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THE MARINE OBSERVER

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Editorial

" He builded better than he knew." The 19th-century poet Emerson was writing of the unknown workman, representative of many others of his kind, who fashioned from stone the great cathedral of St. Peter in Rome.

The pages of history tell of many other men who in building could not even dream of the ultimate results of their labours. James Watt, when he began to build on his discovery that the steam pressure inside a kettle of boiling water would lift the lid, could not have imagined that he was laying the foundation of modern industry; Edward Lloyd, in building up his coffee house clientele in the late 17th century, could not know that on his foundation would be built a great corporation, known and respected throughout the world; the sleepless Beethoven, hearing a repeated knock on a neighbour's door, could little have thought that from the very rhythm of that knock would grow his immortal fifth symphony.

Similarly, the " Divers Worthy Persons, inquisitive into natural philosophy and other parts of human learning ", who, in 1645, assembled for weekly meetings in London, sometimes in lodgings of one of their number and sometimes at the Bull Head Tavern in Cheapside, would have been thought presumptuous had they dared to look forward to the day when their meetings would have grown into the Royal Society, the oldest scientific body in Great Britain, celebrating this year its tercentenary.

The turbulent times of the Civil War and the Protectorate put a temporary stop to these weekly meetings, but they were resumed in 1660, being then put on a firmer basis. From then to the present day the Society has had an uninterrupted existence.

The first Journal Book of the Society, opened on 28th November, 1660, records that after the paper, read by a Mr. Wren, later to achieve fame as London's principal architect after the great fire, " they did, according to the usual manner, withdrawe for mutual converse. Where amongst other matters that were discoursed of something was offered about the designe of founding a Colledge for the promoting of Physico-mathematical experimentall learning ". It was at the second meeting, only one week later, that word came from King Charles II that he approved of the meetings. Thus was born the Royal Society (more fully, The Royal Society of London for Improving Natural Knowledge), the King himself offering to become a member in the following year.

From the time of its royal foundation, the Society has never lost sight of its original purpose, " the promotion of natural knowledge ", and it has sought to do this in many ways, the chief among them being the publication of new scientific knowledge and its discussion at meetings. It has also sought to encourage scientific research, and it is not therefore surprising that the Meteorological Office may in some ways be considered a child of the Royal Society, grateful to its parent for guidance and assistance during the 105 years of its separate existence.

In this tercentenary year it is profitable to cast a glance astern and to view some of the various ways in which the Royal Society has concerned itself with the profession of the sea. Over the years it has been consulted on the longitude problem, the measurement of a degree of latitude, the protection of ships from lightning, the use of coal tar in vessels of war, the methods of measuring the tonnage of ships, the corrosion of copper sheathing by sea-water, and the organisation of the Royal Observatory of which it assumed sole charge in 1710, and on whose board of visitors it still has representatives.

It is the Society's more spectacular maritime activities, however, which will be more widely known. These have largely lain in the sponsorship and support of various expeditions, the better known early ones being those of Captain Cook in 1761, 1769 and 1771, the last of which developed from an Antarctic expedition into circumnavigation of the globe. The famous *Challenger* expedition of 1872 and the various 19th-century expeditions to the Antarctic, as well as those to the Arctic in search of the North-West Passage, all received its blessing whilst, in more recent years, readers of the January 1957 number of *The Marine Observer* will remember that a Royal Society base was established at Halley Bay on the Antarctic continent in connection with the International Geophysical Year. The Society's task of co-ordinating all the International Geophysical Year activities of the United Kingdom was described by Dr. D. C. Martin, the Assistant Secretary, in our July 1959 number.

To the Royal Society in 1854 fell the task of recommending one of its Fellows to be the first Director of the newly formed Meteorological Office. In those days the primary users of meteorological knowledge were seamen, and it was initially for their benefit that meteorological services were formed in all maritime countries. It was natural, therefore, that the first Director should be a seaman, and the Society recommended Admiral FitzRoy for the post. From 1877 to 1906 it nominated the Council which then controlled the functions of the Office, and from then until 1919, when for convenience of administration the office was placed under the Air Ministry, it continued to advise and assist. Up to 1957 it had two representatives on the committee which governs the general policy of the Meteorological Office.

Another of its activities is the appointment of the Gassiot committee, a body formed in 1910 to promote the scientific study of meteorology, terrestrial magnetism, atmospheric electricity and seismology, of which the Director-General of the Meteorological Office is a member.

Among the seamen elected to Fellowship of the Royal Society through the years have been nine Hydrographers to the Navy, the name of one of whom, Admiral Sir Francis Beaufort, is perpetuated in the Beaufort letters and Beaufort scale of wind force.

The scope and functions of the Meteorological Office have grown and its ' customers ' now come from many more walks of life than were visualised by Admiral FitzRoy, but it is appropriate to mention that throughout the years the Marine Division, the lineal successor of the original Meteorological Office, has always been led by a seaman and that it is still the voluntary observer at sea to whom the Office must look for the raw material without which its ability to provide an adequate service for shipping would be severely handicapped.

To believe that man will ever become the complete master of nature would be arrogant and heretical. But we are so bold as to believe that the seaman and the meteorologist together are helping to take him steadily, albeit slowly, towards the day when a maritime casualty due to weather will be a rarity, when the tropical storm and the iceberg alike will no longer be barely foreseeable hazards, and when poor ocean passages will be infrequent because the mariner knows where to find the favourable, and where to avoid the unfavourable, wind and current. In that day, he will have come to terms with the weather and will seldom have to fight it. Then may it well be said of the 19th and 20th century voluntary marine observer that " he builded better than he knew ".

L. B. P.

THE MARINE OBSERVERS' LOG

April, May, June

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

CURRENT RIP

North Atlantic Ocean

S.S. *Umgazi*. Captain R. B. Linsley. London to Dakar. Observer, Mr. J. L. Catterall, Chief officer.

30th April, 1959. At 1700 G.M.T. the vessel passed through a strong current rip lying in an ESE.–WNW. direction. Wavelets in the rip were breaking at right angles to those made by the wind, which was NNW., force 2. The ship, steered at the time by automatic helmsman, deviated from course by about 7°. No soundings were obtained. Speed of ship, 14 kt. Course, 171°. Sea slight. Sea temp. at 1200, 73°F; at 1800, 81°.

Position of ship: 10° 12′N., 17° 25′W.

Note. This current rip was almost certainly experienced at the division between the North Atlantic equatorial current and the equatorial countercurrent.

North Pacific Ocean

M.V. *Port Pirie*. Captain L. J. Skailes. Wellington to Balboa. Observer, Mr. J. Farmer, 2nd officer.

9th April, 1959. At 2230 G.M.T. the vessel passed through a current rip lying NE.–SW. which caused the vessel to heel over and sheer off to port. When back on course again (052°) the previous wake was seen to be some hundred yards to the southward down the current demarcation line. A few minutes before entering the rip, the air temp. was 87°F and the sea 85° (by condenser intake): 10 min afterwards the temperatures were 80° and 77½° respectively. Wind SE., force 1–2. Rippled sea, low swell.

Position of ship: 6° 30′N., 81° 06′W.

Note. This current rip was observed in an area where ocean currents are complex. It is probable that M.V. *Port Pirie* passed across the division between the Peru current and a re-curving branch of the equatorial countercurrent.

DISCOLOURED WATER

Adriatic Sea

M.V. *Shropshire*. Captain H. B. Peate, D.S.C., R.D. Venice to Port Said.

1st May, 1959. When leaving Venice at 1800 G.M.T. a line of discoloured water was observed, stretching in an E.–W. direction for as far as the eye could see. The colour change was from a greyish blue to a dark blue. The sea was choppy at the line of discolouration and calm on each side.

Position of ship: 10 miles S. of the Fairway Buoy.

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

"M.V. *Shropshire* must have seen a land run-off demarcation line leaving Venice but I should have thought such would only follow heavy rain in the nearly tideless Adriatic where most of their rain comes in winter. Such things still reflect the river plankton content of the water inshore, contrasting with the deep blue colour of denser off-shore waters. The distinction is due to physical factors, imperceptible grading being more normal."

North Atlantic Ocean

M.V. *Corinaldo.* Captain J. L. McQueen. Santos to Rotterdam. Observers, Mr. J. MacDonald, 2nd officer and Mr. J. Lamb, Radio officer.

15th May, 1959. At 1620 G.M.T. an extremely strong odour was noticed and, from the bridge, dense lines of demarcation accompanied by occasional dark brown patches were seen running in a NNW.–SSE. direction for about 4 miles. A sample of sea water obtained was found to be full of very small particles. Sea temp. 68°F. Wind NNW., force 2–3.

Position of ship: 21° 20′N., 19° 27′W.

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

"The smell of ozone and brown discolouration and motes in the water strongly suggest *Trichodesmium* Bloom. It is, of course, the emanation from algae and not ozone that one can smell in such circumstances. *Discovery* investigation vessels have twice at least met with *Trichodesmium* Bloom not far from the position given. This, with the demarcation lines, suggests that the vessel was traversing the western boundary of the Canary current."

C.S. *John W. Mackay.* Observer, Mr. D. S. McGarvie, 2nd officer.

28th May, 1959. At 2058 G.M.T. the ship entered a streak of very light green water. No change was noted in the sea temperature, which was 67°F. The line of demarcation between the usual deep blue colour of the sea and this streak was very clear and definite, being in a line 170°–350° through the ship's position. The sea, which had been rippled, became very smooth. It was observed that the sea was filled with innumerable small jellyfish and weed. The fish had a light purple and brown colour.

At 2121 the ship cleared the streak, which was in a line N.–S. The sea again became rippled. No further marine life was seen once clear of this streak.

The sea temperature remained the same throughout the observation. The wind was N'ly, force 1–2, and the ship experienced a very definite southerly set.

Position of ship: 39° 10′N., 53° 32′W.

Note. This observation, which was forwarded to us by the Director of the Canadian Meteorological Branch, was referred to Dr. T. J. Hart, of the National Institute of Oceanography, who comments:

"This is not usual, being well off shore in the western ocean and also a long way south of the Grand Bank. The high temperature suggests Gulf Stream influence but the rich life shows that, if some of it was Gulf Stream proper, it must have been much mixed with river coastal waters before being deflected off shore to the position given."

RADIO FADE-OUT

North Pacific Ocean

S.S. *Loch Garth.* Captain C. C. Dingle. Cristobal (Canal Zone) to Los Angeles. Observers, Mr. F. E. Page, Radio officer and Mr. J. Hunt, 2nd officer.

10th May, 1959. Between 2145 and 2200 G.M.T. there was a complete radio fade-out on all short-wave bands. At 2200 reception began to return. All possible causes of this silence due to technical faults were explored but none was found. The sun was observed to have two small sunspots on it, one in the lower left centre and the other just above the centre.

Position of ship: 8° 30′N., 84° 36′W.

Note. Mr. G. O. Evans, of the Radio Research Branch of the G.P.O., comments:

"A Delinger fade-out similar to this was also reported by the Cable and Wireless station at Suva as having affected all its Pacific Island circuits between 2130 and 2245 on 10th May.

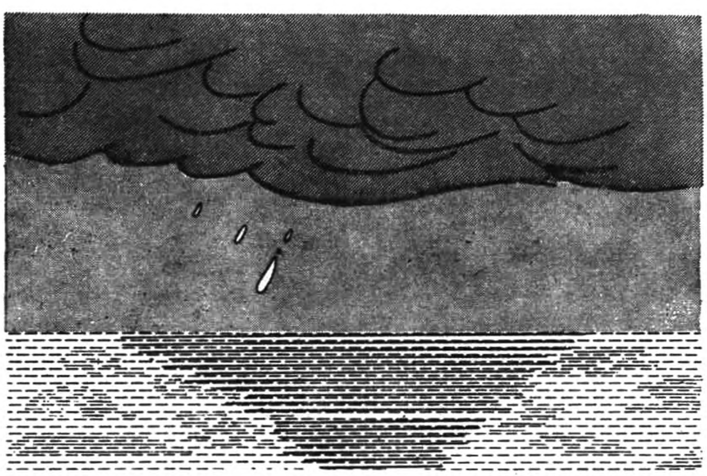
" Delinger fade-outs are caused by an increase in the ultra violet light emitted by the sun and therefore tend to affect radio circuits whose bands traverse the sunlit region of the globe. This particular fade-out was probably associated with five large sunspots which were visible during this period and was followed 36 hours later by severe ionospheric and magnetic disturbances. Reports of Delinger fade-outs from ships in the Pacific Ocean are of particular interest since they can occur at times when the majority of radio circuits incoming to the United Kingdom are partly, or completely, in darkness and are thus not affected by Delinger fade-outs."

LIGHTNING

North Pacific Ocean

S.S. *Devon.* Captain A. C. Rollinson. Los Angeles to Balboa. Observer, Mr. A. E. Robinson, 3rd officer.

30th April, 1959. Between 0130 and 0500 G.M.T. vivid lightning was observed at a distance of over 10 miles, coming from four main centres. The flashes increased in frequency until they were occurring at the rate of one per second. An



unusual type of lightning was seen at 0300, in the form of three distinct and separate ' bolts ' which were similar in appearance to a comet with a tail (see sketch). These came from the base of a cloud and disappeared at the horizon. No thunder was heard until 0540 when the lightning and rain squalls approached to within 10 miles. Air temp. 84°F, wet bulb 78°, sea 84°. Visibility excellent.

Position of ship: 8° 30′N., 84° 30′W.

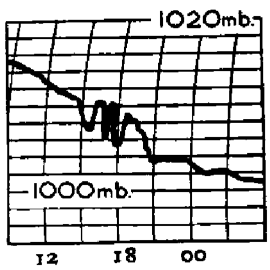
Note. The type of lightning described above as ' bolts ' seems to be a good example of ' ball ' lightning. Further observations of this uncommon form of lightning, particularly with photographs, would be most welcome.

PRESSURE VARIATIONS

Malta Channel

M.V. *Port Victor.* Captain J. A. Fairbairn. Port Said to Liverpool. Observers, Mr. M. F. Norris, 2nd officer and Mr. M. R. Tolman, Senior apprentice.

8th May, 1959. The abnormal variations in pressure, shown in the diagram, took place over a period of about four hours during the afternoon and evening—the first



abnormality being observed at 1515 G.M.T. when the vessel was passing through the Malta Channel at 16 kt. At noon the weather had been fair with the wind ESE., force 4, and the air temperature 70°F, but with the onset of the pressure fluctuations the wind became variable in direction between SE'E. and ENE., and decreased to force 2–3. The sky became overcast and rain began at 1730 and continued for about 2 hours. By 1800 the air temperature had fallen to 62°.

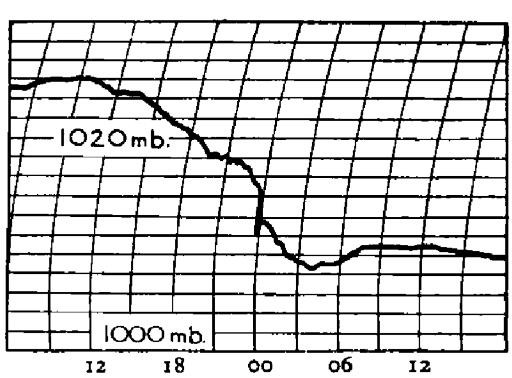
Position of ship at 1515: 36° 01'N., 14° 49'E.

Note. Pressure fluctuations are characteristic of thundery conditions. A depression with associated fronts, lying over northern Tunisia on the afternoon of the day in question, gave rise to thunderstorms or thundery rain over the general area between Malta and Tunisia. The three complete pressure oscillations shown clearly in the diagram suggest, however, some special phenomenon but it has not been found possible to suggest any synoptic weather, or local climatic, origin.

South Pacific Ocean

M.V. *Otaio*. Captain H. N. Lawson, R.D. Balboa to Auckland. Observer, Mr. R. C. Ford, 3rd officer.

13th June, 1959. At 1800 G.M.T. the barometer reading was 1020·5 mb, with an



irregular fall taking place during the evening. A very sudden drop in pressure, followed by a slight, though temporary recovery, was recorded by both barographs at 2330—the reading changing from 1014·8 to 1010·2. From about 2000 onwards the wind, which had been N'W., force 4, increased irregularly to become N., force 8, by midnight. About ½ hour after the sudden fall the wind started backing from N., and by 0400 was WNW., force 6. No other significant change in the weather, apart from a substantial rise in dewpoint between 1800 and 2400, was noticed. At 1800: air temp. 60·5°F, wet bulb 53·5°. At 2400: air temp. 59·8°F, wet bulb 59·1°.

Position of ship: 35° 40'S., 178° 23'E.

Note 1. The Director of the New Zealand Meteorological Service comments as follows:

" The general pressure fall, and the freshening and later backing of the northerly wind, were due to a small, but vigorous, depression which formed over the sea to the WNW. of North Cape. It first became evident on our 1200 G.M.T. chart when a rapidly freshening northerly wind and a pressure fall of 8 mb since 0900 G.M.T. was reported from Cape Reinga lighthouse. The centre was then approximately 70 nautical miles WNW. of Cape Reinga. By 0300 G.M.T. on 14th it was located a few miles east of Gisborne, having moved SE. at an average speed of 28 kt.

" Very steep pressure falls such as the one observed are occasionally reported in association with such depressions. They are not frontal as a rule, the other characteristics of frontal passages not usually being present. They sometimes occur in the neighbourhood of thunderstorms or of rapidly developing thunderclouds, the temporary pressure rise following the steep fall being typical.

"Although the account of the weather does not suggest the presence of a thunderstorm it is possible that thunderclouds may have been in the early stages of rapid development at the time. The amount of low cloud reported by the *Otaio* at 0000 hours G.M.T. was 8/8, so the tops would not have been visible. That the air circulating around the depression was unstable is indicated by reports of thunderstorms at two North Island stations during the morning. These stations did not experience a similar pressure fall, however. The *Empire Star*, sixty or seventy miles south of the *Otaio* at 0000 G.M.T. on 14th June, also reported showery conditions."

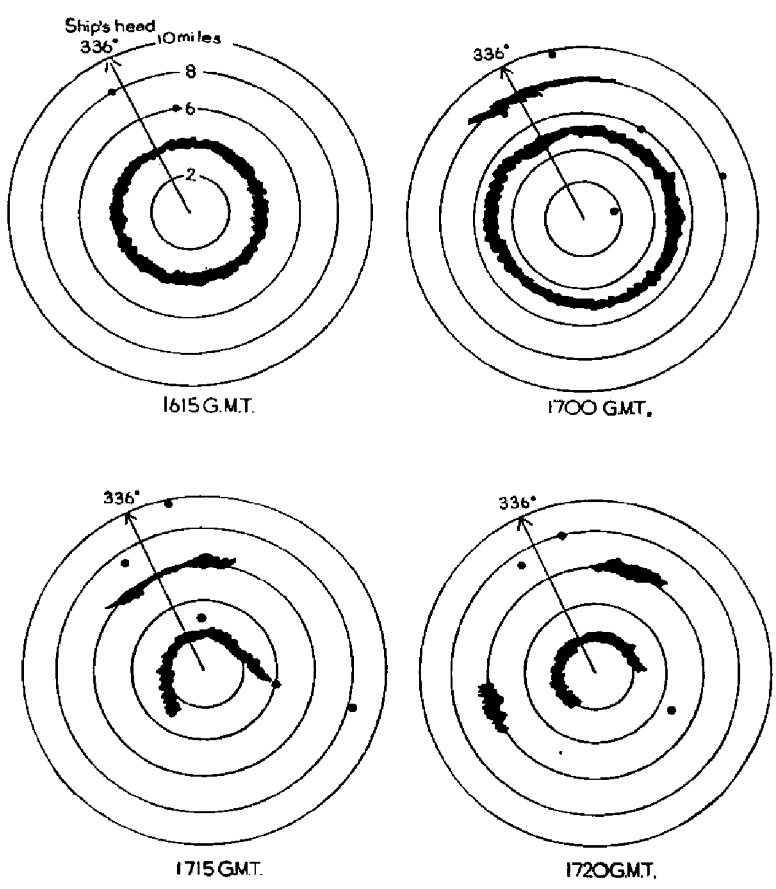
Note 2. This circulatory system experienced by M.V. *Otaio*, with the remarks from the Director of the New Zealand Meteorological Service, are of great interest to meteorologists in the United Kingdom. It seems possible that this type of depression must be closely related to tropical storms but must, however, lack some essential element necessary to produce a violent storm.

SANDSTORM SEEN ON PPI

Red Sea

S.S. *Perseus*. Captain H. C. Large. Aden to Suez. Observers, the Master, Mr. I. Webster, Chief officer, Mr. A. Dyne, 3rd officer and Mr. M. Morgan, 4th officer.

31st May, 1959. At 1600 G.M.T., while steaming 336° at 18 kt, a sandstorm was seen approaching. The radar (gyro stabilised) was working and a band appeared on the PPI ahead at 6 miles. As the vessel approached, this band curved into an almost perfect circle of 4 miles radius, having the ship as centre (see sketch).



A ship on the starboard bow was showing a strong echo at 6 miles and could be seen clearly. Another ship, fine on the port bow, was showing a strong echo at 8 miles but could only be seen faintly. These two ships were distorted so that they seemed to have very tall hulls rather like skyscrapers.

At 1644 the sun set normally. At 1645 the ring on the PPI was still clearly visible and looked like heavy rain; it did not close right in around the ship but stayed at about 4 to 6 miles. At about this time Ras Zarafana light began to show at 280° but appeared high in the sky, well above the charted height of the light.

At 1700 the wind had dropped away to 340°, force 2. Ships' lights approaching from the N. were clearly seen up to 10 miles, and were observed to twinkle. The circle seen on the PPI had now given way to a band ahead which again curved round and circled the ship, this time at 5 miles radius with the ship as centre. Another band less marked than the first was at the same time seen ahead at 8 miles (see sketch). Ships showing echoes on the PPI beyond both bands were seen visually up to 10 miles. The lights of these ships were twinkling brightly. No clear horizon could be seen, only a brownish haze. The lights of these ships approaching seemed to be above where the horizon should have been. The skyline of the mountains to the W. could still be seen in this half light and the haze seemed to come about half-way up them.

At 1710, radar circle now only two miles ahead but four miles astern, i.e. ship no longer in the centre of the circle. At 1715 (see sketch), echoes fading astern. At 1720 (see sketch), quite dark.

At 1723, all traces gone from the PPI but horizon still far from clear. Ships' lights seen 8 miles ahead and 10 miles astern but still twinkling.

At 1730, Ras Zarafana light dropped to about charted height and ships' lights more or less on where the horizon should be. Horizon much sharper but still hazy. At 1755, Ras Zarafana light seen through haze well abaft the beam. The loom of Ras Abu Darag light seen ahead at 17 miles. Lights of ships still twinkling astern but not ahead.

At 1800, some fine sand could now be felt on the superstructure and decks, but not very much.

The radar was run on the 10 mile range throughout. At all times a bold clear echo was returned from the coast line. Air temp. 80°F, wet bulb 69°, sea 72°. Wind NNW., force 6, decreasing.

Position of ship: 28° 36′N., 33° 02′E.

Note. This is the first report we have received in response to our request, on page 82 of the April 1959 number of *The Marine Observer*, for details of the performance of radar in sandstorms and duststorms.

It was forwarded to the Radio Advisory Service who commend the observers for the detail with which the observation was made. So few observations of this nature have so far been received that the experts hesitate to pronounce an opinion on them. They hope, however, that many more will come in which will, in due course, enable them to give an explanation of this complex problem.

WHALES

Indian Ocean

S.S. *South Africa Star*. Captain R. S. Hopper, D.S.C. Thursday Island to Aden. Observer, the Master.

25th June, 1959. 0954 G.M.T. sighted a school of 15–20 whales, less than 5 cables from the ship. They varied in size from four or five very large ones to what I assumed to be calves or large porpoises. Around the school, large porpoises were leaping, or they may have been small whales, light grey in colour. Two or three of the large whales were in front of the pack and one was in the rear—an extremely big whale. The rest were packed densely behind the leading whales, but the pack were, so far as could be seen, making no headway, just lying still, except the rear whale which was moving slowly across and turned once.

I happened to have my large binoculars handy and had an excellent view.

Leaping over the school of whales and occasionally coming down with a heavy splash on top of them were several very large swordfish. The sword was plainly visible and they appeared to be much bigger than the surrounding porpoises. They were occasionally clearing the water and falling, the tails striking the water first, with a heavy splash close to the whales. I was hoping to see some action on the part of the latter, but while they were in sight they just huddled close together. Outside the pack were porpoises darting in all directions. There was no question of mistaking these for swordfish—the difference was quite apparent and behaviour was more regular.

Position of ship: 6° 10′N., 63° 30′E.

Note 1. Mr. S. G. Brown, of the National Institute of Oceanography, comments:

" Stories of swordfish attacking whales, either alone or in company with thresher sharks, are numerous and they have perhaps been current since the time of man's first sailing in oceanic waters. These accounts have usually been received with scepticism by zoologists, some going so far as to say that they are purely mythical. The fact that the killer whale (*Orcinus orca*) is sometimes called the ' swordfish ' by mariners because of its elongated dorsal fin, and that this whale is known to attack other species of whales, has introduced an element of uncertainty and contributed to the rather unsatisfactory nature of the evidence.

" There is no doubt that the swordfish (*Xiphias gladius*) does in fact attack large whales. In February 1951 parts of a swordfish sword were found in a 73 ft male blue whale (*Balaenoptera musculus*) killed in the Antarctic by the Norwegian whaling factory ship *Thorshøvdi*. In February 1959 a similar find was made on the same vessel, this time in an 85 ft female blue whale.

" Captain Hopper's account is a most valuable eye-witness record of what seems to have been an attack by a number of swordfishes on a group of whales. It is not possible to identify the whales or porpoises but his note that four or five very large ones were present suggests that the sperm whale or one of the larger species of baleen whales may have been involved. The date and position in the southern Arabian Sea would fit either possibility. His sketch [not reproduced here] of the swordfish definitely identifies it as *Xiphias* or one of the spear or sail-fishes (*Istiophoridae*)."

Note 2. Mr. Brown has sent this observation to Norway for publication in the *Norwegian Whaling Gazette*.

JELLYFISH

Red Sea

M.V. *Canopic*. Captain T. H. Davies. Aden to Suez.

19th and 20th April, 1959. While on passage through the Red Sea, a very large number of jellyfish, having blue centres, was seen, the surface of the sea being thickly covered with them for two days. Although commonly seen in shallow coastal waters, they are not often encountered in such deep waters. The sea temperature decreased during the period from 85½°F to 79°. Wind mainly NNW'ly, force 1–2. Sea calm or slight.

Position of ship: at noon on 19th, 17° 12′N., 40° 30′E; at noon on 20th, 21° 12′N., 38° 06′E.

Note. This observation has been forwarded to the Director of the Natural History Museum.

PHOSPHORESCENCE

North Atlantic Ocean

S.S. *Calabar*. Captain D. H. Coughlan, R.D. Funchal to Freetown. Observer, Mr. H. A. Ross, 2nd officer.

From about 2200 G.M.T. on 1st May, 1959, phosphorescence was observed. It was not very bright nor widespread but at 0200 on 2nd May it became particularly bright. Combined with misty conditions it made the visibility appear much less than it really was. Ships less than 6 miles distant, which were quite sharp and distinct when viewed through binoculars, were blurred and at times almost invisible when observed with the naked eye. The sea also took on a much rougher appearance whereas it was actually only a slight sea. Patches of phosphorescence were a brilliant white in colour while the bow wave was pale green. At 0200: air temp. 64°F, sea 63·4°. Wind N'E, force 4. Sea slight.

Position of ship: 21° 40′N., 17° 17′W.

Note. Mr. E. W. Barlow, late of the Marine Division of the Meteorological Office, comments:

" We have had a number of observations in which the advent of phosphorescence appears to have a calming effect on the sea. How far this is a real effect is not yet known. In some cases it is clearly stated by the observing ship that the effect is an illusion. The above observation is of special interest as it is believed to be the only one we have had in which the sea appeared to become rougher."

M.V. *Drina.* Captain R. C. S. Woolley, R.D. London to River Plate. Observers, Mr. W. McC. Carver, 3rd officer, helmsman and lookout.

30th June, 1959. At 0030 G.M.T. phosphorescence appeared in balls all around the ship. They were of a very bright whitish colour and it appeared as if numerous torches were being flashed on and off. Although each ball was only seen for a fraction of a second at a time there did not appear to be any movement through the water. This phenomenon only lasted until 0042, when there was no more to be seen.

Position of ship: 5° 06′N., 26° 43′W.

Gulf of Panama

M.V. *Port Dunedin.* Captain G. Carling. Curaçao to Panama. Observer, Mr. R. Center, Junior 3rd officer.

5th April, 1959, 0330 G.M.T. When the vessel was 2 miles off the Isle of Bona, a line of phosphorescence was seen, extending from the shore in a direction 290°–110° as far as the ship. The line then changed in direction to 150°. It was about 5 to 6 yd wide and was the only continuous band seen. Other broken lines of bright phosphorescence, of an average length of 100 to 150 yd and 5 to 6 yd wide, were observed lying approximately in a 290°–110° direction; these were accompanied by glowing patches about 10 yd in diameter. Up to about 0400 G.M.T. the phosphorescence was very marked, but from that hour onwards it was not outstanding and was visible in the bow wave only. Air temp. 76°F, sea 76°. Wind NE'ly, force 3.

Position of ship at 0000: Panama Canal.

North Pacific Ocean

S.S. *Devon.* Captain A. C. Rollinson. Los Angeles to Balboa. Observer, Mr. A. E. Robinson, 3rd officer.

29th April, 1959. Phosphorescence was seen from the bow wave to the stern, pale green in colour, between 0445 and 0500 G.M.T. The bow wave was observed to be not ' breaking clean ', but surrounded by a pale green haze (approx. 9 in. high) giving the appearance of a transfer of the phosphorescence from one medium to the other. During the same period the sea temperature dropped 5 degrees, to 80°F—almost the same as the air temperature—and shallow fog patches formed. After 0506 visibility improved, and although phosphorescence was still visible it was not comparable with the previous brilliance.

Position of ship: 11° 01′N., 89° 27′W.

Note. Mr. E. W. Barlow comments:

" Only one instance of the transfer of luminosity from the sea to the air has ever been received (S.S. *Tweed*, Vol. 29, 1959, page 14). In view of the shallow fog patches recorded, it is more probable that the apparent transfer in the above observation was due to reflection from a very shallow layer of mist just above the sea surface."

Australian waters

M.V. *Trevince*. Captain F. G. Bolton. Geelong to Cape Town. Observers, Mr. G. Cowling, Chief officer and Mr. W. R. Clipson, 2nd officer.

7th June, 1959, between 1900 and 1945 G.M.T. As night darkened before rain, much phosphorescence became visible in the bow wave and wake. Within a few minutes of the commencement of rain, large phosphorescent patches were seen and for ¾ hour the ship continued to pass through these. About 15 or 20 were seen of various sizes, the smallest about 20 ft in diameter, and the largest between 350 and 400 ft long by about 30 ft wide. All patches were of about the same brightness and lying along the troughs of the swell. The overall brightness was such that the lookout reported it as a flashing shore light, while for several minutes it was thought to be a ship bobbing in the swell. Brighter blobs gave an appearance of lumpiness to the patches but the closest one, which was passed within about 30 ft, had the appearance of boiling water. This did not seem to be caused by the rain, which was moderate at the time, but rather by an irregular underwater swirling motion. At 1800: air temp. 59°F, sea 58°. Wind N., force 5.

Position of ship: 38° 12′S., 137° 16′E.

Note. Mr. E. W. Barlow comments:

" The luminescence certainly appears to have been stimulated by rain on this occasion, though the possibility of a near coincidence in time of two unrelated phenomena cannot wholly be ruled out. A few similar observations have been published in this journal from time to time, the most striking of which is that of S.S. *Empire Orwell*, in Vol. 27 (1957), page 142. In that observation, intermittent luminescence was only seen along the leading edge of a heavy shower. Precisely the opposite effect is recorded in the observation of S.S. *Umtata*, Vol. 26 (1956), page 7. On this occasion luminescence in wave crests did not begin until the cessation of fine drizzle. When drizzle began again 35 min later the luminescence was greatly reduced. Rain stimulation is clearly not a major cause of luminescence, as in the great majority of observations no rainfall has been recorded during or immediately preceding the phenomenon."

Tasman Sea

M.V. *Port Adelaide*. Captain W. Eastoe. Auckland to Albany. Observer, Mr. K. M. Curnow, 3rd officer.

10th April, 1959, 1330 G.M.T. Passed through a band of phosphorescence stretching approximately N. and S. and ¼ mile in width. The phosphorescence took the form of ' star fish ' and ' cigars ', the former about the size of a teaplate and the latter about 12 in. long and 2 in. in diameter. They gleamed brilliantly and could be seen a mile away. Sea temp. 68°F. Wind WNW., force 3. Sea moderate.

Position of ship: 35° 12′S., 168° 12′E.

Note. Miss A. Clark, of the Natural History Museum, comments:

" The ' cigars ' are probably *Pyrosoma*, a colonial tunicate: the ' starfish ' of teaplate size is possibly *Cyclosalpa pinnata*, another colonial tunicate."

Arabian Sea

S.S. *Esso Manchester*. Captain J. Rattray. Suez to Fao. Observers, Mr. P. O'Connor, 2nd officer and Able Seaman W. Burke.

1st June, 1959, 2315 G.M.T. Brief quick flashes of white light were seen on the surface of the sea ahead and on each side of the bow. They appeared to be elliptical in shape rather than circular and varied in size from 10–40 ft along the major axis and 5–15 ft along the minor axis. The flashes were seen up to a distance of 600 ft from the vessel. At the same time the look-out on the forecastle reported coloured rays of light radiating from the stem of the ship, over the surface of the water to a distance of about 20 ft. Some of the colours noted and remembered by the look-out were red, purple, blue and green. The whole phenomenon lasted about ¾ hour. Air temp. 84°F, sea 86°. Sea calm, moon approximately two points abaft the starboard beam at altitude about 20°.

Position of ship: 26° 08′N., 56° 40′E.

Note. Mr. E. W. Barlow comments:

"The area covered by each flash in this observation is too large for it to be caused by the flashing of a single individual organism. It must therefore be assumed that large numbers of small or minute organisms flashed into luminescence simultaneously. This places the observation in a different category from that of M.V. *Drina* above. It seems likely, however, that the stimulus was due to the passage of the ship in both cases, as the flashing was not seen except in the neighbourhood of the vessels. The flashing of whole areas of the sea is not a frequent occurrence but previous observations have been published in this journal.

"The observation of the coloured rays radiating from the stern is of very great interest. Although it has been stated that the luminosity of the sea may show colours other than green, blue and white, or various shades of these, no previous observation of such colours has ever been received by us."

ABNORMAL REFRACTION

off Cape Finisterre

S.S. *Orontes.* Captain R. J. Craddock, O.B.E. London to Port Said.

12th June, 1959. Between 1500 and 1600 G.M.T., the air temp. rose within 30 min from 65° to 71°F, while the wet bulb increased from 59° to 63° but the sea temperature fell from 60° to 58°. At the same time, very well defined refraction effects were seen, the masts and funnels of passing ships being elongated to about three times their normal length; they were not inverted. All round on the seaward side, there was what looked like a high thick bank of fog, which at times resembled a mountainous coastline. This was found to have no real existence as it continued to recede as the ship advanced. Wind N'ly, force 4–5.

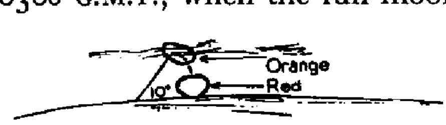
Position of ship: 42° 40′N., 9° 25′W.

Note. Reference to the synoptic chart for 1200 G.M.T. on 12th June shows that a NE'ly wind was blowing across the Bay of Biscay and North-West Spain. About the time that the rise of temperature was noted, the vessel had passed into the lee of the land, thereby losing the relatively cool sea air, which was then replaced by warm air from off the land where the temperature was in the seventies. This warm air flowing over the cool water produced the stratified conditions in the lower atmosphere necessary for the formation of the distorted images described. This example clearly illustrates how abnormal refraction can occur, i.e. any circumstances under which abnormal gradients of temperature and humidity are produced.

St. Lawrence Estuary

S.S. *Beavercove.* Captain N. W. Duck, D.S.C., R.D. Montreal to London.

26th April, 1959. At 0300 G.M.T., when the full moon was rising over the low



eastern shore, it was bright red in colour and had the distorted appearance shown in the sketch. This condition persisted for about 30 min, until an altitude of 10° was attained, when the moon regained its normal shape. Air temp. 39°F, sea 36°. Wind NE'E, force 4. ⅜ Sc.

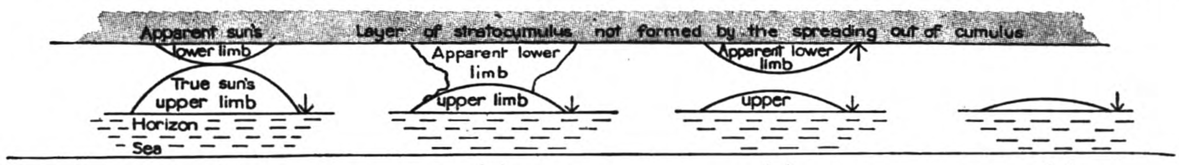
Position of ship: 17 miles south-west of Bic Island.

Note. This type of distortion is frequently observed at sunrise and sunset (see, for example, the present " Marine Observers' Log ", below, and also that for July 1959, page 113). This again indicates abnormal gradients of temperature and humidity in the lower layers of the atmosphere. The distorted image and variation of colour described above would require special conditions over a great depth. The October 1959 number of this journal, page 178, gives further examples as observed by M.V. *Port Auckland* of abnormal images of the moon.

South Atlantic Ocean

M.V. *Tantallon Castle*. Captain J. B. James. Cape Town to Avonmouth.

11th June, 1959. At 1636 G.M.T., towards sunset, when the sun's upper limb



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

was still well above the horizon, an inverted image of this limb, but smaller in area, appeared beneath a narrow band of Sc lying very low on the western horizon. The image directly above the true sun appeared to touch the latter at its highest point (Fig. 1). As the remaining segment of the setting sun decreased in size, the inverted image grew larger and somewhat distorted: contact with the true sun was now made along a considerable part of the edge of the upper limb (Fig. 2).

A wider gap developed between the upper limb and the inverted image as the sun was on the verge of disappearing below the horizon (Fig. 3); as it passed from sight the image simultaneously vanished. Air temp. 68°F, wet bulb 68°, sea 64°. $\frac{3}{8}$ Ci, $\frac{1}{8}$ Sc. Wind calm. At 1830 the vessel entered thick fog.

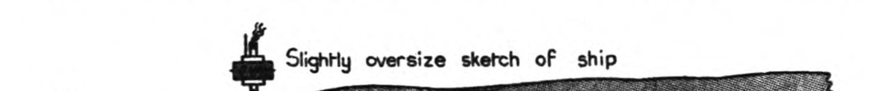
Position of ship: 20° 32′S., 12° 07′E.

Note. This observation can be compared with one reported by M.V. *Achilles* in the July 1959 number of this journal. Again, as in most sunset phenomena involving abnormal optical effects, this is associated with some special distribution of temperature (perhaps a discontinuity) in the upper atmosphere. Aberrations of the sun's image are closely related to the green flash, which also requires special atmospheric conditions.

Strait of Magellan

M.V. *Sarmiento*. Captain G. Pattison. Talcahuano to Punta Arenas. Observer, Mr. J. S. Ross, 2nd officer.

18th June, 1959. While lying at anchor in Punta Arenas harbour, a vessel was observed at 1800 G.M.T., bearing 053°, in the direction of 2nd Narrows, and had the



appearance shown in the sketch. The two images appeared clear above the intervening land, which was of much greater height than the ship. The vessel observed was estimated to lie 5–10 miles beyond the peninsula. When it reached position (a) in the sketch it was seen to be right way up, but with a gap between the ship and the water. The refraction effects disappeared when the vessel was about 7 miles away. Air temp. 39°F, wet bulb 37°.

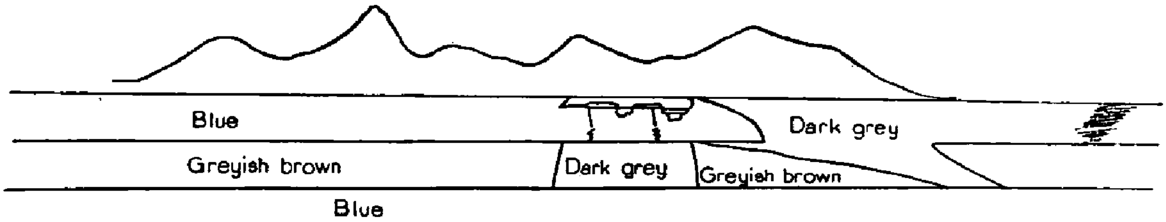
Position of ship: 53° 10′S., 70° 54′W.

Note. There have been frequent reports of abnormal refraction during recent months, all of which can be explained by abnormal temperature and humidity gradients in the lowest layers of the atmosphere. The example described and illustrated above is quite remarkable. The rays of light from the distant ship must have been bent over the intervening land, and the light from the upper part of the vessel must have passed along two quite different tracks to produce the two images.

Australian waters

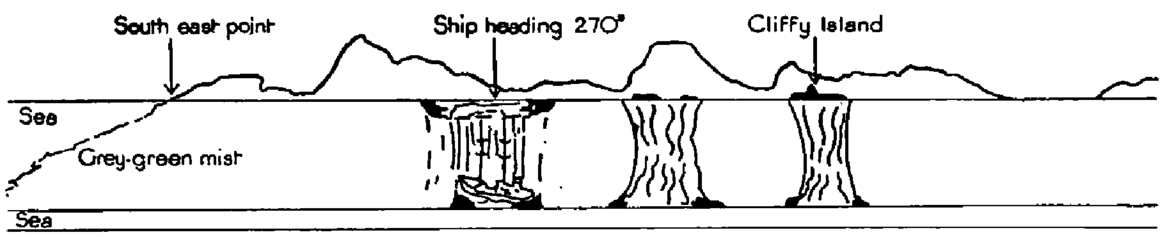
M.V. *Port Launceston*. Captain V. G. Battle. Sydney to Fremantle. Observers, Mr. C. H. P. Brown, 3rd officer and Mr. A. H. Hodgson, Junior 3rd officer.

1st February, 1959. The presence of a heavy grey-brown mist for much of the day gave rise to the impression that there was a double horizon. At 0320 G.M.T.



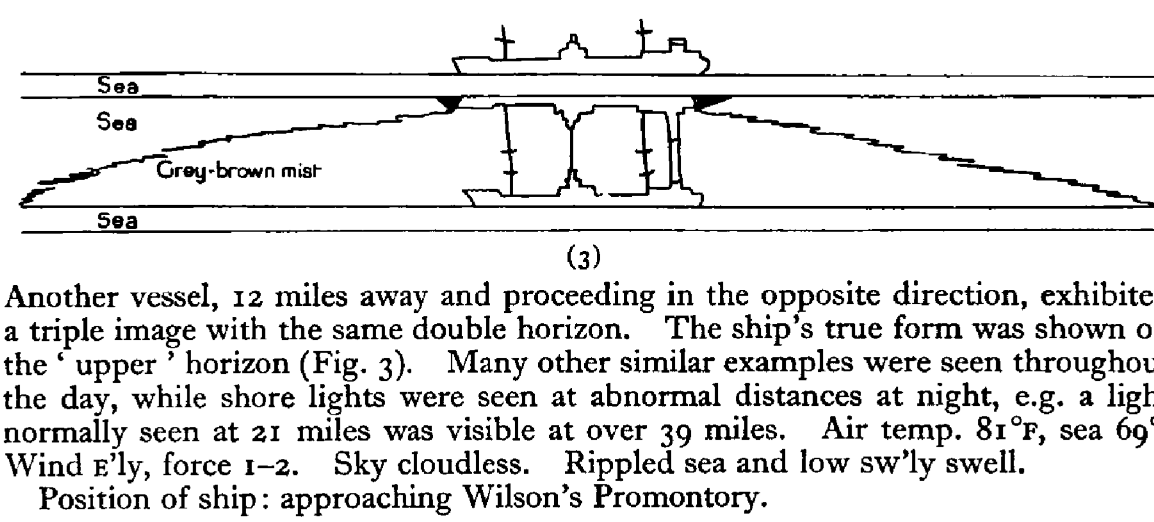
(1)

a Swedish tanker 12½ miles away (by radar) suddenly appeared inverted over a vague shape, identified as Cliffy Island, distant 22½ miles (Fig. 1). The illusion lasted for 15 min, after which it faded and assumed the shape shown in Fig. 2. Cliffy Island



(2)

and other small islands appeared very clearly on the ' upper ' horizon while, pro jecting downwards from them, was a mass of wavy-looking grey-green mist and haze. Shortly afterwards, the tanker appeared as one blurred, inverted image.



(3)

Another vessel, 12 miles away and proceeding in the opposite direction, exhibited a triple image with the same double horizon. The ship's true form was shown on the ' upper ' horizon (Fig. 3). Many other similar examples were seen throughout the day, while shore lights were seen at abnormal distances at night, e.g. a light normally seen at 21 miles was visible at over 39 miles. Air temp. 81°F, sea 69°. Wind E'ly, force 1–2. Sky cloudless. Rippled sea and low SW'ly swell.

Position of ship: approaching Wilson's Promontory.

Note. This spectacular display was experienced in an anticyclone which covered the Bass Strait during 30th January, 1959, and, moving steadily eastwards, was finally clear of this area by 3rd February. The ship's observations indicate that she was in an area in which several different air masses converged. The display appears to have been observed while the ship was temporarily in an air mass with high temperature and high dewpoint, surrounded by cooler air masses.

SCINTILLATION OF VENUS

South Pacific Ocean

S.S. *Gothic*. Captain L. J. Hopkins. Balboa to Auckland. Observers, Mr. A. J. Worricker, 3rd officer and Mr. M. Jenkins, 4th officer.

21st June, 1959, 0812 G.M.T. The sky was covered with Sc and Ac, except for a very narrow segment near the horizon. As Venus, bearing 293°, emerged from behind the cloud into the clear sky, it changed from its normal brilliant white to a red colour and then quickly reverted to white. This cycle occupied about 3 sec and then the planet appeared to set, but it reappeared about 1 sec later. At first it shone with a white light as before, but a moment later a red light appeared immediately below the white one. The red and white lights were quickly replaced by a single green one as the planet set. The phenomenon was observed both with the naked eye and through binoculars. Air temp. 56°F, wet bulb 54°. Wind variable, force 1.

Position of ship: 35° 02′S., 178° 07′W.

Note. We have received many interesting observations of the fluctuations of the colour and scintillations of Venus. The above observation is interesting and rare because it is possible that it is an observation of the green flash of Venus when the planet was well below the horizon. This again indicates temperature abnormalities over very great depths of the atmosphere.

BROCKEN SPECTRE

Galapagos Islands

M.V. *Rangitane.* Commodore R. G. Rees. Panama to Wellington. Observers, Mr. G. MacIver, 2nd officer, Mr. J. N. Jackson, 4th officer, Mr. R. Sadler, 2nd Radio officer and Mr. R. Young, 4th Radio officer.

28th April, 1959. When off Isla Isabela the vessel passed through fairly dense fog banks about 80 ft in depth. There was no cloud above, apart from a few large Cu, and the shadows of the observers' heads, surrounded by a coloured halo, were cast by the sun on to the fog.

Position of ship at 1800: 0° 24′S., 92° 12′W.

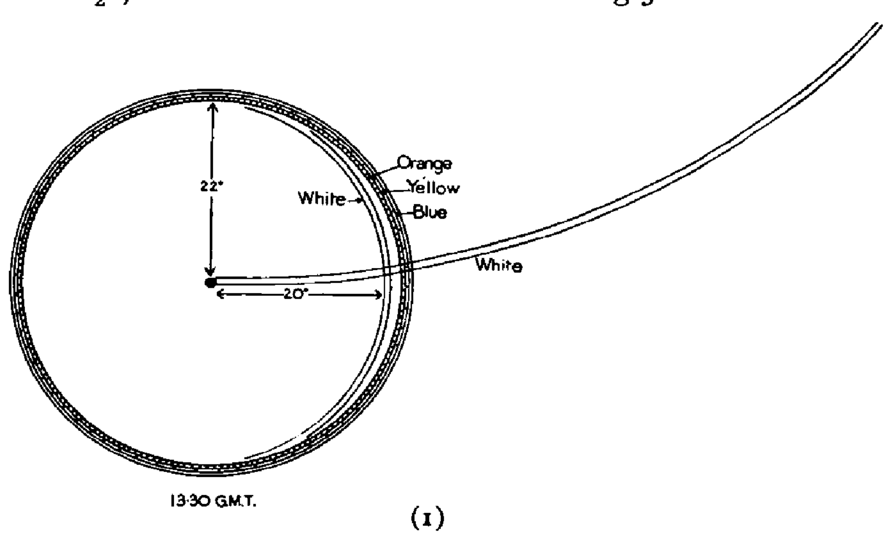
Note. This phenomenon is most frequently experienced over Arctic waters. On the occasion described above, it has been experienced in the tropics because of the effects of the cold Peru current.

SOLAR HALOS

Caribbean Sea

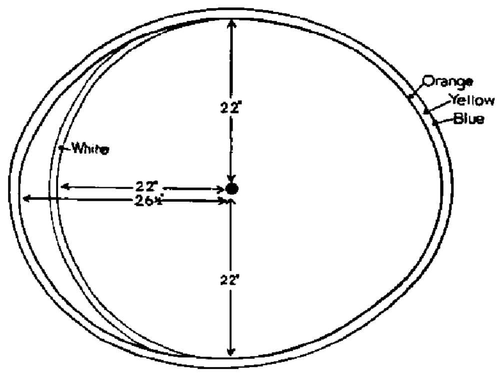
M.V. *New Zealand Star.* Captain E. L. Jermyn, M.B.E. New Zealand to Curaçao.

8th April, 1959. At 1330 G.M.T. (0900 local time) a halo was observed, radius 22° and width about 1½°, the sun's altitude at the time being 51°. After a few minutes



(1)

(Fig. 1) the halo intensified showing the colours orange, yellow and blue in that order outwards. At the same time two fainter arcs formed, each about 1° wide and white in colour. One was inside the right hand semicircle of the main 22° halo, the horizontal distance between the sun and this halo being 20°. The other arc began at the sun and swept round to the south, parallel to the horizon, through about 50° of azimuth before being lost in clear sky.



14·00 G.M.T

(2)

By 1400, when the sun's altitude was 53°, the two fainter arcs had disappeared and the main halo, still showing bright spectral colouring, had assumed an elliptical shape, the longer arcs being horizontal (Fig. 2). The short radius was 22° and the long 26½°. Inside the left-hand curve of the ellipse was part of a 22° halo, about 1° wide and white in colour, quite faint compared to the colouring of the ellipse.

At intervals throughout the afternoon a 22° halo, but only this, was observed round the sun.

The angles were measured by sextant from the limb of the sun to the inner edge of the arcs. Cloud: 2/8 fair weather Cu beneath thin Cs, and wisps of Ci.

Position of ship: off Curaçao.

Note. The second of the fainter arcs described above, running parallel with the horizon, appears to be part of a parhelic circle. This observation is, however, of particular interest because of the elliptical shape of the 22° halo. Another elliptical halo, quite different in character from that described above, was reported in the July 1959 edition of this journal, page 116.

Mediterranean Sea

M.V. *Achilles*. Captain D. R. Jones. Liverpool to Port Said. Observers, Mr. R. C. Risely, Chief officer, Mr. W. B. Bannerman, 2nd officer, Mr. W. B. Johnson, 3rd officer and Midshipman P. R. Cook.

2nd May, 1959. At 1100 G.M.T., when the sun's altitude was 69°, a complete 22° halo showing brilliant colouring was seen in a sheet of Cs. An arc of a second halo of radius 45°, which was even more brilliant, was also present. It was split at its western end, the lower portion being straight and parallel to the horizon. About 10 min later, a well defined parhelic circle appeared, which persisted for 25 min and appeared to expand as the altitude of the sun decreased. The 22° halo remained visible for 1½ hours, while the arc of the 45° halo faded after 30 min.

Position of ship: 32° 58′N., 28° 00′E.

Note. This is an interesting solar halo complex which is exceptional because of the brilliant spectral colours seen. The 45° arc no doubt corresponds to the 46° arc usually observed, although the split in the western end suggests something unusual. An accurate sketch of the complex would have been valuable.

North Atlantic Ocean

M.V. *Interpreter*. Captain W. Weatherall. Galveston to Liverpool. Observers, the Master and Mr. J. Pearson, 3rd officer.

27th April, 1959. At 1520 G.M.T. a halo having a radius of 11¼° and a width of ½°

was seen round the sun, which was then at an altitude of 63°. The outstanding colours seen at that time were green and blue, with a very slight tinge of violet, but these disappeared completely by 1527, leaving a halo of white light. The normal darker sky was seen inside the halo until 1550, when the shading became lighter and cirrus could be seen crossing the sun. At 1600 the colouring reappeared, orange and yellow being seen on this occasion. By now the radius had increased to 18° and the sun's altitude to 70°; the absence of dark sky inside the halo was especially noticeable. By 1620 the halo was seen to be disintegrating and 3 min later it was no longer visible.

Position of ship: 30° 55′N., 72° 58′W.

Note. This observation is of particular interest since halos (as distinct from coronae) of such small radius have only very rarely been observed. The violet tinge in the halo is also extremely unusual.

BLUE FLASH

South Pacific Ocean

M.V. *Taranaki.* Captain C. Beck. Balboa to Auckland. Observer, Mr. J. Bain, 4th officer.

23rd May, 1959. At 0130 G.M.T. the sun, after having been hidden for some time, reappeared at an altitude of approximately 0° 40′. In anticipation of phenomena occurring, the sun was observed through a telescope, and, a few seconds before it set, the perimeter of the small segment remaining above the horizon seemed to have a blue tinge. As the sun set a vivid blue flash was seen. Air temp. 79°F, sea 80°. Wind, calm. 7/8 Cu.

Position of ship: 17° 26′S., 120° 06′W.

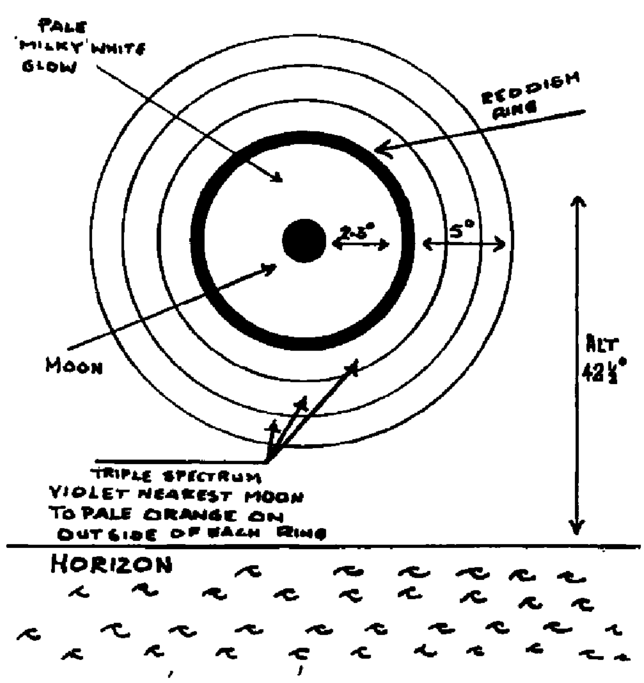
Note. A blue flash is experienced when the atmosphere is sufficiently clear for there to be very little scattering of the blue part of the solar spectrum by atmospheric dust or water particles. A considerable amount of blue light is then left in the direct solar beam after rays from the green to red sections of the spectrum have set.

LUNAR CORONA

South Pacific Ocean

M.V. *Hertford.* Captain H. C. R. Dell. Port Chalmers to Balboa.

23rd May, 1959, between 0420 and 0425 G.M.T. After a period of clear skies and



remarkably good visibility, Ac cloud was seen to be approaching rapidly from NE'ward. In the first few thin pieces of cloud which passed across the moon the fine lunar corona shown in the sketch was observed. The aureole surrounding the almost full moon was 2°–3° in radius and of a pale milky white hue, bounded by a narrow ring of reddish light. Outside this were three perfect multi-coloured rings, each of which exhibited violet on the inside, shading to pale orange towards the outside. The overall radius of the corona was about 8°, and the moon's altitude $42\frac{1}{2}$°.

Position of ship at 0600: 19° 54'S., 106° 18'W.

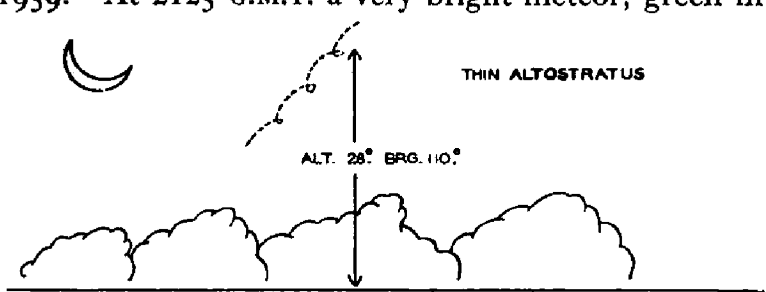
Note. It is only relatively seldom that a corona (either lunar or solar) showing three rings is observed. Coronae with four rings are rarely seen.

METEORS

Arabian Sea

M.V. *Benvannoch.* Captain J. P. Robertson. Aden to Penang. Observer, Mr. G. B. Goldie, 2nd officer.

27th June, 1959. At 2125 G.M.T. a very bright meteor, green in colour and of



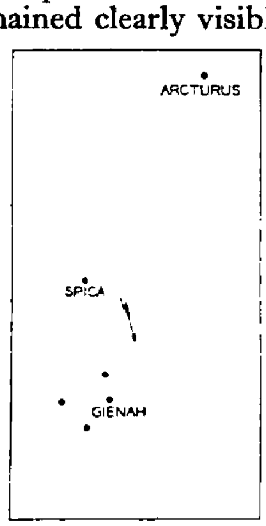
intensity similar to that of Jupiter, was seen on a bearing of 110° at an elevation of 28°. It fell at rather a steep angle towards the horizon and was visible for about $2\frac{1}{2}$ sec. The main feature of interest was the erratic path followed by the meteor, which described a spiral of three complete turns, as shown in the sketch. The sky was covered with a thin veil of As and some Cu were present round the horizon: visibility was good.

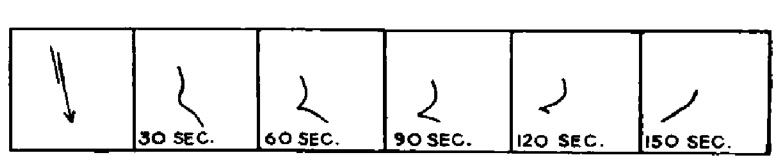
Position of ship: 10° 14'N., 66° 53'E.

Mediterranean Sea

M.V. *London Pride.* Captain J. Wallace. Hamburg to Bandar Mashur. Observer, Mr. O. Connor, 2nd officer.

12th April, 1959. At 0115 G.M.T. an exceptionally brilliant meteor was observed near Spica. It left a trail 2° in length, which persisted for about $2\frac{1}{2}$ min. The trail remained clearly visible to the naked eye for the first 20 sec, but thereafter bino-





culars had to be used to see it. Observations were made at intervals of 30 sec and the shapes taken by the trail were noted. These are shown in the accompanying sketches. Visibility was very good and the sky cloudless.

Position of ship: 37° 12′N., 6° 46′E.

Note. This report has been passed to the Director of the Meteor Section of the British Astronomical Association. The observer is to be congratulated on making such an excellent observation of the meteor trail.

The Pattern of the General Atmospheric Circulation

By G. A. TUNNELL, B.SC.

(Marine Division, Meteorological Office)

Introduction

(It will help to make this article more interesting and instructive if *Meteorology for Mariners* is at hand for easy reference, in particular Part III which describes basic phenomena. The maps on pages 89, 90, 94 and 96 are generalised diagrammatic maps similar to Figs. 1–4 but the latter are based on actual observations. The diagram opposite page 178 giving the general surface ocean current circulation of the world is also of interest because ocean currents are greatly influenced by the wind, while the more conservative oceans themselves have in their turn a marked influence upon the weather.)

To mariners crossing the North Atlantic the distribution of cyclones and anticyclones must seem to have little order except that they move generally eastward. This contrasts with the tropics where the steadiness of the trade winds has been of great value in the past to ocean-going sailing ships. A comprehensive picture of the world wind system can be obtained by plotting on world maps the vector mean winds (see pages 74 to 76 of *Meteorology for Mariners*) obtained from the many thousands of observations made in merchant and naval ships and at land stations.

Figs. 1 to 4 give for the months January, April, July and October mean flow lines drawn mainly from vector mean winds but occasionally, where these are not available, values have been deduced approximately from frequencies of wind direction only. The direction of the mean wind at any point of a flow line is the direction of the tangent to the line at that point. These maps give a pattern of mean wind direction (but there is no indication of the strength) for all the world. This is known as the planetary wind pattern or general circulation, from which it is possible to understand a great deal about seasonal and latitudinal and longitudinal variations of world climate and ocean currents. They show, for example, why daily (not average) flow patterns of surface wind appear almost continually chaotic in some areas, while in others variations are small.

A great deal of energy from the atmospheric wind is transmitted to the sea by friction at its surface but its relatively higher density causes the sea to react more slowly and rapid fluctuations are smoothed out. The general movement and circulation of the oceans is therefore closely correlated with mean planetary wind patterns (averaged over weeks) rather than with the synoptic patterns. However, the relationship between wind and ocean currents is complex. The rotation of the earth, for example, results in the narrow, fast flowing Gulf Stream between Florida and off Cape Hatteras and a much less definite flow in the east of the North Atlantic. This uneven distribution of ocean currents in its turn has a great influence on weather systems in the North Atlantic. [Neumann in a recent paper states that off Cape Hatteras an average of 40 million tons of water per second is transported by the Gulf Stream, northeastward.]

As the planetary flow patterns of the atmosphere are inseparable from, and owe many of their characteristics to, the more permanent features of the world distribution of atmospheric pressure, mean pressure maps for January, April, July and October are given in Figs. 5 to 8, but as the period of their data differs from that of the winds, the wind and pressure maps do not entirely correspond. [It is important to note in passing that this arises because although the overall climate of the world is changing so slowly that it is almost impossible to detect any general trends, it is subject to almost continuous periodic and random variations of long and short periods and of varying magnitude. One must therefore always expect averages based on data of differing periods to show some lack of correspondence.]

Physical principles of the general circulation

Whenever there are large vertical or horizontal differences of temperature or water vapour content in the atmosphere, there is usually set up simultaneously some exchange mechanism like atmospheric turbulence, or convection, tending to cause the rapid reduction of the gradients. If any mechanism exists which tends to increase gradients it will frequently thereby serve as a means of generating the corresponding exchange mechanism. For example, with the advection of Arctic air over the warm water of the Gulf Stream, Arctic smoke and cumulonimbus cloud are produced which are part of the energetic convective processes tending to remove the differences in temperature and water vapour pressure between the sea surface and the Arctic air mass. The general circulation is a world-wide mechanism by which heat is transferred from the equator to the poles. Steep gradients of temperature and humidity are produced in specific areas and along lines where giant exchange mechanisms are set up, the most important being the depressions experienced so frequently in the North Atlantic in the vicinity of the Polar Front (see Figs. 1 to 4). The lines along which these occur are the mean frontal zones; the Polar Front is typical. These zones are not obvious on synoptic charts but are clearly visible in mean flow maps like Figs. 1 to 4 when there are sufficient data to

(text continued on page 78)

KEY TO FLOW AND CONTOUR MAPS ON PAGES 74–79, 83

1. Centres of mean high and low pressure are indicated by the following letters:

[A] = Azores High
[B] = North Pacific High
[C] = South Pacific High
[D] = South Atlantic High
[E] = Indian Ocean High
[F] = Siberian Cold High
[G] = Canadian Cold High
[H] = Australian Continental High
[I] = Sahara Winter anticyclone. (This is barely separated from the Azores High, i.e. [A].)
[S] = Minor North American Monsoon Low over Mexico.
[T] = Depressions in the Antarctic trough
[U] = Indian Monsoon Low
[V] = North Australian Monsoon Low
[W] = South American Monsoon or Continental Thermal Low
[X] = Sudan Low
[Y] = Aleutian Low
[Z] = Icelandic Low

2. The following letters are used to indicate the character of the predominating air mass:

mA = Maritime Arctic air
cA = Continental Arctic air
mP = Maritime Polar air
cP = Continental Polar air
mT = Maritime Tropical air
cT = Continental Tropical air
E = Equatorial air. (The active component in the production of the intense monsoon rains.)

3. The following lines (apart from the coastline and the map grid) are used on the maps:

——————— = Isobars
———————→ = Mean flow lines
— — — — = Approximate position of mean frontal zones.

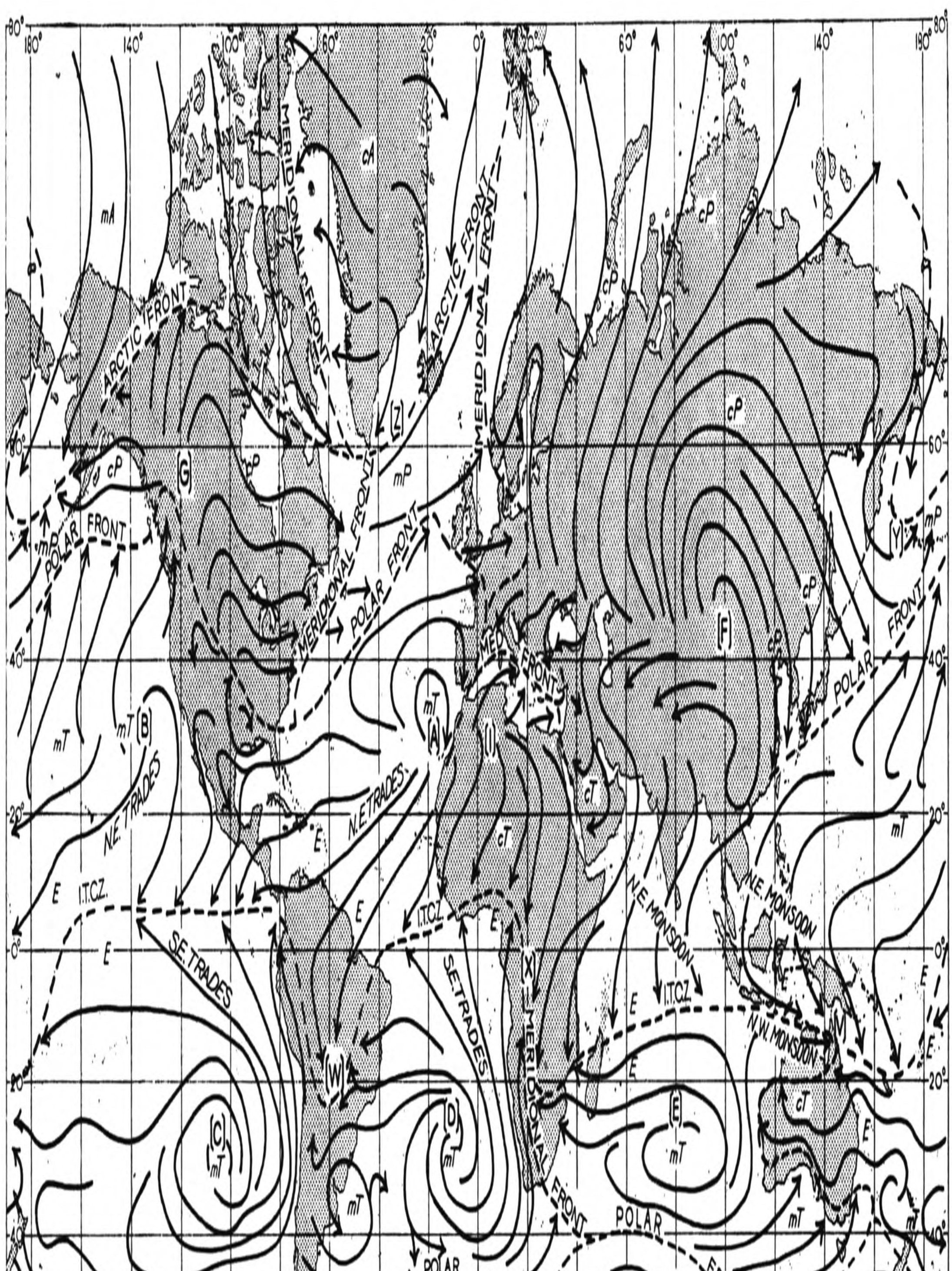


Fig. 1, January. The mean position of atmospheric flow lines over the earth's surface (solid lines), with approximate positions of frontal zones (pecked lines). (See key on page 73.)

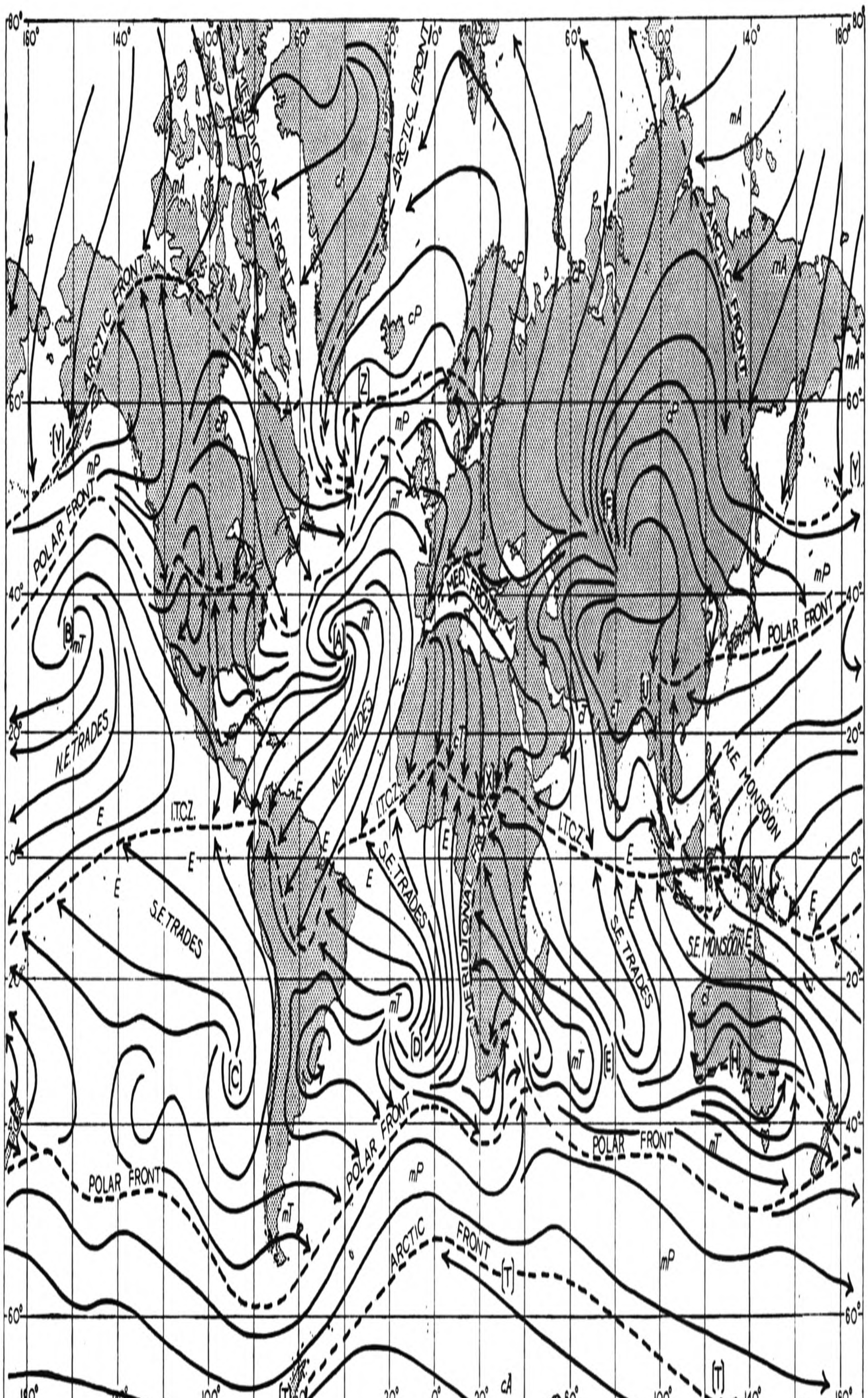


Fig. 2, April. The mean position of atmospheric flow lines over the earth's surface (solid lines), with approximate positions of frontal zones (pecked lines). (See key on page 73.)

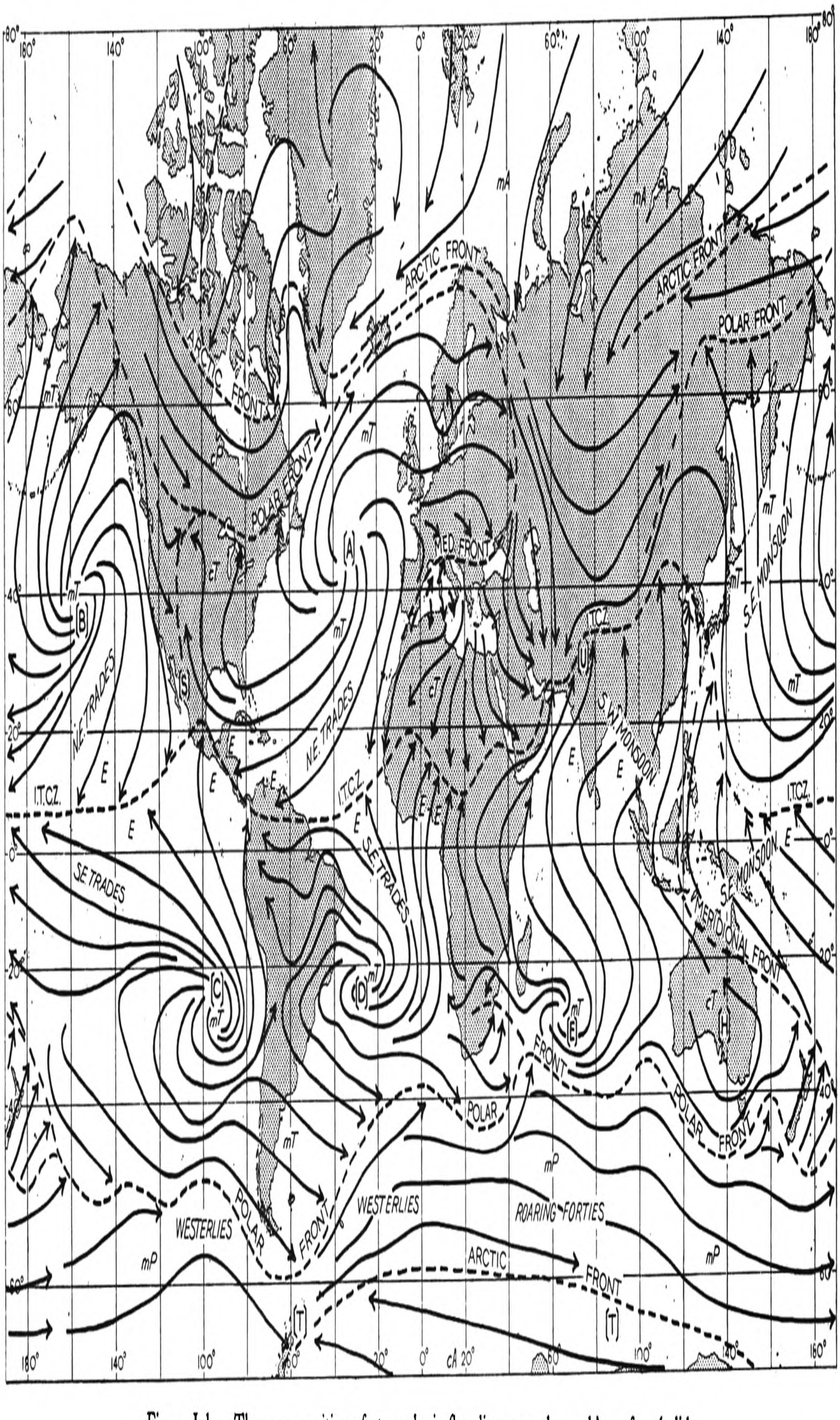


Fig. 3, July. The mean position of atmospheric flow lines over the earth's surface (solid lines), with approximate positions of frontal zones (pecked lines). (See key on page 73.)

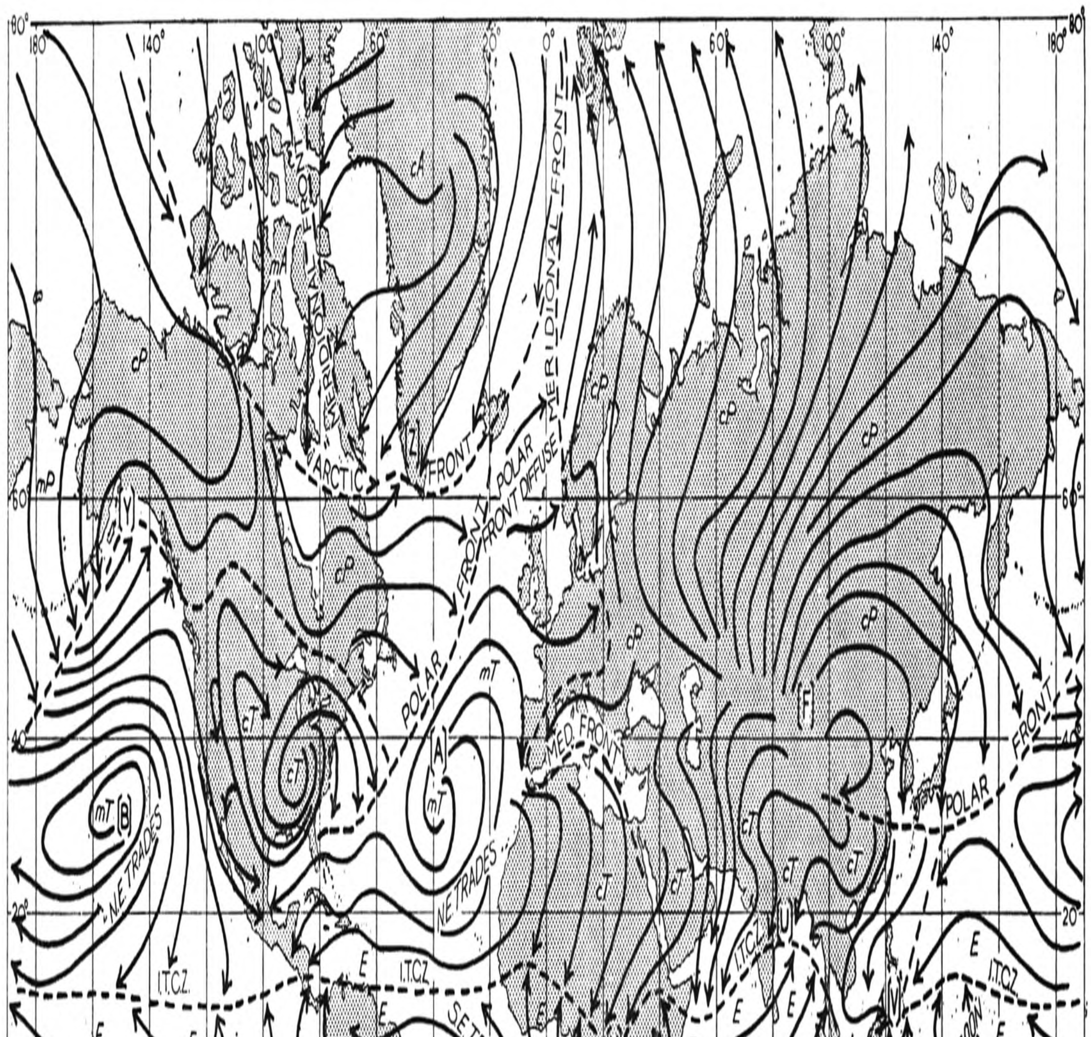


Fig. 4, October. The mean position of atmospheric flow lines over the earth's surface (solid lines), with approximate positions of frontal zones (pecked lines). (See key on page 73.)

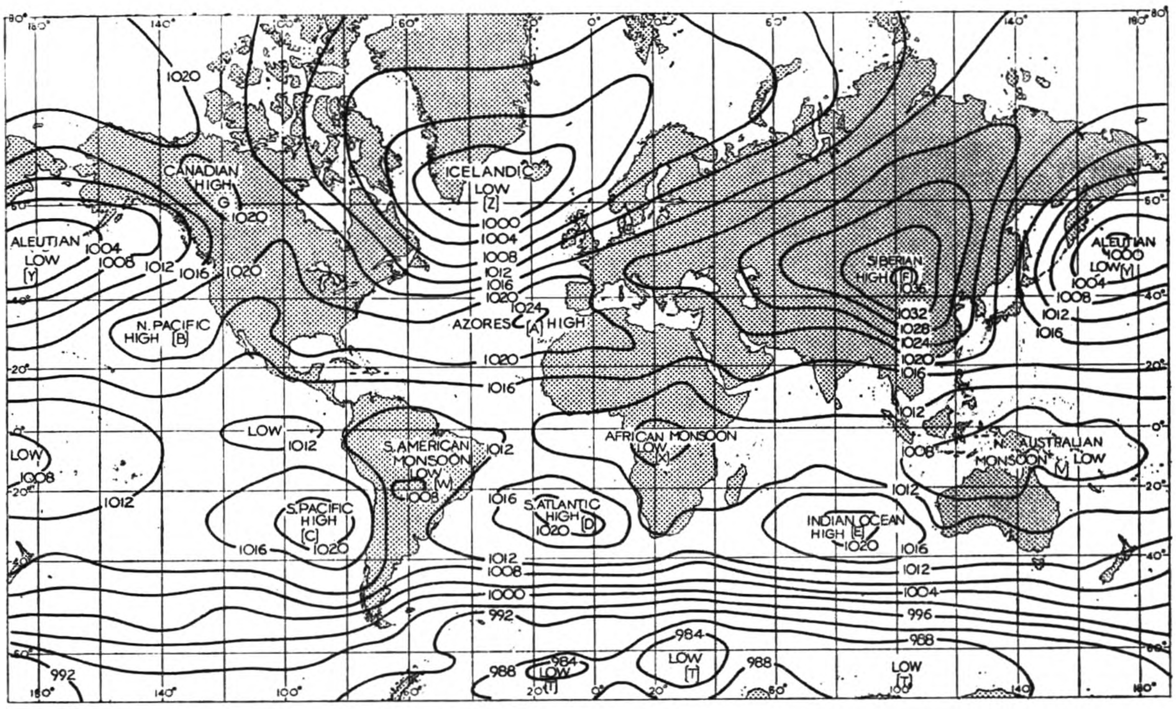


Fig. 5, January. Mean sea level pressure in millibars. (See key on page 73.)

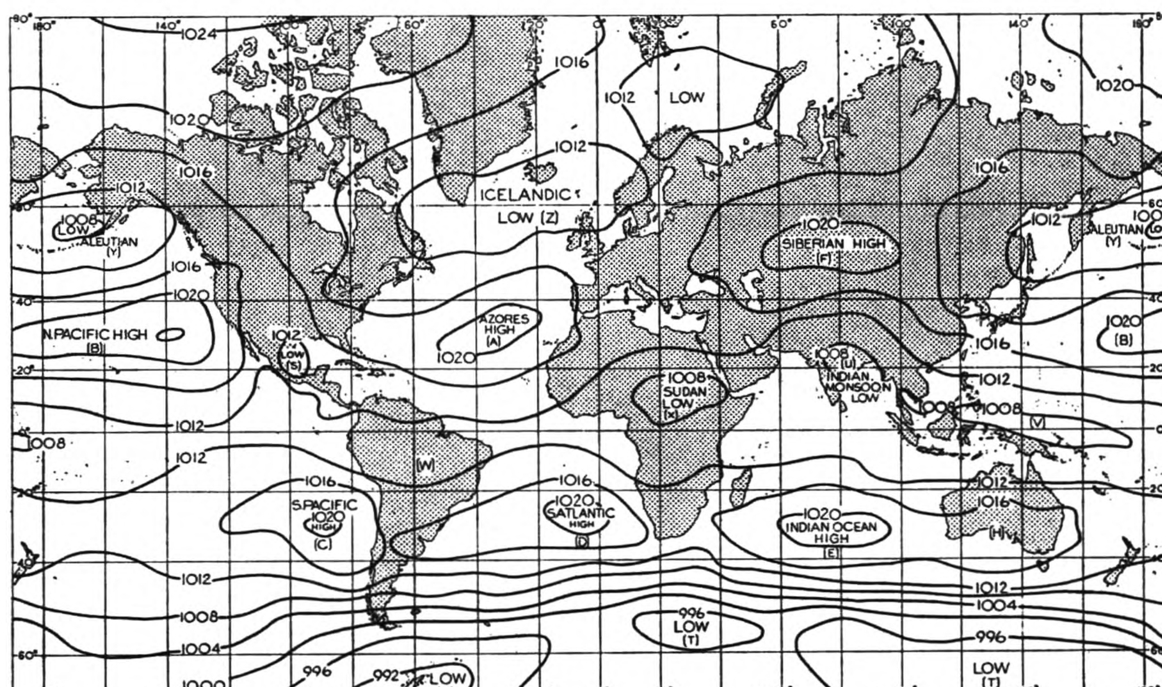


Fig. 6, April. Mean sea level pressure in millibars. (See key on page 73.)

give good averages of wind and pressure. (Good averages of temperature, humidity, cloud and rainfall can help to confirm the positions of the mean frontal zones.) Mean frontal zones arise because of some of the more permanent features of the day-to-day world distribution of atmospheric pressure, and the wide systematic variations over the earth's surface of the intensity, and absorption by the atmosphere and the earth, of solar radiation, which together cause the existence of air mass source regions. These are areas of the world in which about the lowest 10,000 ft of the atmosphere has very little motion and in which there exist extremes of temperature and humidity at the surface as the result of the gain or loss of excessive amounts of radiant heat or moisture. Great masses of air, while in these regions,

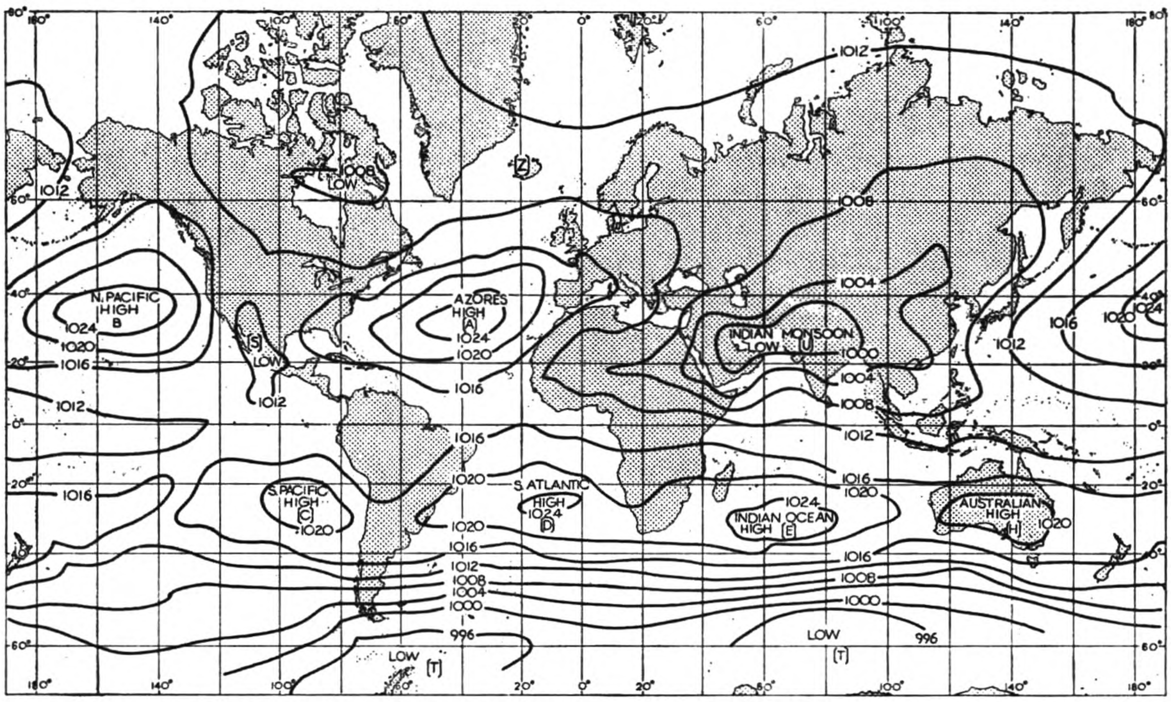


Fig. 7, July. Mean sea level pressure in millibars. (See key on page 73.)

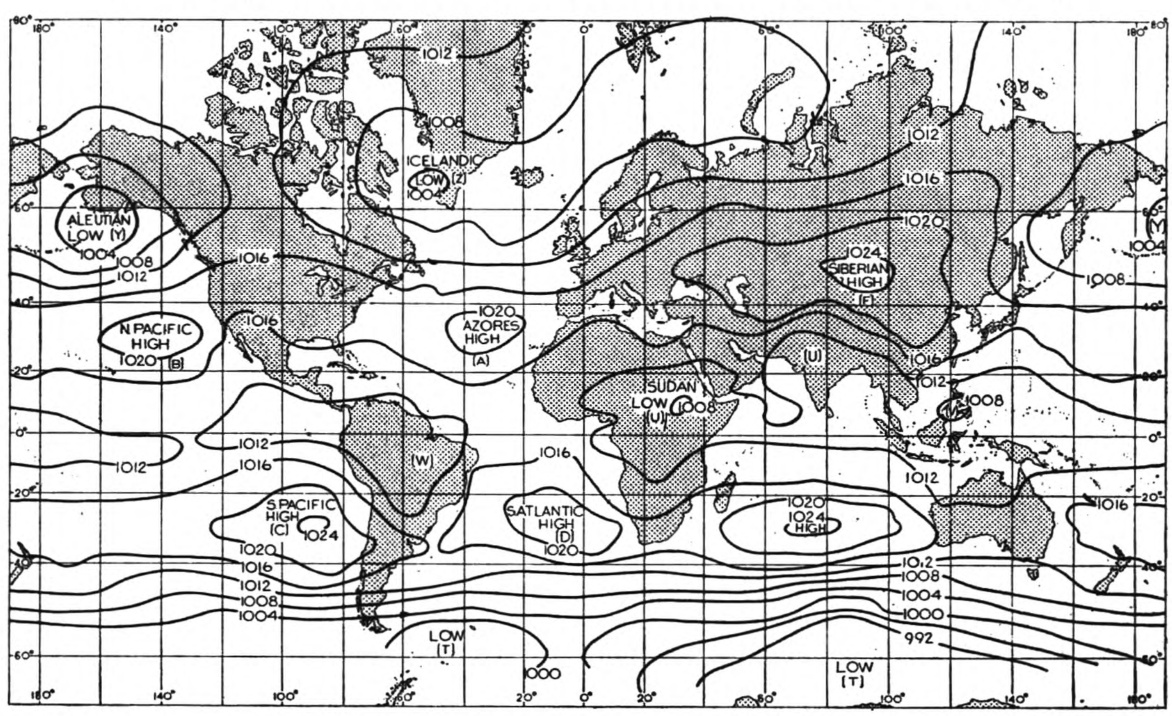


Fig. 8, October. Mean sea level pressure in millibars. (See key on page 73.)

take up special characteristics which change very slowly when the air (now part of a known and identifiable air mass) finally moves away. Air usually moves away from a source region in the circulation of an anticyclone and it meets air from another source region along a line known as a front. As a result of the steep gradients of temperature and humidity caused by the differences in the two converging air masses, there is usually a violent exchange (e.g. cyclonic development) at the front causing it to move and develop very irregularly, but the location of the interaction has a fairly stable mean position along a mean frontal zone. [Air masses, source regions and fronts are described in Chapter 9, page 88, of *Meteorology for Mariners.*] The approximate location of mean frontal zones is given in Figs. 1 to 4 by broken lines.

Semi-permanent anticyclones

If one compares daily synoptic pressure maps with long period mean pressure maps (Figs. 5 to 8 for example) for any given month, it will be noted that they are most similar in the areas covered by high pressure in the sub-tropics.

These are the warm sub-tropical maritime anticyclones which are situated in the sub-tropical latitudes of all large oceans. They are all source regions of equatorial (E), or poleward flowing maritime tropical air (mT). The one of greatest interest to residents of the British Isles is the Azores high or anticyclone ([A] in Figs. 1 to 8) of the North Atlantic, but mariners are well aware of the corresponding anticyclones [B], [C], [D] and [E] in the other oceans. Although these anticyclones fluctuate from day to day in strength and position, they are a permanent feature; any forecaster will agree that few North Atlantic weather maps are without an Azores anticyclone [A], which creates the North Atlantic tropical maritime air mass and then directs it northeastwards into the North Atlantic to interact with cold air masses from North America and the Arctic in the formation of North Atlantic depressions. In Figs. 5 to 8 it can be seen that the two northern hemisphere maritime anticyclones A and B expand and intensify in July. This leads to an increasing tendency for maritime tropical air to move north bringing climatic seasonal changes in adjacent land masses, particularly western Europe and British Columbia.

There are three Southern Hemisphere maritime anticyclones; [C], [D] and [E], which are more intense in July and October but do not have such great seasonal changes as [A] and [B].

There are cold semi-permanent anticyclones over Greenland and the Antarctic which are source regions of continental Arctic air (cA). Lack of data prevents them from appearing clearly in Figs. 5 to 8. In winter there are anticyclones over seasonally cold land masses. They are the Siberian high ([F] in Figs. 5, 6 and 8) which is actually centred south of Siberia; the anticyclone over N.W. Canada [G]; the extension of the Azores anticyclone [A] over the Sahara [I]; and the winter anticyclone over Australia [H].

Although all these anticyclones are associated with a static process like winter cooling, they have a dynamic quality. They have a dual role in the general circulation; one is static and the other is dynamic. In the first role they are source regions where air masses are conditioned, and in the second role their circulation directs the flow of air masses to the mean frontal zones where they interact with other air masses. The Siberian high, for example, has in January a maximum central pressure of more than 1036 mb [about 10 mb in excess of the Azores high in July], sufficient for widespread atmospheric subsidence to occur affecting air masses flowing from Asia into the Middle East and into western Europe.

The character of the areas round the poles differs from each other. The Antarctic is an intensely cold area covered by ice and snow where there is a typical cold anticyclone. The Arctic polar basin on the average experiences high pressure but is often the scene of intense depressions in which air is exchanged with lower latitudes.

Source regions

The effect of an air mass upon the general circulation depends largely on the characteristics it is given in its source region, because after leaving this region its continuous modification while passing over land and sea is controlled and limited by characteristics given it while in the source region. For example, air coming from a maritime anticyclone like the Azores high [A] has often subsided (see *Meteorology for Mariners*, page 13) and is therefore very dry and stable, in its lower layers. The stability is increased when the air flows poleward over relatively cold sea surfaces. When it passes northwards this stability will control the character of the modifying turbulence and convective exchanges of heat and moisture within the air mass and between the air mass and the underlying land or sea surface. Air originating in a maritime anticyclone is able, therefore, to retain the special characteristics necessary for it to operate as a warm air mass in depressions in the vicinity of a mean frontal zone (in this case the North Atlantic Polar Frontal Zone), perhaps more than 1,000 miles from its source.

The source regions for maritime tropical air (mT) and equatorial air (E) are the warm maritime anticyclones. Equatorial air is a special type of maritime tropical air; it has moved from its maritime anticyclone towards the equator and beyond, over warm water; it is very warm, almost saturated and is the dynamic element in the creation of monsoon rains. Source regions of continental tropical air (cT) are usually dry desert areas of high pressure where winds are light and there is intense heat and an air mass can become hot and dry over a great depth. Typical of this are the inland areas of the Sahara, Australia and Arabia. The winter anticyclones of the Sahara and Australia [I and H] are also sources of continental tropical air (cT).

The areas of almost permanent high atmospheric pressure of Greenland and the Antarctic are sources of the relatively dry continental Arctic air (cA), while the slightly more humid air received directly from the ice and sea areas of the polar basin is maritime Arctic (mA) (see *Meteorology for Mariners*, page 91).

The two winter anticyclones of Asia and Canada [F] and [G] are sources of continental polar air (cP). Polar and Arctic air that has taken part in the formation and remained after the decay of polar front depressions in both the northern and southern hemispheres has a special character and is called maritime polar air (mP). It is cool but humid and can have a dual role in the formation of depressions. It can act as cold air with tropical air forming the warm sector air, or it can act as warm sector air with Arctic or continental polar air forming the cold air sector (see *Meteorology for Mariners*, page 98). The difference between polar and Arctic air masses, which are both cold, is that polar air need not be cold in its high levels but Arctic air is cold over a very great depth. In the northern hemisphere this is brought about by intense night cooling with much mixing in depressions that have passed into the polar basin. The cooling processes over polar ice caps are not well understood but some of the coldest air masses are conditioned in the Antarctic.

Planetary frontal zones

There are five mean frontal zones which encircle the world zonally, i.e. very approximately parallel to lines of latitude, and they are indicated in Figs. 1 to 4. There are two Arctic fronts, two polar fronts and the inter-tropical convergence zone (I.T.C.Z.). The polar fronts are mean divisions between tropical air masses and polar air masses and the Arctic fronts are the mean divisions between polar and Arctic air masses. The I.T.C.Z. divides southern hemisphere Equatorial and tropical air from that of the northern hemisphere. There are not always sufficient climatic data to trace these zones completely round the world, for example over Asia.

The mean planetary frontal zone most easily traced is the inter-tropical convergence zone. This is because it is near the equator, a part of the world where the sustained strong pressure gradients essential to depressions are not possible and wide transitory fluctuations of the position of the zone do not occur. In addition, extensive movement of the I.T.C.Z. is usually associated with monsoon rainfall and it then separates very dry desert air (cT) from moist maritime air (E) and the dividing zone is easily detected by the discontinuity in the humidity at the division of the air masses. In oceanic equatorial areas, where the I.T.C.Z. divides very similar air masses, the zone is often diffuse and wide.

Conditions at the Arctic and polar fronts fluctuate so widely that their mean positions are not evident on synoptic charts. However, they are not difficult to locate if one uses the mean flow lines and mean pressure maps where they are frequently clearly evident in frontogenetic mean flow patterns and troughs of low mean pressure. For example, off the east coast of the United States during most of the year continental polar air from N. America converges with air from the Azores high at the mean polar front. This front can easily be seen in the wind and pressure maps of the Monthly Meteorological Charts of the Atlantic Ocean (M.O. 483). The front is confirmed in the distribution of precipitation and cloud although the intense sea temperature discontinuity between the Labrador current and the warm Atlantic water is an additional climatic influence causing a discontinuity in mean air temperatures.

Marine atlases have provided a further means of checking the location of mean frontal zones. It has been found that a good indication of the location of a zone at any specific time of the year is given by surface sea and air temperatures in areas where the local range of fluctuation of the air temperature is much greater than that of the sea surface temperature. This is infrequent because surface layers of the air usually follow closely the variations in sea surface temperature. At a position where the fluctuations of air temperature considerably exceed those of sea temperature it has frequently been impossible for the lowest layers of air to be in temperature equilibrium with the sea and one can conclude that such a position is one of great fluctuation of air mass type and probably near a frontal zone. This technique has been used widely in the preparation of Figs. 1 to 4.

In many places over land, also, mean fronts can be confirmed by climatic atlases, for example from the distribution of heavy rain or cloud and steep gradients of mean temperature and vapour pressure. When a mean frontal zone in its seasonal movement passes over a place there is a seasonal change in the predominating air mass. For example, Figs. 1 to 4 show that there is a great seasonal movement of mean fronts over Alaska. At Kandle in Alaska, which is north of the Arctic front in winter and south of the polar front in summer, there is a range of mean monthly temperature of from $-9{\cdot}7$°F in January to 52.7°F in July. Dutch Harbour, just north of the polar front in winter and south of it in summer, has a mean temperature of 31·9°F in January and 51·3°F in July. The difference in seasonal temperature change is due to the Arctic front moving south of Kandle in January but not of Dutch Harbour.

If therefore one knows the position of a place in the planetary wind system and therefore its predominating air mass and its proximity to a mean front, it is possible to deduce its climate and seasonal changes of climate. From their relative positions in the planetary wind system, it is possible to assess how well climatic data from one place may represent the climate of another.

Minor and meridional zones of convergence

In winter there is a minor convergence zone, called the Mediterranean front, which is particularly significant to Mediterranean weather. It is the zone dividing the warm dry desert air of North Africa from that which has passed over Asia or Europe and which in winter is usually of a cold continental origin. In this zone there is great activity and it can be associated with violent sandstorms in North Africa or intense thunderstorms over the Mediterranean.

This type of local convergence zone, highly significant to a particular area, is usual and familiar to forecasters and navigators in many areas.

There is a remaining important type of convergence zone not already mentioned which is the meridional convergence zone dividing similar air masses originating from different sources.

There is a meridional front near Greenland dividing continental Arctic air from maritime Arctic. Climatic data suggests the existence of a very diffuse zone over the western Atlantic; it divides maritime polar air from continental polar and gives the approximate limit of the predominance of polar air of a truly continental origin.

Some of the most intense rainfall amounting to many inches a month falls where equatorial air (E) from adjacent maritime anticyclones meets along a meridional front. This is particularly evident at the meridional front which crosses the Philippines in July (Fig. 3) and that over the southern half of Africa in April and

October (Figs. 2 and 4). Although meridional mean frontal zones are the locations of much rainfall and therefore of atmospheric convergence and storminess, they do not mark any radical climatic differences.

This contrasts with zonal frontal zones described in the section above whose passage always indicates a radical seasonal change of climate.

Areas of low average pressure in temperate latitudes

There are clearly defined areas of low pressure in all world maps of average mean sea level isobars; these areas, of course, vary in detail seasonally and with period of observation but they are a permanent feature of world climate. Two systems are well known to British meteorologists. They are the Icelandic low [Z] and the Aleutian low [Y] (Figs. 5 to 8). It will be seen that there are similar areas in the Antarctic [T]; these differ from Y and Z in that they are not divided by great continental land masses. These areas of low average pressure in temperate latitudes are seldom obvious on synoptic charts, which usually contain many depressions without any specifically fixed position. The location of low average pressure does not, therefore, reflect in temperate latitudes a permanent feature of the daily planetary wind system but indicates where depressions are most probable. It will be seen from Figs. 1 to 4 that average low pressure occurs where there is a high probability of air from the Arctic or from a cold continent converging with air from a maritime anticyclone and causing the development of depressions—the largest possible exchange mechanism. [Deep intensely cold air not only causes the formation of depressions but can rejuvenate old depressions when introduced into their circulations, by causing maritime polar air already in the circulation to behave as warm sector air.]

Monsoon lows

Average pressure is always low in the vicinity of the I.T.C.Z. and during the hot season it is always low over continents in low latitudes, because the intensively heated land causes convection and general upflow of air over large areas resulting in a fall of surface pressure. Flow into these thermal lows (see *Meteorology for Mariners*, page 107) displaces the I.T.C.Z. from its normal position near the equator to one occasionally hundreds of miles northward or southward. This can be seen over Asia and Africa in July (Fig. 3) and over South America in January (Fig. 1).

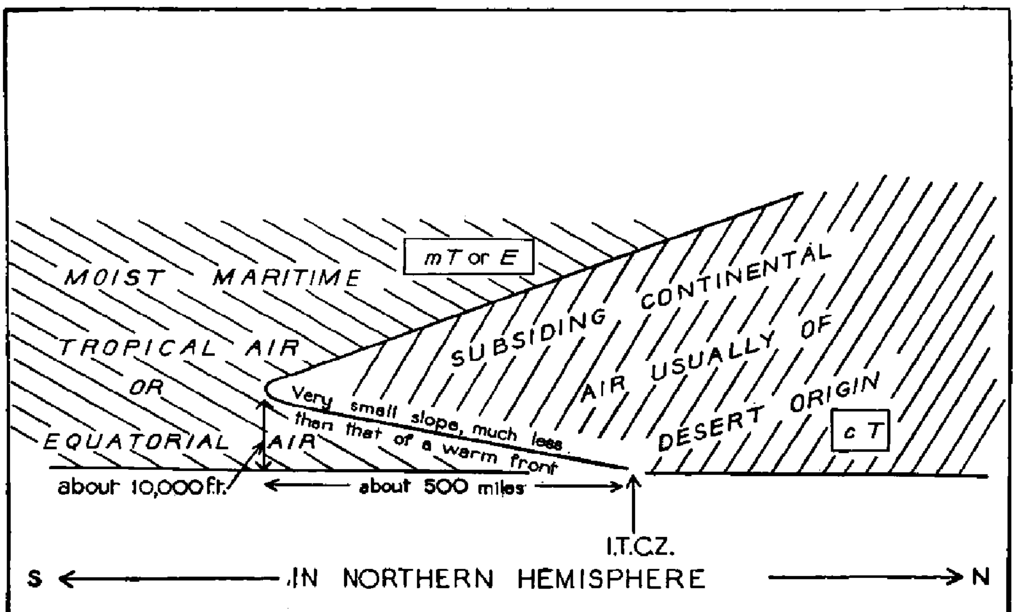


Fig. 9. Vertical cross-section of air masses at I.T.C.Z. during a monsoon season when hot desert air is displaced by the advance of warm maritime air into a continental thermal low.

The movement of the I.T.C.Z. away from the equator over a hot continent usually brings a moist maritime tropical or an equatorial air mass into juxtaposition with a dry continental tropical air mass.

When this happens, the vertical distribution of air mass layers is of special significance. Usually the warm moist air (E) moves forward in a shallow wedge under the warm, drier cT air. However, aloft the cT air mass is cooler and it flows under the E air mass. There is, therefore, a ' nose ' of warm dry air (see Fig. 9) which causes unstable conditions, especially if it becomes moist by rain falling through it. There are violent duststorms in the vicinity of the I.T.C.Z. and sudden violent outbreaks of intense and widespread tropical thunderstorms from within the moist air mass (E) 200 miles or more from the I.T.C.Z. This accounts for much of the thundery rains associated with monsoons at the I.T.C.Z. The convergence of air into the Indian monsoon low is so intense that much rain is caused orographically by the flow in of warm moist unstable air over the mountains of western India. It is inferred above that a depression in temperate latitudes is activated largely by air mass temperature differences; in a monsoon low it is air mass humidity differences which cause the violent vertical and horizontal exchanges.

Conclusion

It will be seen that a knowledge of the planetary surface wind patterns gives a framework by means of which the study of world climate may be fitted together to produce a comprehensive ' picture '. Areas of average low or high pressure are self-evident in Figs. 5 to 8 but mean frontal zones discussed at length above are far less easily comprehended. Nevertheless these are locations where air masses are most likely to interact and where exchange systems (e.g. cyclonic disturbances) are likely to develop. The reason, therefore, for mean frontal zones not being very evident in day-to-day synoptic maps is that they are at the scene of the greatest disturbance of mean flow patterns. As the general circulation requires continuous and at times violently energetic exchange mechanisms to achieve the world-wide transfer of heat, water vapour and energy, it is understandable that the picture of the general planetary flow patterns and lines and areas where vital activity is generated can only be found after the day-to-day variations have been smoothed out by statistical analysis involving many thousands of observations. The thousands of observations made every month by the fleet of British voluntary ships is therefore quietly providing over the years a mass of data whereby many vital features of the weather, hidden by the complexity of the day-to-day variations, may be found by patient and careful analysis. Modern high speed computing machines should be a great help in this work.

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Weather and the Fishing Industry

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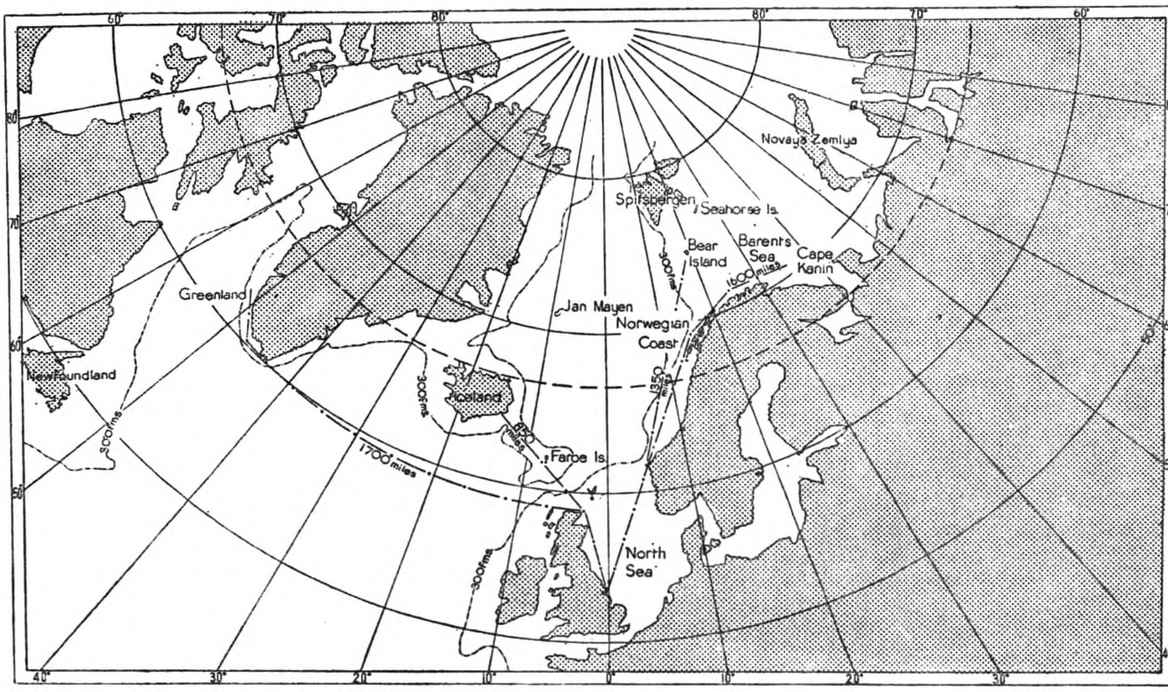
Fishing is probably more directly influenced by the behaviour of the elements than any other mode of food production, including farming. The fisherman is continuously conscious of the weather around him from the moment he leaves harbour. Although there is much inshore and river fishing throughout the world, more than half of Britain's fish in particular comes from Arctic fishing grounds, where conditions are perhaps more severe than in any other fishery in the world from the operator's point of view. Distant water trawlers, which fish off Iceland and Bear Island, the Barents Sea and Greenland, typically spend about five days going to the fishing grounds, ten days fishing there and five days returning, with a crew of about 20 including a wireless operator. In the course of over 40 such trips concerned with experiments on the stowage in ice and the freezing of fish at sea, a number of incidental observations have been made on the impact of the weather on fishing.

The long-term effect of weather and climate (meaning the range and average of the weather encountered) on the growth, survival and distribution of fish stocks and consequently on catching rates, is a biological problem which has been reviewed by the Food and Agriculture Organisation of the United Nations.[1] More immediately, rough weather affects the ability of the ship and crew to fish, or even to remain stable and afloat,[2] and this influences the design of fishing vessels and gear. Weather also affects the keeping qualities of fish and the means of preservation adopted.

Fishing in bad weather

Distant water trawlers fishing in the Arctic are vessels from 150 to 200 ft in length, and are probably among the best seaships in the world, regardless of size. They remain in the open sea at all times of the year in any part of the northern waters where fish may be found. While they can keep afloat in all but the very worst conditions, their ability to fish is naturally more limited. In a great many cases the limit is imposed not by the ship but by the human element, when conditions on the open deck of the vessel become too severe for the fishermen to continue to haul and shoot the gear or to handle the catch without grave danger. Many vessels of modern construction are capable of being worked in winds up to force 8,



The distant water fishing grounds.

although manhandling parts of the net over the side can then be an arduous task, particularly if the ship has a high freeboard. Since a trawler has to lie broadside on to the weather when hauling the gear, there comes a point in rough weather when there is a real danger of swamping from taking too heavy seas or from capsizing, and fishing has to be abandoned to enable the ship either to lay stem on to the weather or to run before the wind.

Generally, however, the trawler is obliged to stop fishing before this point is reached because the men are no longer able to keep their feet to handle the gear, are in danger of being carried overside by heavy seas, or are working in too low a temperature to be able to use their limbs effectively.

During the winter months much valuable fishing time is spent riding out gales. It is not always possible to extend the length of the fishing period by the time lost in this way because fuel stocks are limited and, moreover, the fish caught early in the trip must be landed within a certain period if it is not to be too stale.

Some attempts can be made to protect the men from the weather and thus improve the ability of the ship to fish up to its own limit of stability. This can be done by covering in the open working deck with a further shelter deck, giving the men a comparatively warm and dry place in which to operate, but the extra weight above the ship's centre of gravity together with increased surface area affected by wind pressure and ice deposition may detract from any gains made.

Although the bulk of Britain's fish is caught by distant water trawlers, there has since the war been a new development in the factory ships, of which the British *Fairtry* was the pioneer. These vessels catch fish by trawling over the stern instead of the side, fillet it below deck and freeze the fillets hard so as to preserve it for a longer period. They can therefore fish over a much greater distance from base than is possible with mere ice to preserve the catch. On the type of vessel some 240 ft in length now chiefly used it is said to be the safety of the fishing gear rather than that of the man which puts a stop to fishing when wind reaches force 8.

Trawlers in the Arctic depend a great deal upon each other for immediate weather information, as they are in many cases the only vessels regularly working in these waters. Their radio weather messages often form the basic information from which the official bulletins are compiled. A number of these ships, although not equipped with meteorological instruments, send in regular daily weather messages to the

Meteorological Office from as far afield as West Greenland and Labrador to Novaya Zemlya and Spitzbergen. A good wireless operator on one of these ships knows where to listen to a weather report of some sort at almost any hour of the day, and can understand the basic words in several languages, usually Norwegian, German and perhaps French or Icelandic in addition to his own tongue. Weather reports from the Norwegian and Icelandic coastal stations are generally comprehensive, frequent and reliable, but the grounds more remote from land are not so well covered, i.e. Bear Island, Barents Sea and Spitzbergen, although local reports are available from Norwegian weather stations maintained on Bear Island, Sea Horse Island and Spitzbergen. Most of the weather news available in these areas is however what the fisherman can see for himself by looking out of the bridge window, and what the next twenty-four hours will bring is not easily determinable. The Greenland coast is well served by a daily report in English from the Danish station at Julianehaab, so that probably the area least well served is that east of Northern Norway, from Vardø to the Cape Kanin area. This is not normally covered by the regular Norwegian forecasts, although there is a Russian bulletin for these waters which is also given out in English.

To sum up, the weather information service in the Arctic is more generally a report on prevailing conditions rather than a forecast, and in the more exposed and 'poorly covered' sea areas the prediction of rapidly approaching severe depressions cannot usually be given in time to be of use. It is only fair to add that even if such information were available the dictates of fishing would probably still govern the movements of the fleet.

When fishing is impossible, the ship 'dodges' the weather as far as possible while remaining in the same spot in order to resume fishing as soon as conditions ease. An indication of the severity can be given by the fact that one trawler working off the Norwegian Coast this year was able to shoot and haul its gear only ten times in as many days, an operation which normally is completed every two to three hours. During one bad spell in this area recently, the Norwegian radio station at Tromsö gave out over a hundred storm warnings within a couple of weeks.

The modern trawler is normally able to live through the worst weather it is likely to encounter, but there are two conditions which are especially dangerous. Firstly, the most unwelcome form of heavy weather is when the ship is in a following sea. A trawler running before the wind is of such a length and speed that it often coincides with the length and speed of the waves accompanying it. It is then quite possible for a large sea to be shipped fairly quietly over the stern and run forward along the deck, filling any openings and putting the whole ship under such a tremendous weight of water that the vessel is submerged. The solution in these circumstances is usually to slow the ship down sufficiently to break step with the seas and allow the waves to overtake and pass the ship. The second danger, and a much more difficult one to combat, is the problem of icing[3] (already discussed in a recent number of *The Marine Observer*[4]). Ice deposition on trawlers generally takes one of two forms. The less dangerous, but nevertheless unwelcome form, takes place in relatively calm weather and is known as 'black frost'. A layer of air heavily laden with water vapour just above freezing point envelops the ship and deposits a skin of ice over the whole of the superstructure of the ship if the exposed metalwork is below the freezing point. The quantities of ice that are deposited in this way are not usually enough to be a danger to the ship, particularly as they are distributed evenly all over the ship, but it can prevent any further work aboard until it is cleared, as all moving parts of the fishing gear, radar scanners, windlass, etc., are probably immobilised. Removal is carried out by hand with axes, hot water hoses, etc., and is a slow and laborious task. The much more dangerous form of icing occurs in very bad weather, when spray driven off the waves comes into contact with the ship's structure in air temperatures below the freezing point of sea water. This is a self-aggravating condition, in that the weather is usually so bad that the ship is unable to turn round to run south clear of the bad weather, and as the wind remains more or less in the same direction relative to the ship, the ice deposits pile up on one side and produce a list. This in turn causes the ship to take more and more water, until eventually the excess weight causes the ship to capsize. As scuppers and freeing ports become choked, large quantities of water tend to be held on deck, again lying on the side to which the ship is listing, until it too freezes. There is no real cure for this problem, only prevention. Weather conditions must be watched and if severe gales are imminent in an area where the air temperature is such as to encourage icing, then the ship should steam to the southward into warmer waters. Since the tragic loss of two British trawlers in 1955 in this way, some ships have been built with reduced superstructure area and less rigging to reduce the icing hazard. This year three trawlers have been lost off the North American coast, one each from Canada, Germany and Iceland, almost certainly from the same cause.

Design of ships and gear

The design of an Arctic trawler is first and foremost determined by the type of weather in which it has to work. The shape and strength of the hull has been evolved over the last century to become a specialised art in the field of naval architecture.

In the case of the Arctic fisheries the ships have to be designed to meet severe climatic conditions. A trawler has to serve as transport, working platform, storage space and home. There is no port of destination. Arrival point may be a spot in a wild and angry sea a long way from harbour, and there the men must work, and work hard, to earn a living. Trawlermen, particularly those employed in the distant water fisheries, lead an extremely arduous life, away from port for three to four weeks at a time, with three days at the most at home before the next trip begins.

The vessel in which a fisherman must live and work has to be warm, dry, robust and seaworthy, seakindly but steady enough to enable a man to keep his feet in all but the worst of weather, be swift through the water on the passage home, be able to carry enough fish to make the voyage economical, and preserve that catch in the best condition possible. Almost every one of the expensive items of equipment installed in modern trawlers is in some way influenced in its design by the weather conditions in which it has to be used. Some, like the radar sets used, are there to combat weather. Some, like the inflatable life-rafts that they now all carry, are there to protect the men from the dangers of it. From the insulation round the fishroom to the thickness of the ropes on the trawl net, weather is the guiding design factor.

It is only fair to add to all this that the fisherman as yet does not want a fine flat calm every day—he needs a bit of a roll on the ship to help heave his gear aboard, a breeze behind him can still push him along a knot or two faster, even though he no longer uses a sail. His fish-washing machine works all the better for a little movement of the ship, and a nice cool breeze will reduce his worries about the fish going off in the summertime.

Temperature and fish spoilage

Owing to unavoidable contamination during hauling and gutting, the dead fish harbours marine bacteria, which subsequently multiply the faster, causing more rapid spoilage the higher its temperature.[5] Effectively chilling, by means of ice, is the basis of distribution in fresh condition. Warm weather, or fish from tropical waters, present difficulties in the rapid initial chilling although there is some evidence that, once chilled, tropical fish keeps somewhat better, because further removed from its normal environmental temperature than fish taken from the northern waters. The temperature of the air and sea around the trawler on the catching grounds in the Arctic varies from season to season, ranging from about the middle fifties in summer to below 0°F in winter in the case of the air, and from about the middle forties down to freezing point for the seawater itself. Even in these comparatively cold climes spoilage can take place fairly rapidly unless every precaution is taken to ensure that the fish is cooled and kept cool as soon after catching as possible. Delays in stowing the fish below deck, leaving the fish exposed to even the weak Arctic sunlight, can do a considerable amount of harm in a relatively short time. Use is sometimes made of awnings, particularly in the case of the occasional voyages to North-West Africa for hake from Milford Haven. Once the fish is stowed down in the hold in plenty of crushed ice it takes up the temperature of melting ice, 32°F, but the outside air and sea temperatures continue to be an important factor in the storage life of the fish, particularly in summer and during the voyage to the home port through the warmer southerly waters. For although the sea around the ship may still be in the forties, this is still a good deal warmer than the mass of fish and ice at a little below 32°, and as three-quarters of the fishroom wall surface is below water level, a considerable amount of heat can flow through the walls to warm up the fish, with consequent increase in spoilage. Similarly direct rays from the sun upon the deck can produce rapid warming of the air in the fishroom and again awnings and running cold water over the decks are necessary expedients in the summer and autumn. Many trawler fishrooms are now thermally insulated, so that although fish docks are considerably warmer than the Arctic (and there is even some generation of heat as fish stales) nevertheless the fish is not usually above 32°F when it is taken out of the fish-hold. At this temperature it normally remains in edible condition for something like 16 days, representing the maximum age of the fish landed from most distant water trips. Taking full account of the difficulties and discomforts of the job, it is not considered that an appreciable improvement in the best standards of fish handling at sea can be expected that could result in any noticeable increase in the keeping quality of fish.

Meteorological conditions ashore, particularly temperature and to a much lesser extent humidity, have a considerable effect on the fish after it is taken out of the fishing vessel and during subsequent processing and distribution. The temperature of the fish, generally speaking, is allowed to rise during wholesaling and retailing, and the process of decomposition is correspondingly accelerated.[6] Every additional 10°F increase speeds up the bacterial multiplication responsible for the development of stale and putrid flavours by 250 per cent. So that at 52°F, for example, spoilage is nearly 6 times as fast as it is at 32°F. Although, by and large, the land distribution of fish is of shorter duration than the delay between catching and landing, a disproportionate degree of spoilage can be incurred, owing to the adverse effect of the higher temperatures mostly encountered. Ice is not always available, or else is not applied in adequate quantities nor with sufficient skill, to counter the heating effect of the atmospheric conditions, particularly in summer.

Freezing is a means of obviating spoilage during distribution. ‘ Quick freezing ’ of really fresh fish, followed by cold storage at temperatures as low as —20°F, keeps fish in good condition for many months.[7] Obviously, to secure the maximum benefit from the freezing process, distant water fish needs to be frozen aboard the fishing vessel. The *Fairtry* and numerous Russian factory vessels freeze their entire catch. More recently, experiments have shown the advantages of freezing only the first part of the catch and icing the remainder in the existing type of trawler.[8] There seems no reason, however, to suppose that the change of emphasis from icing to freezing for preserving the catch will throw up any very new aspects of the impact of the weather on the fishing industry.

To conclude, the fish industry has to battle with meteorological conditions from even before the fish is caught until after it is sold to the consumer. The methods of preservation adopted, with varying success, are dictated primarily by the necessity to counteract the adverse effects of the elements.

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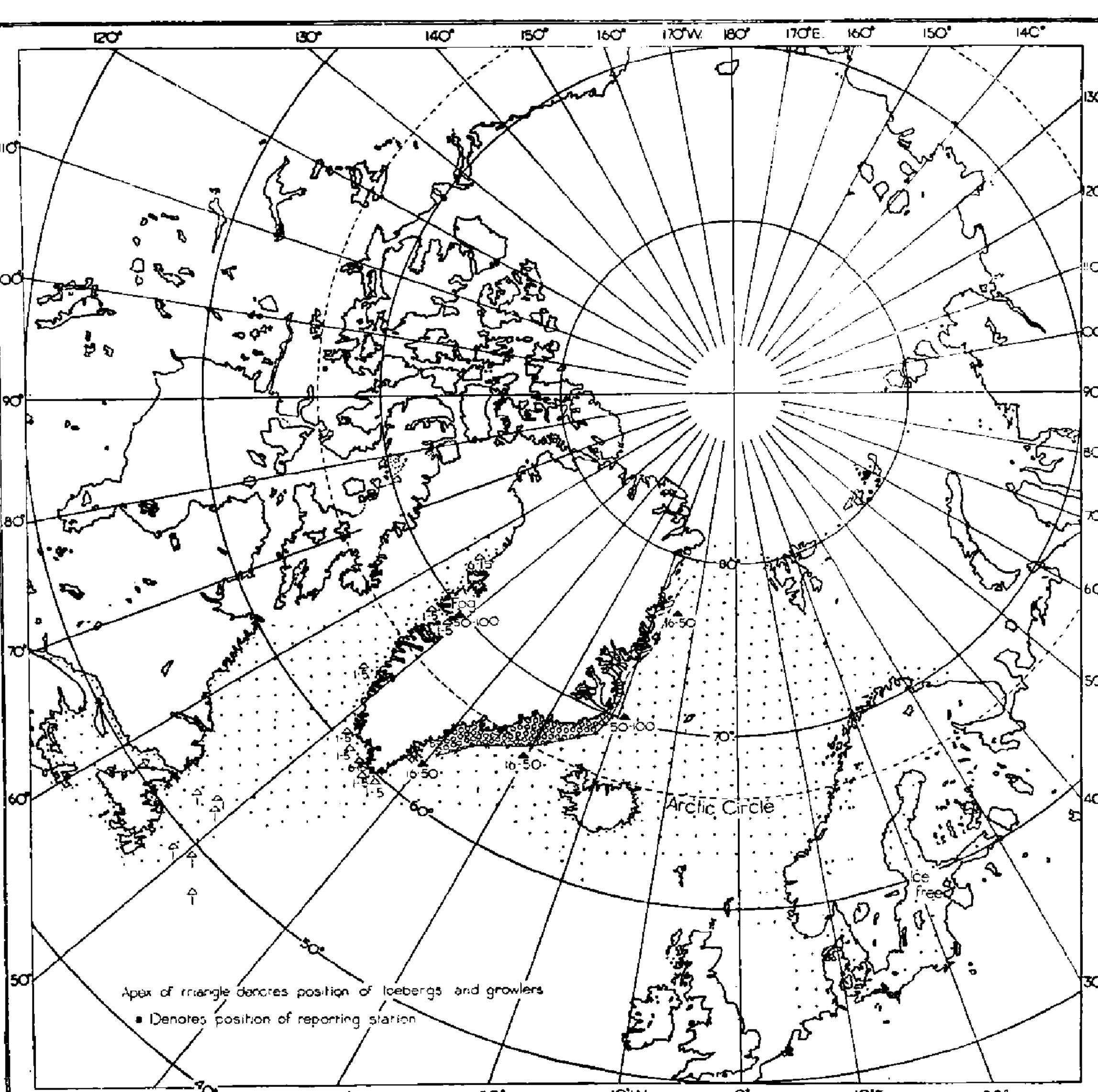
NOTES ON ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN

At end of October 1959



Distribution of sea ice at end of October 1959. (Key as for November map.)

RELEVANT WEATHER FACTORS

During October there was very intensive cyclonic activity over the central North Atlantic Ocean between north-west Europe and Canada, and abnormally high pressure over western Europe, northern Asia and north-west Canada. There was also above-normal cyclonic activity over Baffin Bay and the Davis Strait, which resulted in an abnormally strong average gradient wind from the north-west over north-eastern Canada.

Sea temperatures were above normal in the Atlantic north of 40°N. and east of 30°W., and below normal to the west of this.

BAFFIN BAY, DAVIS STRAIT AND HUDSON BAY

Little or no field-ice was reported in the Davis Strait at the end of October, but ice must have been forming in the Canadian Arctic, western Baffin Bay and Hudson Bay.

Small numbers of icebergs were reported off western Greenland with coastal areas free of pack-ice all along the coast to well north of 70°N.

ST. LAWRENCE RIVER, GULF OF ST. LAWRENCE AND GRAND BANKS

This area was free of field-ice, but there were a few icebergs in Belle Isle Strait and north-west of Newfoundland. Only a very few icebergs penetrated south of 48°N. and east of 48°W.

EASTERN GREENLAND

Land-fast ice formed in coastal areas of eastern Greenland north of 72°N., with pack-ice all along the coast south of this, except in the extreme south of Greenland. The area of field-ice, however, was below normal. Numerous icebergs were reported north of 62°N., to 80°N., but comparatively few had arrived off Cape Farewell.

At end of November 1959

RELEVANT WEATHER FACTORS

There was during November much cyclonic activity over the eastern Atlantic, and depressions were also frequent in the Russian Arctic and the Davis Strait. Abnormally high pressure over Europe and Asia caused warm air to flow from the south over the extreme eastern North Atlantic, and to penetrate to the Arctic. The Azores high was more intense than normal and warm air was therefore experienced frequently off the east coast of North America, but cold air continued to be advected into Canada from the Arctic.

Averages of sea temperatures indicated considerable amounts of cold water in the central Atlantic between Europe and Canada.

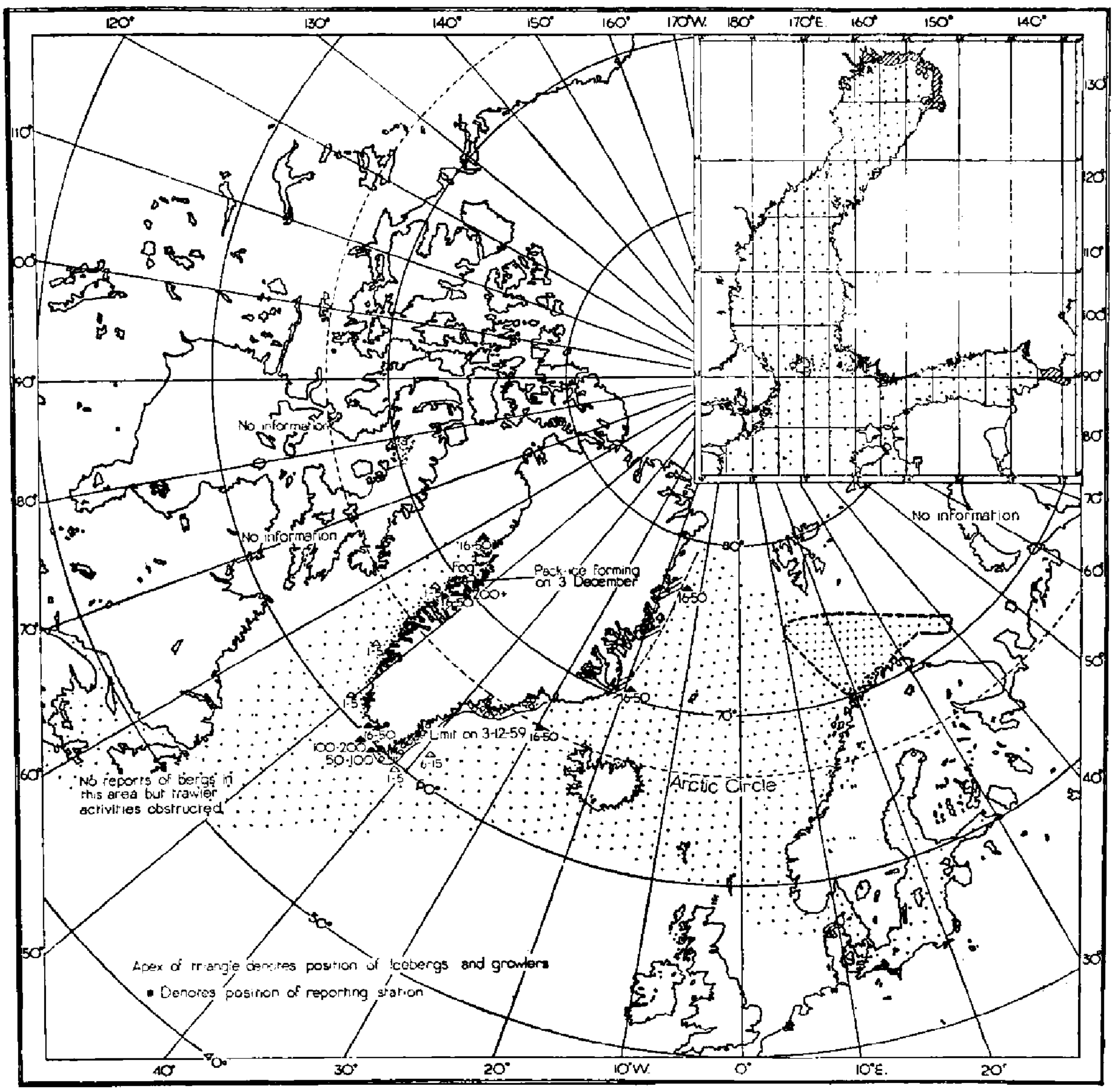
BAFFIN BAY, DAVIS STRAIT AND HUDSON BAY

No reports of field-ice were received from this area towards the end of November, although the formation of extensive areas of field-ice must have continued in the Hudson Bay, the Canadian Arctic and west and north-west Baffin Bay.

Along the west coast of Greenland small numbers of icebergs were reported, but there were larger numbers to the north of 70°N. and increasing numbers were reported west of Cape Farewell. Trawlers reported obstruction from ice in this area.

ST. LAWRENCE RIVER, GULF OF ST. LAWRENCE AND GRAND BANKS

There was little or no field-ice or icebergs reported in the Gulf of St. Lawrence and over the Grand Banks. There were increasing dangers from ice in the St. Lawrence Seaway and St. Lawrence River as the time for closing the Seaway approached.



Distribution of sea ice at end of November 1959.

KEY

Open water	Hummocked ice	Radar boundary
New or degenerate ice	Lead	Assumed boundary
Very open pack-ice [1/10-3/10 inc.]	Polynya	Limit of observed data
Open pack-ice [4/10-6/10 inc.]	Y Young ice [2"-6" thick]	Undercast
Close pack-ice [7/10-9/10 inc.]	W Winter ice [6"-6½' thick]	Few bergs [< 20]
Land-fast or 'field-ice' [10/10] [no open water]	P Polar ice [>6½' thick]	Many bergs [> 20]
Ridged ice	— Known boundary	Few growlers [< 100]
		Many growlers [> 100]

EASTERN GREENLAND

Field-ice was consolidated in this area during November, with continuous fast-ice extending well out to sea north of 70°N., but the total area of field-ice remained well below normal.

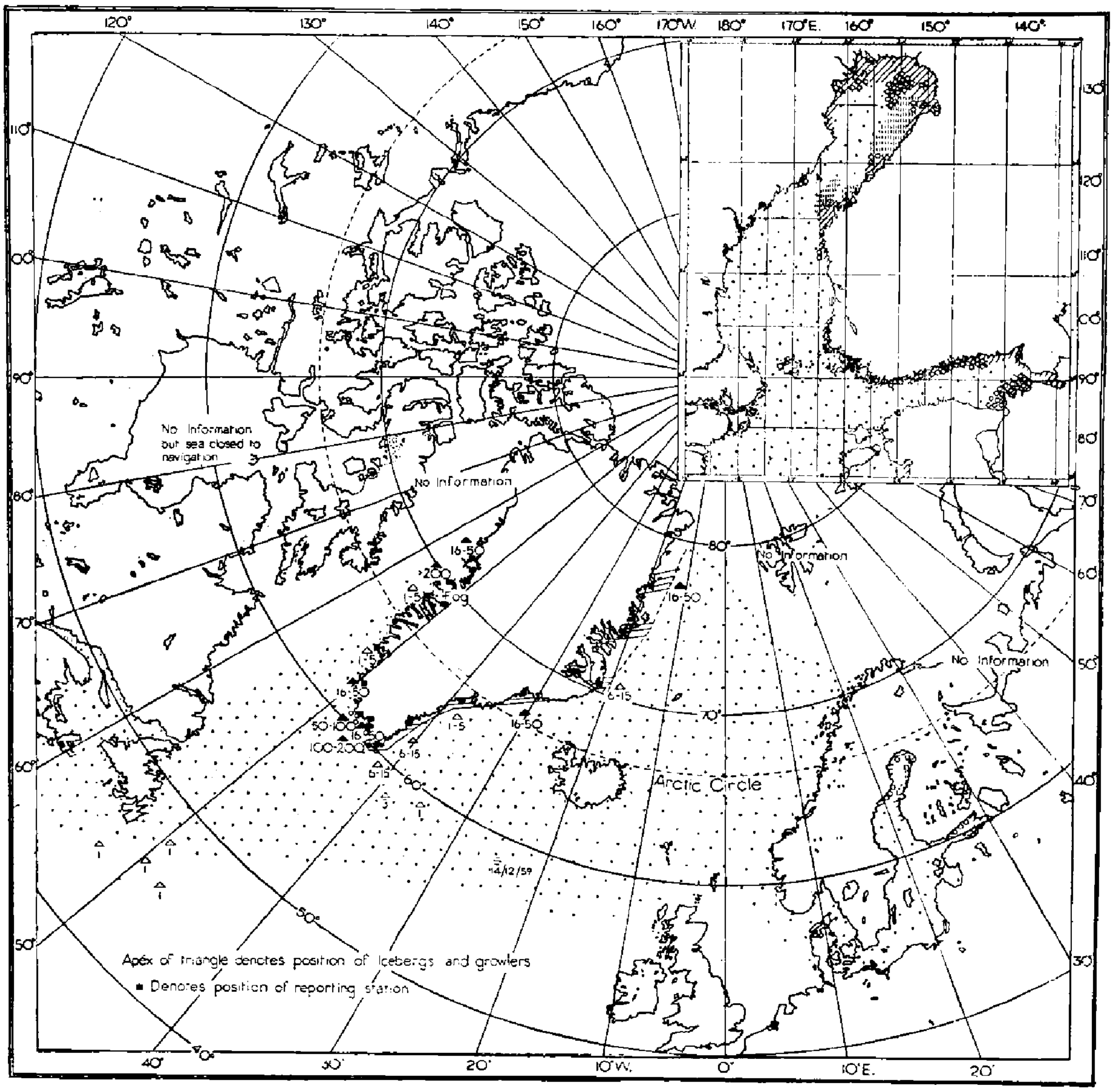
Large numbers of icebergs continued to move down the coast from the north, with increasing numbers arriving off Cape Farewell.

BALTIC SEA

The first ice of the season was reported towards the end of November in the north of the Gulf of Bothnia, in the east of the Gulf of Finland, and in the Gulf of Riga. The onset of the ice occurred during a short spell of very cold weather, associated with the southward movement of an anticyclone from the Arctic which caused a flow of polar continental air from Russia towards the Baltic Sea.

Icebreakers were in use in the north of the Gulf of Bothnia and in the east of the Gulf of Finland. The main part of the Baltic Sea remained ice free (see Table 2).

At end of December 1959



Distribution of sea ice at end of December 1959. (Key as for November map.)

RELEVANT WEATHER FACTORS

During December, cyclonic activity was mainly concentrated in the eastern North Atlantic. Pressure continued to be abnormally high over western Russia and was above normal over eastern North America. Air masses over north-west Europe and North America were generally warmer than normal, but periods of very cold air were experienced in the lowest layers north and east of the Baltic.

It was apparent from a number of computed sea temperature averages that colder than normal water extended from south of Greenland into the central North Atlantic directly west of the British Isles.

BAFFIN BAY, DAVIS STRAIT AND HUDSON BAY

Land-fast ice was reported from west Greenland stations, but only to the north of 70°N. This suggested that most of Baffin Bay north of this was covered with field-ice, but that there was probably a smaller area of ice in Baffin Bay than normal, as land-fast ice usually forms south of 70°N. in December. It was also apparent that most of the Hudson Bay and sea areas of the Canadian Arctic must have been almost covered with field-ice.

Increasing numbers of icebergs were reported off western Greenland west of Cape Farewell and also towards 70°N. It is possible that this increase might have been associated with the increase in the number of icebergs moving southwards east of Greenland.

ST. LAWRENCE RIVER, GULF OF ST. LAWRENCE AND GRAND BANKS

The Montreal shipping season closed on 22nd December, which appears to be the latest closing date on record. The closing of the Welland Ship Canal on about 15th December was also very late. The port of Quebec, however, remained in continuous use. The approaches to the Gulf of St. Lawrence, the central area and most of the coastal areas of the Gulf remained ice free up to and beyond the end of December. There was probably a considerable amount of ice in shallow coastal waters around sheltered bays towards the end of the month.

Increasing numbers of icebergs were reported south of 48°N. off Newfoundland. Table 1 gives a summary of the number of iceberg sightings by merchant ships picked up in the Meteorological Office from radio broadcasts.

Table 1. Icebergs reported during December 1959

LIMITS OF LATITUDE AND LONGITUDE	DEGREES NORTH AND WEST					
	56	54	52	50	48	46
No. of bergs reported south of limit.. ..	19	19	16	12	6	0
No. of bergs reported east of limit	19	18	12	7	1	0
Extreme southern limit	46° 20'N., 52° 38'W. on 31.12.59					
Extreme eastern limit	46° 40'N., 48° 00'W. on 31.12.59					

EASTERN GREENLAND

Increasing numbers of icebergs were reported off eastern Greenland. Some of these had clearly arrived in large numbers off Cape Farewell and some moved south-eastwards into the Atlantic where they were reported by merchant ships. In addition, reports of degenerate ice and field-ice were observed well south of Iceland. These reports were consistent with the low sea temperatures observed in the Atlantic.

Land-fast ice was reported all along the east coast of Greenland, but little or no pack-ice. The extent of the coastal field-ice remained below normal.

It was probable that the abnormalities in the ice situation off eastern Greenland at this time were associated with the high level of cyclonic activity in the eastern North Atlantic during October, November and December.

BALTIC SEA

There was very little change in the ice situation in the Baltic during December. Field-ice in areas in the north of the Gulf of Bothnia and in the east of the Gulf of

Finland had consolidated and increased by the end of the month, but the south and south-west of the Baltic remained remarkably free of ice (see Table 2).

Table 2. Summary of Ice Conditions reported from a selection of places in the Baltic Sea

	November 1959								December 1959							
	Length of Season		Ice days			Navigation conditions			Length of Season		Ice days			Navigation conditions		
Place	First day ice reported	Last day ice reported	No. of days ice reported	No. of days continuous landfast ice	No. of days pack-ice	No. of days 'dangerous to navigation' but assistance not required	No. of days assistance required	No. of days closed to navigation	First day ice reported	Last day ice reported	No. of days ice reported	No. of days continuous landfast ice	No. of days pack-ice	No. of days 'dangerous to navigation' but assistance not required	No. of days assistance required	No. of days closed to navigation
Aarhus	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Copenhagen	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Kiel	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Stettin	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Gdansk	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Klaipeda	—	—	0	0	0	—	—	—	8	24	12	0	5	6	—	—
Riga	—	—	0	0	0	—	—	—	8	20	13*	13*	0	11	—	—
Pyarnu	25	30	5	0	0	—	—	—	1	31	31	23	2	12	16	—
Leningrad	25	30	6	6	0	—	6	—	1	31	31	28	3	10	21	—
Viborg	25	30	6	6	0	1	5	—	1	31	31*	28*	0	9	21	—
Helsinki	—	—	0	0	0	—	—	—	7	31	25	21	0	24	—	—
Turku	—	—	0	0	0	—	—	—	11	31	21	4	0	5	—	—
Mariehamn	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Mantyluoto	—	—	0	0	0	—	—	—	8	31	22	0	1	2	—	—
Vaasa	20	25	2	0	0	—	—	—	5	31	27	26	0	5	21	—
W. Norrskar	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Oulu	16	30	15	12	0	5	5	—	1	31	31	31	0	3	28	—
Lulea	19	30	12	7	0	11	—	—	1	31	31	31	0	6	23	2
Bredskar (Umea)	—	—	0	0	0	—	—	—	6	31	26	0	1	25	—	—
Alnosund	—	—	0	0	0	—	—	—	12	31	20	14	0	19	—	—
Stockholm	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Norrkoping	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Visby	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Kalmar	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Goteborg	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Oslo	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—
Kristiansand	—	—	0	0	0	—	—	—	—	—	0	0	0	—	—	—

* Includes one report of " no ice " which was presumed erroneous

G. A. T.

OBSERVATIONS FROM AUXILIARY SHIPS IN SOUTH AFRICAN WATERS DURING THE I.G.Y.

Readers of *The Marine Observer* will know that one of the features of the International Geophysical Year (I.G.Y.) programme was the special effort made by the World Meteorological Organisation to increase the number of reports received from merchant ships in the ' unfrequented ' areas of each ocean. For this purpose, efforts were made to recruit as many merchant ships as possible (which were not already Selected or Supplementary Ships) to make observations and send coded radio weather messages in a simplified form when in those areas only. The message included the first four ' non-instrumental ' groups of the Selected Ships' code F.M. 21A, with the addition of the group PPXTT, the ' X ' indicating that the pressure and temperature readings are made with the ships' own instruments. These messages were prefaced with the code-word SHIGY. These ships, known as Auxiliary Ships, were only asked to make reports when actually in the ' unfrequented ' areas of the ocean as shown on a map issued to each ship recruited (and as shown in the map on page 99 of the July 1959 number of this journal). Port Meteorological Officers in various ports of the world did their best to recruit as many ships as possible for this purpose. Owing to the ever present need for reports from ' sparse ' areas for synoptic meteorology, the World Meteorological Organisation has arranged that this Auxiliary Ship scheme will continue for an indefinite period.

The following notes are compiled from a letter received from Mr. A. B. Crawford, Port Meteorological Officer at Cape Town, who was in effect the originator of this Auxiliary Ship scheme when it was introduced at the Commission for Maritime Meteorology's conference in 1956. These notes illustrate the success of this scheme in so far as South African waters are concerned, an area in which such reports are particularly valuable because there is so much relatively ' unfrequented ' ocean in that vicinity.

"As far as South Africa is concerned, the introduction of the Auxiliary Ships (' Shigy ' ships) during the period of the I.G.Y. has been marked by considerable success.

" During 1958 (i.e. the last 12 months of the I.G.Y., for which I happened to have the figures available) 33,199 radio weather messages from ships were received altogether by the South African Weather Bureau. Of these, 10,379 (i.e. 31%) were received from the Auxiliary Ships.

" If we subtract the total number of reports received from the whaling ships (4305) then the messages received from the Auxiliary Ships amount to 36% of the total—a considerable figure (whaling ships operate only during the months of December to March). Another interesting fact regarding radio weather messages received from ships at sea in our waters is that only 25% (4,629 reports) of messages received from Selected Ships (again, ignoring whaling ships) were from the ' sparse ' areas. The remaining observations from the Selected Ships were received from coastal waters or from ships on the normal trade routes between South Africa and Europe and North America. On the other hand, 60% (6,227 reports) of the messages from 'Auxiliary ' Ships were from ' sparse ' areas."

NEW METEOROLOGICAL OFFICE HEADQUARTERS BUILDING AT BRACKNELL

Since the war the headquarters branches of the Meteorological Office have been dispersed between London (central administration and some of the research branches), Harrow (marine, climatological research, instruments and library) and Dunstable (forecasting and forecasting research).

During the war, the branches now at Harrow were housed at Wycliffe College, Stonehouse, Gloucestershire, whence they had moved in 1939 partly from Kingsway and partly from South Kensington. It was during this period that the ' emergency temporary accommodation ', still in use, was set up at Dunstable to contain the forecasting branches, whilst the branches housed in Kingsway continue to occupy premises originally designed for private business offices.

Except for the very early days when the Meteorological Office was set up under Admiral FitzRoy in the Board of Trade building in Parliament Street, it has never occupied anything but rented or temporary premises. Moreover, never since they moved from rooms at 63 Victoria Street, London, in the early part of this century, have the headquarters branches ever been united in locality.

But now the Meteorological Office is to have a home of its own in Bracknell, Berkshire. In three buildings, adjacent to each other, the tallest of which will rise to eight storeys, the whole Meteorological Office headquarters organisation, after 105 years of metaphorically ' living in digs ' will have its permanent home.

On 28th October, 1959, the foundation stone of the new buildings, into which the Office is expected to move early in 1961, was laid by Sir Cyril Hinshelwood, M.A., D.SC., President of the Royal Society. Before the stone was placed, Sir Cyril tapped a sealed canister into a small previously prepared cavity. This contained a copy of the *Daily Weather Report* and *Daily Aerological Report* dated 20th October, a copy of the *Meteorological Office Annual Report*, and a copy of the centenary issue of *The Marine Observer* and of its shoreside contemporary, *The Meteorological Magazine*. Sir Cyril remarked that archeologists of the future might find the documents of some interest but that he hoped it would be a very long time before they discovered them.

This *Daily Weather Report* contains, in addition to meteorological data from many stations, a circumpolar chart of weather for part of the northern hemisphere including the North Atlantic, north of 30°N., the whole of the Arctic Basin, and the land masses of U.S.A., Canada, Europe and North Russia (including Siberia). It is interesting to note that on the copy thus preserved for posterity are plotted the observations of 59 ships in the North Atlantic. This, of course, includes observations which were initially received by Canada and the U.S.A. This chart, however, is necessarily on a comparatively small scale, where five thousand miles is represented by a mere four inches, and it would be hopelessly crowded if we attempted to plot every ship's observation on it. The working chart at Dunstable from which this printed *Daily Weather Report* is compiled and on which the Atlantic Weather Bulletin is largely based, covers only the North Atlantic east of 40°W. and, with much more room for plotting ships' observations, gives a much truer picture of the meteorological coverage given by observing ships. It is encouraging to know that 59 British ships (the number is coincidental) and 13 trawlers contributed to the Dunstable weather map for that day, sending in all 165 radio weather messages.

Ships which were observing in 1955 may still have the centenary number of *The Marine Observer* (January 1955) on board and many of them will have their observations thus preserved in the Marine Observers' Log in that issue. Of historical interest also will be the fleet list published in that number.

Masters and officers of merchant ships have always been welcome visitors to the Meteorological Office at its various locations, and the fact of all now being in one place will make it easier to show such visitors the general work of the Office. We shall therefore look forward to welcoming them to our new home at Bracknell, which, although rather further from London than Harrow, is only an hour's journey from Waterloo.

Our Port Meteorological Officers and Agents will, of course, continue to operate from the ports.

L. B. P.

SHIPPING OPERATIONS IN HUDSON BAY

The Commonwealth Shipping Committee has, since May 1930, issued reports on the Hudson Bay marine insurance rates with the object of enabling underwriters in London to appreciate the physical circumstances of the route as they become better known, and also to enable those in Canada to appreciate the factors which have to be taken into account before a rate can be quoted.

From time to time we have reviewed some of these reports in this journal, and we have lately received the eighteenth, which covers the 1958 season of navigation.

During that season 55 ships made voyages to Churchill and loaded full cargoes of grain for European ports. This number of ships was the highest on record, being nine more than in the previous season and seven more than the previous record of 48 in the 1956 season. Seventeen ships made two voyages and two ships made three voyages.

The first ship in was the British M.V. *Richard de Larrinaga*, a Selected Ship, which entered the port on 26th July. The last British ship to leave was the S.S. *Baron Renfrew*, also a Selected Ship. She left on 8th October. Only two ships left after her, one Greek and one Dutch, the last one sailing on 11th October. This was actually some days before the last date permitted by the underwriters and the first ice did not begin to form in the Bay at Churchill until 15th November. Throughout the 1958 season the Canadian Government ice-breaker *N.B. McLean* was stationed in the area during the trading season, and was available to give information and advice to the masters. In addition, the Canadian Government made 12 aerial surveys over the area and passed the results to the *N.B. McLean* and to the shipping press in London.

Helped by the increased knowledge of the meteorological conditions of this route, much of which is undoubtedly due to the observations of Selected and Supplementary Ships, the Commonwealth Shipping Committee now considers that there is no greater danger on the Hudson Bay from 13th August to 30th September than there is on the St. Lawrence Seaway and that the additional premium required for the Hudson Bay trade during this period should now be removed.

L. B. P.

ROYAL NAVAL BIRD WATCHING SOCIETY

We have always felt that bird watching and meteorological observing at sea are sympathetic sciences, for in looking skywards for wind and cloud the observer will not fail to notice any birds in the vicinity, whilst the bird watcher will automatically, even if subconsciously, note the background of cloud or sea. It is not surprising therefore that the additional remarks pages of meteorological logbooks have frequently contained ornithological observations. These have always been extracted and forwarded to the Royal Naval Bird Watching Society who, in letters, comment for *The Marine Observer*, and in their own annual publication *Sea Swallow* have expressed their thanks and emphasised the usefulness of such reports.

Recognising the growing popularity of this form of observation in the Merchant Navy, and appreciating that the amount of sea time put in by merchant ships is infinitely greater than that put in by H.M. ships, the Society in 1956 threw open its membership to all masters, officers and men in the Merchant Navy interested in ornithology. It is interesting to note that 8 of the 13 new members who joined during the past year were from the Merchant Navy.

The business discussed at the Thirteenth Annual General Meeting of the Society held at the Admiralty on 12th December, 1959, at which we were glad to see two shipmasters, contained much to interest the voluntary marine observer.

All the reports from sea received by the Society in the 13 years of its existence have now been catalogued by ' years ' and placed in the library of the Natural History Museum. Already the collection includes copies of reports from over 200 voyages in all the seas of the world, covering many thousands of observations. The series will be continued year by year and it is hoped that it will provide a valuable background for studies by ornithologists of the geographical distribution of ocean birds. We know that observers who have, in the additional remarks pages of their meteorological logbooks, contributed to this unique collection of data will be glad to know of the use to which it is being put.

The Chairman said that such an outstanding contribution to this worldwide survey was being made by the Merchant Navy that Admiral Sir Charles Lambe, the First Sea Lord, as President of the Society, was asking the Master of the Honourable Company of Master Mariners to suggest a name for the office of a Merchant Navy Vice-President. Furthermore, Captain P. P. O. Harrison of the New Zealand Shipping Company was to be asked to represent the Merchant Navy on the Editorial and Advisory Board of the Society, a Board which has hitherto consisted only of Naval officers and scientists.

The annual *Sea Swallow*, a 44-page booklet about the size of *The Marine Observer*, which is free to members paying an annual subscription (and obtainable by others from the Honorary Secretary, R.N.B.W.S., " Melrose ", 23 St. Davids Road, Southsea, Hants, at 4*s.* 0*d.*), in addition to being the Annual Report of the Society, contains much interesting reading. There are articles on the general requirements of bird reporting at sea, the wandering albatross, star navigation of nocturnal migrating birds and bird watching around Gibraltar and in the Clyde Estuary. Several of the most interesting reports received from ships at sea during the year are published.

A point of interest is that the New South Wales Albatross Study Group are now ringing albatross with a red band of reflecting aluminium making the birds readily detectable at night. Observers are asked to report any of these seen to the Wildlife Division of the C.S.I.R.O., Canberra, Australia, or in their meteorological logbooks.

Sea Swallow contains also a catalogue of books recommended for study or reference, grouped geographically, particulars of the Society and a form of application for membership.

L. B. P.

MARINE MONSTERS

" . . . wherein are things creeping innumerable, both small and great beasts. There go the ships: there is that leviathan, . . ." (Psalm 104, v. 25).

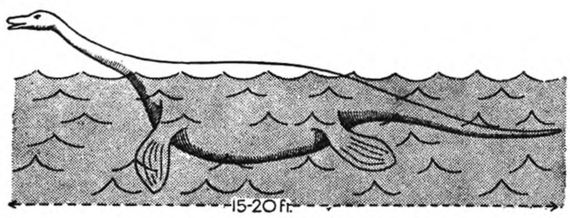
Probably most of us have some interest in monsters, especially marine monsters. Certainly the Loch Ness one attracted plenty of attention and doubtless there are some who are still intrigued by that unsolved mystery. Perhaps it was all a hoax, or possibly the legend might stem from the secret testing of some sub-marine speedboat. But the more imaginative of us may prefer to leave open the possibility of a real creature having been involved. It might perhaps have been a whale of some sort, or as a more remote possibility, some lone survivor of a species thought to be extinct. This may sound far-fetched, but the coarse-scaled, goggle-eyed fish, known as the Coelacanth, was considered extinct and only known by fossilised remains, until a live one was captured in recent years. We may well imagine that the first settlers in Australia had quite a shock on meeting their first emu. The spectacle of a creature adapted to a different environment or a different way of life from that with which we are familiar naturally induces a feeling of wonder, if not awe.

A few weeks ago, the writer, who is responsible for the revision of the weather sections of the Admiralty Pilots, was wandering, inland, in the vicinity of Peterborough. Those of you who know this area will be familiar with the many clusters of tall chimneys rising high above the rather flat landscape. These chimneys serve the brick kilns which in this area produce a high proportion of the country's output of bricks. Near to the kilns are the huge excavations whence is dug the stiff blue-black clay which is the raw material for the brick manufacture. This is the so-called ' Oxford clay ' of the middle Jurassic period of geological time, and is dated by the experts as being of the order of 150 million years old.

A particularly deep and extensive excavation invited inspection. After the recent rains the clay was difficult to negotiate, but the finding of several intriguing marine shells compensated for the heavy going. Some of these shells were perfect internal casts, in brass-coloured iron pyrites, of extinct marine molluscs called ammonites whose closest living relative is the ' Pearly Nautilus ' which now inhabits tropical waters. This might provide a little food for thought. The fact that the marine counterpart of these ammonites now frequents tropical waters suggests the possibility that a warmer climate obtained while the blue mud was being deposited on the sea bottom in the region which is now Peterborough, but which was then the ' continental shelf ' of a pre-British continent.

Conversation with some of the staff in the brick-field led to an invitation to see some bones which had been revealed by the digging of a drainage trench. These bones were found on inspection to be those of a marine reptile—Plesiosaurus.

Luckily this monster is well and truly extinct and has no living near-relations.



Plesiosaurus, a marine monster of some 150 million years ago.

Imagine an enormous porpoise, with a long snake-like neck, elongated crocodile-like tail, powerful fore- and hind-flippers for free swimming, and you have some idea of the creature. Of the bones found, practically every vertebra, from neck to tail, was present, together with most of the limb bones. They were in excellent condition, having been fully petrified. A single limb bone—the humerus, was taken and served to confirm, with the Palaeontology Department of the British Museum, that the reptile was Plesiosaurus.

On another occasion, in the same general area, remains were found of a pre-historic 'armour-plated' type of crocodile, the 'armour-plating' consisting of large bony plates some four inches square which covered the back and belly of the reptile (Steneosaurus).

Associated with these, and other large reptiles, were found abundant traces of wood, suggesting the proximity of a well-wooded coastline. The experts say that the flora of the Oxford clay is mainly palms and ferns. This combination of flora and fauna suggests a tropical climate in this region at the period considered. The contemplation of the blue clay of Peterborough and its vegetation and reptiles, calls to mind some words from the Pilot, Australia V, which describes the coast of tropical north Australia: "... 10 fathoms, blue mud. Alligators abound." Thinking of the conditions of the tropical mangrove swamp, with lush foliage, swarming with reptiles, which 150 million years ago occupied the area where now stands Peterborough, we may well reflect how times have changed.

B. F. B.

Book Reviews

American Practical Navigator. An epitome of navigation originally written by Nathaniel Bowditch, LL.D. $10\frac{1}{4}$ in. × $7\frac{1}{4}$ in. pp. 1524. *Illus.* U.S. Navy Hydrographic Office, Washington, 1958. $6.25.

An adequate review of this monumental technical book is a formidable task and might well occupy an excessive amount of space. It seems a pity that the authors chose to include so much information in one enormous volume, for this book contains a summary of almost everything a navigator needs to know. It would surely have been more convenient to the reader if all the Appendices (page 900 *et seq.*) had been published as a separate volume. As the appendices include a glossary and navigational tables, such an arrangement would presumably have been much to the reader's benefit.

The introduction to the book tells us that the *American Practical Navigator* was originally compiled by an American shipmaster and mathematician by the name of Nathaniel Bowditch. Bowditch must have been a remarkable man. Son of a shipmaster, he was born at Salem, Mass., in 1773 and he acquired his navigational knowledge during some seven years at sea, during which he showed his practical skill as a navigator. He had always been keen on mathematics, and while he was at sea he did much of the 'spade work' in preparing this navigational treatise. The first edition was published in 1802, about one year before he came ashore and entered the insurance business.

The mathematical and scientific skill of Bowditch became world-wide and among the honours he received was membership of the Royal Society.

The high quality of his navigational textbook is shown by the fact that more than 700,000 copies have been printed in about 70 editions since it was first published in 1802. This modern revision of the book is truly a lasting memorial to this great man and a remarkable book it is. An enormous amount of work and care must have gone into its preparation.

The book is divided into eight parts and a total of 44 chapters and is profusely illustrated with diagrams, maps and photographs. The print and paper are of high quality. Part I, entitled " Fundamentals ", deals with the history of navigation, basic definitions, chart projections and the general subject of charts themselves. The subject of projections, for example, is admirably illustrated and described and the authors contrive to bring out the technical terms in bold print. The historical section is dealt with very fairly with no national bias. Part 2, entitled " Piloting and Dead Reckoning ", deals with navigational instruments also (including the gyro and magnetic compass). The whole subject of compass error and adjustment of the compass is dealt with reasonably adequately in one chapter of about 50 pages. The section on piloting gives numerous useful hints to the navigator about handling a ship in coastal and narrow waters, anchoring, etc., and includes some excellent problems and answers about such subjects as depth over a bar at a certain state of tide, sequence of tidal streams in a given area, etc.

Part 3, entitled " Electronic Navigation ", deals first of all with the general subject of radio waves, which are discussed in a straightforward and graphic manner, the general principles underlying the application of electronics to navigation and finally the measurement of direction and distance by electronics (e.g. R.D.F., Consol and radar). Obviously one cannot deal in any way adequately with such an important aid as radar, with all its known pitfalls, in company with these other devices in a chapter comprising some 20 pages, but the authors do manage to include some quite good illustrations and worked examples to show the importance of plotting when using radar as an anti-collision device. The final chapter in this part deals reasonably comprehensively with the hyperbolic systems (Loran, Gee and Decca, etc.).

Part 4, devoted to celestial navigation, has nine chapters—" Navigational astronomy ", " Instruments for celestial navigation ", " Sextant altitude corrections ", " Lines of position from celestial observations ", " The Almanac ", " Time ", " Sight reduction ", " Comparison of various methods of sight reduction " and " Identification of celestial bodies ". The chapter on " Navigational astronomy " is particularly interesting and the illustrative figures which are very clear have been carefully prepared. The chapter on sextant altitude corrections seems to go into rather a lot of detail which, though interesting, is perhaps unnecessary and rather confusing to the practical navigator. Each chapter contains practical problems and answers, illustrated as necessary with figures. The seventh chapter in this part discusses almost every method and table for sight reduction that has ever been used, but curiously enough Norie's tables are omitted, although Norie's Epitome is mentioned in Chapter I. This part contains some excellent ' identification of star charts ', the names of the stars and identification hints being very clearly indicated.

Part 5, " The practice of navigation ", contains a wealth of practical advice to the navigator, concerning marine navigation generally, polar navigation, lifeboat navigation and air navigation. The final chapter discusses, without going into any detailed mathematics, the question of navigational errors and their recognition and possible elimination.

Part 6 discusses oceanography in adequate detail, under the headings of " The oceans ", " Tides and tidal currents ", " Ocean currents ", " Ocean waves ", " Sound in the sea " and " Ice in the sea ". Also in this part is a chapter on the effect of waves on " amphibious operations ". It is a bit surprising that the chapter on ice has no illustrations of ice conditions in the Antarctic, although it has good maps showing " Average ice conditions around the Arctic Ocean " and in April, May and June on the Grand Banks.

Part 7 is entitled " Weather " and deals with " weather observations ", " weather and weather forecasts " and " tropical cyclones ". This seems to be the least satisfactory section of the book, for it tends to go into rather too much detail about meteorological instruments and observations which are of no practical interest to the mariner, but it says too little about the practical value to the navigator of radio weather bulletins and other meteorological information. A little more might also have usefully been said, by way of encouragement to the navigator, to send coded weather messages by radio. One would gain the impression, reading the chapter on weather observations, that the anemometer was normally used for wind observations aboard ship and that estimates of the wind force and direction from the appearance of the sea was secondary. The suggestion that " clear skies are characteristic of an anticyclone " shows the difficulty of generalisation; winter anticyclones often have overcast skies for days. A suggestion is made that " in a slow moving well-developed frontal wave the barometer may begin to fall several *days* before the wave arrives "; surely this is rather unusual.

The authors wrongly liken the Pampero to the Bora—with the suggestion that both these are ' fall winds '—i.e. " cold winds blowing down an incline ". In the chapter on tropical cyclones, no mention is made of diurnal range of pressure in the tropics—but the rather surprising statement is made that " when the storm centre is 500–1,000 miles away the barometer usually appears restless, pumping up and down a few hundredths of an inch ". Apart from these criticisms this meteorological section is adequate and it is well illustrated.

Part 8 deals with the production of charts, hydrographic surveying and oceanic soundings. It is well illustrated and seems to be very up to date.

The Appendices, which have been mentioned earlier, include a Glossary, considerable miscellaneous data (distances, areas, length, speed, etc.), buoyage systems, chart symbols, tidal data, mathematics and interpolation (about 50 pages), maritime positions and extracts from Tide Tables and from the *Nautical Almanac*, and more or less complete navigational tables.

Its price of $6.25 is not very expensive when one considers the wealth of information it contains.

C. E. N. F.

Dutton's Navigation and Piloting, by John C. Hill, Thomas F. Utegaard and Gerard Riordan. 10½ in. × 7 in. pp. 796, including plates and figures. *Illus.* United States Naval Institute, Annapolis, Maryland, 1957 and 1958.

As stated in the preface, this book stems from *Navigation and Nautical Astronomy* by Commander Benjamin Dutton, United States Navy. It has now been tailored to meet more nearly the course in navigation of the United States Naval Academy. The change in title has been made desirable by its entire revision and reorganisation into parts.

It contains in easily digestible form most of what is contained in the *Admiralty Manual of Navigation*, Vols. 1 and 2. The many excellent and original diagrams will help the newcomer to the subject to quickly grasp the basic principles involved in fixing his ship's position on the earth's surface by terrestrial or celestial observations or by means of electronic aids.

The chapter on polar navigation will interest those who visualise the introduction before long of the atomic powered cargo-carrying submarine, following the trans-polar route under the ice successfully accomplished in 1958 by the American atomic-powered submarine *Nautilus*.

A chapter on lifeboat navigation has been included which contains some very practical advice for the prudent mariner, who wishes to acquire the essential knowledge he needs should he ever be faced with the responsibility for the navigation and preservation of life in an open lifeboat after an emergency in which his ship has been abandoned.

Although the chapter on electronic navigation does not include any mention of some of the electronic equipment to be found on board many British ships at the present time, such as the Decca navigator and Consul, the principles underlying all electronic systems of navigation are well explained and radar and Loran are dealt with at some length.

Although this book is written primarily for use of midshipmen at the United States Academy, its 35 chapters and 17 appendices provide any student of navigation with all the information he will require to gain a sound knowledge of the subject, and it certainly deserves a place in any library of technical books provided for the use of junior deck officers.

A. D. W.

Hurricane Forecasting. U.S. Weather Bureau, Forecasting Guide No. 3. 10¼ in. × 7¾ in. pp. 108, including 92 figures. Washington, 1959.

This booklet is a very comprehensive guide to the problem of hurricane forecasting and the reader is bound to be impressed by the ingenuity and energy with which the problem is being tackled by the U.S. Weather Bureau and the National Hurricane Research Project.

The first step in forecasting a hurricane [defined as a non-frontal cyclone of tropical origin with which are associated winds of 64 knots (Force 12) or more], is to become aware of its development or existence, and this in itself is a major problem.

The authors point out that although widespread convection always accompanies the early stages of hurricane development, convection alone is not sufficient. It must take place within an existing low level disturbance which in turn must be located beneath a region of high level divergence, perhaps associated with the train of vortices which is a characteristic feature of high level flow in the tropics during the hurricane season. However, no simple relationship between an intensifying storm and the upper level flow has yet been established, and it will be gratifying to mariners to know that despite such modern aids as upper air charts, aircraft reconnaissance, electronic computers and radar, surface observations from ships still play, and will continue to play, a vital role in giving early indication that a storm is forming, and in determining the approximate position of the centre.

Once the position of the centre is known, the forecaster is faced with the difficult but extremely important task of deciding its future motion. Classification of tropical storms for the last 70 years shows that approximately 60% move in the tropical easterlies all the time and 30% recurve from the easterlies to the mid-latitude westerlies. Storms tend to be steered in the direction of the prevailing broad scale flow in the mid-troposphere and curving of the track towards the north is associated with the pre-existence or development of an upper trough extending from the westerlies and situated to the west of the storm centre. For long and medium range forecasting it is therefore essential to forecast changes of the large scale circulation over a period of several days. This cannot yet be done with sufficient accuracy, but the authors hope that the application of more precise numerical methods to 5-day forecasting will lead to an improvement. However, in the opinion of the reviewer no marked improvement can be expected in either long, medium or short range forecasts until a much extended network of upper air soundings has been provided. Soundings are still largely confined to the island chains in the Caribbean area, and over vast areas of the tropical and sub-tropical North Atlantic there are still no upper air data.

For short period forecasts, a variety of methods has been devised and the time-honoured method—simple extrapolation of the past motion of the storm—is rightly given due prominence. There are also two methods based on the steering principle, using upper winds, either observed winds or geostrophic winds taken from contour charts, and two purely statistical methods (based on sea level pressure and 500 mb height data) whereby predictor equations are derived. Numerical prediction methods have also been tried, but results have been poor. This is not surprising, since the influence of latent heat of condensation has been neglected and the data available to represent the initial state of the atmosphere are inadequate. A method of taking into account latent heat of condensation is being developed.

A final section deals with storm effects (destructive surface winds, rainfall, floods, storm tides). Valiant attempts are being made to apply physical principles to the forecasting of these destructive characteristics of the hurricane but the problem bristles with difficulties. Details of the wind field vary markedly from one storm to the next, knowledge of the distribution of convergence of the winds in the hurricane circulation is inadequate for successful rainfall prediction, and dynamical models of storm surge generation are too complicated for ready use. In practice, empirical methods of forecasting are used.

At the end of the Guide are four appendices giving examples of a 24-hour hurricane forecast, each by one of the different methods mentioned in the section of the Guide dealing with short range prediction of movement. As is not unusual when a single example is chosen to illustrate a general method, the forecast for each occasion was remarkably good. However, three of these methods rely on prediction equations which are open to the criticism that they are based solely on an observed field of pressure (or pressure-height), and do not take into account the influence of pressure changes during the period of the forecast, particularly in the region towards which the hurricane is moving. An experienced forecaster would always try to take such changes into account (using the latest available 24-hour 500 mb forecast chart) and it is open to question whether the overall standard of accuracy achieved by the ' objective methods ' exemplified in the appendices is any higher than that which could be achieved by an experienced forecaster, using simple extrapolation of the track modified, if necessary, by an assessment of changes in the 500 mb upper flow.

The Guide contains a large number of well presented maps and diagrams, and an exhaustive list of references.

F. E. L.

All about Ships and Shipping, edited by Edwin P. Harrack. 6 in. × 4 in. pp. 729. *Illus.* Faber & Faber Ltd., London, Tenth edition, 1959. 32s. 6d.

This book, the first edition of which was published as long ago as 1903, is an encyclopaedia in miniature. Mr. Frank Carr, the director of the National Maritime Museum, in the foreword, describes it as " a nautical reference library in a nutshell, when time and space are limited. It is both a fascinating compendium of things a sailor or ship-lover needs to know, and a bedside book which tempts one to browse ".

The book is divided into four parts, but it is Part I, comprising 36 chapters, which forms the real body of the work, the other three being primarily lists of ships and companies, and statistics of various kinds. In this part the reader may learn of the evolution of the ship from the raft or floating log; of methods of navigation and the instruments used; of the development of the Merchant Navy; of fishing and yachting; of canals, docks, signals and lights; of liners, cargo ships, tramps and tankers, their owners and capabilities; in fact, of the thousand and one things which form the basis of many a discussion and argument aboard a ship. Of particular interest to the seaman are the separate chapters on the ' fringes ' of the sea service, Trinity House, Lloyd's, Lloyd's Register, the Marine Society, the Royal National Lifeboat Institution, the Customs and Excise, and H.M. Coastguard, whilst items such as the 20-page nautical vocabulary, the lists, with line drawings, of the ships of both the Royal and Merchant Navies, and the coloured plates of house flags and funnels provided us with many a profitable browse.

It is not to be expected that a work embracing such a multitude of subjects can be without blemish but it is surprising to find in the paragraph about the North

Atlantic shipping tracks on page 37 such a large error as " the more northerly is to be followed in summer and the more southerly in winter ". This is quite contrary to the facts for it is in summer, when the ice extends south, that the more southerly tracks are followed. We found Chapter 6 (Atmosphere) disappointing, largely on the score of imperfect revision. In it, the strength of the wind in Beaufort force is still given in terms of the canvas carried by a full-rigged ship, a criterion which was superseded twenty years ago by the ' state of sea criterion '. The general theory of wind circulation is very much over-simplified. Stratocumulus cloud is wrongly named ' cumulo-stratus ' and the obsolete word ' nimbus ' is used for rain cloud, instead of ' nimbostratus '. Some criticism must also be made of the meteorological advice given in this chapter. For example, there is no foundation for the statement that " If the full moon shall rise red, expect wind ", and the statement " Fogs indicate settled weather " is much more likely to prove correct on land than at sea.

Some of the information in other chapters is also out of date. In Chapter 5 (Time), for example, we read of men having four hours rest one night and eight the next, regardless of the fact that, except in the smallest ships, the two-watch system was abandoned a quarter of a century ago. It is surprising, too, to find Loran written of as though it were peculiar to U.S. ships only. On the other hand, credit must be given to many authors for bringing their chapters right up to date. The 14-page diary of events (Chapter 21) takes us up to the 60-day submerged record of the U.S. nuclear submarine *Seawolf* in August–October 1958, the flags and funnels include those of the new British and Commonwealth Co. and the lists of ships include the names of some which have not yet left the yard.

The book has a good index which, in conjunction with a remarkably good table of contents, enables the reader to turn up a required reference very readily. It is the sort of book which one likes to have in one's cabin on long voyages and in foreign ports for there is much in it to promote discussion, to settle argument and to thumb through at leisure. Ten editions in 56 years bear witness to its popularity. It has, moreover, the merit of being small enough in page area to be easily handled in one's bunk yet too thick to be slipped unseen into a shipmate's pocket!

F. E. L.
L. B. P.

Personalities

RETIREMENT.—In November last, CAPTAIN P. MULLEN made his last voyage as Master of the *Leinster* after 41 years' service with the British & Irish Steam Packet Company, which included 36 years in command and more than 10,000 crossings of the Irish Sea.

Peter Mullen was quite determined to follow the family tradition of the sea, and although his father disapproved, on account of a brother being lost at sea, he played truant from school one day at the age of 14 and joined the coaster *Rostrevor* at Newry, Co. Down, as deck boy. Subsequently his wishes prevailed and he was allowed to continue the career of his choice, and joined the Leyland liner *Winifredian* on the North Atlantic trade.

After two years in deep-sea ships he transferred to the coasting trade and on passing his mates' certificate in 1918 joined the Dundalk & Newry Steam Packet Co. which later amalgamated with the British & Irish Steam Packet Co.

Captain Mullen passed for Master in 1920 and was appointed to his first command, the *Kittywake*, in 1923. For some years after the war he was relieving Master for the Dublin passenger ships *Munster* and *Leinster* and in 1953 was appointed permanent Master of the *Leinster*.

Captain Mullen has for some years been sending weather reports on the Liverpool/Dublin run.

We wish him health and happiness in his retirement.

J. R. R.

RETIREMENT.—After 12 years' service as Shore Captain at the Ocean Weather Ship base in Greenock, CAPTAIN G. W. STEER retired in January 1960. It was in August 1947 that *Weather Observer*, the first British Weather Ship, put to sea, and Captain Steer has thus been responsible for the local administration and operation of these ships from the beginning; the ships have carried out their duties regularly and efficiently.

George William Steer was born in 1894 and he served his time with the Weardale Shipping Co. of Sunderland. He passed for 2nd mate in December 1914, served as 3rd officer in the Well Line (Brocklebank Co.) till 1916, and, after some service in a benzine carrier running from the United States to Bordeaux, he joined the R.N.R. and served as a navigator and in command in the auxiliary patrol until 1919. He witnessed the surrender of the German High Seas Fleet.

He passed for Extra Master in 1919 and joined the Hindustan S.S. Co., Ltd. (Common Bros.) as 2nd officer and was in command in that Company from 1924 till 1942. From 1942 till 1947 he was at the Ministry of War Transport on special work planning the stowage of military cargoes. In April 1947 he was appointed Shore Captain at the Ocean Weather Ship base.

While he was at sea Captain Steer did voluntary meteorological work on behalf of the United States Weather Bureau.

We wish him health and happiness in his retirement.

C. E. N. F.

APPOINTMENT.—CAPTAIN F. A. ELSTON, formerly in command of the British Ocean Weather Ship *Weather Watcher*, has succeeded Captain Steer (see above) as Shore Captain at the Ocean Weather Ship base.

Captain Elston, who was born in 1903, served his apprenticeship with Messrs. Elder Dempster & Co., Ltd., and remained with that company until 1930 when he had attained the rank of 2nd officer. From 1930 to 1939 he served aboard the G.P.O. Cable Ships, where he attained the rank of Chief officer. Soon after the outbreak of the Second World War he joined the Navy as Lieutenant R.N.R., and was promoted to Commander in 1944. His duties, both afloat and ashore, were connected with the Underwater Weapons Department.

He took command of *Weather Watcher* in 1947, and remained in command of her until his appointment as Shore Captain, except for a short period when he did temporary duty as Port Meteorological Officer in London. Captain Elston did some voluntary observing work on behalf of the Meteorological Office while he was in the Elder Dempster Line.

C. E. N. F.

OBITUARY.—We regret to record the death, which occurred at his home in Withernsea, Yorkshire, only a few hours after his return from an Icelandic fishing voyage in November 1959, of Mr. A. R. CORNISH, skipper of the trawler *Kingston Turquoise*, owned by the Kingston Steam Trawling Co. Ltd. of Hull.

Albert Richard Cornish, who held a foreign-going Mates' Certificate of Competency, was born at Cardiff in 1899. Grandson of a sailing ship master, and son of a Chief Engineer who was drowned at sea, at the age of 15 he became an apprentice with W. C. T. Jones of Cardiff.

He rose to be Chief Officer but, due to the shipping depression of the 1920s, he joined the deep sea trawling industry as a deck hand. Twelve months later he became skipper and for some time carried out experimental fishing at Colombo.

He joined the Kingston Steam Trawling Co. Ltd. in 1930 and remained with them until his death except for the period of the Second World War, when he was commissioned into the Royal Naval Reserve as a Lieutenant.

His Naval service included navigating duties in destroyers based at Belfast early in the war and later command of trawlers on escort duties, one being the *Leicester City*, on the dangerous run to and from Russia during which time he was twice mentioned in despatches.

Near the end of the war he was discharged on a pension and resumed fishing, when he was twice very close to ramming German U-boats but failed only through lack of speed.

He was President of the Hull Trawler Officers' Guild for some years and in that capacity he had the honour of being presented to Her Majesty the Queen and the Duke of Edinburgh when they visited Hull.

His association with the Meteorological Office went back to 1936, when he was one of the second group of three trawler skippers who then volunteered their help with weather reporting in high latitudes. When the "Trawler Scheme" was renewed after the war, Skipper Cornish again became a voluntary observer and many valuable radio weather reports were received from the *Kingston Turquoise* under his command.

He leaves a widow, three sons and two daughters, to whom we extend our sympathy.

W. H. C.

Notices to Marine Observers

B.B.C. WEATHER BULLETINS FOR SHIPPING

The early-morning weather bulletins for shipping broadcast on the Light Programme (1,500m) will be broadcast at 0645 clock time instead of 0645 G.M.T. as from 10th April, 1960 (the date of commencement of British Summer Time).

Originally this early-morning weather bulletin was one of the external services, all timed according to G.M.T., provided by the B.B.C. on 1,500m before the programme proper commenced at 9 a.m. Now, however, these other external services have ceased and so the B.B.C. have asked us, in view of the fact that the 1,500m transmitter now comes on at 6.30 clock time, to agree to the change mentioned above. We agreed to the change after ascertaining from various interests of the shipping industry and yachtsmen that the new time was acceptable to them.

THERMOMETERS IN CANADIAN PORTS

Voluntary marine observers are advised that Port Meteorological Officers at the following Canadian ports hold stocks of the British new sea thermometers: Halifax, Nova Scotia; Vancouver, British Columbia; St. John, New Brunswick.

SEA ICE ENQUIRIES

The Marine Division of the Meteorological Office is receiving at present a great deal of ice information that could be of help to owners and masters of ships contemplating voyages to areas liable to contain ice.

The information received includes up-to-date reports from the Great Lakes, the St. Lawrence River, the Gulf of St. Lawrence, the Grand Banks, Greenland and the Baltic Sea. More limited but useful information is available concerning the approaches to north-west Europe, northern Russia and the Canadian Arctic.

Information can be obtained by telephone from Harrow 4331, extension 31 or 300 (9.30 to 4.30, Monday to Friday, excluding public holidays) or by letter* to : The Director-General, Meteorological Office (M.O.1), Air Ministry, Headstone Drive, Harrow, Middlesex.

* A charge is usually made when written enquiries are answered.

ICE PHOTOGRAPHS

The Marine Division is starting a collection of outstanding photographs of sea ice. Some of these photographs may be published from time to time in *The Marine Observer*.

Any photographs with special merit either in their quality or in their uniqueness in illustrating some abnormal ice formation will be gratefully accepted. 'Common or garden' photographs of pack-ice or icebergs are very useful if they are of a high quality.

If observers have any technical difficulties in photographing ice and they write to us about them, we will do our best to find solutions.

IN LIGHTER VEIN

The following appeared in the meteorological logbook of the S.S. *Esso Manchester*, received here on 30th December, 1959.

" Whilst putting the vessel alongside at Wilmington, U.S.A., the docking pilot pointed to the Stevenson screen which was hanging well out on the wing of the bridge and enquired of the 3rd officer what it was? The 3rd officer puffed out all 32 in. of his chest at being given the opportunity of explaining something to our American cousins. He went into great meteorological detail and technical explanation, touching upon dewpoints and humidity in passing.

" The pilot listened patiently to this lengthy discourse, and when the 3rd officer paused for breath, enquired bluntly, ' But does the — thing have to hang right there? ' "

Note. The pilot would be a stranger to the Stevenson screen as it is not used in American ships. In them, as also in Canadian ships, temperature data are obtained from the sling psychrometer. The use of this is shown in the drawing below by Mr. J. D. Lampitt of the S.S. *Waihemo*, a Selected Ship on the Canadian Fleet List, sent to us by the Canadian Meteorological Branch. The two methods of obtaining dewpoint require different tables and it is prudent to remind officers of U.K. Selected Ships to make sure that they are using only the Stevenson screen table when computing the dewpoint. Some code cards, other than the British, give only the psychrometer table.

Mistakes of this nature occasionally occur.

Meteorological Office (Marine Division) Atlases

The following are published by the Marine Division of the Meteorological Office and may be purchased from the bookshops of Her Majesty's Stationery Office at any of the addresses on the title page. Copies are available for reference by shipmasters and shipowners in the offices of Port Meteorological Officers.

Meteorological Atlases

Monthly Meteorological Charts of the Atlantic Ocean. M.O.483, 1948. (60°S–70°N, 80°W–40°E) 180*s.* (post 3*s.* 3*d.*)

Monthly Meteorological Charts of the Western Pacific. M.O.484, 1956. (60°S–60°N, 100°E–155°W) (16¾″ × 23¾″) 105*s.* (post 2*s.* 9*d.*)

Monthly Meteorological Charts of the Eastern Pacific. M.O.518, 1956. (60°S–60°N, 160°W–60°W) (17½″ × 24½″) 147*s.* (post 3*s.* 3*d.*)

Monthly Meteorological Charts of the Indian Ocean. M.O.519, 1952. (50°S–30°N, 20°E–120°E) (16½″ × 22½″) 126*s.* (post 2*s.* 9*d.*)

The above four atlases contain monthly charts of wind, barometric pressure, air and sea temperature, and all meteorological elements including some typical tracks of tropical revolving storms.

Monthly Sea Surface Temperatures and Surface Current Circulation of the Japan Sea and Adjacent Waters. M.O.M.447, 1944. (20°N–47°N, 110°E–150°E) (20″ × 17″) 7*s.* 6*d.* (post 9*d.*)

Monthly Sea Surface Temperatures of Australian and New Zealand Waters. M.O.516, 1949. (50°S–10°S, 100°E–180°) (19¾″ × 12¼″) 10*s.* (post 7*d.*)

Monthly Sea Surface Temperature of the North Atlantic. M.O.527, 1949. (30°N–68°N, 80°W–15°E) (19¾″ × 12¼″) 10*s.* (post 7*d.*)

Monthly Meteorological Charts and Sea Surface Current Chart of the Greenland and Barents Seas. M.O.575. (60°N–80°N, 30°W–120°E) 126*s.* (post 2*s.*)
This atlas contains a generalised surface current chart for the area and monthly charts of wind, barometric pressure, air and sea temperature, and all meteorological elements.

Current Atlases

Currents of the Indian Ocean. M.O.392, 1939. (50°S–30°N, 20°E–140°E) (30″ × 20″) 10*s.* (post 7*d.*)

South Pacific Ocean Currents. M.O.435, 1938. (60°S–0°, 140°E–70°W) (22″ × 34″) 12*s.* 6*d.* (post 1*s.* 1*d.*)

The above two atlases contain quarterly "current arrow" and "current rose" charts.

Quarterly Surface Current Charts of the Atlantic Ocean. M.O.466, 1957. (60°S–70°N, 80°W–20°E) (22½″ × 18″) 32*s.* 6*d.* (post 1*s.* 6*d.*)

Quarterly Surface Current Charts of the Western North Pacific Ocean with monthly chartlets of the China Seas. M.O.485, 1949. (0°–60°N, 98°E–160°W) (21″ × 16″) 25*s.* (post 11*d.*)
The above two atlases contain current rose charts, predominant current charts, and vector mean current charts.

Ice Atlases

Monthly Ice Charts of the Arctic Seas. M.O.M.390a, 1944. (60°N–80°N, 80°W–110°E) (12″ × 7″) 3*s.* 6*d.* (post 5*d.*)
Polar ice, mean limits of sea ice, extreme limits of sea ice, extreme limits of bergs.

Monthly Ice Charts of Western North Atlantic. M.O.478, 1944. (37°N–53°N, 72°W–35°W) (12″ × 7½″) 4*s.* (post 7*d.*)
Mean limits of pack, extreme limits of pack, mean limits of bergs, extreme limits of bergs.

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