterwards whilst on passage from London to San Francisco she stranded near Dungeness but was refloated. In 1913 she was sold to a Belgian firm, renamed *Kassai* and, being in Hamburg in August 1914, was interned for the whole of the first world war. In 1919 she passed to Italian ownership and was renamed *Monte Bianco.* The end of her career came on 23rd June, 1921, when she was abandoned on fire 400 miles from the Society Isles, 33 days out from Newcastle, New South Wales, towards Genoa, with coal. L. B. P.

RADAR PERFORMANCE IN SAND AND DUST STORMS

Shipmasters and officers will have noticed that tables giving radar detection ranges are now published as part of the Supplements to the Admiralty Pilots. These tables have been supplied by the Radio Advisory Service and built up from data supplied to them by ships in their radar logs. The meteorological logbooks of observing ships also have frequently contained radar narratives, all of which have been passed to the Radio Advisory Service for their record and comment. The observation from the *Clan Davidson* on page 56 of this issue is a case in point.

It is hoped that both these methods of collecting information in this important field will continue.

The Radio Research Station of the Department of Scientific and Industrial Research is keenly interested in the effect of sand and dust storms on radar performance and have promulgated the following comments which will be of interest to shipmasters and officers:

> There is . . . very little definite evidence concerning the effects of sand and dust storms on radar performance. There is good reason to believe that true sand storms can produce both appreciable echoes and significant attenuation at 3 cm wavelength . . . in general, dust particles are a good deal smaller than sand particles, not much of an echo would therefore be expected from dust when the radar wavelength is of the order of 3 cm.

To assist the Radio Research Station in the formulation of a more complete scientific appraisal of this problem and its importance to seamen, we would ask voluntary marine observers to miss no opportunity of switching on their radar in all occurrences of dust or sand storms and to write the results in the " Additional Remarks " pages of the meteorological logbook.

We should like to emphasize that we are not asking for any duplication of effort and if the ship is already keeping a radar log for the Radio Advisory Service we would not expect her to enter particulars also in her meteorological logbook.

OCEAN CURRENT OBSERVATIONS

One of the encouraging examples of the work of the voluntary observing fleet during recent years has been the increasing number of observing ships who have included ocean current data in their meteorological logbooks. In the last three months of 1950 ocean current observations appeared in 52·1 per cent of all logbooks. The figures increased throughout the same periods of 1952, 1954 and 1956 when they were 59·7, 65·7 and 66·8 respectively, but in the last quarter of 1958 we were sorry to find that the figure had fallen to 60·1 per cent.

We realise that on very few passages are ocean current observations possible all the time, and we would much rather have a blank space than a doubtful observation. But there can be very few sea passages which cannot offer two consecutive days of fine weather with good sights, and an ocean current observation requires only these in conjunction with an appreciation of the ship's course and speed through the water.

It may be that some officers are omitting these observations through lack of knowledge of what is acceptable and what is not. The broad outline of our requirements is given on page 58 of *The Marine Observer's Handbook*, page II—5 of *The Marine Observer's Guide* and in the instructions at the beginning of the new meteorological logbook. It is hoped that the following supplementary notes will encourage ships to make these observations and, at the same time, prevent them from going to unnecessary trouble by compiling ocean current data which is inherently not accurate enough for incorporation into the ocean current atlases.

First, let us reiterate our oft repeated statement that there is no ocean in the world from which we have sufficient ocean current data. Ships have sometimes mentioned that they have not given us this data because they were using only the well known trade routes, or because no unusual currents were experienced. If the future editions of the ocean current atlases are to be of the use to seamen which we hope, we must have observations of all currents experienced, from nil to the phenomenal and from all oceans.

The surface current observations from the open ocean which are the most useful are those computed between two star fixes at twilight. This is because the fixes are accurate, the period between them short enough to make it probable that the ship has only experienced one current in the elapsed time and also short enough to reduce any errors in the dead reckoning course and distance to a minimum.

Noon to noon currents are generally acceptable though never quite so good as those from stars to stars. For one thing, the noon position, though it is normally taken by several officers, can only be regarded as a running fix, the accuracy of which may be dependent on a due appreciation of a current experienced between the morning sun sight and noon, the very element which we are trying to find. However, for practical purposes, when spread over 24 hours, this error is probably negligible in the majority of cases, and the chief thing which mitigates against the accuracy of a current so computed is that the ship may have experienced two or more currents during the 24 hours. These may give a resultant quite different from its constituents. This is particularly so in a fast ship, and for this reason we do not accept 24 hour currents from ships of 16 knots or over. Current observations from noon on one day to morning stars on the next or from evening stars on one day to noon on the next are, in general, acceptable. Currents worked between morning stars on two successive days or between evening stars on two successive days are acceptable from ships of less than 16 knots and are preferred to noon to noon currents, but no current for a longer period than a " ship day ", which may be 24½ or even 25 hours, need be entered.

The inherent inaccuracies of the normal noon position, however carefully it is compiled, will have a disproportionate effect on a current compiled from morning stars to noon or from noon to evening stars, and any such currents are not accepted for the atlases and should not therefore be entered. Officers will, however, be aware that there are many occasions when a true fix is possible in daylight and the sun may be crossed with Venus, the moon or even Jupiter. Such a fix gives the enthusiastic observer of ocean currents a golden opportunity especially when stars have been missed, and the presence of one or other of these bodies on a suitable bearing at noon will ensure the accuracy of the noon position, in which case a morning star to noon current would be acceptable.

It is necessary, however, to caution the over-enthusiastic officer against putting himself to needless trouble by working out currents which overlap or duplicate each other and which will consequently have to be discarded. For instance, suppose a ship gets the following positions:

(1) Noon (a.m. sun, run up to meridian altitude)
(2) Venus and sun in the afternoon
(3) Stars about 7 p.m.
(4) Stars about 5 a.m.
(5) Sun and moon in the forenoon
(6) Noon (a.m. sun, run up to meridian altitude)

There is a variety of currents which could be worked but many of these would overlap. The ones most acceptable to us would be those between 2 and 3, 3 and 4, and 4 and 5, i.e. short periods between true fixes none of which fall in the period of a current already worked.

When selecting currents for incorporation into the atlases we have to take into consideration the wind and weather. The dead reckoning required for these observations depends simply on the true course steered and the distance steamed through the water *since the observation from whence the current is being computed*, making due allowance for leeway only. Some ships, such as loaded tankers, will make little leeway in any but the strongest wind, others, such as high sided ships flying light, will make a lot, and because of the uncertainty of the amount of leeway made by ships in winds of *force* 6 *and above* it has been our custom to discard all currents computed in such circumstances. *If the wind has been blowing at force* 6 *or above* for an appreciable time, say three hours, no current observation need be recorded.

The state of loading of the ship and the means of measuring her speed are also taken into consideration. Ships which measure their distance by engine revolutions only are bound to give an uneven performance when the propeller is not reasonably well immersed, i.e. when the ship is in light condition, and currents should not therefore be recorded in these circumstances.

When coasting and in sight of land, currents computed between shore fixes are most desirable. It should be ensured, however, that the ship is not being influenced by tides.

The accuracy of radar in its present state of development leads us to be cautious about accepting currents dependent on radar fixes, especially in low latitudes where abnormal performances are known to be frequent.

Our appreciation of a meteorological logbook from a ship trading in constantly stormy waters, e.g. North Atlantic, is not lessened by the omission of ocean current observations unless her records show her to have had a reasonably smooth passage with clear skies enabling good sights to be obtained. On the other hand, ships which habitually use the fine weather routes are expected to provide ocean current data. If for any reason this cannot be given, it should always be stated in the appropriate place in the meteorological logbook. L. B. P.

THE NATIONAL OCEANOGRAPHIC COUNCIL—ANNUAL REPORT

This report for the year 1st April, 1957, to 31st March, 1958 (published by Cambridge University Press, price 5s.), concerning the activities of the National Institute of Oceanography, includes the following items of general interest.

Marine physics

The Institute have maintained tidal gauges at Stornoway and at Lerwick. The charts have been read and the data made available to the Tidal Institute. The gauges were operating in time to study the surge of 1st February, 1957, which occurred when a depression moved rapidly from a position south-west of Ireland past the north of Scotland. The winds in the North Sea were from the south-east, and the appearance of a small surge at Stornoway and Lerwick and higher surges on the east coast, gave some support to Mr. Crease's theoretical conclusion that surges from the Atlantic Ocean will be amplified along the east coast. There were notable surges from the Atlantic Ocean during the winter of 1957–58, and examination of the records and meteorological charts suggests that they do not have time to develop to appreciable size when depressions travel straight in, in an easterly direction; the long travel from the south-west along the continental shelf seems to be necessary for significant growth.

OCEAN CIRCULATION. Some notable improvements have been made to the simple devices which measure current by using a jelly surface that sets horizontally to record the inclination of a container which swings or leans over with the current The direction of the trend is given by a compass that sets in the jelly. They are being used increasingly by fishermen and fishery research ships, and doing much to build up knowledge of the sub-surface currents.

THE SEA FLOOR.—Soundings have been recorded aboard *Discovery II* over 12,000 miles of ship's track and they have been plotted and communicated to the Hydrographer of the Navy. The isolated sounding of 575 fathoms in 32° 20′N., 27° 38′W. marked ETC S.S. *Cruiser* 1907 on Admiralty Chart 2060A was found to be part of a more extensive bank some 40 miles wide with soundings less than 500 fathoms.

NEW INSTRUMENTS.—The development has continued of a general purpose pressure recorder with an A.C. output whose frequency varies with pressure. It promises to be a very precise instrument. The first application is likely to be as a wave recorder in which it will be possible to use the tides as a calibration.

The prototype of a simple anemometer for recording the horizontal components of the wind has been used satisfactorily for the greater part of the year.

Marine biology

Observations on whales continue to be received from merchant ships and others, and a new analysis of the data from the Atlantic Ocean was published in *The Marine Observer* (July and October 1958). It shows among other things that there is no great difference in the frequency of occurrence of whales in the North Atlantic, South Atlantic and Indian Ocean, and that in all three regions they are scarcest in the central oceanic areas.

Further good progress has been made in the marking of whales. It is largely done by international co-operation through the International Whaling Commission and generous assistance by the whaling companies, the Institute acting as the co-ordinating body. Some 300 humpback whales were marked in 1957 in the waters of Australia, New Zealand and the S.E. Pacific Islands, and over 570 whales have been marked in the Antarctic in the seaon 1957–58. Fifty-six marks were recovered in 1956–57, and at least 68 are reported from the Antarctic in 1957–58.

Photographs of squid were taken near the Canary Islands and Madeira at depths of 250 m and 900 m, and of a fish at 200 m. The most remarkable photographs, however, were a series of 30 secured in one lowering of the camera at 4–500 m near the bottom off the Desertas Islands. This showed a dramatic sequence in which a squid was held on the hook and attacked and eaten by another squid. A newly designed underwater ciné camera was also used, but since squid were scarce it has not yet been adequately tested.

R.R.S. 'Discovery II'

This ship was again kept fully employed throughout 1957. She steamed 23,789 miles and spent 1,760 hours on scientific stations and 2,933 hours in steaming.

Two major periods, each of nearly three months, were spent in current-measuring observations in the Gulf Stream and in working oceanographic stations across the North Atlantic in the latitudes of 48°, 32° and 24°N. as part of the I.G.Y. programme. All this work was carried out in close collaboration with the Woods Hole Oceanographic Institution, who generously provided most of the oil fuel which *Discovery II* had to take on in the United States: a number of American scientists took part in the cruises, and the work in the Gulf Stream was carried out jointly with the Woods Hole research vessel *Atlantis*. Between these long cruises, the ship was on charter to the Admiralty for about two and a half months, and a short cruise was carried out as part of the Institute's normal programme. During the latter, facilities were provided for research to be undertaken by members of the Department of Geodesy and Geophysics, Cambridge University and of the Department of Geology, Liverpool University.

SUPPLY OF STATIONERY TO OBSERVING SHIPS

For many years past, parcels of stationery have been sent to observing ships twice yearly by post through the owners.

Whilst generally satisfactory, this uniform distribution has had its disadvantages. It has been expensive, sometimes to the shipowner as well as to the public purse, and has often resulted in some ships receiving more stationery than they need.

On the grounds of economy, the mode of distribution of stationery to observing ships has now been revised.

In future all blank logbooks, message pads, plotting charts, etc., will be supplied by the Port Meteorological Officer or Merchant Navy Agent in a United Kingdom port. The supply will be in accordance with the ship's estimated requirements for the ensuing voyage and will, of course, always be made in consultation with the master or observing officers. The requirements of individual ships vary and it is hoped that this new method of distribution will ensure that, whilst every ship has an adequate supply, no ship will accumulate a surplus.

Ships on protracted voyages or on permanent station abroad will receive their stationery by post from a Port Meteorological Officer in the United Kingdom who will previously consult the owners regarding a suitable address for the forwarding of it.

In order to guard against ships running short of logbooks or message pads, particularly when on long runs between ports abroad, we are arranging for a small supply to be held by the Port Meteorological Officers in Auckland, Bombay, Calcutta, Cape Town, Chittagong, Halifax, Hong Kong, Karachi, Kingston (Jamaica), Madras, Melbourne, Montreal, Port of Spain (Trinidad), St. John (New Brunswick), Singapore, Sydney, Vancouver and Wellington. The addresses of these officers are given in the *Marine Observer's Guide* and any ship short of stationery should apply to the appropriate officer for replenishments.

A small stock of instruments also, for replacements in British observing ships, is kept at Bombay, Calcutta, Madras and Hong Kong. When drawing from this stock, the master or observing officer will be asked to sign a form of receipt and to hand the defective instrument to the officer supplying the replacement. In the case of instruments lost overboard or broken with no pieces remaining, he will be asked to sign a certificate of loss and the whole transaction will be conducted as it would be if the ship were in a home port.

The quarterly number of *The Marine Observer* will continue to be supplied to all observing ships by post on publication. It will, as before, be addressed to the captain of the ship (not by his name) care of the owners. L. B. P.

STATE OF SEA PHOTOGRAPHS

In the January 1958 number of *The Marine Observer* we invited readers to send in photographs of the state of sea engendered by winds of various Beaufort forces.

The response to this invitation has fallen rather short of our hopes, but between pages 86 and 87 of this number, we publish a selection from those we have received in the year since we first asked for them. These illustrate the state of sea with winds of forces 1 to 10, but to date, no photographs illustrating a calm or force 11 and 12 have been received.

We would be glad to have original photographs of the sea under the influence of these three Beaufort forces, as well as any photographs which the photographer thinks might be an improvement of those published in this number.

The aim of this collection is the ultimate publication of a " state of sea " card, on the lines of the present cloud card, to assist observers to assess the force of the wind by the appearance of the sea as laid down in the sea criterion (see *Marine Observer's Handbook*, pages 35 and 36, or Table V on the Ships' Code Card).

A really good camera and the proper use of a filter are the pre-requisites of good sea photographs. They should be taken in the open sea after the wind has been blowing long enough to raise the appropriate sea. All photographs should be accompanied by the following details:

Name of ship, date and time of photograph, latitude and longitude, direction and force of wind, approximate height of the photographer above the sea, name of photographer.

The copyright of the photograph will remain the property of the photographer unless he likes to surrender it to us. All photographs will be acknowledged and negatives returned if required.

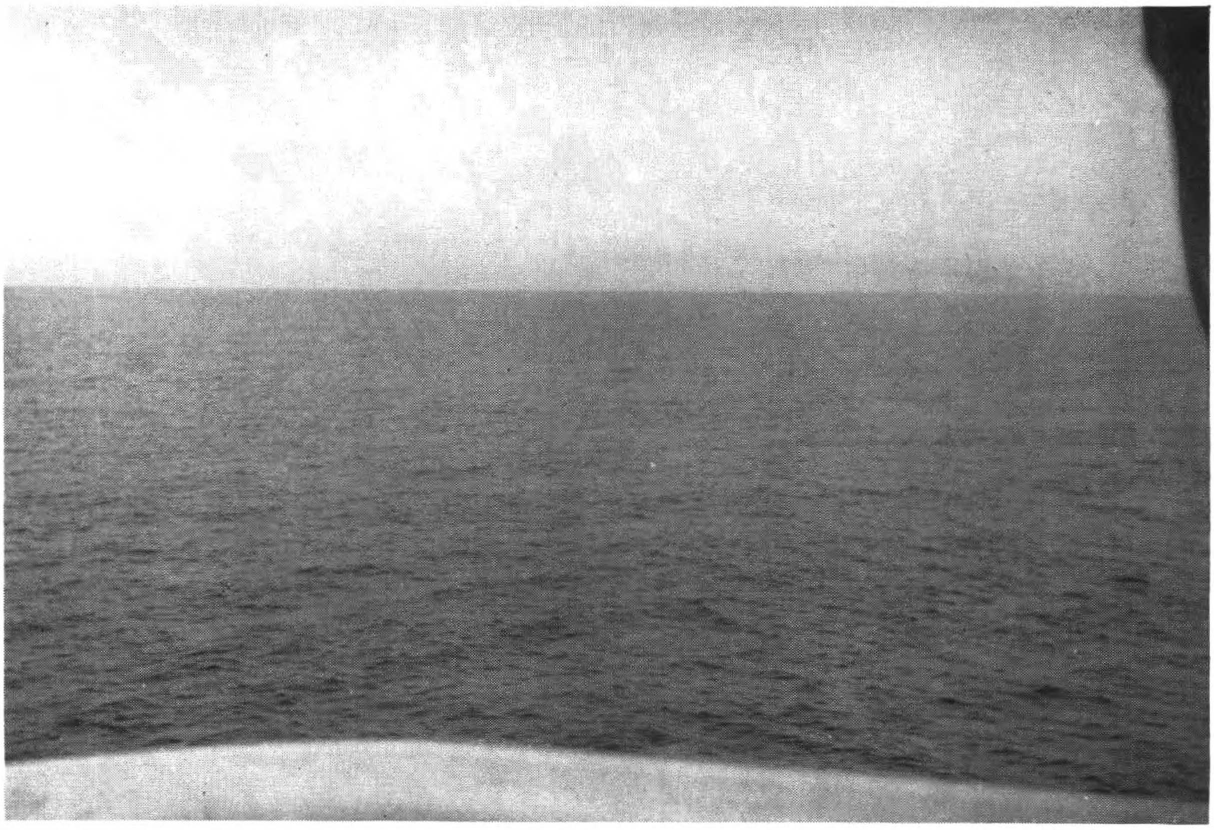


Photo by R. Palmer, S.S. " Heldia "

Force 1.

Photo by R. R. Baxter, S.S. " Clan Chattan " (*Crown Copyright*)

Force 2.

STATE OF SEA PHOTOGRAPHS (See page 86)

(*Between pages* 86 *and* 87)

Force 3.

Photo by R. Palmer, S.S. " Heldia "

Force 4.

Photo by P. J. Weaver, M.V. " Sydney Star "

Force 5.

Photo by P. J. Weaver, M.V. " Sydney Star "

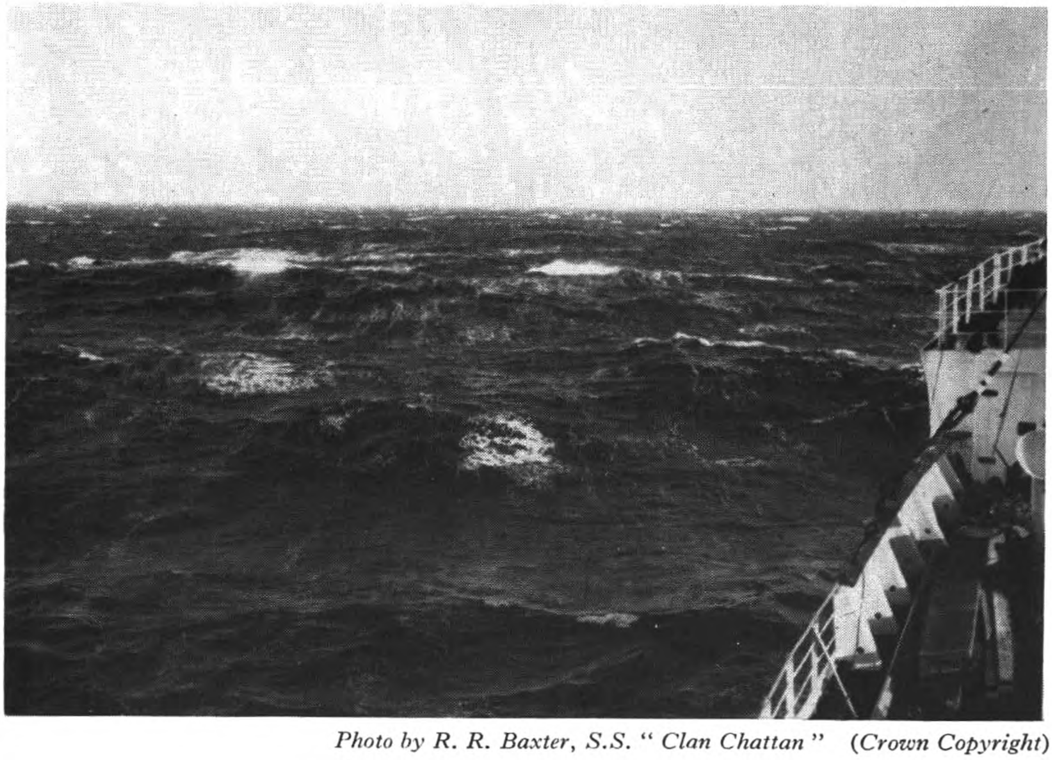
(*Between pages* 86 *and* 87)

Force 6.

Photo by R. R. Baxter, S.S. " Clan Chattan " (*Crown Copyright*)

Force 7.

Photo by R. R. Baxter, S.S. " Clan Chattan " (*Crown Copyright*)



Force 8.

Photo by R. R. Baxter, S.S. " Clan Chattan " (*Crown Copyright*)

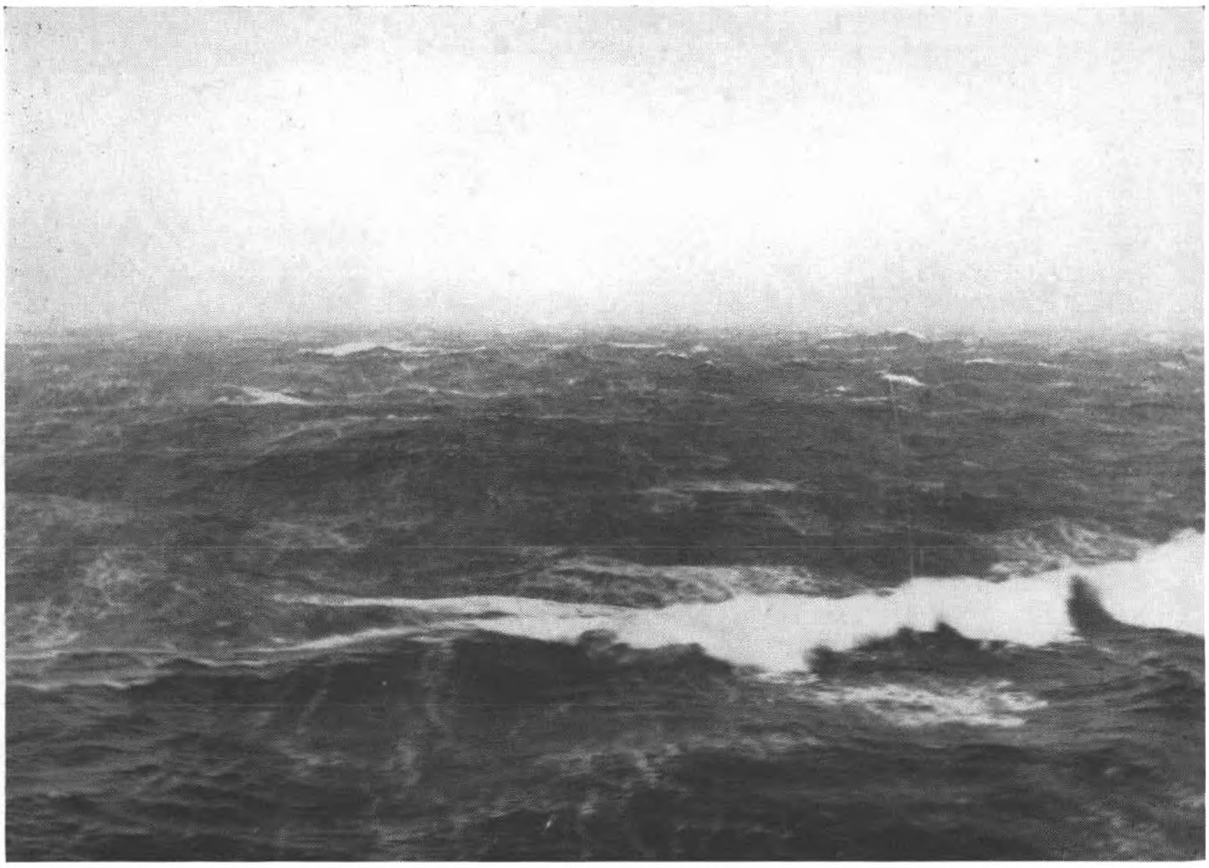


Photo by P. J. Weaver, M.V. " Sydney Star "

Force 9

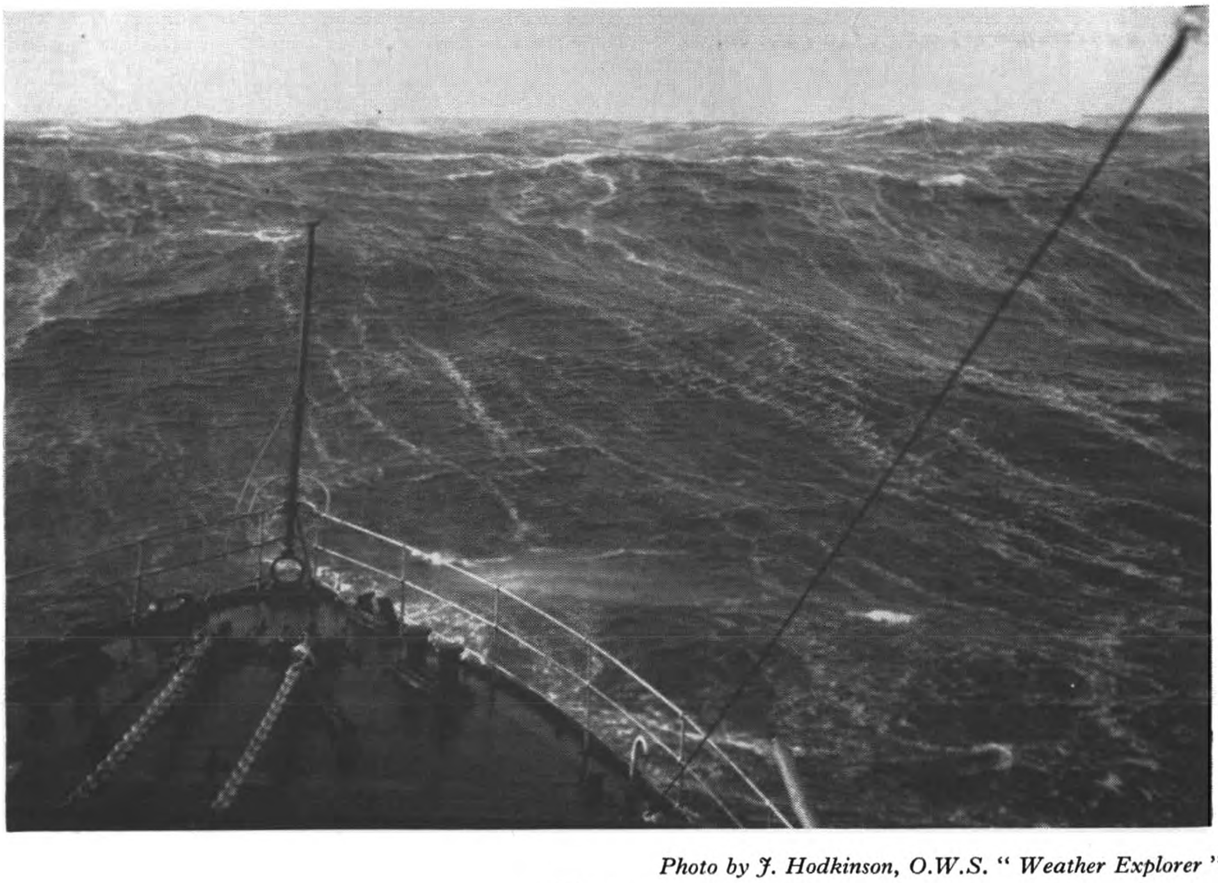


Photo by J. Hodkinson, O.W.S. " Weather Explorer "

Force 10.

Book Reviews

Zur Niederschlagsmessung auf see: Ergebnisse von Vergleichsmessungen auf Feuerschiffen und benachbarten Inseln (The Measurement of Precipitation at Sea: Results of comparative Measurements obtained on Light-ships and Neighbouring Islands). By Dr. H. U. Roll. $11\frac{1}{2} \times 8\frac{1}{4}$ in. pp. 15, including diagrams and tables. Deutscher Wetterdienst, Seewetteramt: Einzelveroffentlichungen No. 16, Hamburg, 1958. Price 1.30 D.M.

A good knowledge of the rainfall distribution over land is of great economic value for agriculture, drainage, water-supply and many industrial and social activities: fortunately, reasonably accurate rainfall measurements over land are available though some difficult problems remain. While the economic value of the knowledge of the distribution of rainfall amount over the sea is much less there is still a need to obtain a fair picture of that distribution, both for economic reasons and for theoretical considerations such as the calculation of the energy exchange between the sea and atmosphere. To deduce this distribution it is necessary to have rainfall measurements of satisfactory accuracy though it is realised that the degree of accuracy will be much less than that attainable for land observations.

This paper on the subject is by Dr. Roll, Head of the Department of Maritime Meteorology of the German Marine Weather Bureau.

After studying the problem of the measurement of precipitation at sea he discusses the results of investigations so far published including those carried out aboard the weather ships of the United Kingdom, Holland and Norway. He comes to the conclusion that it is likely that the best way of assessing the accuracy of various methods of measuring precipitation at sea is to compare measurements made aboard ship with those made in good exposures on neighbouring low lying islands.

He compares the results of measurements made by light-vessels in the North Sea off the German coast with those made on the neighbouring islands of Heligoland and Neuwark. He divides the stations into two groups. Group A includes Heligoland and the two nearby light-vessels P8 and P11 while Group B includes Neuwark and the three adjacent light-vessels Elbe 1, Elbe 2 and Elbe 3, the latter group being nearer the land. He then compares the results obtained on the light-vessels and islands and analyses them statistically.

His conclusions are:

(1) that useful values can only be obtained at stations far enough from the land to be unaffected by coastal influences.

(2) On the basis of approximately 100 monthly totals for stations in Group A, the mean difference in rainfall between lightship and island station was $-8\cdot1$ per cent, the average deviation being $31\cdot4$ per cent. The mean percentage difference in precipitation represents the decrease in the monthly amount of precipitation collected aboard ship due to a combination of several effects of conditions aboard that ship. The individual differences in precipitation between light-vessels and island are distributed round this mean value as for a normal distribution being random in character. The causes of these deviations cannot be determined individually. They may be the consequence not only of inhomogeneities of the precipitation field, features of the air flow, differences in the suspension of the ship's rain gauge (particularly as regards the plane of the aperture), but also of incorrect readings.

This paper is as important as any that has been written on the subject of the measurement of precipitation at sea and could usefully be studied by anyone concerned with this problem—which is as yet a long way from satisfactory solution.

P. R. B.

Statistik der Meereswellen in der Nordsee—auf Grund von Beobachtungen der Bordwetterwarten des Deutschen Wetterdienstes (North Sea Wave Statistics—Based on observations of Ship Weather Stations of the German Meteorological Service). Compiled by O. Petri. 11½ in. × 8¼ in. pp. 38, including charts, diagrams and tables. Deutscher Wetterdienst, Seewetteramt: Einzelveroffentlichungen No. 17, Hamburg, 1958. Price 2.50 D.M.

Wave statistics are required by a wide variety of users, which include the Royal Navy, shipowners, shipbuilders, marine radar manufacturers and builders of harbours, sea walls and platforms for oil and coal drilling, but the information that can be given these inquirers is almost inevitably inadequate.

Regular and reliable wave observations are made by ocean weather ships, and statistics based on these have been published in several papers. Reports are also made by many merchant ships on the longer routes but few ships on the shorter routes make such observations: we therefore find that comparatively few wave observations are available in such areas as the North Sea and for this reason this publication is particularly welcome.

The statistics in this volume have been prepared from wave observations made by the German Fishery Protection Vessels *Meerkatze* and *Poseidon* and the Fishery Research Vessel *Anton Dohrn*. The observations were made by trained meteorological personnel using the standard procedure.

The statistics are represented in the form of histograms, tables, cumulative frequency curves and other graphs, and are given for wave height and period alone and for these elements in relation to wind force and wind direction. They are first shown for the North Sea as a whole but later this area is divided into four parts and some statistics are then shown for each part. Full discussion of the results follows.

This is a valuable contribution to our knowledge of wave statistics in a small enclosed sea and anyone who has to answer inquiries on waves in the North Sea will want this publication.

P. R. B.

The Green Flash and Other Low Sun Phenomena, by D. J. K. O'Connell, S.J. 9¾ in. × 6¾ in. pp. 192. *Illus.* North Holland Publishing Co., Amsterdam, 1958. 45s. (22.50 guilders).

There is an extensive literature of optical meteorological phenomena, to be found, in the case of the green flash, in astronomical as well as meteorological periodicals. The green flash is, however, the only one to have formed the subject of whole books. Prof. Dr. M. E. Mulder's *The Green Ray* was published in 1922. Now follows this splendid volume, a specialised study of the green flash and of the distortions of the sun's disc observed near the horizon, due to refraction or scintillation effects, or both combined. The Vatican Observatory at Castel Gandolfo is admirably situated for this purpose, on elevated ground 12½ miles from the sea. During most of the year the sun sets on the Mediterranean horizon, about 50 miles distant.

The author, Father O'Connell, conceived the idea of photographing the phenomena with large astronomical telescopes. This presented many technical difficulties and great credit must be given to Father Treusch, a skilled photographer on the observatory staff, for surmounting them and achieving such outstanding success, both in colour and monochrome photography. A few small-scale photographs in colour of the green flash had previously been obtained by others using ordinary cameras; these showed no detail but served finally to kill the discredited but obstinately recurring theory that the green flash was a subjective phenomenon, due to colour fatigue of the retina of the eye. The photographic reproductions in this book are unique. They are on various large scales, some showing the whole sun and others part of it, highly magnified. There are 19 colour plates, each containing from two to five pictures of successive stages of sunsets at the sea horizon and sunrises over land horizons. In addition there are a very large number of photographs in monochrome. Many interesting details and varieties of the green flash and the distortions are shown.

The equipment used is described, with photographic illustrations. The eyepiece of the telescope was replaced by a camera with its lens removed, so that the film was in the primary focus of the object glass. The instrument mainly used was a Zeiss refractor of nearly 16 inches aperture, but a larger reflecting telescope and smaller auxiliary instruments were also employed. Cinema cameras were used to get successive photographs at short time-intervals, down to about four per second. Coarse- and fine-grained scintillation is well shown on many of the photographs; the larger the telescope used the more this is magnified. Scintillation is not usually visible in instruments as small as binoculars and this is perhaps the reason why none of the colour photographs shows a clear-cut green segment of the sun, such as has often been seen at sea and elsewhere with such instruments.

Several different kinds of colour film were used. Apart from the difficulty of timing exposures of such an evanescent phenomenon as the green flash, the correct exposure constituted a great problem; incorrect exposure falsifies colour.

One reproduction shows a simultaneous mixture of green and blue flash. This is an example of detail which could not be distinguished by using binoculars, in which this flash would have appeared of an intermediate colour.

Colour photographs are given clearly showing the green rim on the upper limb of the sun and moon when near the horizon and the red rim on the lower limb. These rims are produced by the colour dispersion of normal refraction and are visible in telescopes of moderate or large size. They are not usually visible in binoculars but such observations are occasionally made; see, for example, *The Marine Observer*, January 1957 (M.V. *Gloucester*) and July 1956 (M.V. *Norfolk*). Two plates show the green (or blue) and red rims of Venus close to setting. Another shows the green flash of the sun at the top of a cloudbank. The red flash at the sun's lower limb was photographed, but there is no colour photograph taken at the instant of the flash.

A notable feature of the book is the inclusion of synoptic charts and radiosonde tables and graphs for a number of the sunsets, showing discontinuity layers (temperature inversions) at various heights in the atmosphere. The sun or any other body near the horizon is not seen by an observer only by light passing through the lowest part of the atmosphere. Westward of the horizon the light has passed obliquely through the whole extent of the atmosphere and may therefore be affected by discontinuity layers at any height in the atmosphere along the line of its passage. According to the thickness or intensity of the inversion layers more or less of the sun's light is reflected out of the line of sight and serrations of the lateral limbs of the sun are produced. Opposite pairs of these are joined by dusky streaks of various intensities across the disc and in extreme cases the sun may be cut into two or more parts by completely dark bands. These detached segments often give a brilliant green or blue flash at a later stage of the sunset. Short interval photographs show successive portions of the sun's disc being affected in a similar manner as they sink through the same inversion layer. Photographs of serrations and " blind strips " in the actual green flash are given.

Many of the photographs show scintillation of various degrees of intensity. Scintillation, due to minor changes of air density at various heights along the path of the light, is a more or less rapid change, both of form and colour; scintillation of the upper limb may thus have an effect on the colour of the green flash.

The factors which influence the appearance and intensity of the green flash are discussed in this book. The green flash is well known to be a capricious phenomenon, being often absent or feeble when conditions for its appearance seem favourable. It is difficult to estimate the relative importance of the many factors which may influence the flash, but it seems certain, from this photographic research, that the effects of inversion layers and the more marked forms of scintillation are important.

Increased colour dispersion by abnormal refraction is also a cause, which is perhaps most effective in high latitudes. Mirage produced by low-level temperature inversions sometimes intensifies the flash by the direct or reflected images coalescing at the moment of setting.

There is a selected bibliography of 307 references to the literature of the green flash and a further six on the technique of colour photography. Among the general references the reviewer's article in *The Marine Observer*, 1936, is included. Nearly half the bibliography refers to individual observations, which include only one from *The Marine Observer*. It appears that the author did not have access to this journal with its wealth of observations, which include a number of varieties of the phenomenon which are not referred to in the general account of it given in this book.

Three colour reproductions show an unusual and unexplained conjunction of separate red and green areas on the sun's upper limb or on a detached segment, a transition stage to the final green or blue flash. *The Marine Observer*, January 1950, contains one visual observation of this phenomenon (M.V. *Pacific Exporter*).

A few of the photographs show how the appearance of green rays rising up from the sun could occur if the observation were made with binoculars or the naked eye. The author considers that these appearances explain the reports of such green rays. Such an explanation, however, covers only very small-scale ray effects and is wholly inadequate to account for rays and other forms of well-defined green light seen at or after sunset, sometimes reaching quite high altitudes.

The book contains an interesting historical section, but which does not profess to be complete. There is evidence that the green flash was familiar to the ancient Egyptians. Observations of the blue and red rims of Mars were published in 1815. The first known published observation of the green flash was that made by W. Swan on 13th September, 1865.

The book was printed, and the photographs reproduced, in Vatican City.

E. W. B.

Personalities

RETIREMENT.—CAPTAIN F. C. BROOKS retired from the sea in November 1958, after 45 years at sea, over 34 of which were served with the Bibby Line. Since 1956 he has been Commodore of the company in the *Worcestershire*.

Frederick Charles Brooks first went to sea in January 1914, serving his apprenticeship in the sailing ship *Claverdon*, owned by George Gordon and Co. of Glasgow. After only 18 months at sea he was promoted to acting 3rd Mate and 6 months later to 2nd Mate on the *Claverdon*, in which capacity he remained until the completion of his indentures.

Shortly after passing for Master (square-rigged), Captain Brooks joined the Bibby Line in July 1924 as 4th Officer of the *Oxfordshire*. He continued to serve in this company and was appointed to his first command, the *Dorsetshire*, in 1942. He subsequently commanded *Cheshire*, *Staffordshire* and *Worcestershire*. Nearly a quarter of a century of Captain Brooks's service with the Bibby Line was spent in two ships *Dorsetshire* and *Worcestershire*.

Captain Brooks saw service in both world wars. During the 1939–45 war he served in the hospital ship *Dorsetshire* and was at the St. Nazaire evacuation and the invasion of Sicily. He was awarded the Coronation Medal in 1953.

Captain Brooks has an admirable record with the Meteorological Office, dating back to 1924 when he was in the *Oxfordshire*, and in 14 years he has sent in 39 logbooks, 29 of which have been classed "excellent". He received Excellent awards in 1948, 1951, 1952, 1955 and 1956.

We wish him health and happiness in his retirement.

J. R. R.

Notice to Marine Observers

ATLANTIC WEATHER BULLETIN FOR SHIPPING

Three changes have been made in the stations which are included in Part VI of the above bulletin (as listed on page 29 of M.O. 509, *Decode for use of Shipping*). They are as follows:

Main station 04281 Simiutak has been deleted and 04280 Narssaq (60° 54′N., 46° 00′W.) substituted.

Alternative station 01306 Hellisoy Lt. has been deleted and 01311 Flesland (60° 17′N., 05° 14′E.) substituted.

Alternative station 07601 Biarritz (ville) has been deleted and 07602 Biarritz/Parme (43° 28′N., 01° 32′W.) substituted.

M.O. 509 will be amended in due course. These alterations will be incorporated in the next reprint of Form 1258, Plotting Chart for use with Atlantic Weather Bulletin for Shipping.

INSPECTION OF INSTRUMENTS

Principal Observing Officers are requested to see that when the ship arrives in a home port all Meteorological Office instruments, books, atlases, stationery, etc., are readily available for muster by a Port Meteorological Officer or Agent. If the Observing Officer himself is unlikely to be aboard or free to attend the muster it would greatly help if he would leave a note as to the whereabouts of the various items (including the spare thermometer and remains of any broken instruments).

RADIO WEATHER MESSAGES FROM THE U.K. REPORTING AREA

1. It has been noticed that some ships are still addressing their radio weather messages to the old address "Weatherdun Wire London". As mentioned previously, such messages should be addressed to the United Kingdom coastal radio station to which they are sent, preceded by the word "OBS", e.g. "OBS PORTISHEAD". No further address is necessary.

2. A few ships are still sending their radio weather messages through Valentia and Portpatrick. As we have stated before, these two stations, which are operated by the Republic of Ireland, are not now on the list of detailed radio stations for the United Kingdom.

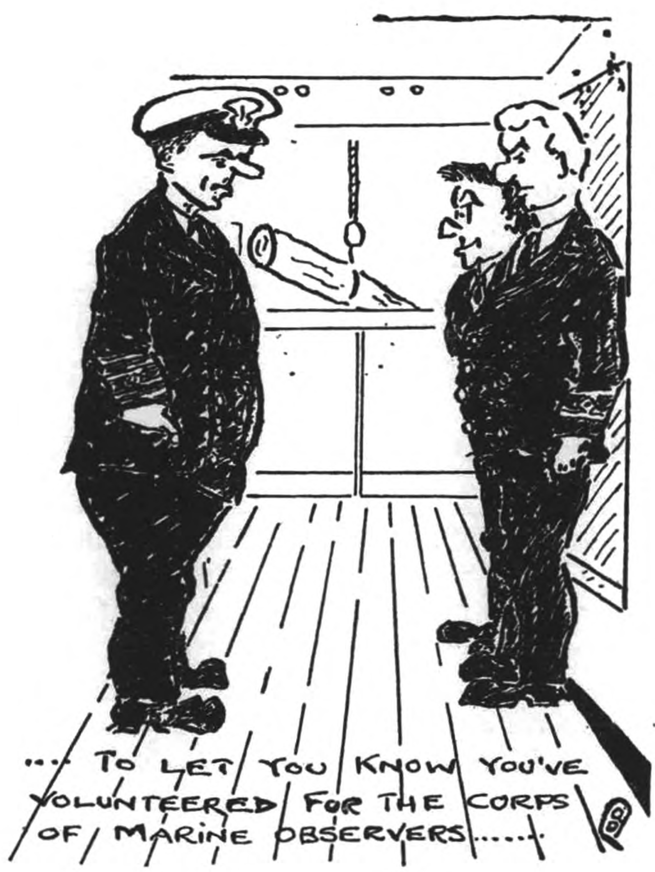
The substance of both parts of this notice is contained in Part IV of *Marine Observer's Guide* (as amended).

IN LIGHTER VEIN

When making observations
It makes me want to cry,
I go to read thermometers
And there's the wet bulb—dry!

Anon.

Note. In the observation referred to in this verse, as the wet bulb was in fact dry, the dew point had to be transmitted as XX in the radio weather message from the ship. For various practical reasons such an omission may be a serious handicap to the meteorologist receiving the message, particularly in an area where fog is liable.



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