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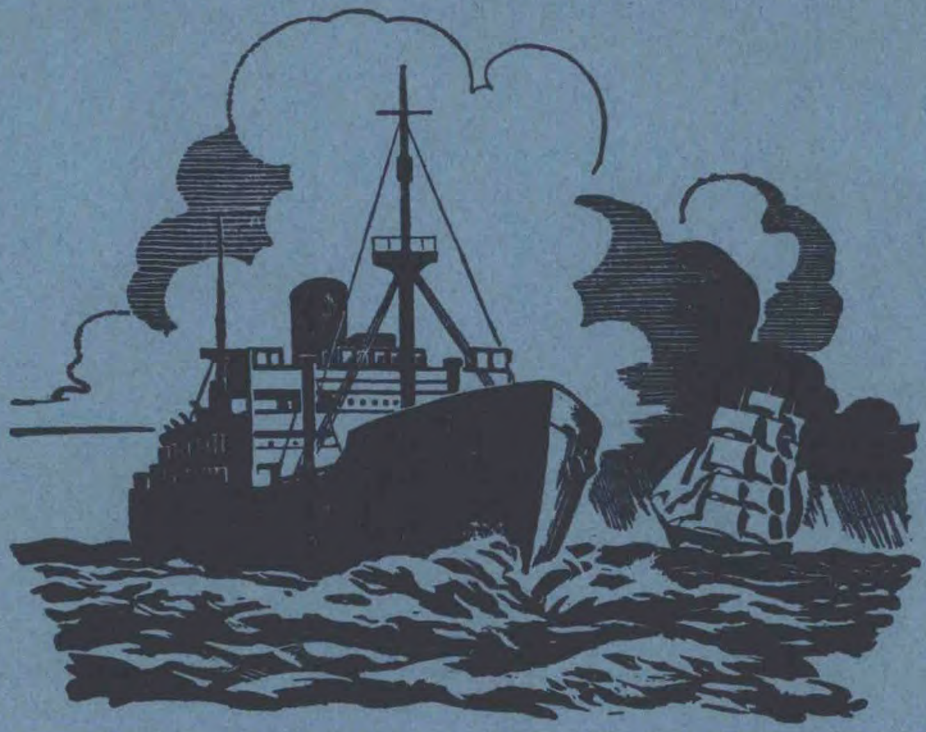
Met.O. 777

The Marine Observer

A quarterly journal of Maritime Meteorology



Volume XXXVI No. 214

October 1966

PRICE *6s. 6d.* NET

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THE MARINE OBSERVER

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

VOL. XXXVI **No. 214** **OCTOBER 1966**

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Letters to the Editor, and books for review, should be sent to the Editor, "The Marine Observer," Meteorological Office, Eastern Road, Bracknell, Berkshire

Published for the Meteorological Office by
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Editorial

Diversification. Many words of this nature have crept into the English language of recent years; some of them are useful, many of them would have been better understood had they been left in the full form of their constituents and almost without exception they are all ugly. Occasionally we have found one in the additional remarks pages of a ship's meteorological logbook but, as yet, there is no general sign that this motley crew intends to put to sea.

But the word 'diversification' became fashionable in the shipbuilding industry some time ago when yards were obliged to seek alternative ways of maintaining full employment in the face of falling order books. One yard even turned to building fabricated houses and house equipment.

With the rise in U.K. orders, however, it became less necessary for shipyards to turn away from their traditional purpose and, as far as shipbuilding was concerned, the word seemed likely to die a natural and unlamented death.

But it has once again been brought to mind by the recent news that a Birkenhead shipyard is to construct a fountain which will be installed as the centrepiece of the Goree Piazza development near the Pier Head, Liverpool. Instead of throwing up sprays of water, so wasteful and such a nuisance on a windy day, the new fountain will spill quantities of water from a number of buckets which topple over as they fill. In 1965 the first of these fountains was installed in the British Industrial Fair in Tokyo and evidently was a great attraction, its effect being said to be intriguing and harmonious and resembling the sound of waves breaking on shore.

Something of the sort, to outward appearances, was to be seen some fifteen years ago at the South Bank Exhibition during the Festival of Britain, but the working of the new fountain is based in the well-known effect of slack tanks on the stability of a ship which might, in extreme rolling conditions, cause her to capsize. In it, the shaped buckets are filled with water by an electric pump, rolling as they do so until the moment when their stability disappears and they capsize, emptying their contents with a splash into the fountain pond.

The spectre of slack tanks must have haunted many a shipmaster ever since the day when ships were first built with double bottoms for the carriage of liquids; dividing and sub-dividing double bottom tanks and thus reducing the free surface area undoubtedly reduced the hazards but there will be many who remember working a GM during the loading of a mixed cargo and being told something such as "don't forget that No. 2 tank will be slack by the time she gets down to Cape Horn". Perhaps this worry is today somewhat lessened by the stability indicator which is a normal piece of equipment in a ship, but to the problem of a ship's initial and future stability in the upright condition will always be added the problem of the sea and swell waves which will be encountered; on long sea passages this problem can be acute. In the Australian trade for instance, in the writer's day, it always seemed to be half-way through the passsage, the Roaring Forties outward and Cape Horn homeward, when tanks were most likely to be slack, that the highest waves would be met.

A lot of work has been done on the subject of waves since the war and some of the many articles written in *The Marine Observer*, particularly those in the April and October 1965 numbers and in the April 1966 number, each written by an expert in his own particular field, bear witness to the value of ships' observations in this branch of research. Knowledge of waves combined with knowledge of stability are essential elements in the quest for the safety of life and property at sea and the former can only be acquired by the patient accumulation of data by ships. The concluding words of the American naval officer who wrote the article *Development and Characteristics of Sea Wave Charts on the NSS Facsimile Broadcast* in the April 1966 number of *The Marine Observer* are prophetic: "The time should not be far distant when the mariner can rely on instantly available, reliable forecasts of sea height conditions for anywhere that his sailing orders may direct his course."

In February 1965 the Hull trawler *Boston Pionair* foundered with all hands in a position thought to be towards the western edge of the Dogger Bank. Discussion of the probable wave heights which she met in her last hours formed a prominent item at the subsequent inquiry and an expert, incidentally the author of one of the articles above mentioned, was of the opinion that in the force 9–10 winds then blowing, thirty-five feet would probably have been the maximum wave height on the Dogger Bank but, in the deeper water around, it might have been as much as 15 feet higher. His calculations, he said, were based on the best available data but still subject to an error of twenty per cent. in either direction. This is a large margin for error which will undoubtedly be cut down as more observations are received.

The question of the stability of trawlers also came up for consideration and, since the disaster, the Board of Trade has issued a notice to owners, skippers and builders of fishing vessels which fixes the minimum righting lever and gives certain recommendations as to how this minimum should be achieved. The *Boston Pionair*, it was said, more than complied with the recommendations made but, according to the calculations of the senior ship surveyor, did not quite have the minimum righting lever suggested.

The Court found "that the *Boston Pionair* was overwhelmed in severe weather conditions by a wave or a succession of waves which caused her to roll with such severity that her righting lever was extinguished and that she had thereby lost her ability to right herself. The possibility of damage to the hull or superstructure cannot be excluded".

That knowledge acquired in the vital problem of the safety of ships in a seaway can be used in the construction of an ornamental fountain is perhaps a little surprising. It was no less surprising to hear on a BBC programme last winter, the vice President of the English Tiddlywinks Association, when questioned as to the prospect of a World Tiddlywinks Cup Contest, give as his opinion that if such a contest were ever possible, it would have to be held in England because only the English climate could be relied upon to give the necessary humidity range. In subsequent correspondence, this gentleman confessed that this was perhaps a somewhat lighthearted way of ending his interview but nevertheless we were glad to have an opportunity of studying a brochure: *The Science of Tiddlywinks—an Investigation by the Cambridge University Tiddlywinks Club.* Among the many facets of the game, the brochure goes into considerable detail concerning meteorological factors: aerodynamics, draughts, atmospheric density, humidity and temperature.

Strange indeed are the 'fringe benefits' of meteorology and its associated sciences! If we may be permitted to use the word, this is indeed 'diversification'.

L. B. P.

October, November, December

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

It sometimes happens that we are unable to offer an explanation for phenomena reported. In such cases we shall be very glad to hear from any reader who can put forward an authoritative or a possible explanation, which could be published in this journal. We should also be glad to hear from any reader who has witnessed a similar phenomenon in the past, but which has not previously been communicated to us.

SQUALL

Red Sea

s.s. *Ellenga*. Kuwait to Suez. Observer, Mr. R. P. Harris, 3rd Officer.

7th November 1965.

GMT

0630: Wind SSE, force 3. Fair with $\frac{3}{8}$ Cu and light Cs. Distant thunder heard. Air temp. 87°F, sea 87°. Pressure (Aneroid) 1010·5 mb. Sea moderate.

0700: Instrumental readings unchanged. Wind and sea as before. Heavy Cb building up, from SW through N to NE.

0730: Heavy rain clouds ahead, of a dark green hue, surrounded by other black clouds. A waterspout seen forming to the north. It lasted 10 min then collapsed. Intense vertical forked lightning appeared at regular intervals in the NW.

0745: Wind NW, force 2. Loud thunder close by. Several small but intense eddies passed very close to ship. Pressure 1012 mb. Sea slight.

0800: Wind NW, force 9. Completely overcast with low cloud and heavy rain. Visibility only $\frac{1}{2}$ mile. Air temp. 74°. Waves 10 ft high. Period 2 sec.

0815: Wind force 10. Air temp. 70°. Pressure 1015 mb.

0830: Wind veered to N, force 7–8. Heavy rain. Visibility and sea as before. Temp. and bar. steady.

0900: Wind veering E'ly, force 4. Rain ceased and cloud breaking in the NW. Pressure 1013·5. Sea moderate, wave height 3 ft.

0915: Wind E, force 3. Sky clear overhead, rain clouds on the horizon. Air temp. 71°. Pressure 1012·2 mb. Sea moderate.

0930: Wind SE, force 3. Fair. Air temp. 75°. Pressure 1011 mb. Sea moderate.
Position of ship at 0630: 20° 43′N, 38° 36′E.
Position of ship at 0900: 21° 21′N, 38° 11′E.

Note. Reference to the charts for the 7th November, issued by the Meteorological Service of the United Arab Republic, shows that a small depression was centred about 100 miles to the NE of Jeddah. This depression formed part of a large trough of low pressure lying NNE/SSW across the Red Sea. It is probable that the violent squalls reported had been experienced as the vessel crossed the trough line of the depression.

SOUTHERLY BUSTER

off New South Wales

m.v. *Eastern Moon.* Captain W. G. White. Hong Kong to Sydney.
Observers, the Master, Mr. R. Sanderson, 2nd Officer and the G. B. Reef Pilot.

16th December 1965. During the afternoon while the vessel was proceeding down the east Australian coast a local 'Southerly Buster' was experienced. In the previous three hours, very strange clouds having considerable vertical development were seen in the south and west, while the sky gradually darkened and deepened in hue to a 'gun-metal' blue colour. At 1412 EAST (0412 GMT) the wind which was NNW, force 3, died away and a comparative lull occurred. The radar was switched on to observe the approaching front, and the approx. area covered was 20 miles wide by 8 miles deep. The squall then approached rapidly from the SW and the water in its path was whipped to fine spray with several small water spouts vainly trying to form.

At 1421 the squall hit the ship and torrential rain, driven horizontally, immediately reduced the visibility to less than 50 yd. Wind speed was estimated in excess of 50 kt.

At 1425, when a SPESH report was made, the wind backed to the south and a severe hailstorm was experienced. The barograph which had been indicating a falling tendency for the previous two days immediately dropped 2·1 mb to 998·3 mb. Air temp. fell from 86° to 80° F.

At 1428 the wind had backed to the SE and at this stage lightning with simultaneous thunder occurred.

By 1430, although no decrease in wind speed had taken place, visibility improved and the rain fell less heavily, and by 1436 it was possible to see some 2 miles ahead of the ship.

Unfortunately it was not possible to plot the track of the front as hail had smashed the perspex cover on the wave guide on the radar scanner's horn, rendering the set non-operational.

Position of ship at 0425 GMT: 29° 49′S, 153° 38′E.

Note. This observation was forwarded to the Australian Bureau of Meteorology whose comment is as follows:

"The meteorological analyses for the date and time of this phenomenon do not indicate the likelihood of a typical Southerly Buster. The cool southerlies have extended along the coast during the preceding 24 hours and the wind as reported, NNW 3, is not apparent from our coastal network.

"In this situation, as analysed, the only circumstance under which a strong southerly could occur would be as a short-period convective squall such as accompanies large Cu or Cb. This, however, does not altogether agree with the record of 'a fall in tendency for previous two days' which is typical of a northerly flow pattern preceding a Southerly Buster. Also coastal reports do not indicate unstable cloud formations although these were probably present some distance seaward.

"The area covered, 20 miles wide by 8 miles deep, does suggest the small scale phenomenon typical of a local convective squall, as does also the temperature fall of only 3·3°C (temperature changes with Southerly Busters are usually of the order of 10°C).

"In summary, evidence at our disposal suggests the occurrence was not the Southerly Buster change typical of a summer frontal passage along the New South Wales coast, but a convective cell accompanying a large Cb forming in unstable southerlies off the coast. The charts indicate such flow from high latitudes and, providing the ship was not close inshore, such cloud development could be expected."

Note 2. Eastern Moon is a voluntary observing ship on the Hong Kong Fleet List.

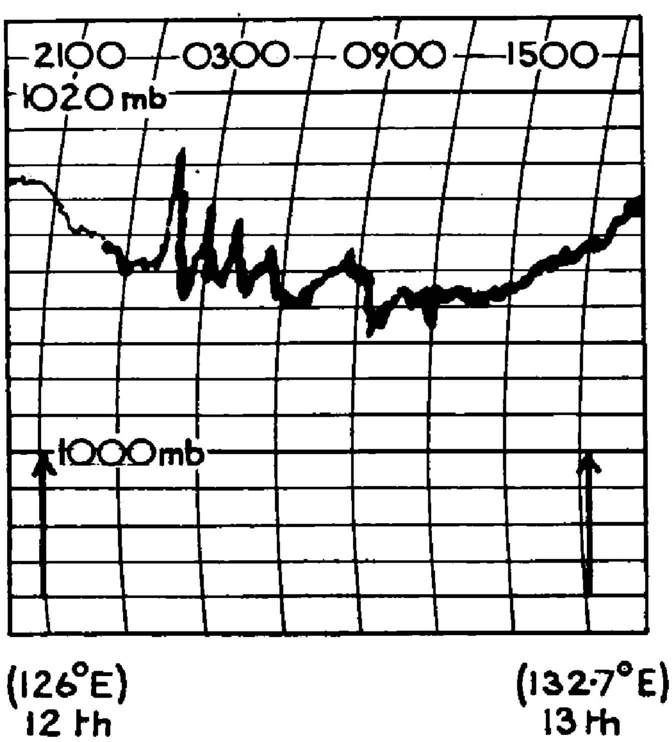
LARGE ERRATIC PRESSURE VARIATIONS

Great Australian Bight

m.v. *Rhexenor*. Captain C. S. Mackinnon. Singapore to Adelaide. Observers, the Master and Mr. G. A. Davies, 3rd Officer.

12th and 13th October 1965 (all times LMT). At 2100 on the 12th the curve of diurnal variation of pressure faded out and pressure began to fall quite rapidly. Very large and erratic changes of pressure occurred up to midday on the 13th, the greatest being a rise of 6 mb at almost 0200, followed by an even more rapid fall of 8 mb shortly afterwards (as shown). Vivid flashes of forked lightning were seen all round the horizon during the very early morning. When daylight came there was evidence of tremendous turbulence in the C_L9 clouds which had protuberances hanging from them. These were especially noticeable at the times when pressure fell sharply. The sky was generally chaotic and in a state of continual change. At about 1500 the barograph began to rise continuously but slightly unsteadily. The weather at the ship itself was quite unremarkable, apart from a little drizzle, in spite of the threatening appearance of the sky which suggested the imminence of violent squalls. The wind was S'W, force 3. Course 091° at 15½ kt.

Position of ship at 1800 SMT on the 12th: 35° 24'S, 122° E (abeam of Esperance Bay).



Note. A Meteorologist in the Commonwealth Bureau of Meteorology, Melbourne, comments:

"The surface chart for 17Z on the 12th October shows a low pressure trough extending from about Onslow, across the central Bight, connecting with the Southern low pressure belt. Two small low centres are situated in the trough, one of 1006 mb about 120 miles southeast of the ship and another 420 miles northwest of the ship.

"At this time an upper air trough at approx. 18,000 ft was about 300 miles west of Cape Leeuwin lying NW–SE, with a 50 to 60 kt maximum wind over the Bight. The surface low near the ship was almost directly below the inflow area of the wind maximum and just north of the axis.

"Unfortunately there is no upper air sounding available near the position of the ship, but, judging from cloud cover reported by ships in the area and the 23Z sounding from Forrest it would seem that the air over the ship would be fairly moist up to about 16,000 ft approx., drying out above.

"This situation would be dynamically favourable to vertical motion and, once started, the moisture distribution would favour vertical instability, as manifested by the violent cloud movement and lightning.

"The barograph trace is a good example of the development of 'thunderstorm highs and lows' which sometime occur in low pressure troughs of this type.

"The rises and falls of pressure are associated with blasts of cold air from the cloud above, and commonly, where this cold air reaches the surface, a squall occurs. That one was not observed is surprising. The magnitude of the first pressure fall, 8 mb, indicates a well developed and mature storm passing the ship."

Note 2. The *Rhexenor* is an Australian Selected Ship.

WHIRLWIND

Suez Canal

m.v. *Glenorchy*. Captain H. S. Taylor. Port Said to Aden.

24th September 1965. When the vessel was in the Suez Canal about 5 miles south of Port Said at 1030 LMT, a whirlwind was seen on the beam, on the eastern side, about ¼ of a mile away. It was also travelling south, at a speed about ½ kt slower than the vessel which was doing 5–6 kt. The base of the disturbance seemed to be about 10 ft in diameter and clouds of sand were being whisked up into a spiral as the disturbance revolved in an anticlockwise direction. The height of the column was estimated to be about 70 ft and the time taken for one revolution about 6 sec. The intensity of the sand and dust carried up varied according to the surface, the whirlwind being almost invisible when passing over rocky ground and very dense when traversing soft sand. It was lost sight of astern some 30 min after being first sighted. Air temp. 83°F. Wind, light airs, force 1. Cloud $\frac{2}{8}$ fair weather Cu.

Note. The synoptic chart issued by the Meteorological Service of the United Arab Republic for 1200 GMT on the 24th indicates that the wind in the Port Said and Suez area was generally from the NNW or N, force 2–4. The relatively cool wind from the sea was thus blowing almost directly along the Canal and in juxtaposition to the warm currents of rising air over the adjacent land. The rising currents, and variations of temperature and wind speed could cause the development of a local area of low pressure in the form of vortices. Such conditions could well result in the formation of the whirlwind described.

LARGE HAILSTONES

Mediterranean Sea

m.v. *Glenartney*. Captain R. G. Rippon. Port Said to London. Observer, Mr. M. Godbehear, 2nd Officer.

21st December 1965. Thunder and lightning with heavy rain occurred quite near to the vessel at 1230 GMT. Later the rain turned to hail, which persisted for 25 min. The maximum size of the hailstones was 1·2 cm, the majority being from 0·5 to 0·75 cm in diameter. The larger stones were of the 'flattened spheroid' variety and consisted of clear ice in which were a few air bubbles: the smaller ones were of opaque white ice. Also observed were several irregularly shaped pieces of ice about 1 cm long. At 1200: Air temp. 59·9°F, wet bulb 55·6°, sea 64°. Wind SW'W, force 4.

Position of ship: 34° 54'N, 19° 54'E.

Note. At midday a well defined upper-air trough lay over the Mediterranean from the Gulf of Lions to the Gulf of Sidra, while at the surface there was a small depression to the east of Malta. The large hailstones had been formed as a result of the marked convergence and the vertical motion of the air which must have occurred in the trough. A thunderstorm occurred at Malta during the morning.

LIGHTNING

off Algiers

m.v. *British Strength.* Captain K. J. Mackay. Milazzo to Antwerp. Observers, Mr. G. Luff, 2nd Officer and Mr. P. B. Sargeant, 3rd Officer.

8th–9th November 1965. The vessel passed through heavy thunderstorms between 2330 and 0030 GMT, some really spectacular lightning flashes being seen, including several that seemed to radiate from a central spot of light, like the spokes of a wheel. Various colours were noted, including pale green, like neon lighting, while some flashes had a reddish tinge. Most of the discharges occurred to the south-west and south of the ship.

During the storm the barograph trace showed erratic up and down movements of about 1 mb. The radar was in use and indicated a line of very heavy rain passing about 4 miles astern. At 0000: Air temp. 66·2°F, wet bulb 64·2°, sea 68·4°. Wind N'W, force 3.

Position of ship: 37° 23'N, 3° 36'E.

ST ELMO'S FIRE

Indian Ocean

s.s. *Oriana.* Captain C. Edgecombe. Colombo to Fremantle. Observers, Messrs M. D. Rushan, 1st Officer and R. L. Jackson, Junior 2nd Officer.

19th December 1965. At 2250 GMT during heavy continuous rain with no lightning visible, a pure white fan-shaped discharge was observed on the top telescope holder of the port 10 in. signalling searchlight. This was accompanied by a loud buzzing noise. On placing one's foot on a wooden grating some 3 ft below the lamp, the discharge immediately stopped and, when one's foot was taken off again, the discharge was resumed. The same effect was noticed if one approached too close to the searchlight. This phenomenon of St. Elmo's Fire lasted for 10 min during heavy rain, and when the rain moderated the discharge gradually subsided.

Air temp. 82°F, wind W'N, force 3.

Position of ship: 2° 52'S, 88° 15'E.

Mr. J. Gibb, Principal Observing Officer, comments: For the third time in just over two years, previous occasions 7th November 1963 and 14th September 1965, St. Elmo's Fire has been observed on one or other of the 10 in. signalling searchlights. Of interest is that the signalling searchlights are the only ferrous metal objects on an otherwise completely aluminium navigating bridge. This aluminium extends down seven decks until it is joined with the steel decking and superstructure of B deck. Perhaps this factor is contributory in the relative frequency of the phenomenon.

Note. Dr. J. A. Chalmers, Department of Physics, University of Durham, to whom this report was submitted, comments:

"The only reason I can see for the effect of the wooden grating might be that the weight of the foot could alter the effectiveness of the contact of the searchlight with 'earth', i.e. the sea. There seems little obvious reason for ferrous objects showing preference to aluminium objects unless, again, it is a question of resistance to 'earth'."

Note 2. The *Oriana* is a Canadian Selected Ship. The observation made on 7th November 1963, referred to by Mr. Gibb, was published in the January 1965 number of *The Marine Observer.*

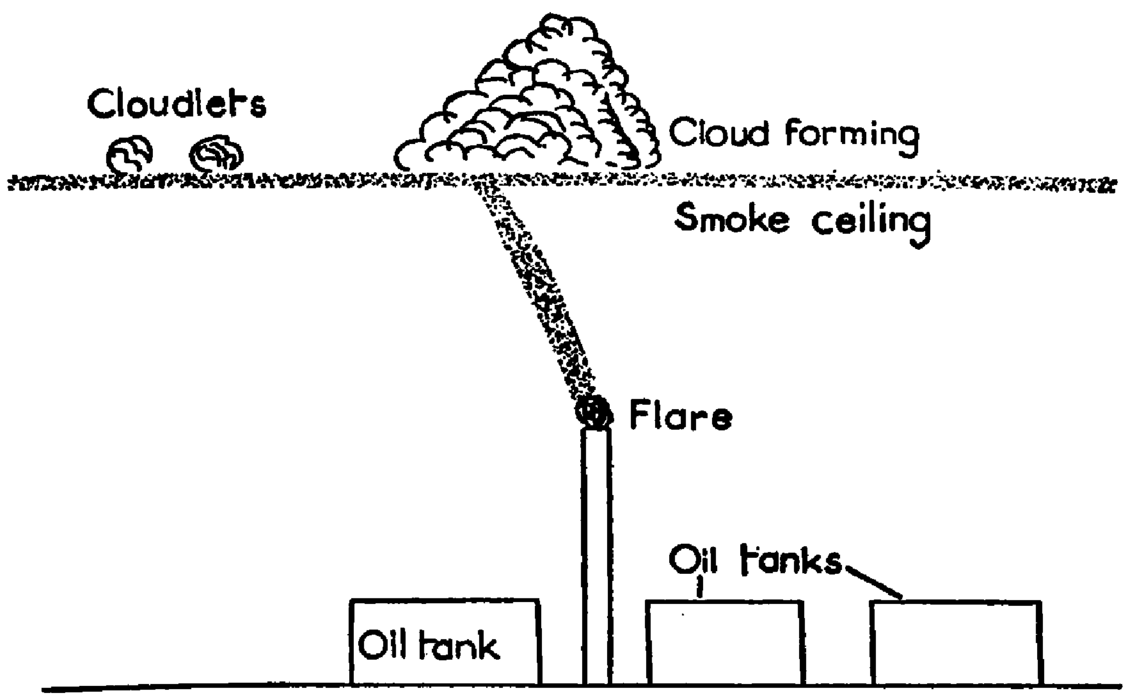
ARTIFICIALLY PRODUCED CUMULUS

Dammam Harbour

m.v. *Trevalgan.* Captain G. Joslin. At anchor. Observer, Mr. R. G. Whisker, 3rd Officer.

6th November 1965. While the vessel was at anchor in Dammam Harbour, the smoke from the chimney flare of the Ras Tannura refinery was seen throughout the day, from 0800–1700, rising into the air to a ceiling of several hundred feet where it levelled off and spread out for several miles. Immediately above the chimney and above the smoke layer a white cumulus cloud had formed which maintained much the same size throughout the period, although the general shape was constantly changing. Some other very small clouds of cumulus type were seen at times along the top of the smoke ceiling which was estimated to be at about 300 ft above the ground. Air temp. 85°–82°F, dew point 73°–72°, sea 85°. Sky cloudless.

Position of ship: 26° 31′N, 50° 13′E.



Note. The flattening-out of the smoke into a layer is a clear indication of the presence of an inversion at the level of the layer. Rising currents of air, unless particularly vigorous, are unable to penetrate beyond an inversion. It appears probable that the discharge from the chimney was so humid that it had to rise only a short distance for it to be cooled to its dewpoint, this occurring at the level of the inversion. For the reason stated above, the cumulus was unable to get very far above the inversion. The release of moisture on condensation would, however, result in increased buoyancy, allowing the rising currents to penetrate a short distance above the inversion.

SEA SMOKE

North of Ushant

s.s. *Methane Princess*. Captain W. S. Atkinson. Canvey Island to Arzew. Observers, the Master and Mr. M. D. Coles, 3rd Officer.

14th November 1965. At 1015 GMT snow began to fall heavily and there was a marked drop in air temperature from 49°F to 36°. The wind was E'ly, force 7–8. Visibility was reduced in the snow to between ½ mile and 1 mile. At about 1030 extensive sea smoke was seen which extended to a maximum height of about 20 ft and although not thick it was quite noticeable. By 1100 the snow had turned to a mixture of rain and snow, but the sea smoke persisted; at 1115 the precipitation ceased and the sea smoke dispersed rapidly. The air temp. after precipitation had stopped rose to 40°. The sea temp., by E.R. intake, was 57° throughout.

Position of ship: 48° 54′N, 4° 54′W.

Note. Reference to the synoptic weather charts for the morning of the 14th November shows that a slow-moving occlusion lay from off the coast of south-west Ireland to near Bordeaux.

On the east side of the front, over the western end of the English Channel, the wind was ESE or SE, force 7–8, with the air temperature only a few degrees above freezing point in the vicinity of the French coast. Locally, the air was humid during periods of snow or sleet. The sea temperature was much higher than that of the air, being around 55°F. Such conditions are extremely favourable for the formation of sea smoke, the process being described in a note to an observation on page 172 of the October 1964 number of *The Marine Observer*.

English Channel

m.v. *Longstone*. Captain F. Surtees. Immingham to Port Etienne. Observers, Mr. K. Roberts, 2nd Officer and Mr. J. Pykett, 3rd Officer.

22nd November 1965. At 0855 GMT when Dungeness was bearing 296° at a distance of 8 miles, bands of sea smoke approx. 4 ft high were seen lying in a 150°–330° direction. The vessel passed through the bands which together were about ¾ mile wide. Visibility at the time was about 2½ miles. Air temp. 34·2°F, wet bulb 33·0°, sea (by condenser intake) 49·0°. Wind NNW, force 4–5.

Note. Reference to our synoptic charts, showing the conditions from hour to hour, indicates that the air over the coastal belt of south-east England was near freezing point and also rather damp, about 0900 GMT. Sleet or snow occurred locally. As the cold damp air was carried over the very much warmer water of the Channel by the fresh NNW'ly wind, conditions then obtained which were very favourable for the formation of sea smoke.

FLUCTUATION IN WATER LEVEL

Lake Erie: Toledo, Ohio

m.v. *Crystal Jewel*. Captain D. Patrickson. At Toledo. Observer, Mr. M. V. Ricketts, 2nd Officer.

22nd October 1965. When the vessel arrived at Toledo, the wind was NE'ly and the direction of the current was up the River Maumee at approx. 5 kt. While in port there was a prolonged spell of SW winds which caused the current to flow down river and the water level fell below chart datum. It was noticed that after a day of SW winds that there was a surge up-river causing the level to rise for about 5 hours. This was said to be caused by the water 'piling-up' at the east end of Lake Erie and then surging back. During calm periods, especially in the mornings and evenings, water was observed returning into the river. On the morning of the 4th November an unusual drop was noticed of one foot in one hour.

DISTURBED WATER

Eastern China Sea

m.v. *Glenogle*. Captain W. J. Moore, D.S.C., R.D. Kobe to Hong Kong.

13th August 1965 at 2330 GMT. A large area of disturbed water was observed, the sea at the time being only rippled by a light breeze. The disturbance took the form of a large kidney shape around a smooth patch measuring 300 yd. across. On its south side (the double curve) the water was very turbulent. Sea temperature 82·5°F on three successive readings as the ship passed about half a mile away.

Position of ship: 29° 53′N, 128° 20′E.

Note. This observation was referred to Dr. L. H. N. Cooper of the Marine Biological Association of the U.K. at Plymouth who, in turn, forwarded it to Professor Y. Miyake of the Japanese Meteorological Research Institute who comments:

"I asked Dr. Y. Kizawa, a seismologist in my Institute to investigate this matter. The results of his investigations at four stations, Yakushima in 30° 27′N, 130° 30′E, Tanegashima in 30° 44′N, 131° 00′E, Nase in 28° 23′N, 129° 30′E, and Nagasaki in 32° 44′N, 129° 52′E, which are engaged in meteorological seismological work near the observed site and the seismological observatory at Matsushiro, Nagano Pref., Honshu in 36° 32′N, 138° 13′E which is equipped with a seismograph of magnitude 10^5, are as follows:

"No abnormal tidal wave was recorded.

"No seismographic records which indicate an earthquake near the site were obtained.

"No report on any submarine volcanic eruption near the site reached the Maritime Safety Agency.

"No appreciable microbarometric oscillation of the atmosphere or internal gravity waves were observed."

Note 2. Though there is no seismic or meteorological explanation for what was seen, we feel that this observation deserves publicity because it is an example of the cordial international character of oceanographic research and the potential value which scientists place on observations from ships.

CURRENT RIPS

North Andaman Sea

m.v. *Bombala*. Captain D. M. Gill. Penang to Rangoon. Observer, Mr. V. P. Harvey, Chief Officer.

5th October 1965. At 0015 GMT the vessel encountered a well-defined current rip running 030°–120°, and extending over a width of about 3,000 ft. The sea in the vicinity was slight but in the rip, in scattered places only, it resembled the state produced by a force 4 wind but with a much shorter period. The vessel was on a course of 343° and steering by auto-helmsman : the maximum deflection caused by the rip was 10° to port of the course line. The rips were experienced for 25 min, the depth of water varying from 78 fm on entering the disturbed area to 70 fm on leaving it. Sea temp. varied between 81°F and 85°. Wind SW's, force 2.

Position of ship: 14° 12'N, 95° 59'E.

PACK ICE AND WILD LIFE

Mansel Island area

m.v. *Warkworth*. Captain K. Jewell. Churchill to Swansea.

11th–12th October 1965. Cape Acadia was passed in clear water on a course of N'E, but at noon LMT in 62° 03'N, 79° 06'W the vessel entered pack ice of about 20% cover. This rapidly increased until in 62° 14'N, 79° 02'W there was thick solid pack ice and progress to the north was impossible. At 1600, the icebreaker *N.B. McLean* arrived after forcing a passage through the ice from an easterly direction. After some hard work by the *N.B. McLean* the vessel made progress to the north-east and was able to make her own way through the ice close north of Digges Islands at dead slow speed, the icebreaker staying in attendance until Cape Wolstenholme was cleared. Though progress was possible by keeping close to the coast off Digges Islands it was pretty obvious that solid pack stretched for miles along their whole length at a distance of about 4 miles north of the coast. After clearing Cape Wolstenholme the ice cover rapidly decreased and the last floes were met at the western end of Charles Island. On the south shore of the Island no ice at all was seen. Later, some large icebergs were observed in Hudson Strait, but there was no pack ice. Sea temp. was 30·5°F at 1800 on 11th in 62° 12'N, 79° 00'W.

Notes on the wild life:

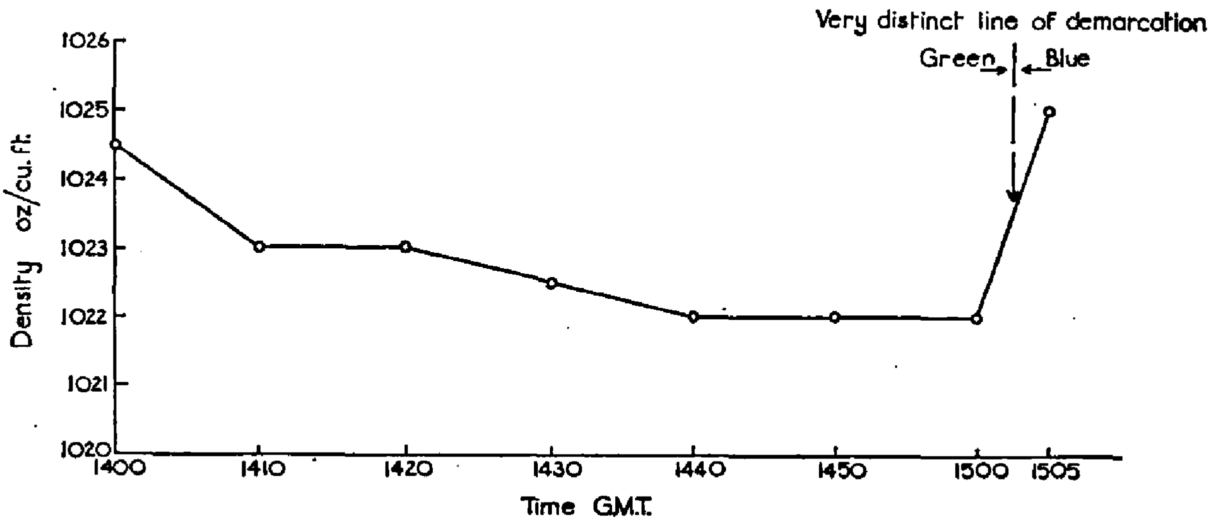
In Churchill harbour, one glaucous gull was seen in company with Herring gulls. The only bird life observed in Hudson Bay were Herring and Iceland gulls and several flocks of black ducks, probably Scoters.

In the ice described above, a very large seal or walrus was seen stretched out on an ice floe. Many Guillemots were also seen in the Hudson Strait in addition to Iceland and Herring gulls, and on one occasion a school of whales was noted, but the type could not be determined as they did not rise far enough out of the water. Off the Button Isles we were met by large numbers of Fulmars, Kittiwakes and Little Auks. The observation seems to suggest that the Fulmar, though common all over the North Atlantic, does not appear to venture far, at least not in large numbers, up the Hudson Strait. None at all were seen in Hudson Bay.

SEA WATER DENSITY CHANGE
off Rio Magdalena

m.v. *Rakaia*. Captain F. S. Angus, RNR. Curaçao to Panama. Observer, Mr. N. Drummond, 3rd Officer.

12th October 1965. From 1400 GMT, D.R. position 11° 27′N, 74° 51′W until 1505, D.R. position 11° 21′N, 75° 06′W the sea water density was taken at 10 min intervals to try to determine the limits of the outflow from the Rio Magdalena. The values found are shown in the accompanying graph. The western limit of 'fresh' water was plainly seen as there was a very clean-cut line between the green and blue water.



The last two density readings, at 1500 and 1505, were taken as close as possible to the line of demarcation, the eastern limit of which was not so clearly defined as the western, as the water changed only gradually from blue to green. Throughout, the sea water temperature remained steady between 82° and 82·5°F.

Note. The two D.R. positions bore 360° (T) and 315° (T) respectively from the river mouth.

FISH SPAWN
North Indian Ocean

s.s. *Orcades*. Captain R. J. Brittain. London to Sydney. Observer, Mr. N. R. Messinger, Sen. 4th Officer.

4th–6th July 1965. From Long 60°E, along a course line of 100° (T) to Minicoy Island, vast amounts of fish spawn were seen continuously for two days. The presence of the spawn was more marked at night when it became phosphorescent and and appeared to bubble to the surface. Occasionally a streak of white foam was seen passing rapidly through it.

Mean sea temp. 85°F. Wind SW'ly, force 4–5.

Position of ship at noon on 5th: 9° 00′N, 67° 48′E.

Note. Dr. P. H. Greenwood of the Natural History Museum comments:

"This certainly is a very interesting observation but only a collection made at the time and properly preserved would enable us to make really worthwhile comments. My principal concern is the identity of this substance. I doubt very much whether it was fish spawn. Admittedly, very little is known about the spawning habits of marine fishes, but I have no knowledge of any fish spawn which would appear in this way. There are, of course, a number of other marine organisms whose spawn it might be, and the substance could be composed of adult animals."

Note 2. This observation is published because it provides a salutary example of how a potentially valuable observation of this nature can be spoiled through not being backed up by a specimen. This is a point which has frequently been mentioned in *The Marine Observer* and in letters to shipmasters, particularly concerning narratives of discoloured water. All Port

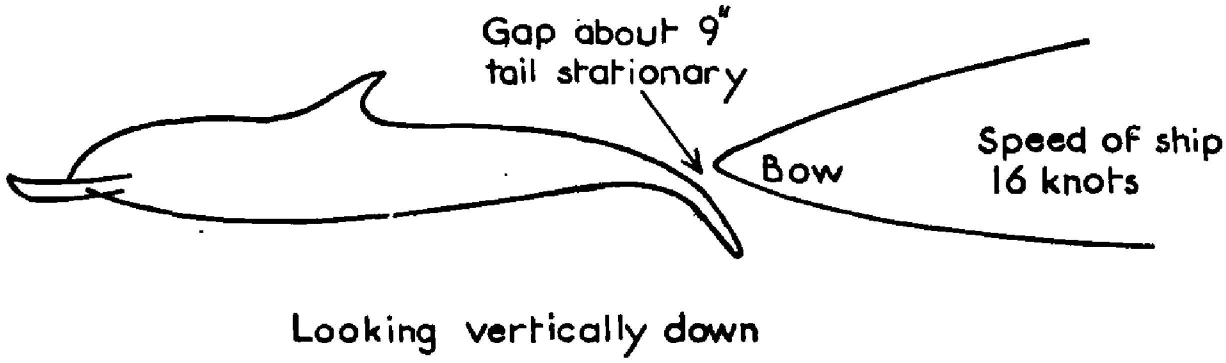
Meteorological Officers in the U.K. carry a stock of bottles and preservative, together with full instructions for their use, and these are readily available on request. Ships' officers are urgently requested to keep a few of these bottles by them and to do their best to obtain specimens to back up their narratives.

PORPOISES

vicinity of Cape Trafalgar

m.v. *Port Wellington*. Captain K. W. Allen. London to Port Said. Observer, Mr. R. L. Goodworth, 4th Officer.

9th November 1965. The vessel was approaching the Strait of Gibraltar from the west at 16 kt about mid-afternoon when I noticed away on the starboard bow a school of basking porpoises. As the vessel approached they moved in a direction to cut across the bow. I went up to the forecastle head and, looking over, saw eight of them keeping station on the bow. This in itself may be quite usual but further observation showed that they were not actually swimming, i.e. not moving their tails. They progressed at the same speed as the ship whilst also performing various acrobatics. Two or three of them during their manœuvres were lying on their sides in such a position that I was amazed that they were not washed on to the stem bar.



Another movement they made was a spiral consisting of three or four complete turns, about one turn per second, with their backs always on the outside of the spiral, the axis being along the direction of travel of the ship. They also performed many jumps which enabled me to see that they were all eight feet long. The duration of their stay was about 6 min and the most amazing thing was that they started to make their characteristic squeaking noise in the last minute before they left. I strongly believe that they were communicating with one another as if they were giving a signal to leave. As regards the forward motion without movement of the tail, I think that they were riding on some sort of standing wave. It could not be the usual bow wave as such waves are not produced until the bow has passed, except in the case of tankers, which push water ahead of them.

Position of ship at 1500: 36° 06'N, 6° 06'W.

Note. Dr. F. C. Fraser of the Natural History Museum comments:

"Mr. Goodworth's observations corroborate in detail those made previously by people interested in dolphins bow-wave riding. The subject has been considered for quite a number of years and in an article on the subject published in *Science*, vol. 129, P. F. Scholander wrote: 'If, therefore, the porpoise, assisted by his pectoral fins, steers himself horizontally and leans his tail fluke against the upwelling water of the bow wave, he cannot help but be pushed along with the ship. As the water, in fact, is thrust not only upward and forward but also outward, he may ride keeled over on the side if he wishes. Moreover, as this mode of propulsion does not require that his lungs be empty, he need not take his ride in silence but may whistle to his fellow freeloaders as much as he deems fit. This, I believe, is the way dolphins ride the bow wave, and if it is not, they should try.'

"Much work has been done on vocal inter-communication among dolphins and there is no doubt about their capacity in this direction. Mr. Goodworth is more fortunate than I myself because he could hear the squeaks. In 1946, I observed dolphins playing at the bows of the vessel I was in at the time. My shipmates could hear the squeaks but they were at a pitch beyond my upper threshold of hearing.

"The spiral movements of dolphins leaping from the water into the air has also been observed (*Journal of Mammalogy*, vol. 44)."

LUMINESCENCE

Mediterranean Sea

s.s. *Mobil Enterprise*. Captain John L. James. Naples to Sidon. Observer, Mr. C. J. C. Harker, 3rd Officer.

29th October 1965. At 0040 LMT, although the sea was only rippled, the water disturbed by the passage of the vessel was seen to be luminescent, the colour being white or green; the intensity varied between bright and dim. The radar was off at this time. Though no luminescence could be seen away from the vessel, it was thought worthwhile to shine the Aldis lamp on the water and see what the result would be. The beam from the Aldis was played on the water at various distances all around the ship, using flashes of long and short duration, but no effect at all was seen.

Occasionally there were small, isolated pieces of bioluminescence and when the light was played on these they became invisible until the lamp was switched off, when they were no brighter than before. On the other hand there were occasional small points which lit up like cat's eyes under the lamp, but when the light was removed they were not visible. This is one example of several recent trials made, sometimes with the radar on, which gave similar results. These may be of interest because the results are very different from some reports from the Indian Ocean published in *The Marine Observer*. Wind SSE, force 1. Sea rippled.

Position of ship: 33° 00'N, 17° 42'E.

off E. Coast of Oman

s.s. *Mobil Endeavour*. Captain F. L. Curtis. Suez to Bandar Mashur. Observer, Mr. A. F. Marston, 2nd Officer.

1st November 1965. When the vessel was off Ras-al-Jumaila at 1500 GMT, the bow wave was a brilliant milky white, as were the tops of the wave crests when on the point of breaking. The light from the Aldis lamp when shone on the glowing waves had no appreciable effect on the intensity of the luminescence.

At 1600 GMT when off Ras-al-Khebba, the bow wave and wave crests again appeared highly luminous, the wave tops being a brilliant green colour; there were also many luminous dots or spots on the surface of the sea which were visible for 10 min. Once again the Aldis light beam had little or no effect on the luminosity. Wind light. Sea calm. Sky cloudless. Moon in 1st quarter, overhead. Sea temp. 80°F.

Position of ship at 1500: 22° 06'N, 59° 36'E.

Mediterranean Sea

m.v. *Cannanore*. Captain L. C. Kingswood. Port Said to Hamburg. Observer, Mr. R. M. Eaton, 2nd Officer.

20th December 1965. At 0600 GMT numerous luminescent particles were seen in the sea, having the colour of stars. Tests were made by shining the Aldis lamp (1500 watts) on the sea surface at an angle of 45° from a height of 47 ft for various lengths of time from 1 to 5 sec but without results. The luminescent particles only appeared where the water was disturbed, as in the bow wave. Wind WSW, force 5. Overcast. Sea temp. 59°F.

Position of ship: 36° 30'N, 3° 40'W.

Note. A considerable number of accounts have been received of bioluminescence having been initiated or intensified when the light from an Aldis lamp has been directed on the sea surface. The experiments now described have been selected by Dr. R. H. Kay, University Laboratory of Physiology, Oxford, to show the other side of the picture—no stimulation resulting from the use of the Aldis light.

ABNORMAL REFRACTION

Gulf of Aden

m.v. *City of Wellington*. Captain H. Lewis. Suez to Aden. Observers, the Master, Mr. C. W. Rapley, Jnr. 2nd Officer and Mr. A. E. Struthers, 3rd Officer.

18th October 1965. At 2130 GMT, soon after passing Perim Island, it was noticed that a reflection of the light on Balfe Point (Perim Is.) was visible on the horizon to the south-east, appearing as the loom of a distant light. This continued to be seen until the vessel was about 20 n. miles from the Point, at which position the true light was seen only as a loom above the horizon. At all times the bearing of the false light was exactly opposite to that of the true light.

None of the lights of Aden were seen to be similarly affected as the port was approached. Air temp. 82·3°F, wet bulb 74·8°, sea 87·5° Wind SE, force 2.

Position of ship: 12° 35′N, 43° 30′E.

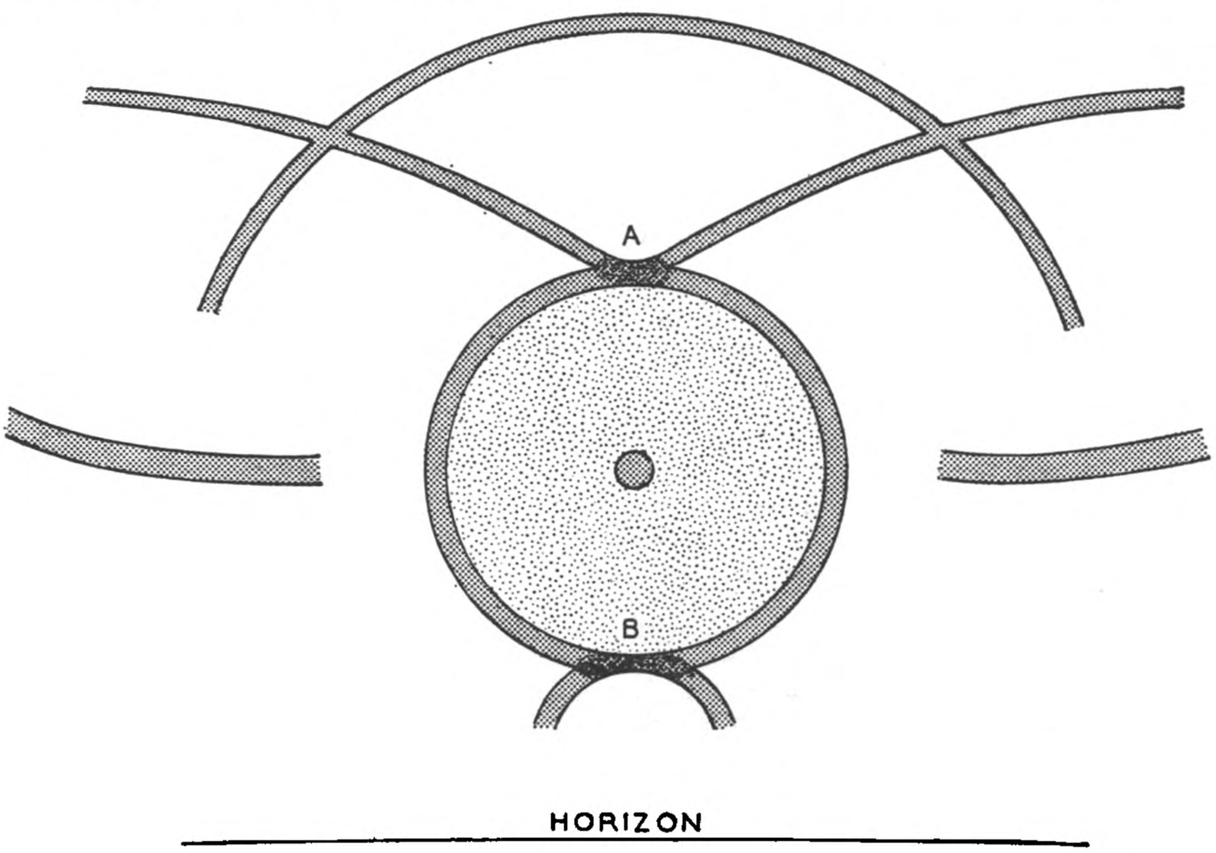
Note. This is the fourth report which we have had of this very interesting and rather rare phenomenon. Previous accounts were published in the following issues of *The Marine Observer*: January 1964, p. 19; October 1964, p. 180 and January 1965, p. 17. A note on the probable cause was given on p. 19 of the January 1964 issue.

SOLAR HALO COMPLEX

North Atlantic Ocean

m.v. *Nova Scotia*. Captain J. H. Williams. St. John (New Brunswick) to Liverpool. Observer, Mr. A. C. Herdon, 3rd Officer.

1st October 1965. The halo complex shown in the accompanying diagram was clearly seen from 1200–1600 GMT. The radius of the inner halo was 21° 26′ and that of the partial outer concentric halo was 46° 30′. Two wing-shaped arcs, each subtending an angle of about 54°, crossed the outer concentric halo, meeting at the



centre of their span directly above the sun and in contact with the upper edge of the inner concentric halo. At the point of contact a brilliant spectrum could be seen subtending an angle of at least 1¼°. About 1530, the most vivid period, two more haloes were seen. One was a white arc which would have stretched right across the halo complex, passing through the position of the sun, if it hadn't been rendered invisible by the glare. The other was a small, but vivid, inverted half halo of about 6° radius; it was in contact with the inner halo, its upper edge crossing the latter's lower limb. At this point also vivid colouration was seen. Altitude of sun: 21° 50'; bearing 094°. Cloud, Cs and As.

Position of ship: 43° 16'N, 66° 15'W.

Note. It is quite unusual for a halo-complex such as this to be reported, and we are glad to publish Mr. Herdon's interesting description of it.

BLUE FLASH AT MOONSET

off Muscat

s.s. *British Destiny*. Captain A. Lawson. Kharg Island to Suez. Observer, Mr. D. Roberts, 3rd Officer.

1st December 1965. Through binoculars, a blue flash was observed as the moon set behind the mountains at Muscat. The atmosphere was exceptionally clear and dust free. Sky cloudless. Air temp. 75·7°F.

Position of ship at 1800: 24° 12'N, 58° 24'E.

Note. The blue flash phenomenon seen at sunset or moonset is essentially the same as the green flash, but in the case of the moon it has been less often observed. Due to the long passage of the white rays of the sun or moon through the atmosphere, almost the only rays which escape the effects of absorption or scattering are the red and blue–green. Refraction causes the blue–green rays to appear at the top of the disc, while the red occur at the lower edge. The blue–green rays are thus the last to be seen at the moment of setting.

EXCEPTIONAL VHF PROPAGATION

Arabian Sea

s.s. *British Destiny*. Captain A. Lawson. Aden to Mena-al-Ahmadi. Observer, Mr. D. Roberts, 3rd Officer.

29th October 1965. At 0600 GMT while the vessel was passing Masira Island, clear speech contact by VHF, RT, was made with m.v. *British Seafarer* anchored at Karachi. Channels 16 and 12 were used for approx. 5 min, after which the signals became distorted. The distance was 510 miles: the normal range of VHF is 20–70 miles. Sky cloudless. Visibility over 30 miles. Air temp. 79·7°F. Wind NW, force 2.

Position of ship: 20° 30'N, 59° 06'E.

Note. Mr. G. O. Evans of the Post Office Engineering Department comments:

"The clear speech radio contact over a distance of 510 miles was probably associated with weather conditions which could give rise to long distance VHF radio reception. Such conditions have often been observed in the Arabian Sea area.

"Reception of VHF radio signals at distances well beyond the normal range can occur when conditions in the atmosphere are such that the transmitted rays are bent so that they follow the earth's curvature.

"These conditions usually occur when the air becomes drier as the height above the surface of the sea increases and are often associated with low wind speed and fine weather. In the Arabian Sea area they may arise from hot dry air from the adjacent land mass extending for some distance over the sea. This will occur during the forenoon as the land mass heats up more rapidly than the adjacent sea.

"It may be of interest to note that records exist of radar sets operating from the Indian coast on 60 mc/s picking up echoes from the land mass of the East African coast over distances of 1,500 miles."

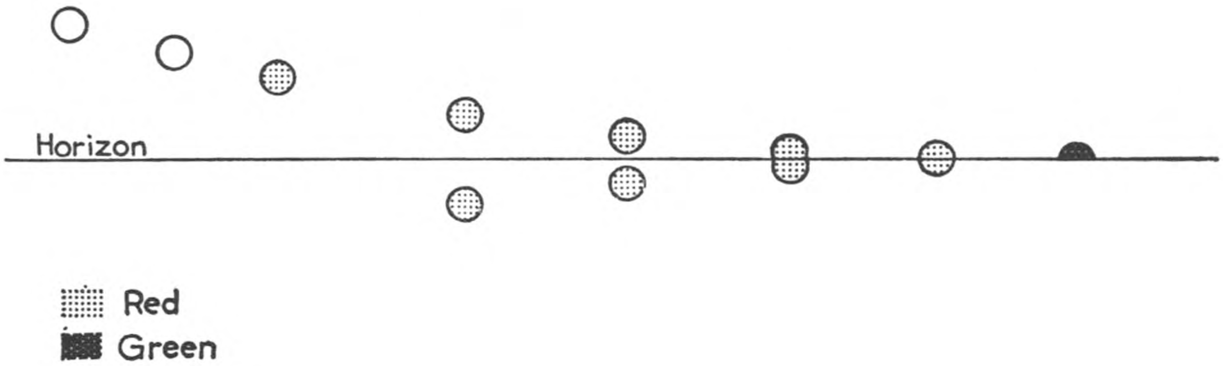
VENUS—ABNORMAL REFRACTION

Gulf of Aden

m.v. *Delphic*. Captain C. A. Borthwick. Aden to Suez. Observer, Mr. M. H. Murray, 3rd Officer.

11th November 1965. At 1744 GMT when Venus was about to set, bearing 237°, it changed from yellowish white to red. Shortly afterwards the planet appeared double, i.e. with a red image a short distance beneath the true disc. The image was below the horizon line and it gradually rose to meet the horizon as Venus decreased in altitude. At the moment of disappearing the two red discs coalesced and for an instant changed to a light green colour. The various phases of the phenomenon are shown in the accompanying sketch. Air temp. 79°F, wet bulb 75°, sea 79°. Sky cloudless. Wind NE'E, force 3.

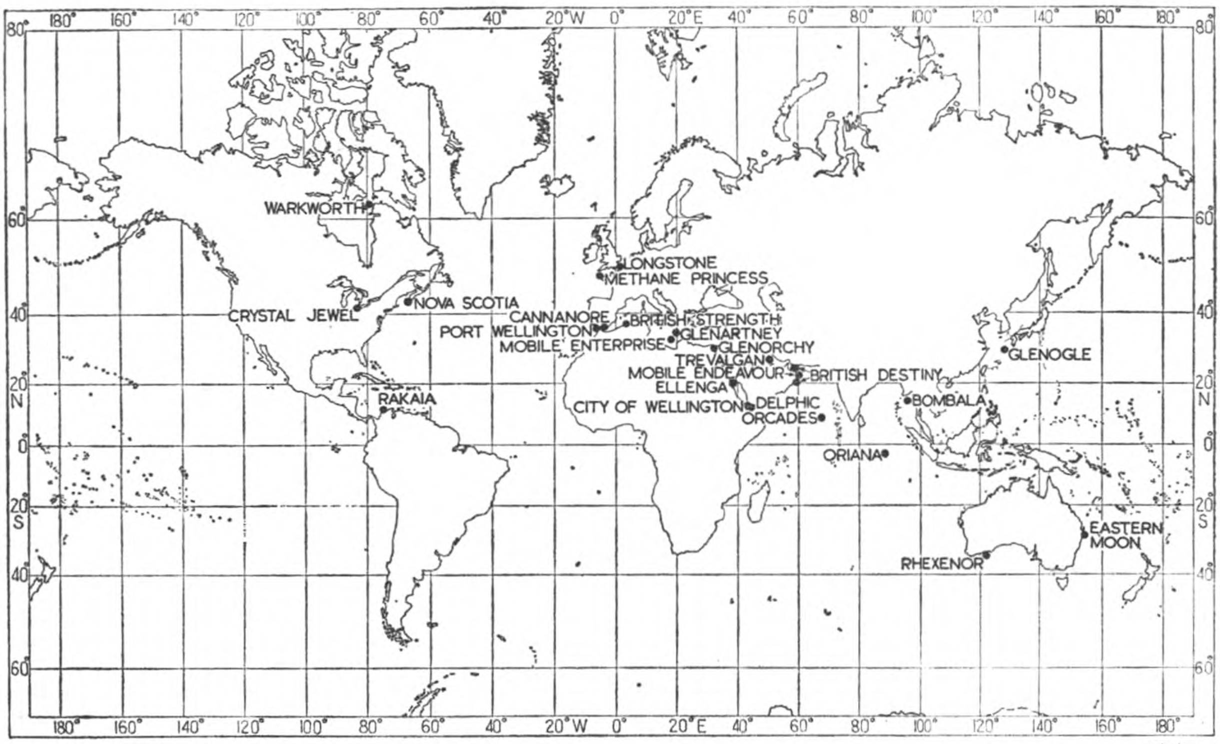
Position of ship: 12° 35'N, 44° 37'E.



Note. The phenomenon described by Mr. Murray seems to be due to a combination of the effects of mirage and the well-known green flash. Venus is seen directly, while underneath it is its reflected image, with the horizon lying between. The yellow-white rays from the planet have an increasingly long distance to travel through the atmosphere as it nears the horizon and, due to absorption and scattering, only the red and blue green rays are left, the red being visible at the bottom of the disc and the green at the top. As the planet disappeared below the horizon the last colour to be seen would be the green at the top of its disc.

COMET IKEYA-SEKI, 1965 f

This comet, which was visible mainly in low latitudes between late September and early December 1965, has so far been reported to us by 83 ships. All the observations have been sent to Mr. Ridley of the British Astronomical Association and all the observers were informed that he would be contributing an article about it to this number of *The Marine Observer*. We very much regret that it has not been possible to include the article in this issue but it is hoped to publish it in the January 1967 number.



Positions of ships whose reports appear in " The Marine Observers' Log".

AURORA

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

"Reports of aurora from British ships for the period October–December 1965, with the addition of one just received for September (welcome to m.v. *Warkworth,* another new name in our list) are briefly summarized in the following list. Solar activity continued at a low level and the reports again come from ships located in higher latitudes.

"Displays were reported in detail from m.t. *St. Giles*, positioned in the auroral zone off the south coast of Greenland, for the nights 30th–31st October and 1st–2nd November. Here, even during quiet solar periods, the aurora can be at its most spectacular, and we hope that the resultant cricked neck of the observer at this time was only a temporary disability.

"A simple sketch from the *Weather Monitor*, made on 12th December, illustrates the helpfulness of such sketches to transmit information of irregularity of form which may be difficult to describe adequately by means of the usual symbols.

"So far this season—these notes are being written at the end of June—there have been many interesting reports of noctilucent cloud observations from land-based observers. Watchers in the South of England were rewarded by seeing clouds on 27th–28th June when the display was visible much further south than usual. Exchange of data on the clouds has been speeded up between collecting centres in Alaska, Estonian SSR and Edinburgh. In order to ascertain the extent of the clouds, observations made on ships would be most valuable. We realize that recognition of these clouds is still not widespread, but doubtful observations can be assessed at the data centre.

"Many thanks to all observers and those involved in ensuring that the reports are received at the Balfour Stewart Auroral Laboratory, University Meteorology Department, Drummond Street, Edinburgh. We ask again for your continued cooperation."

Note. Details of noctilucent clouds are given in the *Marine Observer's Handbook.*

DATE (1965)	SHIP	GEOGRAPHIC POSITION	Λ	Φ	I	TIME (GMT)	FORMS
25th Sept.	*Warkworth*	60°00′N 58°15′W	020	71	+80	0001–0600	All forms
28th	*Warkworth*	60°00′N 88°25′W	350	71	+84	0400–0520	All forms
2nd Oct.	*Silversand*	55°42′N 42°06′W	040	65	+73	0300–0600	RR, V
5th	*Dukesgarth*	52°30′N 17°00′W	070	59	+69	2100–2115	HA, P
21st	*Aldersgate*	58°00′N 32°00′W	050	67	+74	—	N
22nd	*Sagamore*	53°24′N 42°42′W	040	64	+73	2000–dawn	HA ,RR, N
	Aldersgate	55°36′N 43°30′W	040	65	+74	2230	N
23rd	*Aldersgate*	55°12′N 44°42′W	030	65	+74	0001–0800	HA
	Sagamore	53°42′N 35°24′W	050	64	+71	2000–0615	RA, RR, N
	Weather Surveyor	59°20′N 18°35′W	070	65	+72	2100–2300	N
26th	*Weather Surveyor*	59°06′N 18°20′W	070	65	+72	0001–0200	N
27th	*Weather Surveyor*	59°00′N 19°25′W	070	65	+72	0300, 0500, 0600	N
30th	*St. Giles*	59°45′N 43°45′W	040	69	+76	2245–0055	HA, RB, RR, P, N
31st	*Weather Surveyor*	59°06′N 19°35′W	070	65	+72	0001, 0300–0500	N
1st Nov.	*Weather Surveyor*	59°00′N 19°00′W	070	65	+72	0001	N
	St. Giles	59°40′N 40°40′W	040	69	+75	2315–0200	HA, RA, RB, P, N
	Weather Adviser	61°09′N 29°24′W	060	69	+76	2330	RA
2nd	*Weather Surveyor*	59°00′N 18°35′W	070	65	+72	0001–0200	N
	Weather Adviser	61°14′N 29°40′W	060	69	+76	0145–0400	HA, RA, N
4th	*Weather Surveyor*	59°05′N 18°35′W	070	65	+72	0200	N
6th	*Weather Adviser*	62°02′N 33°10′W	060	70	+76	2330–2350	RA
13th	*Weather Adviser*	61°52′N 33°22′W	060	70	+76	2045–2215	HA, RB, RR
14th	*Weather Adviser*	61°57′N 33°00′W	060	70	+76	1950–0100	HA
16th	*Weather Adviser*	61°56′N 33°10′W	060	70	+76	1955–2330	N
17th	*Weather Adviser*	61°52′N 33°27′W	060	70	+76	2350	HB
20th	*Weather Adviser*	61°56′N 33°07′W	060	70	+76	0250–0400	HB, V, P
		61°55′N 33°10′W	060	70	+76	1955–0100	HB, RA, V, P
21st	*Weather Adviser*	61°57′N 33°00′W	060	70	+76	0350	V
		62°04′N 33°08′W	060	70	+76	0840	HB
		61°57′N 33°00′W	060	70	+76	2030–0700	HA, V, N
22nd	*Weather Adviser*	61°56′N 33°02′W	060	70	+76	1945–2400	HA, V, N
23rd	*Weather Adviser*	61°57′N 33°08′W	060	70	+76	1950–2400	V, N
		61°54′N 32°50′W	060	70	+76	0600	RA
24th	*Weather Adviser*	61°54′N 30°36′W	060	70	+76	2000–2200	RA, N
	Weather Monitor	60°40′N 28°05′W	060	68	+74	2100–0500	RB, N
25th	*Weather Adviser*	61°11′N 29°30′W	060	70	+76	0100, 0300, 0600	N
	Weather Reporter	58°58′N 18°47′W	070	65	+72	0600, 0700	N
	Weather Monitor	61°30′N 31°35′W	060	69	+75	2100–2400	N
	Weather Adviser	59°48′N 23°02′W	070	66	+74	2345	V
26th	*Weather Monitor*	62°00′N 32°35′W	060	70	+76	2300	N
27th	*Weather Monitor*	62°00′N 32°35′W	060	70	+76	0100–0400	RB, N
		61°50′N 32°50′W	060	70	+76	2300–0100	N
28th	*Weather Monitor*	61°42′N 32°55′W	060	70	+76	0500	HA
29th	*Weather Monitor*	61°55′N 32°50′W	060	70	+76	2200, 2300	HA
30th	*Weather Monitor*	61°55′N 32°50′W	060	70	+76	0200, 0300	N
4th Dec.	*Weather Monitor*	62°00′N 32°55′W	060	70	+76	0300	P
10th	*Weather Monitor*	61°50′N 32°50′W	060	70	+76	2141–2200	RB, RR
11th	*Weather Monitor*	62°00′N 33°30′W	060	70	+76	2100, 2200, 2400	HA
12th	*Weather Monitor*	62°00′N 33°30′W	060	70	+76	0200, 0300	HA, RR
14th	*Weather Monitor*	62°00′N 33°25′W	060	70	+76	2300	HA
18th	*Weather Monitor*	62°05′N 32°25′W	060	70	+76	0001, 0200	N
						1845–2000	RR,N
	Weather Surveyor	59°00′N 18°05′W	070	65	+72	2000–2200	N
19th	*Weather Monitor*	59°30′N 23°05′W	060	66	+74	2100–0300	RR, N
	Weather Surveyor	58°55′N 19°05′W	070	65	+72	2345–0330	P, N
24th	*Weather Surveyor*	58°50′N 19°30′W	070	65	+72	0200	N
		58°40′N 19°50′W	070	65	+72	2200–2400	P, N
25th	*Weather Surveyor*	58°40′N 19°35′W	070	65	+72	0200–0500	N
		59°00′N 19°10′W	070	65	+72	2345	N
26th	*Weather Surveyor*	59°00′N 19°40′W	070	65	+72	2200, 2300	N
27th	*Weather Surveyor*	59°00′N 19°05′W	070	65	+72	2300	N

KEY: Λ = geomagnetic longitude; Φ = geomagnetic latitude; I = inclination; HA = homogeneous arc; HB = homogeneous band; RA = rayed arc; RB = rayed band; R(R) = ray(s); P = patch; V = veil; N = unidentified auroral form.

DISCUSSION ABOUT WEATHER ROUTEING OF SHIPS

On 9th March a special informal meeting was held aboard the *Wellington*, Headquarters ship of the Honourable Company of Master Mariners, alongside the Victoria Embankment in London, to discuss various aspects of weather routeing of ships, its value for economic and safety purposes and its techniques.

Up to the present British shipowners and ship masters have not shown much interest in weather routeing nor do they seem to have fully realized the practical value of facsimile maps to the mariner, not only to assist in weather routeing, but for other purposes. Weather routeing is a subject which has been discussed a couple of times at meetings of the Institute of Navigation and articles on the subject have appeared from time to time in *The Marine Observer*. The purpose of this meeting aboard the *Wellington* was to ventilate the subject a bit more and to try and find out the present views of shipowners and ship masters.

The Master of the Honourable Company, Commander H. G. Morison, D.S.C., R.D., R.N.R., presided and there was a large attendance.

Six principal speakers read papers of exactly 15 minutes' duration, each paper being followed by 10 minutes' discussion.

In view of the importance of this subject, each of the papers and its relevant discussion will be published in *The Marine Observer*, the first three being in this number and the remainder in the January 1967 number.

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Discussion on Weather Routeing of Ships

THE GENERAL PROBLEM OF WEATHER ROUTEING BY THE SHIPMASTER HIMSELF OR AS ADVISED BY THE METEOROLOGIST ASHORE

By C. E. N. Frankcom

(Marine Superintendent, Meteorological Office)

Weather routeing, in its widest sense, can be defined as the art of taking advantage of all available meteorological and oceanographic information in order to get the safest and most favourable passage for a ship.

There is nothing new about weather routeing; in some form or other it has been practised by mariners as long as there have been ships. Before radio came into the picture, weather routeing was based entirely on the climatological aspect, in other words upon knowledge and experience of seasonal winds and ocean currents. The recommended routes in the Indian Ocean and China Sea, with their monsoon winds and reversing currents, give a striking example of this. During the 19th century the sailing-ship master practised it extensively on a worldwide basis. The modern Admiralty publication *Ocean Passages of the World* reminds us of the weather routes that sailing ships were advised to take in the various oceans and also contains recommended routes for steamers, based on climatological considerations which still hold good. As another example we have the 'concise rules for the avoidance of tropical storms', which have been practised by mariners since about 1840.

The modern form of weather routeing involves synoptic meteorology as well as climatology.

Since about 1920, except during the war years, radio bulletins for shipping have included enough ship reports to enable shipmasters to construct their own crude weather maps. Early editions of *The Marine Observer* show that it was not infrequent in those days for a master to alter course as a result of some such map, combined with information given in the written bulletin, to avoid the worst of a particular depression. Since 1948 most meteorological services have issued, by radio, coded analyses whereby the shipmaster can reconstruct the weather map for any particular time, as drawn in the meteorological office. To assist in completing the picture a number of ship reports and land station reports are added to the radio bulletin, which also contains a written statement of the general weather situation and a forecast for the next 24 hours in that area. In the Atlantic, for example, the U.K. bulletins cover the area north of 35°N and out to about 40°W, whereas the U.S.A. and Canada cover the western part of the Ocean and there is an overlap between the two areas. The analysis message also contains data for drawing a prognostic map.

The study of meteorology, including the plotting of a coded analysis, forms part of the Board of Trade exams for masters and mates. Unfortunately, it takes about half an hour for an experienced officer to plot an analysis and there is the disadvantage, for example in the middle of the North Atlantic, where the overlap occurs between the analyses issued by the U.S.A. and U.K., that two analyses have to be married, which adds to the burden of the job on the part of the officers concerned. Nevertheless, many officers do plot these bulletins and it is not unusual for the course or speed of the ship to be adjusted in order to avoid the worst of the weather on occasions when it is fairly obvious, from a study of the map, that such action is likely to be useful.

A recent improvement in communication, from the viewpoint of the shipmaster, is the use of facsimile which has not yet been fully exploited. By this system, complete weather maps of oceanic areas are broadcast by radio by meteorological services throughout the world on a fixed schedule. The U.K., for example, broadcasts every six hours an analysis and 24-hour prognostic for most of the Atlantic and once a day they issue a 48-hour and 72-hour prognostic map for the same area and ice maps for the northern hemisphere. The U.S.A. and Canada issue similar maps and also actual and forecast maps showing the height, period and direction of waves.

All these facsimile maps are transmitted on such frequencies that they can be received aboard any ship with a suitable radio receiver. At present facsimile equipment combined with a specially designed radio receiver is obtainable in this country either on purchase or on hire maintenance. It seems that the best place for it is the chart room or wheelhouse. So far only about 15 British ships are so fitted.

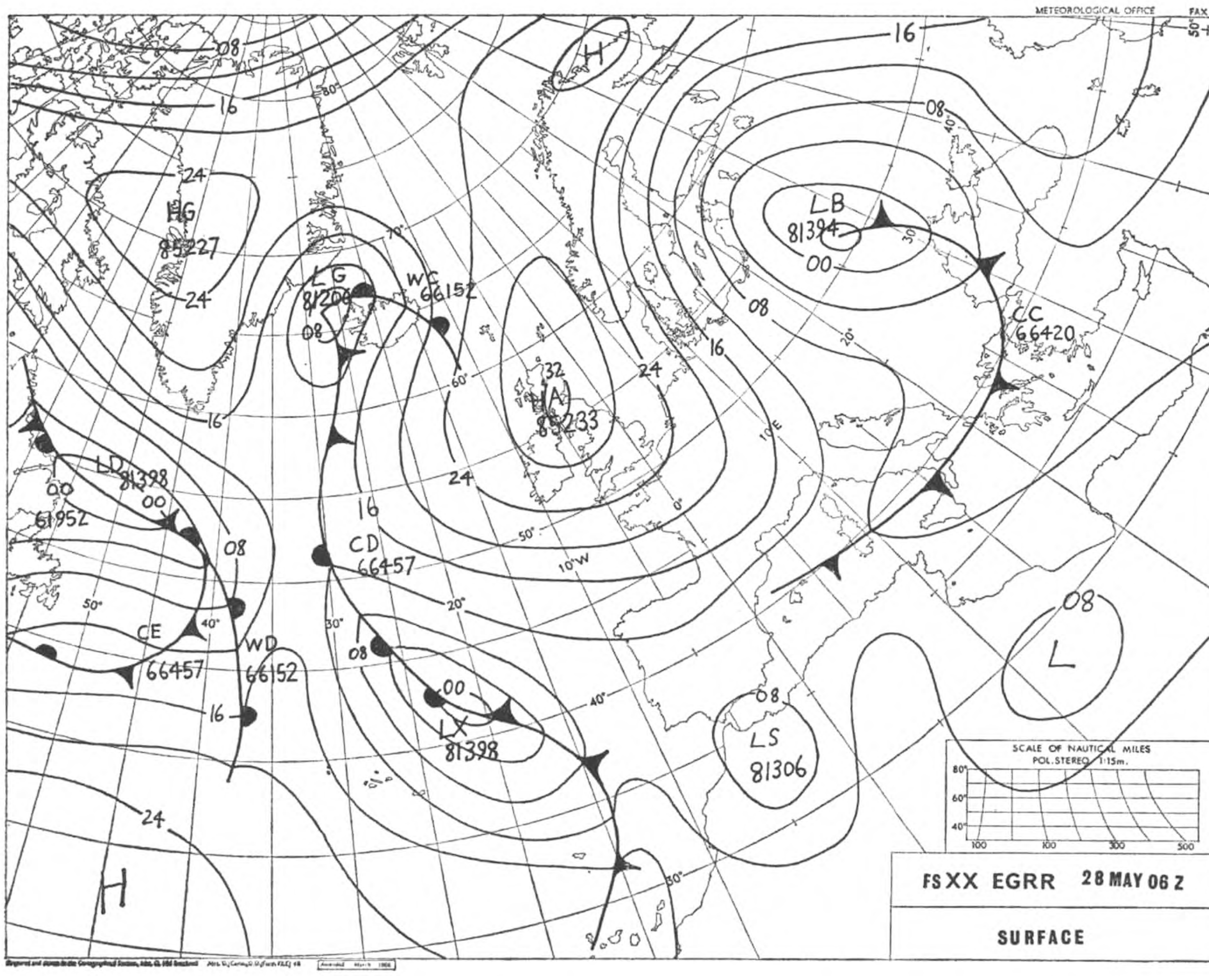
If a ship is fitted with facsimile the master has before him a more or less constant picture of the weather situation on the ocean in which his ship is located and, to assist him in interpreting this, he has the ship reports broadcast in the radio bulletin and also the written statement of the weather and the forecast. These prognostic and analysis maps show isobars and fronts, centres of highs and lows and certain coded information from the International Analysis Code. Facsimile does away with the necessity of the ship's officer having the laborious business of plotting the map and for various practical reasons it presents a much truer picture of the weather as seen by the meteorologist than the officer could draw from the coded analysis message. A surface prognostic chart, FSXXX, is shown on page 188.

It is my contention that, if he has kept his meteorology reasonably up to date, any master mariner should be able to understand and make use of all these facsimile maps.

The days of the 10–12 kt ship are rapidly passing into history; the speed of the average ocean-going cargo ship nowadays seems to be about 15 kt and speeds of from 18 to 20 kt are by no means unusual. It seems, as a result of this increase in the speed of the average ship, combined with advances in meteorological technique and hence the accuracy of forecasts, that synoptic weather routeing has become a practical proposition. Synoptic weather routeing implies nothing more than making a continuous study of the wind and wave situation throughout the passage of the ship and making whatever adjustments to course and speed as are considered prudent, in order to get the safest and most favourable passage. The most favourable passage does not necessarily mean the shortest one but it may well mean the smoothest, with the result that the ship suffers the least damage to herself or her cargo and enables the most work to be done aboard the ship during the passage. The fuel consumption is also kept reasonable and, although she may steam a slightly greater distance, her arrival in port is no later, perhaps a little earlier, than if she had proceeded on the shortest route.

The modern theory, which has probably always been recognized by seamen, is that waves are the element which have the most adverse effect on the ship's movement through the water and this applies whether the waves be sea or swell. The aim of weather routeing, therefore, is to avoid the areas where the waves are highest.

The conventional form of synoptic weather routeing of ships as it is understood at present means that, at the request of a shipowner, a meteorological service or a commercial meteorological organization provides the master of the ship with daily



A typical surface prognostic chart as broadcast by radio facsimile.

advice, by radio, as to the route he should take during a particular passage across an ocean, to avoid, whenever practicable, waves in excess of (say) 4 metres in height. Meteorologists in the United States have been the pioneers of this form of weather routeing, and since 1954 the U.S. Naval authorities have regularly provided this facility for their military sea transport ships. These vessels provided ideal guinea-pigs for the experiment, and in the early days some ships were deliberately routed by the shore authorities in this way, while other ships were left to their own devices and a study of the results claims that, in general, the routed ships did somewhat shorter and more economical passages, burned less fuel and suffered less damage to ship and cargo than those which were not routed. This weather routeing technique is to ascertain the distribution of waves for as long as possible into the future along the normal route of the ship from the point of departure to the destination. First of all 3- to 5-day prognostic charts of surface weather and waves along the anticipated track are constructed. An estimate is then made of the reduction in the ship's speed likely to occur due to meeting waves of different heights, based upon the estimated performance of the ship from actual experience during service. A map is then drawn for each day of the period showing isopleths of ship speed on various courses through the anticipated waves. By continuing this process, the least-time track is computed and the master is advised as to the initial track on which he should proceed. From time to time during the passage, the meteorologist will recommend to the master any amendment to the track that he considers desirable; alternatively a reduction or increase in speed may be recommended and this process continues throughout the voyage. In order to get the best out of weather routeing, it seems desirable to have a facsimile receiver aboard the ship so that the master can have before him some of the maps that the meteorologist has consulted. The U.S. Naval authorities provide this facility only for vessels operated by the U.S. Government.

Commercial meteorological organizations in the United States provide weather routeing to merchant ships of any nation on repayment.

In 1960, the Netherlands Meteorological Institute, at the request of the Holland-America Line, started a ship routeing programme, based upon the U.S. procedure. Mr. Tunnell, in his talk, will describe in some detail the Netherlands technique.

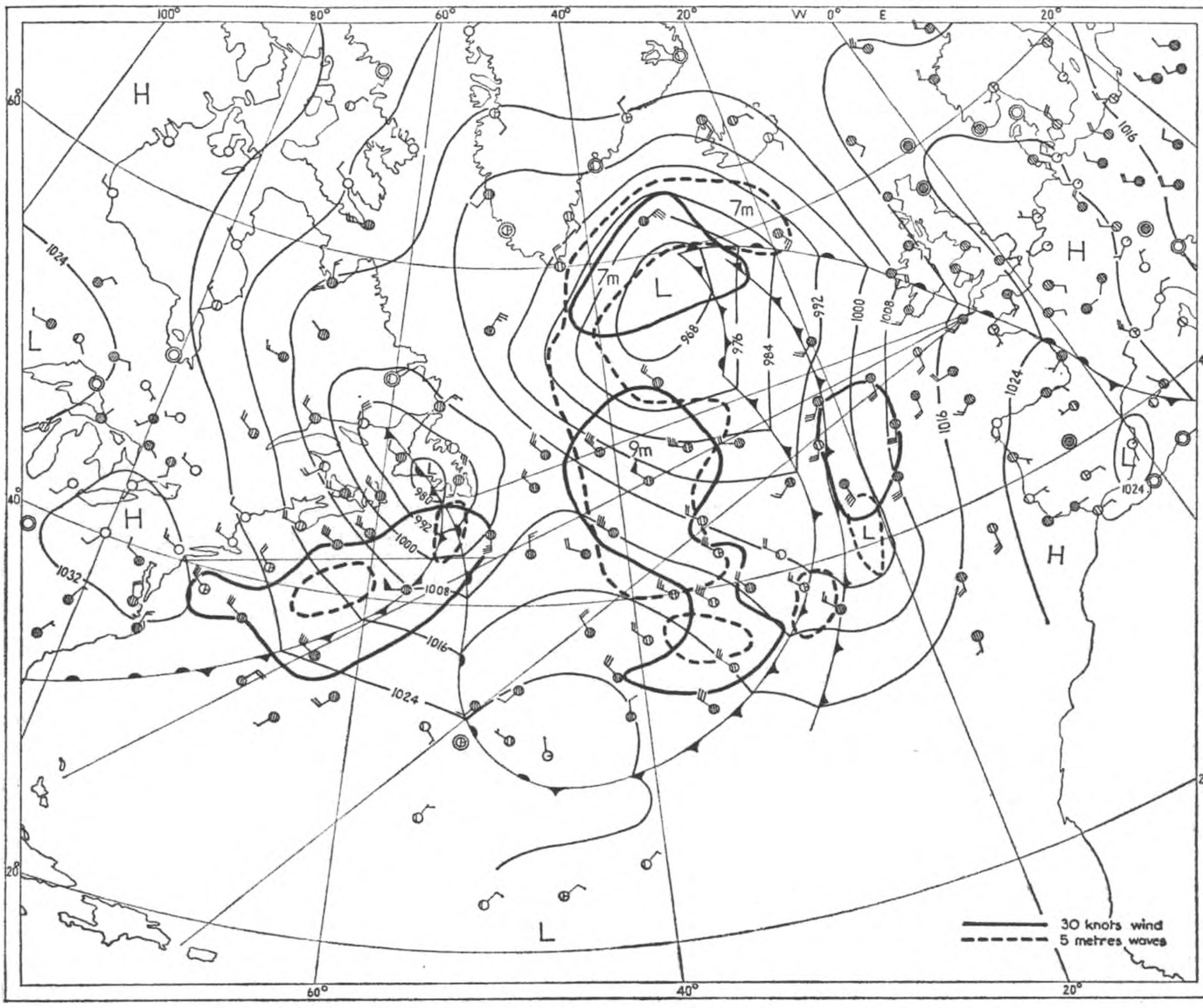
The general tendency of these weather routeing techniques seems to be that the resultant ship's track is a combination of rhumb lines and a great circle; the diversions do not necessarily have to be very drastic.

Weather routeing advice from the shore has to be tailor-made for the ship concerned. The shore authorities need to know quite a lot about the particular ship's behaviour in a seaway and as this is a personal service the shipowner has to pay for the facility. I understand that the cost is not very high. When routeing from the shore it is only guidance and advice that the meteorologist can give: the responsibility as to whether he accepts the routeing advice must rest with the master and he must be free to accept or disregard it if he thinks it right to do so. It seems desirable, for various practical reasons, that the routeing officer should be, or be advised by, a Master Mariner. It seems to me that weather routeing across the North Atlantic can be of limited value to passenger ships and to cargo ships on certain trades which are restricted to the North Atlantic lane routes.

The success of synoptic weather routeing depends largely upon the available network of meteorological observations and this is largely the reason why, in my opinion, weather routeing from the shore is only likely to be successful, for many years to come, on certain North Atlantic trades, where there is always a good network of ships' observations, and to a limited extent in the North Pacific. It is obviously desirable that the routed ship should herself be a Selected Ship.

My personal view is that, although weather routeing from the shore can be beneficial for certain regular North Atlantic traders, the master of a ship provided with a facsimile receiver can get quite a lot of success in doing his own somewhat rudimentary weather routeing, consulting the meteorologist by radio when he is in any doubt or difficulty. With practice he might become quite proficient at it. The H/F radio telephone should be of great assistance to him in this for he can, thereby, speak directly to the duty forecaster at almost any meteorological service at any time of the day or night and seek his advice in this way for the mere cost of the telephone message and I think there is no doubt that almost all meteorological services would co-operate. Weather routeing by the master himself has the advantage of being world-wide in its application, because of the world-wide network of facsimile broadcasts and radio weather bulletins covering most oceanic areas which are now available. Nobody knows more about the behaviour of his ship in a seaway than her master. Although the average British Master Mariner, if he has kept reasonably up to date, should be able to interpret any of the facsimile maps that are likely to be of interest to him; if he does decide to try his hand at weather routeing, it might be desirable for him to have a short training course in this.

I have already mentioned the value of wave maps. It is fairly obvious that the sea wave situation is allied to the wind force and dependent upon the fetch and the length of time the wind has been blowing. If you superimpose the map of actual wave conditions on a synoptic map of the North Atlantic for example, in its normal stormy condition, it will be found that, to a large extent, the highest wave contours are in the vicinity of the steepest barometric gradient. It seems to me that the shipmaster might perhaps find it useful if he had, in addition to the analysis map, a map showing the wind field, in other words the isotachs or lines of equal wind force. The chart on page 190 shows a typical synoptic situation in the North Atlantic; on this the 5-metre wave contour and the Beaufort force 7 wind contour (wind speed 30 kt) are superimposed. Although it is true that these isopleths tend to follow the steepest barometric gradient there is quite a lot of divergence from it and some of the waves shown are probably swell waves.



Synoptic chart for 4th January 1966 with isopleths of wave height and wind speed superimposed.

I don't think there is any need, at present, to provide much in the way of special facsimile maps for mariners but it might be useful to show the direction of movement of weather systems and a few significant wind arrows in the analyses and to include daily wind field maps. Those maps which are already broadcast form part of the general international facsimile network and it is more economical to take advantage of these than to substitute any special facsimile service for shipping, because the cost of such a service would be appreciable. The snag is that the schedules for these facsimile transmissions are fairly tight at present because of the amount of information which has to be broadcast in order to satisfy international meteorological needs. When using facsimile there is only need to switch on for the particular maps that the mariner is interested in; the exact time at which the various maps begin transmission are published and kept up to date.

Facsimile maps are normally on the polar stereographic projection. It seems that the easiest way for the master to use them is for the ship's position and course line to be plotted on each facsimile map he needs to consult. This is a small task compared with plotting an analysis. One of the advantages of facsimile reception is that it is independent of the radio officer's watches in a 'single operator' ship.

To summarize, it is my opinion that weather routeing from shore is of value to ships regularly engaged in certain trades in the North Atlantic and perhaps in the North Pacific, particularly if those ships are on fixed schedules. The benefits are somewhat marginal, but any time in port that can be saved due to less time at sea and thereby minimizing stevedoring overtime, or anything that can be done to minimize damage to cargo due to heavy weather and to economize in fuel, is all to the good. For ships in trades other than the North Atlantic it seems preferable that the master of the ship should do his own weather routeing, aided by the facilities I have mentioned. Similarly, the masters of regular North Atlantic traders who don't wish to be routed from shore, can do some rudimentary but quite useful weather routeing themselves.

DISCUSSION

A questioner: I wonder, are the mariners being offered what they want in this particular service as regards the vital chart facilities, times of transmission and so on? I don't really think we have thought about it long enough. We certainly haven't discussed it and that is why we are here this afternoon. Are we really satisfied that what we get is what we want?

Commander Frankcom: It is very difficult to interpret the users' wishes because, so far, only 15 British ships are fitted and we don't hear a lot from them, with one notable exception, the Sugar Line, who do tell us what they think of the available facsimile maps. The surface analysis and prognostic maps, wave maps and ice maps, which I have already mentioned, are broadcast and I can't see what else could usefully be provided, other than a few minor improvements like showing occasional wind arrows on the surface analysis and prognostic maps. Showing these arrows isn't vital, because any seaman knows how the wind blows round a depression or anticyclone but to get the wind speed you need to put a scale across the gradient and that is one reason why I think occasional wind arrows would be useful. Arrows showing the direction of movement of weather systems would also help and another useful addition might be a chart with lines of equal wind force once or twice a day, to which I have already referred.

Captain C. J. Wennink (Shell International Marine): This is not so much meant as a question but should be seen as a follow-up to what Commander Frankcom has just said. We have at present two of these weather facsimile machines in our ships, one of British and one of German manufacture. Firstly the charts are often insufficiently clear where it concerns wave height prediction, as a result of which they afford little practical use to masters in evading adverse wave fields. Secondly the extent of the wave fields that may be encountered as a result of North Atlantic depressions is such that reasonably early action is essential to prevent adding too many miles to one's voyage. This requires accurate knowledge of anticipated wave heights, directions and wave length, and such information is not available from the present pattern of published charts. We will endeavour to make a comparison between the efficiency of shipboard weather routeing and that undertaken by professional meteorological organizations ashore but our shore-based routeing trial scheme, which we have been running for approximately a year and a half and which terminated on 1st March, has not yet been analysed and therefore I am not in a position to say how the two systems will eventually compare.

Captain J. Baird (Furness Ship Management): A remark has been passed here about the average shipmaster being very slow to take up this system. Well I think this may be a bit of a gimmick and mariners are conservative people. I am quite convinced that seafarers for many generations have been doing their own weather routeing. The average shipmaster is keen on this and he will not go through the centre of a storm if he can possibly avoid it. I would like to hear more about this weather routeing business, for it is a subject in which we are deeply interested.

551.509.5:629.12

The Techniques of Preparing Weather Routeing Advice Ashore

AN ACCOUNT OF THE SHIP ROUTEING METHODS DEVELOPED BY K.N.M.I. (THE ROYAL NETHERLANDS METEOROLOGICAL INSTITUTE)

By G. A. Tunnell

(Marine Branch, Meteorological Office)

In November of last year (1965) I spent three enjoyable weeks in the Netherlands Weather Routeing Office. My overall impression was that, apart from the virtues of the routeing techniques, the careful consideration of the routeing of individual ships has great virtues in itself. It assures that the master has a clear analysis and interpretation of all the relevant information available over a vast area. The Routeing Office staff with the facilities and support of the Netherlands Meteorological Service at their disposal have a most complete and reliable knowledge of the weather and wave fields likely to be encountered by a ship over three days. The advantages of weather routeing claimed by Mr. Verploegh, the officer in charge of the Dutch office, are surprisingly modest in view of the very efficient way in which the work is carried out. This reflects the difficulties in assessing very accurately the movement and developments of weather systems over three days.

It seems to me that the great difference between American and Netherlands methods is that the former make a great use of electronic computers while the latter have devised a method based on the accepted principles first put forward by U.S. Navy Hydrographic Office but in which the personal judgement of the routeing staff can be used at every stage in the light of actual ships' observations. The overall aim of the routeing, as carried out in the Netherlands, is to assure that the ship keeps to her schedule with a minimum of disturbance from waves or weather.

The most important part of the Netherlands organization is the close and continuous communication between the ship and the Routeing Office. The Netherlands Meteorological Institute devised an efficient weather routeing code system and special arrangements with Scheveningen Radio Station which recognises routeing messages and gives them priority. The Routeing Office is kept closely informed of a routed ship's movements, i.e. times of departure, courses and speeds, and the master can query a route and continuously consult the Routeing Office to get agreement as to the most satisfactory course of action in his particular situation. The routed ship also keeps the Office informed as to prevailing weather and wave conditions in her immediate proximity.

Ships request a route by telegram in a specially devised code, giving details of time of departure and destination. In response to this the Routeing Office sends out three types of messages in the same special code. The first message is an AAROT message which is received just as the ship is beginning her ocean crossing. This message gives the whole route, tactically distributed weather systems (i.e. those likely to affect the route) and a 48-hour wave forecast. The AAROT message may be followed at any time by WYROT giving a change of route with new tactics and a new wave forecast. After 48 hours from the issue of a route or change of route, whether an intervening WYROT has been sent or not, a new wave forecast is sent and if a route is proving to be satisfactory the ship receives these wave forecasts frequently, at least every 48 hours.

There are three main problems in weather routeing ships. These are weather forecasting over three days, wave prediction for the same period, and the actual routeing of the ship, based on sound navigational principles and knowledge of ships' performance in waves. The Netherlands Routeing Office employs each day an officer engaged on each of these problems. The first problem is in the hands of the Meteorological Prognostic Officer. He analyses the weather over the whole North Atlantic from Newfoundland to the Caribbean and from the North of Scotland to the Azores. This includes a careful study of weather systems moving from North America to the Atlantic. With the help of American, British and German facsimile broadcasts of three days' surface and upper air forecasts and the use of the thorough analyses prepared by the Netherlands Central Forecasting Department the Officer has an adequate knowledge of three days of future weather systems likely to affect shipping routes. Keeping the weather developments continuously under review the Meteorological Prognostic Officer briefs the Ship Routeing Officer. Another officer, the Wave Cast Officer, is engaged in preparing wave charts for 0000 and 1200 GMT, each based on synoptic surface weather maps for similar times. The equations of motion of the atmosphere have been carefully utilized to prepare scales whereby a very accurate representation of the distribution of wind strength and wind direction may be charted (isotach charts). In addition actual wind observations from ships are used subjectively to modify the isotach charts to fit in with actual observations.

Similar scales based on a careful study of ocean wave theory are used to prepare wave charts. Again these are modified subjectively to fit in with actual ships' observations. The wave chart is based on two successive wind charts and the build-up and decay and movement of sea wave and swell fields is estimated and charted.

The Routeing Officer uses the work of the Meteorological Prognostic Officer and the Wave Cast Officer to assess the wave conditions likely to be experienced by a ship he is routeing. The ship is then routed so that she will keep to her schedule but have a minimum of disturbance. She is also routed so that she will be strategically well placed with regard to any weather system under review that may develop in excess of what is expected.

A fourth Officer reviews in retrospect each route followed by every ship directed by the Routeing Office and assists the other three officers as necessary. He gathers all known weather and wave data and carries out 'post mortems'. The masters of routed ships receive a report of their routes based on these careful hind-casting analyses. Statistics are being prepared to evaluate how effective is the work of the Routeing Office, based on the careful analysis of time lost and time spent in heavy seas. The claims of the Royal Netherlands Meteorological Institute for their ship routeing are marginal and amount to 3–6 hours saved in time of crossing or time spent in heavy waves; the true gain can only be assessed by careful study over a considerable period. With, for example, special or vulnerable cargo on deck when there is an overriding need for minimum waves, weather routeing can be decisive.

The Routeing Office is open from 7.30 in the morning until 10.15 in the evening and Routeing Officers are on call during the night.

A ship can communicate with the Routeing Office at any time if she initiates the message and two-way exchanges are possible. But the Routeing Office itself has to fit in with the ordinary radio watch arrangements of merchant ships. As stated above the maximum efficiency has been derived from this system by special arrangements with Scheveningen Radio Station.

Mr. Verploegh emphasizes that ship routeing is essentially a practical problem and that the routeing officers must have nautical experience and know about ships and their manœuvres.

It is found that when sea waves exceed 3–4 metres ship captains almost always slow down and/or change course. A routeing officer must be aware of the effect of wave direction on a ship. It is found for example that in waves of greater height than 5 metres and at more than 40° from the ship's heading, waves and spray break over the ship to an extent depending on her characteristics, and the wave length. Very strong beam winds do not generally create such a wet ship because she is often rolling so much that she tends to slow down.

If a Routeing Officer suspects a development of a high wave field, he must initiate avoiding action at least 18 hours before a modern ship is likely to encounter it. Slower older ships need even earlier action. Frequently the direction of sea is more important that the height of the waves. A ship may, by altering course relative to a wave field, e.g. turning from waves from astern to say 30° on the quarter, change her period of pitch motion from 9 seconds to almost twice this period. This could take a ship clear of her resonating period.

Waves of more than 6 metres from astern can under certain circumstances break heavily on board a ship and put her into unexpected serious danger. It is of course vital that when unexpected and serious dangers arise the Routeing Office should be immediately informed. The Routeing Office is then bound to reply immediately with an assessment of the situation likely to develop and support or otherwise for any action decided by the master.

A Routeing Office is also in a position to give advice about special meteorological hazards. For example, ships must be routed with respect to tropical storms in accordance with safety rules; or if a ship is carrying a particularly vulnerable deck cargo the highest waves associated with an extra tropical depression may be quite dangerous to that cargo and have to be avoided.

I found very little to criticize in the procedure employed in the Netherlands Routeing Office. In due course electronic computers will be used more in this work. A great deal of time will be saved in 'wave-casting' by this means but the subjective side of the work, i.e. the modification of charts in the light of actual observations, must I feel be retained. I also think that the sustained interest of one or two shipping companies, whereby certain of their ships are regularly weather routed over an extensive experimental period, is essential in order to develop the techniques of ship routeing. The staff engaged on the work must include nautical officers as well as meteorologists and they need quite a lot of training and practice to get experience of each other's side of the work and sufficient knowledge to use all available techniques and information. The enthusiastic co-operation of the Holland-America Shipping Line and the active work of the Directorate of the Royal Netherlands Meteorological Institute were absolutely essential to get the Netherlands Routeing Office to its present high state of effectiveness. Full and frank discussions between the staff of the Routeing Office and the masters of routed ships is also essential.

The rapid increase in knowledge of ocean waves has made weather routeing possible. It could be even more efficient if there was a corresponding increase in our knowledge of day-to-day variations in ocean currents.

Discussion

Mr. Simpson (Marine Science Laboratories, Menai Bridge): I wonder if Mr. Tunnell would like to enlarge on the method by which the Dutch deduce their wave data from wind speeds and directions.

Mr. Tunnell: They take a sequence of synoptic charts and map the wind field using a specially designed scale which takes into account the curvature of the isobars and latitude. Two successive synoptic charts are used to estimate the development of waves and calculate how they are going to move, taking into account fetch and wind trajectories, etc. Further specially designed scales are used for this part of the work.

Mr. Simpson: Is this based on the American method?

Mr. Tunnell: It is. It's based on the U.S. Hydrographic Office publications. There is a pamphlet on their ideas published by the Netherlands Meteorological Service but that is in Dutch. I believe that practically all the available papers on the subject were used but the main inspiration was the U.S. Hydrographic Office. The detailed theory of waves doesn't arise very much in practice because the work is carried out exclusively with scales and a series of rules whereby wave patterns are built up. I will say, however, that using both the wind and wave maps, after using actual observations subjectively for a while, ship routers get a feel for their work and they can draw in the wave fields quite easily. There are types of depression that have similar wave fields which can be anticipated and moved on.

Mr. Simpson: How much detail of the work can I ask for?

Mr. Tunnell: The Dutch give isopleths of amplitude, say every metre, and they draw lines across the chart showing the direction of the waves. If the waves are not building up they conclude that they are decaying and then lines are drawn to show swell amplitude and direction.

Captain Peterson (R) receiving his barograph from Dr. B. J. Mason, F.R.S., at Bracknell. 9th November 1965 (*see* page 203).

(*Opposite page 195*)

Captain Hocken (L) receiving his barograph from Mr. J. Hogan aboard the *Somerset* at Port Adelaide. 20th December 1965 (*see* page 203).

Captain H. Jowett (Furness Ship Management): We have heard what the Dutch are doing with regard to wave fields and I am sure we would all like to hear what the British are doing.

Mr. Tunnell: We are studying the various techniques of wave forecasting and the issue of facsimile wave maps, but for various practical reasons we are unable to initiate such a service until there is a demand for it by the shipping industry. The question of the usefulness of broadcasting wave data has been put to the industry but there has been no active demand, except from the Sugar Line. The Dutch Weather Routeing System was put on its feet by the active interest of the Holland-America Line and the resulting activities of the Netherlands Meteorological Service.

Captain Jowett: I appreciate that, but surely isn't it the fact that it is up to the Meteorological Office to convince the ship owner that this will save him money?

Mr. Tunnell: To create a weather routeing service like the Netherlands one is quite a big undertaking. It means establishing a separate operational unit which needs to deal with quite difficult technical problems. For the Meteorological Office to set up such a unit, there would have to be a specific demand for it on the part of the ship owner, because the initial outlay would be appreciable.

Commander Frankcom: I would like to say something here. The Meteorological Office is the State Meteorological Service and we are there to serve the public generally but we cannot go around selling our wares; we can merely draw them to the attention of potential users. If any British ship owner requires weather routeing facilities for his ships, I feel sure that the Meteorological Office would endeavour to lay it on; I have already explained that we know enough about the subject to do this. But it would mean getting extra staff and any Government department needs to show a real requirement before this can be authorised. We cannot issue a service in the hopes that someone might show interest in it. As I have already stated, weather routeing from the shore is a 'tailor made' service and ship owners who use it would have to pay something for the facility.

A questioner from the U.S. Navy Weather Service: I think there is an essential difference between the Dutch method and the method that has been adopted in the U.S.A., particularly the U.S. Navy weather routeing system. Generally there is a choice of route from the beginning of the passage and, if one can choose what seems likely to be a fair weather route, one can start off on that route. I think the Dutch method is always to start off on a great circle track and I have no doubt this is important from the viewpoint of economics, because they feel our method will not necessarily save much time. On the other hand the Dutch endeavour to manœuvre to avoid the worst of the weather, thus avoiding wear and tear on the ship and enabling more work to be done on board. It is probably in this field that they experience the maximum saving.

Captain Horn (Holland-America Line): The Netherlands ships normally adhere to a great circle course to some extent but, although the Masters are able to exercise some measure of control over their ships whilst at sea, they have little influence on the economics of shipping. The mariner must realize that costs are important and, where there is need of saving, I feel it is up to him to examine the potentials of weather routeing, perhaps in the first instance by a more detailed analysis of costs than is carried out at present.

551.5:330:629.12

Economic Aspects of Weather Routeing

By H. J. S. Canham
(British Ship Research Association)

As already stated in the first paper, weather routeing has been practised in one form or another for a very long time, and the purpose of this discussion is to consider how it can be more widely applied, developed and refined.

I believe that the principal justification for weather routeing will always be the increase in margins of safety and added comfort to cargo and crew that will arise from the avoidance of heavy weather. Looking ahead, however, it seems to me that the economic advantages of weather routeing will play an increasingly important part and eventually determine how a weather routeing service should be organized.

Let us have a look at the ways in which weather routeing could possibly lead to economies in operating costs. First of all it is obvious that the successful avoidance of high seas will eliminate heavy weather damage and also damage to cargo from this cause. To be truthful, I have no idea at present what proportion of present-day operating costs are attributable to these causes, but there is something to be saved here on maintenance costs and perhaps insurance. This will apply to all types of ship.

Other economic benefits will be influenced considerably by the type of ship, and perhaps it would be helpful for me to say a few words about operating economics generally.

Commander Frankcom has already drawn attention to the way speeds of ocean-going ships have increased within recent years, and alongside this there has been the really dramatic increase in the size of bulk carriers and tankers. The reasons for these changes are not hard to find. The cost of building a large tanker is relatively cheaper than building a small one. Since capital cost factors such as depreciation and interest account for something like half the annual operating cost, the freight cost per ton of cargo falls sharply as deadweight tonnage increases. For example, increasing the deadweight of a tanker from 30,000 to 60,000 tons would reduce the freight cost by 40 per cent.

For a given size of ship, the freight cost is a function of the speed of the ship and the value of the cargo. There will generally be a particular speed at which the freight cost is a minimum for a particular charter rate, and the speed for minimum freight cost rises as the charter rate increases. There are, of course, many other considerations which govern the choice of design for a particular trade, for example the terminal facilities available at the various ports of call, and these have influenced the way that dry cargo ships have tended to become rather faster and tankers to become very much larger.

The same considerations apply to a more limited extent to existing tonnage, and for a given ship with fixed annual costs for depreciation, interest, insurance, wages, victualling, repairs and maintenance, there will be a particular voyage speed at which the freight cost is a minimum for a given charter rate and bunkering charges. An example of this is the slow running of tankers when charter rates are low.

In theory, therefore, the steaming time for a given passage should depend on the current market conditions, but in practice this can only be applied to tramps and tankers, since scheduled ships such as passenger and cargo liners have their sailings arranged well in advance. Another important factor is the proportion of time spent in port and at sea, since the benefit of steaming at optimum speed at sea would be lost if port facilities could not cope with varying times of arrival and departure.

We are all very much aware of the unsatisfactory position which prevails at the principal ports at home in respect of rates of loading and discharge of general cargo, and the consequent lack of availability of berths. I am quite certain that this is a fundamental reason why more interest has not been shown by owners of dry cargo tonnage in liner service in reduction of operating costs by optimizing speed at sea, and here we come back to weather routeing as a means of ensuring that costs arising at sea are in fact kept to a minimum.

Since weather routeing can only be a potential benefit to shipping in regions where there is a high proportion of unfavourable weather, let us consider three distinctly different types of ship in service across the North Atlantic.

First, the fast passenger or cargo liner with a speed of 20 kt or more. Such a ship will usually be required to operate to a fairly tight schedule and will have a large amount of installed power, partly to attain high speed anyway, but partly as a margin to make good speed lost in unfavourable conditions. If such a vessel meets heavy weather, her speed may prove a disadvantage in that bow motion will be more severe than for a slower ship of the same size. So a voluntary reduction in speed must be made which will add to a speed reduction already imposed by the weather. The latter may not be particularly large by itself. Being a fast ship she should often be able to avoid bad weather by deviating at quite a late stage from her normal route, or alternatively by varying her speed along the latter. Deviation will increase the steaming distance but this will be offset by her ability to maintain a high speed. A ship of this type would not profit by arriving early, but weather routeing would help to minimize or eliminate time lost on passage due to bad weather. This benefit might be difficult to measure directly in economic terms, but could neverthless be an important factor.

Bunkers for a ship of this type will account for about 20 per cent of the total annual operating cost, and this will amount to an annual fuel bill of not less than £100,000 and, for a very large and fast passenger liner, considerably more than this. Since the power plant will be large and the fuel consumption high, adjustments made in speed to suit the weather situation can have a profound effect on fuel consumption. In other words, by varying ship's speed and course in the given weather situation prevailing over the region, there will probably be many ways of completing the passage on schedule and of avoiding heavy weather, but there will only be one particular way of navigating the ship which will result in the least consumption of bunkers. To achieve this it will almost certainly require adjustments to be made in speed, and perhaps in course, at frequent intervals throughout the passage, and there are so many factors which have to be taken into account that a computer is required to calculate the desired course and speed at any stage of the passage. From studies made at B.S.R.A. we believe that reduction in fuel consumption of 10 per cent could be achieved in certain circumstances, and this is certainly worth having. A ship of this type will spend less time than slower ships on passage and will therefore be less dependent on the accuracy of 3–5 day forecasts.

Turning now to slower speed cargo vessels of 15 kt, these spend more time in regions having greater probability of bad weather and their ability to avoid heavy weather by deviation is more limited. They will be more dependent on the accuracy of medium-range weather forecasts since avoiding action will have to be taken at an earlier stage. Ships of this kind usually steam at constant power until forced to make a voluntary reduction in speed. Speed reduction imposed by the weather will be somewhat greater, and bow motion less, than for a fast ship of the same size. (Who was it said that a 10–12 kt cargo ship had a built-in speed reduction factor in bad weather? In other words, the imposed speed reduction was enough to keep bow motion within reasonable limits.) A tramp ship would benefit directly by minimizing passage time by weather routeing (minimal time routeing), the cargo liner to a lesser extent. The fuel bill for these ships is probably only about 15 per cent of the total annual operating cost and amounts to £40,000–£50,000. Savings in fuel cost will be achieved as a result of a reduction in steaming time, but minimizing fuel without optimizing speed would not be worthwhile. Mr. Tunnell has referred to savings of 3–6 hours achieved by Dutch-routed ships and, from the U.S.A., savings of 12 hours have been reported.

The tanker in service on the North Atlantic would probably be operating to and from the Caribbean and consequently will spend only part of the passage time of 12–13 days in the bad weather zone, but it will still be at least 4–5 days in that zone. The ship will steam at constant power and in this case advantage can be taken of a reduction in steaming time because of the satisfactory berthing situation at oil ports. One major oil company has said that a saving of less than 1 per cent on passage time on such a route would justify weather routeing on economic grounds.

It has been estimated that the annual saving in fuel costs for all British Ships operating over the North Atlantic is likely to be not less than £2 million if weather routeing was adopted on a widespread scale.

The actual savings achievable will obviously depend upon the reliability of weather forecasts, which at the present state of the art has some way to go to cover the 6-day passage across the North Atlantic. For some considerable time we must recognize that on occasions the weather will not behave in the expected way and that routeing advice may cause a ship to experience worse conditions than would be the case if normal course and speed had been maintained. The economic benefit of weather routeing will be felt when a number of voyages have been completed.

It is very likely that in the future more and more specialized types of cargo ships will be built to operate between fixed ports having special terminal facilities, with very much quicker turn round. Since this will justify increased speed at sea, one can foresee the possibility that increasing attention will be given to minimizing passage time or fuel consumption, and the weather routeing advisory service may have to be developed accordingly. But, whether or not it develops to this point, there are benefits to be obtained at once in terms of increased margins of safety and it is not impossible that service power margins could be reduced in future designs. This could lead to reduction in the first cost of new tonnage, which would be reflected in the part of the annual operating cost attributable to depreciation and interest.

DISCUSSION

Captain Jowett: I would like to address a question to previous speaker, Mr. Tunnell. From his experience with the Dutch meteorological office, could he give us an idea of the volume of shipping they handle with this service and can he, perhaps, supply figures related to saving and the cost?

Before he answers that question I would like to make a comment. I suggest that in addition to the immediate advantage of routeing, which is concerned with individual ships on individual voyages, perhaps there is a longer term benefit to be gained because the feed-back process of data from which a pattern can be forecast, ought to accumulate into a very valuable agglomeration of voyage data which should be of considerable interest. I would like to know how far this longer term aspect is being considered and how these considerable data are being analysed and recorded.

Mr. Tunnell: The Dutch charge £30 for a crossing, and I understand that the Holland-America Line, with three very difficult deck cargoes in a recent winter, earned sufficient to pay for a large part of their routeing programme. The Holland-America Line seem to have no doubt about the value of routeing. With regard to records, data from the ships and issued forecasts are recorded continuously. This is part of the post-mortem process of investigating the efficiency of the routeing. I should like to emphasize that it is essential for routed ships to keep a fairly detailed log of engine performance, navigational data, and the weather experienced. The routeing authority can then assess the ship's performance in various conditions of weather, sea and swell.

Mr. Canham: I think I can answer one point and that is to touch upon the service they can provide in Holland. I had occasion to visit the Dutch routeing office myself about eighteen months ago and found they were routeing about six ships. They said that with the staff then available they considered they could cope with up to twelve ships at any one time. That represented something like the upper limit with the staff they had.

Captain W. E. Warwick (Cunard Line): We have heard that the Holland-America Line have been a great advocate of this service in the Netherlands. Was it the management of the Holland-America Line who asked for it or the shipmasters?

Captain Horn: We have Captain Wepster as head of our nautical department and I think that as soon as weather routeing was suggested he talked with Mr. Verploegh, the head of the Dutch routeing office, and they decided to go through a trial period of 18 months, with three ships on the New York run. At the end of the trial period we had our ships routed to and from the Gulf of Mexico. I happened to be the first

Master on a Gulf of Mexico ship, so I have now been involved in routeing for about four-and-a-half years, and I wouldn't like to do without it.

Captain Warwick: I wonder whether many shipmasters asked for it.

Mr. Meade (Meteorological Office): There is an interesting problem here. An earlier speaker has asked who is selling the technique of weather routeing. The position at present is that the Meteorological Office is describing a service that could be provided subject to certain conditions. If it appears that we are pushing the idea then I would explain that our purpose is to describe it and it is for the shipping lines to decide whether the service is worth having. Obviously a stage could be reached when either the shipping lines could tell us they were not interested or we ourselves would conclude that they were not.

I would like to pose a question to Mr. Canham arising from his speech. We have a lot of experience in the aviation world in this sort of routeing. When an aircraft arrives on its E.T.A. nobody suggests that the weather forecast was one hundred per cent. accurate; there is a small error inherent in even the best weather forecasts. All it means when an aircraft arrives dead on time is that a lot of factors have combined together to produce that result. Now, in forecasting surface wind and swell and that sort of thing there are going to be some errors, however small. I have a suspicion that the one per cent value of weather routeing that Mr. Canham mentioned, or even a two per cent saving, could not be identified as a weather benefit. It could be due to another source not known at the time. It could be control of the ship or the ship itself being somewhat more lively during a particular voyage. But I think it would be unrealistic if anybody thought that identifiable saving in terms of one per cent or two per cent on a particular voyage could be attributable to weather routeing or weather forecasting.

Mr. Canham: I quite agree with what you say, although I think perhaps you slightly misunderstood what I intended to say. The figure I quoted was not one which was supposed to have been achieved, but one which would make weather routeing worth while and below which it would not justify the cost involved. That figure, then, just represented an indication of the order of saving needed to justify the institution of weather routeing. Quite clearly, in my view, greater saving than that should be achievable. As you say, routeing advice on any particular passage will produce errors because the ship won't do quite what she is expected to do. The weather situation may not develop as expected and the result would be something between what was expected and what was actually achieved. As to how large these figures will be I just don't know but, nevertheless, taking a large number of ships and passages over a long period of time, if there is any reasonable saving it should be felt in the operating economics.

Mr. Tunnell: To find out if there is going to be any saving as a result of routeing you have to test it for a year or more and study the matter statistically. You couldn't possibly find out on one or two routeings. You have to have operational data from ships, weather and wave observations and find out statistically whether there is a gain. When the gain is marginal it is a difficult problem and a lot of data is needed.

A questioner: How much deviation would you be prepared to make on, say, a passage from Fastnet to Cape Race?

Mr. Canham: I don't pretend to be a mariner or a navigator. I do know that on some of the exercises that have been done by our American friends there were very substantial deviations.

A questioner: I would say that on a passage from Fastnet to Cape Race, which would take about four-and-a-half days, if we have to deviate a distance covering more than twelve hours it would never be a gain because, with a depression, a ship is seldom held up for more than twelve hours.

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On Humidity over the Sea

By Dr. H. Markgraf
(Deutscher Wetterdienst, Seewetteramt, Hamburg)

The economic importance of a correctly controlled environment for cargo whilst in transit has increased the attention given to humidity over the oceans. Until recent years little data were available but in 1953 the late Mr. P. R. Brown published a paper (*Meteorological Magazine*, Vol. 82, pp. 357–364) on humidity over the Atlantic Ocean based on observations from British ships. Data have also been collected from other oceans. The Meteorological Office has kindly loaned copies of tables from this paper to the author and the results are shown in the following diagram.

Since 1950, German Selected Ships have gradually been equipped with whirling psychrometers with which to make humidity observations as the screen psychrometer data from German vessels did not seem reliable. Some of the results from more recent observations are shown opposite.

It can be seen from these figures that the annual variation of relative humidity over the oceans is noticeably smaller than that of Continental stations but is sufficiently clear. Contrasting with the Continental stations, the highest monthly values do not occur in the winter but looking at the first figure on the left hand side (*a*) we see that in the Gulf of Guinea (4½°N, 5°W) there are double wave maxima in April and August/September. These are about the periods when the sun is going through the zenith. In this area the African SW monsoon blows all the year round.

The next curve (*b*) (9½°N, 26°W) shows a striking maximum in the summer months July and August when the SW monsoon blows; the remaining months are in the NE trade winds.

Curve (*c*) represents the area near Cape Verde where the NE trade winds blow all the year round and the less-pronounced humidity maximum occurs about May.

The humidity maximum returns to August in the next diagram (*d*) in an area where the NE trade winds predominate again.

Diagram (*e*) has little annual variation as the area is on the edge of the trade wind region with an E'ly prevailing wind and the humidity ranging from 75%–81·5% with a maximum in July. On the other hand, at the root of the NE trade winds (*f*) and in a region of prevailing W'ly winds (*g*), we find a large summer maximum from June–September.

In the last curve (*h*), drawn for an area in the southern hemisphere, the maximum occurs in the southern summer.

Looking finally at the four curves drawn by P. R. Brown (on the right hand side of the diagram) the second one, near the limit of the trade wind region (29°N, 45°W) shows a small range 75%–82% with maxima in July–September, the value for August being uncertain.

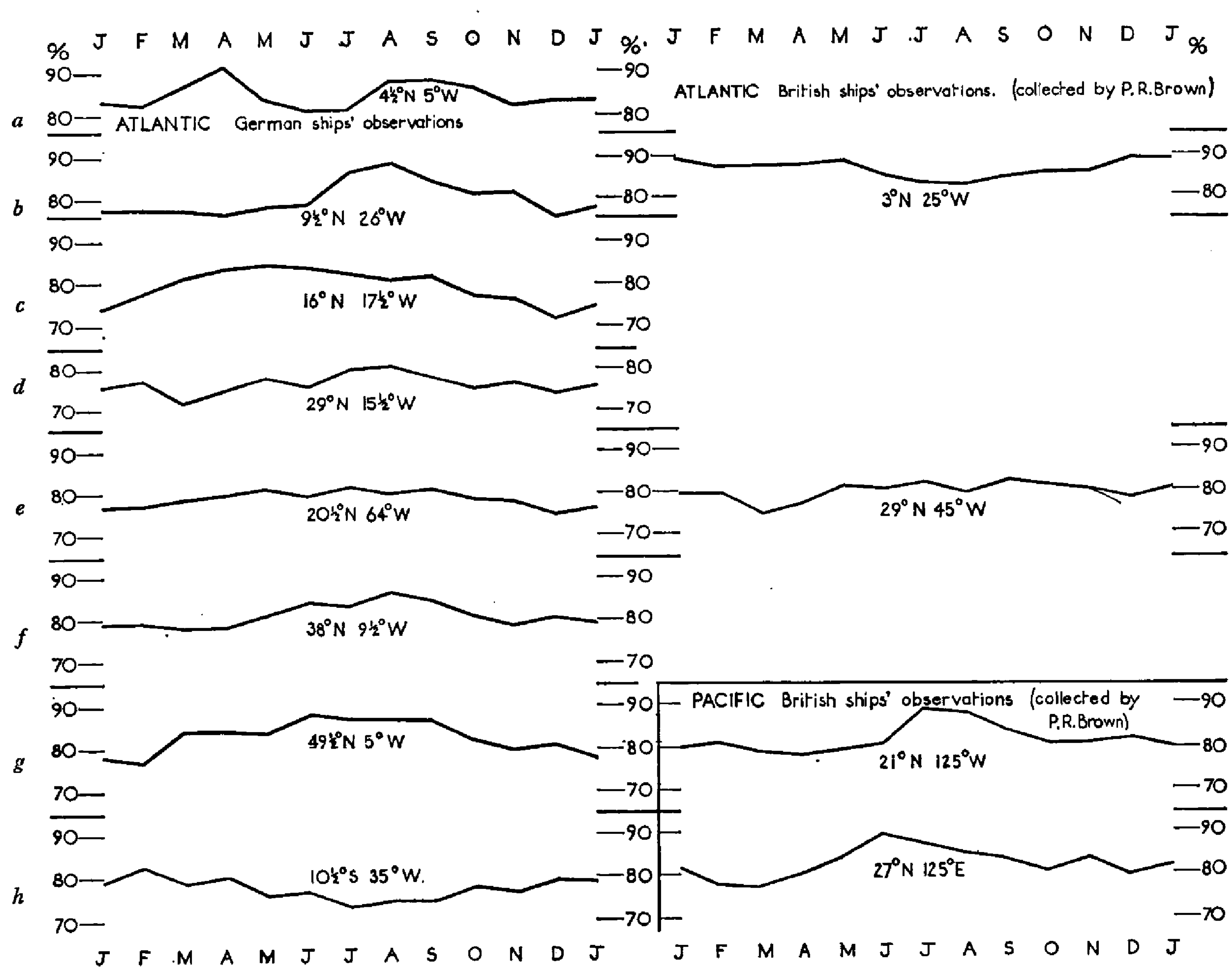
In the Pacific, represented by the lower two curves, the maxima occur in the summer. The uppermost Atlantic curve for 3°N, 25°W is very interesting for it shows that the relative humidity slowly increases, during the prevailing NE trades, from February to May as if aiming at a summer maximum; then suddenly it decreases rapidly when the SE trade winds impose a humidity regime that has a minimum in July–September and a maximum in December–January.

For further information see Publication No. 40, Deutscher Wetterdienst, Seewetteramt, Hamburg, concerning the Atlantic Weather Ships' observations.

Editor's Note. We are very pleased to receive this article from Dr. Markgraf, for it is, in a way, a memorial to the late Mr. P. R. Brown, who worked in the Marine Branch of the Meteorological Office from 1950 to 1960.

Humidity maps are not included in the marine climatological atlases which were prepared in the Marine Branch during the last war, because it was not felt that there were sufficient data of a reliable nature at that time to compile such maps.

Dew point maps for all the oceans have now been prepared in the Meteorological Office



Annual variation of humidity over the oceans.

(for the months of February and August, representative of winter and summer), and these will be published in a separate booklet in the near future.

Dew point isopleths are also shown on the monthly routeing charts, prepared jointly by the Hydrographic Department and the Meteorological Office and published by the Hydrographer of the Navy.

The detailed tables from which Dr. Markgraf's graphs were derived are available in the Meteorological Office and at the Seewetteramt (Deutscher Wetterdienst) in Hamburg; photo-copies can be supplied on request.

SYNOPTIC WEATHER MAPS PREPARED BY RADIO OFFICER

In May 1965 the Editor of *The Marine Observer* was in New York, attending an Air/Sea Rescue conference. After the conference he visited the United States Weather Bureau Office at Rockefeller Centre, to discuss selected ship observations, weather bulletins for shipping and other matters of mutual interest, with Mr. McKee, the Marine Supervisor there. Mr. Van Eck, Radio Officer aboard m.v. *Katsedyk*, of the Holland America Line, was also in that office, which he visits whenever his ship is in New York. During the conversation Mr. McKee mentioned the excellent weather maps which Mr. Van Eck regularly prepares for the master aboard his ship and produced one of these maps for inspection. The Editor of *The Marine Observer* was so impressed that he asked Mr. Van Eck to prepare, during his next voyage, a map for publication in *The Marine Observer*, with the hope that this might encourage Radio Officers in British ships to try their hand at preparing weather maps.

The maps which Mr. Van Eck prepared for this purpose are reproduced on the opposite page. Extracts from letters he has written on the subject are given below.

Much credit is due to Mr. Van Eck for the enormous trouble he has taken to prepare these maps and the initiative he has used in picking out the appropriate radio transmissions to enable him to show so much detail, both concerning weather and waves.

It may be that certain Radio Officers aboard British merchant ships already carry out this rather interesting job of preparing weather maps; if so we would be interested to hear from them. If any Radio Officer would like to try his hand at this job, subject to the agreement of the ship's master, any of our Port Meteorological Officers would be pleased to give advice about it. Information on the subject is contained in *Meteorology for Mariners* and in the *Ship's Code and Decode Book* (Met.O.509), a copy of which is aboard all Selected and Supplementary Ships.

Comments by Mr. Van Eck:

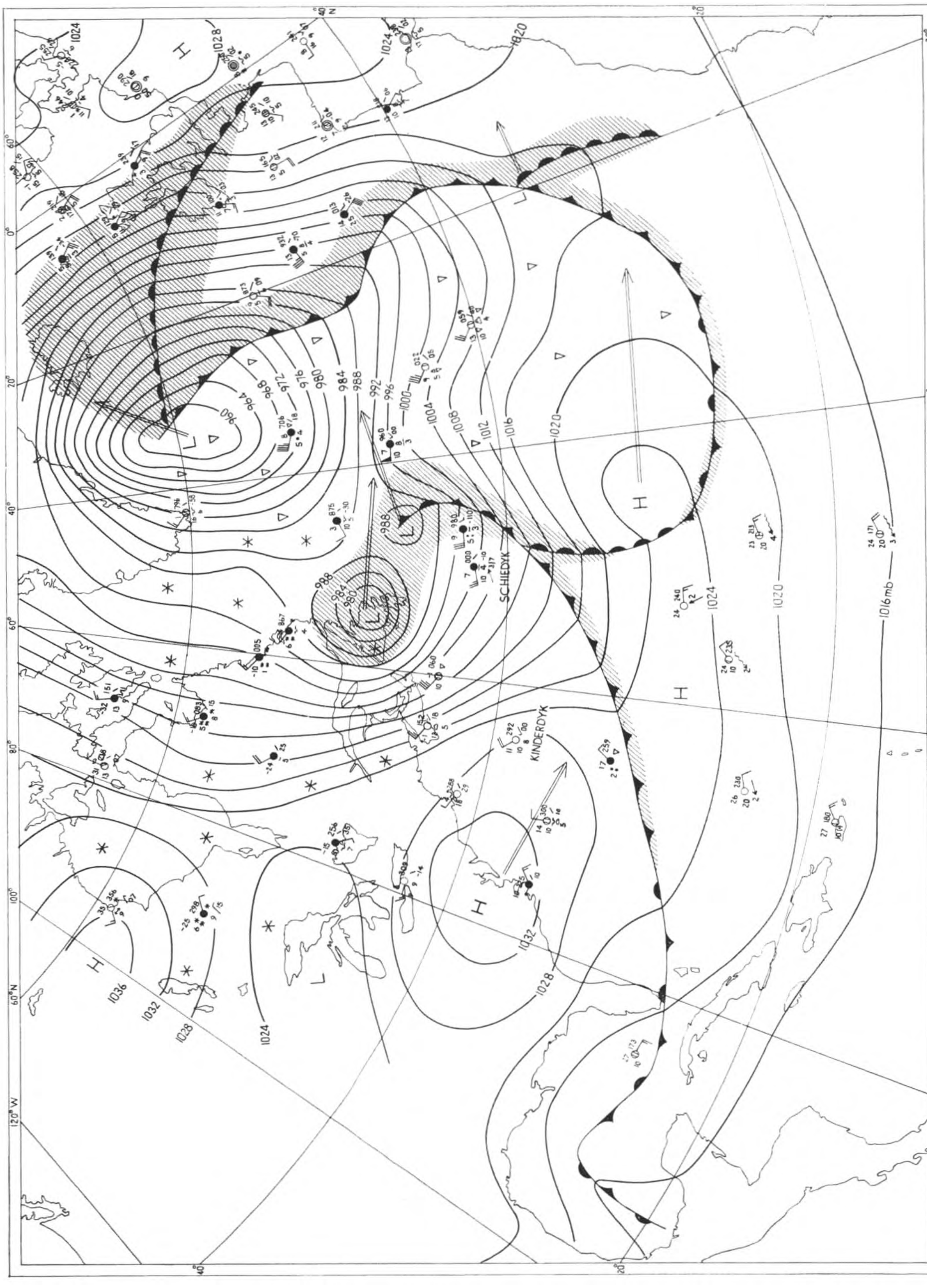
"The ships' and land-stations' data for these maps were received from radio station DDJ Germany.

"The data are plotted simultaneously with the reception of the whole transmission, which takes about two hours. By that time the map is plotted and, after another one or two hours, it has been analysed with fronts and isobars. In addition I need about one hour to prepare the wave and swell maps.

"I analyse the maps myself, combining these later with the coded analysis of the U.S. Weather Bureau from Washington/NSS or with the British analysis from Portishead, depending on our position on the Atlantic. (In this case I used the U.S. analysis.) In my opinion a combination of my own analysis with the official one is essential since a six-hourly preparation of weather maps round the clock is impossible while it often happens that there is a lack of ships' observations over great areas of the ocean.

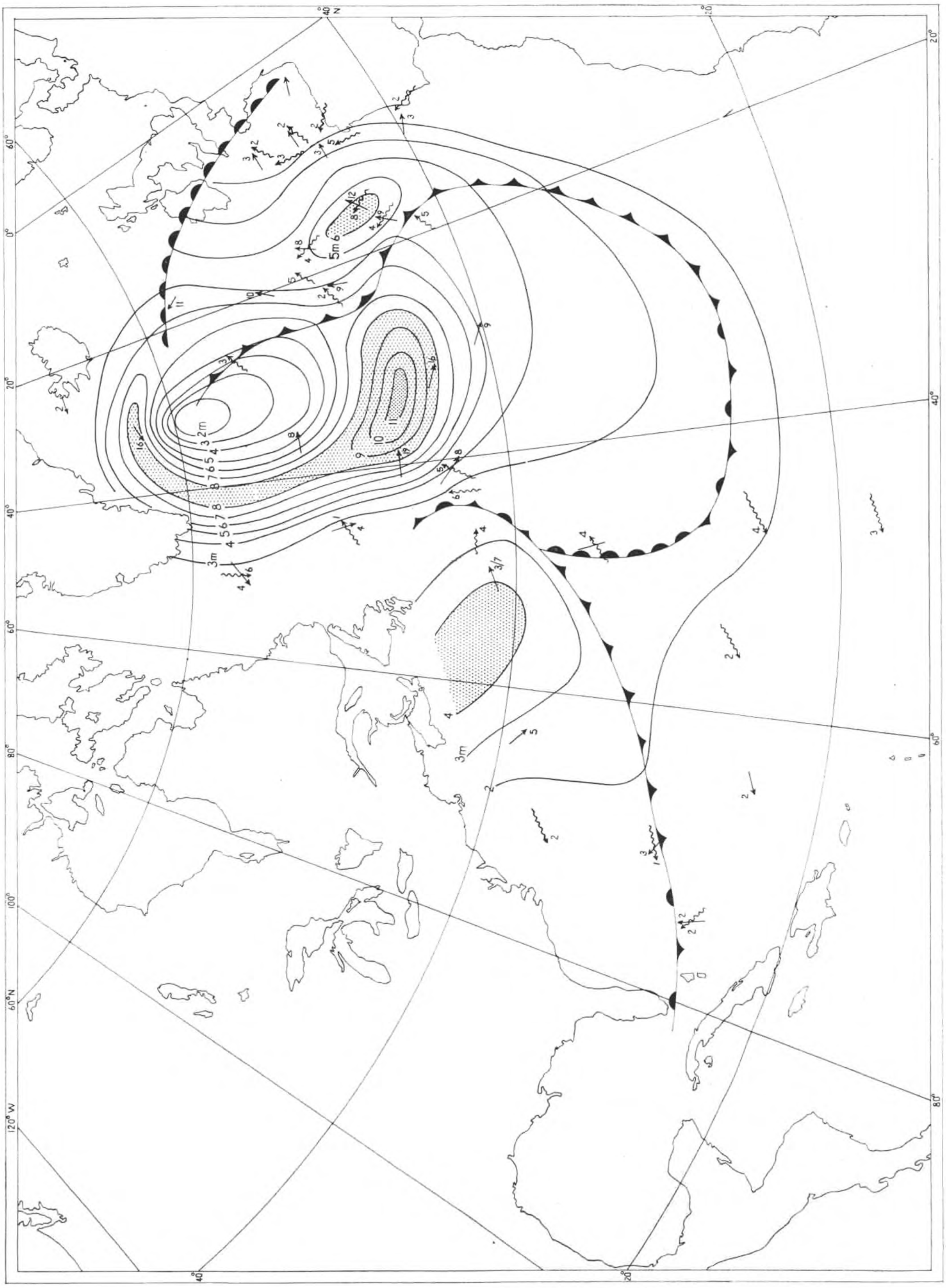
"The wave maps have to be analysed entirely by myself because, as far as I know, there is no regular wave analysis transmission from any meteorological service ashore. The data for these maps are obtained from the last two or three groups of the ships' observation messages, received directly from the ships or from DDJ.

"In addition I always prepare an inference of the synoptic and wave map, to-



Synoptic chart prepared from radio weather bulletins.

(*Opposite page 203*)



Synoptic chart of sea conditions prepared from radio weather bulletins.

gether with a forecast of the weather and wave conditions along our track for the next 24 hours.

"Although this job requires a lot of extra time, apart from the other routine work on board, I like to do this because it is usually much appreciated by the Master; it enables him to take precautionary measures when necessary for the safety of the vessel and/or the cargo, while it is sometimes possible to avoid the worst weather or wave conditions by changing the ship's course a little."

PRESENTATION OF BAROGRAPHS

As announced in the October 1965 number of *The Marine Observer*, four barographs were awarded, during that year, to shipmasters of long and zealous voluntary service on behalf of the Meteorological Office, this being the eighteenth year in which these special awards were made.

It is understandable that it is seldom possible to bring the four shipmasters together in one place at the one time, in fact only once, in 1956, has this been achieved. The 1965 awards touched a record both for time and distance between the presentations.

Of the four, only Captain Peterson of the Royal Mail Lines was able to come to Bracknell in person to receive his award, Captain Dawson of the Cunard Line having retired to the South of France because of ill health and unable to visit England during the winter, Captain Hocken of the New Zealand Shipping Company having retired to South Australia and Captain Hodson of the Port Line being called away to a pierhead jump only a few days before arrangements had been made to receive him at Bracknell.

Captain Peterson, accompanied by Captain K. E. McClure and Mr. W. S. Lewis, respectively Marine Superintendent and Manager of the Royal Mail Lines, came to Bracknell on 9th November 1965 and, because of the impracticability of foreseeing a date to do similar honour to Captain Dawson, the London Marine Superintendent of the Cunard Line, Captain M. Forster, came down also to receive the barograph on Captain Dawson's behalf.

In making the presentations over a glass of sherry, Dr. B. J. Mason, F.R.S., Director-General of the Meteorological Office, mentioned the great value of ships' observations to the Meteorological Office and through the Office, to ships in general. He pointed out that the ships of both companies represented there had long and impressive records of voluntary meteorological service, that of the Royal Mail Lines going back to 1888 when we received a meteorological logbook from the *Essequibo* and that of the Cunard Line going back even further to 1867 when one of their Captains sent us a book which he had compiled successively in three of his commands. Captain Peterson, who was the third shipmaster of the Royal Mail Lines to be presented with a barograph, had been observing since 1926, whilst the observing record of Captain Dawson, the eleventh Cunard Line shipmaster to receive an award, went back to 1923.

The first meteorological logbook and the personal record cards of both Captains were produced to the assembled company who subsequently took luncheon with the Director-General and Senior Officers of the Meteorological Office prior to a tour of the office.

In the meantime, Captain Hocken's award had been taken out to Adelaide in the *Somerset* by Captain I. Y. Batley and, on behalf of the Director-General of the British Office, was presented to him by Mr. J. Hogan, the South Australia Regional Director of the Australian Bureau of Meteorology. The ceremony was staged on the bridge of the *Somerset* on 20th December 1965, soon after her arrival at Port Adelaide and was attended by some 15 people including representatives of the Department of Shipping and Transport, the ship's Agents, the Harbour Board and various shipping interests and the stevedoring industry. Representatives of the Press, Radio and Television also attended and three television stations presented a short film of the presentation ceremony in their evening news session.

In making the presentation, Mr. Hogan thanked Captain Batley and the New Zealand Shipping Company for allowing the ceremony to take place aboard the *Somerset* which, he said, was a most appropriate setting firstly because the Company's association with the British Meteorological Office went right back to 1855 when Money Wigram's full rigged ship *Kent* became their first voluntary observing ship and secondly because Captain Hocken himself had served the Company for 46 years, ever since 1919, and had been a voluntary marine observer since 1928. Mr. Hogan said that all meteorological services throughout the world were indebted to men like Captain Hocken for their reports, without which their services could not function efficiently. "We in South Australia", he concluded, "are particularly aware of the value of ships' reports from the Bight and Southern Ocean areas and would welcome reports from every ship in the area."

It was not possible to let Captain Hocken see his first meteorological logbook and personal record card but photocopies of these documents were given to him at the presentation.

It was not until the end of April that Captain Hodson returned home to receive his award and on 3rd May 1966, Mr. B. C. V. Oddie, Deputy Director of the Meteorological Office, acting on behalf of the Director-General, accompanied by the Marine Superintendent, Commander Frankcom, the Nautical Officer, Lt. Cdr. Philpott and the Port Meteorological Officer in London, Mr. J. C. Matheson, went down to the *Port Melbourne* in King George V Dock, London, to make the presentation and to meet the Marine Superintendent of the Port Line, Captain A. C. Russell and Assistant Superintendents, Captains F. R. Gorman and J. Rowland Hill.

In his speech, Mr. Oddie mentioned that of all the shipping companies whose ships were observing for us to-day, the Port Line, through one of its constituents, had the longest record for it was as long ago as December 1854, when the Office itself was less than a year old, that the full rigged ship *United Kingdom*, operated by J. P. Corry & Company of Belfast, had been equipped as an observing ship. Captain Hodson himself had been a voluntary observer since 1925 and his first meteorological logbook and personal record card were there for him to see.

After the presentation, the Meteorological Office party was most hospitably entertained to luncheon aboard the ship and would like to record their thanks to the Port Line for a most enjoyable 'nautical occasion'; to us in the rural surroundings of Bracknell the smell of a ship comes all too seldom nowadays!

Photographs of the presentations to Captain Hocken and Captain Peterson are opposite pp. 194 and 195.

L. B. P.

NOTES ON ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN FROM APRIL TO JUNE 1966

APRIL

Canadian Arctic Archipelago. Although winds were very variable in direction there was a preponderance of northerlies and easterlies and temperatures were kept sub-normal, in some places by as much as 7°C. The whole area was, as usual, completely ice covered.

Baffin Bay. Except south and west of 70°N 60°W this area experienced a cool month with temperatures 5°C below normal. In the extreme south-west, however, it was rather mild for the time of year. Ice cover was much as usual.

Hudson Bay, Foxe Basin and Hudson Strait. Over all these seas, winds during the month were variable. Temperatures early in the period were exceptionally high—up to 11°C above average—but later fell as much below. Shore leads, particularly on the eastern side of Hudson Bay and in Hudson Strait, were a little more developed than usual but elsewhere the pack-ice was quite normal.

Davis Strait, Labrador Sea and Great Bank. In spite of mainly northerly or north-easterly winds both air and sea were relatively warm, as in the previous month. Less pack-ice than usual was reported and it was, in fact, an exceptionally light April for iceberg sightings.

Southern Newfoundland Sea. In this area, too, prevailing northerly winds failed to bring relatively high sea temperatures down to normal and, as a result, all ice had cleared, exceptionally, by the end of the month.

Gulf of and River St. Lawrence. Air temperatures varied one or two degrees either side of normal but the water was generally 2°C warmer than usual. Ice cleared rapidly, the season being the most advanced of the past 6 years.

Greenland Sea. Easterly to north-easterly winds persisted during the month over much of this area. North of 75°N and south of 65°N the air was relatively cool but between these parallels it was a couple of degrees warmer than usual. The sea, too, was comparatively warm. Pack-ice, as a result, was somewhat less extensive than in a normal April and at the end of the the month ship reports from round about 74°N indicated that the ice edge was as much as 60–120 miles closer in-shore than usual, in marked contrast to the state of affairs earlier in the year.

Spitsbergen. Although the air tended to recover from intense cold of the winter and, in fact, by the end of the month was slightly warmer than usual, the sea remained cold—some 2°C below average in temperature—and the ice fields, especially immediately south and west of Spitsbergen itself, were more extensive. The ice edge to the west of Spitsbergen was confirmed during an aerial reconnaissance made by Meteorological Office staff.

Barents Sea. Winds here were variable in direction. Air and sea temperatures were both markedly sub-normal, the former being as much as 8°C cooler than average; sea about 2°C down. The pack-ice, as may be expected, was more extensive than usual, especially in the southern half of the sea.

White Sea. Here the ice cover was much as usual, with air temperatures very variable but mainly on the low side.

Baltic Sea. The severity of the winter persisted to some extent, air temperature being about 8°C and that of the sea about 2°C below normal. Consequently the very thick ice in the Gulf of Bothnia showed only small signs of clearing although there were, indeed, a few leads. In the Gulf of Finland and in the sea off Stockholm some ice remained, but further south, in spite of lowish temperatures, all ice had cleared.

North Sea. No ice was reported.

MAY

This month was notable for the beginning of regular receptions by the Meteorological Office of Automatic Picture Transmissions (A.P.T.) from the U.S. Satellite ESSA II. The interpretation of these resulted in greater precision in the fixing of ice limits. There was also a marked increase in the number of ice reports from civil airline pilots.

Canadian Arctic Archipelago. As a result of relatively warm conditions the ice in Amundsen's Gulf in the extreme west and in Lancaster Sound at the eastern end of this area was more broken than usual. Elsewhere the cover was normal.

Baffin Bay. Mainly northerly winds early in the month kept air temperatures at first well below normal but these tended to rise later. There was, however, less ice than usual. A study of satellite pictures established some curious and rapid alternations in the degree of ice cover in the Kane Basin and also a hitherto unsuspected clearance in the Smith Sound.

Hudson Bay. Persistent north-easterly winds during the first part of the month resulted in the air then being some 6°C below average temperature but there was subsequently a warming up to normal, or even a few degrees above. Over the eastern half of the Bay pack-ice was much more broken than usual but on the western side conditions were about normal. Some shore leads were, however, reported even from the latter area.

Foxe Basin. Winds and temperatures were very variable, the latter fluctuating about the mean. Pack-ice was much as usual.

Davis Strait. In spite of persistent cool north-easterly winds, particularly over the eastern half of this area, sea temperatures were a few degrees higher than normal with the result that ice clearance was well ahead for the time of year.

During the last few days of the month the yacht *Griffin*, retracing the ancient *Vinland* exploration of the Vikings, was circumnavigating the ice-pack just off the south-west of Greenland and daily passed useful information as to sea temperatures and ice concentrations to London by radio telephone.

Labrador Sea and Great Bank. A mainly cyclonic air circulation was maintained over these seas during the period. Air temperatures, at the start of the month on the low side, rose and finished up just higher than usual. The sea, however, as earlier in the year, remained as much as 2–3°C above normal. Clearance of the pack-ice was, as a result, well ahead for the season and by the end of the month there was none off Newfoundland and relatively little off the south coast of Labrador. The number of icebergs, too, was far less than in a normal year.

Gulf of St. Lawrence. A south-westerly airstream prevailed here and raised temperatures from a couple of degrees below average to about the same amount above. Water, on the whole, was slightly on the warm side. As a result no pack-ice remained and only in a few places were icebergs or growlers seen.

Southern Newfoundland Sea and River St. Lawrence. No ice remained in either of these areas.

Greenland Sea. Except in the extreme north where winds were variable, north-easterlies persisted throughout May and kept air temperatures down below normal. As in previous months, however, the sea was slightly warmer than usual, by as much as 3–4°C just north of Iceland, with the result that pack-ice along the east Greenland coast, was variable in amount and in places mobile but on the whole less than average. Shore leads to the north of Scoresby Sound were seen from satellite photographs to be more developed than expected.

Spitsbergen. Contrary to the relationship during April the air here was much colder than usual while the sea was slightly warmer. There was still a lot of ice for the time of year.

Barents Sea. West to north-westerly winds kept both air and sea temperatures sub-normal over most of this area and in consequence, as in the previous month, pack-ice was much more extensive than in most years. Leads, however, were seen (by A.P.T.) to the lee of Spitsbergen and Franz Josef Land.

White Sea. A mainly south-westerly airstream helped to raise temperatures from about 3°C below to 3°C above normal. The break-up of the ice proceeded at the usual rate.

Baltic. Although temperatures rose quite quickly and reached, in the Gulfs of Bothnia and Finland, levels 3–4°C higher than normal, ice still remained in these areas. There was, at the end of the month, in spite of rapid melting, more ice than in any similar period over the past six years. There was a little ice at the beginning of the month near Aland but with rapidly rising temperatures in this area it quickly dispersed. Further south there was no ice at all during May.

Table 1. Icebergs sighted by Aircraft and Merchant Ships in the North Atlantic and Davis Strait

(This does not include growlers or radar targets)

Limits of Latitude and Longitude		Degrees North and West													
		68	66	64	62	60	58	56	54	52	50	48	46	44	42
Number of bergs reported south of limit	April	> 745	> 739	> 731	> 713	> 582	480	327	79	15	10	1	0	0	0
	May	> 187	> 186	> 186	> 166	110	101	101	90	55	18	1	1	0	0
	June					Incomplete Data									
	Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Number of bergs reported east of limit	April	> 745	> 745	> 727	> 622	> 460	> 364	> 134	> 64	> 48	> 32	> 8	1	1	0
	May	•	•	•	> 187	> 187	> 186	> 173	> 99	> 76	> 32	> 3	0	0	0
	June					Incomplete Data									
	Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Extreme southern limit	April	47° 35′N, 54° 05′W on 8.4.66													
	May	44° 40′N, 46° 45′W on 31.5.66													
	June	Incomplete Data													
Extreme eastern limit	April	60° 00′N, 42° 00′W on 5.4.66													
	May	51° 10′N, 46° 00′W on 6.5.66													
	June	Incomplete Data													

• Probably large numbers, but none sighted in excess of those reported in further south positions or in further east positions.

> ("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 greater than the value given.

Extreme limits during the 3-month period are underlined.

June

Canadian Arctic Archipelago. Both winds and temperatures were very variable, the latter ranging from about 3°C below to 3°C above normal. Nevertheless the clearance of the ice noted in May continued and Amundsen's Gulf and Lancaster Sound, as well as Prince Regent Inlet, were almost ice free. Elsewhere conditions were as usual.

Table 2. Baltic Ice Summary: April–June 1966

No ice was reported at the following stations during the period: Emden, Bremerhaven, Gluckstadt, Tonning, Husum, Flensburg, Kiel, Lubeck, Copenhagen, Aarus, Oslo, Kristiansandfjord.

No ice was reported at any of the stations during June.

Station	April 1966									May 1966								
	Length of Season		Ice Days			Navigation Conditions			Accumulated Degree Days	Length of Season		Ice Days			Navigation Conditions			Accumulated Degree Days
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
Leningrad	1	30	30	30	0	0	30	0	1322	1	2	2	0	0	2	0	0	—
Riga	1	8	8	0	8	0	0	0	523	0	0	0	0	0	0	0	0	—
Pyarnu	1	30	30	26	4	0	4	26	820	1	5	5	0	5	0	4	0	—
Viborg	1	30	30	30	0	0	30	0	—	1	10	10	8	2	0	10	0	—
Stettin	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—
Gdansk	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—
Klaipeda	0	0	0	0	0	0	0	0	348	0	0	0	0	0	0	0	0	—
Ventspils	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—
Tallin	1	30	30	0	30	7	22	0	—	1	2	2	0	2	2	0	0	—
Helsinki	1	30	30	30	0	0	30	0	1135	1	4	4	1	3	1	1	0	—
Mariehamn	1	30	30	28	2	25	5	0	915	1	5	5	0	5	5	0	0	—
W. Norrskar	1	24	24	0	18	0	9	14	—	2	2	1	0	1	0	0	0	—
Turku	1	30	30	27	0	5	25	0	1122	1	1	1	0	0	1	0	0	—
Mantyluoto	1	28	28	28	0	0	28	0	—	0	0	0	0	0	0	0	0	—
Vaasa	1	30	30	30	0	0	17	13	1688	1	10	10	8	0	0	10	0	—
Oulu	1	30	30	30	0	0	0	30	2071	1	20	20	20	0	0	0	20	—
Roytaa	1	30	30	30	0	0	0	30	—	1	27	27	27	0	0	0	27	—
Lulea	1	30	30	30	0	0	0	30	2233	1	22	22	19	0	3	0	19	—
Bredskar	1	30	30	30	0	0	15	15	—	1	13	13	13	0	0	4	0	—
Alnosund	1	30	30	30	0	0	0	30	1346	1	10	10	8	2	9	1	0	—
Stockholm	1	30	30	5	25	29	0	0	714	1	2	2	0	2	0	0	0	—
Kalmar	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—
Visby	1	9	8	0	8	2	4	0	—	0	0	0	0	0	0	0	0	—
Goteborg	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—
Skelleftea	1	30	30	30	0	0	0	30	—	1	19	19	19	0	0	1	18	—

CODE:
A First day ice reported.
B Last day ice reported.
C No. of days that ice was reported.
D No. of days continuous land-fast 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 and its thickness. They are derived from daily averages of temperature (00 + 06 + 12 + 18 GMT) and are the sum of the number of the degrees Celsius below zero experienced each day during the period of sustained frost.

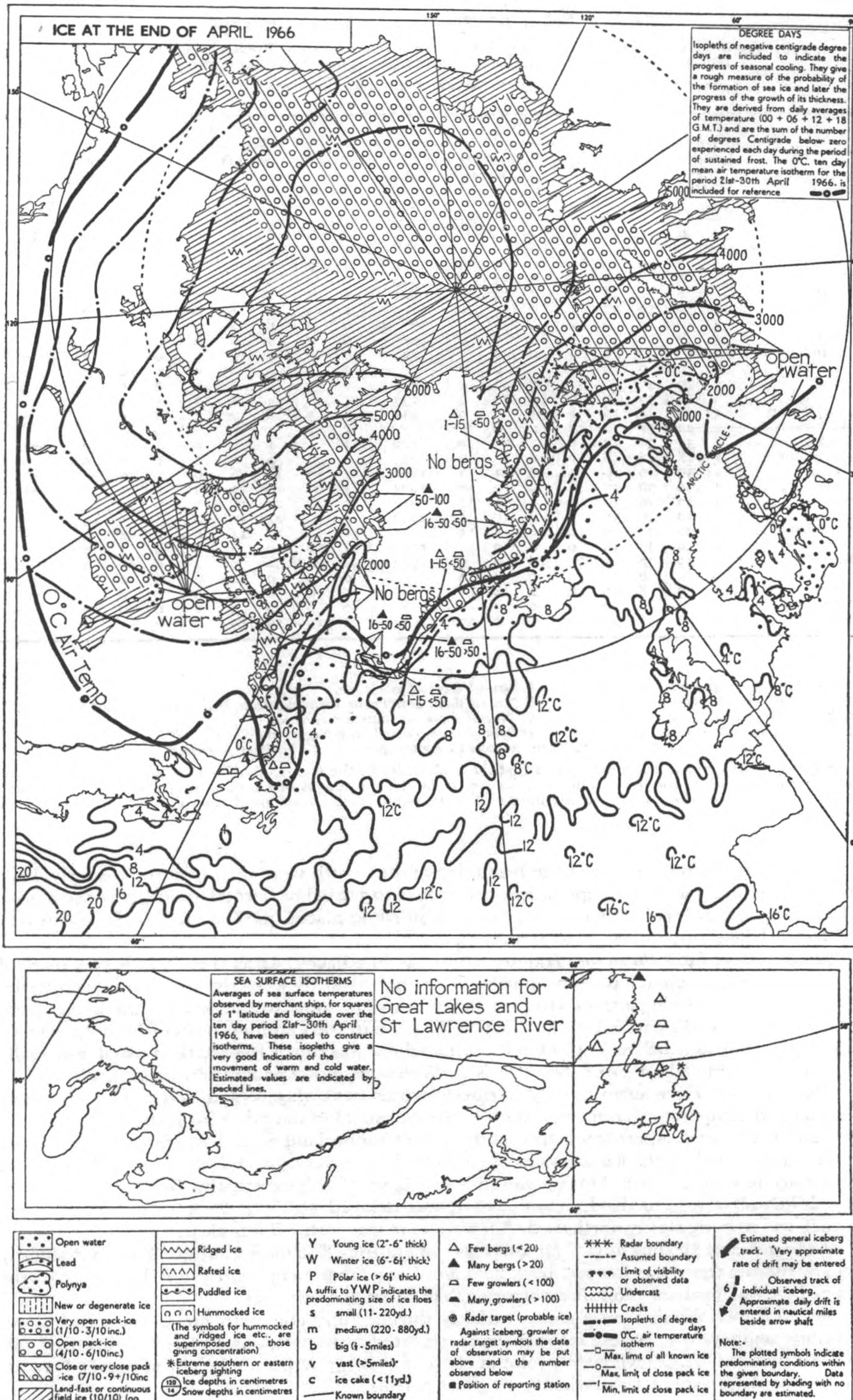
Baffin Bay. Winds, which at the beginning of the month were mainly north-westerly, later became southerly and air temperatures rose from 2 to 3°C below normal to a degree or so above. There was much less ice than usual, the edge in some places, particularly off the north-east of Baffin Island, retreating up to 100 miles.

Hudson Bay, Foxe Basin and Hudson Strait. As in adjacent areas there was here a marked reversal in wind direction from northerly or north-north-westerly to mainly southerly, although in southerly parts of Hudson Bay there were some westerlies. Temperatures were very variable, tending to fall in the north and to rise in the extreme south of Hudson Bay, in some places by as much as 3–4°C. On the whole there was much less ice than usual, especially in the extreme north of Foxe Basin, in Ross Welcome and over Hudson Strait itself.

Davis Strait. Here again mainly northerly winds gave way to southerlies but, curiously enough, air temperatures remained slightly sub-normal. On the other hand the sea was a little warmer than usual. Apart from the mouth of the Cumberland Sound where there was rather more than usual pack, ice amounts were well below average and icebergs and growlers generally few in number. During the first few days of the month the *Griffin*, sailing from Fredrikshaab across to the Labrador coast, was delayed at about 62°N 51°W by open pack which was moving slowly northward. A few miles to the north all was clear.

Labrador Sea. In spite of cool air and sea temperatures fluctuating round about but slightly below normal there was less ice, both field and bergs, than usual. Off the Labrador coast the pack belt was probably 60 miles narrower than in an average year.

Great Bank. Winds were mainly westerly during June and both air and sea had about average temperature. A few icebergs were reported, one particularly large, being first observed by a B.O.A.C. civil airline pilot at 48° 49′N, 50° 35′W from a height of 26,000 feet. Its subsequent movement was tracked by U.S. ice patrols.


ICE AT THE END OF APRIL 1966
DEGREE DAYS
Isopleths of negative centigrade degree days are included to indicate the progress of seasonal cooling. They give a rough measure of the probability of the formation of sea ice and later the progress of the growth of its thickness. They are derived from daily averages of temperature (00 + 06 + 12 + 18 G.M.T.) and are the sum of the number of degrees Centigrade below zero experienced each day during the period of sustained frost. The 0°C. ten day mean air temperature isotherm for the period 21st–30th April 1966. is included for reference
0°C Air Temp
open water
No bergs
ARCTIC CIRCLE
SEA SURFACE ISOTHERMS
Averages of sea surface temperatures observed by merchant ships, for squares of 1° latitude and longitude over the ten day period 21st–30th April 1966, have been used to construct isotherms. These isopleths give a very good indication of the movement of warm and cold water. Estimated values are indicated by pecked lines.
No information for Great Lakes and St Lawrence River
Open water
Lead
Polynya
New or degenerate ice
Very open pack-ice (1/10 - 3/10 inc.)
Open pack-ice (4/10 - 6/10 inc.)
Close or very close pack-ice (7/10 - 9+/10 inc)
Land-fast or continuous field ice (10/10) (no open water)
Ridged ice
Rafted ice
Puddled ice
Hummocked ice
(The symbols for hummocked and ridged ice etc., are superimposed on those giving concentration)
Extreme southern or eastern iceberg sighting
Ice depths in centimetres
Snow depths in centimetres
Y Young ice (2"-6" thick)
W Winter ice (6"-6½' thick)
P Polar ice (> 6½' thick)
A suffix to YWP indicates the predominating size of ice floes
s small (11-220yd.)
m medium (220-880yd.)
b big (½-5miles)
v vast (>5miles)
c ice cake (< 11yd.)
Known boundary
Few bergs (< 20)
Many bergs (> 20)
Few growlers (< 100)
Many growlers (> 100)
Radar target (probable ice)
Against iceberg, growler or radar target symbols the data of observation may be put above and the number observed below
Position of reporting station
Radar boundary
Assumed boundary
Limit of visibility or observed data
Undercast
Cracks
Isopleths of degree days
0°C. air temperature isotherm
Max. limit of all known ice
Max. limit of close pack ice
Min. limit of close pack ice
Estimated general iceberg track. Very approximate rate of drift may be entered
Observed track of individual iceberg. Approximate daily drift is entered in nautical miles beside arrow shaft
Note:- The plotted symbols indicate predominating conditions within the given boundary. Data represented by shading with no boundary are estimated.

Greenland Sea. North of 70°N an unusual south-westerly airstream prevailed with the result that air temperatures rose up to 3°C above mean values. The sea was also exceptionally warm being 4°C above normal. Although the general extent of the ice fields did not differ very much from average there was evidence that there was quite rapid thinning and heating. Wide leads developed just north of Scoresby Sound and were also seen further north, by satellite, some 100 miles off the Greenland coast. South of Scoresby, all around Iceland and in the Denmark Strait where the characteristic north-easterly was dominant, air temperatures were a little on the low side and the sea about normal or slightly above. Ice cover here varied rather considerably, with much drifting, especially in the Angmagsalik region off which the Danish supply ship *Nella Dan* became hemmed in for a time by hummocked polar pack.

Spitsbergen. Air temperatures in the north recovered somewhat and finished 2°C higher than average, the sea over the whole area being similarly warm. Apart from some fast-ice round the islands of Spitsbergen itself there was now less pack than usual.

Barents Sea. Wind direction was very variable and so was air temperature. North of 75°N, with temperatures on the whole above normal by about 2°C, ice amounts were well below average. Extensive leads developed, in fact, to the south-east of Spitsbergen and on the south side of Franz Josef Land. South of 75°N there was still some ice to the west of Novaya Zemlya and rather more than usual in Cheshkaya Guba but with quickly rising sea temperatures near North Cape there were signs towards the end of the month of rapid melting all over.

White Sea. Air temperatures fluctuated rather violently with the variability of the wind but the break-up of pack, well advanced in the south-east of the sea early in the month, proceeded briskly and all was cleared by half-way through the period.

Baltic. Southerly winds bringing a heat spell with air temperatures on the average up to 7°C above normal and the sea rapidly warming all combined to clear away the remnants of the heavy winter ice. The last report of ice from coast stations (in the extreme north of the Gulf of Bothnia) was on 3rd June and it is probable that all remaining pack had melted by 10th.

N. B. M.

Note. The notes in this article are based on information plotted on ice charts each month, similar to the map shown opposite, but on a much larger scale (39 in × 27 in). They are available at the price of reproduction on application to the Director-General, Meteorological Office (Met.O.1), Eastern Road, Bracknell, Berks. Alternatively, they may be seen at any Port Meteorological Office or Merchant Navy Agency. Ice charts are also broadcast by facsimile.

SPECIAL LONG-SERVICE AWARDS

Special Awards for long and zealous voluntary service at sea for the Meteorological Office were instituted in 1948 as an addition to the annual 'excellent' awards for especially good work during any one year. Four of these awards, which are inscribed barographs, are made every year, the qualification for an officer's entry into the 'zone' being a minimum of 15 years in which he has sent us at least one meteorological logbook including, of course, at least one in the year previous to the award. The Marine Branch keeps a card index of all voluntary observers at sea; a card is started for an officer as soon as his first observations are received, whether they be from a Selected or a Supplementary ship or an Auxiliary ship, always provided, of course, that his name appears on the logbook or forms; thereafter a note is made on his card of his every subsequent return, the serial number, date received and the assessment (Excellent, Very Good or Good) given to it. We thus have, on individual cards, a complete record of an officer's voluntary service for us.

Each year, the cards of all officers with 15 or more years' voluntary observing service who have sent in at least one return during the preceding year are extracted; their individual records are then worked up by a formula which considers their length of service and the quality of each meteorological return they have made and this effectively places them in an order of merit, the first four being selected for the awards. Gaps in voluntary observing at sea are inevitable: time ashore for examinations, the laying-up of ships, time served in a capacity in which the officer takes no part in the voluntary observing and service in ships which are not on the voluntary observing list will all preclude an officer's service being continuous and we have sometimes found that the 15 years have been spread over a period of as long as 40 years. This is the first year in which the qualifying service of one of the recipients has no gaps in it.

Seventy-eight officers were in the zone for the 1966 awards; the formula was applied to each of their cards with the result that the Director-General of the Meteorological Office is pleased to award inscribed barographs to the following:

1. CAPTAIN G. H. PERCY (Cairn Line), who sent us his first meteorological logbook in 1948 when he was in the *Cairnavon.* In 18 years he subsequently sent us 30 meteorological logbooks of which all but 6 were classed 'excellent'.
2. CAPTAIN J. S. MOATE (Port Line), who first observed for us in the *Port Darwin* in 1928. In 18 years he has sent us 33 meteorological logbooks of which 26 have been classed 'excellent'.
3. CAPTAIN W. A. HADDOCK, O.B.E. (Head Line), whose first meteorological logbook came to us in 1929 from the *Lord Antrim.* Captain Haddock has, in 21 years, sent us 52 meteorological logbooks altogether and has received the 'excellent' classification 20 times.
4. CAPTAIN R. WHITE, D.S.C. (Blue Star Line), whose first meteorological logbook was received in 1932 from the *Albion Star.* Captain White has 19 years' voluntary observing to his credit and has sent us 39 meteorological logbooks of which 26 have been classed 'excellent'.

We congratulate these four shipmasters on this recognition of their valuable voluntary service over many years. They will be personally notified of the award and of the arrangements which will be made for its presentation.

An account of the presentations of the previous year's awards appears on page 203.

L. B. P.

INDIAN EXCELLENT AWARDS

(From the Deputy Director-General of Observatories (Forecasting), India)

India Meteorological Department had 47 Selected and 75 Supplementary Ships on the list of Voluntary Observing Fleet during the year ending 31st March 1965. 1,031 logs consisting of 12,284 meteorological observations were received from these ships in the Department during the year. The weather observations recorded and transmitted by these ships were of great value in the day-to-day forecasting of the Department, and in particular for issuing warnings to ships.

This Department wishes to convey its appreciation to all the officers concerned for their valuable co-operation.

Awards, in the form of books to Captains, Observing Officers and Radio Officers of ships whose meteorological work has been adjudged to be 'excellent', are offered and the following ships have been selected for such Excellent Awards for the year 1964-65:

NAME OF VESSEL	OWNER
State of Bombay	Shipping Corporation of India Ltd.
State of Madras	Shipping Corporation of India Ltd.
State of Maharashtra ..	Shipping Corporation of India Ltd.
Rajula	British India Steam Navigation Co. Ltd.
Karanja	British India Steam Navigation Co. Ltd.
Islami	Mogul Line Ltd.
Krishna Jayanti	Jayanti Shipping Co. Ltd.
Bahadur	Asiatic Steam Navigation Co. Ltd.
Jag Doot	Great Eastern Shipping Co. Ltd.
Indian Industry	India Steamship Co. Ltd.
Jalavihar	Scindia Steam Navigation Co. Ltd.

In addition to the ships mentioned above, the following have been awarded a "Certificate of Merit" for commendable work done during the same year:

State of Travancore-Cochin	*Mohammedi*	*Jag Mitra*
	Mozaffari	*Vishva Prabha*
State of Bihar	*Saudi*	*Vishva Maya*
Jaladhruv	*Kampala*	*Jaladharti*

HONG KONG EXCELLENT AWARDS

(List supplied by the Marine Liaison Officer, Royal Observatory, Hong Kong)

Ten meteorological logbooks classified as 'excellent' have been returned by the masters of Hong Kong Selected and Supplementary Ships. Their names, together with the names of their ships and of the deck and radio officers who have thereby qualified for awards, are listed on page 212.

Book Review

Weather Studies, by L. P. Smith, B.A. $5\frac{1}{2}$ in × $7\frac{3}{4}$ in, pp. 131, *illus*. Pergamon Press Ltd., Headington Hall, Oxford, 1966. Price: 15*s*.

Many a sailor is traditionally supposed to have sold his farm and taken to the sea; equally, many a sailor is reputed to dream of the day when he can make enough money to buy a farm. Agriculture and (if the reviewer may presume to write a word which has been used verbally for many years) 'nauticulture' have always been linked together, chiefly perhaps by the vast difference which separates them, yet with one indisputable tie—their mutual dependence on weather wisdom.

The author, who has for many years been responsible for agricultural climatology in the British Meteorological Office and is currently President of the Commission for Agricultural Meteorology in the World Meteorological Organization, has produced this handy little volume with the idea of interesting young scholars in the elements of meteorology. It is as certain that some of them will ultimately go to sea and become members of the Corps of Voluntary Marine Observers as it is that some of them will eventually become farmers, though the great majority will undoubtedly adopt other walks of life. But dependence on and respect for the weather is common to all vocations and there is something here for all of them.

The book is divided into five main parts: Measuring the Weather, The Weather in Graphs (including wind roses and weather maps), The Weather in Pairs (e.g. temperature and wind, rain and wind, rain and pressure, etc.), Local Weather (e.g. rainfall in the garden, weather under glass and in the classroom) and Forecasting the Weather. Each part is subdivided into from 4 to 9 sections, about a page or two in length, and each section is followed by an 'assignment' which sets down a few practical experiments by which the material in the preceding section may be illustrated and proved. There are 40 sections and thus 40 assignments.

The whole work is written in a most friendly manner and one somehow receives the impression that Mr. Smith is devising some new games; this is surely a most refreshing approach to a serious subject. There is unfortunately one glaring error on page 8 concerning minimum temperatures, probably due to sketchy proof reading. Here it is stated that "alcohol expands as the temperature decreases" and though this error is perhaps redeemed by the subsequent statement that the said alcohol retreats back into the thermometer bulb, the general effect of the whole sentence would only be to confuse the mind of the reader.

Your reviewer feels that this book is rather elementary for the average ships' officer but that it could be an agreeable Christmas or birthday present to a younger member of the family or to a young school-teacher. Its limp, though robust, cover makes it easily portable and the many graphs, diagrams and photographs of common cloud types, some in colour, enhance its interest.

L. B. P.

Recipients of Hong Kong Excellent Awards

Name of Vessel	Captain	Observing Officers	Radio Officers	Owner/Manager
Anking	B. McLennan	R. J. Smith, D. A. Daish, J. N. Edwards	Raymond Wat Kwan	China Navigation Co. Ltd.
Galle	D. W. R. Gash	A. C. Walker, Tai Lin Yung, Yeung Kwok Ming	F. Renshaw	Tech Cheong Enterprises (H.K.) Ltd
Hoi Wong	J. Bjerkenes	A. Bjelland, F. Thorsen, O. Espesseth	H. Fastingsen Chan Shiu Wing	Karsten Larrsen Co. (H.K.) Ltd.
Sinkiang	R. J. Shipp	T. S. Payne, H. Davis, M. Pellegreni	—	China Navigation Co. Ltd.
Szechuen	R. F. D. Pook	A. L. Carter, A. J. Mills-Irving, R. F. D. Davis	Tsui See Man	China Navigation Co. Ltd.
Kweichow	R. E. Brooks	J. Lough, G. M. Adams, J. P. G. Kelly, B. Hibbendine	Chan Wing Tsung	China Navigation Co. Ltd.
Eastern Glory	F. H. Main	M. K. Montgomery, A. H. Dalton	D. I. Griffiths	Indo China S.N. Co. Ltd.
Chefoo	K. D. Johnson	A. M. Allcott, R. E. Hermen	Yue Shiu Ming	China Navigation Co. Ltd.
Anshun	R. Kennett	D. A. Roche, L. R. Jones, T. W. Allsop	—	China Navigation Co. Ltd.
Sinkiang	R. J. Shipp	T. S. Payne, D. J. Taylor, J. D. Arbuthnot	—	China Navigation Co. Ltd.

Personalities

RETIREMENT.—CAPTAIN R. J. BRITTAIN retired recently from the sea owing to ill health, his last command being the P. & O.–Orient Liner *Orcades*.

Ronald Jack Brittain was born in 1908 and received his pre-sea training in *H.M.S. Worcester*. After serving his apprenticeship he joined the Clan Line as 4th Officer of the *Clan Macnair* in January 1924 and thirteen years later, in March 1937, he joined the Orient Line.

During the second world war he saw plenty of action particularly when the evacuation of British troops took place from France in 1940. At St. Nazaire, when Chief Officer of the *Oronsay*, he embarked about 6,000 troops plus a thousand survivors from the ill-fated *Lancastria* in five hours under constant air attack. The first bomb struck the *Oronsay* on the bridge and exploded in the officers' accommodation, destroying all navigational equipment except the wheel. On arrival off Plymouth next day her bows and shell plating at No. 1 hatch were so studded with holes from shrapnel and splinters that her forepart looked like a pepper pot.

When the P. & O. and Orient Line fleets merged in 1960, he was promoted to his first command, the *Orion*, and has since commanded the *Oronsay*, *Orsova* and finally the *Orcades*.

Captain Brittain's association with the Meteorological Office goes back to 1925 when he sent us his first meteorological logbook from the *Clan Sinclair*; thereafter in 10 years he has sent us 26 logbooks of which 11 were classed as 'excellent'. He received an Excellent Award in 1965 when he was in command of the *Oronsay*.

We wish him health and happiness in his retirement at Folkestone.

J. C. M.

RETIREMENT.—CAPTAIN L. W. FULCHER completed his last sea voyage in command of the *Rangitoto* in July last.

Leslie Woodland Fulcher, born in 1906, joined the New Zealand Shipping Company as 4th Officer in 1929 and in 1948 he was appointed to his first command, the *Tekoa*. He subsequently commanded a number of the Company's cargo ships before being appointed to the *Rangitoto*, which he commanded for the past eight years.

Twice during his war career Captain Fulcher had the misfortune of having to abandon ship. The first occasion was when he was Chief Officer of the *Hertford* and the ship was mined in the approaches to the Spencer Gulf, South Australia, on 7th December 1940. Although the ship was severely damaged he, together with the Master and a number of the ship's company, re-boarded her the following day and successfully took her into port with the aid of tugs. She finally completed repairs in Australia during January but, whilst proceeding independently on passage from Panama to Halifax, she was torpedoed with three casualties: three members of the crew having apparently been trapped and killed in the engine room. After three days in a lifeboat with 21 men he was rescued and landed safely at Halifax.

Captain Fulcher's association with the Meteorological Office goes back to 1929 when we received his first meteorological logbook from the *Norfolk*. In 27 years he has sent us 56 books of which 49 were classed as Excellent; he received Excellent Awards in 1931, 1932, 1933, 1934, 1951, 1952, 1954, 1956, 1959, 1962, 1963, 1965 and 1966—a remarkable record. In 1956 Captain Fulcher was presented with the special award, a barograph, for good voluntary observing over a long period of years.

We wish him health and happiness in his retirement in Folkestone where he lives with his wife and daughter.

J. C. M.

RETIREMENT.—Early in 1966, CAPTAIN T. S. GRAHAM retired from the service of the Donaldson Line after a noteworthy career of 45 years with the same Company.

Thomas Graham was born on the Isle of Cumbrae, overlooking the waters where many of his departures and landfalls were made. He first went to sea aboard the *Gracia* and on completion of his apprenticeship in 1925 passed for Second Mate, continuing to serve aboard the Company's ships on various trades. He obtained his Master's Certificate in 1929 and in 1939 was appointed to his first command, the *Coracero*. From then onwards he commanded eight of the Donaldson Line ships, his last one being the *Laurentia* which he had on the North Atlantic trade for twelve years.

During the second world war, Captain Graham saw service in all oceans and was engaged in many of the major operations of the war at sea including the rigorous Murmansk and Archangel run and the western Pacific Ocean. Most of his war service was, however, spent on the Atlantic Ocean where the *Coracero*, his command at the time, was torpedoed and sunk south of Iceland on 17th March 1943.

Captain Graham, a most enthusiastic voluntary marine observer, is keenly interested in all aspects of meteorology. His enthusiasm was an inspiration to all officers serving under him. During his time in command of the *Laurentia*, she figured in the short list of ships which had sent in the best meteorological logbooks during the year in five separate years and in the July 1957 number of *The Marine Observer* her picture was published as one of the three ships which had gained the highest markings during the preceding year.

Captain Graham's first meteorological logbook was received in 1948 from the *Moveria*. Since that year, he has given unbroken service to the Meteorological Office as a voluntary marine observer, sending us 34 meteorological logbooks, 25 of which were classed as 'excellent'. During his 17 years of zealous service for the Meteorological Office he received 13 Excellent Awards.

We wish him a long, healthy and happy well-earned retirement.

R. R.

RETIREMENT.—Master of the Liverpool–Dublin passenger ship *Munster* and Senior Master of the British and Irish Steam Packet Company's fleet, CAPTAIN J. WILLIAMS retired on 6th April 1966 after 46 years at sea.

Born near Criccieth, North Wales, John Williams first went to sea as an apprentice in 1920 with the Shaw Savill & Albion Line and after passing for Second Mate he joined the British and Continental Plate Line. Eight years later he joined the Coast Line Group and in 1937 was appointed to the permanent staff of the British and Irish Steam Packet Company.

During the second world war, Captain Williams commanded munition and petrol carriers in the Mediterranean. He was one of seven shipmasters who sailed American river-boats across the Atlantic to decoy U-boats from a troop convoy. Three of these vessels were sunk by U-boats. For his part in this operation he was awarded the O.B.E.

Returning to the service of the B. & I. fleet after the war, Captain Williams spent many years as master of passenger vessels, the *Innisfallen* on the Fishguard–Cork service and latterly the *Munster* on the Liverpool–Dublin service until his retirement.

Short sea and coastal vessels making sea temperature observations and transmitting them to the Meteorological Office have been a valuable addition to the voluntary observing fleet since the end of the war and Captain Williams has for many years co-operated in this way. He received an Excellent Award in 1964 when in command of the *Munster*.

We wish him health and happiness in his retirement.

J. R. R.

RETIREMENT.—CAPTAIN D. WOLSTENHOLME retired from the service of Messrs. T. & J. Harrison Ltd., whom he describes as "one of the most understanding firms in the Kingdom", in July after 47 years with them.

Douglas Wolstenholme received his early education at the Manchester Warehousemen & Clerks School, later known as Cheadle Hulme School, and went straight to sea from there in May 1919 as an apprentice in the *Student*. He passed for Second Mate in June 1923 and joined the *Chancellor* as 3rd Officer in October 1923; these were the years of the great shipping depression which brought promotion almost to a standstill. He spent the war years as Chief Officer in various Harrison ships, none of which came to any harm, his only adventure being the towing of the *Parkgate* for 1,000 miles into Mombasa when he was in the *Journalist*. He was appointed to his first command, the *Scholar*, in July 1947 and came ashore to the relieving staff from the *Dalesman* last March. Captain Wolstenholme's voluntary observing record goes back to 1925 when he sent us his first meteorological logbook from the *Colonial*. Since then in 18 years, he has sent us 31 meteorological logbooks, 21 of which have been assessed 'excellent'; he received Excellent Awards in 1949, 1951, 1952, 1959, 1960 and 1966.

We wish him health and happiness in his retirement.

L. B. P.

OFFICIAL PUBLICATION

Quarterly Surface Currents Charts of the Western North Pacific Ocean (Met.O.485), 2nd edition, Her Majesty's Stationery Office, London, reprinted with minor amendments 1966. Price 50*s*.

This publication (formerly M.O.M.476) has been prepared in the Marine Branch of the Meteorological Office and consists of quarterly charts of current data for the Western North Pacific, west of 160°W, and monthly chartlets of the China Seas. The observations cover a period 1855–1939 and have been used to compute current roses, predominant directions, average rates and vector means. The size of the publication is approximately 16 in × 21 in.

Notice to Marine Observers

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Printed in England for Her Majesty's Stationery Office by
William Clowes and Sons Ltd., London and Beccles

Dd. 125603. K.16. 10/66

S.O. Code No. 40-38-66-10