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The Marine Observer

*A quarterly journal of Maritime
Meteorology*



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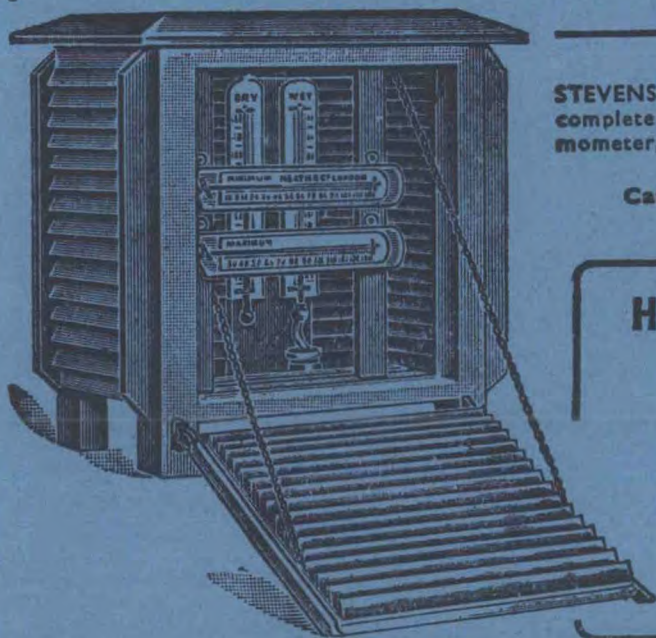
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A QUARTERLY JOURNAL OF MARITIME
METEOROLOGY PREPARED BY THE MARINE
BRANCH OF THE METEOROLOGICAL OFFICE

APRIL, 1953

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Editorial

A recent Editorial in *The Marine Observer* discussed the activities of the World Meteorological Organisation. There is another international organisation, on a non-governmental level, the International Union of Geodesy and Geophysics (generally known as I.U.G.G.), which deals, amongst other things, with meteorology, oceanography, magnetism and seismology. This organisation held its latest general assembly in Brussels in August, 1951. The Report of the Association of Physical Oceanography of the I.U.G.G. emphasizes the close relationship which exists between the two sciences of oceanography and meteorology. At the conference in question, no less than 44 scientific papers were read concerning the exploration of the ocean floor, currents, waves, turbulence and miscellaneous oceanographical subjects. In addition a joint meeting was held with the Association of Meteorology of the I.U.G.G. concerning the general circulation of oceans and atmosphere, and another joint meeting was held with the Associations of Meteorology and of Seismology about the question of microseisms, those minute disturbances like miniature earthquake ripples which occur relatively frequently in various parts of the earth's surface and which are only detectable by extremely sensitive instruments. Microseisms incidentally have an interest for meteorology as they are thought to be associated with the deeper weather systems and with tropical disturbances.

Professor H. U. Sverdrup, in his presidential address, reviewed developments in oceanography over the last 100 years and pointed out that it was Maury who, in 1852, published his charts of ocean surface currents and temperatures and "thus took the first step towards a systematic representation of the surface conditions of the sea". In 1855 Maury published the first comprehensive text on oceanography—*Physical Geography of the Sea*. Maury was a seaman and it is good to know that he is thus the "father" of oceanography, and indeed of organised international meteorology. Throughout Professor Sverdrup's address, the relationship between oceanography and meteorology was always in evidence. In a general sense the obvious relationships are in respect of ocean currents (both at the surface and in the depths), variations of sea temperature, density and salinity, the meteorological effect on tides and the general question of interchange of energy between ocean and atmosphere. Professor Sverdrup quoted the work of Bjerknes, the noted Norwegian meteorologist, and pointed out that certain theories applicable to the atmosphere are also theoretically applicable to the ocean, but are infinitely more difficult of solving in the ocean even "if all the ships in the world were at disposal and could be anchored all over the oceans".

Of the new instruments available, the bathythermograph, which gives a continuous record of temperature variations in the ocean, seems to be the most useful to the meteorologist as well as to the oceanographer. Professor Sverdrup referred to the important part that radio location at sea plays in the work of the oceanographer, particularly with regard to accurate determination of surface currents.

As was mentioned in this address it was the British research ship *Challenger* (1872-76) which carried out the first comprehensive oceanographic voyage. There are few charts which have not some reference to H.M.S. *Challenger*. Britain has thus always played her part in oceanographic research and it is good to know that there is a modern H.M.S. *Challenger*, which fairly recently completed a voyage of research during which the deepest known depth of 5,906 fathoms was located in the Pacific Ocean. The British National Institute of Oceanography owns two research ships, *Discovery II* and *William Scoresby*, both of which have recently carried out quite extensive research voyages.

The voluntary marine observer at sea plays a part in quite a big way in adding to our physical knowledge of the oceans. It is true that most of his work is primarily meteorological, but knowledge of the winds over the oceans, for example, helps to solve problems about their effect upon the surface waters and hence in relation to

the surface currents; air and sea temperature readings and humidity assist in solving problems about exchange of energy between ocean and atmosphere. Observations of the surface currents are in fact directly oceanographical in nature and our knowledge of the surface currents of the oceans is certainly very largely due to the work done, up to the present, by voluntary observers at sea. Oceanographical research voyages have, of course, helped to add to that knowledge and recent detailed observations with the aid of Loran, off the American coast, have given much detailed and accurate information of the currents in that area. The voluntary observer at sea also contributes considerable oceanographical knowledge, in the form of observations of phosphorescence (bioluminescence), height and period of waves, and of special phenomena which he observes during the course of a voyage. More recently marine observers have been contributing observations about whales and here again is direct oceanographical research.

British oceanographers recently staged an exhibition at the Royal Geographical Society entitled "Exploring the Sea". The exhibits covered all branches of oceanography—marine biology, exploration of the ocean bed, including the use of the core sampler and the seismic shooting method, as used aboard the British ocean weather ships in 1949, the detailed study of waves by means of instruments, the use of current meters, etc. Included in this exhibition was a section from the Meteorological Office atlas showing surface currents of the China Sea. Thus the work of the voluntary observer at sea finds its place, as it rightly should, among that of the professional oceanographer, as well as among that of the meteorologist.

MARINE SUPERINTENDENT.

Ships' Radio Weather Messages Appreciated

It is encouraging to note, from letters received in the Marine Branch periodically from the Directors of Commonwealth Meteorological Services, the amount of help which is given to them by British selected and supplementary ships.

Information received from the Royal Observatory, Hong Kong, shows that the monthly average number of reports received there have shown a steady increase since the war until the monthly average during 1952 reached a figure of 84, which compares with 7 in 1946 and 62 in 1947. In the October, 1952, number of this journal we published what the Director at Hong Kong has aptly called "record breaking figures" of reports received during a typhoon of June, 1952, namely 162 weather reports in one day from merchant ships of various nationalities.

It is not Hong Kong alone that has appreciated the services of British selected ships, and the following extract from a letter recently received from the Director of the British Caribbean Meteorological Service will doubtless interest our readers who trade in that area.

"The officers of the S.S. *Arakaka*, a British selected ship, may be interested to know that their report at 0600 G.M.T. on 7th October, 1952, was the first indication of the formation of hurricane EASY. Another selected ship whose reports are valued most highly by the Piarco forecasters is the *Regent Hawk*, and I shall be glad if you will inform her officers how much we appreciate their excellent reports. Reports from shipping in the area 10°-20°N, 45°-55°W, are most valuable during the hurricane season, and if any ship cannot contact a U.S. radio station I shall be glad if they will pass the report to MET TRINIDAD."

The Marine Observers' Log



April, May and June

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

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

Responsibility for each observation rests with the contributor.

SCHOOL OF FISH

North Atlantic Ocean

O.W.S. *Weather Observer*. Captain N. F. Israel, D.S.C. At Ocean weather station Juliett.

28th April, 1952, about 0130 G.M.T. The vessel was seen to be in a large and widespread school of small fish whilst stopped on station Juliett. A net was devised from a balloon target and two were caught and were preserved on board. The fish were about 3 in. long, with the head large in comparison with the body; they were in two shades of steel-grey and covered with round spots like dabs of solder. Among these fish was seen an occasional squid or squid type of animal, "pinkish" and about the size of a dinner plate.

Position of ship: $53^{\circ} 30' \text{N}$, $20^{\circ} 00' \text{W}$.

Note. The two fish referred to above were sent to the Ministry of Agriculture and Fisheries, from whom the following reply has been received:

"The Latin name of the fish is *Myctophum punctatum*—they have no English name. They are reported as being fairly common in the North Atlantic but we have not heard of such large shoals as these. We are sending a note about this record to one of the zoologists at the British Museum who is particularly interested in small pelagic fish.

"We are always pleased to get reports and samples of this nature."

FISH SPAWN

Gulf of Panama

M.V. *San Veronica*. Captain M. A. Connell, O.B.E. Valparaiso to Panama. Observer, Mr. L. F. Lawrence, 2nd Officer.

15th May, 1952, 1600 G.M.T. The ship passed through large patches of dense fish spawn, which extended as far as the horizon in all directions. Sea temp. 81.5°F .

Position of ship: $02^{\circ} 50' \text{N}$, $81^{\circ} 33' \text{W}$.

CURRENT RIPS

Atlantic Ocean

M.V. *Pilcomayo*. Captain F. A. C. Thacker. Rio Grande (Brazil) to Curaçao. Observers, Mr. J. H. Napper, Chief Officer, and Cadet Oxborrow.

20th May, 1952, 0630 S.M.T. A tide rip was observed about 3 miles to sw (the ship on a NW'ly course). At 0655 S.M.T., when the ship had passed through the rip, it was seen that the water had changed colour from deep blue to grey-blue. The rip consisted of a line about 6 ft wide of confused waves and extended in a N-S direction from horizon to horizon. At 0630 S.M.T., 21st May, 1952, it was observed that the sea slowly changed back to deep blue.

Date	Time (S.M.T.)	Specific gravity	Sea temp. (°F)
20th	0630	1027	82
20th	0705	1020	81
20th	0745	1017	81
21st	0630	1025	81

The photograph (opposite page 76) was taken just after the ship had crossed the tide rip. The light-coloured water nearest the ship's starboard side is the fresh water.

Position of ship at 0655 S.M.T., 20th May: $04^{\circ} 25' \text{N}$, $50^{\circ} 17' \text{W}$.

Note. This rip was probably the boundary between the true oceanic water of the South Equatorial Current and a body of water which was a mixture of the oceanic water with Amazon river water, reducing the specific gravity.

Off Coast of Portugal

M.V. *Port Adelaide*. Captain C. R. Townshend. Port Said to Hull. Observer, Mr. G. B. Bonds, 3rd Officer.

18th June, 1952, 1415 G.M.T. The ship passed through a rip extending from horizon to horizon (025° to 205°), while the ship's head swung considerably to starboard. The rip appeared just southward of Burlengas Island. Two hours previous to the crossing the sea temperature was 68°F , just after crossing the rip it rose to $74\frac{1}{2}^{\circ}$ and $1\frac{1}{2}$ hours later it fell back to 67° .

Position of ship at rip: $39^{\circ} 13\frac{1}{2}' \text{N}$, $9^{\circ} 36' \text{W}$.

Central American Waters

M.V. *Port Phillip*. Captain E. E. Roswell. Bluff to Balboa. Observers, the Master and Mr. D. Burgess, senior 3rd Officer.

11th May, 1952, 2130 G.M.T. Three current rips extending in a 10° – 190° direction were observed about half a mile apart. There was no change in the colour of the water. The current appeared to be moving against the wind, which was 190° , force 4. Sea temp. 83°F .

Position of ship: $03^{\circ} 05' \text{N}$, $83^{\circ} 33' \text{W}$.

FALL OF SEA TEMPERATURE

North Atlantic Ocean

S.S. *Hudson Firth*. Captain J. Gibbons. La Romana (Dominican Republic) to London. Observer, Mr. W. G. Lambert, Chief Officer.

1st May, 1952, between 1515 and 1615 G.M.T. There was a sharp fall of sea temperature from 68°F to 48° , and air temperature from 64° to 52° . Wind was wsw and from that direction a large bank of stratus cloud approached, giving rise

to thick drizzle interspersed with thick fog patches until 1635 G.M.T. After 1635 dense fog set in until 0030 2nd May. During this period the wind backed and veered a number of times, finally becoming steady ssw. At 0030 there was a steep rise of sea temperature from 47° to 60° , and air temperature from 50° to 60° . During the whole period relative humidity remained constant at 100 per cent. Course was $064^{\circ}(T)$, speed 10 kt.

Position of ship at 1615 G.M.T. on 1st May: $41^{\circ} 25' N$, $49^{\circ} 00' W$.

Note. A fall of sea temperature such as is given in this observation is normally experienced only at or near the northern edge of the Gulf Stream, where the cold water of the Labrador Current converges with the warm water of the Gulf Stream. Often the boundary between the cold and warm currents is irregular and tongues or eddies of the cold water may penetrate the warm water, or vice versa. It is difficult to find an explanation of the above observation, as the ship was centrally in the main flow of the Gulf Stream southward of the Great Bank of Newfoundland and the nearest part of the flow of the Labrador Current is over 200 miles to the north-westward in April and May. This observation has been referred to the National Institute of Oceanography.

DISCOLOURED WATER

South Atlantic Ocean

S.S. *Novelist*. Captain T. E. Steel. Walvis Bay to Liverpool. Observer, Mr. I. Macaulay, 2nd Officer.

8th April, 1952. From shortly after noon until 1600 G.M.T. the colour of the water became a very pale green, similar to that seen in shallow water where the bottom is sandy. No soundings were taken as the depth by the chart is 500 fathoms. Between 1415 and 1445 a large patch of water, light greenish-brown, was observed about half a mile to the S which stretched back to the horizon. A distinct line was seen between the two areas of discoloured water. Sea rough, moderate swell.

Position of ship: $20^{\circ} 15' S$, $11^{\circ} 48' E$.

PHOSPHORESCENCE

Gulf of Panama

S.S. *Devon*. Captain A. Hocken. Balboa to Sydney. Observers, the Master and Mr. N. Collett, 2nd Officer.

22nd April, 1952, 0600 G.M.T. On rounding Toboguilla Island the ship passed through numerous patches of crescent-shaped phosphorescence. Although the patches varied in size from 20 to 50 ft in length and 5 to 15 ft in breadth at the middle part, they all presented a similar outline, and appeared stationary. The patches were visible well forward of the ship, so could not have been caused by the vessel's passage through the water. There was no particular orientation of the patches, more of which were seen at intervals during the ensuing hour.

Position of ship: $08^{\circ} 49' N$, $79^{\circ} 29' W$.

South Atlantic Ocean

M.V. *Stirling Castle*. Captain J. Trayner. Southampton to Cape Town. Observer, the Master.

18th April, 1952, 1830 G.M.T. The ship steamed into an area of brilliant phosphorescence, interspersed with dark patches; the horizon appeared to be illuminated with white lights and the broken water close to the ship showed emerald green. The sky was cloudless and the stars very bright. The phenomenon lasted for about 12 miles.

Position of ship: $33^{\circ} 00' S$, $17^{\circ} 25' E$.

Arabian Sea

M.V. *Clan MacDougal*. Captain P. Macmillan. Aden to Cochin. Observer, Mr. D. W. Stewart, 3rd Officer.

21st April, 1952, 1600 to 1800 G.M.T. The ship passed through an area of phosphorescence which gave the impression of hundreds of electric torches being flashed under the sea surface. This effect was visible up to about 30 yards from the ship. At the same time streaks of yellow scum were seen on the surface. Air temp. 85°F, sea temp. 86°.

Position of ship at 1800 G.M.T.: 10° 16'N, 74° 03'E.

South China Sea

M.V. *Szechuen*. Captain D. Needham. Singapore to Hong Kong. Observer, Mr. J. Paton, 2nd Officer.

21st May, 1952, 1805 G.M.T. Parallel bands of light about 15 ft broad were observed on the surface of the sea ahead and at right angles to the ship's track.

The ship entered the illuminated zone without distorting the formation, but at 1812 the bands of light on the port side began to revolve in a clockwise direction around a centre 6 points (67°) on the bow, distant about 1 cable (600 ft). As the centre of rotation came more on the beam the apparent direction of rotation was reversed. When the centre had passed the bridge, the revolving motion ceased, and at 1816 straight bands of light appeared to radiate from a centre 1 point abaft the port beam. By 1818 the phenomena had become less well defined but continued as spasmodic flashes of light until 1823 when they disappeared. At no time was there any sign of phosphorescence in the ship's wake. Air temp. 84°F, sea 86°. Wind sw's, 12 kt, sea slight. Course 031°, 12 kt.

Position of ship at 1805: 04° 05'N, 106° 11'E.

Note. This is an observation of the phosphorescent wheel, which is a fully authenticated but rare phenomenon; only three previous observations of it have been published in the post-war volumes of this journal. The above observation is of particular interest for two reasons: (a) the bands on the same side of the ship revolved in opposite directions at different times; (b) the bands did not rotate at all during part of the time the ship was passing through them.

Only two previous observations have been received in which the direction of rotation reversed itself while the centre of rotation remained on the same side of the ship. These were made by S.S. *Arracan* in 1927 and S.S. *Talma* in 1929. These observations completely refute the theory that the rotation is only apparent and is due to the ship's motion past fixed bands. This theory would require that the bands always revolved in a clockwise direction on the port side and simultaneously in a counter-clockwise direction on the starboard side, if the bands were present on both sides of the ship. The cause of the phosphorescent wheel is at present quite unknown; it remains one of the mysteries of nature.

WATERSPOUT

Irish Sea

S.S. *Empire Gaelic*. Captain H. T. Green. Larne to Preston. Observer, Mr. R. Harper, 2nd Officer.

3rd June, 1952, 0355 G.M.T. A waterspout was observed about half a mile away on the starboard side. It appeared as a grey vaporous funnel suspended from a small, very black cloud, which was at a height of 2,000 ft. The funnel did not actually reach the sea. The sea immediately below became agitated and was almost enveloped in a small area of low-lying white vapour. The waterspout moved eastwards at about 10 kt and lasted for about 4 minutes.

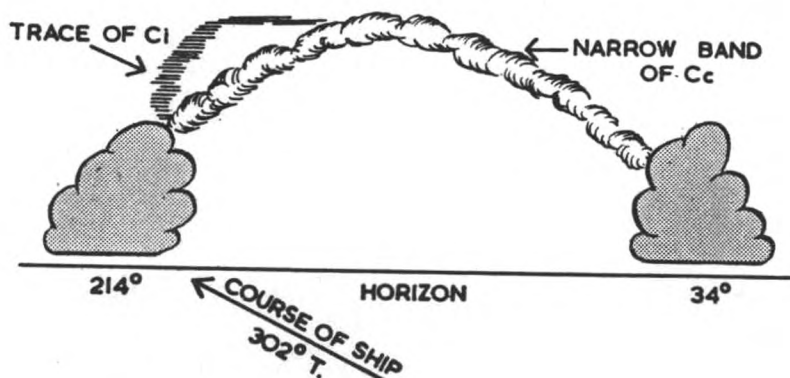
The weather at the time was good, light N'y breeze, rippled sea. There was unusually high refraction, giving phenomenal visibility.

Position of ship: 353°(T), distant 11 miles from Bar Light Vessel.

UNUSUAL CLOUD FORMATIONS

South Indian Ocean

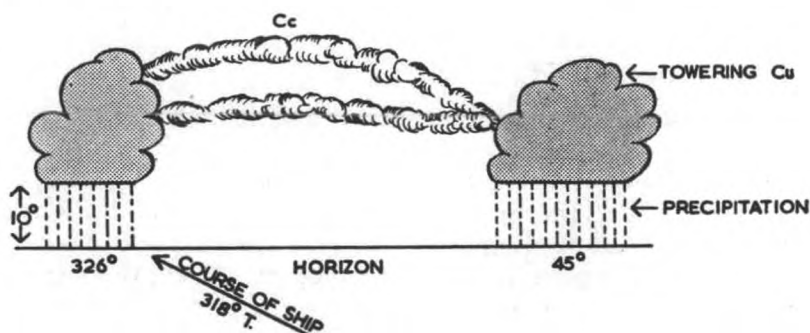
M.V. *Port Adelaide*. Captain C. R. Townshend. Sydney to Aden. Observer, Mr. G. B. Bonds, 3rd Officer.



1900 G.M.T., 31st May, 1952.

31st May, 1952, 1900 G.M.T. Two very dark towering Cu clouds bearing 034° appeared to be joined to a single dark towering Cu cloud, bearing 214° , by a narrow band of Cc which stretched across the sky over the ship. This formation lasted about 2 hours before disintegrating. The moon was not visible at the time and the sky was cloudless except for the above formation.

Position of ship: $14^\circ 35'S$, $78^\circ 43'E$.



1600 G.M.T., 3rd June, 1952.

A somewhat similar cloud formation was observed from the same ship by Mr. E. E. Chapman, 4th Officer, on 3rd June, 1952, at 1600. On this occasion the moon was practically overhead, and slight drizzle typical of "monsoon weather" was experienced as one of the Cu clouds passed over the ship. The phenomenon lasted for 1 hour 15 minutes.

Position of ship at commencement: $03^\circ 08'S$, $62^\circ 40'E$.

ARCH SQUALL

North Pacific Ocean

S.S. *Cape Grafton*. Captain C. A. Jones. Victoria, B.C., to Cardiff. Observer, Mr. Saunders, 2nd Officer.

18th May, 1952. The photograph shown opposite is of roll Sc observed from the ship. No precipitation occurred at or near the time of this observation, and no noticeable change in weather conditions. Air temp. $57^\circ F$, wind NW force 2, good visibility.

Position of ship: $45^\circ 06'N$, $125^\circ 12'W$.



Current rip, Atlantic Ocean, 20th May, 1952.
(See report from M.V. *Pilcomayo* on page 73.)



Arch squall, North Pacific Ocean, 18th May, 1952.
(See report from S.S. *Cape Grafton* opposite.)

Opposite page 77



Aerial photograph of the Royal Observatory, Hong Kong.
(See article on page 99.)



Dolphins just keeping ahead of a vessel doing $13\frac{1}{2}$ knots.
(See letter on page 111.)

MIRAGE AND TEMPERATURE FLUCTUATIONS

Mediterranean Sea

M.V. King Robert. Captain G. Craze. Port Said to Rotterdam. Observers, Mr. P. W. Kidd, 2nd Officer, and Mr. A. D. Terras, 3rd Officer.

23rd June, 1952, 0800 G.M.T. The wind backed to SW (from NNW) and unusual changes in air temperature were recorded; the atmosphere became very warm and dry while wind increased to force 6 in gusts. In one of these gusts (at 0820) the dry bulb rose to 89°F and the wet bulb fell to 71° ; but shortly afterwards wind shifted to W and decreased to force 2, while air temperature fell. The sky was $7/8$ clouded with Ac, As and Cs; visibility good. At 0850 the horizon from W-N gave the appearance of a line of cliffs, taking the form of low sandy islands towards N. At 0920, when wind increased to force 5-6 in warm gusts, the mirage gradually disappeared. The sky by this time was clearing from the westward, and at 0935 wind again backed to SW force 3-4, falling away. By 1030 cloud was $1/8$ Cs and visibility excellent, air temperature $83\frac{1}{2}^{\circ}$ and wet bulb $73\frac{1}{2}^{\circ}$. Sea temperature remained 76° throughout; barograph trace very unsteady.

Position of ship at 0800: $37\frac{1}{2}^{\circ}\text{N}$, $06\frac{1}{4}^{\circ}\text{E}$. Course $263^{\circ}(\text{T})$, speed 11 kt.

ABNORMAL REFRACTION

White Sea

S.S. Tintern Abbey. Captain W. J. Thomas. Middlesbrough to Archangel. Observer, Mr. A. H. Carfrae, 2nd Officer.

14th and 15th June, 1952. On entering the White Sea and through it to Archangel weather was fine with light E'ly winds, much haze and considerable refraction. The effects of the refraction were greatest off the Zimni coast ($66^{\circ} 31'\text{N}$, $42^{\circ} 14'\text{E}$, to Archangel), which had the appearance of steep vertical cliffs. These conditions made it difficult to obtain satisfactory positions from bearings of shore objects.

Cabot Strait, Gulf of St. Lawrence

S.S. Beaverglen. Captain D. Parsons, R.D., R.N.R. London to Montreal. Observer, Mr. P. P. Ainsworth, 2nd Officer.

30th May, 1952, 2315 G.M.T. Port aux Basques Lighthouse, distant 33 miles, was visible from a position $130^{\circ}(\text{T})$ from the lighthouse. Upon approaching Cape Ray the horizon appeared to be elevated $6\frac{1}{2}'$, and an exact replica of the land beyond the horizon was visible above it. The foreshore was likewise elevated, but to a lesser degree, and at sea-level still remained on the actual horizon. Altitude of the sun, $3^{\circ} 59'$. Height of eye of observer, 52 ft. Air temp. 41°F , sea temp. 44° . Fig. 1 gives the appearance of Port aux Basques Lighthouse and neighbouring land at this time.

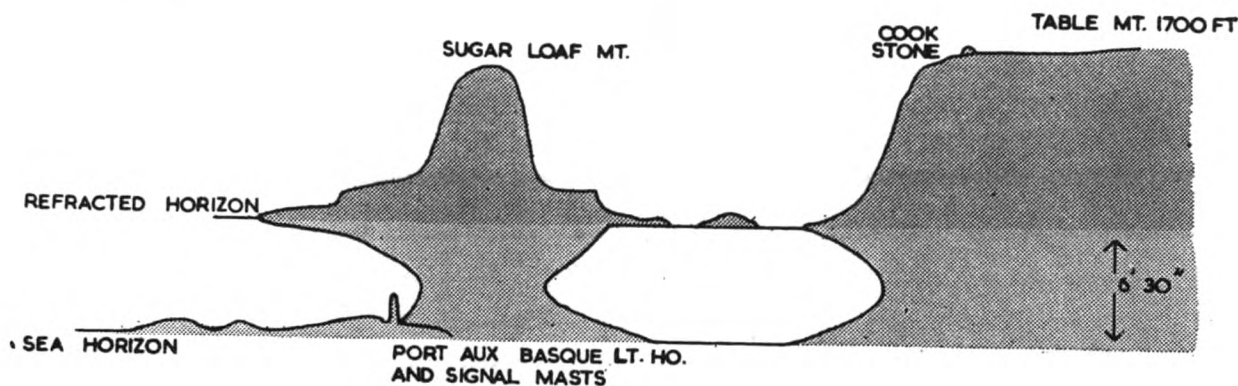


Fig. 1. 2315 G.M.T.

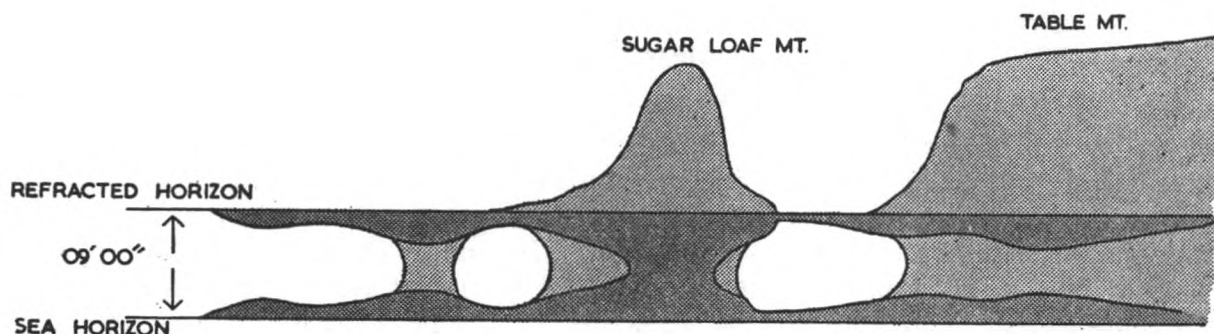


Fig. 2. 2330 G.M.T.

Fifteen minutes later when the ship was in a position $126^{\circ}(\text{T})$ from Cape Ray Lighthouse and distant 31 miles, the horizon appeared elevated 9'. While the image of the land behind appeared similar to Fig. 1, the foreshore was completely inverted in front of the higher land behind, giving the impression of two separate and distinct instances of refraction. Fig. 2 presents this view which was visible until darkness fell, but refraction apparently persisted after dusk as two images of Cape Ray Light were seen, one on the horizon and the other elevated. Air temp. 41°F , sea temp. 44° .

Position of ship: off south coast of Newfoundland.

Note. These two observations illustrate the phenomenon of superior mirage, the condition for the formation of which is that an inversion of air temperature exists over the sea at a suitable height. The change from cooler to warmer air at this height must also be fairly sudden. In superior mirage an inverted image is seen above the object, and if fully developed, as in these observations, a direct image is seen above the inverted one in contact with it.

In Fig. 1 the mirage brings land into view which would otherwise be invisible below the horizon, so that the lowest part, the erect image, is only an image, the actual view of the land being impossible. In Fig. 2 the same applies to the distant land, but in the case of the foreground, which is now also subject to superior mirage, the lowest part is the observer's direct view of the land, which may, however, be raised or distorted to some extent. The inverted image and the direct one above are true images as in the case of Fig. 1. The observation of Fig. 2 is a rather unusual one as two sets of superior mirage are superimposed.

Red Sea

S.S. *Perim*. Captain R. J. F. Paice. Adelaide to Hull. Observer, Mr. P. J. Stead.

22nd May, 1952, 1230 G.M.T. A "false" horizon was clearly defined. Ships on the horizon were considerably distorted; masts and funnels appeared lengthened. At times ships appeared as box-like objects, changing back to normal appearance after two minutes. Sky cloudless, visibility good.

Position of ship: $25^{\circ} 25' \text{N}$, $35^{\circ} 30' \text{E}$.

On the same day at 1510 the Brothers Island Lighthouse was observed with the lighthouse appearing upside down and the island suspended above it, while the whole form constantly changed shape. At 1535 two lighthouses were observed one above the other separated by a small gap, although the island appeared to have resumed normal position.

Position of Brothers Island Lighthouse: $26^{\circ} 19' \text{N}$, $34^{\circ} 51' \text{E}$.

Off Cape Town

M.V. *Winchester Castle*. Captain G. W. B. Lloyd. Cape Town to Southampton. Observer, Mr. J. D. MacMillan, 4th Officer.

30th May, 1952, sunset. The upper limb of the sun appeared elongated and remained above the horizon for approximately two minutes. Three minutes later a bright red light appeared, intermittently, in the sea about two-thirds of the

distance to the horizon. The light was rectangular in shape, 40' of arc in length and 3' wide, and lasted for eight minutes. Fifteen minutes after sunset a ship was sighted, bearing 250°(T) with inverted image above, masts touching; the upper horizon appeared 10' above the true horizon. An occasional radar echo was observed on this bearing at 18 miles range. Later the ship's navigation lights appeared double. Air temp. 64°F, sea temp. 59°.

Position of ship: 33° 40'S, 18° 07'E.

Note. The inverted image of the ship seen after sunset is the phenomenon of superior mirage, see note to the observation of S.S. *Beaver Glen*. In this case the direct image which sometimes appears above the inverted one was not seen.

The projection of a distorted image of the sun, or part of the sun, on the sea surface after sunset is a very unusual and interesting observation and we cannot remember any previous case being put on record. It is not possible to give any simple explanation of it as the rays of light from the sun below the horizon must have followed a very complicated course.

SOLAR CORONA

Red Sea

M.V. *City of Swansea*. Captain F. J. H. T. Vizer. Aden to Suez. Observer, Mr. A. K. Earl, 3rd Officer.

3rd April, 1952, from 0908 to 0918 G.M.T. A solar corona was observed having an approximate maximum diameter of 14°. Clearly defined circles of blue, orange-yellow and red were visible, the last named appeared farthest from the sun. Some Ac obscured a small section at first but after 0918 G.M.T. the corona appeared to turn white and merge with the Ac.

Position of ship: 12° 54'N, 43° 16'E.

SOLAR HALO

Formosa Strait

M.V. *Yunnan*. Captain D. C. Sim. Shanghai to Hong Kong. Observers, Mr. J. Storey, Chief Officer, and Mr. J. G. de C. Veale, 2nd Officer.

25th April, 1952, 1000 G.M.T. Observed double solar halo bearing 282° as shown in Fig. 1. This phenomenon was visible for about half an hour, but its form changed to that shown in Fig. 2 as the sun set behind a low bank of St. The spectrum was clear throughout.

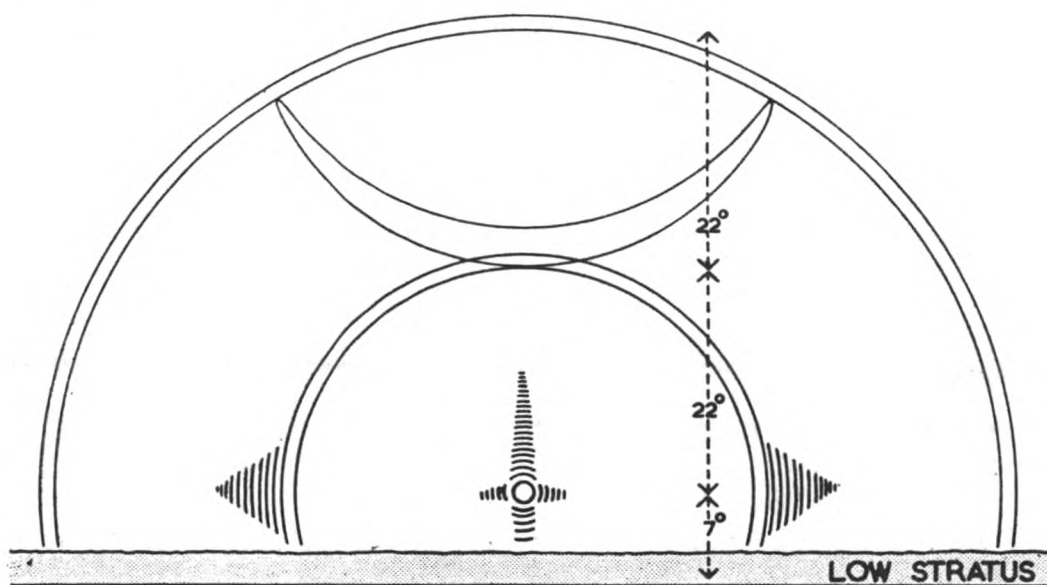


Fig. 1. 1000 G.M.T.

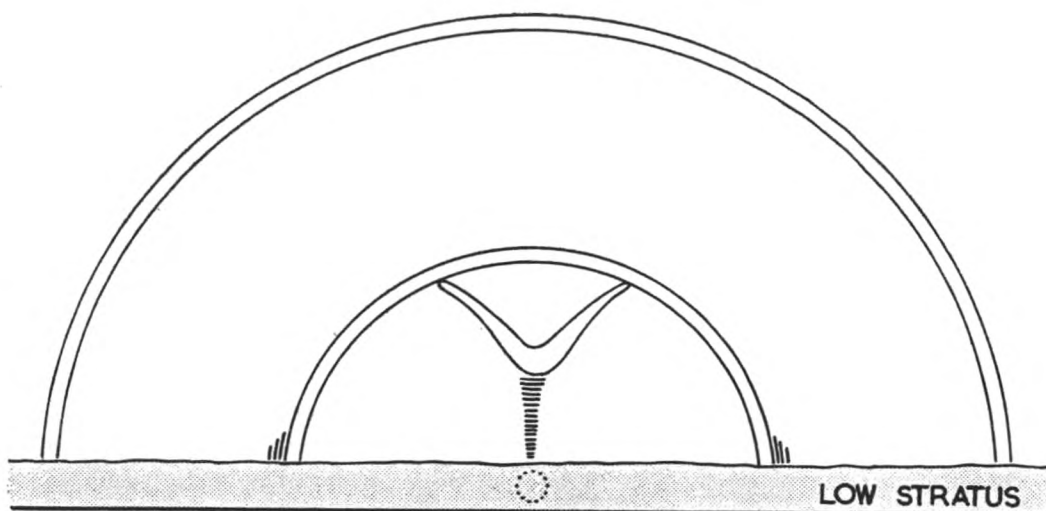


Fig. 2. 1030 G.M.T.

Air temp. 68°F, wet bulb 62°, sea 66°. Wind 040°, 20 kt. Visibility 30 miles with slight dust haze.

Position of ship: 24° 05'N, 118° 33'E.

Note. The first observation (Fig. 1) shows an interesting halo complex, including the halos of 22° and 46° radii, the upper contact arc to the 22° halo and two parhelia (mock suns) of the 22° halo, these being somewhat ill-defined and at the same altitude on either side of the sun. In addition, the rather rare phenomenon of the solar cross is seen, the vertical part of which is formed by a sun-pillar extending above and below the sun. The horizontal portion of the cross is a small part of the parhelic circle (mock sun ring).

In the later observation (Fig. 2) the cross is hidden by cloud except for the upper part, which has become Y-shaped. Sun-pillars are formed in two ways. The true sun-pillar is produced by reflection of sunlight from those ice crystals which are situated in the vertical line through the sun. Another kind of sun-pillar may be seen when the secondary halos of 22° radius are formed. Each of these halos is centred on one of the mock suns, from which the light of the halo is derived by refraction, just as the light of the common halo of 22° is derived from the sun itself. Observations of the secondary halos are rare as they are usually too faint to be seen. When the sun is at a low altitude the mock suns are situated on the ordinary 22° halo and in this case the secondary halos of 22° pass through the actual sun. In the region of the sun the two halos are therefore superimposed for a short distance above and below the sun. The augmented brightness of this part may be sufficient to enable it to be seen when the greater part of each secondary halo remains invisible. This is the case in Fig. 1 and such a pillar, usually rather ill-defined and flaring, is known as a parhelic sun-pillar. In Fig. 2 the secondary halos have evidently brightened a little so that a separate part of each is also seen, forming the branches of the pillar. This is a very interesting observation, the branching pillar having been very rarely recorded.

GREEN FLASH

South Pacific Ocean

M.V. *Ruahine*. Captain A. I. Robertson, R.D., A.D.C., R.N.R. Wellington to Balboa. Observer, Mr. P. Harrison, Chief Officer.

2nd June, 1952, 0010 G.M.T. A brilliant green flash was observed at sunset; duration 1½ sec.

Position of ship: 15° 48'S, 113° 30'W.

3rd June, 1952, 0047 G.M.T. A brilliant green flash was observed at sunset, duration 1½ sec.

Position of ship: 12° 48'S, 107° 21'W.

AURORA

North Atlantic Ocean

M.V. *Port Phillip*. Captain E. E. Roswell. Curaçao to London. Observer, Mr. N. L. Wilton, junior 3rd Officer.

26th May, 1952, 2355 G.M.T. The horizon appeared to be illuminated from 300° to 040° by an auroral arc extending up to about 22° and later to 25° . Bright white streaks or rays extended to the top of the arc intermittently, with alternate increase and decrease of intensity till about 0045. The whole phenomenon resembled a battery of searchlights pointing upwards. A faint glow illuminated the northern to north-eastern horizon until dawn.

Position of ship: $48^{\circ} 03'N$, $12^{\circ} 56'W$.

AURORA AND REMARKABLE LIGHTNING

South Indian Ocean

M.V. *Melbourne Star*. Captain F. N. Riley, D.S.O. Adelaide to Southampton. Observers, the Master, Mr. R. B. Escreet, 4th Officer, and Mr. C. T. Whitaker, 3rd Officer.

27th June, 1952, 1800 G.M.T. The evening was dark but fine, and exceptionally clear, with $1/8$ Cu at 4,000 ft. The first signs of a coming display of aurora had the appearance of distant lightning. By 1900 the aurora was more pronounced and appeared as ribbons of flickering light in an arc extending from about 180° to $290^{\circ}(T)$, with the lower edge sharply defined in a brilliant golden orange colour, while the upper edge was more whitish. The lower edge slowly increased in altitude until it reached about 18° . The width of the arc, measured at the horizon, was 29° . It was observed to the NW that diffused patches of light were scattered across the horizon; these illuminated the lower cloud (Cu) most vividly with a pale bluish-white colour.

At 2015 a brilliant red rod shot upwards from the horizon to about 15° and then spread out about 15° on either side in a vivid pale pink. By 2030 the aurora had attained such brilliancy that the evening resembled sunrise, but soon the sky became overcast, with a rising wind and falling barometer. At 2130 the colourful scene was fading out.

During the whole display no exceptional errors in the magnetic compasses were observed, although around 2030 the cards were swinging 5° or 6° either way.

At 2130, following on the display of Aurora Australis, the sky became overcast at 1,500 ft and lightning became intense, the flashes being about 10° above the horizon and circling around the sky. There were also streaks which commenced at about $170^{\circ}(T)$ and travelled through an arc of 130° over the zenith and terminated with a crack and a slight rumble of thunder. The colour of the streaks was a whitish-blue, while intense rain storms followed at intervals of 7 to 10 min. Lightning of a general character developed, while single cracks of lightning were observed at $160^{\circ}(T)$ at an altitude of approximately 8° . These were light blue in colour and left a crimson streak in the sky for about 6 sec.

At 2330 a light-blue streak was observed in the form of an arc between bearings 280° and $310^{\circ}(T)$, with a thickness of 4° to 5° and altitude of 10° . The edges were of a bright crimson with a centre of pale blue. This streak increased in altitude to about 20° , in a vertical direction towards the zenith and remained 3 to 5 min

before it disintegrated. At 0030 (28th) the sky was $\frac{3}{8}$ clouded and no more lightning was observed.

Position of ship at 1800 on 27th: $33^{\circ} 35'S$, $46^{\circ} 50'E$.

Note. This is an interesting observation as the thunderstorm which followed the auroral display seems to have shown abnormal forms of lightning. The crimson streaks left in the sky by some of the flashes were probably an effect of persistence of vision, coupled perhaps with colour fatigue of the eye due to the brilliance of the original flashes. An ordinary lightning flash, where the track of the flash is seen in the sky, is a result of persistence of vision, but this does not normally last for more than half a second or so.

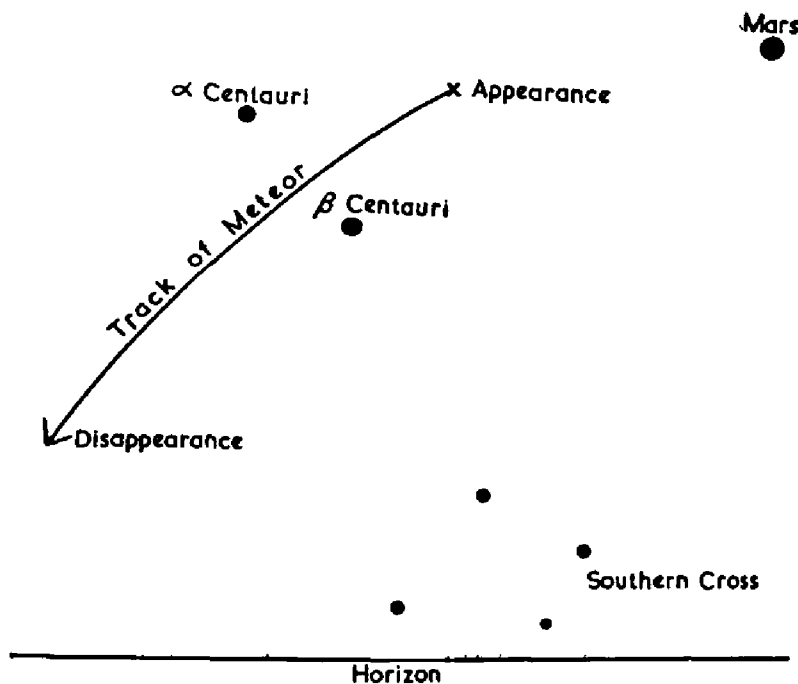
The phenomenon seen at 2330 is more difficult to explain. It is not clearly stated that the sky remained completely overcast at this time, in which case the phenomenon might have been a bi-coloured auroral ray. This is the most likely explanation as it does not seem possible for a lightning flash to persist for three to five minutes, but the bearing on which it was observed seems to argue against it being of auroral origin.

METEORS

South Indian Ocean

M.V. *Port Adelaide*. Captain C. R. Townshend. Sydney to Aden. Observer, Mr. L. G. Garnham, 2nd Officer.

30th May, 1952, 2235 G.M.T. A very bright white meteor of magnitude -2.0 was observed. It appeared with a flash, bearing approximately 220° , to the westward of α Centauri (Rigel Kent) at altitude 30° . It travelled towards SE between α Centauri and β Centauri, and disappeared at altitude 10° . The phenomenon



lasted for 3 to 4 sec, and had a very distinctive white trail which became orange in colour towards its end. The trail was visible for 4 to 5 sec after the meteor had disappeared. The sky was almost cloudless with a trace of Ci, which was not near the phenomenon.

A number of shooting stars were seen before and after the meteor was visible.

Position of ship: $17^{\circ} 32'S$, $83^{\circ} 53'E$.

South Pacific Ocean

M.V. *Port Fairy*. Captain C. A. Hodson. Lyttleton to Balboa. Observer, Mr. R. C. W. Marr, 4th Officer.

24th May, 1952, 0755 G.M.T. A very brilliant meteor was visible for about $1\frac{1}{2}$ sec, giving as much light as a full moon. It appeared to fall almost vertically towards the horizon and disappeared in the vicinity of Benetnasch.

Position of ship: $12^{\circ} 05'S$, $107^{\circ} 22'W$.

ZODIACAL LIGHT

Caribbean Sea

M.V. *Ruahine*. Captain A. I. Robertson, R.D. A.D.C., R.N.R. Curaçao to Southampton. Observers, Mr. P. Harrison, Chief Officer, and Mr. J. Cosker, 4th Officer.

11th June, 1952, 0030 G.M.T. The Zodiacal Light was observed, bearing $300^{\circ}(T)$, of conical shape, with base on the horizon and apex of cone between Spica and Dubhe. The brightness of the light could not be estimated because no part of the Milky Way was visible at the time. Cloud $1/8$ Cu.

Position of ship: $12^{\circ} 51'N$, $68^{\circ} 02'W$.

UNIDENTIFIED OBJECT

Aden outer anchorage

S.S. *Empire Medway*. Captain H. A. Shaw. At anchor in Aden outer anchorage. Observer, Mr. G. R. Grieve, 3rd Officer.

The exact date is not given but the ship was in the anchorage between 1400 G.M.T., 18th April, 1952, and 0800, 23rd April. At 0250 a bright object was observed and the following observations made:

Time (G.M.T.)	Altitude	Bearing
0257	$38^{\circ} 14\frac{1}{2}'$	062°
0259	$38^{\circ} 13'$	067°
0304	$38^{\circ} 06'$	074°
0320	—	077°

The object was then lost behind low clouds and was not again seen.

The object was approximately the size of planet Venus, circular in shape with an apparent black centre in a luminous disc. It was seen to pass above fine cirrus cloud giving an altitude of more than 20,000 ft. It was moving in a direction contrary to the surface wind, but was found not to be a planet or any star of possible size. The possibility of the object being a balloon released by the R.A.F. station has been put forward. The object was seen also by the Master and Chief Officer.

Wind 080° , clouds moving at moderate speed. Time of sunrise 0246 G.M.T. Cloud, $4/8$ towering cumulus, small amount of fine cirrus gradually dispersing.

Position of ship: $12^{\circ} 46\frac{1}{2}'N$, $44^{\circ} 57'E$.

Note. This is an unusual observation; the object was probably a meteorological balloon carrying instruments. These balloons, which are white, are released from the ground at Aden airfield twice a day (the dawn ascent being at about 0230 G.M.T.) and rise at 1,000 ft/min. In April the wind up to 20,000 ft is usually light from an easterly direction, but at 30,000 ft is strong from the westward. The balloon would not enter the westerly wind until above 20,000 ft, some 20 minutes or more after release, i.e. about sunrise. It would then be at sufficient height to reflect the sun's light. The westerly wind constantly increases in force with height, and would blow the balloon towards the east, dragging the instruments behind. An observer at sea-level not far from the point of release would view the instruments in front of the balloon, giving the appearance of the "black centre in a luminous disc".

Research into the Weather of Southern Oceans

This article, written by members of the Naval Weather Service, was contributed by the Director of Naval Weather Service.

The Naval Weather Service has recently published a number of research papers about the meteorology of the Southern Oceans based on investigations carried out at the Royal Naval Weather Centre at Simonstown. Although these papers may be too technical for other than professional meteorologists, readers of *The Marine Observer*, particularly those who have served in selected ships on the South America - South Africa - Australia shipping routes, may be interested to know that much of the work was based on observations over the oceans, and reports from their ships may have contributed to the successful completion of this research.

Meteorologists have long surmised that the movements of weather systems in Southern Oceans are more regular than those of their northern counterparts. Confirmation of this has not hitherto been possible because observations from the continents have not been co-ordinated with sufficient reports over the sea areas to determine the life histories of individual weather systems.

During the years 1946-50 the R.N. Weather Centre at Simonstown, at the request of the South African Weather Bureau, was responsible for the preparation of the daily forecasts for shipping on the coasts of South Africa and the ocean routes converging on the Cape. Apart from reports from land stations in the Union, the information usually available was confined to reports from the Falkland Island Dependencies (2,500-3,000 miles away), Tristan da Cunha (1,200 miles to the west) and occasional reports from ships on the Cape - South America and Cape - Australia routes. The lack of synoptic information to the south and west was a severe handicap to successful forecasting.

Although the Falkland Islands reports are most valuable to forecasters in the Union, the Falklands are five to six weather days from the Cape and the reception of the "collective" report issued from Port Stanley is very irregular. The observations from Tristan da Cunha are even more important, but the topographical features of the island unfortunately result in some of the observations being unrepresentative. For example, from certain quarters the winds have to be estimated; there is frequent orographic cloud; and only readings from automatic instruments are available for the night hours. Before 1947 observations from ships were very infrequent and many synoptic charts from which forecasts had to be attempted included only the doubtful Tristan da Cunha observation 1,200 miles to the west. Similar difficulties were experienced by forecasters in South America, Australia and New Zealand. It was not, therefore, surprising that papers written on synoptic meteorology of the Southern Hemisphere were largely hypothetical. The principal requirement for progress was sufficient information from ocean areas to provide a series of authentic charts. Even though the slow collection of data only allowed the charts to be drawn retrospectively, the conclusions derived from them would enable the forecasters to make maximum use of the limited wireless weather reports usually available.

No weather station is in a better position than Simonstown to undertake such research into Southern Hemisphere meteorology. It is at the focal point of the southern trade routes and close to the port of departure and return of expeditions to the whaling grounds of the far south, and is therefore ideally situated for collection of the vital information from the Antarctic Ocean and of the Roaring Forties, regions normally visited only by whalers and their attendant ships.

As the operations of the whale factory ships, supply ships and catchers are limited by international agreement, weather and hours of darkness, etc., to the summer months only, the months from November to April each season were studied in detail. No charts based on a reliable coverage of ship reports have therefore been prepared for the winter months. For the present it must be assumed that the same

weather processes operate in winter as in summer. This is not an unreasonable assumption in the Southern Hemisphere, for the vast region between the ice cap and 35°s is devoid of any large land mass which might give rise to appreciable differences between the summer and winter generating areas. It is to be expected, of course, that the penetration of cold air from the Antarctic into tropical regions will be stronger and deeper in winter with the retreat northwards of the thermal equator, and the consequent movement of depressions and their associated rain belts to a more northerly track in winter than in summer.

Many of the ships on the normal trade routes in the South Atlantic and South Indian Ocean are selected ships and their observations were readily made available by the Marine Division of the Meteorological Office. These reports were invaluable, for they were made with regularly tested instruments and reflected the high standard of marine observing maintained in these ships. However, every ship observation was so important to the fitting together of the weather "jig-saw", particularly south of 40°s, that recourse had to be made to collecting information from non-selected ships also. Even if the instrumental records received from some of the ships were not always reliable, visual observations were most useful in providing clues to the movements of storm centres and the weather associated with them.

The collection of this information from all available ships was no small task. The shipping movements were closely followed from *Lloyd's Weekly Index* and those ships which passed through Cape Town outward bound were contacted locally at the docks. If they were not already selected ships, their barometers were checked and they were provided with special logbooks to be collected on their return to Simonstown or posted to Simonstown on completion of their voyage. During the visits to ships in Cape Town, extracts were made from their logs; many ships, other than selected ships, not calling at Cape Town, were specially enrolled by correspondence. Selected ships co-operated in this scheme as a matter of normal routine, but they were also visited and extracts made from their logbooks as necessary.

It is fitting to pay tribute in this journal to the many masters and officers of all the ships concerned for the voluntary assistance given in making observations, keeping logs and sending extracts to further this research. Very few of the officers approached failed to give wholeheartedly of their services. Logs were returned from ships of all nationalities from ports all over the world; they reflect the genuine interest seafaring men have in the study of weather over the oceans, and their willingness to co-operate in research projects of this nature. During the three summer seasons 1946-49 over 700 logs were collected containing an estimated total of some 40,000 observations.

This wealth of information made it possible for the first time to construct authentic weather charts for a large area of the Southern Hemisphere. Some of the conclusions derived from a study of the charts were:

(a) Around the periphery of the Antarctic Continent the circulation is usually anticyclonic with a belt of occluding depressions moving eastward in approximately 60°s at a mean speed of advance of 20-25 knots. Each of these depressions is associated with a polar front on which secondary depressions form. These move south-eastwards to coalesce with and reinvigorate the occluding primary as it migrates eastwards, thus creating the illusion that a belt of permanent depressions encircles the Antarctic Continent—a hypothesis held by many early workers in Southern Hemisphere meteorology. It was considered that a primary depression centred, say, near the South Orkneys would move eastwards around the Antarctic Continent and arrive at the South Orkneys again 15-20 days later. In actual fact it is not really the same depression but probably the fifth or sixth offspring in its family that reappears.

(b) The cold air escaping from the Antarctic is released in a series of surges. The

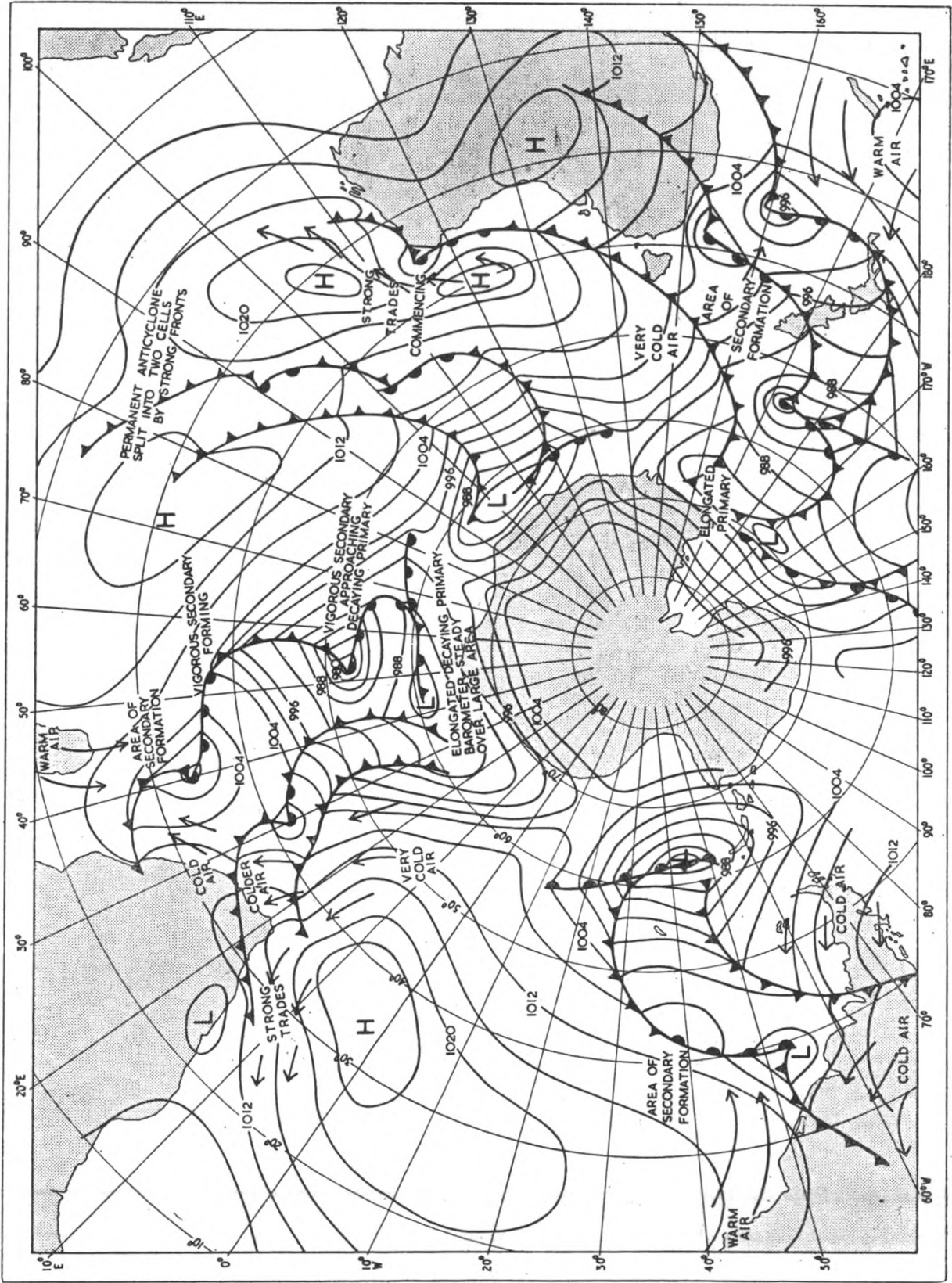
air associated with each successive surge is less modified in its passage towards the tropics and hence is readily distinguishable from the air associated with its predecessor. Thus when frontal conditions are experienced on the ocean routes between the Plate and Cape, or Cape and Australia, not one front but two or three in succession are usually recorded. The wind backs from N'ly to w'ly or sw'ly then veers to N'ly again, and the sequence is repeated for a period lasting two to three days before the final outburst of very cold air sets in from a s'ly quarter and the cold anticyclone becomes established. The following extracts from the log of M.T. *Amiens* in October, 1947, are typical of this sequence of events:

Date	Noon Position	Time (G.M.T.)	Wind	Temp. (°F)	Weather	Remarks
6th	33° 42'S, 5° 25'E	1200	WNW 2	63	oir	{ First cold front passed through.
		1600	SSW 2	61	c	
7th	33° 45'S, 1° 10'W	1200	N 1	62	c	{ Second cold front passed through
		1800	W 5	60	pqr	
8th		0400	SSW	52	bc	Very cold air set in.

(c) There is little doubt that the “ horse latitudes ” of the South Atlantic, South Indian and South Pacific Oceans are regions where the weather is largely influenced by semi-permanent anticyclones. Frequently strong ridges protrude southwards from these anticyclones and are sufficiently tenacious to deflect the escaping cold air polewards again, but sometimes the anticyclones are displaced, or even temporarily divided into two or three weak cells, by an extra strong outburst. In the main, however, the easiest escape routes for the cold air in its passage towards the tropics are in the regions of weak circulation between the high cells, i.e. along the east and west coasts of the three main continents. The air escaping on the west sides of the continents is usually unimpeded and causes an intensification of the south-east trades for a period of two or three days; the air escaping on the east sides often meets warm air coming southwards from the tropics around the north-western quadrant of the adjacent anticyclone and vigorous secondaries are formed. Thus the regions north-westward from Cape Point, Cape Leeuwin and Juan Fernandez frequently experience se'ly gales after the passage of cold fronts, while the areas to the south of the Mozambique Channel, Tasman Sea and River Plate Estuary are the breeding grounds of vigorous young depressions. These depressions, after an initial slow northward movement, recurve and deepen during their passage south-eastwards towards the pole and eventually rejuvenate the decaying primary systems in the region of the 60th parallel.

Winds in the south-east quadrant of these depressions will be from an E'ly direction, and although the Roaring Forties is a region of prevailing w'ly winds, it is not unusual, therefore, to find strong E'ly winds being reported in these latitudes, though their duration is usually short-lived.

(d) It is usual to associate a very low barometer with strong or gale force winds, but this is not necessarily so in the sea areas in the region of 60°s. Here the centres of the large low-pressure systems tend to be elongated on an east-west axis. A ship may therefore steam along the long axis through the centre of a depression for many hours, perhaps days, with the barometer in the region of 970 mb and yet experience only light to moderate winds. A hundred miles or so to the north and south of the ship winds of hurricane force may well be blowing. The following examples from the ships *Thorshammer* and *Norhval* during November, 1947, may be of interest.



Typical synoptic chart of the Southern Hemisphere.

Date	Noon Position	Time	Barometer	Wind
27th	57° 47'S, 80° 07'E	1800	975	NE 3
28th		0000	972	NE 2
28th		1200	972	NNW 2
29th		0000	972	NW 2
29th	57° 43'S, 82° 26'E	1200	972	NW 2
30th		0000	973	S 3
27th	57° 34'S, 79° 53'E	1800	971	NE 3
28th		0000	968	ENE 1
28th		1200	966	NW 1
29th		0000	967	NW 1
29th	57° 27'S, 80° 00'E	1200	967	SW 1
30th		0000	976	S 2

These points are demonstrated in a typical chart shown on page 87.

Interest in the synoptic processes of these vast ocean areas has been intensified of late, partly because it has been realised that there are general problems of circulation that need clarification before the specialised problems of the various continents can be effectively investigated. To this end the data collected at Simonstown have been made available to assist in projects being undertaken by the National Institute of Oceanography, the Massachusetts Institute of Technology and the French Meteorological Service. Nevertheless, whatever the outcome of these efforts may be in providing a better understanding of the weather processes of the Southern Hemisphere, the practising forecaster must still rely upon an adequate coverage of regular observations. The South African Weather Bureau and Australian Meteorological Branch have set up reporting stations on Marion and Heard Islands in the sub-Antarctic; much is being done at present on an international level to encourage whaling ships to report observations by w/r, and in the main the observations from ships on the Southern Ocean routes continue to be of the greatest importance to forecasters. For reasons of economy the Naval Weather Centre at Simonstown had to be closed down just when a strong liaison had been established with so many "regulars" calling at Cape Town. It seems that the good work is being ably carried on by the Port Liaison Officers at Cape Town and a number of Australian and New Zealand ports, who are doing a grand job in recruiting, equipping and maintaining reporting ships, with a consequent continued increase of ship reports.

It is hoped that you who frequent these waters are co-operating to the best of your ability to assist forecasters in their work. The more information you provide the greater the probability of the success of their services to you.

DIFFICULTIES IN CLEARING WEATHER REPORTS THROUGH COASTAL RADIO STATIONS

If a selected or supplementary ship experiences difficulty in clearing radio weather messages to any shore radio station a note should be made in the meteorological logbook mentioning this fact. The note should specify the name and call sign of the station, the frequency or frequencies which were tried, the length of time during which attempt was made to clear the message and any other particulars which the radio officer considers helpful. The Meteorological Office will then be in a position to take steps in an endeavour to prevent such difficulties occurring in future, through the good offices of the World Meteorological Organisation.

Hints on Observing

3. WIND

By Cdr. C. H. WILLIAMS, R.D., R.N.R., and Capt. J. R. RADLEY

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

In this third article of the series we are dealing with the observation of wind direction and force, items that have been noted in ships' logbooks for hundreds of years.* It is, however, only since Admiral Beaufort's day (1774-1857) that observations of wind have been recorded in a uniform manner and utilised for specific meteorological purposes. Previous to that, the wind was logged in a somewhat sketchy fashion, such as "a fine breeze", "it blows fresh", "a fret of wind", and so on. No doubt the seamen of those days knew what was implied by these terms, at any rate in their own locality, but the actual force or speed of the wind to which these terms referred is uncertain.

Beaufort Force

The speed of the wind is usually estimated and expressed in Beaufort's scale, or "Beaufort force" as it is now known. The Beaufort scale, which was introduced in 1808, has undergone many minor changes since its inception, and the table on pages 90-91 shows these in tabular form. The sea disturbance equivalents, which provide a picture of the sea disturbance created by winds of various forces, were introduced as a result of an I.M.O. conference at Berlin in 1939. They were proposed by a German merchant seaman, Captain Peterson, and were modified as necessary after consultation with mariners of various countries, including officers of British selected ships.

Beaufort force is in general use at sea throughout the world. Some years ago the International Hydrographic Bureau published a chart of it in no fewer than 35 different languages. Originally it was usual to judge Beaufort force by the effect of the wind on a ship's speed under sail and by the amount of sail she could carry, but as time went on it became customary to estimate wind direction and force by its effect on the sea surface and that method remains in use today. The Beaufort force is in general use not only at sea but ashore, and in fact some special "shore" equivalents were evolved by the Meteorological Office in 1905.

As winds of over force 12, hurricane (68 kt), have been measured at times, the upper limits for Beaufort numbers was in 1944 extended up to 17, the wind speed of this being 110 to 118 kt. We hope that none of our readers will ever experience such excessive winds. These Beaufort numbers above 12 are, however, not used at sea; they are only suitable for use when reliable anemometers enable these exceptional wind speeds to be accurately measured.

Knots and degrees

In merchant ships it has long been customary to think of and to log wind direction and speed in compass points and Beaufort force, and this custom is likely to continue. We speak of a "moderate sw gale" and not of a "30 knot 225° wind"; but for international meteorological purposes, such as coded weather reports, the latter method is obviously more precise and easily understood in all languages. Therefore the international meteorological code requires the reporting of wind speed in knots and its direction in tens of degrees.

*It seems that logbooks date from the fifteenth or sixteenth centuries, and were so named because they contained the record of the ship's speed by log, and other navigational notes copied from the log-board or log-slate kept by the officer of the deck. These boards were ruled up for times, speeds by log, courses steered, wind, etc., and usually written in chalk to be rubbed off after the data had been entered in the logbook. The log itself was so called from ancient times when an actual piece of wood was thrown overboard and the ship's speed judged by its passage alongside.

Table showing history of Beaufort's

EARLY SCALE, 1769	BEAUFORT'S NUMBER	BEAUFORT'S SCALE, 1806	BEAUFORT'S CRITERION, 1806 (OFFICIALLY INTRODUCED IN 1838)		MODIFIED CRITERION, 1874	
Stark calm.	0	Calm.	—		—	
Calm weather.	1	Light air.	Just sufficient to give steerage way.		Just sufficient to give steerage way.	
Little wind.	2	Light breeze.	With which a well- conditioned man-of- war, under all sail, and clean full, would go in smooth water from:	1 to 2 knots.	That in which a well- conditioned man-of- war, with all sail set, and clean full, would go in smooth water, from:	1 to 2 knots.
A fine breeze.	3	Gentle breeze.		3 to 4 knots.		3 to 4 knots.
A small gale.	4	Moderate breeze.		5 to 6 knots.		5 to 6 knots.
A topsail gale.	5	Fresh breeze.	In which the same ship could just carry, close hauled:	Royals, etc.	That to which she could just carry in chase, "full and by":	Royals, etc.
Blows fresh.	6	Strong breeze.		S'gle reefs and t'gallant sails.		Topgallant sails.
A hard gale.	7	Moderate gale.		Double reefs, jib, etc.		Topsails, jib, etc.
A fret of wind.	8	Fresh gale.		Triple reefs, courses, etc.		Reefed upper- topsails and courses.
A storm.	9	Strong gale.	With which she could only bear:	Close reefs and courses.	That with which she could scarcely bear lower main topsail and reefed foresail.	Lower topsails and courses.
A tempest.	10	Whole gale.		Close reefed main topsail and reefed foresail.		
—	11	Storm.		Storm stay- sail.		That which would reduce her to storm stay-sails.
—	12	Hurricane.	To which she could show no canvas.		That which no canvas could withstand.	
From a publication entitled "An historical account of the Great Storm of 1703".			Admiral Beaufort's criterion was for a full-rigged ship of the period (1800-1850).		The original criterion was modified as above in 1874, after double topsails were in general use.	

The wind speed is still estimated aboard ship in Beaufort forces 1 to 12, and is logged as such, but a table enables the observer to convert the Beaufort number into knots for transmission in the radio weather message. In fact the table of knots enables a more exact definition of the wind speed to be made. We all know how often at sea it is difficult to say whether the wind speed is a strong force 4 or a weak force 5 and we log force 4-5. The knot system enables us to say in the message the exact figure corresponding to the wind speed being experienced.

Estimation of wind speed and direction

Both direction and force of wind can be estimated by eye. It follows that, as no instruments are involved, the accuracy of these wind observations depends entirely on the experience, care and judgment of the officer concerned. This judgment is acquired by ships' officers as part of their training, in the same way as skill and

Wind Scale and the Sea Criterion

MODIFIED SCALE, 1906-1924	COASTAL CRITERION, 1906	SEA CRITERION
Calm.	—	Sea like a mirror.
Light breeze.	Sufficient to give good steerage way to fishing smacks with the "wind free".	Ripples with the appearance of scales are formed, but without foam crests.
	Fishing smacks with topsails and light canvas "full and by" make up to 2 knots.	Small wavelets, still short, but more pronounced; crests have a glassy appearance and do not break.
	Smacks begin to heel over slightly under topsails and light canvas, make up to 3 knots "full and by".	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses.
Moderate breeze.	Good working breeze. Smacks heel over considerably on a wind under all sail.	Small waves, becoming longer; fairly frequent white horses.
	Smacks shorten sail.	Moderate waves, taking a more pronounced long form; many white horses are formed. (Chance of some spray.)
Strong wind.	Smacks double-reef gaff mainsails.	Large waves begin to form; the white foam crests are more extensive everywhere. (Probably some spray.)
	Smacks remain in harbour and those at sea lie to.	Sea heaps up, and white foam from breaking waves begins to be blown in streaks along the direction of the wind. (Spindrift begins to be seen.)
Gale force.	Smacks take shelter if possible.	Moderately high waves of greater length; edges of crests break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.
	—	High waves. Dense streaks of foam along the direction of the wind. Sea begins to roll. Spray may affect visibility.
Storm force.	—	Very high waves with long overhanging crest. The resulting foam in great patches is blown in dense white streaks along the direction of the wind. On the whole the surface of the sea takes a white appearance. The rolling of the sea becomes heavy and shocklike. Visibility affected.
	—	Exceptionally high waves. (Small and medium-sized ships might be for a time lost to view behind the waves.) The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility affected.
Hurricane.	—	The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected.
In 1924 it was decided to revert to Beaufort's original scale.	For a ketch or yawl-rigged average-sized sailing trawler, loaded, with clean bottom.	Introduced by the International Meteorological Organisation, Berlin, 1939.

knowledge are gradually learned in other ancient crafts, that is, by being passed from senior to junior in the ordinary course of duty.

In the *Marine Observer's Handbook* on page 35 is printed the Beaufort scale with the equivalent wind speed in knots, and the Sea Criterion describing the usual appearance of the sea surface for different wind forces. This sea criterion is an excellent guide when judging wind force by eye; a study of its descriptions compared with one's own observations can assist in forming a sound judgment of wind speed. It is obvious that the sea criterion applies only in the open sea well clear of the land, so that sufficient "fetch" is available for the sea to attain its proper size relative to the wind. If a ship is in the lee of the land it is clear that allowance must be made for that fact.

Further notes giving some assistance in judging wind speed were published in *The Marine Observer*, April, 1951, page 126, in an article entitled "Observing the

apparent wind on shipboard". In it the Beaufort numbers are related to the feel of the wind, the angle at which smoke rises, the behaviour of halliards, the sound of the wind in the rigging and the behaviour of flags.

There is a corresponding criterion for use ashore, that for force 2 being "wind felt on face, leaves rustle, ordinary vane moved by wind"; force 3, "leaves and small twigs in constant motion, wind extends light flag", and so on.

The sea criterion and the other notes are the result of careful observation and are most useful as a general guide, but cannot be quite accurate in all circumstances. The observer's judgment in making these observations is affected on different occasions by such factors as the amount and direction of the light, the length of time the wind has been blowing with its present force and direction, the depth of the sea, the effect of strong tides and so on. If the wind is increasing, its force will be in excess of that indicated by the appearance of the sea surface and vice versa. It is well known that in tidal waters the disturbance of the sea will be far greater when the wind is against the tide than when it is with the tide. Precipitation causes some smoothing effect on the sea. A leading American meteorologist, Dr. C. F. Brooks, has observed that a wind blowing over relatively warm water creates more sea disturbance than when blowing over colder water; readers whose voyages take them into areas where sharp changes of sea surface temperatures occur may like to confirm this for themselves*.

For winds greater than about force 3, there is very little difficulty in estimating the direction of the wind. Seamen speak of the "eye" of the wind, and this refers to the direction from which the wind blows. It is often clearly indicated by the streaks blown along the sea surface as shown in Figs. 5 and 6, and by the small breaking tops of the waves which are, of course, at right angles to the wind (Fig. 2). In Figs. 3 and 6 the camera is looking straight to windward. Under ordinary conditions, an officer situated at a ship's standard compass, with a clear all-round view, can very accurately see the true wind direction in this manner and can at the same time estimate the Beaufort force from the appearance of the sea surface.

The parallelogram of velocities

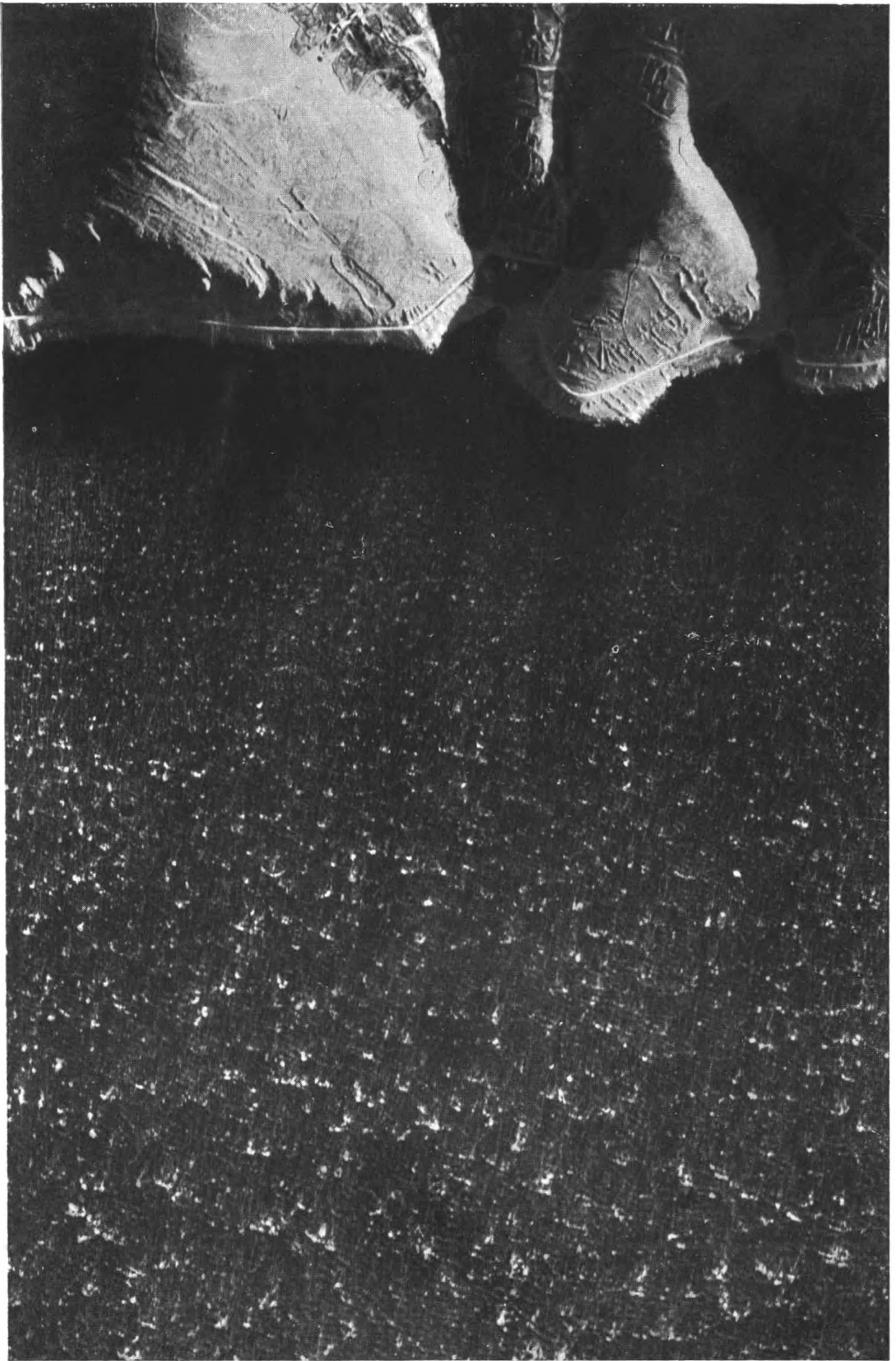
To estimate the wind direction and force correctly is more difficult in modern ocean-going ships than it was in the smaller and slower ships of a few years ago. Nowadays navigating bridges are higher and ships' speeds are often much greater, so that on a dark night with a light wind it is often quite impossible to judge the true direction of the wind by eye alone. Under such conditions the observer must deduce the true wind from the apparent or relative wind by noting the direction in which the smoke blows, the feel of the wind on the face or on a wetted finger, or by other similar means, making allowance for the speed of the ship. The method is described in the *Marine Observer's Handbook* on page 37; it can be done either by a table or by plotting a parallelogram of velocities. With light winds and in a fairly fast ship the difference between the apparent wind and the true wind can prove quite surprising, both in direction and speed.

It is instructive to use both methods occasionally, first that of judgment by eye and then that in which, with the aid of a table or diagram, the true wind is deduced from the apparent wind.

Anemometers

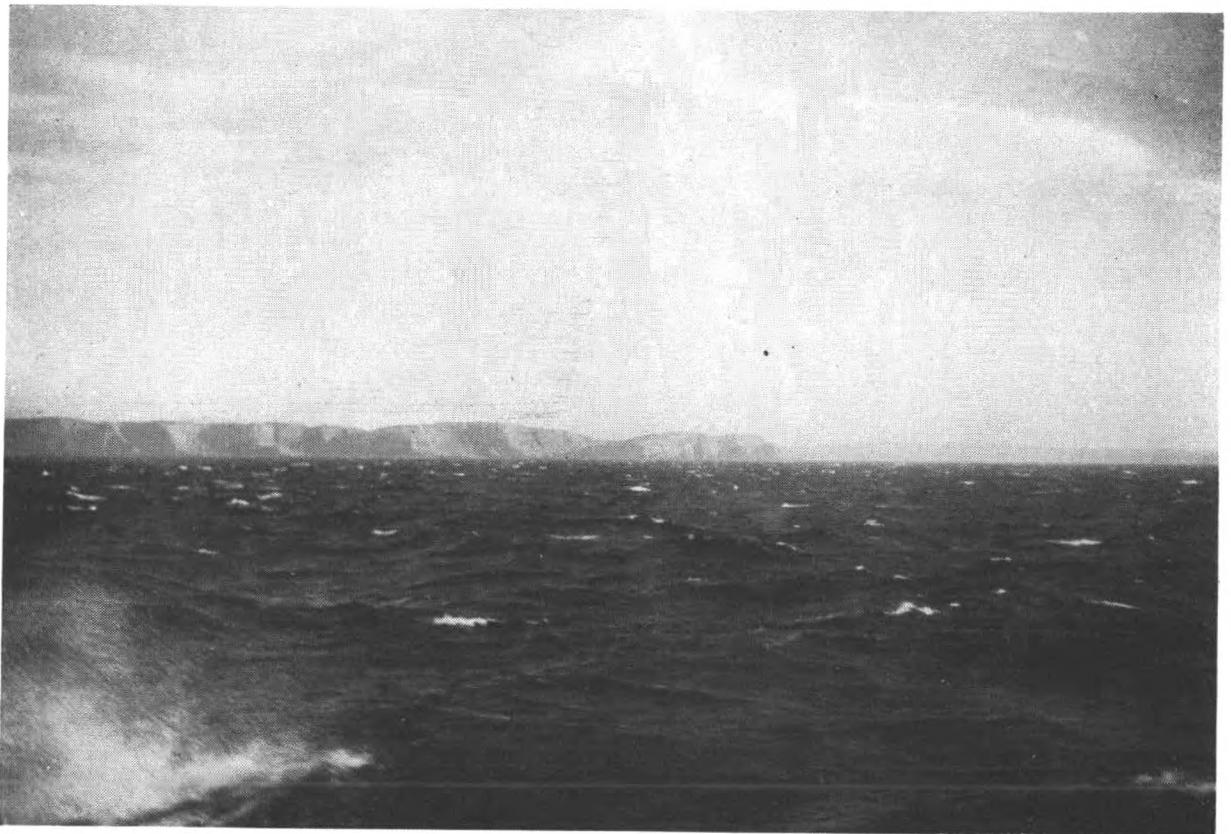
Certain British lightvessels make regular weather observations. In their case the judging of wind force by eye as usually practised at sea is not always possible because of a variety of causes such as nearness of land, shallow water, sandbanks, etc. These craft are therefore supplied with small hand anemometers which show the wind speed in knots. In anchored ships such as light vessels there is, of course, no difficulty in judging wind direction.

*Mr. Brown's article on page 94 also discusses this subject.



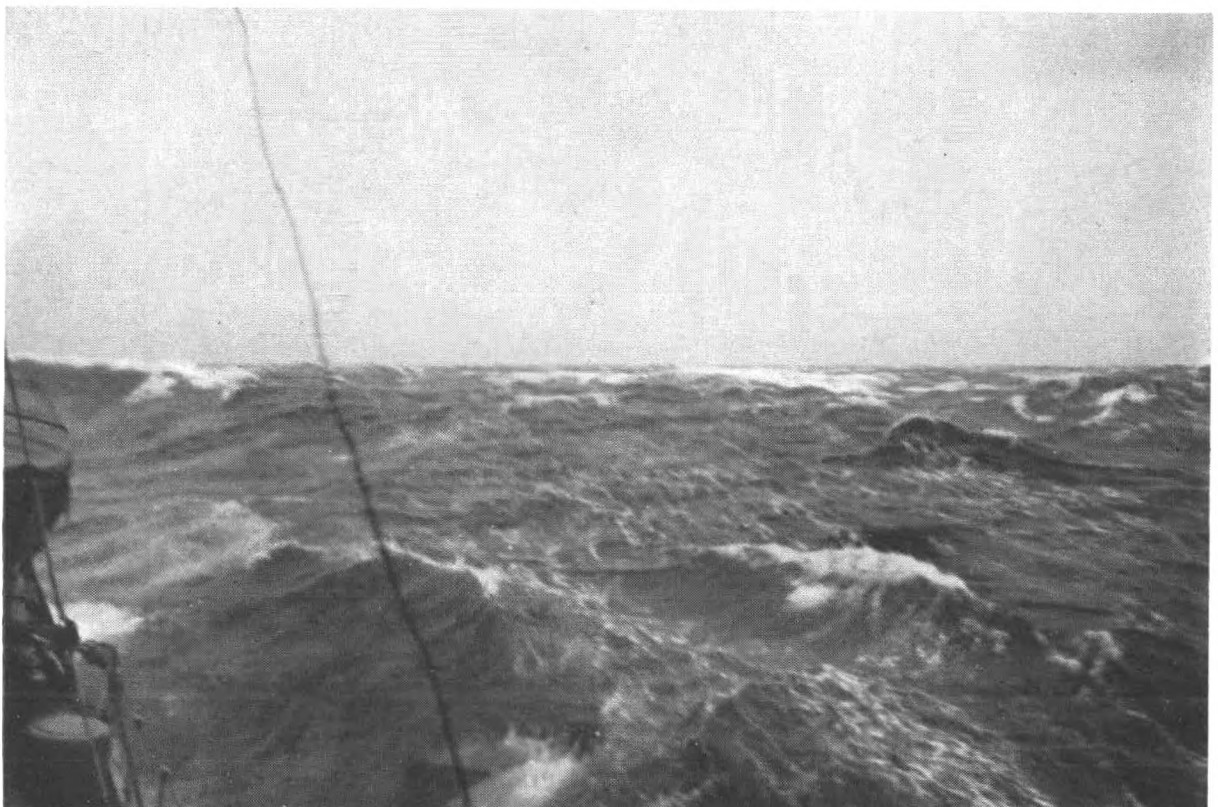
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Fig. 1. Aerial photograph showing generation of waves by an off-shore wind, 13th December, 1943, SE of Fiume.



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Fig. 2. Beaufort force 5.



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Fig. 3. Beaufort force 7.



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Fig. 4. Beaufort force 8.



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Fig. 5. Beaufort force 10.

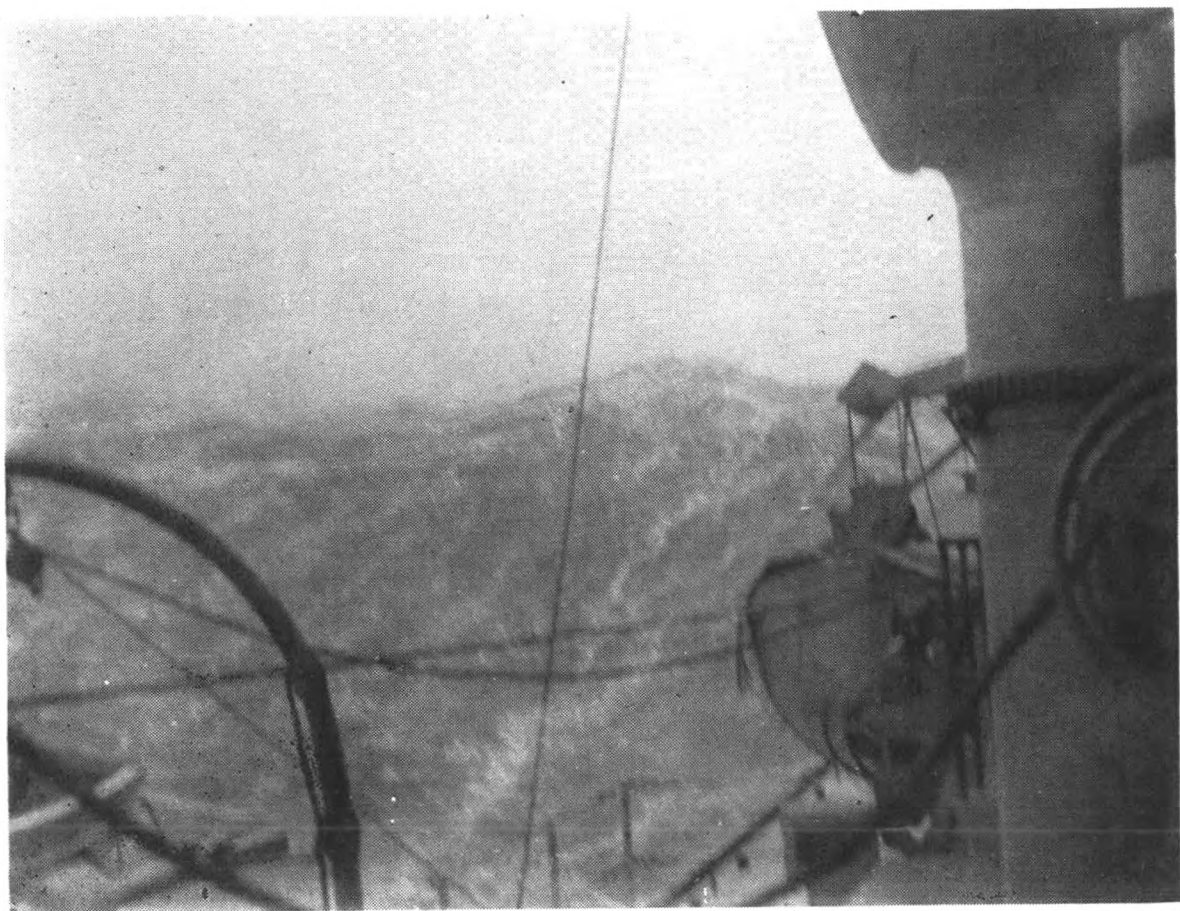


Fig. 6. Beaufort force 12.

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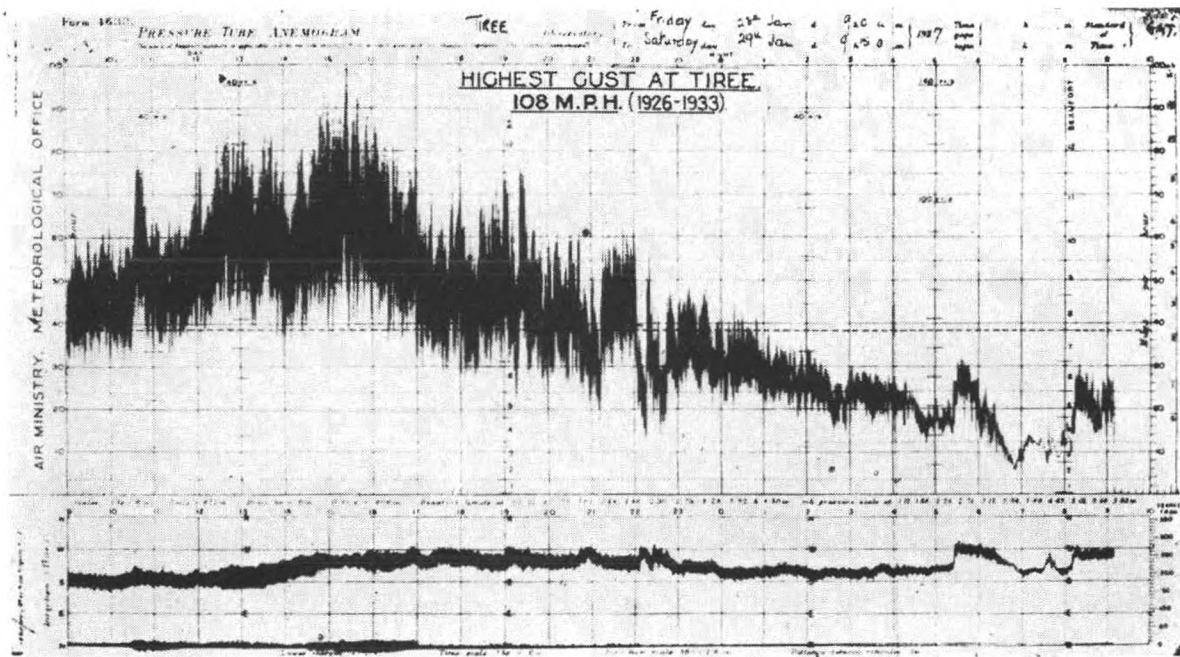


Fig. 7. Anemometer trace of a gale at Tiree. The upper trace shows the speed of the wind and the lower trace the direction.

British ocean weather ships are specially fitted with anemometers on the masts, which record electrically on a graph in the meteorological office below deck.

Gustiness

Gustiness of the wind and unsteadiness in direction is quite common both afloat and ashore, but is more pronounced ashore. This gustiness is clearly shown in Fig. 7, which is a reproduction of an anemogram giving the force and direction of the wind as recorded on a Dines pressure-tube anemometer.

The effect of such gustiness on a tender or "light" ship or upon a vessel under sail can, in certain circumstances, have serious results. Important as the force of these gusts are to a seaman, however, it is the mean wind speed which should be logged in the meteorological log, and not the maximum wind speed.

Use made of wind observations

A glance at any weather map will show the importance of accurate reports of wind direction and force, for when such a map is being plotted it is to the former that the trend of the isobars is related, while wind force is related to the pressure gradient; the stronger the wind the closer the isobars are to each other. Accurate wind observations can thus be very useful to the forecaster as a check on the accuracy of a doubtful pressure reading.

From the above notes it should be clear that these observations of the true direction and force of the wind, made in a moving ship at sea, require the utmost skill and care. It is a subject in which all seamen can take an interest, and its practice can help to develop the skill in judgment that is the mark of an observant and efficient officer.

S.S. CAIRNVALONA

The last page of a logbook recently received in the Marine Branch concluded with: "These are the final observations from the S.S. *Cairnvalona* as the vessel is due to be scrapped after the present discharge of cargo, being 33 years old. Hoping the reports have been of service. 2nd Officer."

Cairnvalona had been a selected ship since 1937. During the war no records were kept of course, but the instruments remained on board and she was visited every time she came to the United Kingdom. She earned an "Excellent award" in 1948 when commanded by Captain Molineux.

R.M.S. ORMONDE

Orient Liner, 15,047 tons gross

This ship arrived at Tilbury in November, 1952, having completed her 75th and last voyage to Australia. She had the unusually long life of 35 years, having been built in 1917 by Messrs. John Brown & Co., Ltd., of Clydebank.

The *Ormonde* was an interesting ship from the point of view of the Meteorological Office, for she was one of the ships of the voluntary observing fleet during practically the whole of her long career. The first meteorological logbook received from her was for the period November, 1917, to May, 1918, and they were received regularly since then, except for the period of the Second World War. No fewer than 91 logbooks were sent in from the ship. It is doubtful if any other ship has contributed meteorological logs for so long and so continuously.

In December, 1952, the *Ormonde* left Tilbury for the Clyde, to be broken up.

C. H. W.

Wave Data for the Eastern North Atlantic

By P. R. BROWN, M.SC., A.R.C.S., D.I.C.
(Marine Branch, Meteorological Office)

A few coastal wave-recording stations are in existence giving accurate and detailed data on ocean waves reaching these stations, one of which is at Perranporth in Cornwall, while the available wave data in the open sea is mainly from merchant and ocean weather ships. Until 1949 ships' observations of sea disturbance were generally recorded in the sea and swell codes, of which there were several and which allowed of little detail in reporting waves. These codes merely classified the sea as slight, moderate, rough, etc., and the swell as low, moderate or heavy, but gave no specific figures for height and period. Since 1st January, 1949, the present international code for reporting the height, period and direction of waves has been in force and this allows of more detail. Many papers have been written on the theory of the generation of sea waves by wind and the reader interested in this aspect

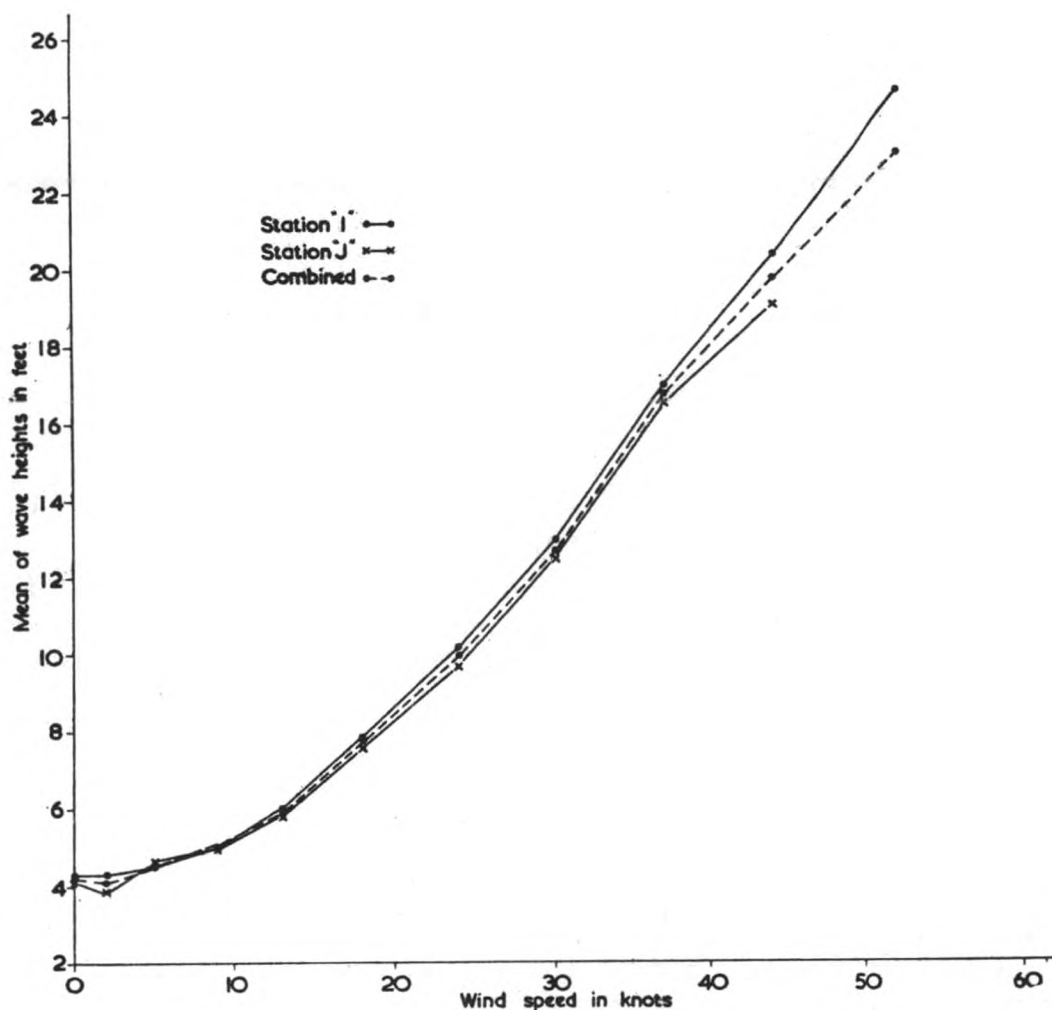


Fig. 1.

cannot do better than refer to a paper by the Admiralty Research Laboratory,^{1*} based mostly on the Perranporth data, and several papers by Sverdrup and Munk, for example². It was, however, decided that a statistical study of the wave data

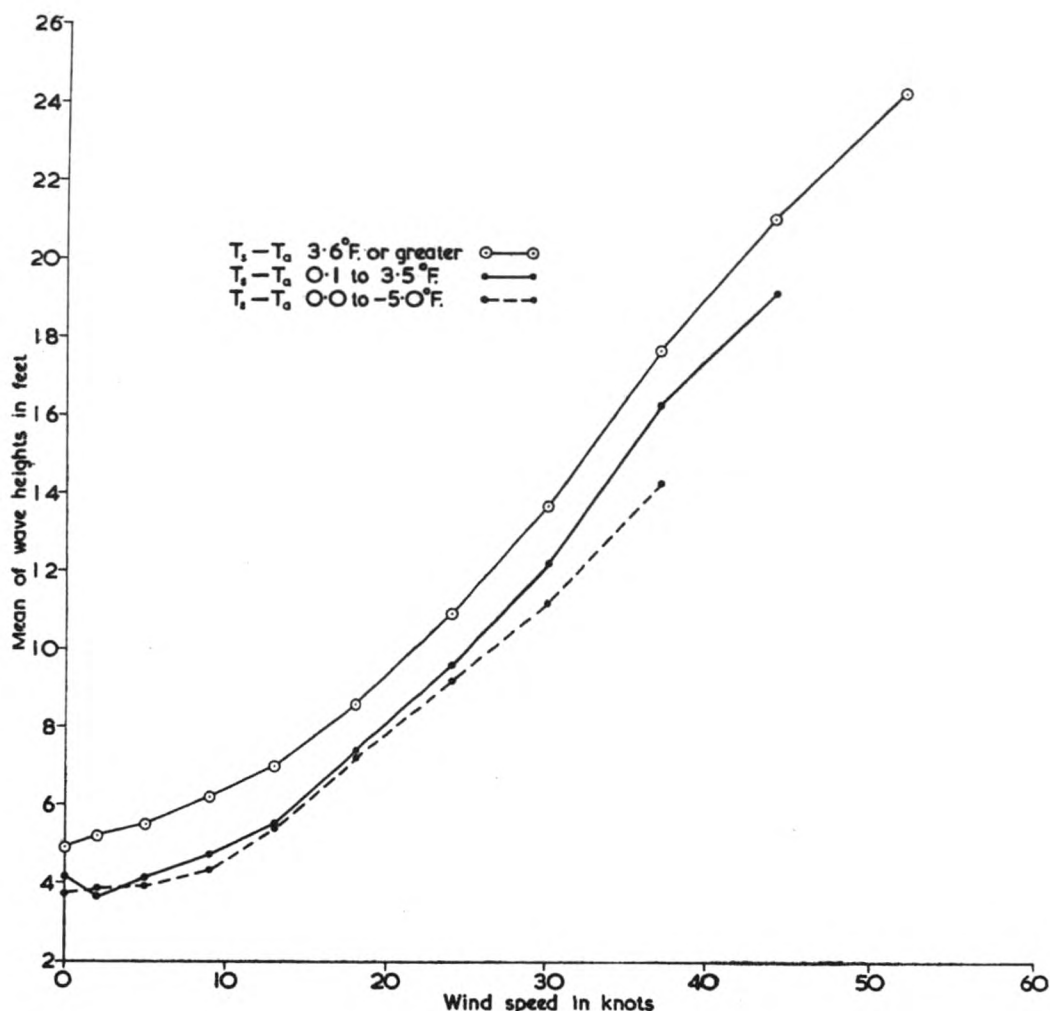


Fig. 2.

from ocean weather ships at stations "I" and "J" in the North Atlantic would be useful. Since the computations were completed, a paper by Roll³ giving the results of a similar investigation, and published in the last few months, came to the notice of the author. As, however, the results obtained by the author are in somewhat different form it was decided to publish them but with little discussion.

Wave height and wind speed

17,285 observations for stations "I" and "J" in the areas $57^\circ\text{--}62^\circ\text{N}$, $15^\circ\text{--}24^\circ\text{W}$, and $50^\circ\text{--}56^\circ\text{N}$, $15^\circ\text{--}23^\circ\text{W}$, respectively for the period January, 1949 to December, 1951 were used, these observations being on punched Hollerith cards. The wind speed is that recorded by an anemometer 56 ft above the sea surface in two of the ships concerned and 62 ft above in the two other ships, and the wave height reported is the mean maximum height of the waves.

* The numbers refer to references on page 98.

The cards were sorted into wind forces and then wave heights and the means of the wave heights were computed for each wind force. The results for stations "I" and "J" and the combined data are shown in Fig. 1, all means for 50 observations or less being neglected. The accepted means of wind speed for each Beaufort force were used. The observations are for simultaneous values of wind and waves, and since the latter include both sea and swell it is not to be expected that when the wind is calm or light at the station the wave height will necessarily be zero or very small respectively, since on most occasions there will be swell which will have originated elsewhere previously.

The sea-air temperature difference is known to be a factor in the relation between wind speed and wave height. The cards for stations "I" and "J" were combined and sorted into three groups of sea-air temperature difference ($T_s - T_a$), these being -5.0° to 0.0°F , 0.1° to 3.5° and 3.6° and greater. The cards were then sorted for wind speed and wave height as before and the wave heights computed for each wind force. The results are shown in Fig. 2, all means for 45 observations or less being neglected. The distribution of wave heights for station "J" with winds of Beaufort force 4 are shown in Fig. 3 for the three groups of sea-air

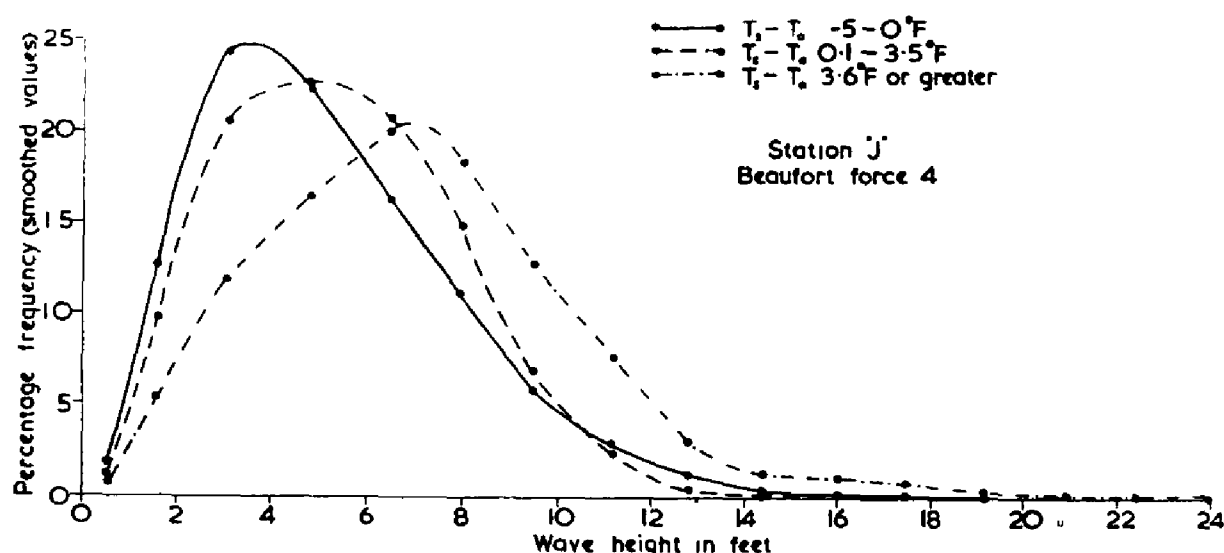


Fig. 3.

temperature difference, the frequencies of wave heights having been smoothed by means of the formula $\frac{a_1 + 2a_2 + a_3}{4}$. The distribution for other wind forces for both "I" and "J" are generally of similar form to this, although often the curves for the negative and 0.1° to 3.5° $T_s - T_a$ approximate more closely to one another.

The combined observations for stations "I" and "J" for wind forces 4, 5 and 6 were separated, and these were sorted separately for sea-air temperature difference and then wave height and the mean wave height computed for each value of $T_s - T_a$. The results are shown in Fig. 4, all means for less than eight observations being neglected. For wind forces 5 and 6 there is a marked minimum of mean wave height at about $T_s - T_a = 0$, where the observations are numerous. At $T_s - T_a$

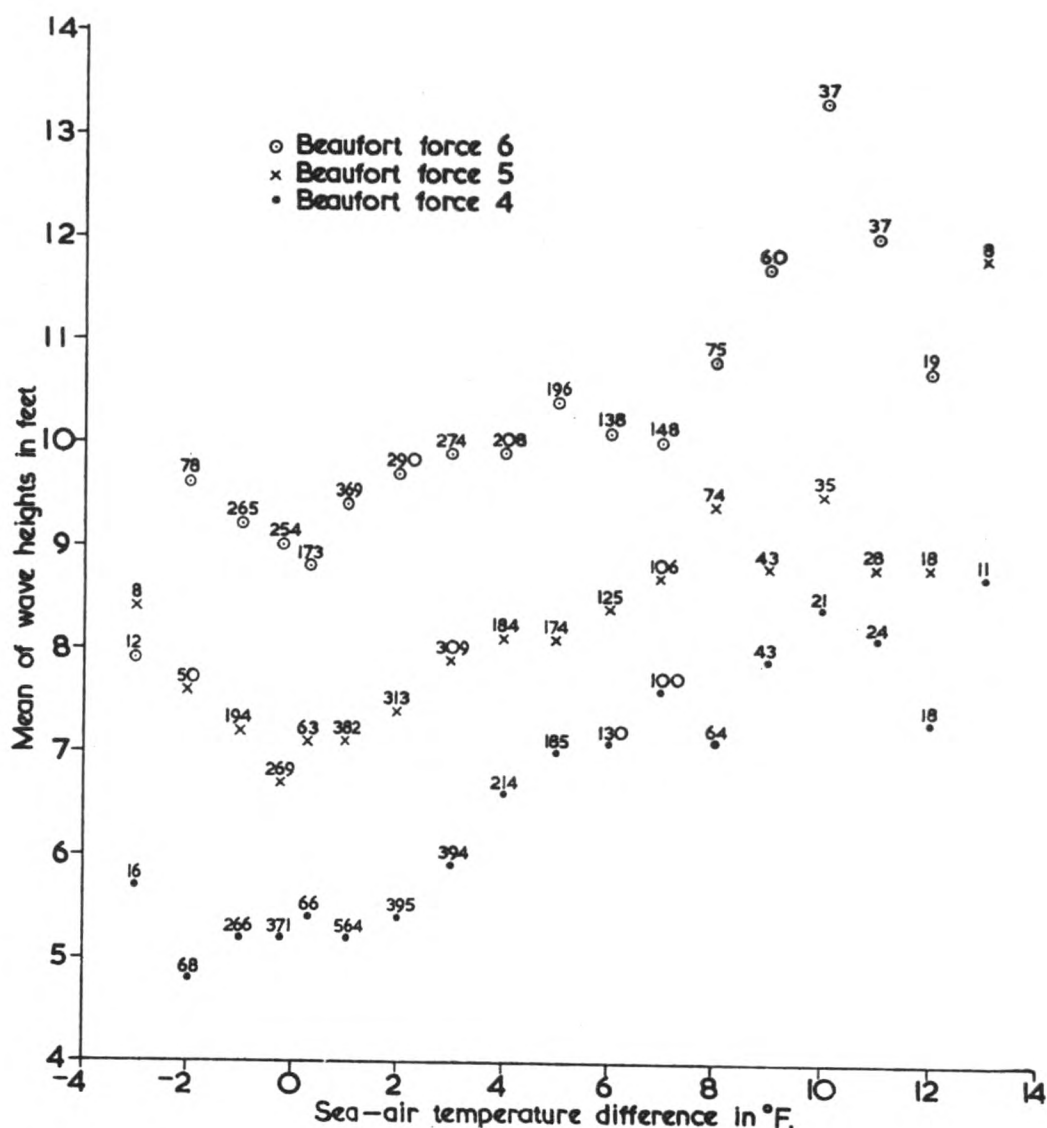


Fig. 4.

values of over 5°F and less than -2°F observations are less numerous and a large scatter is to be expected. The increasing wave height with increasing instability, as signified by increasing $T_s - T_a$, at values of $T_s - T_a$ greater than zero is also not surprising. Seilkopf, among others, has given an explanation of this and a summary of the explanation is given in Roll's above-mentioned paper. No sound explanation of the increasing wave height with increasing stability for negative values of $T_s - T_a$ is obvious: indeed before any attempt is made at an explanation it would be interesting to know if other countries with ocean weather ships obtained the same result from an analysis of their data. Unfortunately merchant ship observations cannot generally be used for this specific purpose since the wind speed is, to a large extent, estimated from the appearance of the sea surface, whereas on ocean weather ships anemometers are available for this purpose.

Wave period and wind speed

Finally the cards for station "I" for each wind force were sorted into $T_s - T_a$ groups -5.0° to 0.0°F , 0.1° to 3.5°F and 3.6°F and greater, and then sorted for wave period and the mean periods computed. The results are shown in Fig. 5, all means

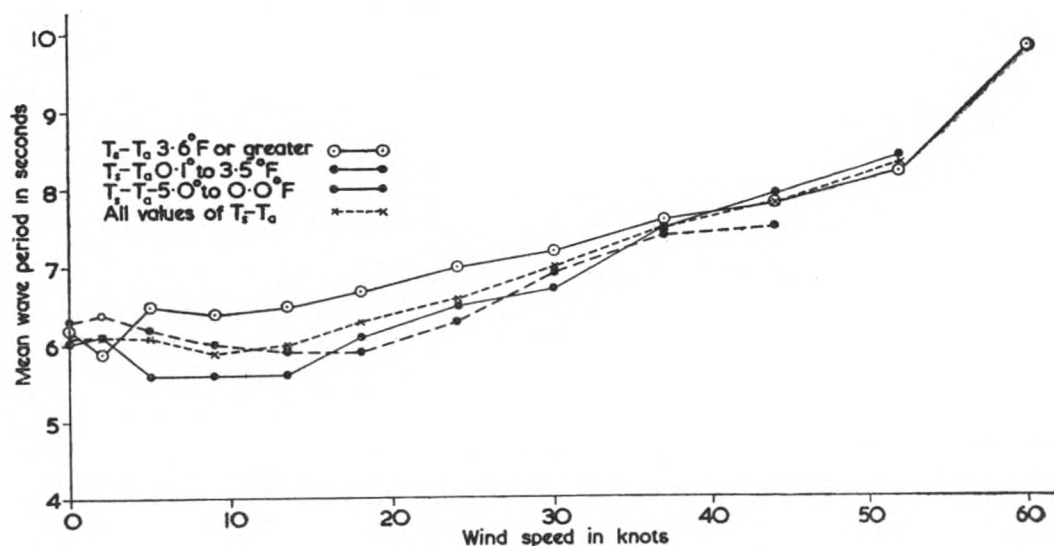


Fig. 5.

for less than 10 observations being neglected. Also shown on this figure is the mean wave periods irrespective of sea-air temperature difference, and for this any mean for less than 50 observations has been neglected. It is to be expected that the graphs will have a different form at low wind speeds from that at higher wind speeds, since the swell reaching the station from other localities will normally be predominant for low wind speeds. The variation of mean wave period with wind speed for all values of $T_s - T_a$ is almost linear from Beaufort force 3 to 10 inclusive. The correlation coefficient between the two sets of values in this range of wind speed is 0.998, and the regression equation for the mean period in this range is:

$$\text{Mean period (in seconds)} = 6.9 + 0.058(u - 28.37)$$

where u is the wind speed at mast height in knots.

Conclusions

The analysis of wave observations from ocean weather ships in the eastern North Atlantic shows that for a given wind force the mean wave height increases with increasing values of sea-air temperature difference ($T_s - T_a$) above zero. It also suggests that, at least for Beaufort wind forces 5 and 6, the wave height increases with increasing $T_s - T_a$ above zero, giving a minimum value for the mean wave height when the air temperature is equal to the sea surface temperature. The mean wave period appears to vary linearly with the wind speed, at least in the range of Beaufort wind forces 3 to 10.

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A Condensed History of the Royal Observatory, Hong Kong

By L. STARBUCK

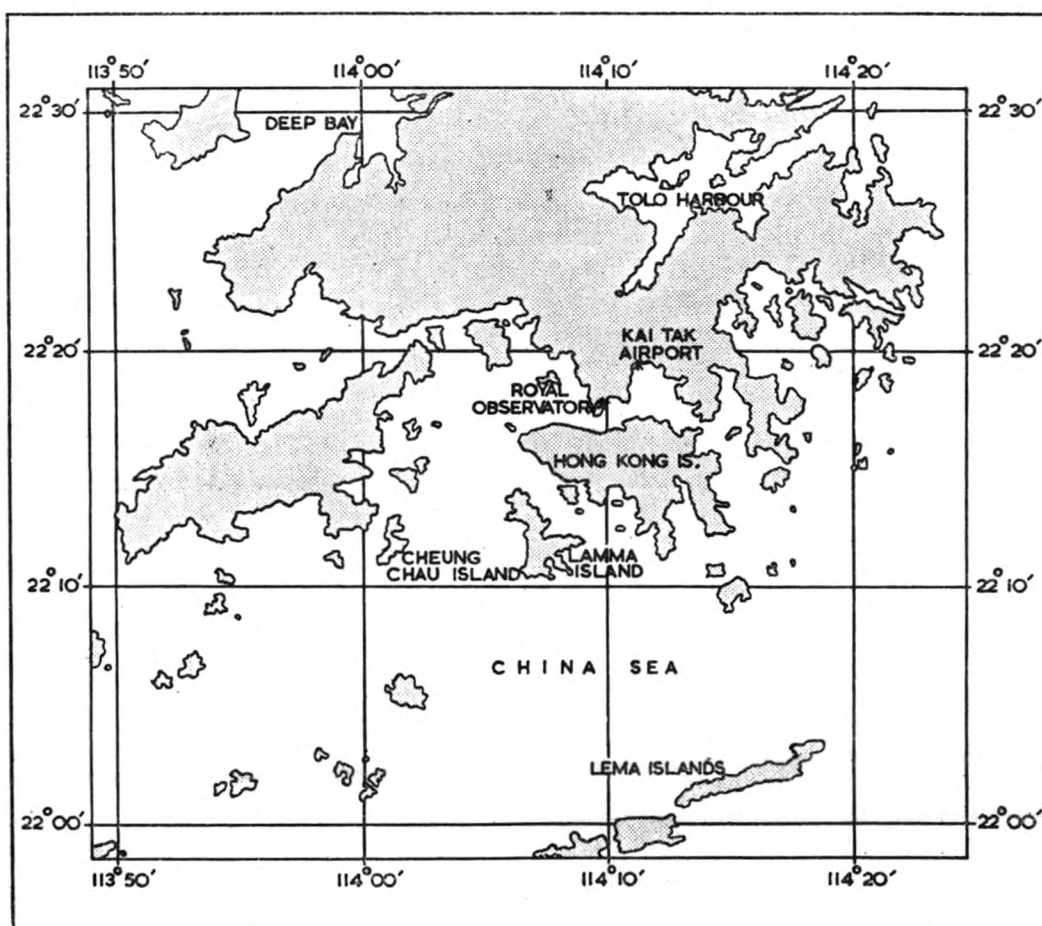
(Assistant Director, Royal Observatory, Hong Kong)

The establishment of an observatory in the Crown Colony of Hong Kong was first suggested by the Royal Society in 1879. It was pointed out that Hong Kong was a Colony which was "favourably situated for the study of meteorology in general and typhoons in particular". In 1882 a scheme was approved by the British Government as follows:

- (a) Meteorological observations in accordance with the United Kingdom requirements of a first-class observatory.
- (b) A time service for the Colony.
- (c) Magnetic observations.

Curiously enough there was no provision made for a weather forecast service. Dr. W. Doberck was appointed Government Astronomer.

The Observatory was built on the Kowloon Peninsula, facing the harbour, on the top of Mount Elgin, a small hill of decomposed granite which at that time rose abruptly on all sides from the surrounding ground. By the end of 1883, the building was nearing completion. Dr. Doberck moved in and began meteorological observations three times daily from 1st January, 1884. The times of observation were 10, 16 and 22 hours local time and were made for pressure; temperature; wind



Map showing area around Hong Kong.

velocity and direction; cloud type, amount and direction of motion; rainfall amount; and sunshine duration. A fourth daily observation, at 13 hours, was introduced in May.

Magnetic observations of horizontal and vertical force and declination were begun in specially constructed premises in the compound. Astronomical observations were made with a 6-in. Lee Equatorial and with a 3-in. transit circle. The main purpose of the astronomical branch of the Observatory was "the determination of local time, but instruments are also available for making observations of such astronomical phenomena as happen to be particularly conspicuous in this region". A time ball was erected in front of the police station at Tsim Sha Tsui (southern tip of the Kowloon Peninsula) "directly facing the shipping". The ball was dropped for the first time on 1st January, 1885.

The foundations of a storm warning service were laid when on 25th May, 1884, Dr. Doberck published a statement to the effect that "whenever there are indications of strong winds, notice will be given to the Harbour Office, the Telegraph Companies and the Newspapers". By August of the same year a drum, ball and cone system of signals, based on the four compass points, was introduced. A typhoon gun at the foot of the signal mast at Tsim Sha Tsui police station was fired once when a gale was expected, twice when winds of typhoon force were likely to occur, and three times when the wind was "likely to suddenly shift around during gales". There were in effect, therefore, from the outset, local (the gun) and non-local (the symbols) systems of storm warning. The general public insisted on confusing them to the exasperation of the Director, and, to a certain extent, they have insisted on confusing them ever since!

In 1890 more definition was given to the system of non-local warnings by introducing two sets of symbols, one in red, which referred to tropical disturbances at more than 300 miles distance from the Colony, and another in black which referred to disturbances at less than 300 miles distance. Night signals, a pair of lanterns, without specifications except to distinguish between a veering wind (vertical), and a backing wind (horizontal) were introduced in the same year.

In 1891 the annual report of the Observatory contained the following comments:

The staff recommended by the Observatory Commission as a minimum below which this institution could not be expected to do justice to the immense shipping interests in this great port, has now been appointed but it is regretted that in the meantime the staff was so utterly inadequate. The work done in the past two years has suffered in consequence, and no amount of expense now could possibly remedy the loss. Once a certain phenomenon has passed unrecorded the opportunity for observing it can never arise again, the same conditions being never repeated in the physical world.

The medical references contained in an appendix to the report are interesting, if only from the manner in which they demonstrate the great advances made in the general health of the Colony since those days:

In spring, between the two monsoons, bronchial catarrh and pneumonia are prevalent. Measles, mumps and simple continued fevers are very common.

In summer the dampness of the air is excessive. Europeans suffer much from prickly heat and similar diseases produced in consequence of the heat and dampness. The Chinese are also subject to diseases of the skin, especially the different varieties of tinea. Malarial fevers and diarrhoea are the worst hot weather diseases, the former chiefly of an intermittent type in summer. They are worst in August and September, when the Colony is under the influence of the high pressure areas preceding and lying to the north of typhoons. In these areas the wind is light and the air descending, so that it is stifling, dusty and probably full of bacteria. Want of sleep during such weather tends to produce anaemia from loss of appetite and therefore lays the foundation for many diseases such as diseases of the brain.

In autumn the dampness of the air decreases, and the temperature falls rather suddenly when the NE monsoon sets in. This causes affections of the chest and catarrhs, but Europeans enjoy almost an immunity from phthisis while to the Eurasians this is an

ever-present scourge. Malarial fevers assume more frequently the remittent and bilious remittent type. Beri-beri is frequent amongst the natives, but cholera is never more than a minor evil in Hong Kong.

In winter dysentery—the dreaded scourge of the Pacific—occurs. This is the worst disease of the China coast and often leads to abscess of the liver. Smallpox is endemic and occasionally epidemic. Typhoid fever is very rare, but typho-malarial fevers are common during the end of the winter and also in spring along the southern coast of China and Annam.

The most unhealthy places are situated in ravines between the hills, near marshy land or paddy-fields. In such places malaria is deadly. Between 1,000 ft and 2,000 ft up on the hills the air is pure and fever less common and of a milder type, which is as a rule easily cured by quinine. It is more agreeable to live in the upper regions although the air is frequently saturated with moisture.

In the annual report for 1892 we read:

The total number of ships whose logbooks have been made use of was 270; the total number of days' observations was 5,278. This number might with advantage be increased. The difficulty is that we are all so closely engaged at the observatory that no more than one of us at a time can be spared for visiting ships in the harbour, and he can devote only half of his hours of duty afloat. Every vessel entering the harbour ought to be boarded, and every logbook found to be properly kept ought to be copied; that would be useful for storm warnings.

Unfortunately there is no prospect of additional clerical help for the purpose so useful to shipping as this undoubtedly is. The immense bulk of records from stations on shore is not utilised for anything beyond investigations of typhoons.

At the beginning of February, 1897, the storm signals invented by Admiral Fitzroy in 1861 were introduced, and the typhoon gun was fired when the drum was hoisted. "In spite of the great advantage accruing from the adoption of the system of storm signals in use in England and in other countries", states a contemporary report of the Directors, "it has been decided to revert to the system in use here from 1884 to 1896 inclusive". It was actually decided on the suggestion of the Committee of the Chamber of Commerce, which stated: "Those signals, having been in use for thirteen years, were becoming gradually more understood and rightly interpreted by the boat and seafaring people as the time went on, as is always the case, the Committee believe, when a system of signalling is introduced."

During 1903 it was decided to arrange the drum, ball and cone in pairs so as to indicate the bearing of typhoons from eight instead of four compass points. At the request of the Hong Kong General Chamber of Commerce the Government decided to adopt, in addition, the Shanghai flag system of signalling meteorological information. A mast for this purpose was erected at Blackhead's Hill, Kowloon Point. The changes came into force on 1st January, 1904. In the same year standard time, eight hours in advance of Greenwich, was adopted instead of local time.

In the year 1906 there occurred the shocking typhoon disaster on 18th September. The Director commented as follows:

Could earlier warning have been given it would doubtless have contributed to the saving of life and property as far as the boat population in the harbour is concerned. The damage in the Colony must in any case have been extensive, for apart from the suddenness with which this gale came on, it occurred at flood tide, which, owing to the typhoon, was of exceptional height and was responsible for a great deal of damage along the sea front, against which no precautionary measures would have prevailed, the damage being quite out of proportion both to the duration and the severity of the storm.

The maximum hourly wind velocity of 77 miles, registered between 9.30 a.m. and 10.30 a.m. (H.K.M.T.) did not reach full typhoon force. On the other hand there were during this interval some four or five squalls of great severity.

The typhoon gun, which was formerly fired whenever a strong gale was expected

in the Colony, was dispensed with in 1907. Its place was not fully taken by the bombs, which were to be fired only when the wind was expected to reach gale force. New night signals were mounted on the roof of the water police station at Tsim Sha Tsui in July, and were repeated at the Harbour Office and on board H.M.S. *Tamar*. The following year, whenever black signals were hoisted in Hong Kong, Canton was notified. Shortly afterwards Canton adopted the Hong Kong system of storm warnings.

The Directors' annual report for 1912 states that in May of that year the "China Coast" code was modified so as to utilise 16 points of the compass instead of eight when signalling the tracks of typhoons.

In June, 1912, His Majesty, King George V sanctioned the designation "Royal Observatory".

A system of supplementary storm warnings was begun in 1916, an announcement being made in the following terms:

For the benefit of native craft and passing ocean vessels a cone is exhibited at several outlying stations during the time that any of the day signals are displayed in the harbour, to indicate that there is a depression somewhere in the China Sea, and that a typhoon warning is displayed in the harbour.

Full 24-hourly observations were made from 1916. Most probably inspired by the famous researches of Sir Gilbert Walker on the relation between the weather of different seasons, the possibilities of "long-range forecasting" were studied in connection with Hong Kong's not infrequent affliction from droughts:

An investigation into weather conditions in China, Siberia, India, South Africa and South America prior to winter droughts in Hong Kong, yielded no evidence of a correlation by which these droughts might be predicted.

By 1917 the varying significances of the storm warning systems had reduced to a fairly stable principle and alterations since have only been minor ones. A service of wireless time signals was begun in September, 1918. Visual time signals, three vertical white lights flashing seconds on a five-minute programme, were begun in the following year, and operated at 21 hours each evening.

While on leave in England during 1920, the Director was requested by the Government to discuss with the Air Ministry meteorological provisions for aviation. Pilot balloon observations for the determination of directions and velocities of upper winds were first made in 1921.

Co-operation from British ships in the area suffered an inexplicable decrease in 1923 and evoked the following comment by the Director:

It will be seen (from a published table) that while the number of foreign ships sending weather reports by radio telegraphy has increased by 17 per cent, the number of British ships has decreased by 30 per cent (compared with the previous year). This is a serious matter which is engaging the attention of the Government.

The following year he was able to report:

The question of regular observations from ships by wireless telegraphy was taken up vigorously by the Chamber of Commerce with the gratifying result indicated in the above table.

The "above table" showed a total of 665 British ships for 1924 against 196 for 1923! It would be interesting to know the technique adopted by the Chamber of Commerce, but the records are silent on the point.

A recommendation that routine earthquake observations should be made at the Observatory having received Government's approval, an underground chamber near the main building was constructed in 1924. In addition to housing the seismographs, this room also contained the clocks, which thereafter were subjected to considerably less temperature variations, with a consequent improvement in their rates.

The Royal Air Force were concerned in what were the first rain-making experiments in the Colony in 1929:

The water shortage having become very serious, on 18th June R.A.F. planes from the R.A.F. base, Kai Tak, dropped 6½ cwt. of powdered kaolin on cumulus cloud, with a view to producing rain. The experiments were suggested by a Hong Kong resident and were sanctioned by the Naval Authorities at the request of the Hong Kong Government, not with any hope of producing rain, but to satisfy the public. The results were as expected.

The dropping of the time ball ceased on 30th June, 1933, "with the approval of the Naval Authorities and the Hong Kong General Chamber of Commerce, the opinion being expressed that in comparison with radio-telegraphy and telephony the method had become obsolete".

A conference on storm warning procedures between the Directors of the Weather Services of Hong Kong, Shanghai (Zikawei) and the Philippines was held in Manila in April, 1934. As a consequence a uniform code, including four international symbols, was adopted in Hong Kong and the Philippines from 1st January, 1935.

The year 1937 was remarkable for a typhoon of exceptional severity. Fortunately adequate warning was able to be given, the No. 1 or stand-by signal having been hoisted 26 hours before gales first blew in the Colony. An extract from a special appendix to the *Hong Kong Meteorological Results*, 1937, reads as follows:

... the typhoon of 1st-2nd September was extremely destructive. Of the 101 steam vessels berthed in the Hong Kong harbour and its environs, 28 were stranded; of the 3,500 junks and sailing craft, 1,255 were reported sunk and 600 seriously damaged. The strandings of the steam vessels caused the deaths of one European and four Chinese, while the estimated fatalities connected with loss and damage to sailing craft was 11,000. In the last 30 years there has not been more extensive damage to structures and vegetation. . . . The highest hourly velocity reported by the Beckley anemograph was 93 "miles" in this typhoon, but in view of the extensive damage sustained by shipping after adequate warning of its approach had been given, it is improbable that a more destructive storm has been experienced in Hong Kong.

Pilot balloon observations, first begun in 1921, were made more and more frequently until two ascents per day were made whenever the cloud base was above the Peak (1,800 ft). In 1938, 667 balloon ascents were made. Throughout the same period meteorological flights were undertaken occasionally by Royal Navy and R.A.F. planes, as many as 69 being flown in 1928. A daily meteorological flight, undertaken by the Far East Flying Training School, was instituted on 1st April, 1939.

The meteorological office in the new terminal building at the Kai Tak Airport came into operation during 1939. The Far East conflict broke out on 8th December, 1941, and the Colony fell to the Japanese forces on Christmas Day.

The Observatory was used rather casually as a meteorological station during the Japanese occupation of Hong Kong, 1941 to 1945, but the more important activities of the compound appear to have been the operation of two anti-aircraft guns similar to the familiar British 4.7's. The buildings fortunately suffered only superficial damage, but almost the whole of the equipment was removed and no records survive of any observations taken during the period. The three senior officers were interned. On their liberation they took over the Observatory from the Japanese and one of them remained until he was able to hand over to the Fleet Meteorological Officer of the Royal Navy.

During the military administration of Hong Kong the Observatory was operated by a joint Royal Navy and Royal Air Force cadre. By the time the civil administration took over the Colony in May, 1946, there were two European officers available for duty and 10 of the former Chinese staff had reported at the Observatory. To meet the expanded needs of aviation meteorology, some additional staff were

appointed. The work at the Observatory was taken over from Services personnel and the transfer completed by the end of July, 1946. In August, 1947, responsibility for the aviation weather service was taken over by the Observatory; all forecasting services were later transferred to a meteorological office at Kai Tak Airport.

Developments in the department since the war and up to this time had been in the direction of aviation meteorology. The rapid advance of aviation in the Colony after the reoccupation enormously increased the meteorological commitments of the department. A welcome addition to this staff was the appointment of a marine liaison officer, who could take over the important work in connection with weather reports to and from shipping.

The Washington International Meteorological Code was introduced 1st January, 1949. Daily meteorological flights to a height of 12,000 ft were resumed from 1947 and continued until the installation of radio-sonde equipment in the autumn of 1949. On the recommendations of a Conference on Storm Warning Procedures, held in Manila in May, 1949, revised regional storm-warning codes were brought into effect on 1st January, 1950. The principle of storm warning remained the same but more definition was allowed for in location, direction and speeds of the storms signalled.

A time service, based on a specially designed master clock, was resumed in April, 1950. The clock is rated on radio time signals, the transit circle removed by the Japanese never having been replaced. It is hoped to resume seismological observations soon and an application of such observations to typhoon movements is under consideration.

Institute of Navigation

At the Annual General Meeting of the Institute of Navigation (1952) Rear-Admiral Day, Hydrographer of the Navy, was re-elected President of the Institute. In his Presidential address, which was entitled "Navigation and Hydrography", he outlined the improvements in the art of the hydrographer which had been made possible by modern navigational aids.

Hydrography was defined as the science which provides the seaman with his charts and with the physical information about his locality to enable him to navigate safely. Admiral Day mentioned that the Hydrographic Office was formed as early as 1795, and that since that time at least a part of almost every coast has, at some time, been surveyed by surveyors of the Royal Navy. Among the modern problems of the hydrographer was that of deciding the best method of depicting efficient natural radar targets on charts. During his address Admiral Day mentioned the relationship which existed between oceanographers and hydrographers, in addition to the oceanographers natural link with the practical navigator. In discussing the work of the Institute of Navigation Admiral Day praised the voluntary work of those who had produced the Institute's handbook, *Use of Radar at Sea*. Technical Committees of the Institute are at present studying plotting methods for use with radar, particularly in relation to its use as an anti-collision device. Another Working Group is investigating the degree of accuracy at present attainable and desirable at sea with a view to a possible simplification of the method of working up astronomical observations. Admiral Day also mentioned the big part that the Institute had played in preparing the new Nautical Almanack.

Interesting papers which were read during the year at the Institute included "Recent Work on Polar Navigation", "Meteorology and Navigation", "Navigation and the Ocean Weather Service" and "Radar Chart Matching Devices".

Among the six new Fellows of the Institute who were elected was Captain R. W. Colbeck, R.N.R., Marine Surveyor to the Mersey Docks and Harbour Board.

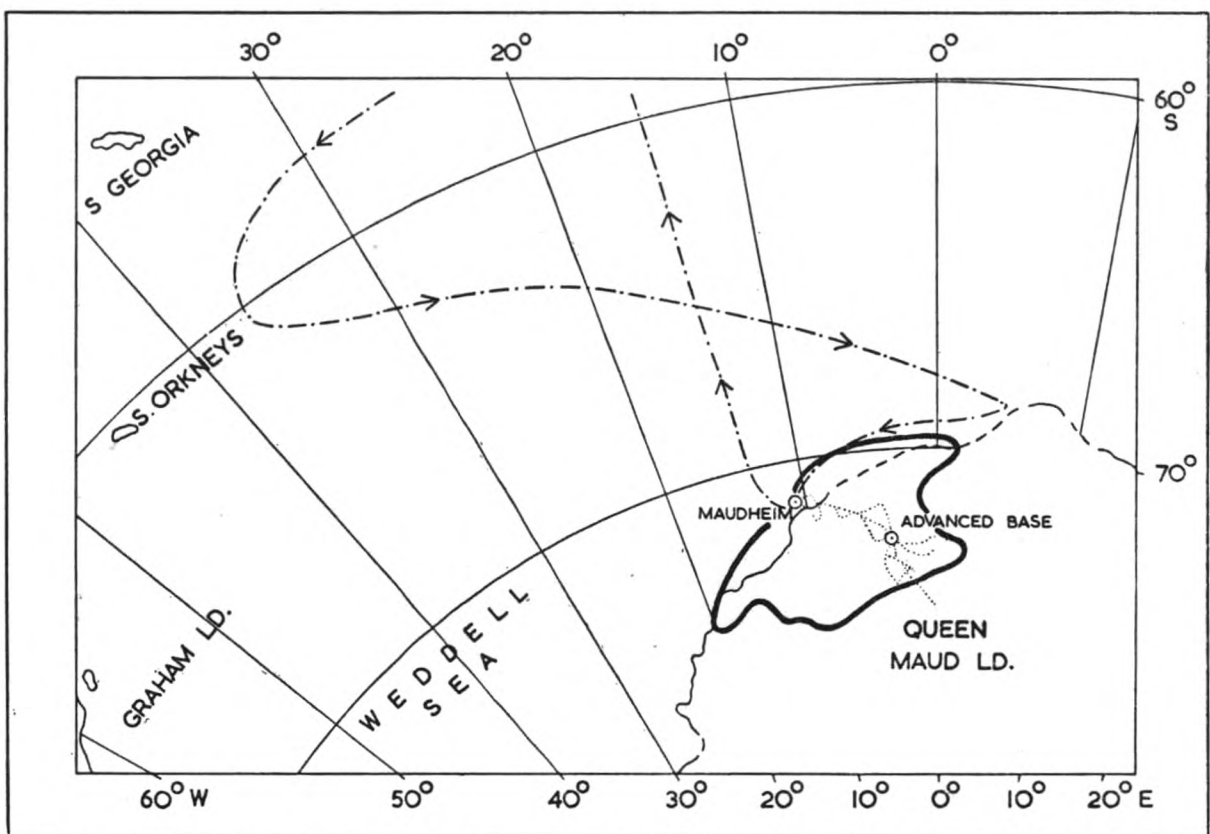
C. E. N. F.

Queen Maud Land Expedition

By G. DE Q. ROBIN, M.SC.

(Mr. Robin was the senior British member of the expedition)

The lengthening of the shipping season to Spitzbergen, the northward movement of cod around Greenland, and the retreat of glaciers around the North Atlantic, are all evidence of the climatic fluctuation at present taking place. Observations from other parts of the world are necessary before it is possible to decide whether this fluctuation is confined to certain areas and due to changes in atmospheric circulation, or whether it is worldwide and perhaps due to changes such as in the sun's radiation. Judging by German aerial photographs taken in January, 1939, Dronning Maud Land, the Norwegian sector of the Antarctic, appeared to be a particularly suitable area for such studies.



— — — Track of the Norsel
Sledge journeys

(Area outlined is that covered by aerial reconnaissance)

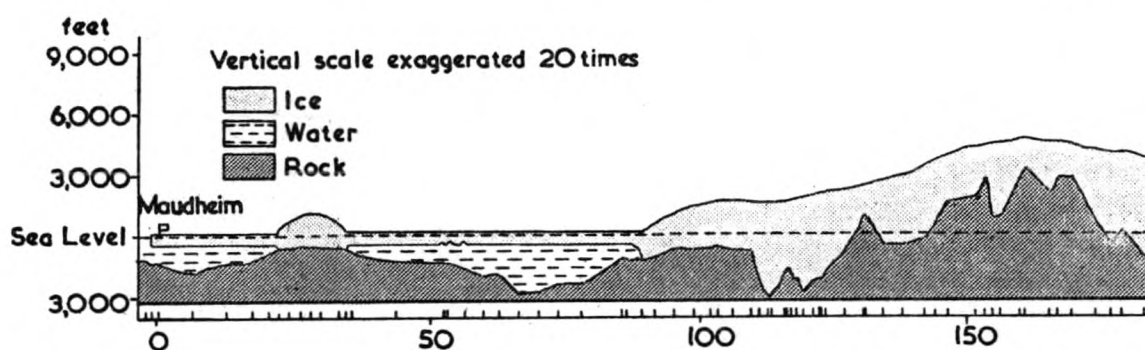
Map showing route of the *Norsel* taking the expedition to Maudheim, the sledge journeys and the area covered by aerial reconnaissance.

The Swedish glaciologist, Professor H. Wison Ahlmann, who is now Swedish Ambassador to Norway, was able to arouse interest in Norway and Britain as well as in Sweden for an expedition to these parts. Dr. H. U. Sverdrup, the oceanographer who had recently been appointed Director of the Norwegian Polar Institute, drew up plans which were supported financially by the Norwegian Government, together with contributions by the British and Swedish Governments. A comprehensive meteorological programme was added, one particular investigation being the examination of the little known upper atmosphere of the Antarctic. As the area had not been investigated apart from reconnaissance flights, survey and geological

programmes were also planned. With much help from the Governments and industry in all three countries, preparations for the expedition were completed during 1949.

One month after an advance party of five men, 60 dogs and some heavy mechanical equipment had left Norway in the whaling factory *Thorshoevdi*, the expedition sailed from London in November, 1949, in the *Norsel*, a Norwegian sealing vessel. The *Norsel* is a 700-ton diesel-driven steel ship with the hull strengthened and shaped for working in ice. In addition to some 300 tons of expedition stores, an R.A.F. unit of five men with two Auster light aircraft were carried.

After a call at Cape Town, and a rough trip through the forties, the *Norsel* had to travel west to meet the *Thorshoevdi* in 59°S , 40°W . The transfer of the advance party, dogs and equipment was effected in a slight swell by skilful winch handling and the use of whales as fenders. With a considerable amount of deck cargo, the *Norsel* then pushed south-east through belts of pack ice alternating with open water. Dense pack was encountered on 19th January, 1950, in 66°S , 16°W , and the *Norsel* was finally stopped some 30 miles north of the reported position of the Greenwich Meridian ice tongue. After eight days of probing into the pack ice up to 6°E , the *Norsel* turned to the west. With the assistance of aerial reconnaissance of the pack ice and coastal ice cliffs, Kap Norvegia was reached on 3rd February, and a suitable landing point was finally located on 10th February. The base, Maudheim, was then built on shelf ice some two miles from the inlet where *Norsel* had berthed. The *Norsel* sailed on 20th, and in spite of an anxious week beset in the ice, she reached Cape Town safely before proceeding to the Newfoundland sealing grounds.



Ice thickness profile along a 380-mile line inland from Maudheim. The upper surface is that of the ice, while the dark shaded layer represents the rock surface as found by seismic soundings made at the points marked along the distance scale. Near Maudheim, the middle layer is that of sea water.

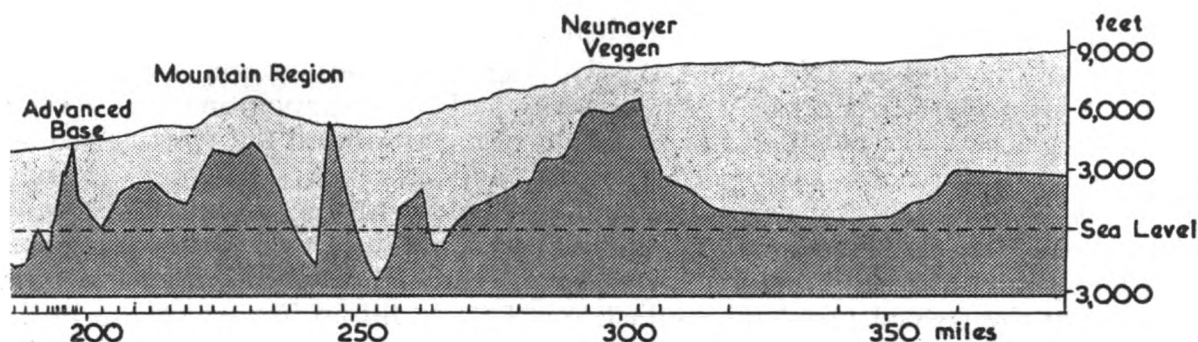
With its small isolated community living on 600-ft thick floating shelf ice, Maudheim had much in common with a ship at sea. Even its radio call sign LH2F was allocated from the shipping list, and its situation on flat shelf ice provided a meteorological exposure as good as on board ship.

After a month's work the comfortable and convenient base buildings were in order and the glaciologists and meteorologists settled down to their studies. Daily upper-air ascents with radio sonde and rawin (radio-theodolite) were started, and the techniques of manufacturing hydrogen and releasing the balloons in high winds were gradually mastered. Some 650 ascents were made during the expedition, and these, together with surface studies of incoming and outgoing radiation, and of temperature and wind gradients, are now being examined to obtain a better idea of the heat balance between the snow and the atmosphere in these regions. The low temperatures experienced under clear skies in winter, spring and autumn were found to be mainly confined to the lower levels of the atmosphere. Temperature differences of up to 20°F were measured between the top and bottom of a 30-ft

meteorological mast and associated mirage effects were very frequent. The lowest temperature recorded at Maudheim was -52°F , while temperatures of -40°F were not uncommon during the winter. During winter-time, cyclonic depressions generally passed north of the base causing gales and giving temperatures of 0°F to -10°F , with winds varying from 30–60 kt.

The glaciological work around the base brought to light new facts about the shelf ice. Precise levelling indicated that the surface height of the shelf ice above sea-level remained practically constant throughout our stay, in spite of an annual accumulation of snow equivalent to some 40 cm of ice. The explanation is apparently that the surface of the shelf ice is spreading out, as was shown by accurate surveys of a network of stakes planted around the base. Other glaciological work at the base included continuous measurements of ice temperatures down to 330 ft, and detailed examinations down to this depth of ice-samples brought to the surface by means of a Canadian boring machine.

The winter was also employed in preparing equipment for the summer journeys to the inland mountains, which had been roughly mapped from the air by the Germans. Apart from the first essential of an accurate survey, various glaciological and geological journeys were carried out. Firstly, a dog-sledging party spent 40 days reconnoitring and marking a safe and generally crevasse-free route of 180 miles to the inland mountains. Then the expedition's tracked vehicles, American-built "weasels", made two trips along this route to establish an advanced



supply dump of eight tons of stores. Dog-sledging parties were then able to journey out from this point during the 1950-51 and 1951-52 southern summers.

In two seasons' field work the surveyor carried out a triangulation covering some 24,000 square miles with a high degree of accuracy. Stereoscopic photographs from ground stations and air photographs were taken to cover this area. Together with the triangulation these will make it possible to produce accurate detailed maps of the mountain areas. At the same time a geological reconnaissance survey was made over the whole of this area, finding sedimentary and metamorphic rocks in different regions. Besides examining the temperature and structure of the inland snow and ice, the glaciologists examined the mountains for signs of past glaciation. In the distant past, ice appeared to have covered all the main mountain masses, but the form of small glaciers and the presence of lichens right down to the snow surface on small nunataks* indicated that no recent retreat of glaciers had taken place.

During the second summer a party carried out seismic shooting measurements along a 380-mile line from Maudheim, through the mountains and on to an inland ice plateau. The system is one of echo sounding, using T.N.T. explosions to produce

**Nunatak*—an isolated mountain peak projecting like an island above the surface of an ice cap.

the sound wave. The waves reflected from the rock bed are picked up by means of seismometers and recorded photographically. Ice thickness varied from 830 ft near the coast to 7,900 ft on the ice plateau. The diagram across pages 106 and 107 shows these results, and indicates that the continental shelf around Antarctica may be hidden from ships' echo-sounders by coastal ice hills and floating shelf ice.

At the same time as these summer journeys were taking place each year, the *Norsel* visited Maudheim with supplies and aircraft to carry out a programme of air photography. The problem of forecasting for these flights was difficult, as there were no meteorological stations closer than the Falkland Islands Dependencies, over 1,000 miles distant. To meet this situation, arrangements had been made for whaling factory ships to send coded weather reports to Cape Town radio and Maudheim. The system worked admirably, and added greatly to the reliability of the flight forecasts issued at Maudheim. It is hoped that the forecasts issued to the whaling factories were also of use.

The flying during the 1950-51 summer was considerably hampered by bad weather, but during the following summer a Beechcraft twin-engined plane, flown by the Swedish Air Force, successfully completed the programme of air photography. Had the ice conditions prevented the *Norsel* reaching the base in the 1951-52 summer, this Beechcraft would have used floats to evacuate the party from Maudheim. This was not, however, necessary as the ship was able to force a passage through the pack ice in 10 days that year, three days longer than the previous summer. Maudheim was evacuated in January, 1952, and after transshipping at Santa Cruz the party landed in England on 18th February. Three members of the expedition did not return, as they had lost their lives when a weasel plunged over an ice cliff into the sea in bad visibility on 23rd February, 1951.

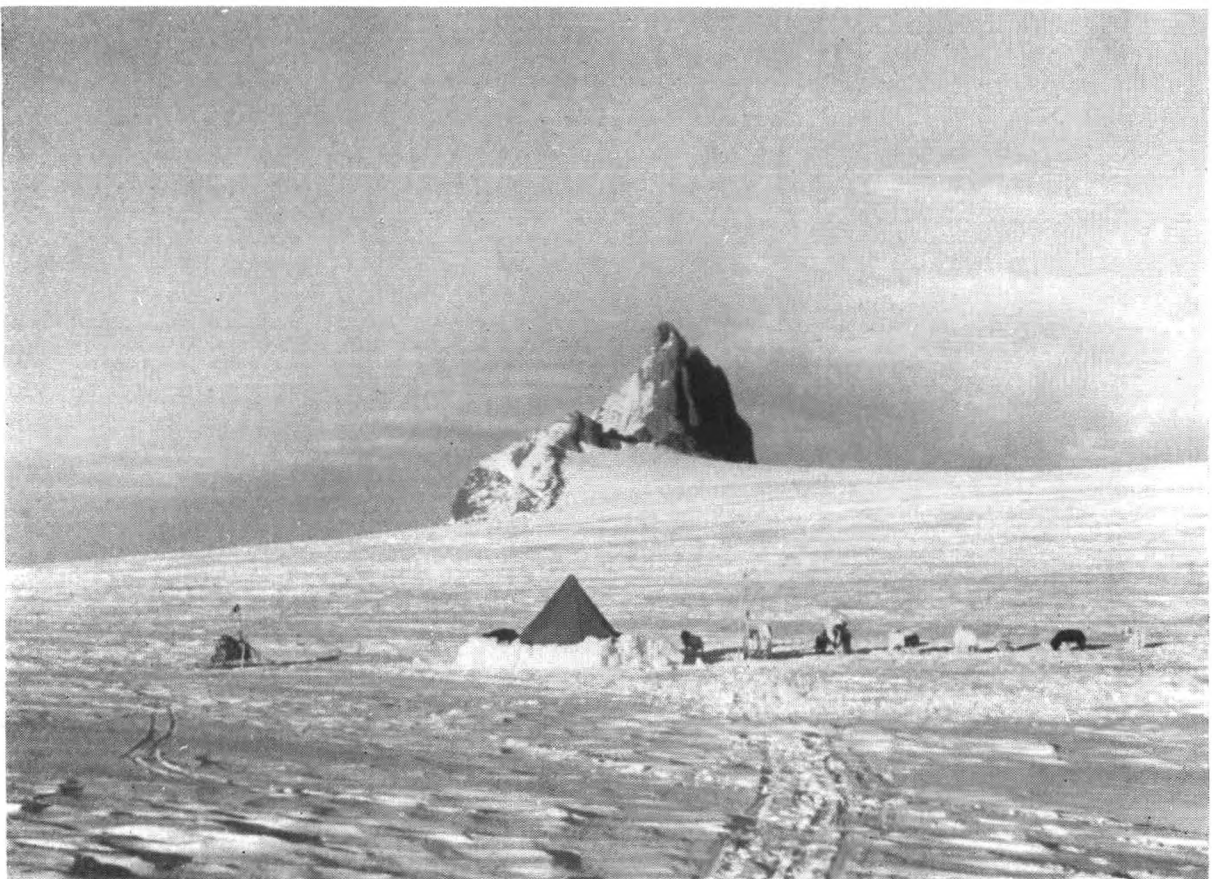
The final phase of the expedition, the working up and publication of the results, is now taking place in Europe. While it was perhaps disappointing that a rapid retreat of glaciers was not found to be taking place, as around the North Atlantic, the glaciological results have been valuable, and at times surprising. Results additional to the main investigations include detailed studies of the adaptation of human beings to cold climates, measurement of variations of the earth's magnetic field and some auroral photography. The meteorological results themselves, in addition to the special problems studied, will help to fill an important gap in the global picture of the circulation of the atmosphere at all levels. It is by this world-wide gathering of data from stations on land and sea that our knowledge of meteorology will advance so that this science can be of increasing benefit to mankind.

Note.—As mentioned in the Editorial to the January, 1953, number of *The Marine Observer*, special arrangements were made in co-operation with the South African Weather Bureau for whaling vessels to send radio weather messages for the benefit of this expedition. The position of the ship was sent in cypher in order to avoid its interception by rival whaling vessels. During the two seasons that the expedition was at Maudheim, about 700 radio weather messages from British whaling vessels were sent to the expedition via Cape Town Radio.



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The expedition ship *Norsel* stopped by pack-ice.



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The surveyor's camp site below a prominent peak which formed an important point in the triangulation network.



U.S. Coast Guard

Captain G. Van A. Graves at the observer station of an Ice Patrol aircraft. The use of aircraft to supplement merchant ship reports gives greater mobility at less cost than a surface search by Ice Patrol cutters.



U.S. Coast Guard

An iceberg typical of the many that menace the North Atlantic shipping lanes during the spring months. Because of its characteristic shape this type of berg is sometimes termed a "dry-dock berg".

International Ice Patrol

By Capt. G. VAN A. GRAVES, U.S.C.G.

(Capt. Graves is the Commander of the International Ice Patrol)

As a result of the *Titanic* sinking in 1912, caused by collision with one of the icebergs which annually populate the North Atlantic steamer lanes near the Grand Banks of Newfoundland, the International Ice Patrol was established and has been active each year except during the two world wars. As set forth in the International Conference for the Safety of Life at Sea and the U.S. Code, the U.S. Coast Guard provides the personnel, ships and planes necessary for the execution of this job. Financial support is provided on a percentage basis by the several nations signatory to the International Conference.

During the ice season headquarters for the Ice Patrol is maintained at the U.S. Naval Station, Argentia, Newfoundland. Here the U.S.C.G. radio station Radio Argentia, NIK, broadcasts twice-daily ice bulletins to shipping, and collects ice, water temperature and weather reports from vessels in the vicinity of the Grand Banks.

Other units of the Ice Patrol Organisation which are based at Argentia are two long-range B-17 bombers used for ice observation, and a medium-sized Coast Guard cutter used for oceanographic survey work to determine currents and consequent ice movement; when ice conditions are severe enough to necessitate a surface patrol, two larger Coast Guard cutters are added.

One of the most valuable sources of ice information are the reports from merchant ships. In addition, recent years' experience with the Coast Guard units assigned to Ice Patrol have shown that the B-17s are invaluable for getting a synoptic picture of the ice conditions. Each radar-equipped plane, carrying a trained ice observer and two loran sets for pinpoint navigation, can effectively search an area of 35,000 square miles on a single flight, even in poor visibility. The use of aircraft has materially reduced the cost of Ice Patrol by making the much more operationally expensive cutters unnecessary except in times of very heavy ice in the areas adjacent to the shipping lanes.

Of course, the primary purpose of the Ice Patrol is to protect shipping on the North Atlantic lane routes, and one of the purposes of this article is to inform ships' masters as to how they can assist the patrol and help protect themselves. Merchant ships render much help to the Ice Patrol, and themselves, by reporting surface sea temperature as well as ice sighted to Radio Argentia, NIK. With the sea temperature reports from ships in the Grand Banks area over a two-week period, an Ice Patrol oceanographer at Argentia constructs a chart of sea surface temperatures. This chart indicates the general features of the Labrador and Atlantic Currents, and the important area where they meet near the Tail of the Grand Banks. Although this chart does not give specific values of the velocity of the currents, it will indicate their direction and relative strength, both useful aids in forecasting the drift of ice. In addition to their oceanographic use, these regular reports from shipping, which should include position, course and speed of ship, enable the Ice Patrol to keep a plot of all ships in the area and to send timely warning if any vessel is heading towards danger, or to co-ordinate rescue operations when necessary.

After 1st April of each year the oceanographic vessel surveys the Grand Banks area, taking water samples at various depths at each of a close network of oceanographic stations. The temperature and salinity of each sample is determined, and by methods of dynamic oceanography a surface current chart is constructed for the area while the ship is still at sea. In addition to current direction, this chart provides an accurate picture of velocity, and has been proven over a period of years to give good results in forecasting movements of icebergs. A copy of this chart is transferred at sea to the Ice Patrol cutter, if one is being used, and the original chart is sent to Argentia for use at Ice Patrol headquarters. Newer and more convenient

current determining aids are being tested on the oceanographic vessel, the most important being the Von Arx current meter, which determines currents by measuring the electric current produced when a body of water moves through the earth's magnetic field.

In addition to the aspects of oceanography which are of immediate use to the Ice Patrol and shipping, the oceanographic vessel each summer conducts a survey of the Baffin Bay and Labrador Sea area, and much research has been done on the number of icebergs calved annually from the west Greenland glaciers and the currents which carry them on their long trip to the Grand Banks. Results of these studies are published annually in the *U.S. Coast Guard Bulletin, International Ice Observation and Ice Patrol Service in the North Atlantic Ocean*.

Other scientific studies are being conducted by Ice Patrol units to try to reduce the cost without sacrificing safety. An investigation on the sensitivity of radar to ice has been conducted, and will be continued in the future; it is hoped that this will result in more effective radar sets for ships navigating in the ice areas. Ways to increase the efficiency of air scouting during periods of low visibility are under consideration, and it is foreseeable that in the near future shipping will be able to cross the ice areas with less danger, and also with less financial expense to the nations supporting the International Ice Patrol, than is now the case.

A record of the number of icebergs drifting south of the 48th parallel each year is kept by the Ice Patrol and is used as a yardstick to measure the relative severity of each ice season. Data for the past 50 years show that an annual average of 433 bergs cross 48°N. In 1950, 460 bergs were counted south of 48°N, and in 1951 only 6. Naturally the annual cost of Ice Patrol cannot be made exactly proportional to the berg count, but every effort is being made to keep the cost consistent with the danger to shipping.

Finally, it is desired to thank the great many masters of vessels on the North Atlantic run who co-operate so willingly and assist so much in the successful operation of this safety service. Further, the Commander of the International Ice Patrol would be pleased to receive any comments on the patrol, any suggestions for improvement of the service and any criticisms. It has been our constant endeavour to protect shipping from the danger of floating ice and we are anxious to know the ideas of all our friends at sea on this matter.

Book Review

Les Frontières de l'Océan (The land-sea boundary of oceans). By J. Bourcart. 7½ in. × 5½ in. pp. 320. Albin Michel. Paris, 1952. 900 fr.

This book is one of a series with the general title of *Sciences d'Aujourd'hui* (Science Today) which are intended to supply readers of moderate scientific attainment with a compact statement of the modern position in various specialised branches of science.

The author's aim is to describe the regions to seaward and landward of the coast line together with the problems demanding solution in these regions. He confines himself mainly to an outline of present-day knowledge on the evolution and modification of coast lines and the continental shelves of the oceans, with particular reference to the coastal regions around France. Before the Second World War the study of oceanography in France had been largely neglected for a long time, but a study of these problems became an urgent matter for the Allies at the period before the re-occupation in 1944. After the war problems of reconstruction (e.g. the dredging of estuaries which had become silted up) arose in France, and as a result permanent organisations such as the "Comité d'Océanographie" were set up which amassed the information collected by Allied aircraft and Commando reconnaissance about the beaches of France in the war period and continued research on such other problems as is required in peace.

The present book describes the results already achieved. In the treatment of the coastal problems most emphasis is placed on the geological aspects. The seaman will nevertheless find useful and up-to-date information on subjects of interest to him. The treatment of waves and swell includes diagrams showing the profile of waves and an example of the instantaneous topography of the sea surface during rough weather; the effect of coastlines and obstacles such as breakwaters on the movement of swell are also described. There is a short description of the instruments used to measure the pressures exerted by waves on cliffs and breakwaters, and of the damage done to coastlines and property by waves during storms. Erosion and transport of material near shores are described and the book includes excellent descriptions and diagrams of submarine canyons in several parts of the world. Fluctuations of sea-level are considered in some detail, the author agreeing with others that the recent widespread small rises of level have been associated with changes in the extent of the Scandinavian ice cap, while local changes, e.g. in Western Europe, have been caused by rises or falls of coastlines.

In a book of this size the omission of an index is a disadvantage, but this is a minor criticism and altogether there is a great deal of valuable information both in the text and diagrams for the general reader who wishes to acquaint himself with the lines along which research workers in this subject are proceeding at the present time.

R. F. M. H.

Letters to the Editor

SPEED OF DOLPHINS AND PORPOISES

Sir,—For more than 20 years I have been interested in the speed of marine creatures and have spent many hours trying to measure and estimate their rate of swimming.

At times I believed the fantastic speeds credited to porpoises, ranging from 40 to 100 knots, which have been published from time to time. However, recently I have been forced to the conclusion that the maximum speed of this creature is 14 knots; but that it is capable of short bursts of much greater speed of a few seconds' duration.

I base these statements on the following observations. When a ship is steaming at speeds of up to $13\frac{1}{2}$ knots, porpoises will maintain station ahead, sometimes for as long as 30 minutes; but when the ship makes 14 knots porpoises only maintain station for a few seconds, then drop astern. At 15 knots they make no attempt to keep ahead, and rapidly drop behind.

The photograph (opposite page 77) shows porpoises keeping just ahead of the stern of a vessel doing $13\frac{1}{2}$ knots.

Chief Officer,
S.S. *Clan Lamont*.

R. R. BAXTER.

Note. The above letter was sent to the British Museum (Natural History), South Kensington, and the following comment received:

"May I in the first place make a correction. The animals in the photograph are common dolphins and not porpoises; although I appreciate that these common names are applied rather loosely, I think that when, as in the photograph, the long tapered snout and typical body colouring are clearly seen it is advisable to use the name by which this species is generally known.

"Dr. G. A. Steven in *Science Progress*, No. 151, 1950, basing his conclusions on the time taken for common dolphins to cover a known distance between one ship and another being towed by it, gives 20 knots as the speed of the animals. He adds: 'It is not improbable that the speed of 20 knots exhibited by the animals represents fairly accurately the maximum speed of which dolphins about 7 ft in length are capable, even in short bursts; for in overtaking from astern it seems that the animals might have been going all out to catch up.'

"On the whole, Chief Officer Baxter's observations agree with Dr. Steven's. He deserves congratulations both for his careful observations and for his fine photograph of the dolphins."

HURRICANE AT JAMAICA, AUGUST 1951

An account of the hurricane that devastated the town of Kingston, Jamaica, in August, 1951, and the experiences of the *Jamaica Producer* were published in the July, 1952, number of *The Marine Observer*. Another ship that was in Kingston Harbour at the time was the cable ship *Norseman*, and at our request Captain Vickers has written the following account of his experiences.

Sir,—When on passage from St. Lucia, British West Indies, to undertake a cable repair north of Jamaica a w/T warning was received on the night of the 14th to the effect that a hurricane had formed just east of Martinique. Reports the following morning showed that the storm was approaching at about 20 knots on a WNW course which would have taken it well to the north of Jamaica. I therefore altered course to take shelter in Kingston Harbour, where I was sure we would be comfortable though on the southerly fringe of the disturbance.

To my surprise, reports received from reconnaissance aircraft the next morning indicated that the storm had turned west and was heading directly for Jamaica. A few hours later a further report showed some confusion as to the position of the centre, so we continued towards Kingston and entered harbour at 10 p.m. on 15th August. The next morning all doubts about its position were dispelled and its westerly course at 17 knots was confirmed.

I requested a berth and took maximum fresh water, firstly to put the ship well down to her loaded marks, secondly to have sufficient fresh water to enable me to continue my voyage without delay after the storm without having to risk an infected supply due to mains fractured by storm damage, and thirdly so that the tanks could be pumped out to float the ship if she went aground.

On the morning of the 16th I took the *Norseman* away from the wharf, moored at the eastern end of the harbour in 8 fathoms and commenced preparations. Both the Chief Officer and myself had experienced a typhoon in Hong Kong harbour, and so were fully aware of what was in store. We forthwith stripped the ship of awnings, spars, buoys, in fact anything movable, including boat covers, etc.

As is well known, the most nerve-wracking effect of a hurricane is the complete and utter black-out. Rain and water blown off the sea reduce visibility to a few yards, so that you never know whether the anchors are holding or not. Our job then was to devise some method of knowing whether our anchors were holding and of regulating the engine speed so that minimum strain be put on the anchors and cables. We therefore painted a 40-gallon steel cask red and white halves and secured it with a wire 25 fm long to the third shackle from the starboard anchor. With 90 fm chain paid out the barrel floated 30 fm ahead, but by steaming up to the anchor with the chain leading slightly aft, the barrel was about 10 fm ahead. A barrel painted mast colour was secured directly to the port anchor.

The hurricane reached Kingston about 8.45 p.m. that evening (16th August) and struck with considerable force from the outset; there was no fresh or strong breeze to begin with, it simply crashed down with a roar from about N'W. We moored our ship with 90 fm starboard anchor and 60 fm port anchor and immediately started main engines.

In our cable ships we have two small searchlights on the wings of the bridge which we kept trained on the barrels as far as possible—going at full speed when the barrels disappeared into the darkness ahead and reducing speed when they came into view at or near our bows. We eased our engine revs. from 60 to 30 whenever the wind got a point on our starboard bow. The ship then dropped back on her cable and the barrels were allowed to disappear temporarily ahead. The ship quickly dragged the cable bight to lead directly ahead which had the effect of bringing the ship's head directly into the wind. We then increased to full speed until the barrels were sighted again. In this manner we nursed the ship for 10 hours, and our average revs. were 75 rev/min., or about three-quarters speed.

At midnight the wind slowly veered to NE with a velocity we afterwards heard

was 120 m.p.h. and at 1 a.m. our wing bridge windows blew out and the fore yard-arm broke—fortunately nobody was hurt. Our minds were at rest with regards to other ships drifting on to us, for, as I mentioned before, we had anchored at the far eastern end of the harbour for the very purpose of keeping clear of “drifting and dragging vessels”.

It was clear from the outset that we were in the northerly semicircle and that the centre would pass close to the southward. Later reports showed that it passed about 25 miles to the south. At 2.30 a.m. the wind was easterly and a slight decrease in speed was noticeable.

The first glimpse of dawn was about 0450 and we were delighted to see that we were in exactly the same place we had anchored the evening before, and heading SE, from which direction gale force winds were blowing with violent gusts up to full hurricane force. At 7 a.m. the wind steadied to moderate gale and engine movements and helm were discontinued.

A sorry sight to behold at daylight. Apart from ourselves and two other vessels the other seven had grounded and the town of Kingston was completely devastated—but with all this you are doubtless familiar.

Capt. T. A. Vickers, R.D., R.N.R.
Cable ship *Norseman*.

Personalities

RETIREMENT.—CAPTAIN H. S. ALLAN, R.D., R.N.R., the Commodore of the P. & O. fleet, retired in November, 1952, after 44 years at sea, 39 years of which were in the P. & O. Company.

Henry S. Allan was born at Saltcoats, Ayrshire, and went to sea in 1908 as an apprentice in the ships of Messrs. George Smith & Sons of Glasgow, with which firm he served until 1913, when he joined the P. & O. S.N. Co. as fourth officer of the *Palma*. Throughout the 1914-18 War he served in the Royal Navy as an R.N.R. officer, mainly in minesweepers in the North Sea and in North Russia, and for the latter service he was awarded the Order of St. Stanislas.

In 1919 he rejoined the P. & O. as a third officer, and was promoted through the usual grades, obtaining his first command in 1939 when he was appointed to the *Mooltan*.

During the last war Captain Allan again served in the Royal Navy, in command of H.M.S. *St. Adrian*, 1939-41, then to Canada to supervise the fitting out of a flotilla of minesweepers and returned to England in 1942. He was promoted Captain, R.N.R., and Commodore Second Class for North Atlantic Convoys, in which he served until September, 1943. He later commanded H.M.S. *Largs* in the Mediterranean, and in 1944 at the Normandy landings.

From January to May, 1945, Captain Allan was Naval Officer-in-Charge, Madras, and later commanded H.M.S. *Artifex* in the British Pacific Fleet.

In 1946 Captain Allan rejoined the P. & O. Company and was in command of the *Palana* until 1947 when he was appointed to the *Strathaird*, in which ship he remained until his retirement. He became Commodore of the P. & O. in December, 1951.

Eleven meteorological logs have been received since the war from ships under Captain Allan's command; five of these have been classed as “Excellent”.

We wish him health and happiness in his retirement.

C. H. W.

RETIREMENT.—At the end of December, 1952, CAPTAIN C. S. BROUGHTON retired from the post of Marine Superintendent of the New Zealand Shipping Company Ltd.

As a young man he served in the sailing ships *Cromdale* and *Mountstewart* from 1910 to 1915, when he obtained his master's certificate. During the 1914-18 War he served in the Royal Naval Reserve, and on demobilisation he joined the New Zealand Shipping Company as fourth officer.

He was promoted to command in 1924 and in 1927 was made Assistant Marine Superintendent at Liverpool. In 1925, while in command of the *Somerset*, Captain Broughton received a Meteorological Office "Excellent Award". In 1949 he became Marine Superintendent in London.

We wish Captain Broughton health and happiness in his retirement.

C. H. W.

Southern Ice Reports

During the year 1952

APRIL

M.V. *John Biscoe*

DATE	POSITION		DESCRIPTION
	LAT.	LONG.	
3	64 10S	61 50W	Bergs and growlers in vicinity of Two Hummocks Is. Very few and scattered.
5	Lemaire Channel and Penala Strait		Thick pack ice in places. New ice 4 in. thick at Argentine I. Few bergs.
6	West coast Booth Is.		Bergs and brash evenly distributed towards w horizon.
10	63 10S	59 40W	Loose pack and brash stretching E. New ice from 58°W to Hope Bay.
11	Antarctic Sound		Pancake ice 5-10 in. thick. New ice in North Sound, navigation seriously impaired.
12	62 45S	57 30W	Vessel beset by unnavigable heavy pack. Pack loosened later in E wind.
13	62 20S	58 10W	Pack ice and new ice, no ice limit to E and W horizons.
15	Admiralty Bay to Bridgeman Is.		Pack ice, northern limit visible, extending further north past Bridgeman I.
23	South Georgia North coast Laurie Is.		No ice or bergs.
26			Pancake ice and scattered bergs.

May and June, no ice reports received. Reports of ice for April, May and June, 1951, will be found in *The Marine Observer*, Vol. XXII, No. 156, p. 103.

Notices to Marine Observers

Postal Arrangements

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

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

Shipowners, Marine Superintendents and all concerned in the despatch of mails to ships are asked to kindly facilitate the despatch and delivery of mail received at their offices from the Meteorological Office and "Air Publications and Forms Stores" to their ships abroad. Addressed to the captains of ships, this contains information required for the conduct of meteorological work at sea, and is most effective if received by the captains at the earliest possible date.

Ice Observation

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

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

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

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

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

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**SOME ATLASES PREPARED IN THE MARINE BRANCH OF THE
METEOROLOGICAL OFFICE AND PUBLISHED BY HER MAJESTY'S
STATIONERY OFFICE**

Atlantic Ocean

Monthly Meteorological Charts of the Atlantic Ocean (M.O. 483, 1948). 19 $\frac{3}{4}$ in. \times 24 in. £2 15s. (1s. 1d.).

Monthly Sea Surface Temperatures of the North Atlantic Ocean (M.O. 527, 1949). 19 $\frac{3}{4}$ in. \times 12 $\frac{1}{4}$ in. 10s. (3d.).

Quarterly Surface Current Charts of the Atlantic Ocean (M.O. 466, 1945). 22 $\frac{1}{2}$ in. \times 17 $\frac{3}{4}$ in. 12s. (6d.).

Monthly Ice Charts of Western North Atlantic (M.O. 478, 1944). 12 in. \times 7 $\frac{1}{2}$ in. 4s. (2d.).

Indian Ocean

Monthly Meteorological Charts of the Indian Ocean (M.O. 519, 1949). 15 $\frac{1}{4}$ in. \times 22 in. £3 3s. (11d.).

Indian Ocean Currents (M.O. 392, Second Edition 1939, reprinted 1950). 30 in. \times 20 in. 10s. (3d.).

Pacific Ocean

Monthly Meteorological Charts of the Eastern Pacific (M.O. 518, 1950). 17 in. \times 23 $\frac{1}{2}$ in. £4 4s. (1s. 4d.).

Monthly Meteorological Charts of the Western Pacific (M.O. 484, 1947). 16 $\frac{3}{4}$ in. \times 24 in. £2 2s. (1s.).

Monthly Sea Surface Temperatures of Australian and New Zealand Waters (M.O. 516, 1949). 19 $\frac{3}{4}$ in. \times 12 $\frac{1}{4}$ in. 10s. (3d.).

Quarterly Surface Current Charts of the Western North Pacific Ocean, westward of long. 160°W, with Monthly Chartlets of the China Seas (M.O. 485, 1949). 21 in. \times 16 in. £1 5s. (5d.).

South Pacific Ocean Currents (M.O. 435, 1938, reprinted 1944). 34 $\frac{1}{2}$ in. \times 24 in. 7s. 6d. (6d.).

Arctic Ocean

Monthly Ice Charts of the Arctic Seas (M.O.M. 390a, revised 1944). 12 in. \times 7 in. 3s. 6d. (2d.).

Prices in brackets give postage (inland)

Publications in this list are obtainable direct from H.M. Stationery Office at the addresses shown on the title page, or from any bookseller.

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Cloud Forms. Definitions and descriptions, with photographs of clouds. (M.O. 233, 6th edition, 1949, reprinted 1952.) 2s. (2s. 1½d.)

Weather Map. An introduction to modern meteorology. (M.O. 225 i, 3rd edition, 1939, reprinted 1952.) 3s. 6d. (3s. 8d.)

Meteorological Glossary (continuation of the "Weather Map" q.v.). (M.O. 225 ii, 3rd edition, 1939, reprinted 1953.) 12s. 6d. (13s.)

Handbook of Weather Messages, Codes and Specifications. (M.O. 510.)

Part I. Transmission schedules and station index numbers. (1949.) 2s. 6d. (2s. 8d.)

Part II. Codes and Specifications. (1948, reprinted 1950.) 2s. 6d. (2s. 8d.)

Part III. Coding, decoding and plotting. (1948, reprinted 1950.) 2s. (2s. 2d.)

(Amendments issued as necessary and priced separately.)

Instructions for the Preparation of Weather Maps with tables of the specifications and symbols. (M.O. 515, 1949, reprinted 1951.) 1s. 6d. (1s. 7½d.)

International Meteorological Code adopted by the International Meteorological Organisation, Washington, 1947. **Decode for the use of shipping**, incorporating the code for weather reports from and to ships and the analysis code for the use of shipping. (M.O. 509, 2nd edition, 1950, reprinted 1952.) 1s. 6d. (1s. 7½d.)

Marine Observer's Handbook. (M.O. 522, 7th edition, 1950, reprinted 1952.) 10s. 6d. (10s. 11d.)

Meteorological Handbook for Pilots and Navigators. (M.O. 448, 2nd edition, 1942, reprinted 1952.) 3s. 6d. (3s. 8d.)

A Short Course in Elementary Meteorology. By W. H. Pick, B.Sc., F.C.P., F.Inst.P. (M.O. 247, 5th edition, 1938, reprinted 1950.) 2s. 6d. (2s. 9d.)

Meteorology of Airfields. By C. S. Durst, B.A. (M.O. 507, 1949, reprinted 1950.) 2s. (2s. 2d.)

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