M.O. 717

The Marine Observer

A quarterly journal of Maritime Meteorology

Volume XXXII No. 196

April 1962

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The range of wind speed and the mean wind speed are quoted for each force; the description of the sea according to the 'Sea Criterion' laid down by the World Meteorological Organisation is also given.

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THE MARINE OBSERVER

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

VOL. XXXII **No. 196** **APRIL 1962**

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Editorial

The article on page 76 concerning the International Ice Patrol appears approximately on the fiftieth anniversary of the disaster which gave birth to this valuable service.

The story of the tragic end of the *Titanic* on 15th April 1912, a bare four days out of Southampton on her maiden voyage, after collision with an iceberg, has been told too often to warrant repetition in these pages.

It was not until the publication of *The Ismay Line* last year that personal stigma was finally removed from the then chairman of the owners, but still outstanding in the controversy which has surrounded this tragedy for fifty years is the boundless faith which the builders, owners, crew and passengers had in the new ship. That of many of the passengers remained right up to the very end and it has been said that the chief initial difficulty which the crew encountered was to induce people to get into the boats; some of them came on deck after the collision, viewed the iceberg and then went back to bed. It is not impossible that, apart from the fact that the *Titanic* was not fitted with sufficient boats and buoyant apparatus to carry everybody on board, this reluctance to believe the worst until it was too late contributed to the appallingly high death roll, for many boats were by no means full when they left the ship. The whole story is so incredible that it seems now almost as if the tragedy were destined to take place, to make the rules for the safety of life at sea more rigid.

Apart from the institution of the International Ice Patrol many other safety rules as we know them today were born of the disaster: the compulsion on the master of a ship to report dangerous ice by all of the means at his disposal; the signing on of a junior rating (later to be replaced by an auto-alarm) trained to listen out for W/T distress calls during the radio officer's watch below; and the carrying of lifeboats sufficient to accommodate the entire complement of passengers and crew. Two other reforms which probably owe their origin to the *Titanic* disaster were the cessation of the practice of stopping a seaman's wages as soon as disaster overtook his ship, and the institution of the Mercantile Marine Widows' Fund.

The *Titanic* disaster was mirrored in another tragic drama enacted about sixty miles south of Cape Farewell during the Second World War, though nothing of it reached the papers. For security reasons, the Ice Patrol and the compulsory radio reporting of ice, either of which might have prevented it, were not functioning. It concerned a ship in convoy which, after a night's steaming through pack-ice, collided with an iceberg and became disabled. An escorting sloop, then commanded by the writer, was left to stand by her whilst the convoy proceeded. Though the damage done to her was soon found to be irreparable, no amount of coaxing nor cajoling, not even the presence of two United States rescue vessels which had been detached from the Davis Strait area when things were found to be hopeless, could induce the master to allow anyone to leave her. Earlier in the war she had taken two German torpedoes almost without change of trim and he believed her to be unsinkable, as the *Titanic* had been thought unsinkable thirty years before. During the second night after the collision she foundered, quite suddenly and almost unnoticed among the icebergs surrounding, yet separating, the three ships who were standing by. Human life stands little chance in those waters and pitifully few of the bodies subsequently taken from the sea had life in them. Poignancy is added to the tragedy by the fact that the ship appeared in *Lloyd's Register* as "specially strengthened for navigation in ice".

These two tragedies can but underline the fact that mere faith in ships is not enough. Faith must be backed up by knowledge of what can harm them; knowledge can only be acquired by the patient accumulation of facts.

We have gone a long way on the road towards helping ships to keep clear of ice since the tragedy of fifty years ago, but a long road lies still ahead. Since October

1959, each number of *The Marine Observer* has contained a comprehensive article, accompanied by maps, on the distribution of ice over the North Atlantic and adjacent areas during a previous quarter. (That for October, November and December 1961 is on page 77 of this issue.) These maps, which are currently available to shipping interests soon after the end of each month, have been made possible by the work of the International Ice Patrol, the observations of ships, and the facsimile apparatus which enables a picture of the ice situation to be seen in this country, or in any ship fitted with a suitable receiver, almost as soon as it is drawn up on the other side. Because of these aids, forecasting of ice is no longer the impracticable proposition that it was thought to be even a few years ago and, though it is yet in its infancy, we have already reached the stage where a good general idea can be given to a shipmaster leaving the United Kingdom of the ice conditions which he is likely to encounter on the other side of the Atlantic or in the Baltic. But for the furtherance of this work facts are necessary: reports from any ships encountering ice, from the Trans-Atlantic passenger liner, the general carrier and the trawler in the high Arctic alike; even a report of "no ice sighted", when ice might reasonably have been expected, is of great value.

Precision in sea-ice forecasting marches hand in hand with precision in weather forecasting. It follows then that the former is no less dependent on the observations of the Voluntary Observing Fleet than is the latter, not only the observations of ships in ice areas but also in adjacent areas. L. B. P.

THE MARINE OBSERVERS' LOG

April, May, June

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

SCIROCCO

Mediterranean Sea

m.v. *Wairangi*. Captain H. O. V. Andersen. Aden to Hamburg. Observers, Mr. C. C. Paterson, Chief Officer and Mr. G. C. Sanderson, 4th Officer.

30th May 1961. At 1515 GMT there were only light airs, from about NE, but at 1525 the wind sprang up from SSE and began to increase rapidly. By 1530 it reached force 6 and blew for some time at that speed. Occasionally, very hot gusts were experienced, which were overpowering in their intense heat. A small waterspout was seen astern of the ship, moving in a N'ly direction. From 1500 to 1530 the pressure as shown by the barograph fell about 5 mb. The air temp. at noon was 75°F, the wet bulb 70·8°, and the sea 66° (by condenser intake).

Position of ship: 35° 02'N, 19° 42'E.

Note. Mr. B. F. Bulmer, of the Climatological Services branch of the Meteorological Office, comments:

This is clearly an example of the 'scirocco'—the hot, southerly wind from the desert which is characteristic of the eastern flanks of depressions moving east in this region. Such depressions are most common in late spring and early summer, and the accompanying scirocco is most noticeable in the afternoon, when the wind is blowing from the strongly heated land.

DRY AIR

Suez Canal

m.v. *Scottish Hawk*. Captain A. Mair. Bandar Mashur to Port Said. Observers, Mr. B. Shepherd, 1st Officer and Mr. J. C. Attwood, 2nd Officer.

29th May 1961. At 1400 GMT (1700 ATS) while on passage north through the Gulf of Suez the air temp. and wet bulb were 92·4°F and 66·3° respectively, giving a depression of 26·1° (dew point 45·7°). Many abnormal refraction effects were seen. Wind NW'N, force 2.

On 30th, while passing through the Suez Canal, the following observations were made:

GMT	Dry Bulb (°F)	Wet Bulb (°F)	Dew Point (°F)	Relative Humidity (%)	Wind
1030	110·0°	74·8°	53·2°	16	S, force 1–2
1130	109·2°	73·1°	48·8°	14	W, force 2–3
1200	112·0°	76·0°	54·8°	16	N, force 2–3

Between the above times much sand was present in the atmosphere and there were frequent dust devils on the banks of the canal. The pilot said that the weather was most unusual for the time of year.

Position of ship at 1400: Port Said.

Note. Scottish Hawk experienced very dry air coming from off the desert during this period. Abnormal refraction arose from the large vertical variations in humidity and temperature near the sea within this dry air mass.

SHIP-MADE CUMULUS

Indian Ocean

m.v. *Hertford*. Captain H. C. R. Dell. Melbourne to Aden. Observers, Mr. M. W. Elsam, 3rd Officer and A.B. Payne.

24th May 1961. At 1050 SMT the wind, which was SE'E, force 5, was fine on the starboard quarter and moving about 1 kt. faster than the ship. Fumes from the funnel were therefore rising almost vertically and at a height of about 400 ft. a small 'fair weather' cumulus cloud formed, which lasted until it travelled clear of the rising hot gases. A second cloud developed and disappeared as the first one did; a third, which formed at 1135 underwent similar changes. Air temp. 85·5°F, dew point 75°, sea 83·1°.

Position of ship: 5° 50′S, 67° 45′E.

Note. Ship-made cumuli have been reported on previous occasions; they are of interest because it is unusual for the atmosphere to be so near equilibrium (and with sufficient moisture) for the heat from a ship's funnel to be able to set up the vertical currents needed to form cumulus cloud. (See observations by s.s. *Himalaya* in our January 1960 number, page 11, and by m.v. *Rangitata* in the April 1961 number, page 64.)

SUDDEN RISE IN SEA TEMPERATURE

North Atlantic Ocean

m.v. *Egidia*. Captain A. J. F. Colquhoun, M.B.E. New York to London. Observers, the Master, Mr. D. Bisset, 2nd Officer and Cadet A. Langmuir.

13th May 1961. At 1813 GMT when we were 43 miles distant from the Nantucket Light-vessel, which bore 303°, a line of demarcation was seen about 4 miles away, towards the south. Course was altered to cross the line, which lay approximately 270°–090°. The echo sounder was brought into use and sea temperature readings taken at 2-min. intervals as the vessel approached the line. The values found are given below.

GMT	SOUNDING (fm)	SEA TEMPERATURE (°F)
1816	88	49
1818	90½	49
1820	94½	48
1822	97	48
1824	100	47
1826	No bottom	60
1828	,, ,,	62
1830	,, ,,	62
1832	,, ,,	62
1906		47
1950		50

During the afternoon fog, thick at times, had been experienced, but it cleared. At 1825, when the vessel crossed the line from the smooth into the slightly disturbed water, the visibility towards the north was 5 miles and about 9 miles towards the south. By 1906 there was fog again with visibility of ½ mile, and the sea temperature had fallen to 47°. By 1950 the sea temperature had increased to 50° and at 2033 the fog cleared and the visibility improved to moderate. At 1800: air temp. 62°F, wet bulb 60°; wind, calm.

Position of ship: 40° 12′N, 68° 42′W.

Note. This is a useful observation of rapid temperature change and a line of demarcation associated with the Gulf Stream. It occurred at the edge of the Gulf Stream. The recurrence of the low sea temperatures illustrates the eddy-like exchanges (often large-scale) that take place between warm and cold water. We hope in the near future to study systematically the occurrence of surface discontinuities in the oceans.

CALM PATCH

North Atlantic Ocean

m.v. *Crystal Bell.* Captain E. R. Owen. Trinidad to Toronto. Observer, Mr. P. G. Kühnel, 3rd Officer.

6th June 1961. At 2230 GMT the vessel passed through a patch of calm water extending about 3 miles in a N–S direction, and as far as the eye could see in an E–W direction.

On entering the calm patch, the ship, which was on auto-pilot, yawed off course considerably and continued to do so until leaving the area. Sea temp. 73°F; wind SSW, force 3.

Position of ship: 36° 06′N, 57° 30′W.

Note. This calm patch occurred near the Gulf Stream but apparently within warm Atlantic water and with a discontinuity in the current. [See Note by Dr. L. H. N. Cooper of the Marine Biological Association of the U.K. in our July 1961 number, page 118. The case considered by Dr. Cooper, however, was further to the north, nearer to the cold water and without a current discontinuity.]

LINE OF DEMARCATION

North Atlantic Ocean

m.v. *Huntingdon.* Captain H. R. M. Smith. Curaçao to Dunkirk. Observer, Mr. G. C. Stalker, 3rd Officer.

25th May 1961. At 1330 GMT the colour of the sea changed quite suddenly from a greenish blue to a dark blue, the two colours being separated by a distinct line lying in an E–W direction. The sea temperature dropped from 61·2° to 59°F on passing from the green coloured water to the blue; there was no change in the air temperature. No cloud was present. Wind N'ly, force 1–2.

Position of ship: 42° 40′N, 31° 50′W.

Note. A very similar phenomenon was commented on by Dr. T. J. Hart, of the National

Institute of Oceanography, in our April 1959 number, page 49. In neither that observation nor the present one did the line of demarcation occur near a well known oceanographical discontinuity, but near to mean polar frontal zones where meteorological conditions fluctuate widely.

DISCOLOURED WATER

Indian Ocean

s.s. *Southern Cross*. Captain L. H. Edmeads. Durban to Cape Town. Observer, Mr. D. G. Gomer, 3rd Officer.

29th April 1961. Between 1315 and 1400 LMT the vessel passed through clearly defined bands or streaks of a vermilion coloured substance lying on the sea surface and extending on both sides of the vessel as far as the eye could see. The bands were about 300 ft. wide and had an oily appearance as if a large amount of red paint had been spilled on the water. Sea temp. 65°F; wind ENE'ly, force 3.

Position of ship: 34° 30'S, 22° 45'E.

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

"Possibly the discoloration is due to a dinoflagellate bloom, perhaps of *Noctiluca*, but ciliate protozoa also give this colour effect when they swarm in inshore waters round the Cape and at other points on the South African coast."

s.s. *Suevic*. Captain C. L. Carroll. Melbourne to Aden. Observer, Mr. A. W. Rees, 3rd Officer.

30th April 1961. At 1530 LMT the vessel entered a large area of discoloured water and passed through it for some 20 miles. The colour of the sea was greenish orange except where disturbed by the ship's wash, where it was green. The discoloration seemed to be very thick down to 1 ft. beneath the surface. There was a general covering over the whole sea, with some very dense patches lying downwind. A very strong odour, like that of bad fish, was noticed while passing through the area. When a sample of the water, taken within the first 2 ft. of the surface, was examined under the microscope, it was found to contain very thick plankton—apparently phytoplankton of the diatom class, cylindrical in shape. The wind was W'ly, force 1, the sea almost calm and the sky clear with strong sunshine when the vessel traversed the area. The sea temp., taken by bucket, was 88°F.

Position of ship: 7° 36'N, 55° 42'E.

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

"This is a most useful and valuable observation. In spite of non-preservation of the sample, I was able to identify the diatoms as *Rhizosolenia castracanei*; I think this is the first occasion on which an extensive bloom of this type has been seen so far from land—about 350 miles from the east coast of Africa—though Darwin in the *Beagle* saw something similar, close in to the Abrolhos, perhaps another species of this cosmopolitan genus."

RADAR NAVIGATION OFF ICE LIMITS

North Atlantic Ocean

s.s. *Birmingham City*. Captain J. R. Campbell. Avonmouth to Halifax, N.S. Observer, Mr. A. Johansen, 3rd Officer.

16th March 1961. At 0100 GMT, a stationary radar target, apparently a large iceberg, was observed on the PPI, bearing 294° at a distance of 4·5 miles on the starboard bow. The course was 266° and the speed 11·5 kt.

As the bearing approached 45° on the bow, what appeared to be a ragged ice edge, 4½ miles long and lying approx. E–W, was observed on the PPI one mile to the north of the iceberg. There was no sea clutter to leeward of these targets, which were 150°, 10 miles from the southernmost extension of known ice as reported by the International Ice Patrol. A radio message concerning this ice was sent CQ and to Cape Race Radio. Air temp. 34°F, sea 44°, falling to 36° in the next hour. Wind SE'S, force 5. 5/8 cloud. Visibility over 10 miles.

Position of ship: 45° 15'N, 48° 13'W.

Note. This observation was forwarded recently to the International Ice Patrol, for possible comment.

UNIDENTIFIED PHENOMENON

Arabian Sea

s.s. *Oronsay.* Captain R. W. Roberts, O.B.E., D.S.C. Aden to Colombo. Observers, Mr. D. Hughes, 1st Officer, Mr. A. N. Perkins, Senior 3rd Officer, the Quartermaster and the look-out.

9th April 1961. At 2005 GMT a disturbance resembling an air bubble breaking surface was seen approximately ¼ mile from the ship, causing discoloured water and dead or stunned fish to appear on the surface over an area of about ⅛ mile. No soundings were obtained on the echo sounding machine on any scale. Air temp. 82°F, sea 85°; wind NE, force 2. Sea calm.

Position of ship: 10° 12′N, 61° 57′E.

Note. This observation has been forwarded to the National Institute of Oceanography.

PHOSPHORESCENCE

North Atlantic Ocean

s.s. *New York City.* Captain F. W. Harris. Avonmouth to New York. Observer, Mr. P. W. Doble, 2nd Officer.

7th May 1961. Vivid phosphorescence was seen in the ship's bow wave at 0410 GMT. It was composed of circular patches about 4 ft. in diameter, and also of small spots. The display was confined to within about 50 ft. of the ship's side and the 'balls' of phosphorescence gave the impression of exploding as they were exposed and reached the surface. The sky was overcast and the vessel was rolling to a heavy NW swell. Sea temp. 54°F; wind NW, force 8.

Position of ship: 41° 36′N, 58° 36′W.

Arabian Sea

s.s. *Yoma.* Captain D. Campbell. Rangoon to Aden. Observer, Mr. C. Sinclair, 2nd Officer.

15th May 1961. Between 2210 and 2250 GMT, bright circular patches of phosphorescence about 2 ft. across were seen rising to the surface of the sea. As they neared the surface, they 'exploded' rapidly to about 50–75 ft. across, still retaining their circular form. Seven or eight of these were observed near the ship, one 'exploding' under the vessel. A rain squall, in which the wind reached force 6, had just passed over. Sea temp. 86°F.

Position of ship: 11° 15′N, 56° 16′E.

Note. The above two observations have been sent to the relevant authority.

SCINTILLATION

New Zealand waters

m.v. *Cymric.* Captain H. C. Smith. Observers, Mr. T. I. Oliver, 2nd Officer and Cadet R. Ford.

11th June 1961. When the vessel was some 7 miles off the land at 1400 GMT, Canopus was seen rising just above a mountain range, coming into sight at an elevation of 8° on a bearing of 166°. The star was white when first seen, but 2 sec. later it changed to green, then after a further 2 sec. the colour changed to red for 2 sec. This 6-sec. cycle was repeated with regularity until about 30 min. later when the star became obscured by cloud. The white colour was tinged with a harsh metallic blue and the green and red colours were especially brilliant. A deep depression had been centred over the area twenty-four hours previously and the cloud at the time of the sighting was only $\frac{3}{8}$ Sc. Visibility was excellent and the clear areas of the sky had the 'washed' appearance often observed after heavy rain. Air temp. 53°F, wet bulb 50°, sea 66°; wind WSW, force 3.

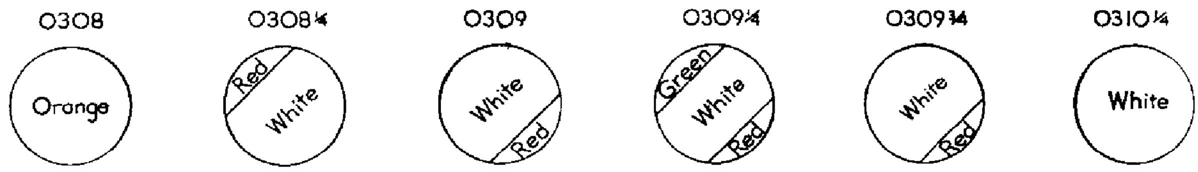
Position of ship: 37° 35′S, 177° 45′E.

Note. See note on observation by s.s. *Romanic* (below).

South Pacific Ocean

s.s. *Romanic.* Captain J. Rickstins. Bluff to Panama. Observer, Mr. G. G. Jackson, 3rd Officer.

20th June 1961. From 0308 until 0310 GMT, shortly after rising above a clear



horizon, the planet Jupiter was observed through a telescope, when the colour sequence shown above was seen to occur. Air temp. 74·0°F, wet bulb, 71·2°, sea 74·3°; $\frac{1}{8}$ Sc.

Position of ship: 4° 31′S, 96° 27′W.

Note. The interesting and unusual sequence of colours can be compared with another display by Jupiter observed aboard m.v. *Port Wyndham* (see our April 1961 number, page 68, and the note in our October 1960 number, page 194).

DOUBLE FOG BOW

North Atlantic Ocean

m.v. *Manchester Vanguard.* Captain D. G. Thomas. Manchester to Saint John, N.B. Observer, Mr. R. G. Ashling, 3rd Officer.

17th May 1961. At 0900 LMT a thick layer of fog covered the sea, but the sky overhead was clear. With the sun very fine on the port quarter at a low altitude, two white concentric fog bows were seen, fine on the starboard bow, see sketch opposite. They were visible for about 1½ hours before fading, as the sun's altitude increased. Air temp. 49°F, wet bulb 48°, sea 42°; wind SSW, force 2.

Position of ship: 43° 26′N, 62° 31′W.

Note. This phenomenon must have been very striking; angular measurements of the fog bows would have given information concerning the size of the fog droplets.

LUNAR RAINBOWS

South Atlantic Ocean

m.v. *Aragon.* Captain T. W. Stevens. London to Buenos Aires. Observers, Mr. J. Wisden, Senior 2nd Officer and Mr. R. W. H. Dole, Junior 3rd Officer.

10th May 1961. Between 2100 and 2112 GMT a lunar rainbow and its secondary were plainly seen. The primary was complete with all the colours showing, but the secondary bow was not seen in its entirety and it was an off-white in colour. The moon was full and at an altitude of 20°. 6/8 large Cu. with showers.

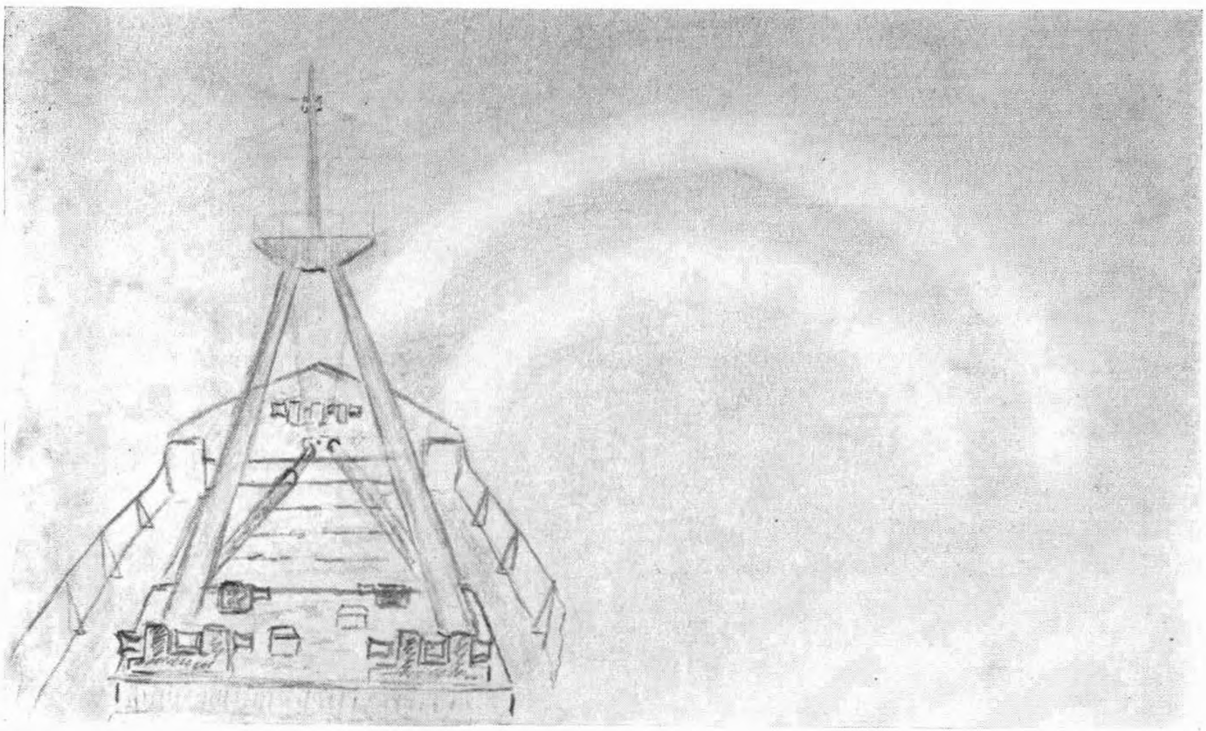
Position of ship: 4° 46′S, 31° 12′W.

ABNORMAL LUNAR HALO

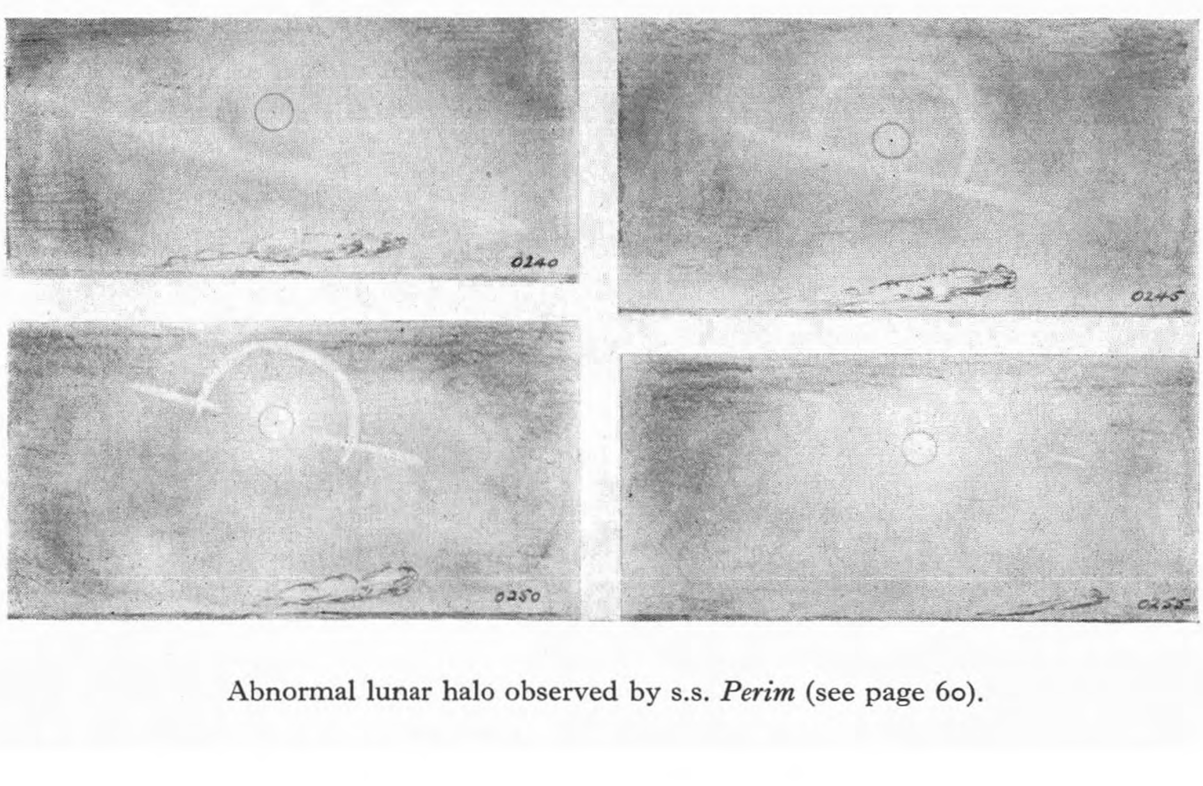
North Atlantic Ocean

s.s. *Perim.* Captain W. H. Waghorn. Liverpool to Curaçao. Observers, Mr. D. C. Smart, 4th Officer and Cadet R. S. Ryott.

29th December 1960. The remarkable halo of 22° radius, see sketch opposite, was seen round the moon from 0240 until nearly 0300 GMT. Some Cs. of type C_H5 was present and also a few small patches of Sc, the weather being fine and



Double fog bow observed by m.v. *Manchester Vanguard* (see page 60).



Abnormal lunar halo observed by s.s. *Perim* (see page 60).

(*Opposite page 61*)

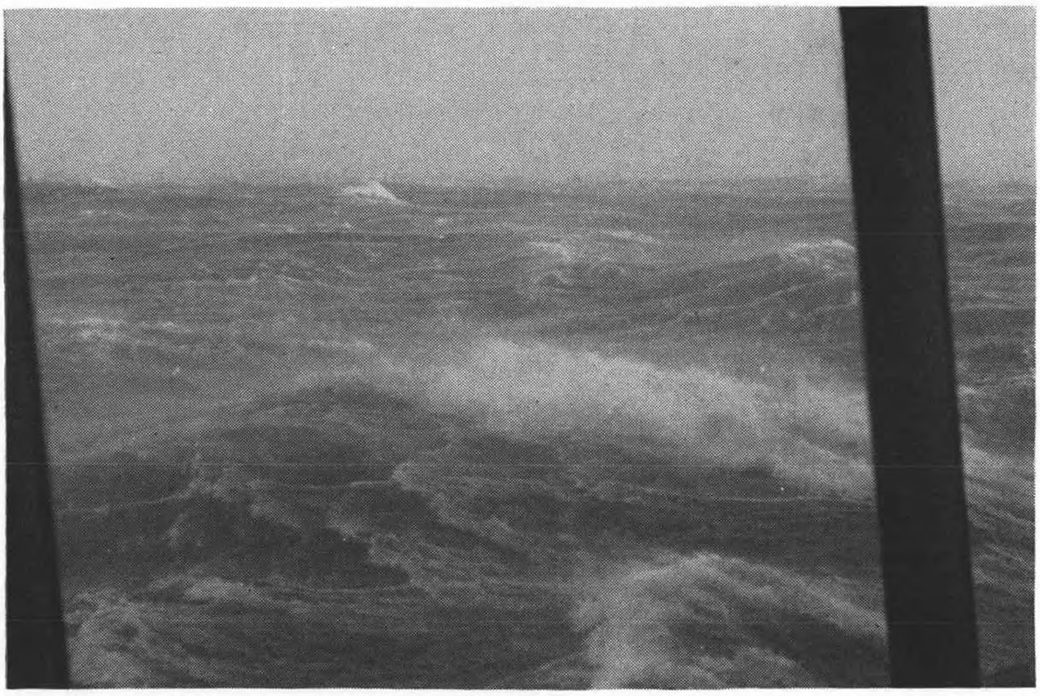


Photo by Kevin O'Keeffe (Crown Copyright)

Beaufort Force 10.

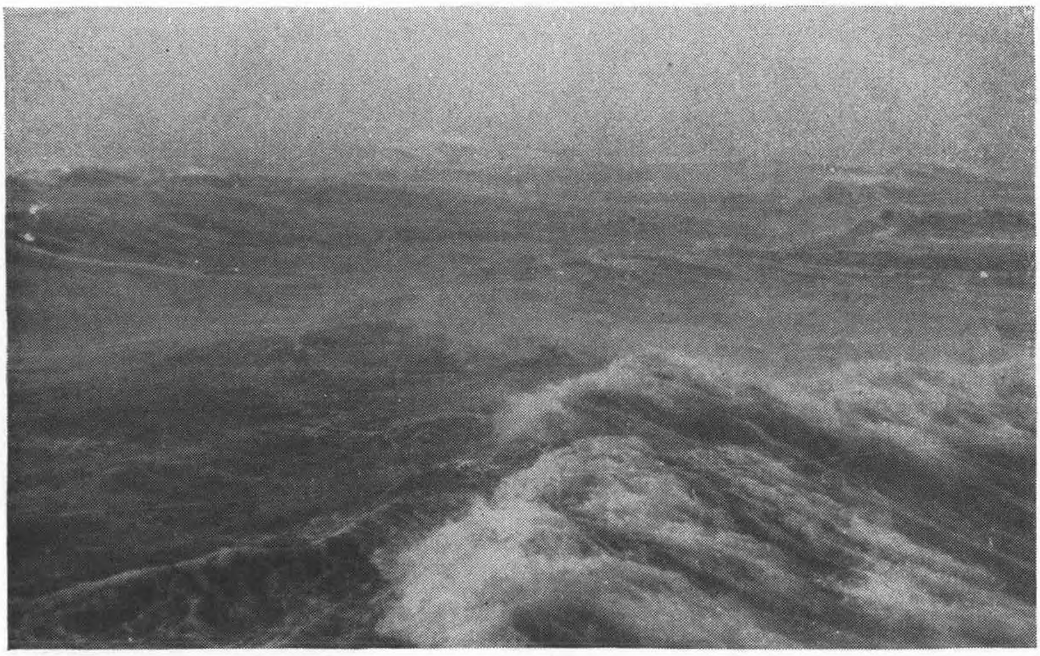


Photo by Kevin O'Keeffe (Crown Copyright)

Beaufort Force 11.

The above photographs, with the wind coming from the beam, may profitably be compared with the existing photographs for these two forces on the *State of Sea* card (M.O. 688A).

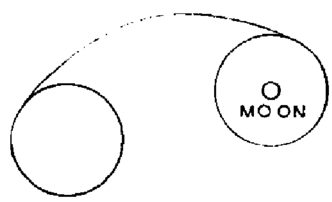
clear. Air temp. 69°F, wet bulb 64°, sea 70°. Barometer, 1025 mb. Wind, s'w, force 2.
Position of ship: 32° 08'N, 44° 41'W.

LUNAR HALO COMPLEX

Gulf of Panama

s.s. *Ceramic*. Captain G. Campbell. Auckland to Balboa. Observer, Mr. J. W. Brew, 3rd Officer.

29th May 1961. Two lunar halos, each of 22° radius, and connected by a link,



were observed at 0245 GMT. One halo was around the full moon which was at an altitude of 54° 56' and bore 123°. The other halo had its centre at an altitude of approximately 45° and bore 250°. Each had a whitish appearance. The link was on the north polar side of both halos. The phenomenon was quite clearly seen, but only for about 5 min. as the sky became cloudy with Ac. Air temp. 81°F, wet bulb 79°, sea 83°; wind w'ly, force 3.
Position of ship: 5° 53'N, 81° 31'W.

Note. This phenomenon is not described in any of our reference books. We can find no record of its having been observed at any time previously in any other Selected Ships.

MOCK SUNS

Irish Sea

s.s. *Empire Cymric*. Captain W. H. Laws. Preston to Larne. Observers, the Master and Mr. H. H. McGibney, Chief Officer.

21st June 1961. At 0430 GMT when the sun bore 054°, altitude 5°, two white balls of light, tinged with red (about 3 times the diameter of the sun), were observed in the horizontal plane at an angle of 22½° on each side of the sun.

Cs. cloud of type C_H6 was present and visibility was excellent. Wind sw'w, force 3. Barometer, 1022·5 mb.
Position of ship: 1 mile from Muck Island.

Note. This is an observation of the 'mock sun', a phenomenon associated with the small solar halo of about 22° radius. Mock suns are two concentrations of light on the small halo at the same altitude as the sun. They are not seen with every solar halo; sometimes one can be seen properly and sometimes, as in the present case, the small halo itself is absent whilst both mock suns are clearly visible. The intensity of these mock suns is usually very great; they are distinctly red on the side nearest to the sun itself, then yellow, changing into a bluish white.

The small halo arises from refraction of the sunlight in a cloud of small ice-crystals, whose shape is known to be often that of a hexagonal prism. The mock suns occur when the axes of a large number of these hexagonal ice-crystals are vertical.

HALOS

Japanese waters

m.v. *Glenorchy*. Captain J. B. Anderson. Kobe to Ksingkang. Observer, Mr. A. Bridson, 2nd Officer.

25th May 1961. At 0400 GMT a double halo was seen round the sun. The first was a complete circle of 15° radius and having the colours red, orange, yellow and a milky white. The other halo was 40° in radius and it extended through 60° of arc on the side of the sun nearest to the horizon; the colours being similar to those seen in a rainbow. There was a fairly dense veil of Cs. at the time and the halos were visible for 10 min. At 0600: air temp. 71·0°F, wet bulb 64·0°; light and variable wind; no low or medium cloud; visibility good.

Position of ship: off Muroto Saki.

Note. The 40° halo is probably a variation of the frequently observed 46° halo while the 15° halo is a variation of the very rare 16° to 19° halo. The fine display of colour is produced by diffraction from a special distribution of crystal sizes in the clouds producing the halos.

ABNORMAL REFRACTION

Great Bank, Newfoundland

m.v. *Edenmore.* Captain A. Wiles. Ijmuiden to Seven Islands. Observers, Mr. J. Ratcliffe, 2nd Officer, Mr. T. V. Kinley, 3rd Officer and Mr. R. J. Carty, Senior Radio Officer.

23rd June 1961. During a break in almost continuous fog, when the visibility became 15 miles with a clearly defined horizon, a tanker was seen on the port beam at a distance of 12 miles. Around the horizon there appeared to be a large bank of fog, topped by two thin layers of low stratus. Beneath each layer of cloud there was an inverted image of the tanker, as shown in Fig. 1. Details (not shown in the sketch) were clearly seen through a telescope. The top image gradually descended and merged with the lower one, presenting the appearance shown in Fig. 2. The

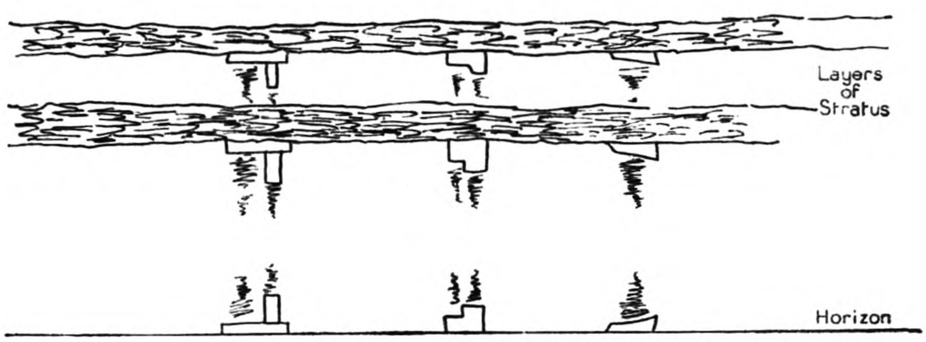


Fig. 1

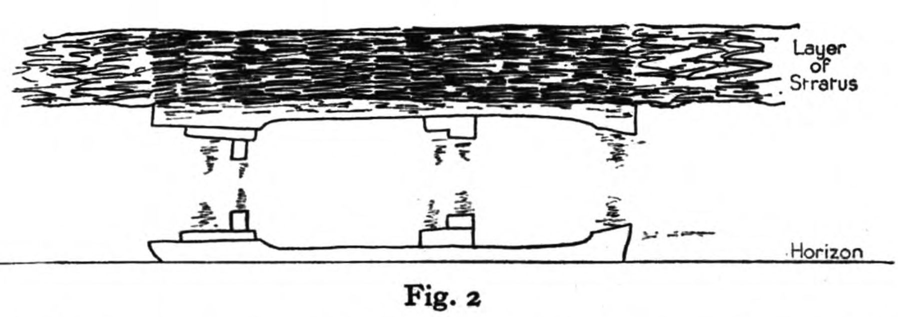


Fig. 2

effect persisted for 15 minutes, after which the tanker was obscured by fog. Air temp. 51·9°F, wet bulb 47·8°, sea 47°; wind S'W, force 2–3. Rippled sea. Stratus on horizon, cirrostratus overhead. Distances by radar.

Position of ship: 48° 08'N, 46° 42'W.

Note. The very great horizontal changes in sea temperature experienced over the Great Bank make abnormal refraction very probable. The phenomena reported by m.v. *Edenmore* were produced by light from the tanker arriving at the observer by many different paths.

Caribbean Sea

m.v. *Durham.* Captain R. G. Hollingdale. Curaçao to Colon. Observers, the Master and Mr. M. B. Shuker, Junior 3rd Officer.

22nd June 1961. At 1845 SMT, shortly before the lower limb of the sun dipped below the horizon, 'waves' in the form of vertically-rising pulses were seen on the sun's disc. They were pale green in colour at first, but as the sun sank they changed to peach and yellow, as did the sky. After the sun had disappeared, the greenish hue, which had previously been there, returned to the whole of the western horizon. Air temp. 79°F, wet bulb 76°, sea 78°; cloud, Ac. and Cc. with Cs.; wind E'ly, force 5; sea rough.

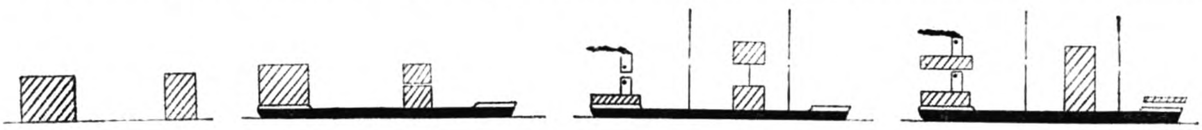
Position of ship: 12° 58′N, 71° 45′W.

Note. This observation of abnormal refraction is evidence of large-scale atmospheric inhomogeneity and movement, causing changes in the refraction of light as it passed through the atmosphere from the sun.

Red Sea

s.s. *Perseus.* Captain W. K. Hole. Aden to Suez. Observer, Mr. J. Carter, Supernumerary 3rd Officer.

31st May 1961. Between 0330 and 0450 GMT a tanker, which was at first 14 miles away, underwent the changes in appearance shown in the sketches below. At times



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

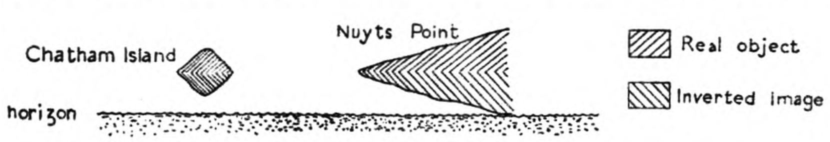
the appearance of the tanker was quite normal. It is interesting to note that the smoke shown in Figs. 3 and 4 was seen coming from the 'upper' funnel only. Air temp. 81°F, wet bulb 73°, sea 79°; wind SSE, force 1. Clear sky; rippled sea. Sand in suspension in the air was occasionally encountered.

Position of ship: 25° 37′N, 35° 39′E.

Coastal waters of S.W. Australia

m.v. *Scottish Hawk.* Captain A. Mair. Adelaide to Bandar Mashur. Observer, Mr. J. C. Attwood, 2nd Officer.

1st May 1961. Whilst navigating along the S.W. Australian coast between Albany and Cape Leeuwin, abnormal refraction effects were frequently seen, both land



and ships seeming to be suspended above the horizon, with an inverted image underneath. At 0625 GMT an island was sighted clear of the edge of the mainland, but when an attempt was made at 0630 to take cross bearings it could not be seen. When the island was looked for through binoculars it was found to be appearing and disappearing. The ship was rolling and pitching to a heavy WSW swell, and when it was at the top of the swell the island was visible; it disappeared when the ship was in the trough of the swell. The island was identified as Chatham Island (610 ft. high) and at 0630 it had been 47 miles distant: to have seen it at that distance would normally require a height of eye of 260 ft. whereas the actual height of the observer's eye was 48 ft., which gave a theoretical range of 36½ miles. By 0700, when still 40 miles distant, it had stopped disappearing but was strongly refracted as shown in the sketch. Air temp. 66·4°F, wet bulb 62·8°; cloud, ⅞ Sc.; occasional rain; wind SSW, force 3; heavy WSW swell.

Position of ship at 0630: 35° 16′S, 117° 24′E.

Note. This abnormal refraction was reported where warm water flowing south from the tropics and from the West Australian current converges with the cold water of the Southern Ocean current. Abnormal refraction is the result of the vertical gradients of temperature and humidity set up in the lowest layers of air flowing over sea whose temperature varies rapidly with horizontal distance.

AURORA

The following notes have been received from Mrs. Mary Hallissey, of the Aurora Survey:

"Auroral observations from ships for the three months 1st April–30th June 1961 are shown very briefly in the following list compiled at the Balfour Stewart Auroral Laboratory of the University of Edinburgh. Explanation of the auroral forms referred to is given below. There is also one observation for March which was received too late for the last publication. The list is shorter than usual partly due to obviously difficult observing conditions in May and June, and partly to the approach of sunspot minimum.

"The only display of note was 14th–15th April, for which *Weather Reporter*, an aircraft en route from New York to London, and land observers in Shetland, had excellent viewing conditions and were able to report in great detail, while many other reports from widely spread areas were also received.

"We are most grateful to all of you who are concerned in recording and sending us auroral information and hope you will continue to let us have data, whether detailed or scanty, whenever possible, making sure that exact times and ships' positions are given."

DATE (1961)	SHIP	GEOGRAPHIC POSITION		Λ	Φ	I	TIME (GMT)	FORMS
5th Mar.	*Cairngowan*	56°42′N	17°18′W	070	62	+70	2320–2330	HB
5th Apr.	*Weather Reporter*	62°05′N	32°47′W	060	70	+76	2355	RB
6th	*Weather Reporter*	62°05′N	32°47′W	060	70	+76	0007–0305	G, RB, R
							2343–2355	HA
7th	*Weather Reporter*	62°10′N	33°31′W	060	70	+76	0001–0020	G
	Weather Watcher	52°30′N	18°40′W	060	59	+69	0001	G
10th	*Clan MacDougall*	30°48′S	114°46′E	180	−42	−64	1330–1350	G, HA
14th	*Weather Reporter*	62°07′N	32°30′W	060	70	+76	0023	G
	Weather Reporter	62°03′N	32°58′W	060	70	+76	2352	HA, R
	Weather Adviser	59°61′N	19°01′W	070	65	+73	2330	S
15th	*Weather Adviser*	59°61′N	19°01′W	070	65	+73	0245	S
	Weather Reporter	62°03′N	32°45′W	060	70	+76	0015–0435	All forms
							2330–0250	All forms
	Ethel Everard	56°24′N	07°30′E	090	57	+70	0400–0425	G, R
17th	*Weather Adviser*	59°04′N	18°59′W	070	65	+73	2330	G
	Weather Reporter	61°57′N	33°10′W	060	70	+76	0130–0435	G, HB, HA, RA, R
18th	*Weather Reporter*	62°00′N	33°32′W	060	70	+76	0155–0345	G, HA, S
20th	*Weather Adviser*	59°07′N	19°17′W	070	65	+73	0235	G
24th	*Weather Adviser*	59°06′N	19°12′W	070	65	+73	0001	RB
26th	*Weather Adviser*	59°03′N	18°50′W	070	65	+73	0230	HA, RA
	Weather Reporter	62°09′N	33°20′W	060	70	+76	0240–0310	G, HA, R, S
28th	*Weather Watcher*	62°40′N	31°10′W	060	70	+76	0205–0210	RA, R
6th May	*Tynemouth*	49°00′N	67°06′W	360	61	+76	0600	DR, R
	Media	40°14′N	71°30′W	350	52	+72	0510–0526	G, RB, R
11th	*Port Invercargill*	48°30′N	62°00′W	010	60	+74	0230–0930	HA, RA, R, S, P
12th	*Arabia*	45°56′N	58°52′W	010	58	+73	0140–0144	L
							0300–0310	
	Weather Watcher	62°10′N	32°50′W	060	70	+76	0230	L
June—	No activity reported.							

KEY: Λ = geomagnetic longitude, Φ = geomagnetic latitude, I = inclination, G = glow, HA = homogeneous arc, HB = homogeneous band, RA = rayed arc, RB = rayed band, R = rays, S = surfaces, DR = drapery or curtain, P = pulsating, F = flaming, L = auroral light seen but no other details available.

UNIDENTIFIED PHENOMENA

South Pacific Ocean

m.v. *Waiwera*. Captain J. O. Williams. Balboa to Auckland. Observers, Mr. B. J. Wardle, 2nd Officer, Mr. C. H. Swindells, 3rd Officer and Cadet M. Orr.

23rd June 1961. From 0815 to 0840 GMT a pattern of rays of light was observed bearing from 180° to 270°. They extended from near the horizon to an altitude of 55° when first seen but the angle of elevation increased until it was just past the zenith. In colour they were white, occasionally tinged with red; in structure they were wispy thin straight rays, resembling weak searchlight beams and sometimes merging into patches. The rays appeared to be related to a point about 10° below the horizon, bearing 260°.

There was continuous movement among the rays, some of which often faded out and reappeared. The moon, which was in its 9th day, was shining brightly through the ray pattern without noticeably weakening the strength of the latter. The brighter stars were also visible through the rays. A few fair-weather Cu. clouds were present but they did not in any way interfere with the observation.

Position of ship: 22° 38′S, 123° 40′W.

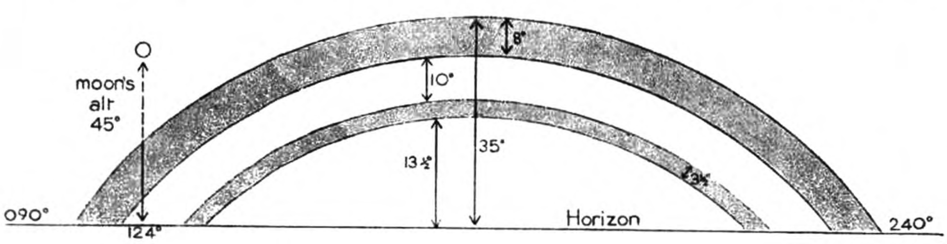
Note. This is an observation of unusual interest. Although the description would suggest that a display of aurora was seen, Mr. J. Paton, of the Balfour Stewart Auroral Laboratory, University of Edinburgh, comments as follows:

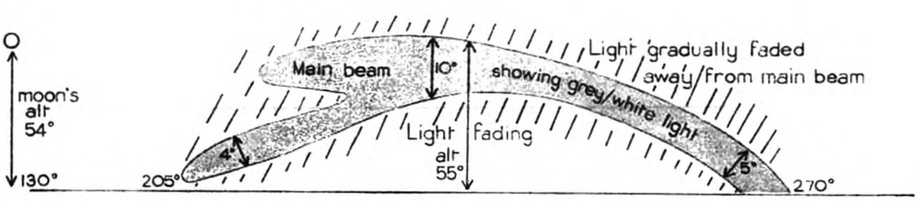
"One can say quite certainly that this is not aurora. At this time the magnetic K_p index was 1 and we have no other reports of aurora. The sketch [not reproduced here] suggests crepuscular rays but the radiation point does not fit with the position of the sun."

Indian Ocean

m.v. *Port Hobart*. Captain W. B. Craig. Aden to Wyndham. Observers, Mr. G. J. Botterill, 3rd Officer, Mr. G. G. Blackler, 4th Officer and Mr. W. Knight, A.B.

1st June 1961. At 1800 GMT the upper of the two arcs illustrated appeared in the sky; 10 min. later, the lower narrower arc became visible. The upper one was





very bright, while the lower was of slightly less intensity; both arcs attained maximum brilliance at 1820 and disappeared at 1832. They extended from 090°, through S, to 240°.

Another arc of different shape, extending from 205° to 270°, developed at 1845. It had a grey/white light which became brightest at 1852; it then gradually faded, finally vanishing at 1900. There was a full moon, which during the display increased in altitude from 45° to 54°.

Only 2/8 of cloud, consisting of small Cu., Ac. and Ci., were present during the observation. Visibility was excellent.

Position of ship: 5° 06′N, 78° 30′E.

Note. Mr. J. Paton, of the Balfour Stewart Auroral Laboratory, University of Edinburgh, comments:

"We can think of no satisfactory explanation of the remarkable arcs seen by observers in m.v. *Port Hobart* in the Indian Ocean south of Colombo around local midnight on the night of 1st June 1961. That they were auroral is unlikely, for geomagnetic disturbance at this time was no more than moderate. The change in shape at 1845 GMT suggests that they might have been caused by dust layers.

"Various sky phenomena, for example the twilight glow and crepuscular rays, may sometimes be so very like aurora that unless special instruments like the spectroscope or interference filter are available, the observer will find it impossible to decide if aurora should be reported. In these circumstances, most observers usually describe what is observed and add that aurora is suspected. We hope that observers will continue to follow this practice. When the report is later examined in the laboratory it is usually possible to ascertain from the level of magnetic disturbance at the time if aurora is likely to have been present; aurora is invariably associated with unusual magnetic disturbance."

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Prospects for Controlling and Forecasting the Weather

By R. C. SUTCLIFFE, C.B., O.B.E., B.SC., PH.D., F.R.S.
(Director of Research, Meteorological Office)

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The ability of man to control his environment, physical and biological, is, I suppose, the secret of his success on earth but, in spite of the efforts of priests and witch doctors through the ages, there is no evidence that anything of significance has ever been achieved in attempts to alter the weather. Man has been forced either to protect himself against its rigours or migrate elsewhere for survival, and this remains true to this day.

Local attempts at control

Yet in recent years there has been a new wave of attention to the subject, even by sober-minded scientists, prompted by the fact that, for a time, there did seem to be every chance of doing something worth while. In many parts of the world where rainfall is deficient or where additional rain could be put to good use, there may often be heavy clouds in the air which pass by and dissolve without giving much rain.

The explanation takes us deep into that field of meteorological science which we call cloud physics. The clouds in the free air, as is fairly obvious to anyone who has flown through them, are much the same physically as a wet mist on the ground or a mountain fog. They are composed of tiny droplets, a thousand to the thimbleful, too small to fall to the earth individually and remarkably reluctant to join together to make a raindrop. Actually they do collide and combine, slowly at first and then more rapidly; if a cloud lasts for about half an hour some large drops will fall out but many clouds die before they have time to rain.

There is, however, a way in which some clouds may be helped along, provided that their temperature falls well below freezing-point. The droplets do not freeze readily but, if stimulated or seeded with ice particles thrown off by pellets of solid carbon dioxide or triggered off by particles of silver iodide, the freezing may proceed rapidly and the ice particles then grow and fall through the cloud, picking up the super-cooled water droplets; and so rain may be quickly stimulated.

This certainly can be made and seen to happen with suitable isolated clouds, and great excitement prevailed for a time at the prospect of achieving something on the economic scale. Especially in America, enterprising business operators were soon prepared to offer their services as rain-makers, at a price; millions of dollars changed hands in a few years and, if it was difficult to prove success, it was equally difficult to prove that seeding operations had had no effect.

The trouble, as anyone might imagine, is that of distinguishing between artificial rain and natural rain which would have fallen in any case. Witch doctors of old no doubt knew this difficulty and were ready to claim anything which followed their incantations but, today, there are methods of statistical analysis carefully designed to disentangle this kind of confusion and after about 15 years of trials of many kinds, the position is frankly discouraging.

Over mountainous country where suitable clouds may be found very frequently, the weight of evidence is that seeding has increased rainfall to some slight extent but the economic value of the process even there is dubious and the whole subject has become less fashionable in the last year or two. It is a disappointing outcome to a very promising idea but much has been learned of cloud physics in the meantime.

Large-scale ideas for control

Ideas for altering weather and climate on the large scale by altering the tracks of depressions, by clearing away ice and snow fields, by warming up the Arctic Ocean and by modifying the general circulation of the atmosphere have been seriously put forward and equally seriously attacked as impracticable, leaving no accepted doctrine on the subject.

The direct attempt to change the weather by competing with the sun in its control of our climate is vain and foolish, for the cost of the energy lavishly expended by the sun in evaporating water to maintain the supply of rain to the earth would, at present electricity prices, approach a million pounds per year for every man, woman and child on earth. If we are to control this colossal heat engine, we must study its mechanism and be very subtle and, so far, no one has suggested anything which is more subtle than heaving a spanner in the works.

Some American writers believe that the Russians are feverishly studying how to warm up the Arctic, and certainly a scheme which involves blocking up the Bering Straits between Alaska and Siberia and pumping the cold water into the Pacific was put forward in Russia. But this scheme was openly and vigorously attacked in the country of its origin on the double argument that, first, it would not work and second, that if it did, it would be a disaster for much of Russia.

Certainly on the knowledge we yet have, any large-scale modification of climate intended to be beneficial in one area would in every likelihood be harmful elsewhere and, knowing that scientists are constitutionally unable to control their own curiosity and will go on thinking and experimenting, even if the outcome may be dangerous, we need not wholly regret the lack of success. In lighter vein, it has been pointed out that the work of the weather forecaster would be even more trying than it is if there were rival teams of weather controllers also at work and, for the present, a short discussion of the forecasting of natural weather must suffice.

Forecasting the weather

Systematic weather forecasting by technical methods which require neither magic nor second sight has been practised in the more advanced countries for about a century. The early success depended on the development of the 'electric telegraph' and has throughout gone forward with the improvements in rapid communication, the telegraph, the telephone, radio, teleprinter, radio-teleprinter, facsimile transmission, television. The possibility of forecasting beyond a few hours ahead in changeable weather arises simply because the weather systems, especially depressions and anticyclones, move slowly across the map, admittedly changing their structure as they do so but broadly carrying their typical weather conditions with them.

If, therefore, we devote sufficient funds and effort to obtaining weather messages from a wide area, we may chart the weather on suitable maps, study how the patterns move and change and predict by extrapolations. Although there are many complications due to such factors as diurnal variations, mountains and valleys, land and sea distributions, man-made atmospheric pollution and a host of natural peculiarities in the behaviour of the atmosphere itself, the simple facts about the behaviour of depressions and anticyclones (outside the tropics) have made forecasting possible. At the same time they have made great improvements in forecasting seem almost impossible.

Putting it very simply, if we study any weather map, there are pressure systems present which behave reasonably coherently for one day, two days or perhaps, in favourable circumstances, a little longer but after that time they disappear, new systems take their place and, until they have begun to take shape, we can do little more than guess their behaviour in detail.

Progress in short-range prediction

The progress of forecasting this century has been mainly in predicting the weather for a day or two ahead, with ever greater attention to detail. For aviation it has gone to greater and greater heights in the atmosphere and greater and greater distances from home, even half-way round the world.

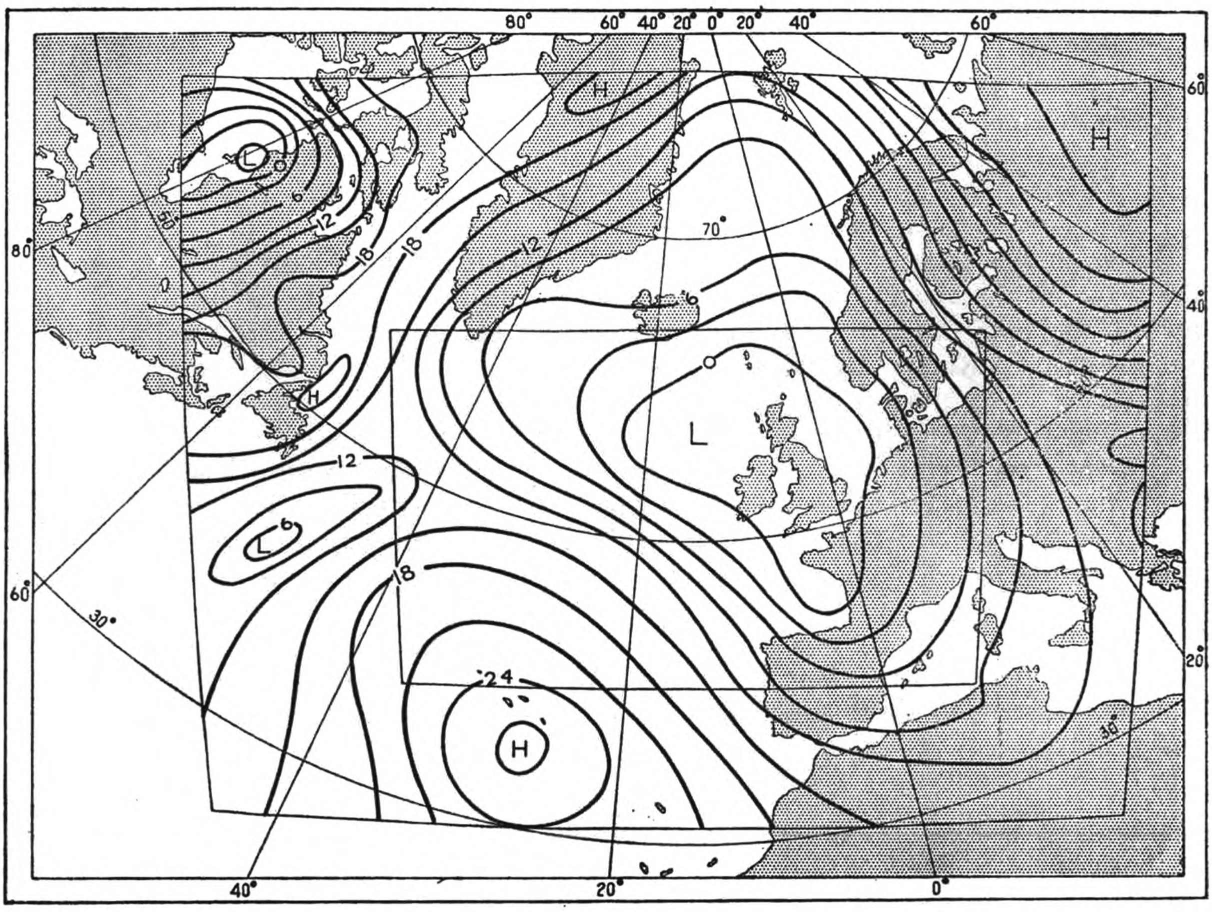


Fig. 1. Actual chart for 12th November 1959. The contours here, as in Figs. 3 and 4, are of the height of the 1,000 mb. level in decametres.

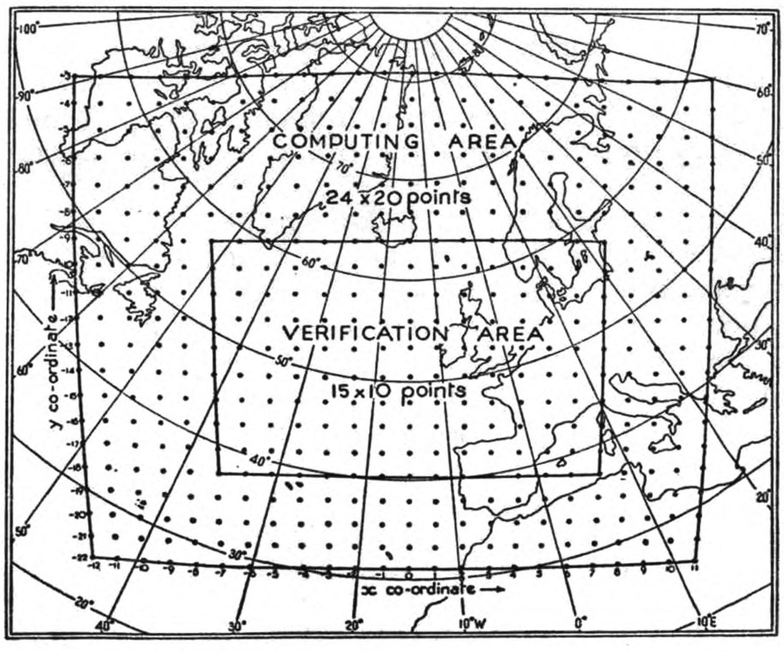


Fig. 2. Area and grid used in numerical calculations.

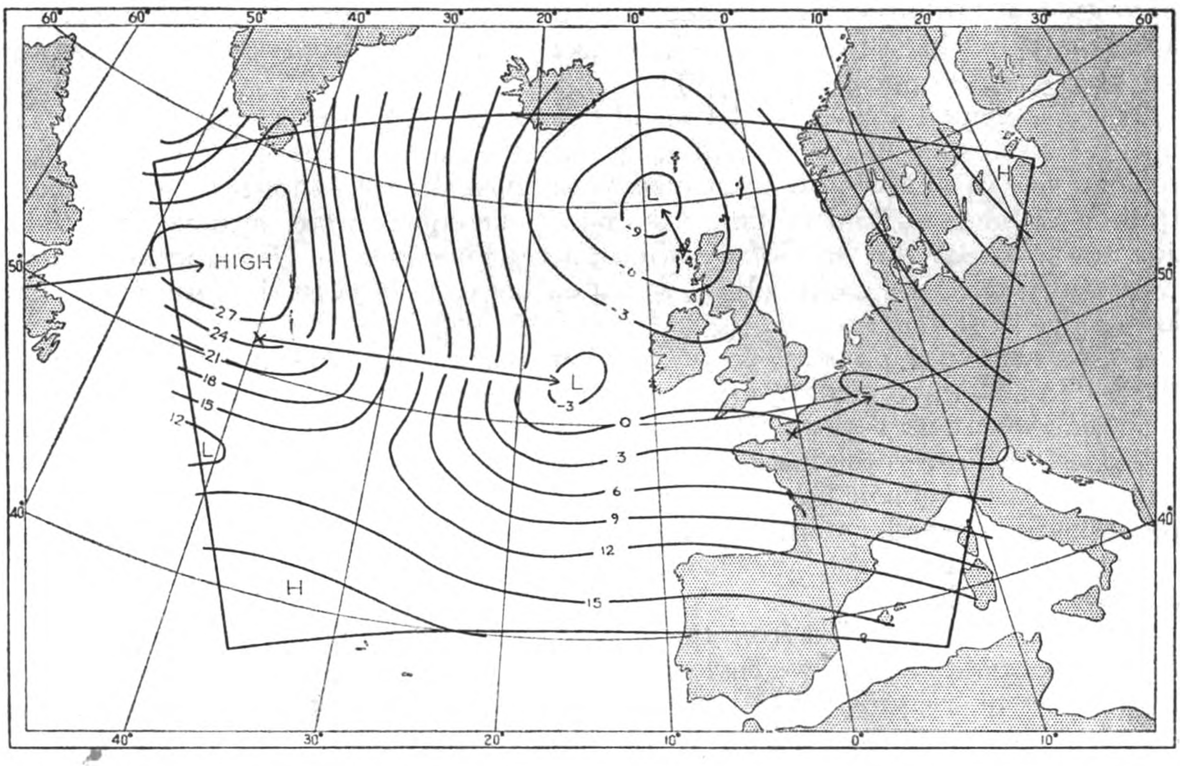


Fig. 3. Calculated chart for 13th November 1959.

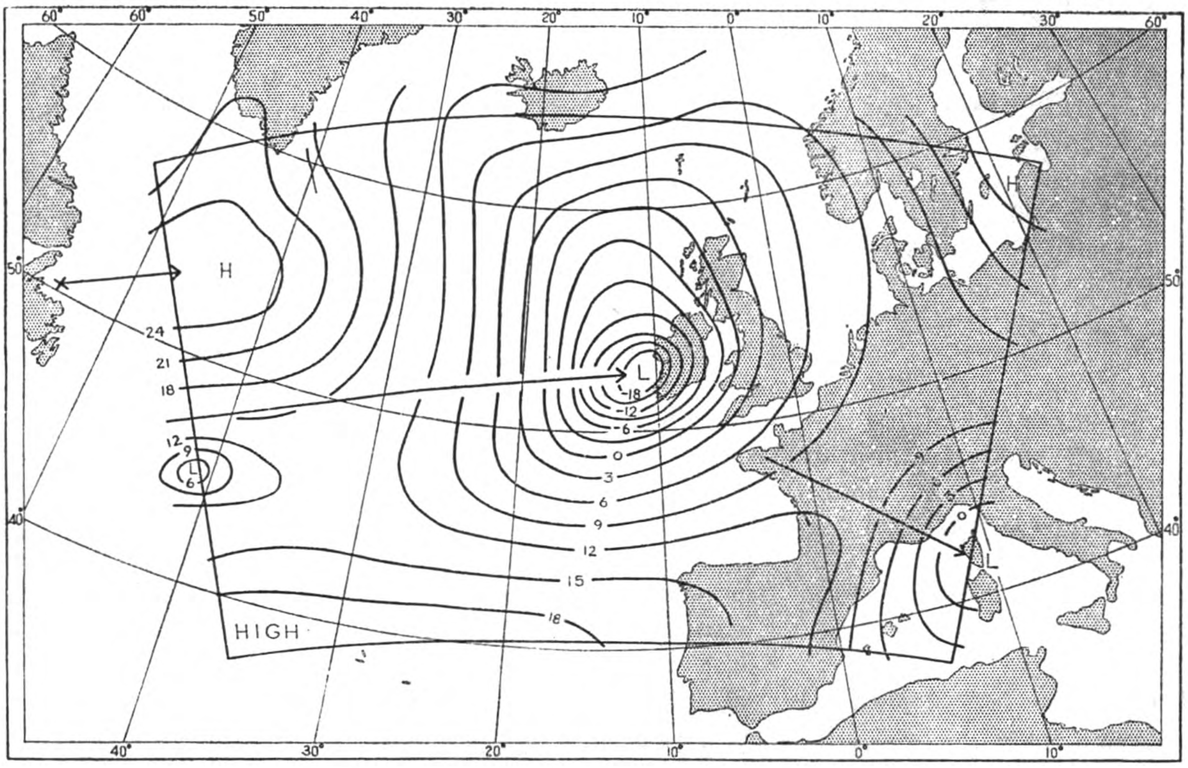


Fig. 4. Actual chart for 13th November 1959.

In this development of short-range forecasting, techniques have been steadily refined as understanding of the atmosphere has advanced, but there was, until the time of World War II, one fundamental scientific weakness. The atmosphere is a fluid in three dimensions and it can be studied thoroughly only if we know the temperatures, pressures, winds, etc., not only near the ground but far into the air above. Balloon-borne radio equipment, the radio sonde, met the practical need and permitted a revolutionary advance in theory and in forecasting technique. (In addition, it has been found possible to take photographs from earth satellites, e.g. see photographs opposite page 72.)

Weather maps for most of the world can now be drawn every day for levels far into the stratosphere; we have the required three-dimensional picture. The theoretician was in this way soon enabled to see how the well-known basic laws controlling all kinds of fluid motion, from ocean currents to water in pipes, had to be adapted to satisfy the ways of the atmosphere. This done, mathematical equations were constructed which, if solved, would enable us to forecast the future from our knowledge of the present.

In mathematical physics, problems often become very difficult to solve when there are many inter-related variables, and it came as something of a shock to expert weather forecasters to learn that the mathematical physicists were presuming to calculate the future weather map in spite of all the complications. As a matter of fact, their achievement has depended on two very fortunate circumstances. First, by something which is little more than a stroke of luck—a scientific fluke—it appears that a dominant factor controlling the movements of the depressions and anticyclones, which forecasters have been concerned with for 100 years, is the average speed of the wind from the ground to the stratosphere. If to this is added the average temperature, we have with only two variables the possibility of a baroclinic atmosphere sufficiently like the real one to make a start on forecasting by calculation.

The second fortunate circumstance was the invention of the high-speed electronic computer which allowed very heavy calculations to be carried out quickly and—in computing language—"in real time", a phrase very appropriate to weather forecasting, for a method which is not fast enough to keep pace with the clock is of no practical value.

Weather charts may now be forecast 24 hours ahead by calculation using electronic computers. Figs. 1, 3 and 4, for example, show actual and forecast contour heights of the 1,000 mb. surface. The 'actual' chart in Fig. 1 was the one on which the forecast chart shown in Fig. 3 was calculated for 24 hours later, the isopleths in Fig. 3 being derived by the computer from spot values at the points shown in Fig. 2. Fig. 4 shows what actually happened.

In brief, by simplifying the physics to make the calculations as easy as possible and by using computers working as fast as possible, realistic forecasts have been made. In America, calculated weather maps are used as an aid to forecasting every day and in several other countries research studies are far advanced. In the United Kingdom routine daily calculations await only the necessary machine installations, although when suitable machines cost anything from £100,000 to £1 million decisions need to be taken soberly.

Obviously, further progress will be made; numerical forecasting by electronic calculation has evidently come to stay; but the complicated details of weather still remain and it will be a long time before the expert forecaster, knowing his territory in every mood of the weather, can safely be dispensed with.

Long-range forecasting

When the forecaster tries to look beyond a day or two ahead, many of his depressions and anticyclones literally dissolve into thin air before his eyes, others take their place and his methods of extrapolation or calculation fail. His difficulties are of a different order for not only, so to speak, must he estimate how each horse will run in the race but first he must guess which horses will come from the stables.

The forecaster can usually say something useful for as long as four or five days ahead if it is sufficient to say that the weather will remain unsettled or generally fine or will tend to become warmer or cooler. Such general persistencies or trends, which may often be discerned, are the basis of what is called medium-range forecasting, so that by long-range forecasting one implies outlooks for even longer periods, of the order of a month or a season, when no attempt at detail is possible.

There are people in the world who will attempt precise forecasting of the weather from day to day a month or even a year ahead—and some will even accept a fee for their services—but one may say with virtually the whole weight of disinterested scientific opinion behind one, that this kind of forecasting is no better than the speculations which any person could make if he knew the kind of weather typical of the place and season of the year—and in many places, including England, there is so much variety at all times of year that the speculation can be of little value.

Nevertheless, in spite of all this difficulty, it remains true that weather does go in spells, often in spells of a week or two, sometimes in spells of months, with the result, for example, that England in 1959 had a lovely summer and in 1960 no real summer at all. Here is clearly some behaviour which we do not understand, which it would be extremely useful if one could predict and which it is reasonable to hope that we might, in time, learn how to predict.

Long-range forecasting of this kind, which attempts to predict the general character of a whole month or a season, is practised in several countries by responsible persons, generally by official services, and with perhaps a modest degree of success. But there are also undisputed failures and it must be conceded that the methods used are neither reliable in practice nor understood in theory.

Some leading forecasters and their methods

Perhaps the most generally used notion is that of 'analogues', which means other weather situations from the past similar to the present in one or more respects. Multanovsky made a reputation for long-range forecasting in Russia before the last war and thought in terms of natural synoptic periods, spells of weather of varying length with recognisable characteristics, although these have validity for only a few days and recent Russian writing has undermined his earlier reputation.

Prof. Baur, who introduced in Germany some thirty years ago the concept of *Grosswetterlagen*, having close affinity with the Russian natural periods, continues to issue long-range forecasts from time to time for varying periods up to a season ahead, putting considerable weight on those curious solar phenomena known as sunspots which vary in number over a cycle averaging something over eleven years in length. Baur relates the weather in Europe with other years when the sunspot cycle was in much the same phase at the same time of year, and by choosing also years which were analogous in other respects, arrives at a prediction.

It must be said at once that the effect of sunspots on the weather is not yet established, although their effect on the ionisation of the high atmosphere is strikingly obvious in radio-communication and in other ways.

Furthermore, Baur has difficulty in matching his years satisfactorily. Nature never repeats herself but, on the whole, the forecasts he has ventured to make in recent years, although vague and cautious, seem to have been correct as far as they went in most cases. Namias of the United States Weather Bureau is another world-famous name in this field. His forecasts of average conditions for a month ahead have been issued regularly for a number of years. The forecasts are clearly presented as maps of the northern hemisphere showing which areas will be warmer or cooler, wetter or drier than average, and they are based on a variety of indications, trends, anomaly patterns and dynamical calculations. But their accuracy, at least for Europe, is not claimed to be of much value.

In France, a specialised technique of extrapolation of pressure-time curves is employed, while in the United Kingdom in the last few years, there have been experimental monthly forecasts prepared in the Meteorological Office using a method of analogues. But again, only marginal success has yet been claimed, and the forecasts have not been offered to the public.

This is an unsatisfactory state of affairs. The practical value of reliable long-range forecasts would be so enormous for agricultural and commercial planning that more effort would be justified. The crucial question is whether the behaviour of the atmosphere is really predictable at all for long periods ahead, and this we ought to be able to discover when we have a good theory of the general circulation.

We may recall that the circulation is a kind of engine driven by solar energy against the brakes provided by friction, and if the circulation behaves differently one year from another—and it certainly does—then one could reasonably suppose that either the energy input or the brakes must be different; either the sun above or the earth below must be the seat of the variations.

This argument, plausible enough, justifies our looking to sunspots, sea temperatures, polar ice and snowfields for guides in long-range forecasting, but there is one serious difficulty related with what mathematicians call non-linearity and engineers call feed-back. About half the energy from the sun is reflected back to space immediately without doing any work, and most is reflected from the clouds. Thus a change in cloudiness can certainly cause much larger changes in the weather than any plausible changes in the sun itself.

Also looking to the lower boundary, heat and moisture are put into the atmosphere where the air is dry and cool, relative to the sea temperature. But far greater changes may be caused by differences in the circulation itself than by the smaller changes in the temperatures of the sea.

Thus it is possible—as the seasons change and the circulation of air goes through its annual cycle, including the monsoons, and changes in position and intensity of the jet streams—that each year the behaviour is different owing to minor past differences which have no cause, except in the sense that everything is a legacy from the past.

Nature is full of behaviours which are so complicated that they defy detailed analysis and prediction. Each tide alters the lie of the sand on the sea shore, but who would predict just what the next tide will do? Earthquakes are particularly common in certain parts of the world for reasons which are well understood, but who will say if this year is to be unusually bad in one part rather than another? Perhaps in principle one can predict the path of a raindrop trickling down a window pane or of a pebble rolling down a cliff, but would they be predictable in practice if we really needed to know?

One cannot say with certainty, for in science it is always difficult to prove that something cannot be done. No experiment can be designed to show that long-range forecasts are for ever impossible. But we may accumulate knowledge by many positive experiments, which may be of three kinds.

First, taking Nature as we find it, we may try to predict by various methods and profit by the experience; this is what has been done hitherto with only slow progress. Second, we may study the circulation by building small-scale laboratory models of the atmosphere; this has been done with much ingenuity using rotating bowls of unequally heated liquid (see Figs. 5 and 6), and has even given suggestive results, but the scaling down of the whole earth to a laboratory model while retaining gravity and atmospheric properties presents formidable difficulties.

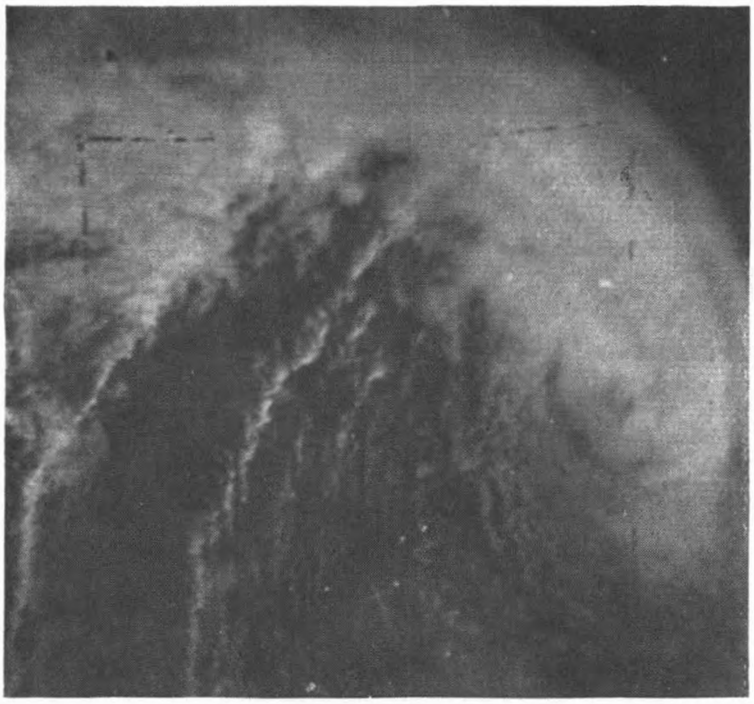
Third, we may make mathematical models—that is, invent systems of mathematical equations which formulate many of the essential physical processes, and by calculation, test the assumptions which have been made. Recent work, especially by Smajorinsky in America, with the aid of electronic computing, has led to remarkably promising results, and it may well be that in time there will be another great achievement to the credit of mathematical physics.

It is only a matter of time and effort before the problem of long-range forecasting will be understood in a scientific sense, but whether forecasts will then be practicable depends on many things. Our present understanding leads us to believe that detailed statements of weather changes day by day will never be possible for many days ahead, but as regards the general character of next summer or next winter, we have no reason to despair.

In the long perspective of a hundred years of forecasting, the last fifteen years

Photo by courtesy of Messrs. Howard M. King, Ltd., Croydon

A precision aneroid barometer (see page 85).



U.S. National Aeronautics and Space Administration

The above two photographs were taken by Tiros I, the first 'weather-eye' satellite, which was launched on 1st April 1960 (see pages 70 and 76).

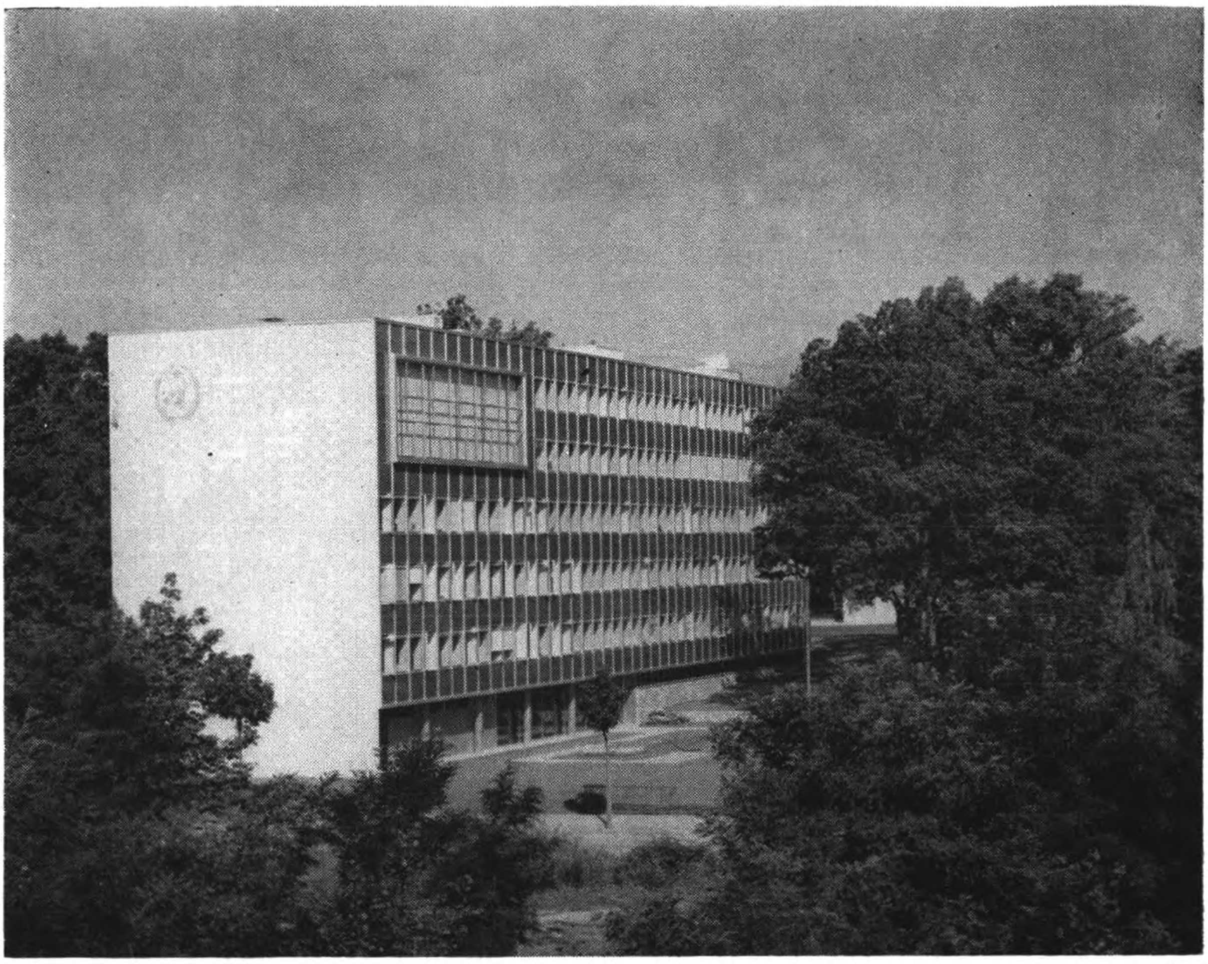
Left-hand photo:

Cloud photograph of a typhoon centred about 300 miles north of New Zealand. Note the spiral cloud bands converging in a clockwise direction around the centre, compared to the counter-clockwise direction encountered in northern hemisphere cyclones.

Right-hand photo:

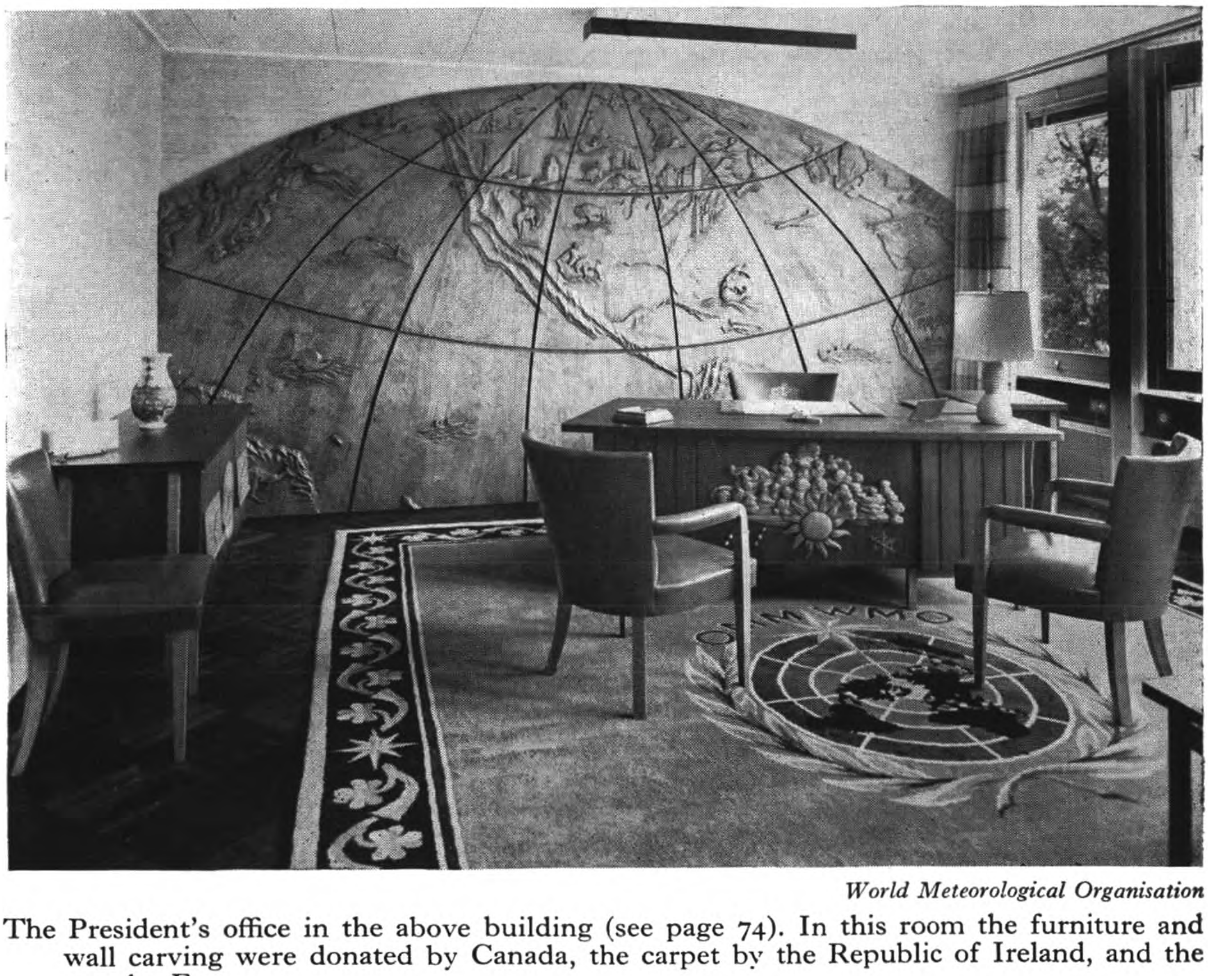
This shows part of the coast of the States of the Community in West Africa, extending from approximately Cape Blanco to St. Louis.

(*Opposite page 73*)



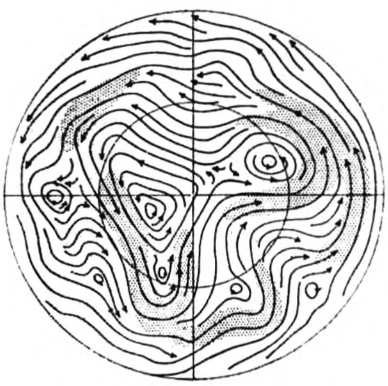
World Meteorological Organisation

The new headquarters of the World Meteorological Organisation in Geneva (see page 74).



World Meteorological Organisation

The President's office in the above building (see page 74). In this room the furniture and wall carving were donated by Canada, the carpet by the Republic of Ireland, and the vase by France.



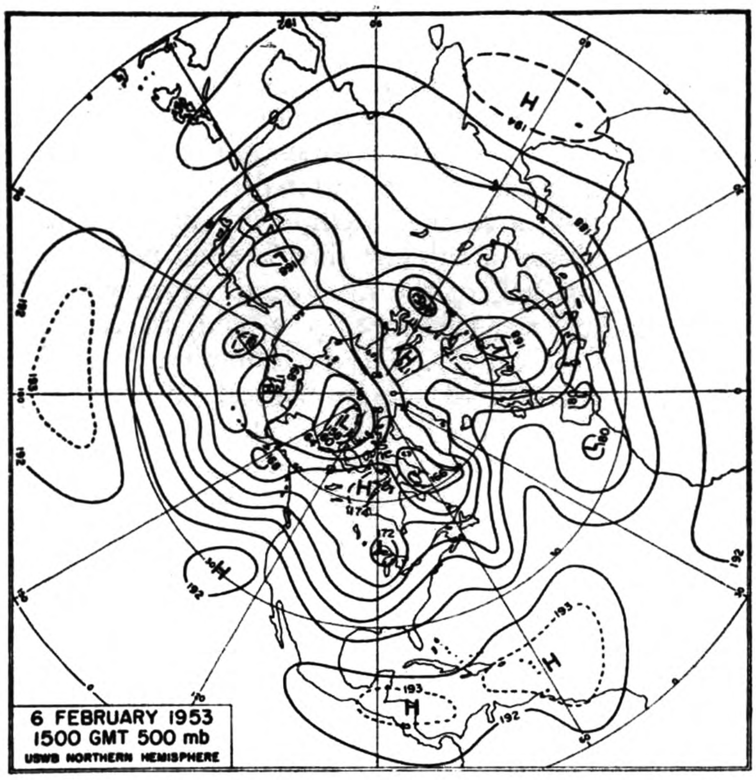


Fig. 5. Fig. 6.

Fig. 5 shows streamlines of the motion of water in a dish (from a photograph). The pattern of the air flow in Fig. 6 is similar to that of the water in Fig. 5.

have been quite outstanding, for in this period weather science has at last taken the place to which it belongs as a branch of fluid mechanics, to be attacked by the methods of mathematical physics. Its problems are complicated and tough but are yielding gradually, and with an economic return sufficient to justify the charting of the atmosphere over the 500 million square kilometres of earth every day, even at a cost of £100 million per year.

551.5:06(26)

International Meteorology and the Mariner

By R. Mathieu and P. Rogers

[The authors are members of the Technical Division of the World Meteorological Organisation's secretariat in Geneva. Mr. Mathieu is closely associated with the work of the Commission for Maritime Meteorology whilst Mr. Rogers is mainly engaged on questions relating to the world-wide network of meteorological stations. They have both been on the secretariat staff for about six years since leaving their national services in France and the U.K. respectively.]

For more than a hundred years the mariner and the meteorologist have worked in close harmony to their mutual benefit. This long and highly successful collaboration began in 1853 and is the product of the foresight shown by a naval officer of the United States Navy. At that time Lieutenant M. F. Maury had already been working for some years on a systematic climatology of the oceans and he soon realised that there was a vital need to obtain meteorological observations from ships at sea on an international scale. It was thus on his initiative that the representatives of a number of maritime countries met in Brussels in 1853 with the aim of instituting a programme in which ships at sea would collaborate.

It is perhaps scarcely an exaggeration to say that this historic meeting constituted the birth of international meteorology. Although it was not until 1878 that the directors of a number of national meteorological services met in Utrecht (Netherlands) and founded the International Meteorological Organisation (I.M.O.), a number of other small meetings were held in the intervening years. Nautical interests were therefore the dominant factor in bringing meteorologists together at the conference table for the first time and in focusing attention on the imperative need to think and act internationally rather than purely nationally. The growth of meteorology as a science with its many present applications owes much to this early recognition of the fact that weather pays no heed to national frontiers.

The second half of the nineteenth century saw the beginning of many national meteorological services in Europe and, from 1878 onwards, regular international conferences were held. The introduction of radio-telegraphy as a means for the rapid transmission of meteorological observations, and the conquest of the air, were milestones in the life of I.M.O. and did a great deal to further the development of international meteorology. In 1950 I.M.O. ceased to exist and the World Meteorological Organisation (W.M.O.), an inter-governmental organisation linked to the United Nations as a specialised agency, took over its responsibilities. At the same time the permanent Secretariat of the Organisation was transferred from Lausanne to Geneva. Although a relatively new organisation, W.M.O., as the direct successor to I.M.O., is in reality one of the oldest international bodies, with a continuous record of service to meteorology covering more than 80 years.

This, briefly, is the background to the events which took place in Geneva on 12th July 1960 when W.M.O. not only celebrated the tenth anniversary of its inception but also inaugurated its fine new headquarters (see photograph opposite page 73). On this day an impressive ceremony was held in the main conference hall of the new building before a distinguished gathering to mark this important event in the life of the Organisation. For the first time in its history W.M.O. thus has a permanent building from which to conduct its world-wide activities and suitable facilities have been provided for some of the many meetings it must hold if it is to carry out fully the responsibilities assigned to it.

The building itself is a modern construction situated appropriately close to the Place des Nations in Geneva and so within easy reach of some of the other international organisations under the aegis of the United Nations with whom W.M.O. must collaborate. Perhaps one of the most interesting and striking aspects of the new headquarters is the international flavour which has been imparted to it by the valuable and distinctive gifts presented by Members (see, for example, the lower photograph opposite page 73). These gifts are many and various and include furnishings, tapestries, panelling, paintings and other works of art and have been selected to represent the materials or craftmanship for which the donating Member is renowned. It is also worth mentioning that the building has been carefully designed to fill the needs of the Organisation and that the conditions under which the staff of the Secretariat work are of a very high standard.

By a happy coincidence Utrecht was again the scene of an international meeting devoted to maritime matters in 1960 when the W.M.O. Commission for Maritime Meteorology (C.M.M.) held its third session there. A brief comparison between the aims of the 1853 Brussels meeting and the main topics discussed at Utrecht in 1960 gives a good idea of the development of maritime meteorological activities over this period of more than a century. The programme of meteorological observations on board ship adopted in 1853 has resulted in the creation of an enormous network of mobile observing stations at sea. Today more than 3,000 ships of all nationalities make voluntary observations which are broadcast internationally and almost instantaneously by radio. This splendid result has enabled first I.M.O. and later W.M.O. to assist in the establishment of a system of forecasts and warnings of the principal meteorological hazards to marine navigation. The inclusion in these messages of forecasts of icing conditions dangerous for shipping is now anticipated and studies are in hand to this effect.

In addition to questions of safety, W.M.O. is also interested in the economic aspects and comfort of transport by sea. The scientific discussions which were held during the recent C.M.M. session in Utrecht took as their subject the relatively new technique of the routing of ships by means of medium-range (about 5 days) forecasts. Quite apart from any financial saving which might result, how many mariners sailing the North Atlantic in winter would not relish the prospect of avoiding the roughest conditions?

The application of such techniques demands close collaboration between oceanographers, mariners and meteorologists and is a good example of another W.M.O. activity, namely, co-operation with bodies specialising in the study of the seas and oceans. For instance, the fishing industry today can no longer be satisfied with methods of locating shoals of fish based only on the fisherman's experience. All the large maritime countries now endeavour to improve their catch by scientific observation and study of the marine environment. International co-ordination of such research is necessary because the major portion of the world's seas belong to no particular country. The International Indian Ocean Expedition which is now in progress is a typical example of a concerted effort to find out more about the oceans, the life beneath them and the behaviour of the atmosphere above them. W.M.O. and numerous meteorological services are giving their support to this vast undertaking.

Another long unsolved problem in the field of maritime meteorology is that of obtaining regular weather information from the large sea areas which are far from normal shipping lanes. Only too often it is precisely these areas which are the breeding grounds of adverse conditions profoundly affecting the operation of ships hundreds of miles away. There is now reason to hope that in the future oceanographers and meteorologists will jointly operate automatic stations installed on buoys similar to those already in use in certain countries for the detection of hurricanes.

Whilst maritime meteorology, as is shown by the examples quoted above, plays an important role in W.M.O. activities, the many other fields of interest should not be forgotten. Some of these are so well-known that it will hardly be necessary to describe them in detail; standardisation of instruments and methods of observation, international codes, telecommunications, assistance to aviation and agriculture, climatological work and the production of various technical publications and guides. On the other hand there are some aspects of international meteorology which are a good deal less well-known. Amongst these may be mentioned the utilisation of natural resources, the meteorological aspects of atomic energy and artificial satellites.

For many countries the provision of energy for the development of industry has become a vital question and it is necessary to devise means of making a more rational use of hydraulic, solar or wind energy. It is evident that it is not even possible to establish a programme to develop these resources without a precise knowledge of meteorological conditions. W.M.O. has therefore been called upon to take up these problems and has already shown its interest; for example, it participated actively in a recent United Nations meeting on new sources of energy.

The meteorological aspects of atomic energy and artificial satellites are of course two comparatively recent additions to the Organisation's field of interest but are likely to be of increasing importance in the future. The panel of experts set up in 1956 has published a study of the meteorological factors relating to the safety and location of atomic reactors and it also took an important part in a meeting arranged by the United Nations on the atmospheric transport and removal of radioactive debris from nuclear tests.

The most dramatic and possibly also the most important recent meteorological event has been the successful launching of the first artificial satellites designed solely to obtain meteorological data. Within the last year or so the prospect of using satellite vehicles to transmit photographs of cloud cover over wide areas of the globe has advanced from a vision of the future to a practical reality. The value of satellite photographs as a means of detecting severe storms in areas devoid of orthodox reporting stations has already been proved and is of direct interest to all who sail the seas (see, for example, the photograph opposite page 72). W.M.O. is playing an active role in the arrangements for the rapid transmission of these photographs so that they can be used operationally as well as for research purposes.

This brief glance at international meteorological activities reflects indirectly the need for each country to possess an up-to-date and efficient meteorological service. Here again W.M.O. is able to help by means of its participation in the technical assistance programmes of the United Nations. Under the guidance of the Organisation and through U.N. funds experts are sent to give instruction or other aid to needy countries, or fellowships are awarded to nationals of the requesting country so that they may receive more advanced training abroad. Aid of this type is often a decisive factor in helping the less-developed countries to bring their meteorological services up to modern standards, and so in advancing the national economy.

These necessarily limited examples give only an incomplete idea of the work carried out by W.M.O. One other less spectacular but scarcely less important side of this work should be mentioned before closing this short article. This is the fostering by W.M.O. of close and friendly relations between experts of the national meteorological services with a view to assisting in the solution of various problems, either national or international. One may hope that the new W.M.O. building, providing as it does an excellent centre for the meetings of such experts, will contribute to the furtherance of this spirit of friendly co-operation and progress.

551.326.7

INTERNATIONAL ICE PATROL, 1962

General information

The United States Coast Guard will resume operations and services of the International Ice Patrol (I.I.P.) for the 1962 ice season at such time as ice conditions make it advisable, normally in February or March.* The primary objective of I.I.P. is to ascertain the position and drift of icebergs and field-ice which endanger, or soon may endanger, shipping in the vicinity of the Great Bank of Newfoundland; to determine the south-eastern, southern and south-western limits of that ice; and to disseminate this information for the guidance and warning of shipping. To accomplish this, I.I.P. employs aircraft based at Argentia, Newfoundland, for aerial ice observation; a vessel for surface patrol when necessary; and an oceanographic vessel for the mapping of ocean currents. I.I.P. collects ice, weather and sea temperature reports from shipping and aircraft traversing the above area, evaluates all ice information in the light of meteorological and oceanographical conditions, and by means of U.S. Coast Guard Radio Argentia (NIK) communicates to shipping the ice situation in the Great Bank area.

Importance of ice, visibility, sea temperature and weather reports from shipping

Each ice bulletin by NIK will contain a request for all ships to report any ice sighted, and when in the area between latitudes 39°N and 49°N and longitudes 42°W and 60°W to make reports every four hours of ship's position, course, speed, visibility, sea temperature and weather conditions. These reports by shipping are of the utmost importance. During periods of low visibility or low ceilings when aerial ice observation is ineffective, ice reports by shipping help the Patrol to relocate drifting ice and to keep its position up to date. The visibility reports are of value in planning ice observation flights to avoid areas where poor visibility precludes effective air scouting, and to concentrate on other areas. Visibility reports are also useful in deciding whether or not special warnings of ice conditions should be broadcast. Sea temperatures are used to construct isotherm charts for estimating ice melting rates and detecting shifts in the branches of the Labrador Current. Wind data are useful in estimating set and drift of ice, especially field-ice, and in forecasting weather for planning ice observation flights.

In reporting ice to NIK, it is important that certain information be furnished, especially from the standpoint of ruling out occasional erroneous reports and obviating unnecessary searches and warnings to shipping. The information desired is:

(*a*) the type of ice sighted, i.e. berg, growler or field-ice. (*Note.* If a radar target is reported which is believed to be ice but is not actually sighted visually, it should be reported as a radar target, *not* as berg, growler or field-ice)

* This article was received after our January number had gone to press.

(*b*) the position of the ice (not the position of the reporting ship)
(*c*) the sea temperature at point of closest approach to the ice
(*d*) weather and visibility conditions.

All shipmasters are strongly urged to make these reports. It is realised that ships with but one radio operator may find it impracticable to report every four hours: these ships are asked to prepare four-hourly reports but delay transmitting them until the radio operator comes on watch. A late report is better than no report.

Communications

Ice bulletins will be broadcast twice daily, at 0048 and 1248 GMT, by Radio Argentia (NIK) on 155, 5,320 and 8,502 kc/s. Each broadcast will be preceded by a call on 500 kc/s. with instructions to listen on 155, 5,320 or 8,502 kc/s. NIK will then transmit a test signal and call sign NIK for about two minutes to facilitate tuning. Transmission of the bulletin will then follow at 15 words per minute, repeated at 25 words per minute.

Ice conditions will be transmitted daily by facsimile at 1330Z on 5,320 and 8,502 kc/s. at a drum speed of 60 rev/min. Ships concerned are requested to mail the facsimile chart copied to the Commander, International Ice Patrol, Navy 103, FPO, New York, for evaluation purposes.

Duplex operation will be used between NIK and merchant ships for general communications such as requests for special information, reports by merchant ships of ice sighted, sea temperatures, visibility and weather.

Merchant ships may call NIK on 500 kc/s. and 8 Mc. maritime calling band at any time; also 12 Mc. band during daylight hours. Ships work 425, 448, 454, 468 or 480 kc/s. or their assigned working frequency. NIK will work 432 kc/s., 8,734 kc/s. or 12,718·5 kc/s. The surface patrol vessel, radio call sign NIDK, when on station will relay between NIK and ships when necessary. There is no charge for these services.

Throughout the ice season, Radio Washington (NSS) will broadcast ice reports daily at 0430 and 1630 GMT.

All reports of ice sightings should be addressed to Commander, International Ice Patrol (NIK).

Aerial ice reconnaissance and dissemination of ice information is also performed for shipping by the Canadian Department of Transport. This organisation, during the period from 10th December 1961 to 30th June 1962, is operating mainly in the Gulf of St. Lawrence and approaches and the coastal waters of Newfoundland to the entrance of Hudson Bay. Details of these services are available in *Guidance to Merchant Ships Navigating in the Gulf of St. Lawrence*, published annually by the Marine Operations Branch, Department of Transport, Canada. For details on the broadcasts of ice information by Canadian stations, see *Admiralty List of Radio Signals*, Vol. 5.

Warning

Carefully conducted tests by the I.I.P. during the 1959 season showed that radar cannot provide positive assurance for iceberg detection. An iceberg is only one-sixtieth as good a radar reflector as a comparable-sized ship. Sea water is a better reflector than ice. The latter statement means that unless a berg or growler is observed on radar outside the area of sea 'return' or 'clutter' on the scope, it will not be detected by the radar. Furthermore, the average maximum range of radar detection of a growler of dangerous size is four miles. Radar is a valuable aid, but its use cannot replace the traditional caution exercised in a passage across the Great Bank during the ice season.

551.326.7

NOTES ON ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN FROM OCTOBER TO DECEMBER 1961

At end of October 1961

RELEVANT WEATHER FACTORS

During October, active depressions were very frequent south of Iceland. Their tracks were in general south of those followed during September, but there was a continued movement NE'wards towards the Barents Sea. Throughout the month there was an active anticyclone over western Europe, and the Azores 'high' was active and extensive. Persistent warm air masses of Atlantic origin covered north-west Europe and sea areas between Greenland and North Russia, which retarded generally the seasonal development of ice. Abnormally low temperatures were experienced in the far north of the Canadian Arctic Archipelago, but the 0°C (32°F) surface isotherm was well north of its normal position. Late in the month a North Atlantic low pressure area extended westwards over North America and maritime air spread into eastern Canada while pressure was building up over northern Greenland. Sea temperatures in the North Atlantic south of Greenland and Iceland and west of the British Isles, appeared to be generally below normal, but in the Denmark Strait they were approximately normal. It is of interest to note that the atomic ice-breaker *Lenin* reported the formation of ice in the strait connecting the Kara and Laptev seas. She also reported variable temperatures falling to minus 18°C (0°F).

CANADIAN ARCTIC ARCHIPELAGO

During October, pack-ice and fast-ice appear to have formed fairly rapidly over the large areas of open water that existed at the end of September, but not sufficiently rapidly to produce an area of ice in excess of normal. Considerable amounts of pack-ice were reported in Foxe Basin and round Southampton Island at the entrance to Hudson Bay, but there was apparently very little fast- or pack-ice in the main part of the Bay, except perhaps adjacent to the north-western shores.

BAFFIN BAY

Fast-ice had formed in the extreme north of Baffin Bay and locally in bays and inlets on the Canadian side of the area. Pack-ice with floes of all sizes was reported west of 70°W in the approaches to Elizabeth Islands. The total area of pack- and fast-ice was less than normal, particularly against the Greenland coast, which appeared to be almost ice-free south of Smith's Sound. Large numbers of icebergs (i.e. more than 20 at a sighting) were reported off all coasts; individual land stations of western Greenland towards 70°N observed more then 200 icebergs.

DAVIS STRAIT

Little or no pack-ice was observed throughout the area and most land stations of south-west Greenland reported observing less than 5 bergs off the coast. The drift of icebergs along the Labrador coast continued. Large groups of icebergs (more than 20) were infrequent. Ships' reports of icebergs suggested that the SW drift was at a rate of about 15–20 n. miles a day.

BELLE ISLE STRAIT AND GREAT BANK

No pack-ice was reported in the Strait or over the Great Bank; the southward drift of icebergs was about normal in numbers and southward penetration. Isolated bergs drifted along off the east coast of Newfoundland and followed the edge of the Great Bank along the 75-fathom line. It appeared from ships' observations that the rate of drift was about 10–15 n. miles a day. Most of the icebergs moving southwards in the Labrador current passed into Belle Isle Strait. This suggests that much of the water of this current entered the Gulf of St. Lawrence.

GULF OF ST. LAWRENCE AND ST. LAWRENCE RIVER

These remained ice-free during October and November.

GREENLAND SEA

There was probably little change in the area of fast- or pack-ice off Greenland since the end of September. The mass of ice was probably less than normal between Spitzbergen and eastern Greenland. No ice was reported off western Spitzbergen or off Bear Island. One land station of eastern Greenland reported more than 200 icebergs within the pack-ice.

DENMARK STRAIT AND ICELANDIC WATERS

Close pack-ice was experienced locally in patches on the eastern Greenland coast; otherwise there was no pack-ice reported. One land station of eastern Greenland north of the Arctic Circle reported 100–200 icebergs moving southwards. South of the Arctic Circle, each land station reported less than 15 icebergs.

BARENTS SEA

Very little change from the end of September. It is probable that most of the Barents Sea had an area and thickness of pack-ice and fast-ice less than normal.

BALTIC SEA

No ice reported.

At end of November 1961

RELEVANT WEATHER FACTORS

There was a fundamental change from October to November in the general circulation. Pressure rose over north-east Canada and the adjacent Arctic, and built up eastwards over Greenland, while it fell between Greenland and northern Europe but rose over south-west Europe. Pressure was consequently abnormally high over eastern Greenland and below normal over north-west Europe. The normal flow of air out of the Arctic was displaced eastwards to areas north and north-west of the Barents Sea. Maritime air continued to move NE'wards from the Atlantic towards the Barents Sea but its northward penetration decreased. The Atlantic depression belt extended over a wide latitudinal zone. Sea temperature in the north-western North Atlantic remained below normal but temperatures were above normal in the Denmark Strait and Norwegian Sea, and normal west and south-west of the British Isles.

Canadian Arctic Archipelago

Meteorological data suggest that the rate of formation of ice in the north and east of this area was well above normal. Few observations are available but reconnaissances early in the month suggest that continuous pack extended over most of the far north of the area at the end of November. Close and very close pack-ice probably predominated, but with localised areas of open water in Foxe Basin and Hudson Strait. In addition to considerable areas of pack-ice in the north and north-west, young ice was forming rapidly over most of Hudson Bay. Icebergs were reported in Hudson Strait.

Baffin Bay

Few reports are available for this area but meteorological conditions and reconnaissances earlier in the month suggest that most of Baffin Bay north of 70°N was full of close or very close pack. There may have been areas of open water towards the centre of the Bay and south of Smith Sound. New ice was reported along the Greenland coast north of the Arctic Circle where the amount of ice (area and thickness) was less than normal almost up to 75°N. More than 200 icebergs were reported by individual Greenland land stations towards 70°N, which suggests that there were considerable numbers of icebergs moving within the pack-ice off the Canadian coast towards the north.

Davis Strait

There were few changes in this area from the end of October.

Belle Isle Strait and Great Bank

The only changes observed in these areas from the end of October were that fewer icebergs were reported moving into the Gulf of St. Lawrence through the Belle Isle Strait, and icebergs drifting off the east coast of Newfoundland tended to keep nearer to that coast, while few icebergs drifted towards the eastern edge of the Great Bank. The southward rate of drift continued to be of the order of 10 to 20 n. miles per day.

Greenland Sea

Meteorological conditions suggest that there was considerable increase in area and mass of ice moving out of the Arctic Basin along the Greenland coast north of 70°N. Fast-ice filled bays and inlets to beyond 30 miles east of the coast in places, while very large polar floes probably existed within the pack-ice moving southwards. Vast floes (greater than 5 miles wide) and ice islands would have been possible. Individual land stations reported 16 to 50 icebergs within the pack-ice. New ice was forming off western Spitzbergen and areas of nondescript ice were reported well west of the coast; an iceberg was reported south of Spitzbergen. It is therefore likely that polar and glacier ice were moving southwards east of Spitzbergen and tending to move round to the west coast.

Denmark Strait and Icelandic Waters

Considerable developments had taken place in Denmark Strait. A large increase in the area of close pack-ice occurred from 65° to 70°N and icebergs appeared off north-west Iceland. These suggest a considerable increase in the flow of the East Greenland current north of 70°N with no corresponding increase south of this. Cold water with icebergs from the north was therefore forced to branch eastwards towards the north of Iceland to converge with the Irminger current, also probably flowing faster than normal.

Barents Sea

Meteorological conditions suggest a general increase from the end of October in the mass of ice in this area. New ice was probably forming in all shallow sea areas in the south-east while polar pack was probably moving southwards extensively east of Spitzbergen.

Baltic Sea

By the end of November the ice season was just beginning in the extreme north of the Gulf of Bothnia and extreme east of the Gulf of Finland. This is approximately three weeks later than normal.

Table 1. Icebergs Sighted by Merchant Ships in the North Atlantic

(This does not include radar targets)

Limits of Latitude and Longitude		Degrees North and West							
		60	58	56	54	52	50	48	46
Number of bergs reported south of limit	October	36	36	36	36	28	11	2	0
	November	> 10	> 10	> 10	> 10	> 8	4	0	0
	December	4	4	4	4	4	4	3	0
	Total	> 50	> 50	> 50	> 50	> 40	19	5	0
Number of bergs reported east of limit	October	36	36	34	12	6	5	1	0
	November	> 10	> 9	> 9	> 7	1	0	0	0
	December	4	4	4	4	2	0	0	0
	Total	> 50	> 49	> 47	> 23	9	5	1	0
Extreme southern limit	October	47° 22′N, 47° 17′W on 25.10.61							
	November	49° 00′N, 51° 59′W on 24.11.61							
	December	46° 25′N, 52° 55′W on 13.12.61							
Extreme eastern limit	October	47° 22′N, 47° 17′W on 25.10.61							
	November	49° 00′N, 51° 59′W on 24.11.61							
	December	47° 00′N, 50° 50′W on 2.12.61							

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

Table 2. Baltic Ice Summary, October-December 1961

No ice reported at all in October 1961.
No ice reported, and degree-days = 0, in November and December at the following stations: Aarhus, Copenhagen, Kiel, Stettin, Gdansk, Klajpeda, Helsinki, Mariehamn, W. Norrskar, Visby, Goteborg, Oslo, Kristiansand, Tallin, Ventspils.

	November 1961									December 1961								
	Ice Days					Navigation Conditions			Degree-Days	Ice Days					Navigation Conditions			Degree-Days
Station	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
Tonning										17	31	15	0	15	11	0	0	
Husum										17	31	14	0	10	8	0	0	
Emden										19	31	11	0	8	7	0	0	
Lubeck										18	31	9	3	2	5	0	0	
Gluckstadt										17	31	15	0	12	10	0	0	
Bremerhaven										26	30	5	0	4	0	0	0	
Riga									1	14	31	18	17	0	10	3	0	107
Pyarnu										10	31	21	13	3	3	14	0	111
Leningrad									33	11	31	21	19	0	4	17	0	252
Viborg										10	31	22	20	0	3	19	0	
Turku									3	27	28	2	0	0	1	0	0	160
Mantyluoto										26	28	3	1	0	2	0	0	
Vaasa									8	12	31	20	19	0	3	17	0	186
Oulu	29	30	2	0	0	2	0	0	23	1	31	31	28	0	4	26	0	322
Lulea	29	30	2	0	0	2	0	0	31	1	31	31	31	0	9	20	2	375
Bredskar										9	31	23	1	0	13	0	0	
Alnosund									25	12	31	15	3	0	15	0	0	240
Stockholm									4	24	31	8	0	0	8	0	0	129
Kalmar										23	31	9	1	2	6	0	0	74
Skelleftea										2	31	15	5	0	14	0	0	
Roytaa	29	30	2	0	0	2	0	0	34	1	31	30	27	0	12	17	1	380
Yxspihlaja										12	31	20	18	0	8	12	0	

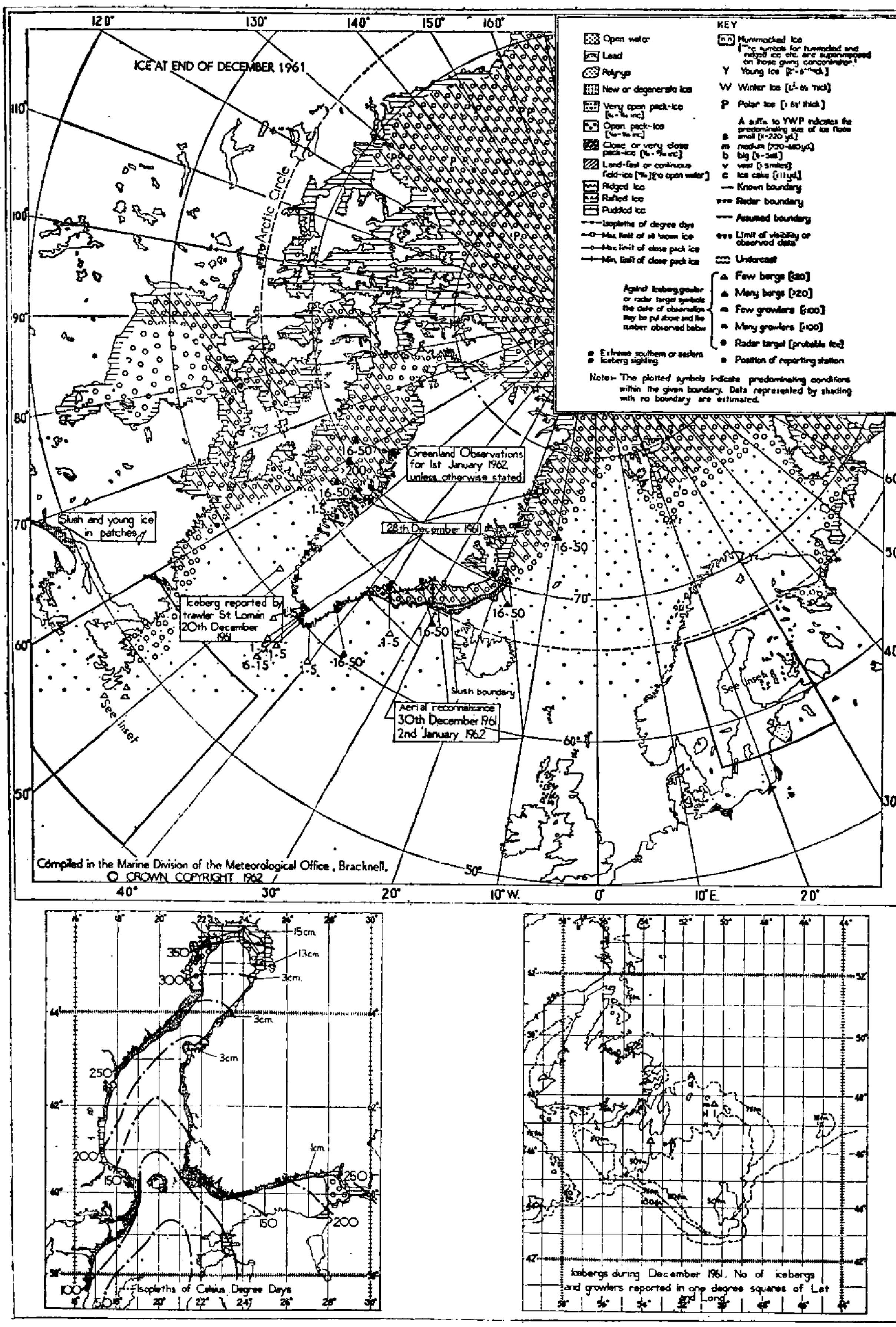
Code: A First day ice reported.
B Last day ice reported.
C No. of days that ice was reported.
D No. of days continuous landfast ice.
E No. of days of pack ice.
F No. of days dangerous to navigation, but assistance not required.
G No. of days assistance required.
H No. of days closed to navigation.
I Accumulated degree-days of air temperature (°C) where known*

* These figures give a rough measure of first the probability of the formation of sea ice, and later the progress of the growth of the thickness of the ice. They are derived from observations taken at 0600 GMT, and are the sum of the number of degrees Centigrade below zero experienced at this time for each day during the period of sustained frost.

At end of December 1961

Relevant Weather Factors

At the end of December pressure had continued to build up across Greenland from northern Canada to western Europe, while it was below normal over western Russia. Arctic



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

air moved extensively southwards east of Greenland. During December, occasional depressions moved from the Atlantic towards the Barents Sea, transporting small amounts of maritime air which maintained temperatures above normal off western Norway. Sea temperatures at the southern entrance of the Denmark Strait and west of Norway remained above normal, and were still below normal over the Atlantic to the south of this. At the entrance to the Davis Strait, and west and south-west of the British Isles, they were apparently normal.

CANADIAN ARCTIC ARCHIPELAGO

Very little information is available for this area but large areas of heavier than normal pack-ice appeared likely from meteorological considerations. Heavy pack-ice with at times vast floes, probably existed in the Hudson Bay, Foxe Basin and Hudson Strait. Considerable concentrations of icebergs (probably more than 20 at a single sighting) must have existed locally along the north and south coasts of Hudson Strait.

BAFFIN BAY

All types of pack-ice are likely to have increased in area and thickness from the end of November to the end of December. Large numbers of circulating icebergs were apparent from individual land station observations towards 70°N on the West Greenland coast. One station reported over 200 icebergs.

DAVIS STRAIT

Fast-ice in bays and inlets and pack-ice off the coast were likely to have increased since the end of November along the Labrador coast, with occasional icebergs moving southwards. Small numbers of icebergs (less than 5 at a sighting) and little or no pack-ice were observed off south-west Greenland and towards Cape Farewell.

BELLE ISLE STRAIT AND GREAT BANK

Few iceberg observations were obtained during December and it is probable that only occasional bergs were drifting southwards, at about 10 n. miles per day, mainly off the east coast of Newfoundland and over the western side of the Great Bank. New ice was reported in Belle Isle Strait.

GREENLAND SEA

The increase in the quantity of polar pack emerging from the Arctic Basin and landfast ice observed at the end of November continued. The general atmospheric circulation was particularly favourable for the movement of polar pack southwards out of the Arctic Basin.

DENMARK STRAIT AND ICELANDIC WATERS

The large area of polar pack observed at the end of November (with a wide eastern fringe of nondescript ice) continued to increase and extend southwards along the Greenland coast. The area of polar pack was greater than normal north of the Arctic Circle but less than normal further south. The individual land stations reported 16 to 50 icebergs off the coast within the polar pack. It is of interest to note that the weather ship at Station 'A' (62°N, 33°W) reported temperatures above normal during this period, while polar pack was above normal off south-western Greenland.

BARENTS SEA

All types of ice increased in this area. The southward penetration of polar pack-ice east of Spitzbergen reached Bear Island, while ice continued to form off western Spitzbergen. A fairly rapid increase in landfast ice and pack-ice was likely in all coastal areas in the east and south-east.

BALTIC SEA

A strong flow of Arctic air on to north-western Europe caused unusual formation of fast-ice in coastal areas of most of the Baltic including some areas in the extreme south. In the extreme north of the Gulf of Bothnia large areas of fast-ice, in places almost eight inches thick, were experienced. The port of Lulea was closed at the end of December.

NEW BRITISH WEATHER SHIP—"WEATHER SURVEYOR"

On 21st December 1961, at the James Watt Dock in Greenock, the fourth and last of the former 'Castle' class frigates to be converted to an ocean weather ship—H.M.S. *Rushen Castle*—was renamed by Mr. John Reid, Provost of Greenock. The conversion work had been carried out by the Blyth Dry Dock and Shipbuilding Co., Ltd., at Blyth (Northumberland). The weather on this meteorological occasion was generally unpleasant—snow underfoot, associated with frost and (rather unusual at Greenock) fog. One consolation was that the fog was not quite so thick as it was further up the Clyde. As a result of the fog the photographers' efforts at the ceremony were unsuccessful—which was a pity in view of the local interest.

The ceremony was witnessed by Sir Graham Sutton, Director-General of the Meteorological Office, and among the official guests were representatives of the Netherlands, Norwegian, Swedish and United States embassies (emphasising the international nature of the weather ships' work), the General Manager of the Blyth Dry Dock Co., Ltd., and representatives of local authorities, Ministry of Aviation, Royal Navy, Royal Air Force (Coastal Command), Ministry of Transport and Meteorological Office. Relatives of members of the ship's company and of Ocean Weather Ship Base staff were also present. The ceremony was preceded by a Civic Luncheon at Greenock Town Hall, provided by the kind hospitality of Provost Reid. The Provost, in welcoming the guests, said how pleased he and the people of Greenock were that the weather ships were continuing to use this port as a base; after thirteen years they had become almost a part of the town, and they provide employment, not only to the seamen who serve aboard them, but also to the shipyard employees and many others. Sir Graham Sutton, in replying, said that Greenock was an ideal base for the ships because of its easy access to the ocean stations at which they operate, its excellent ship repair, stores and rail facilities and its relative freedom (not very evident that day) from fog. He emphasised that the surface and upper air observations provided by the North Atlantic weather ships are, and will continue to be, essential for the work of the Meteorological Office, not only for aviation purposes, but also for general meteorology—which includes services for shipping.

Before the ceremony, the ship's company were lined up near the bow of the ship and were individually introduced to Sir Graham Sutton and the Provost. Sir Graham, in his address to the ship's company, said how much he, as Director-General, appreciated the good job that they did aboard these ships, operating, as they do, always in the stormy waters of the North Atlantic. Most of them had previously served aboard *Weather Watcher*, which was berthed in the same dock, and he hoped that *Weather Surveyor* would be as happy a ship as her predecessor. The Provost then went aboard the ship, accompanied by the Master, and cut a tape to disclose her new name saying "I rename this ship *Weather Surveyor*. May God bless all those who sail in her". After the ceremony all the guests were shown round the ship, and entertained to afternoon tea on board.

The general arrangement of *Weather Surveyor* is almost exactly the same as *Weather Adviser* and *Weather Monitor*, both of which are a slight improvement on *Weather Reporter* (the first of the 'Castles' to be converted), as a result of experience gained with the operation of the last-named. From the ship's company's viewpoint, the most significant improvement, compared with the 'Flower' class vessels, is that the new ships are more roomy and therefore provide much more comfortable accommodation. Operationally, the new ships have more modern radio and radar equipment than their predecessors and there is some improvement in their meteorological equipment. The air/sea rescue equipment aboard *Weather Surveyor* includes two 24 ft. fibre-glass motor lifeboats and inflatable life-rafts. Boat handling arrangements in these ships are a great improvement on that of the 'Flower' class vessels.

In command of *Weather Surveyor* is Captain T. J. Morgan, who joined the Ocean Weather Ships as 2nd Officer in 1949 and was promoted to command of *Weather Watcher* in 1959. Before joining the weather ships, Captain Morgan had had experience as Mate of a whale catcher in the Antarctic, so he has had plenty of experience aboard small ships. Mr. W. Oliver, Radio Overseer, has served in weather ships since 1947 and Mr. D. McSween, Chief Cook, since 1948—which goes to show that some people must like the North Atlantic!

Thus we say farewell to *Weather Watcher*, the last of the 'Flower' class vessels to be employed as a British weather ship. Formerly H.M.S. *Snowflake* she was built by Smith Dock Co., Ltd. at Middlesbrough and launched in 1941. She did a strenuous job on convoy escort duties in the North Atlantic, North Sea and Arctic area (Russian convoys) till 1944 when she was transferred to the Far East. She sank one U-boat and assisted in sinking another. Placed in reserve in March 1946, she was converted to an ocean weather ship in Rosyth Dockland and began her new duties at Ocean Station 'I' in November 1947. Like her three sister ships, *Weather Watcher* did a consistently good and economical job during her fourteen years' service in the North Atlantic. All these ships fully justified their choice and lived up to their reputation for seaworthiness.

C. E. N. F.

551.507.2:551.508.43

A New Barometer for Observing Ships

By L. B. PHILPOTT (Marine Division) and L. BIRD (Instruments Division)

Over a hundred years ago, on 29th October 1856, Marine Barometer No. 1 was issued on loan by the Meteorological Office to the *City of Benares* (Smith & Sons of Glasgow, forerunners of the present Ellerman City Line). She was one of our very first observing ships and her barometer subsequently saw service in twenty ships, being finally withdrawn from the *Manchester Corporation* in 1910. It may now be seen in the National Maritime Museum at Greenwich.

Fifty-four years of faithful service in twenty ships is a very exceptional record for any instrument, particularly such a fragile one as a mercurial barometer. The Kew Committee of the British Association who sponsored the design of this barometer would have cause for pride in their achievement, especially if they could know that today there are more than seven hundred Kew-pattern marine barometers in use in British merchant ships, all of them of substantially the same design as the 1856 instrument though naturally incorporating improvements such as the Gold slide.

Throughout the years, in recruiting ships to the voluntary observing fleet, Port Meteorological Officers have always been confronted with the problem of siting the barometer to the mutual satisfaction of the master and officers, who naturally must have it placed so as not to obstruct their navigational requirements, and the Meteorological Office, who require it to be placed where it will never be exposed to the direct rays of the sun or to suddenly varying conditions of temperature such as might be experienced when opening a chartroom door directly over a fiddley. Moreover, it is most desirable to reduce 'pumping' to a minimum and though modifications to this end have been made in the instrument itself, this is best done by siting the barometer near the centre of gravity of the ship. This possibility gets more and more remote as the construction of ships puts the chartroom, the natural place for the barometer, further away therefrom.

The physical problem of space in the chartroom for a marine barometer is often nowadays a headache, for many older ships have their chartrooms filled with new devices, scarcely even dreamed of when they were built, whilst many chartrooms in new construction, though designed to contain all the modern aids to navigation, yet lack the spare corner in which to hang a marine barometer and to give it free swinging room. Many shipmasters have indeed reluctantly had to decline to let their ships become observing ships because they had no room to suspend a marine barometer. In some small ships, in the short sea and coastal trades where frequent checking against a mercurial barometer is possible, we have supplied a tested aneroid barometer as an alternative to having no pressure observations at all, but the performance of these has needed constant supervision, and has never been considered quite so reliable as that of the marine mercurial instrument.

But within a few years we hope that the troubles engendered of space, siting and performance will be resolved, for a Meteorological Office field trial of a new precision aneroid (made by an outside firm) was recently completed. Issues to observing ships are commencing this year, and a few may already have been supplied by the time this number of *The Marine Observer* is published. This new barometer, which is pictured opposite page 72, has a performance comparable with that of a Kew-pattern barometer, over which it has some advantages when used at sea. It is compact and fitted with an easily read five-figure drum counter which shows whole millibars and tenths. The instrument is robust and may be transported, packed in a special transit case, through the normal registered post with complete safety. During the trial one barometer completed two postal journeys from London to the Isle of Tiree and back without change of zero or calibration.

When used at sea the new aneroid is fitted with a damping device. This reduces a pressure oscillation of + and − 0·5 mb. over a period of 12 seconds to one of + and − 0·05 mb.

The initial cost of the precision aneroid is high compared with that of a mercurial barometer, but this will be offset by an appreciable reduction in the cost of transport, and by the longer average life to be expected.

The new aneroid functions as follows: the movement of the partial vacuum chamber is measured by means of a micrometer screw which is geared to a digital drum counter. In order to protect the instrument against damage and to provide calibration adjustment, a simple jewel-mounted lever is interposed between the aneroid and the micrometer and the point of contact between lever and micrometer is detected by means of electrical contacts forming a special switch. These contacts are of noble metal and are part of the electrical circuit connected to a miniature cathode ray tuning indicator which is a simple triode electronic tube wherein the anode is a fluorescently coated plate. Electrons impinging on the plate cause the fluorescent compound to glow, and by changing the state of the control grid by the switch referred to above, a different fluorescent pattern occurs on the plate. Thus, by observing the fluorescent plate (mounted close to the press button switch in the photograph opposite page 72) and adjusting the micrometer screw, it is possible to detect the point of contact between micrometer and lever very accurately.

The replacement of the marine mercurial barometer by the new aneroids, until every observing ship has one, is not something which can be done in a few weeks, or even a few years. When they become available the first 'customers' to be served will naturally be those ships who, for a variety of reasons, have difficulty in giving us pressure readings as precise as they would like, e.g. the coasters or the smaller Western Ocean ships. It seems likely that the 'carpet slipper weather' ships, especially those with large chartrooms, will have to wait patiently at the end of the queue.

But we look forward with confidence to the day when the new instrument will be in every ship of the voluntary observing fleet, a fleet which may then be able to give even better service that it has done for more than a hundred years and which may even, by the very availability of the instrument, include ships hitherto debarred from participation in voluntary observing at sea.

A REPLY TO MANY LETTERS

By this time every year we have received many replies to the letters to captains and officers telling them they have qualified for Excellent Awards. Obviously we cannot answer them all in view of the large number (at the time of writing some 260-odd) but we like to make this acknowledgment to all of them in print.

A large number of our correspondents are gratified and some of them even a little surprised to learn that their observations are of value. The value of the observations to the Meteorological Office is evident from the fact that each logbook is carefully scrutinised, its information punched on to cards for ease of storage and reference, and even then the book is not thrown away but kept in our archives for further reference if needed—all this is in addition to the more obvious immediate value of the observations for forecasting when transmitted by radio.

Another point frequently raised in the letters is that of 'team work'. A radio officer writes, "I must express that our success is based chiefly on team-work and that recognition of our work in this way spurs us on to even greater efforts". Unfortunately we are unable to reward all of the 'team' and we can only hope that the other observers have been or will be principal observing officers and thus qualify at some other time for an award. It frequently happens that more than one captain, principal observing officer, or radio officer feature in one logbook and all we can do in such cases is to count the number of observations for which each officer is responsible and base our award on the highest figure. Thus we do take care to ensure that our awards go to the person that we consider to have contributed most to that particular logbook, although it is inevitable that occasionally somebody will be passed by.

From our point of view it is encouraging to note the following comment from an observer, ". . . every little we put into the 'obs.' is more than amply repaid by what are, I think, generally agreed to be at sea, most excellent weather forecasts. These may be the source of much comment ashore but at sea they appear to be remarkably accurate". Most gratifying!

Perhaps this extract from an observer's letter points to what is required in a logbook, "I was most agreeably surprised . . . and cannot think why you should wish to nominate me for an award as I do not think that I have done anything exceptional in the way of meteorological observations although I have always tried to be as accurate as possible in reporting weather conditions around my ship each time". The writer of this article, being an ex-observer himself, remembers his own efforts to this end.

In his letter one shipmaster recalls the 1920's when, as 2nd Mate, he was "called for almost every flash of lightning and every shift of wind in order to write it up in the M.O. logbook". He adds, "I rather doubt whether the modern juniors would respond to that routine quite so cheerfully as I did at that time!"

At the time of writing we have distributed some 260 of the 300 awards but we are experiencing difficulty in tracing some of the remainder. The list of recipients was published in the July 1961 number of *The Marine Observer* and we would be pleased to hear from anyone whose name was in that list, but whose letter notifying him of the award has not yet caught up with him. It also helps if the receipts which we send out with every award are returned to us, even if they are signed by 'Auntie' in the officer's absence, as happened on one occasion.

J. D. C.

THE NATIONAL OCEANOGRAPHICAL COUNCIL— ANNUAL REPORT

This report, published by Cambridge University Press at 5s., outlines the work during the year 1960–61 of the National Institute of Oceanography.

Dr. J. N. Carruthers, who has always worked closely with the Marine Division of the Meteorological Office (he contributed the oceanographical sections of *Meteorology for Mariners*), retired from the post of Assistant Director of the Institute, although he remains there in another capacity.

The study of sea waves has continued in co-operation with the Ship Hydrodynamics Laboratory, the National Physical Laboratory and the British Shipbuilding Research Association. Work continued on the prediction, statistical analysis and measurement of sea waves. Ship-borne wave recorders, records from free floating buoys, and experiments in the new towing tank in the Ship Hydrodynamics Laboratory were used to further practical and theoretical investigations.

Dr. S. Ishiguro of the Nagasaki Marine Observatory has continued work on the prediction of tidal surges in the North Sea by means of an electronic computing device (analogue computer) which reproduces current and voltage fluctuations analogous to ocean currents and sea level fluctuations. Arrangements are being made for this apparatus to reproduce the effects of both wind and atmospheric pressure.

Theoretical and practical work has proceeded on the investigation of waves at warm and cold water boundaries within the sea. Analogous atmospheric models such as waves produced by mountain ridges have helped with the theoretical investigation of these so-called internal sea waves. Work has also continued on the analysis and measurement of microseisms set up by severe atmospheric storms above the sea and transmitted over great horizontal distances via the rocks of the sea bottom. The investigation of the variations in sea level across the Channel by measurement of ocean currents by means of Post Office cables also continues.

Deep ocean currents in the vicinity of the Gulf Stream west of Bermuda have been investigated by means of specially designed floats. Currents at 2,000 metres were found to be mainly westerly and attained a rate of three nautical miles per day, while those at 4,000 metres were mainly either north or south and had an extreme velocity of 36 miles in 36 hours. The period of fluctuation of these deep currents appeared to be two or three weeks and the distribution of velocities horizontally suggested that the predominant eddy size was of the order of 100 miles diameter.

Work has continued on simple and easily mass-produced devices for measuring currents on the sea bottom on a large scale. Photography and special magnetic, gravimetric and acoustical methods are being used to survey the geology of the ocean bottom.

Considerable effort has been put into the measurement of the electrical conductivity of the sea and its correlation with salinity and density. The rapid measurement by electrical means of salinity represents a fundamental oceanographical advance in recent years and the Institute has been in the forefront of this work. Methods and apparatus have been compared with those of foreign laboratories during lengthy visits abroad.

The Institute has continued its wide biological programme which includes the study of the effects of light upon plankton and a very full examination of the world whale population.

The building of the new research ship to replace R.R.S. *Discovery II* had not been put in hand by the end of the year under review owing to the unexpectedly long time required for planning the final details of the ship's design,* but *Discovery II* steamed 22,484 miles during the year. She took part in a large multi-ship survey of the overspill across the Faroe-Iceland ridge into the North Atlantic. This was an international project in which British Fisheries Research vessels also took part.

G. A. T.

OBSERVATIONS OF AURORA IN SHIPS

By J. PATON, M.A., B.SC., F.R.S.E.
(Balfour Stewart Auroral Laboratory, University of Edinburgh)

At the beginning of the International Geophysical Year (I.G.Y.) 1957–58, it was arranged that a column in the ships' meteorological logbook should be allocated for the entry of information relating to aurora, in addition to the more detailed observations supplied separately. The purpose of the short coded entry in the logbook was to supply us with information concerning the state of the sky at the time of observation (i.e. whether it was sufficiently clear to be able to conclude

* We have since learnt that the new ship was laid down early this year and is expected to be completed in October.—*Editor.*

that aurora was absent or whether cloud prevented any definite decision) and also to ensure that weak displays, that might otherwise pass unrecorded, would be reported.

This column is now being withdrawn; the reasons for the withdrawal are these: The I.G.Y. was purposely arranged to coincide with a period of maximum solar activity, i.e. the maximum of the 11-year sunspot cycle. By an extraordinary and fortunate chance, the sunspot maximum of 1957 was the greatest that has occurred since solar observations began over 200 years ago. At sunspot maximum, aurora is seen quite frequently in lower latitudes and observers will recall the many spectacular displays that they reported between 1957 and 1959. We are now approaching the period of sunspot minimum when aurorae are much less frequently seen in lower latitudes. For example, at the time of the last sunspot minimum, aurora was not seen in Britain south of geographical latitude 52° during 1952 and 1953. Since most ships ply in lower latitudes, we are therefore withdrawing the column relating to aurora and we wish to thank all observers who have made entries there during these past years.

It is always possible, however, even at sunspot minimum, that an occasional display may penetrate to lower latitudes. Information concerning such displays is of great importance to research workers studying ionospheric and magnetic storms and the associated interference with radio-communications and we would ask observers to record observations of such displays in as much detail as other duties will permit. This should be done in the 'Remarks' pages of the meteorological logbook, or a ship which does not undertake voluntary meteorological observations may send it in narrative form direct to the Balfour Stewart Auroral Laboratory.

In short, it is still of vital importance to us to receive information of every auroral occurrence, from the unspectacular glow on the horizon to the vividly coloured curtains waving in the sky. Details of the positions of the aurora in elevation and azimuth with illustrating sketches are particularly useful.

Analyses of the observations supplied by ships' observers are included in the auroral data now being published in the Annals of the International Geophysical Year, and scientific papers based on this data are already appearing in international journals. One result of the analysis of ships' observations will be of interest to observers. Their observations have clearly shown that aurora penetrates significantly further south in the western Atlantic than in the eastern part of this ocean. Now, a glance at a map showing lines of equal magnetic dip (or inclination) will show that over the Atlantic, these lines lie in an approximately NE–SW direction, reaching lower latitudes in the western Atlantic. So the distribution of aurora is apparently closely related to the dip or inclination of the local magnetic field. Hitherto, it had been thought that the penetration equatorwards of aurora was determined by the geomagnetic latitude. This is an important result and it emphasises the value of the synoptic information supplied by ships' observers.

If any observer should be in or near Edinburgh, we would be glad to have the opportunity of showing him how his observations are used in our investigations. The Balfour Stewart Auroral Laboratory is within the University Department of Natural Philosophy in Drummond Street, Edinburgh 8 (Telephone WAVerley 6945).

Official Publication

METEOROLOGICAL OFFICE REPORT FOR THE YEAR ENDED 31st DECEMBER 1960

This report covers the functions of the Meteorological Office, descriptions of the various services provided, a summary of the weather during 1960 and some of the research carried out during the year—in particular, research on the high atmosphere. There are also sections on international co-operation; Meteorological Office organisation; publications; and a list of books and papers by members of the staff which were published during the year.

The report is published by H.M. Stationery Office at a price of 4*s*. net.

Book Reviews

Mischief among the Penguins, by H. W. Tilman. 8¾ in. × 5¾ in. pp. 192. *Illus.* Rupert Hart-Davis, London, 1961. 21*s*.

This book is not, as its title might lead one to believe, a dissertation on the lighter side of Antarctic exploration, but a factual and very readable narrative of a twentieth-century Elizabethan adventure.

Mischief is an ex-Bristol Channel Pilot Cutter of 29 tons Thames measurement, built in 1906 in the days when the Bristol Channel pilotage was a private venture and a very competitive affair, each pilot having his own cutter. She was coming up to her fiftieth birthday when Major Tilman, to quote the dust jacket, "a distinguished mountaineer and enterprising seaman who finds his pleasure in strange places", bought her and sailed her to the Crozet and Kerguelen Islands, with the object of climbing hitherto untrodden peaks and exploring unknown glaciers.

Gaff-rigged still, as she was originally, she now has an auxiliary petrol engine, but her range under power is less than 300 miles so she is still essentially a sailing ship.

Mischief among the Penguins is the story of her second and successful attempt to reach these remote islands; her first one, the previous year, was abandoned after severe weather damage a week after leaving Cape Town. The abortive attempt is described briefly in the book.

With a crew of five recruited through the personal column of *The Times*, *Mischief* sailed from Lymington on 30th July 1959, reached Las Palmas on 15th August and Cape Town on 1st November. The long passage described by the author as "a shake down cruise, perhaps on the long side" is well described. A month was spent in Cape Town and when she left on 27th November she had on board a Supplementary Ship's Meteorological Logbook supplied by the Port Meteorological Officer there, Mr. A. B. Crawford. *Mischief* was not equipped with tested instruments, nor was she fitted with a radio transmitter, so her observations could not be used by the forecasters, but her meteorological logbook, which we subsequently received here in the Marine Division, is a valuable addition to the meagre knowledge which we have of the South Indian Ocean.

Of recent years, small boat journeys over long stretches of ocean have become not uncommon and many of them have captured the popular imagination. Without in any way detracting from the heroics of such voyages, it must be remarked how often their landfalls have been along coast-lines or perhaps an island backed by a continent. No such fortunate geographical circumstances attended *Mischief* and Major Tilman confesses that "of all the unpleasant things that might happen to us in those lonely seas, this of missing the islands altogether or, worse still, of hitting one in the dark was what scared me most. They are small and scattered, their vicinity is sprinkled with sunken rocks, visibility is very often poor, so that . . . we might easily drift to leeward of them before we knew where we were". That no such calamity occurred is a tribute to the way in which *Mischief* was navigated. One might almost go back to Sir Ernest Shackleton's landfall of South Georgia in a ship's lifeboat in 1916 to find a parallel piece of navigation in this stormy latitude.

But mountaineering, not navigation, was the real object of the expedition and from the first landfall on Possession Island where *Mischief*, who "has been in some rum places but never in any place like this . . . seemed to be in a sort of zoo . . .", the narrative goes ashore almost entirely until she left Kerguelen (where contact was made with the permanent French scientific station established in 1950) two months later.

The story of the expedition's sojourn in the Crozet and Kerguelen Islands is most attractively told and the author has been wise to weave into his own narrative something of the history of the islands, especially of the men marooned on them and the manner in which they survived.

When *Mischief* arrived back in Cape Town, her meteorological logbook was scrutinised with a view to finding out how her observations could have improved the weather forecasts had they been available by radio. In the words of Dr. W. Schmitt, of the South African Weather Bureau, "it would seem that the forecasters concerned stood the test fairly well, although they had some misgivings when the logbook first arrived in Pretoria". As an illustration, two weather maps for 5th January 1960 are included in the book, one being the actual map made by the forecaster at the time and the other one a revised map using the *Mischief* data. From these two maps what seems to be a weak depression on the forecaster's map was found to be quite an active, deepening, fully-fledged system. To quote Dr. Schmitt again, "this case clearly illustrates the kind of error which can be expected in current weather map analysis in regions with isolated observations".

The book is illustrated by nineteen first-class photographs and four maps and diagrams. It is well worthy of a place on the shelves of any ship's officer.

L. B. P.

Sea Swallow—The Annual Report of the Royal Naval Birdwatching Society. 8½ in. × 5½ in. pp. 64. *Illus.* R.N.B.W.S., 1961. 4*s.* 6*d.* (free to members).

The pages of ships' meteorological logbooks have frequently contained narratives, and sometimes photographs and drawings, of birds seen at sea. In order that full value should be obtained from these, some years ago we made contact with the Royal Naval Bird Watching Society (R.N.B.W.S.), and since then a pleasant and profitable association has been built up.

In this, their fourteenth annual report, the Society express their gratitude to the Marine Division of the Meteorological Office for forwarding these narratives extracted from meteorological logbooks, but on our part we are grateful to the Society for fostering the interest of our voluntary marine observers in birds, for bird watching is inseparable from weather watching, and the observer of a bird on the wing will undoubtedly be aware also of the cloud behind the bird, the state of sea below it, and the wind by which the bird is affected.

The report makes very interesting reading to all bird lovers; perhaps the most interesting part is contained in the 20-page summary of observations of sea-birds received during 1960. These reports come from twenty-three observers, two of whom sent in the skins of birds which had died on board, these being subsequently accepted by the Natural History Museum. We note with pleasure that fourteen of these observers were in merchant ships, ten of them being in voluntary observing ships. The notes from the latter sometimes appeared first in their meteorological logbooks and were sometimes forwarded direct to the Society on their special sea reporting sheets.

There are also helpful and interesting articles on the distribution of the fulmars in the North Atlantic; the food of the greater shearwater; bird watching by radar; the sandpiper; and (in view of the two skins already mentioned) some notes on the skinning and preserving of birds.

The report announces the impending publication, it is hoped before the end of 1962, of a handbook entitled *Sea Birds of the South Pacific* by Captain P. P. O. Harrison of the New Zealand Shipping Company, whose contact with the R.N.B.W.S. dates back to the time when his first ornithological observations were extracted from his meteorological logbook and forwarded to the Society.

The Society's title does not mean that its membership is limited to the Royal

Navy; a few years ago, in view of the interest of other seafarers in its work, membership was thrown open to all bird lovers whose business is in great waters, from master to messroom boy, at an annual subscription of 10*s.* for officers and 7*s.* 6*d.* for ratings. The honorary secretary is Lt. Cdr. E. S. W. Maclure, R.N., of "Melrose", 23 St. Davids Road, Southsea, Hants., who will be glad to supply details and from whom copies of this report may be purchased.

Amongst the Society's vice-presidents is a nominee of the Honourable Company of Master Mariners whilst its editorial and advisory board includes the abovementioned Captain Harrison. L. B. P.

Personalities

RETIREMENT.—COMMODORE J. P. DOBSON, C.B.E., D.S.C., R.D., R.N.R., retired from the sea on 4th December 1961, after more than 40 years' service with the Canadian Pacific Line.

John Petter Dobson received his training in H.M.S. *Conway* and served during the First World War in the *Gloucestershire*, an auxiliary cruiser in the 10th Cruiser Squadron. On demobilisation he joined the Canadian Pacific Line, his first ship being the *Metagama.*

Obtaining his Extra Master's Certificate in Liverpool in 1926, Commodore Dobson served in various ships of the Canadian Pacific fleet, but at the outbreak of the last war he was mobilised for service in the R.N.R. as Lieut. Commander and served in various capacities from Commanding Officer of a group of minesweepers to Commodore of Convoys, being demobilised in 1946 in the rank of Captain R.N.R.

Rejoining the Canadian Pacific Line, Commodore Dobson was appointed to his first Merchant Navy command, the *Beaverglen.* He subsequently commanded many of the Canadian Pacific cargo and passenger liners, his last command being the *Empress of Canada*, to which he was appointed when she was commissioned early in 1961.

His association with the Meteorological Office goes back to 1922, when he was 3rd Officer of the *Bothwell.* Since then he has, in twenty-one observing years, sent us 45 meteorological logbooks. He received an Excellent Award in 1948, and in 1957 was presented with a suitably inscribed barograph in recognition of his long and zealous voluntary service on our behalf.

Commodore Dobson has had an eventful and interesting career. He attended two investitures at Buckingham Palace: during the war he was awarded the D.S.C. and in March 1961 was invested with the insignia of a Commander of the Order of the British Empire. At the Coronation in 1953 he led the Royal Naval Reserve contingent, and he retired from the Royal Naval Reserve in the rank of Commodore.

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

RETIREMENT.—CAPTAIN R. W. ROBERTS, O.B.E., D.S.C., retired in January when he brought the *Oronsay* into Tilbury at the end of the longest peace-time voyage ever made by an Orient liner, a distance of some 65,000 miles in five months.

Richard Williams Roberts, who comes of a family with nautical connections going back more than two hundred years, first went to sea in 1916 as an apprentice with Messrs. T. and J. Harrison. He left them in 1926 as second officer and joined the Costeira Co. of Rio de Janeiro as chief officer. In 1929 he joined the Orient Line as fourth officer of their *Ormonde*, remaining with them until he retired.

As staff captain of an older *Oronsay* in March 1942, Captain Roberts took command when the master was taken ill when leaving Liverpool and thus became commodore of the invasion convoy at the landing at Diego Suarez, Madagascar. For his part in this operation he was awarded the D.S.C. Later on in the same year, *Oronsay*, with Captain Roberts again her staff captain, was torpedoed off Freetown. All but five of her complement were rescued, though some of them spent nine days in the boats. For his exploits on this occasion he was awarded the O.B.E. He then served as staff captain of the *Otranto* in the North Africa, Sicily and Salerno landings and in the *Orontes* on trooping duties.

He was appointed to his first permanent command, the *Samkansa* in August 1944, taking part in the landings in the South of France and in Greece. Later on, he took her to the Far East for the rehabilitation of Singapore and Sourabaya after the Japanese occupation. The writer, then acting as King's Harbour Master at the latter port, well remembers the anxiety caused by the navigation of this deep-laden ship through the Madura channel and into Sourabaya Roads, both of which were gravely obstructed by wrecks left from the Japanese invasion three years before. Returning to the peace-time service of the Orient Line, Captain Roberts was, in 1949, loaned to the International Refugee Organisation and worked with them for ten months on the refitting of ships to carry refugees. His subsequent service, with the exception of an occasional relieving voyage, was all spent in command of the *Otranto* and the new *Oronsay*.

Our association with Captain Roberts as a voluntary marine observer goes back to 1923 when he was third officer of Harrison's *Dramatist*. Since then he has, in 17 years, sent us 36 meteorological logbooks. He received Excellent Awards in 1931, 1957 and 1960.

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

OBITUARY.—We regret to record the sudden death at his place of duty, the Port Meteorological Office, London, on 9th November 1961, of MR. H. J. MASTERS, aged 62.

Henry James Masters joined the Meteorological Office in January 1928 at Heliopolis, Egypt, being locally recruited from the Royal Air Force Meteorological Section. For the next 12 years he served as a meteorological observer at various stations in Egypt, Palestine and Trans-Jordan.

Returning to the United Kingdom in April 1940, his first assignment was to Thorney Island, a meteorological station at that time primarily engaged on the preparation of weather forecasts for the R.A.F. Coastal Command in their task of attacking enemy submarine bases and convoys in the Channel, and the protection of our southern coasts against invasion. Subsequently, he served at various meteorological stations and came to the Port Meteorological Office, London, in 1948.

During his 13 years at the Port, Mr. Masters became known to many ships' officers though, as second assistant, his work kept him actually in the office a great deal, especially after it was moved from the City to the King George Dock. His special function was the care and documentation of the instruments in the office and the assembly of the sets of instruments for observing ships. To his thoroughness can be attributed much of the smooth way in which the Port Meteorological Officer and his senior assistant have been able to serve the Voluntary Observing Fleet using the Port of London.

Mr. Masters was a bachelor, his only surviving relative being a brother, to whom we extend our sympathy. J. C. M.

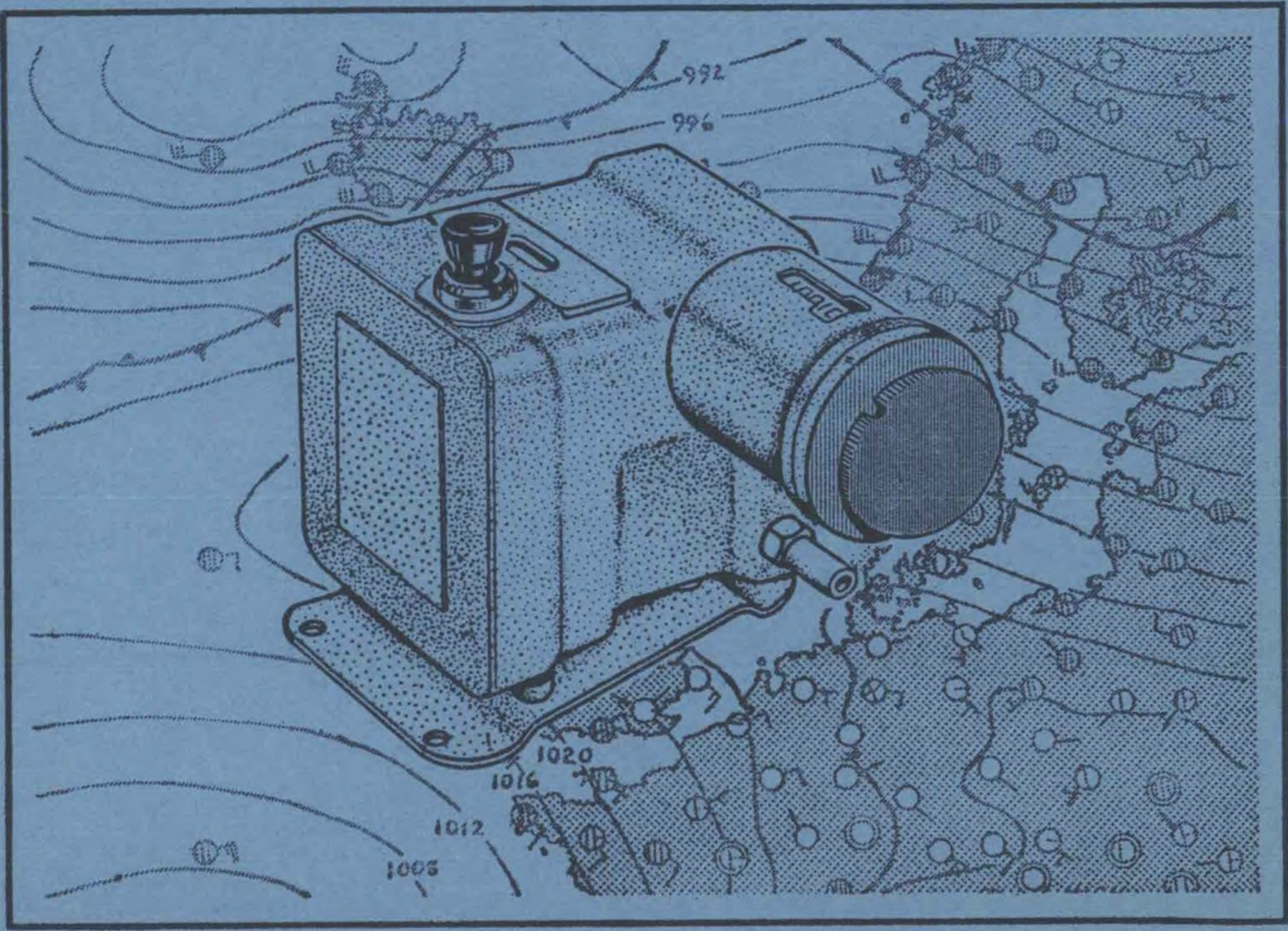
ADDENDUM

The Marine Observer, January 1962:

Page 44, RADIO FACSIMILE BROADCASTS IN AUSTRALIA—

Shortly after going to press with the January number, we learned that, in addition to Australia, another country in the southern hemisphere which makes meteorological broadcasts by facsimile is Argentina, transmitting from Boca (35°S, 58°W).

MECHANISM PRECISION ANEROID BAROMETERS WITH DIGITAL READOUT FACILITATE WEATHER REPORTING



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

RANGE: 900 to 1050 mb. DISCRIMINATION: 0·02 mb.
ACCURACY: At 20°C, ± 0·3 mb. At 0°C & 40°C, ± 0·5 mb. Max. change.

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