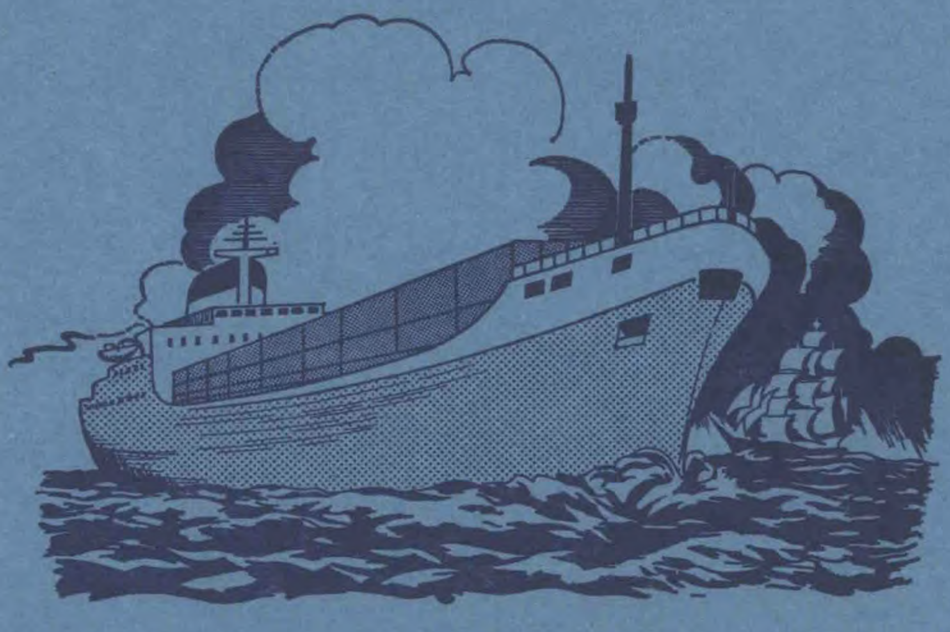
Met. O. 937

The Marine Observer

A quarterly journal of Maritime Meteorology



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THE MARINE OBSERVER

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

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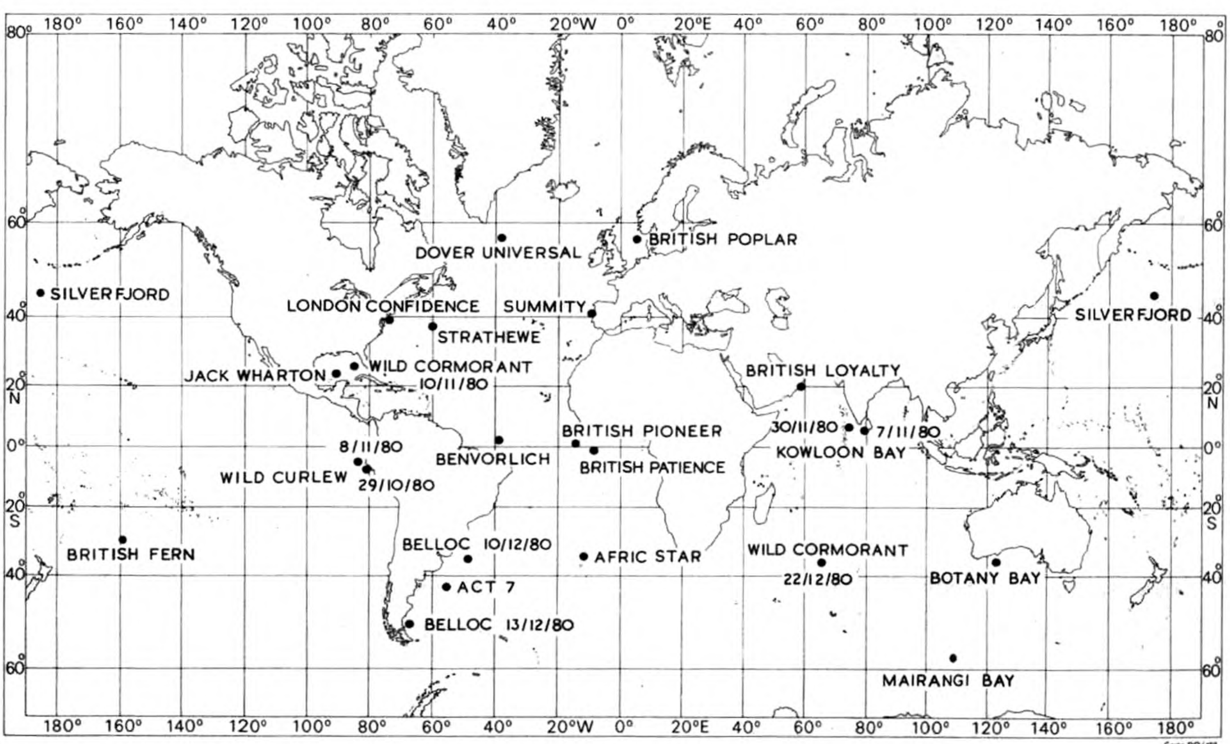
October, November, December

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

Observing officers are reminded that preserved samples of discoloured water, luminescent water etc. considerably enhance the value of such an observation. Port Meteorological Officers in the UK will supply bottles, preservative and instructions on request.



Position of ships whose reports appear in *'The Marine Observers' Log'*

SEVERE STORM

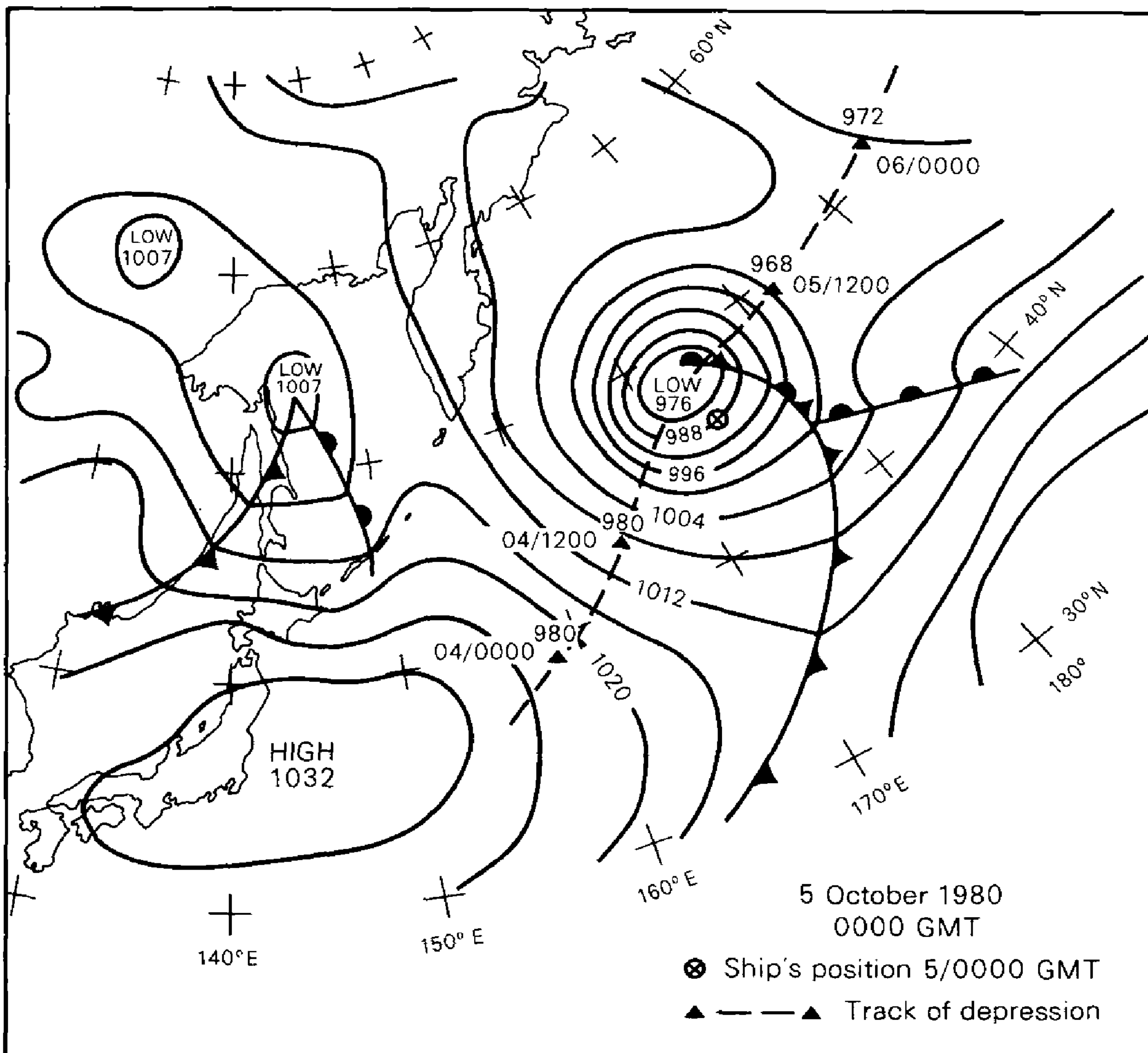
North Pacific Ocean

m.v. *Silverfjord* Captain J. R. Jenkins. Balboa (Panama) to Kobe (Japan). Observers, the Master, Mr J. Knox, Chief Officer, Mr K. Kirby, 2nd Officer, and Mr V. McAdam, 3rd Officer.

4 October 1980. A severe storm, formerly typhoon Vernon, was encountered. The following storm warnings were received:

4 Oct. Storm (990 mb) reported to be in position 39° 00′N, 165° 00′E, moving ENE at 45 knots.

5 Oct. Storm (976 mb) reported to be in position 48° 00′N, 173° 00′E, moving ENE at 35 knots.



The following are extracts from the ship's logbook as the vessel approached the storm:

	GMT	
4 Oct.	1200	Wind E's, force 4, barometric pressure 1012·7 mb, slight following sea and confused swell. Vessel moving easily. Overcast with heavy rain, visibility poor to moderate.

	1600	Wind E'S, force 6, barometric pressure 998·4 mb. Vessel moving easily in rough following sea and moderate swell. Overcast, continuous rain, visibility poor.
	2000	Wind S'W, force 8, barometric pressure 978·0 mb. Rough sea and heavy confused swell. Vessel rolling and pitching heavily at times, shipping water overall. Overcast with rain showers, moderate to poor visibility.
5 Oct.	0000	Wind SW, force 12, barometric pressure 969·2 mb. Extremely rough sea and heavy swell. Vessel rolling and pitching heavily, shipping heavy seas overall. Overcast with intermittent heavy rain. Visibility greatly reduced by driving spray.
	0400	Wind SW, force 12, barometric pressure 962·8 mb, barometer starting to rise. Vessel pitching and rolling heavily and shipping heavy seas over whole main deck in very high seas and extremely heavy swell. Visibility very poor owing to driving spray.
	0800	Wind NNW, force 10–11, barometric pressure 983·5 mb. Very rough seas and very heavy high steep swell. Vessel pitching and rolling violently, shipping heavy seas overall. Overcast, visibility poor.
	1200	Wind NNW, force 10–11, barometric pressure 997·4 mb. Extremely rough sea and very heavy high steep swell. Vessel pitching and rolling violently, shipping heavy seas continuously overall. Overcast, visibility poor.
	1600	Wind NW, force 6, barometric pressure 1010·6 mb. Vessel pitching and rolling heavily and shipping seas over main deck in rough sea and very high short NW'ly swell. Good visibility.

Position of ship at 0000 GMT on 5 October: 45° 43′N, 174° 50′E.

Note. Typhoon Vernon became extra-tropical during the 3rd. The chart for 0000 GMT on the 5th, when the centre was close to m.v. *Silverfjord*, also shows the track of the depression.

HEAVY WEATHER

North Sea

m.v. *British Poplar.* Captain F. M. Fowles. Luleå (Sweden) to Grangemouth. Observer, Mr C. J. Coxhead, 2nd Officer.

30 November–3 December 1980. Late on 30 November the vessel passed through the Sodra Kvarken and the very high barometric pressure of 1032 mb was commented on. The pressure remained high as the vessel progressed down through the Baltic until the evening of 1 December when the clear skies and calm seas started to disappear. During that afternoon the pressure dropped 3·5 mb in the three hours preceding the 1800 GMT observation and the skies started to cloud over; the wind had risen to force 6 from the WSW.

Between 1800 and 2300 GMT on 1 December the vessel was passing through the sheltered waters of the Öresund and the barometric pressure was decreasing more rapidly, with a fall of some 15 mb in the six hours preceding the midnight observation.

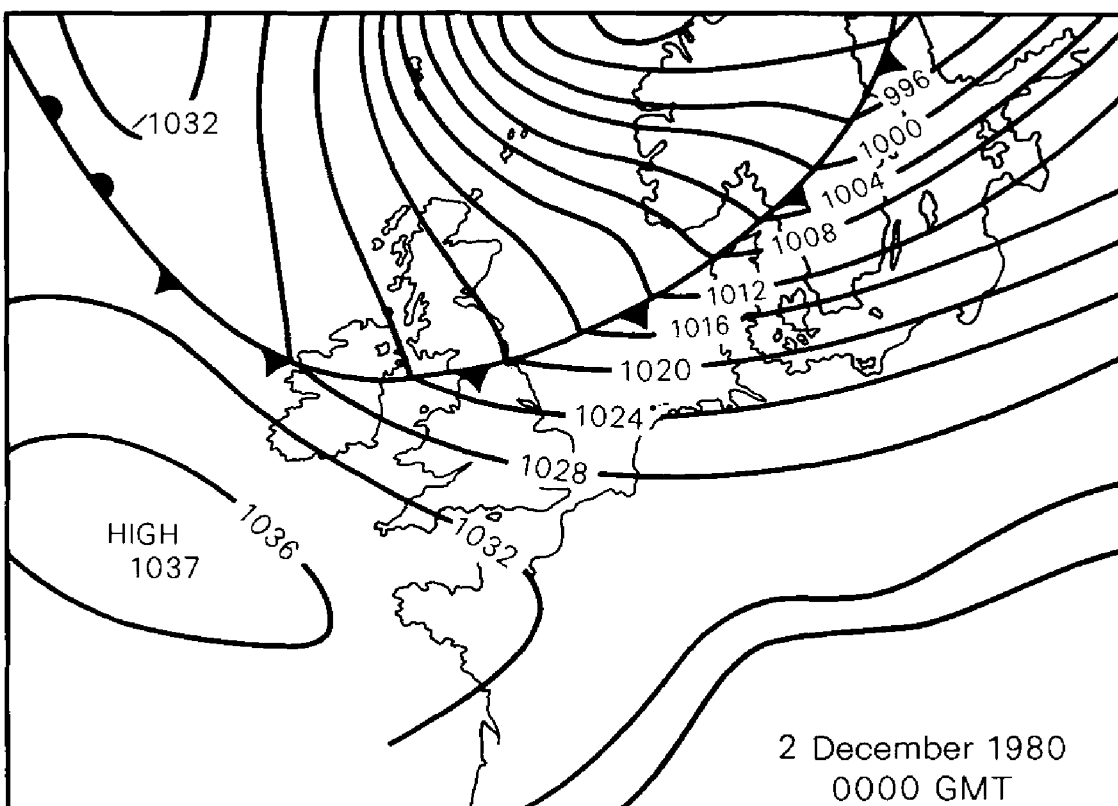
As the vessel emerged from the Öresund, at around 2300 GMT on 1 December, into the less sheltered waters of the Kattegat, the wind suddenly increased to 50 knots from the West. The sea became very rough, with short steep waves, and the vessel was struck frequently by severe sleet and snow squalls. This continued for about two hours and then the wind started to veer and decrease slightly, eventually falling to around 30 knots by the time of the 0600 GMT observation and having veered to WNW. The vessel was still pitching and rolling heavily at times in the severe short seas and the pressure was still falling, though less rapidly.

Around midday on 2 December the vessel moved into the Skagerrak and on to a course of 275°(T) bound for the Firth of Forth. There was a heavy, short sea on the starboard bow and the wind had once again increased to almost 50 knots from NW'N and hardly gusting at all. At about 1200 GMT the barometer steadied at about 989 mb and two hours later the sky cleared completely, the vessel appearing to move out from under a blanket of cloud.

The height of the waves increased dramatically overnight and the wind veered further, becoming N'ly and increasing to force 12 by midnight. The very rough high short seas, now on the starboard beam, were causing the vessel to roll very heavily and rolls of 40° were common.

Throughout the next 24 hours the vessel continued to steam slowly across the North Sea experiencing one snow squall after another until, late on 3 December, the vessel entered the calmer waters of the Firth of Forth.

Position of ship at 0000 GMT on 3 December: 57° 06'N, 5° 00'E.



Note. There was a dramatic change of the weather pattern in the vicinity of the British Isles at the beginning of December 1980. At 1200 GMT on 30 November a large anticyclone, central pressure 1045 mb, was centred over the British Isles with a ridge extending north-east over southern Scandinavia and the Baltic. A depression, 987 mb, was over the Denmark Strait. By midday on 1 December the low had moved to 71°N, 4°E and deepened to 975 mb with the high slipping away to the south-west.

The situation at 0000 GMT on 2 December, as shown on the chart, indicates the strong westerly gradient south of, and ahead of, the cold front and the temporary easing of the gradient immediately to the rear of the front as the wind veers.

By midday the strong northerly gradient had become established right down the North Sea and persisted over the next 24 hours or so, moderating slowly on the 4th.

LINE-SQUALLS

South Pacific Ocean

m.v. *British Fern*. Captain I. Black. Vunda Point (Fiji) to Melbourne. Observers, the Master, Mr N. P. Henderson, 2nd Officer, and ship's company.

1 November 1980. At 1945 GMT the vessel was on a course of 230°(T), speed 14 knots. Up to this time the weather had been fine with light cloud and a fresh NW'ly wind; the barometer was steady. A build-up of cumulonimbus cloud was observed ahead of the vessel and the radar showed rain at 20 n. mile. By 2000 GMT the clouds and sky ahead of the vessel were a greenish hue with lightning visible within the clouds. The wind started to back and strengthen and the barometric pressure rose slightly then fell sharply. At 2015 GMT the wind was W'ly, force 7–8, and the visibility was 5 n. mile with moderate to heavy rain and continuous thunder and lightning. At 2018 GMT weather conditions were: dry bulb 15·5°C, wet bulb 15·5, barometric pressure 1007·1 mb; wind W'ly, force 11, spraying overall, very heavy rain, lightning still persisting, thunder not so frequent, visibility 200 metres. At 2030 GMT the barometric pressure was 1010·1 mb and the wind was W'S, force 8. There was a very steep sea and the sky and clouds were a grey-green colour. The wind veered to NW and decreased to force 6 at 2045 GMT, the barometer steadying at 1010·5 mb. The dry-bulb temperature was 15·5°C and the wet-bulb temperature was 15·0. By 2100 GMT the wind had decreased to force 4–5, NW'ly, and the barometric pressure was 1009·5 mb. The dry bulb was 16·1°C and the wet bulb was 14·7. The rain had ceased and the clouds began to dissolve.

The lightning during the squall was a brilliant blue-white colour and the raindrops at their heaviest were estimated to be 7–8 millimetres in diameter.

At 2325 GMT the vessel passed through a second line-squall which was not as severe as the first, but two decaying waterspouts were observed travelling in a NE'ly direction. The diameters of both spouts were estimated to be 3 metres and the areas of disturbed sea were estimated to be 10 metres in diameter. The cloud base at the time was estimated to be at 200 feet.

Position of ship at 1945 GMT: 30° 22'S, 160° 52'E.

AURORA

North Atlantic Ocean

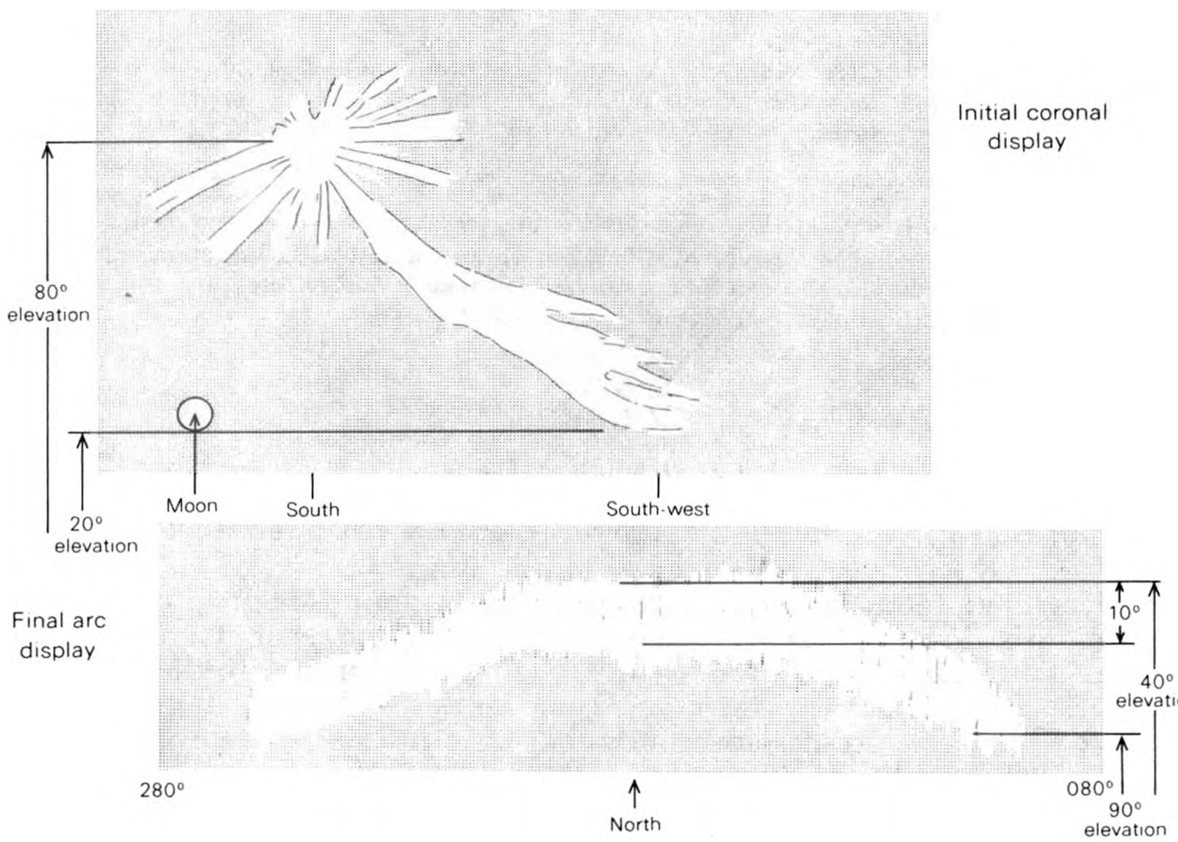
m.v. *Dover Universal*. Captain W. McFarland. Wallsend to Summerside (Prince Edward Island). Observers, the Master, Mr K. Ridgeway, 3rd Officer, and other members of the ship's company.

22–23 October 1980. At 2240 GMT what at first appeared to be streaked moonlit cirrus cloud quickly developed into a coronal aurora, of which the north-eastern sector was missing. The corona was seen to expand quickly and start to glow yellow–green. This initial display of aurora was due south of the vessel, maximum elevation 80°, minimum elevation 20°.

The aurora branched out towards the west, around the vessel in a clockwise direction. It spread first as an arm of the corona and then as a series of interconnecting patches. By 2250 GMT the whole of the clear western sky was covered by the aurora which had become rayed as it spread west. The rays were continually changing in intensity which gave a rippling effect. About half the western sky was obscured by cloud. By 2300 GMT a jagged rayed arc had developed over the northern horizon. The earlier displays of aurora to the south and to the west were rapidly fading as the arc to the north developed. A vermilion–red glow was left in the sky for 10 minutes after the aurora had faded.

The arced aurora spread from 280° through north to 080°(T), with a maximum elevation due north of approximately 40° and a minimum elevation of 20° at the ends. The arc had an average width of about 10° throughout its length. The arc remained until 2320 GMT, when it started to fade, disappearing by 2330. The rayed arc reappeared twice (at 0020 and 0130 GMT), though weaker and broken. It may have appeared more often and been unobserved, as large sections of the sky were frequently obscured by cloud.

From the initial display to when the arc faded all displays were 'bright' to 'brilliant' even though a low near-full moon was illuminating the area much of the time.



Throughout the display no noticeable effects on the magnetic compass were observed. However, the Radio Officer reported that unstable HF conditions, initially from stations in the west, later spreading to stations in the east, had been experienced during the day.

Weather conditions at the time were: dry bulb 7·0°C, wet bulb 5·7, sea temperature 7·3, barometric pressure 996·1 mb; wind SW'ly, force 2.

Position of ship: 57° 00′N, 38° 00′W.

UNUSUAL CLOUD FORMATION

Indian Ocean

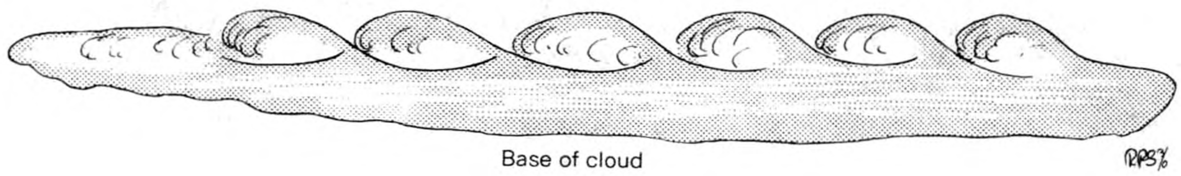
m.v. *Wild Cormorant*. Captain P. Lay. Durban to Sydney. Observers, Mr R. P. Swinney, 3rd Officer, and Mr P. C. Dyer, 2nd Officer.

22 December 1980. At 0915 GMT a small bank of altocumulus was observed on the vessel's starboard bow. The top of the cloud showed a series of perfectly

symmetrical waves which very slowly advanced and merged into one homogeneous mass. Initially the tops of the waves were lighter than the lower mass of cloud.

Surface wind, N'W, force 1–2.

Position of ship: 36° 24'S, 65° 36'E.



Note 1. The sketch illustrates billow clouds. An observation of billow clouds, with sketch and photographs, from R.R.S. *John Biscoe,* was published in the January 1975 issue of *The Marine Observer* (page 13, photographs between pages 16 and 17).

Note 2. The *Meteorological glossary* defines billow clouds as follows:

'Parallel rolls of cloud, separated by relatively narrow, clear spaces. The phenomenon has been explained in various ways: as waves formed at a surface of discontinuity; as convection cells initiated by shearing motion at an almost horizontal boundary between two airstreams; by cellular motion initiated by the development of static instability in a shallow layer of air.'

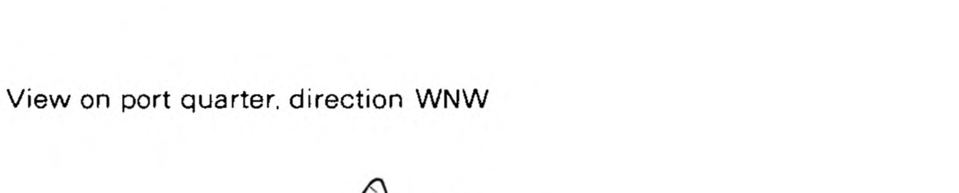
ICEBERG

South Pacific Ocean

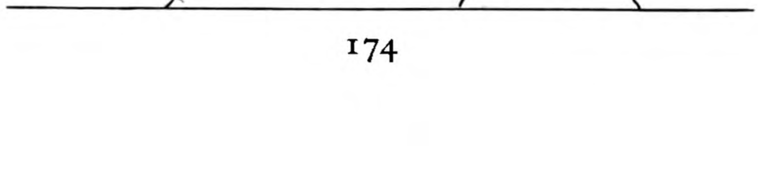
m.v. *Mairangi Bay.* Captain W. Carruthers. Port Chalmers to Flushing via Cape Horn. Observers, the Master and ship's company.

31 December 1980. The vessel was following a composite great circle course via 58° South. At 2245 GMT an echo was observed on the radar at a range of 17·6 n. mile. The vessel altered course to 045°(T) to pass nearer to the object and identify it. The object was maintained on the port bow and, despite reduced visibility due to low stratus and continuous light drizzle, a white–grey shadow was observed through the mist at 2 n. mile.

View on port bow, direction ENE



View on port quarter, direction WNW



The iceberg was about 300 metres long on the water-line, maximum height 46 metres, maximum width about 27 metres. It had a bluish tint and was well weathered—all surfaces being smooth and rounded. As the vessel passed the iceberg at a distance of about 1 n. mile it was observed that the barograph trace dropped about 1 mb.

Weather conditions at the time were: dry bulb 5·6°C, wet bulb 5·4, sea temperature 3·0, barometric pressure 1006·4 mb; wind NNW, force 5.

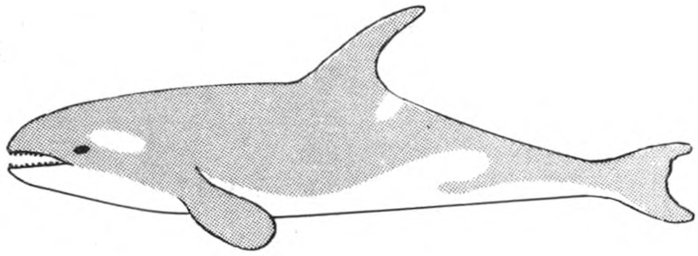
Position of ship at 2330 GMT: 57° 55′S, 108° 56′W.

CETACEA

South Atlantic Ocean

m.v. *Afric Star*. Captain G. Easton. Kuwait to Buenos Aires. Observers, the Master, Mr M. Ashok, 2nd Officer, Mr P. Hughes, and Mr H. Kasprowicz.

26 November 1980. At 1845 GMT killer whales were sighted approximately 140 n. mile north of Tristan da Cunha. Approximately 15–18 whales were sighted, travelling largely in two packs of six, approximately 1–2 metres apart with the remaining number being made up of individuals, occasionally pairs. The packs were observed to travel in very tight formation. All the whales were travelling due south and were observed under ideal conditions. Many passed within 35–70 metres of the ship. The sizes ranged from about 7–10 metres.



They were black in colour with distinctive white markings on the side of the head and on the back just behind the dorsal fin. The dorsal fins themselves were very prominent, ranging in size from 1–1½ metres.

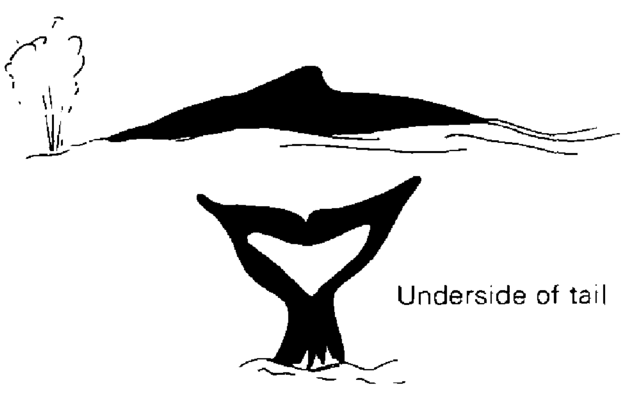
Position of ship: 34° 43′S, 11° 50′W.

Southern Ocean

s.s. *Botany Bay*. Captain W. A. Murison. Fremantle to Melbourne. Observers, the Master and Mr H. A. Wren, 2nd Officer.

5 December 1980. While passing Cape Naturaliste, two whales were sighted at close quarters. The initial sighting occurred at 0245 GMT when a great deal of movement was observed in the water dead ahead at a range of about 2 n. mile. A large tail rose from the water and the whale submerged, rising again on the port beam at a distance of no more than 30 metres. The underside of the tail was clearly seen as being light in colour, while the rest of the body was dark grey. The whales were headed in a northerly direction and were estimated to be about 27 metres in length. Once abeam, the tails rose and submerged again and disappeared from view.

The whales appeared to be playing and, although only two whales were actually clearly sighted, a possible third and much smaller animal was in the vicinity at the time of the original sighting.



Weather conditions were: barometric pressure 1018·0 mb; wind SW'ly, force 3, with a low confused swell and slight sea.
Position of ship: 35° 54′S, 122° 38′E.

Note. Mr D. A. McBrearty of the Department of Anatomy, University of Cambridge, comments:
'An excellent drawing and without doubt a Humpback whale (*Megaptera novaeangliae*), see also *The Marine Observer*, July 1979, page 113.'

CETACEA AND TURTLES

Arabian Sea

m.v. *British Loyalty*. Captain D. Coombes. Aden to Abu Dhabi. Observer, Mr A. D. Haworth, 3rd Officer.

17 October 1980. At 0900 GMT two dolphins were sighted, 6 metres from the ship, apparently basking on the surface but, as the ship drew alongside them, they slowly moved away and dived.

One of the dolphins was very pale; beginning at the beak it was almost white, fading to a sandy brown colour towards the dorsal fin and an even darker brown at the tail. The colouring was interrupted by small patches of darker brown on the head and light brown patches nearer the tail. The dorsal fin was well curved and situated just behind mid-length. The head narrowed towards the short beak and the body appeared well rounded. The flippers and underside were not sighted. It was approximately 4½ metres long.

The second dolphin had the same characteristics as regards shape, but it was light grey in colour over the whole length and was smaller, approximately 3½ metres long. It was swimming alongside the first one, very close, and again the underside was not sighted.

Immediately following this sighting, many dolphins were seen leaping high out of the water. They were approximately 1 n. mile away, so distinguishing characteristics could not be seen. The group was well spread out and there were about 40 in all. They appeared not to be heading in any particular direction but seemed just to be playing. They were all about 2 metres long.

Eight individual whales were seen in the two hours following the dolphin sightings. They passed at distances varying from ½ to 1½ n. mile and they stayed just on or just below the surface. The only part seen was a long dark back with a small, curved dorsal fin approximately three-quarters of the length along their backs. All were about 9–12 metres long and were heading slowly south-west.

At the same time that the whales were seen passing, 15 turtles were also sighted, individually, and all were floating on the surface of the sea. Some of them dived as we approached and others stayed on the surface. They were about 60–90 cm across and many had barnacles on their shells. Many silver-coloured fish, each 30 cm long, were seen lying dead on the surface for the whole of the three-hour period of the sighting.

Weather conditions were: dry bulb 30·8°C, wet bulb 28·0, sea temperature 28·8; wind SSE, force 3.

At 1200 GMT, with the same weather conditions, many dolphins appeared closer to the ship. They were in a large, well-spread school of approximately 200. They were heading north-east, with the ship. Most of the group appeared to be adults, 2 metres long. There were some juveniles, 1 metre long, but these were only few in number. They had a distinct snout, were predominantly dark grey and had the 'figure-of-eight' light grey patches on their flanks which identified them as Common dolphins. The dorsal fin was mid-back and well curved.

They were leaping high out of the water and splashing their tails heavily on the sea as they re-entered the water. Some were doing a full twist in mid-leap. Many were riding in the bow wave and leaping in formation alongside the ship. They stayed with the ship for 45 minutes before falling slowly astern.

Position of ship at 0900 GMT: 19° 56′N, 58° 45′E.

FLYING FISH

Gulf of Mexico

m.v. *Jack Wharton*. Captain T. Dawson. Jacksonville (Florida) to Tampico. Observers, Mr W. M. Marshall, 2nd Officer, and Mr S. Tipp, A.B.

23 November 1980. At 1915 GMT a number of flying fish were found on deck. It was noted that they were of two different kinds. The larger kind had two sets of wings and was about 20 centimetres long, with a maximum girth of 11 centimetres. The smaller kind had one set of wings and the stubs of wings, or very small stunted wings. It was about 17 centimetres long with a maximum girth of 9 centimetres. Both kinds of fish were steel blue on top and silver underneath and had similar scale patterns on their backs.

One of the larger fish was blind in one eye and, on closer inspection, the eye socket was found to be nearly empty. Nothing unusual was found in the stomachs of the fish.

Position of ship: 23° 55′N, 90° 40′W.

Note. Dr F. Evans of the Dove Marine Laboratory, University of Newcastle upon Tyne, comments:

'The flying fish were of two species. The family of flying fish, about 50 species in all, may be coarsely divided into two, those with two wings and those with four. The fish described in this observation were a four-winger and a two-winger. The flight wings are, of course, highly developed fins. The two-wingers have large pectoral fins only, the pelvics being no bigger than herring fins, while the four-wingers have their pelvic fins enlarged to aid gliding. The damage to the eye of the larger fish may have been due to disease or it may have been caused by the teeth of an unsuccessful predator.'

MARINE LIFE

South Atlantic Ocean

m.v. *Act 7*. Captain J. G. Reeve. Lyttelton to Tilbury via Cape Horn. Observer, Mr S. A. Banks, 2nd Officer.

2 October 1980. At approximately 1800 GMT while on a heading of 030°(T), an observation of three creatures was made on the port side at a distance of approximately 150 metres. They all appeared to be about 1 metre in length and relatively broad in the beam. They had short necks with small pointed heads and were shiny black all over.

As we encountered them they were heading in a north-westerly direction. They did not seem at all disturbed by the close approach of our vessel and appeared to behave in the same manner throughout my observations. The behaviour was a repeated dipping of their heads into the water by all three, as if feeding.

Approximately 30 minutes previously, observations had been made at a distance of 500–600 metres of a number of what appeared to be scattered groups of seals. They seemed to be playing and were seen to dive and, on occasion, jump out of the water. On the approach of the ship they dived and none were seen to surface until well astern. The animals in the primary observation differed greatly from these as follows:

(*a*) They did not behave in the same manner.
(*b*) They were not disturbed by the approach of the ship.
(*c*) Body shape appeared much different with a distinctive head and neck and no sign of flippers or tails.
(*d*) Their bodies seemed quite buoyant, similar to those of birds, but not sitting as high out of the water: there were no signs of beaks, wings or feathers.
(*e*) No means of propulsion could be seen although they appeared to be slowly moving through the water.

Weather conditions were: dry bulb 9·8°C, sea temperature 8·5; wind NW, force 1–2, slight sea, low swell.

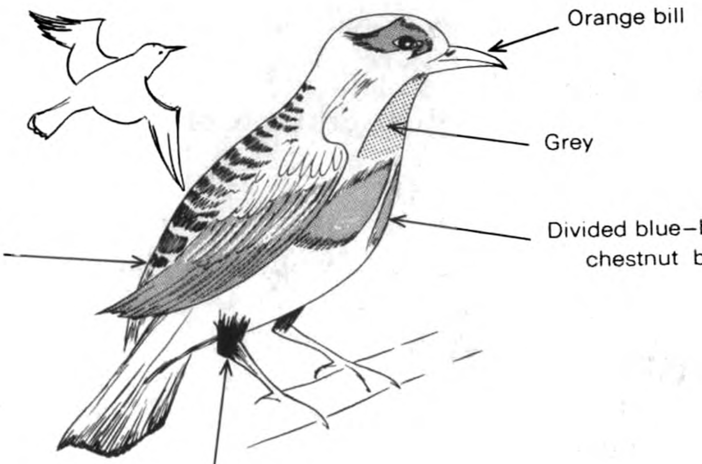
Position of ship: 42° 58′S, 55° 12′W.

BIRDS

Indian Ocean

s.s. *Kowloon Bay*. Captain D. G. Brown. Jeddah to Port Kelang. Observers, the Master and ship's officers.

7 November 1980. At about 1200 GMT the bird shown in the sketch was sighted.



Position of ship: 6° 00′N, 79° 30′E.

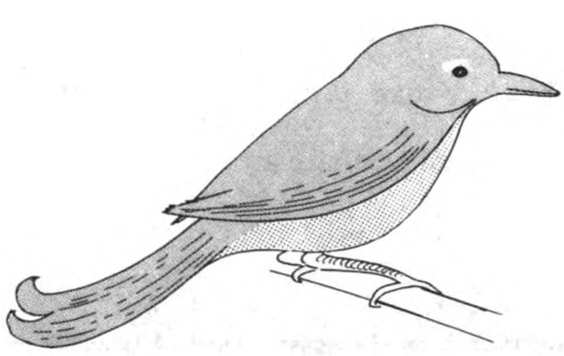
Note. Captain G. S. Tuck, of the Royal Naval Birdwatching Society, comments:

'This is probably a Coral-billed Scimitar-babbler (*Pomatorhinus ferruginosus*). Its range is south-east Asia and its habitat is undergrowth in evergreen forest.'

Indian Ocean

s.s. *Kowloon Bay*. Captain D. G. Brown. Singapore to Suez. Observers, the Master and ship's officers.

30 November 1980. At about 1200 GMT the bird shown in the sketch was sighted. It had a black head and the rest of its body had a blue-black sheen. The bird was about 33 cm long and its most conspicuous feature was its lyre-shaped tail.



Position of ship: 7° 17′N, 74° 55′E.

Note. Captain Tuck comments:

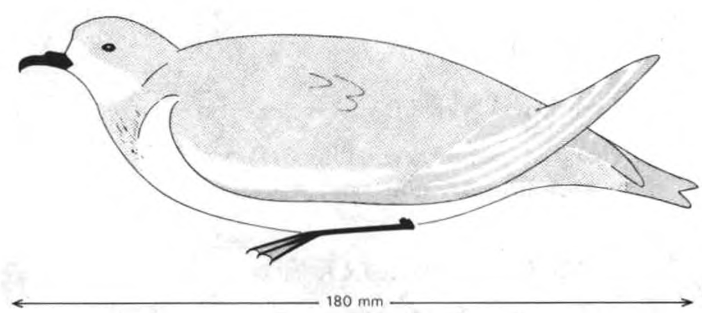
'The bird was undoubtedly a Crow-billed Drongo (*Dicrurus annectans*). The adult has overall black plumage and is stouter and heavier than the Black Drongo. It has a deeply forked black tail with the outer pair of tail feathers upturned to about 45 degrees at the tip. Its range is south-east Asia, where it is a common resident. Its habitat is forest, coastal scrub and mangroves.'

Eastern South Pacific

m.v. *Wild Curlew*. Captain M. A. Hill. Off the west coast of South America. Observers, the Master, Mr G. F. Everitt, Chief Officer, Mr C. S. Campbell, 3rd Officer, and ship's company.

29 October–8 November 1980. During this period the vessel was stopped and drifting about 100 n. mile from the coasts of Peru and Ecuador.

Petrels were observed feeding and flying throughout these 11 days. On one occasion a flock of various species, numbering between 100 and 150, was observed near the ship. Each night we had two or three petrels brought to the bridge after being found on deck either exhausted or unable to take off again.



All of these were set free apparently fully recovered despite the fact that they refused to eat or drink anything. We assumed that the birds were confused by the ship's deck lights because by day no petrels, apart from the larger Pintado Petrels, were observed close to the ship. We could identify only the Pintados and tiny Storm petrels, but we had visits from three other species. One kind was 21 cm long. Several of these birds were observed to have dark brown plumage although some had white rumps; the latter were assumed to be adults. A single dark brown petrel 18 cm long was observed, as was the bird shown in the sketch which had a plumage of white and various shades of brown.

Positions of ship: 29 October, 7° 35′S, 81° 12′W.
8 November, 5° 11′S, 83° 59′W.

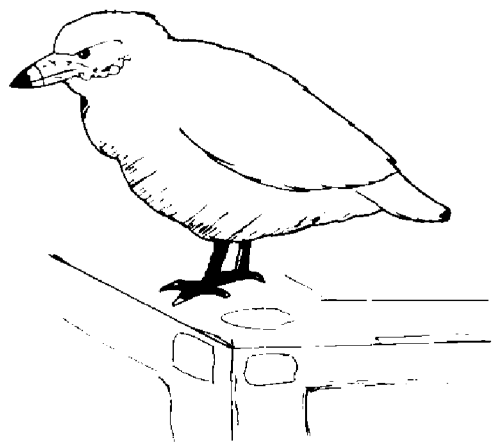
Note. Captain Tuck comments:

'Probably no route but that bordering the coastal areas of Ecuador and Peru can claim such an abundance of large flocks of different sea-birds seen plunging into the sea fishing. Apart from the presence of Pintado Petrels (*Daption capensis*) it was only possible to identify positively some of the smaller Storm Petrels. Other species which could well have been present were Chilean Pelicans, Peruvian Boobies, Guanay Cormorants, Red-legged and Bigua Cormorants, Grey Gulls, Simeon Gulls, and, perhaps less likely, White-chinned Petrels and Sabine's Gulls.'

Magellan's Straits

m.v. *Belloc*. Captain I. Ll. Hughes. Le Havre to Punta Arenas. Observers, Mr J. Owens, 3rd Officer, and Mr A. Jones, Chief Electrician.

13 December 1980. Three birds having the appearance of doves were observed to circle then eventually land on a container carried as deck cargo on the vessel.



They were identified by Mr A. Jones as Yellow-billed Sheathbills (*Chionis alba*). These birds stayed with the vessel until we entered the Magellan's Straits, although they did take off on several occasions to circle the ship and then return to their perch on the same container. The sketch is by Mr Jones.

Position of ship: 51° 30′S, 67° 00′W.

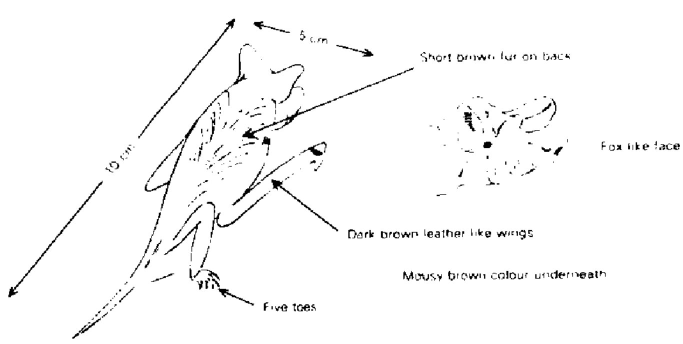
Note. Captain Tuck comments that the identification is correct and the drawing is exceptionally good.

BAT

North Atlantic Ocean

s.s. *British Pioneer*. Captain J. F. Thomson. Ras Tannurah to Rotterdam. Observers, Mr C. W. B. McQueen, 3rd Officer, Cadet M. Skerry, Cadet P. Crocker, and other members of the ship's company.

16 December 1980. At 1300 GMT a bat was found in one of the cadet's cabins.



The vessel was approximately 150 n. mile from land. We are not sure whether the bat had been on board since we left Cape Town or whether it joined the ship at sea. The bat was alive but in a subdued condition, possibly due to daylight. Unfortunately we have not been able to identify the bat, although suggestions ran from a vampire to a fruit bat.

Position of ship: 5° 42′N, 14° 48′W.

Note 1. Mr. J. Edwards Hill of the British Museum (Natural History) comments:

'The bat reported by s.s. *British Pioneer* is a member of the family *Molossidae*, or free-tailed bats, a characteristic feature clearly seen in the drawing provided. Apart from the thickened projection of the tail from the edge of the tail membrane, these bats can also be recognized by their fleshy ears and thick, rather leathery, wings.

'Molossid bats eat insects (they are not vampires or fruit eaters) and are rather difficult to identify without close examination. I cannot therefore say with any degree of confidence to which species this example might have belonged. They are common in West Africa but not usually found so far out at sea. However, a similar bat was found in 1972 on board m.v. *Britannic* (Captain W. A. Murison) at 8° 15′N, 15° 37′W, not far from the present position.'

Note 2. The report of a bat found on board m.v. *Britannic* was published in *The Marine Observer*, January 1973, page 13.

BIOLUMINESCENCE

Gulf of Mexico

m.v. *Wild Cormorant*. Captain P. Lay. Anguillanbank to Gulfport. Observer, Mr C. J. Duncan, 3rd Officer.

10 November 1980. Bioluminescence was observed taking the form of a light green glow which gave a mottled effect, interspersed with bright, very quick flashes of a deep luminous green. The phenomenon was observed to be only within the area of water agitated by the ship's wake. Shining of the Aldis on the sea surface and switching off the radar had no effect.

Weather conditions were: dry bulb 26·5°C, wet bulb 25·0, sea temperature 27·6, barometric pressure 1013·9 mb; wind SE, force 3, moderate sea, overcast.

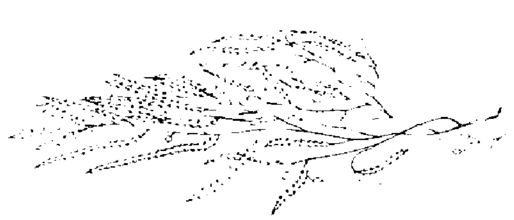
Position of ship: 26° 30′N, 85° 00′W.

SARGASSO WEED

North Atlantic Ocean

m.v. *Strathewe*. Captain D. H. Roberts. Port Said to New York. Observer, Mr J. B. Weston, 3rd Officer.

15 October 1980. After five days of observing and attempting to catch a specimen of light brown weed, a small piece was found on the fo'c'sle after a sea was taken over the bow—indicative of how much weed there was to be seen



in the surrounding sea. The sketch is a representation of the specimen found (one-third of the natural size). The long, thin, serrated 'leaves' were prickly to the touch, the stems were very thin and there were numerous seed pods of varying sizes. The entire specimen, including seed pods, was a uniform light brown in colour. In comparison with the majority of clumps of weed seen in the water, it was a small specimen, some clumps being up to 60 cm across.

Although the general opinion on board was that the weed had originated from the Sargasso Sea, no actual written information on the subject could be found. On the remainder of the voyage around the east coast of the United States it was generally found that whenever the vessel encountered the edge of the Gulf Stream the light brown weed would soon appear.

Position of ship: 37° 30′N, 60° 00′W.

Note 1. The 'seed pods' referred to were likely to have been air bladders.

Note 2. David Bellamy in his book *The Life-giving Sea*, published by Hamish Hamilton in 1975, states:

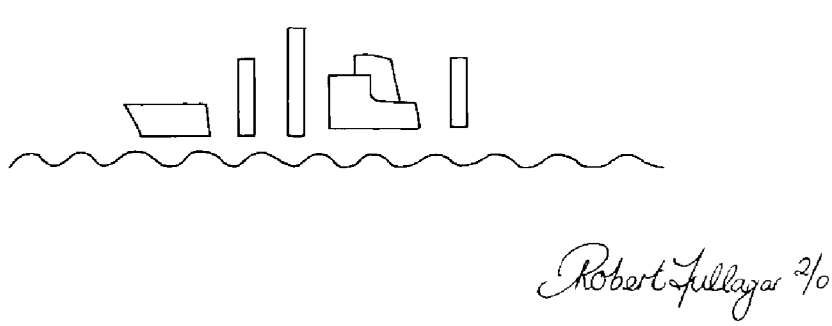
> 'Seaweed Sargassum—from the Portuguese Sargaço meaning grape—is so named because the small air bladders that give this intricately branched weed its floating power look like small yellow grapes. As to origin, fingers pointed at various parts of the world where rocky coastlines could represent its home anchorage. However, there are 7 million tonnes of it free on the high seas and it was realized that none of the supposed breeding grounds could produce that much. Furthermore, two of the most abundant species of floating Sargassum have never been found attached! Today there is every reason to believe that the weeds of the Sargasso live in the open sea, multiplying by vegetative reproduction, i.e. splitting up into new individuals as they grow.'

ABNORMAL REFRACTION

North Atlantic Ocean

m.v. *London Confidence*. Captain F. G. B. Hewlett. St Croix (Virgin Islands) to Port Reading (New Jersey, USA). Observers, Mr R. Fullagar, 2nd Officer, and Cadet J. L. Meade.

3 November 1980. At 2000 GMT whilst in the outer approaches to New York, abnormal refraction was observed for some time on the horizon. A vessel, as shown in the sketch, was observed at a distance of 11·5 n. mile on the port bow.



As the vessel drew closer the fo'c'sle, masts and accommodation appeared to hover above the horizon, seemingly separated from the rest of the vessel, which could not be observed at the time. Although the sea was calm with only small ripples, the waves at the horizon appeared magnified. The sun was at an altitude of 15° in a completely cloudless sky that had previously been covered with a thin layer of cirrostratus.

Weather conditions were: dry bulb 10·8°C, wet bulb 7·5, sea temperature 13·2, barometric pressure 1029 mb; wind, light airs.

Position of ship: 39° 20′N, 73° 38′W.

LUNAR RAINBOW

North Atlantic Ocean

m.v. *Summity*. Captain W. G. Hunt. Casablanca to Bayonne. Observers, the Master, Mr N. J. Bennett, Chief Officer, and Mr A. K. Joscelyne, E.D.H.

16 October 1980. At 2140 GMT when a heavy rain squall was passing to the east of the vessel, a lunar rainbow started to form from the horizon at the southern end of the squall. At first it looked like a searchlight beam but rapidly formed into a perfect lunar rainbow from horizon to horizon between the bearings 020° and 080°(T). Almost immediately a secondary bow appeared outside it, also stretching from horizon to horizon. The altitude of the primary bow was 25°; it was greenish–white in colour, with very faint colouring near the horizon. The secondary bow was much fainter and no colouring could be detected in it. The phenomenon lasted for about 2½ minutes as the squall travelled southwards in the fresh to strong NNW'ly wind.

At 2143 GMT the moon's altitude was 25° 26·5′ and its azimuth was 227·5°(T).

Other weather conditions at the time were: dry bulb 14·5°C, wet bulb 11·5, barometric pressure 1007·0 mb.

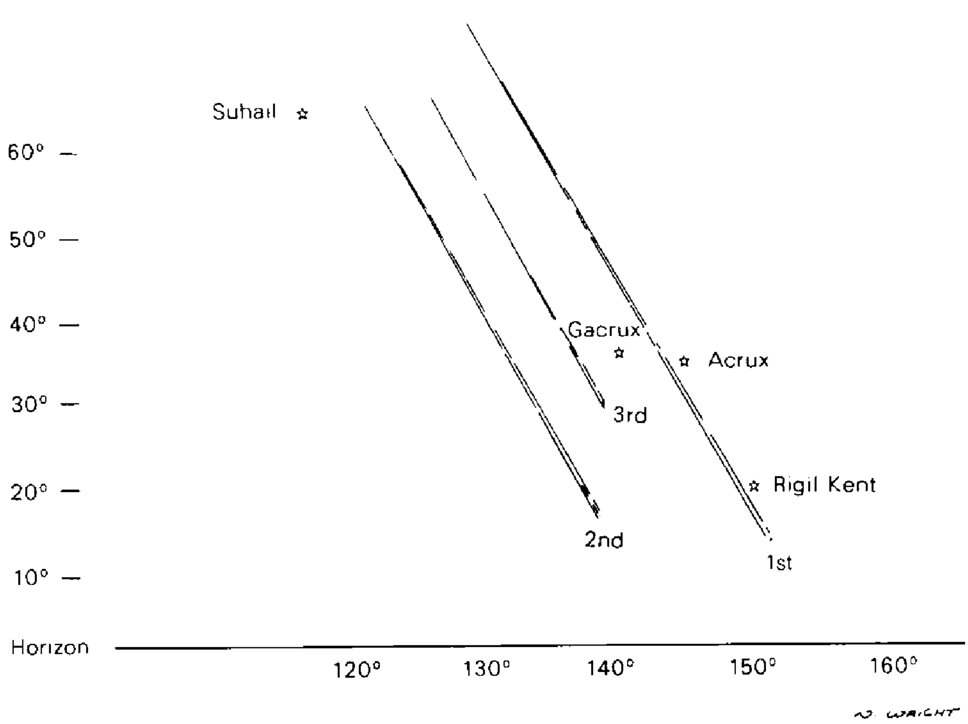
Position of ship: 40° 47′N, 9° 45′W.

METEORS

South Atlantic Ocean

m.v. *Belloc*. Captain I. Ll. Hughes. Le Havre to Punta Arenas (Chile). Observer, Mr N. Wright, 2nd Officer.

10 December 1980. At 0458 GMT a meteor was observed in the eastern sky. It was far brighter than Acrux, more in the region of 2–3 times the brilliance of Venus. The duration of its flight was about 2 seconds but the trail lasted for another 3–4 seconds, changing from white to a more golden colour as it faded.



About 2 seconds later a second meteor on a parallel track was seen. This was the same colour but fainter (above the brilliance of Venus) and had a shorter duration. The trail faded almost immediately. The trail of the first was still visible when the second appeared.

These were immediately followed by a third of shorter duration again but on the same parallel track. It was distinctly reddish–orange in colour, the trail lasting 1–2 seconds.

Unfortunately, it is impossible to give more accurate information. However, considering the short time-period, the parallel tracks and the reasonably close spacing, it would seem that they had the same source and might therefore be of interest.

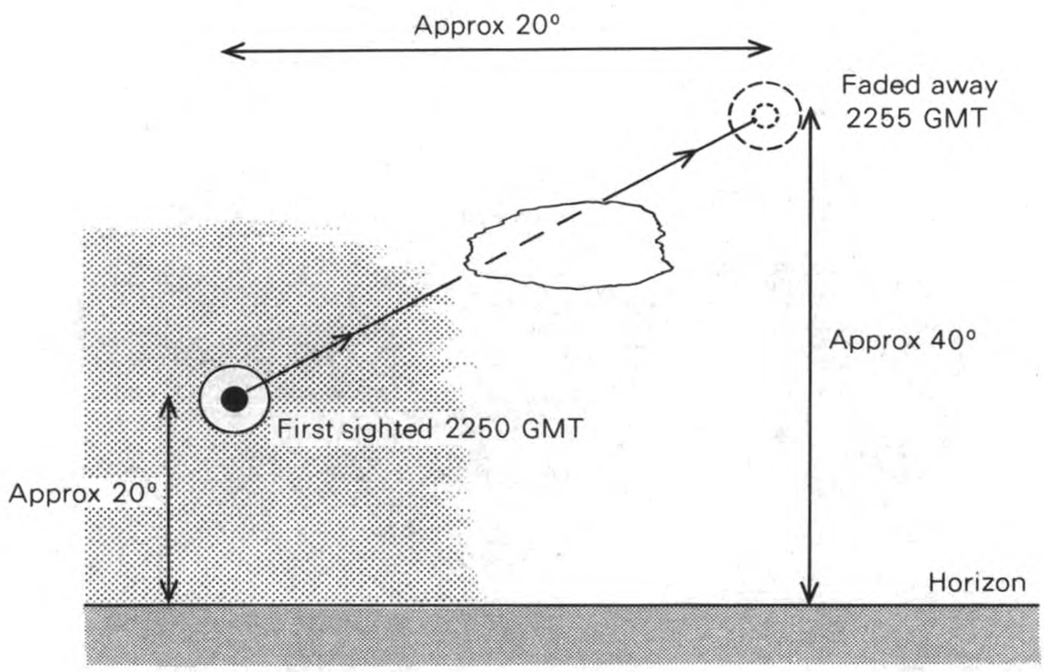
Position of ship: 35° 03′S, 48° 48′W.

UNIDENTIFIED PHENOMENA

North Atlantic Ocean

m.v. *Benvorlich*. Captain H. H. McIntosh. Norfolk (Virginia) to Santos (Brazil). Observers, Mr D. Hughes, 3rd Officer, Cadet D. Smith and Cadet T. Lievesley.

27 November 1980. At 2250 GMT a glowing 'smoke ring' phenomenon was observed on the starboard quarter at approximately 20° altitude and bearing approximately west. It moved towards the stern and climbed in the sky, disappearing behind a cloud and reappearing on the other side before finally fading away at approximately 40° altitude, bearing WNW, at 2255 GMT. The diameter was about 3–4° and the centre seemed to be darker than the surrounding sky when viewed through binoculars.



Weather conditions were: dry bulb 27·0°C, wet bulb 24·6, barometric pressure 1008·2 mb; 3 oktas of cumulus cloud.

Position of ship: 2° 00′N, 39° 00′W.

Note. A somewhat similar report, from s.s. *City of Liverpool*, was published in the October 1963 issue of *The Marine Observer*, page 190.

South Atlantic Ocean

m.v. *British Patience*. Captain N. W. C. Rutherford. Isle of Grain to Bahrain. Observers, Mr N. Carrington, 3rd Officer, and Mr N. Richardson, Radio Officer.

28 December 1980. At approximately 2245 GMT on a moonless night the entire ship and immediate surrounding area were illuminated by what can be best described as a great camera flash.

The flash was bluish–white and a small bolt of lightning appeared to be centred just above the vessel's samson posts. No noise was heard and the flash lasted only a second. The sky was clear at the time and stars of all magnitudes were clearly visible. The only clouds that could be seen were two or three small cumulus clouds; one of these was above the vessel and the others were moving towards us from the south, our course being 142°(T) and the wind being S'E, force 3. The cloud above the vessel was at a height of about 600 feet.

Other weather conditions at the time were: dry bulb 24·5°C, wet bulb 22·0, barometric pressure 1012 mb.

Position of ship: 1° 17'S, 8° 25'W.

551.515:23

The Passage of Tropical Cyclone 'Meli' through the Fiji Islands in March 1979

By P. M. Swan

Editor's note. The author (who was formerly Port Meteorological Officer in Hull) was serving as 2nd Officer in the cable ship *Retriever*, owned by Cable and Wireless Ltd, and commanded by Captain J. H. Neal, on station in Suva harbour, Fiji Islands, in March 1979. This report was recorded in the additional remarks page of the *Retriever's* meteorological logbook, which was received at the Meteorological Office in March 1981. The article 'Incidence and Extent of Tropical Cyclones in the Fiji Islands' between pages 189 and 195 was published in shortened form under the title 'Tropical Cyclones in the Fiji Islands' in the May 1981 issue of *Weather*, and is considered complementary to this report; it is therefore recommended that they both be read.

During the afternoon of Monday 26 March 1979 we heard on the local radio weather news the first reports of a tropical cyclone developing 300–400 nautical miles to the east of Suva. As always, we took note of its position and plotted it on our charts but with no particular feeling of alarm as there had already been several cyclones in the Fiji area during the previous five months, including Fay in late December 1978 which gave cause for concern in that it passed close enough to Suva to give torrential rain. We continued to plot the cyclone's position and movement as reported by Nandi weather office, bearing in mind that owing to a general lack of weather observations from any source and a poor communication system within the island group Nandi would have great difficulty in giving reliable forecasts.

The first forecasts had the cyclone moving south but by the late hours of the 26th the forecast direction of movement was westerly and it appeared that if it continued in that direction it would pass fairly close to Suva.

By 0600 local time on Tuesday, 27 March the cyclone's movement was definitely westerly and we were sure we were in for a 'bit of a blow'. At 0900 the cyclone appeared to be going to pass within 100 nautical miles south of Suva which would give at least gale-force winds to the area. We were at anchor with no chance of getting a safe berth alongside and so the decision was made to prepare to leave port. The barometer was beginning to fall steadily and an hourly log was begun (see extract below). The steady fall in barometric pressure continued and the weather forecasts continued to show that Meli, as the cyclone had been named, was going to pass fairly close to Suva during the evening of 27 March.

At 1400 we weighed anchor and left the harbour to run ahead of the approaching storm and to obtain sea room to the west of Fiji. As can be seen from the observations, we kept well ahead and clear of what turned out to be one of the worst cyclones ever known to have hit the islands to the east and south of Suva.

Meli travelled almost due west from the original forecast position cutting a swathe through the central Lau group, passing close to Lakemba about 40 nautical miles south of Suva, thence through the Kandanu passage and continuing west-south-westwards to leave Fijian waters.

The maximum forecast winds for Meli as it approached were 75 knots and after it had passed the immediate reaction in Suva was, 'Oh well, that wasn't too bad!'. Large numbers of trees had been blown down and a fair amount of minor flooding was experienced in some areas. Two people had unfortunately been killed by falling power lines, several yachts anchored in the harbour which perhaps hadn't taken sufficient notice of the warnings had been blown up on to the nearby beaches, but no severe property damage had been suffered in the city. The overseas ships in the harbour had weathered the storm safely, including the Russian passenger vessel *Felix Dzerzhinskiy* which had taken over the anchorage position we had vacated. The most noteworthy piece of news on the morning of 28 March was that a well-known local passenger vessel the *Cenpac Rounder* (Nauru) of 3200 grt which, like us, had decided to leave the harbour, had been forced aground on the reef off Vatulele island, about 80 nautical miles west of Suva. We had in fact passed close to her on our way back into Suva but she declined our offer of assistance saying that they were in no danger and would wait for the weather to abate before making any attempt to move or abandon the ship and that there were no passengers on board.

It was not until nearly 24 hours after Meli had passed that Suva and Fiji as a whole started to become aware that Meli had been a disaster of major proportions for many outlying islands and communities. Indeed it took over three days for the full extent of the disaster to become known to the authorities in Suva as radio communications became re-established and aircraft and ships managed to visit the islands that had been in the track of the cyclone.

The large island of Kandavu, 50 nautical miles to the south of Suva, had suffered badly. Several villages had been totally destroyed with the typical dwellings of wood and corrugated iron being razed to the ground. In one village, where the community had taken shelter in the stone church, the building collapsed killing over 20 people. Two American yachts trying to take shelter in one of the bays had been overwhelmed and two crew members drowned. Crops and vegetation had been destroyed and water supplies contaminated.

In the Lau group, east of Suva, the island of Nayau just north of Lakemba had been totally devastated with the loss of several lives and the remaining community had to be evacuated to Lakemba. From all over the island group came sad tales of villages, crops, vegetation, water supplies and food stores destroyed. A major rescue and relief operation was mounted with local ships, visiting yachts and Royal New Zealand Air Force helicopters ferrying supplies of food, clothing and medicines to the worst-hit areas and bringing injured people to Suva hospital for treatment. The difficulties of mounting such an operation in Fiji are hard to imagine with so many widely scattered islands, so few facilities in the way of transport and with communications restricted at best to VHF radios—many of which would have been damaged in the storm—and, at worst, to waving arms and signals laid out on the beaches for passing planes to spot. However, within a week, with the Red Cross and the Government co-ordinating the efforts, money and supplies pouring in from individuals, institutions and countries, the immediate needs had been catered for and the long task of rebuilding could begin.

The total cost was over 50 islanders' lives lost, many villages totally destroyed with hundreds left homeless and with no possessions, crops and vegetation ruined, a Taiwanese fishing boat lost with all hands, and several yachts and small boats lost or destroyed. In an area where needs and wants are so much simpler than those of highly developed countries such as the USA or Japan, the destructive force of Meli (whose central wind speeds must have been in excess of the 85 knots eventually forecast, but probably not as high as the 200 knots suggested by some) and her like cannot be measured in simple financial terms—although the damage must have run to hundreds of thousands, if not millions, of Fijian dollars.

Who can imagine the shock and misery suffered by the islanders of Nayau only 140 nautical miles from Suva who waited for five days before anyone even realized how desperately they needed help. No, Meli will not be forgotten and, hopefully, nor will some of the lessons learnt. Not the least of the lessons being that somehow Fiji and the surrounding islands need a better system of communication. How to achieve it and at what cost is another matter.

Extracts from the additional remarks page of the *Retriever's* meteorological logbook for March 1979

Time (Local) and Date	Barometric Pressure (mb)	Wind	Force	Weather and Remarks
0900/27th	1006·9	S	5	'Meli' approx. 140' east of Suva moving west. Cloudy (6/8 C_L3+C_M7). Frequent squally showers.
1200	1004·4	S'E	4/5	O'cast (8/8 C_L3).
1500	1000·6	S'W	6	O'cast C_L8. Swell SE'ly 10–12 ft. V/L's intention to move westward ahead of storm and to get to open water west of Fiji Group.
1800	999·6	S	6	V/L 10' south of Stuart Island, Course WNW.
2100	1000·1	S	6/7	2130 D. R. Posn. 18° 19'S, 177° 13'E. Ac to NW.
0000/28th	1000·6	SW	6/7	
0300	999·8	WSW	7/8	
0600	1002·0	WNW	5/6	Occ. showers.
0900	1002·7	NW	7	Wind veered a point.
1100	1003·2	NW	7/8	Very confused swell.
1200	1002·6	NW	7	
1500	1001·5	N	7	Belt of rain at ship.

551.515.2(961.1)

Incidence and Extent of Tropical Cyclones in the Fiji Islands

By Dr R. D. Thompson

(Department of Geography, University of Reading)

The knowledge and fear of cyclones in the Fiji Islands (12–22°S, 176°E–177°W) have existed for centuries although European observations in the 19th century were qualitative and speculative. The first comprehensive (if over-estimated) survey of cyclones was made by Visher (1925) and, since the Second World War, improvements in the observational network and synoptic analyses have aided more quantitative studies by Hutchings (1953), Gabites (1956, 1963), Giovanelli and Robert (1964) and Kerr (1976).

Tropical cyclones develop from deep depressions and mature to hurricane force when the sustained wind speed exceeds 64 knots (32·7 m s^{-1}) or Beaufort force 12. In the scattered Fiji Island group, large gaps in the observational network create problems for the determination of wind speeds and the stage of development of a cyclone. Satellite information assists forecasters in the location of the centre of the cyclone and mapping of its trajectory. However, satellite data do not yet provide information on the wind velocity field so it is a very subjective exercise to determine the storm's actual wind pattern when situated some 30 km (16 n. mile) from a land station or ship. Hurricane Meli, in March 1979, was a good example of this inadequacy. Its position was located accurately from satellite data but the forecast wind speed proved to be far too low, since the centre was remote from the main observing stations during its most violent stages. Furthermore, the few minor stations that witnessed Meli's intensification were soon silenced when 100 kn gusts toppled anemometer towers and aerial masts.

Cyclogenesis in the Fiji area

Hurricanes that affect Fiji usually develop outside the area, between 8° and 15° South. The initial tropical depressions form in the Intertropical Convergence Zone (ITCZ) where the sea temperature exceeds 28°C and lapse-rate steepening destroys the trade-wind inversion. The associated instability and release of latent heat of condensation act as the primary energy source for the disturbance whose deepening is aided by divergence in the upper troposphere. Organized cyclonic motion occurs when the disturbance moves poleward of 10°S and sufficient Coriolis force exists for intensive spiralling. The cyclones now mature rapidly and minor depressions can develop into full-scale hurricanes in six hours or so.

Hurricanes entering the Fiji area are characteristically small-scale, normally between 160 and 300 km (90–160 n. mile) in diameter, with the central eye some 8–24 km (4–12 n. mile) across. Its circulation is concentrated and symmetrical around the eye with the strongest winds (up to 160 knots) in a ring encircling the storm centre at a distance of some 24 km (12 n. mile) from the eye. The wind speed decreases rapidly inside and outside this high-velocity ring and may be quite light in the relatively calm conditions of the eye. This conspicuous gradient of wind speed results from a strong pressure gradient. For example, during hurricane Bebe (1972), the lowest pressure recorded at the storm centre was 945 mb when the pressure gradient in the wall of the eye was close to 2 mb per n. mile. Torrential rain is associated with the large-scale vigorous convection in the eye-wall and can exceed 200 mm in a 24-hour period. For example, hurricane Bebe's highest total recorded was 755 mm between 23 and 24 October 1972.

Unfortunately for the coastal lowlands of the Fiji Islands, the hurricane-force winds and excessive rainfall are coupled with tidal waves—loka—which can reach heights of 15 metres. Wind and tide sometimes combine to produce a strong positive sea surge, accentuated by that associated with abnormally low atmospheric pressure, which draws the water upward some 30 cm above normal sea level. The destructive potential is increased in estuaries when river floodwater meets and checks this tidal surge and the water piles up and sweeps over low-lying coasts as a formidable wall. For example, during hurricane Meli (1979) a 15-m tidal wave flattened all buildings and vegetation on Nayau Island in the Lau group (Figure 1) and 14 villagers were drowned when swept out to sea.

During their evolution, Fijian cyclones display a most irregular movement (Figure 2) which can be summarized as follows:

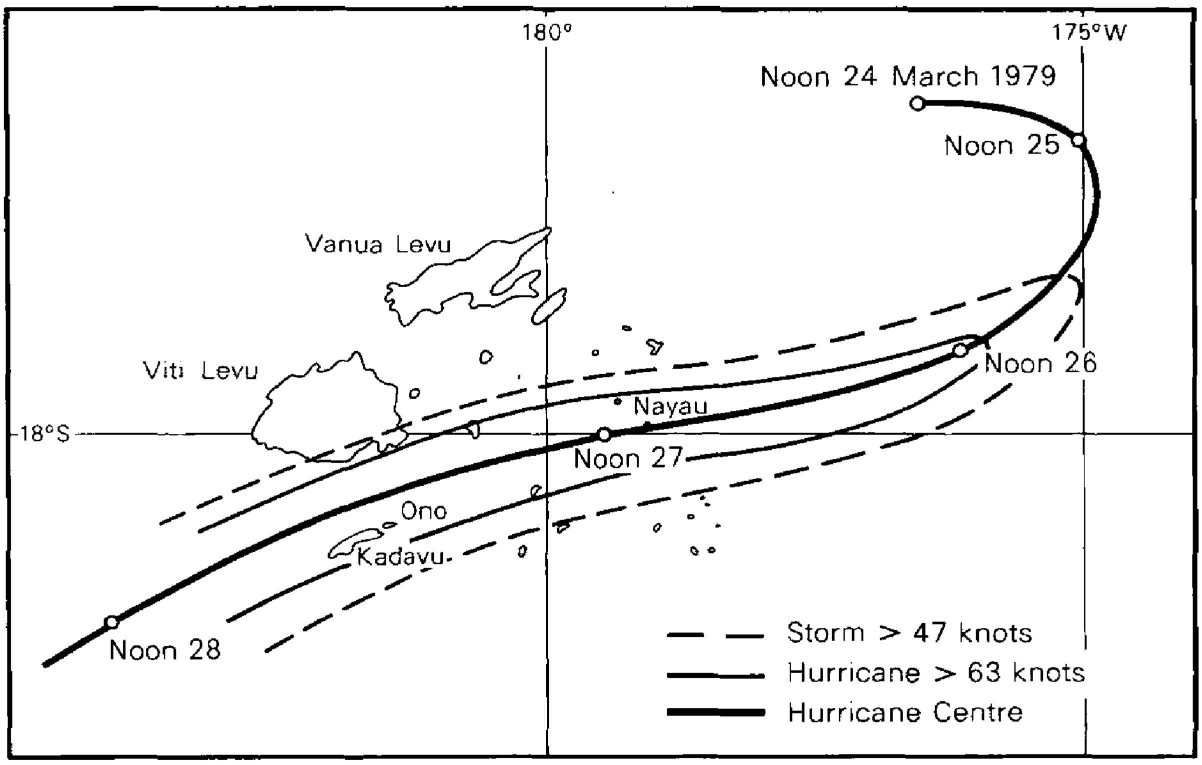


Figure 1. Track of Hurricane 'Meli' and associated winds, March 1979 (source, Fiji Meteorological Service).

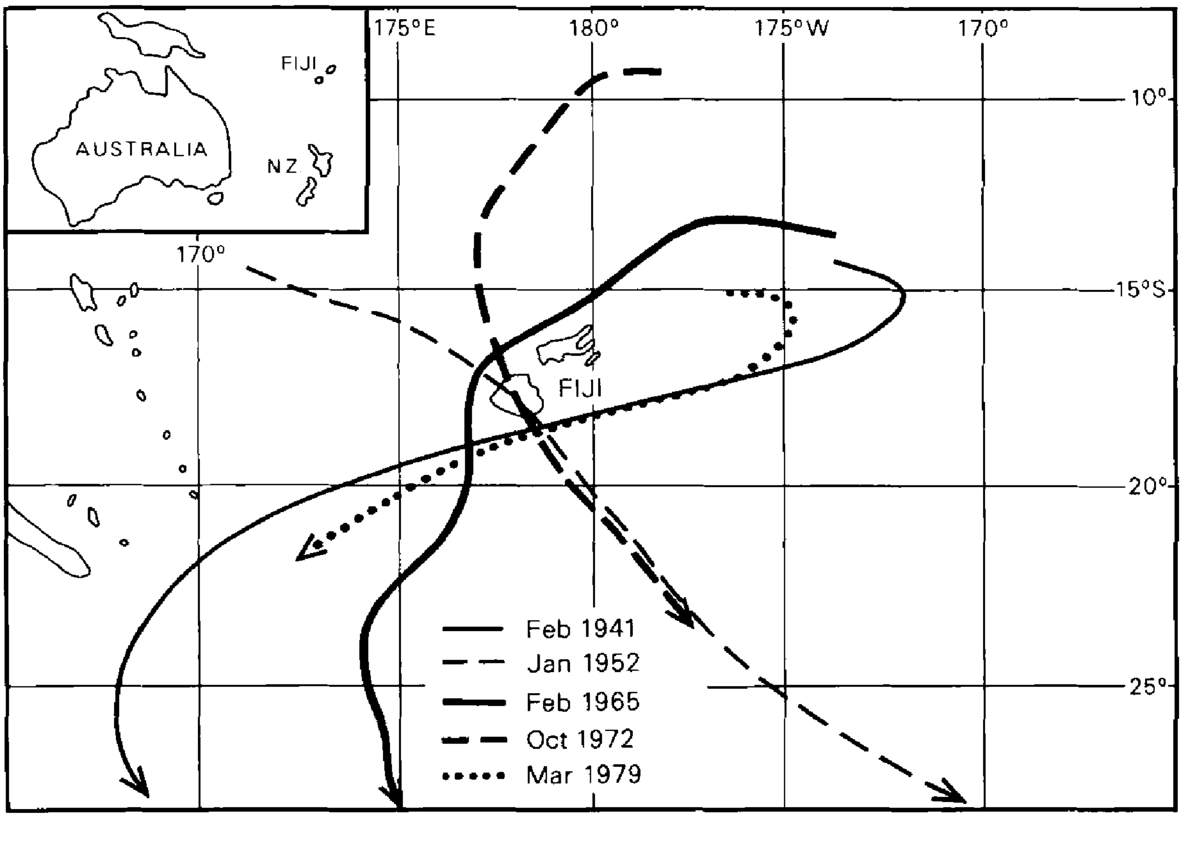


Figure 2. Tracks of severe hurricanes in the Fiji area between 1940 and 1979.

1. Forty per cent move eastwards or south-eastwards throughout their evolution.
2. Thirty per cent move initially towards the west and then recurve towards the south-east.
3. Twenty per cent move eastwards and then recurve towards the south-west.
4. Ten per cent move westwards or south-westwards throughout their evolution.

The frequency of tropical cyclones in Fiji is also characterized by pronounced variability and unpredictability. Between 1923 and 1969, 55 tropical cyclones were observed in Fiji, and, of these, 30 were minor, 14 were moderate and 11 were severe. Over this 47-year period, cyclones averaged about one per year, although there were three periods when they were absent for five years. Severe hurricanes are even more variable in frequency, and of the 28 observed between 1840 and 1979, the average interval was five years. However, the longest period without a severe recorded hurricane anywhere in the Fiji area was 12 years (1912–23) whereas two were observed in 1875.

Table 1 illustrates the monthly frequency of tropical cyclones in Fiji and it is apparent that the period June to September is free from the ravages of these disturbances. The recognized cyclone 'season' in the area occurs between December and April since 91 per cent of all recorded cyclones (1923–69) and 93 per cent of severe cyclones (1840–1979) were observed during this period. However, it is obvious that severe hurricanes can occur outside this recognized 'season'—for example, hurricane Bebe in October 1972.

Table 1. Monthly frequency of tropical cyclones in Fiji: (A) all cyclones observed 1923–69 (minor to severe), and (B) severe hurricanes observed 1840–1979

	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
(A)	14	15	5	5	1	0	0	0	0	0	4	11	55
(B)	6	4	9	2	0	0	0	0	0	1	1	5	28

Fijian hurricanes—case studies

Table 2 indicates the characteristics and consequences of the most severe hurricanes in Fiji over the last 40 years or so.

Hurricane Bebe (1972), regarded as one of the most destructive in Fiji's recorded history, was exceptional in two ways. First, its winds reached hurricane force in an unusually low latitude at about 8°S, near Funafuti in the Ellice Islands (Figure 3). Secondly, its October occurrence was well outside the recognized hurricane 'season' of December to April.

Bebe was first detected on satellite photographs east of the Ellice Islands on 19 October 1972. It matured and intensified rapidly, reaching the hurricane stage in two days as it passed over Funafuti Atoll (Figure 3). Initially, Bebe tracked steadily towards the south-south-west at 8–10 knots and entered the extreme north-west of the Fiji group when it reached Rotuma on 23 October. At this stage, the diameter of the eye-wall was 35 n. mile, pressure was 965 mb and winds exceeded 80 knots. After leaving Rotuma, Bebe recurved towards the south-east and reached its most mature stage over the Yasawa Islands with its lowest pressure of 945 mb and gusts up to 160 knots. It crossed Viti Levu

Table 2. Severe hurricanes in Fiji, 1941–79—meteorological characteristics and social/economic consequences

Date	Lowest Recorded Pressure (mb)	Highest Recorded Wind Speed (Knots)	Number of Homes Destroyed	Number of Deaths	Cost of Damage
20/2/1941	965	97	N.A.	N.A.	N.A.
28/1/1952	958	115	N.A.	23	N.A.
6–9/2/1965	N.A.	N.A.	N.A.	12	N.A.
19–25/10/1972 (Bebe)	945	160	10 000	18	F.$ 20M
24–28/3/1979 (Meli)	N.A.	110	1727	52	F.$ 6M

N.A.—data not available

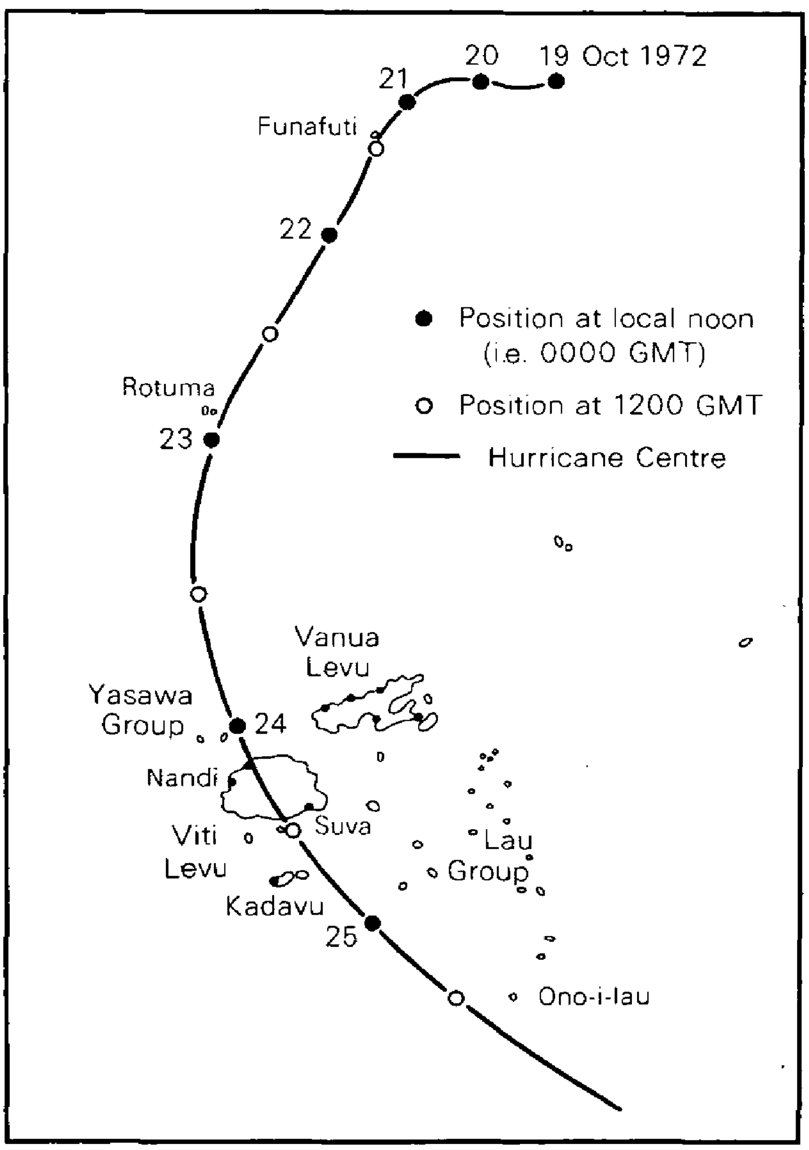


Figure 3. Track of Hurricane 'Bebe', October 1972 (source, New Zealand Meteorological Service (1972)).

on 24 October and, as expected, lost intensity as it moved over the high ground. However, orographic enhancement over the Nandrau Plateau (1224 m) produced torrential rainfall which exceeded 400 mm over the central and south-eastern parts of the island. The highest 48-hour total recorded was 755 mm at Naseuvou, some 27 km north-west of Suva.

When Bebe crossed the south coast of Viti Levu, the pressure at nearby Suva was 974 mb and the wind speed averaged 60 knots with gusts up to 85 knots. As Bebe moved south-eastward over the sea, it continued to weaken and decay. On 25 October, Bebe was centred close to Ono-i-lau (Figure 3) with a central pressure of 991 mb and gusts up to 65 knots. Bebe had now left the Fiji area, leaving behind 18 dead, 10 000 homes destroyed, and devastation costing 20 million Fijian dollars (at 1972 prices).

Hurricane Meli, experienced by the author, is also classed as one of the worst storms ever recorded in Fiji. Meli first appeared on 23 March 1979 as a small depression located north-east of Vanua Levu (Figure 1). Initially, the depression moved eastwards away from Fiji towards northern Tonga but, on 25 March, it suddenly recurved and turned southwards and then south-west back towards Fiji. On 26 March, Meli moved steadily west-south-west at about 10 knots, intensified to hurricane strength and entered the Eastern Division of the Fiji Islands (the Lau group). During the next two days, it increased speed and intensity at rates unknown at the time because of its remoteness from observing stations. Consequently, with unexpected fury and 100 knot winds, Meli devastated Nayau and Ono (Figure 1). On both islands, Meli proved to be ruthlessly efficient in flattening villages, killing 35 people and removing all vegetation. In fact, a week later the 479 surviving villagers were evacuated from Nayau since the island could no longer sustain human life. On 28 March Meli finally moved out of the Fiji area, leaving behind a path of death and destruction unequalled in Fiji's history. Hurricane Meli caused 52 deaths and demolished 1727 houses, leaving 12 000 people homeless on 14 islands. In addition, 34 schools, 46 churches and community facilities, all of which formed part of the investment of nearly 20 000 villagers, were reduced to rubble. The total cost of reconstruction and rehabilitation is estimated to be in excess of six million Fijian dollars, and the effect on the economy will last many years. Damage was particularly severe on coconut trees, the villagers' principal and often sole source of income. The trees will need replanting and take between seven and 10 years to start producing commercial copra. Those still standing will take at least five years to recover and produce. Ironically, they will probably recover just in time to be devastated by the next severe Fijian hurricane.

Conclusions

It is apparent that severe hurricanes occur regularly in the Fiji Islands. Unfortunately hurricanes develop and intensify in areas remote from accurate surface monitoring. Furthermore, this remoteness is coupled with erratic movement pattern so that storms normally approach isolated island groups with unexpected fury. However, the increasing use and sophistication of satellite data have improved the forecasting of hurricane tracks in the last decade although the strength of the approaching storm is still seriously underestimated (eg. Meli, 1979). Future storm warnings broadcast by Radio Fiji must be less conservative and should be associated with detailed instructions on precautionary measures to minimize the loss of life and property.

The Fijians must learn to live with these regular, devastating storms, and villages on low-lying exposed islands in particular, must be made hurricane-proof. The professional siting of buildings must utilize the natural protection of elevation and topography to minimize the damage from loka and 100 knot winds. The buildings must be structurally more sound than the traditional flimsy huts and dwellings which are so easily destroyed by strong winds. Underground communal hurricane shelters are recommended for the protection of villagers during the few hours of intensive hurricane fury.

Finally, after the hurricane has moved away, relief operations will have to be improved with a rapid and comprehensive survey of every island located on or adjacent to the path of the storm. The breakdown of radio communications necessitates immediate aerial surveillance to determine the amount of damage and to accelerate the distribution of food, shelter and medical aid. The distress caused by hurricane Meli was partly due to the complete disregard of the above hurricane code. Detailed guidelines have been prepared jointly by the Economic and Social Commission for Asia and the Pacific, World Meteorological Organization (WMO) and the League of Red Cross Societies (WMO 1977) and in countries subject to tropical cyclones such guidelines need to be studied and put into effect.

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Some Notes on the Use of the New Meteorological Code for Ship's Observations

As announced in the last January edition (Vol. LI No. 271) of this journal, a new meteorological code for ship's observations, designated FM13—VII SHIP, is to be introduced at 0000 GMT on 1 January 1982. Distribution of the new editions of publications and forms to cater for this change began last June and it is hoped that by now almost all British voluntary observing ships will have these. In addition to supplying the seven Port Meteorological Offices in the UK, small stocks of the new publications and forms have been sent to Meteorological Services at the following ports: Hamburg, Amsterdam, Rotterdam, Antwerp, Cape Town, Mombassa, Singapore, Hong Kong, Fremantle, Melbourne, Sydney, Auckland, Wellington, Vancouver, and Montreal. The new publications and forms are easily identifiable by their distinctive red covers or spines and, in addition, all Port Meteorological Officers who have supplied a vessel with these have been requested to stick a special label indicating that the ship has been so supplied on the barograph or in some other prominent position. Any British voluntary observing vessel which has not yet received the new publications and forms and is due to visit any of the ports mentioned above in the near future, should contact the local Port Meteorological Officer and ask for the new stationery. Addresses and telephone numbers of these officers are contained in Part VI of the *Marine Observer's Guide* (Met. O. 477).

A check is being kept at the Meteorological Office of those ships which have received the new publications and forms from any of the above sources. Early in November 1981 a list will be drawn up of those ships which have not received their new stationery and action will be taken to ensure that they do so in good time before the new code is introduced.

Where ships have been supplied in a UK port, the opportunity has been taken for the Port Meteorological Officer to explain the use of the new code to those observing officers who are onboard. Ships which have been supplied abroad should have received a pamphlet entitled 'Ship's Meteorological Logbook' which contains a very brief guide to making the entries in the logbook, but it is emphasized that this pamphlet in no way replaces the instructions contained in the *Ships' Code and Decode Book* (Met. O. 509), the *Marine Observer's Guide* (Met. O. 477A) and the *Ships' Code Card* (Met. O. 694C).

However, it is appreciated that some Observing Officers who have been on extended leave and join their ships a short time before the introduction of the new code will find that the pamphlet mentioned above is not available. For these officers and any others who may not have had the opportunity to study the Code in detail, the substance of the pamphlet is reproduced below. Where Code Tables are mentioned, these are numbered as in *Ships' Code and Decode Book* (Met. O. 509) and *Ships' Code Card* (Met. O. 694C).

Group 1

YY Enter the day of the month as two figures, e.g. for January enter 01, for October enter 10.

i_w Enter Wind Speed Indicator from Table 1. All British voluntary observing ships not supplied with anemometers should enter 3.

Group 2

$L_aL_aL_a$ Enter latitude in tenths of a degree.

Group 3

Q_c Enter the code figure for quadrant from Table 2.

$L_oL_oL_oL_o$ Enter longitude in tenths of a degree in four figures, e.g. 59° 30′=0595, 130° 12′=1302.

Group 4

i_x Indicator for type of station and for present and past weather phenomena. Enter code figure from Table 4. Normally this figure will be either 1 when Group 7 is included in the radio message or 2 when Group 7 is omitted.

h Enter code figure for height of low cloud from Table 5.

VV Enter code figure for visibility from the decade 90 to 99 from Table 6.

Group 5

N Enter total amount of cloud in eighths. If sky is obscured enter 9.

dd Enter true wind direction to nearest 10 degrees. Use 36 for true north and 00 for calm.

ff Enter speed of wind in knots as derived from Beaufort force.

Note. The first five groups are mandatory for all types of observing ships and must always be reported.

Group 6

s_n Enter code figure for sign of the air temperature from Table 10.

TTT Enter air temperature in degrees and tenths.

If for any reason the air temperature is not reported, omit the group entirely.

Enter the wet-bulb temperature in degrees and tenths in the logbook in the column provided.

Group 7

s_n Enter code figure for the sign of the dew-point from Table 10.

$T_dT_dT_d$ Enter dew-point in degrees and tenths obtained from *Dewpoint Tables* (Met. O. 938).

If for any reason the dew-point is not reported, omit the group entirely.

Group 9

Show barometer as read and correction in appropriate column.

PPPP Enter corrected barometric pressure in millibars and tenths, omitting thousands figure.

If for any reason the pressure is not reported, omit the group entirely.

Group 10

a Enter the code figure for the characteristic of the pressure tendency during the past 3 hours from Table 11.

ppp Enter change in pressure in tenths of a millibar.

If for any reason the tendency is not reported, omit the group entirely.

Group 12

ww Enter the code figures decribing present weather from Table 12.

W_1W_2 Enter the code figures describing the past weather from Table 13. The code figures should be selected so that, together with ww they give as complete a description as possible of the weather in the period. The following guide may be of value:

(*a*) select the code figure for W_1 in the same manner as W of the old code.

(*b*) select the code figure for W_2 by excluding the phenomenon covered by W_1 except when the weather has been the same for the whole of the period, when

(*c*) the same code figure selected for W_1 shall be used for W_2.

In general, the code figure selected for W_1 should be greater than or equal to the code figure selected for W_2 and the order in which W_1 and W_2 appear implies no time sequence of past weather.

If both past and present weather have not been observed, the group is omitted.

If both past and present weather are of no significance as detailed on page 3 of *Ship's Code and Decode Book* (Met. O. 509), the group should be recorded in the *Ship's Meteorological Logbook* (Metform 911A) but omitted from the radio weather message.

Group 13

N_h Enter the amount of all Low cloud in eighths, or the total amount of Medium cloud if there is no Low cloud present.

C_L Enter the code figure for the type of Low cloud as per Table 14.

C_M Enter the code figure for the type of Medium cloud as per Table 15.

C_H Enter the code figure for the type of High cloud as per Table 16.

If there are no clouds or the sky is not discernible, this group is omitted.

Group 15

This group contains the section indicator 222 and it is recommended that it be reported at all times.

D_s Enter the code figure for the true course of the ship from Table 17.

V_s Enter the code figure for the average speed during the last three hours from Table 18.

Group 16

s_n Enter the code figure for the sign of the sea temperature from Table 10.

$T_wT_wT_w$ Enter the sea temperature in degrees and tenths.

If for any reason the sea temperature is not reported, omit the group entirely.

Group 18

P_wP_w Enter the period of sea waves in seconds.

H_wH_w Enter the average height of the sea waves in half-metres.

If there is a swell with no sea waves the group is reported as 20000. If there are no sea or swell waves, omit the group.

Group 19

$d_{w1}d_{w1}$ Enter the direction of any primary swell waves.
$d_{w2}d_{w2}$ Enter the direction of any secondary swell waves.

If there are no swell waves, omit the group entirely. If only one system of swell can be observed, enter solidi for $d_{w2}d_{w2}$.

Group 20

$P_{w1}P_{w1}$ Enter period of primary swell waves in seconds.
$H_{w1}H_{w1}$ Enter average height of primary swell waves in half-metres.

If there are no swell waves, omit this group entirely.

Group 21

$P_{w2}P_{w2}$ Enter the period of secondary swell waves in seconds.
$H_{w2}H_{w2}$ Enter the average height of secondary swell waves in half-metres.

If only one system of swell waves can be observed, omit this group entirely.

Group 22

This group is only reported when ice accretion occurs onboard the ship.

I_s Enter the code figure for the type of ice accretion from Table 19.
E_sE_s Enter the thickness of the ice accretion in centimetres.
R_s Enter the code figure for the rate of accretion from Table 20.

This group may be reported in plain language preceded by the word ICING but, whenever possible, the coded version should be used.

Group 23

This group is only to be reported when sea ice and/or ice of land origin is observed. The group must always be preceded by the word ICE.

c_i Enter the code figure for the concentration or arrangement of sea ice from Table 21.
S_i Enter the code figure for the stage of development of ice of land origin from Table 23.
b_i Enter the code figure for description of ice of land origin from Table 23.
D_i Enter the code figure for the bearing of the ice edge from Table 24.
z_i Enter the code figure for the ice situation and trend of conditions over the past three hours from Table 25.

This group may be reported in plain language preceded by the word ICE but, whenever possible, the coded version should be used.

As mentioned in the introductory article on the Code in the last January edition of this journal, the new *Ships' Meteorological Logbook* (Metform 911A) is for the use of both Selected and Supplementary voluntary observing ships. Supplementary ships should report all the groups which have been stippled in the new logbook and Group 15—the stippling of which was unfortunately omitted in the production of the form. In addition, Supplementary ships equipped to make sea surface temperature observations should complete Group 16 and, of course, ships experiencing ice accretion or observing ice whether of sea or land origin should complete Groups 22 and/or 23 as appropriate.

Inevitably, printing errors and other minor mistakes are bound to occur when a number of publications and forms have to be extensively revised within a very limited period. In addition to the omission of the stippling over Group 15 mentioned above, the following errors in the *Ships' Meteorological Logbook* (Metform 911A) have been noted:

(*a*) On the specimen page 8 in the 0600 observation on 17 May, Group 12 should read 70521.

(*b*) On pages 5 and 6 the heading 'Freak Weather Report' should of course read 'Freak Wave Report'.

Also, on the cover of the *Dewpoint Tables* (Met. O. 938) the word Celsius has been incorrectly spelt. We apologize for the errors and would be grateful for notification of any others which are found. These errors will, of course, be corrected in forthcoming editions.

Finally, we hope that the change of code will not discourage marine voluntary observers from continuing the very valuable work which you do not only for the United Kingdom Meteorological Office but also for Meteorological Services throughout the world. The choice of time for the change may not be welcome, especially for those observers with Scottish blood in their veins, but was considered the best for statistical purposes. We hope you will all bear with us and at 0000 on 1 January 'out with the old and in with the new' Meteorological Code.

The Contribution of Marine Meteorology to Economic Development

(Based on a WMO Press Release)

The tourist enjoying the sunshine on the beach outside his fine new hotel and the port construction engineer exposed to cold and damp working conditions may seem to have little in common. Yet each is equally dependent upon weather and sea conditions, and the chances are that the changes which each would strongly dislike, rain, wind, swell and so on, would largely have their origins in ocean areas. The seas and oceans of the world cover over two-thirds of the surface area, and if the land masses were to be skimmed off at sea level, they would be easily accommodated in the ocean space available. This simplification emphasizes the dominance and potential power of the oceanic regions, and it is natural that mankind became aware many years ago of the need for scientific study of all aspects of the oceans and their behaviour. To ignore the results, often hardwon, of these long years in a world where the problems of space, natural resources and social and economic development require unstinting attention would be unsound.

Fundamental to most sciences is measurement; for the oceans, this means observations, both visual and instrumented, and, equally vital, recording of this information. Despite centuries passing since man first put to sea, few data were collected and rarely combined with other information. It was as late as 1853 before the first international agreement upon some uniformity of observation, and agreements upon exchange of data were achieved. In the subsequent years, the use of ships to collect routine and regular observations, whenever at sea, has grown tremendously, there being now some 7000 registered voluntary observing ships. The volume and density of data over the oceans, however, remains very variable—ships have their 'roads' too, and in many regions the information level is still sparse. Whilst this is the position for observations made on the surface of the sea, the situation with regard to underwater observations is very much worse. These data have only been collected routinely for some 30 years apart from scientific cruises and research, and rapid growth is now being supported. In order to apply this resource of data and the applications derived from it to development requirements, it is helpful to appreciate the foundation of the support. Today's marine meteorological and oceanographic data banks use high-speed computers to accommodate their holdings, and data are being collected steadily every day. Even though more are needed, the important feature is that many and varied services are available based on these data, and more and more highly specialized support to engineering, industrial, and social and economic development is being introduced.

As for more information services, one of the strengths is the strong liaison between the service and the user which is created, and that a contribution is made by both sides. In the same way that mariners obtain radio weather forecasts which have made use of information and weather reports from the mariner in their production, so any development study needs to be assisted in determining what further information or data must be obtained. It is only against the background of already acquired knowledge that proper and reliable judgement can be made. The early explorations and development for oil and gas in the North Sea region formed a good example of this situation. In a relatively small sea area, not far offshore with large amounts of data available from land station records, the operators were surprised to find that the detailed information and support they needed was not available. The reason, valid for many developments to come elsewhere, was that such detailed questions, as, for instance, when will the waves next be less than two feet for 36 hours, or what is the maximum rate of wind direction shift and what force will this have on a buoy, had never been posed against real operations. That the marine meteorological services were able to find the answers and establish regular support services to deal with many other complex problems as they arose, all realized in full association with the operators themselves, shows the benefits which can be achieved.

The contribution which can be made to a coastal or estuarine development is also significant. A study of past marine meteorological data can throw light on many development aspects. With computer models, hindcast techniques and forecast programming, considerations of potentially critical factors can be completed. The risks to a coastline of flooding by surge or storm effects, and the engineering requirements of dykes, harbours, barrages, the frequencies of high or storm winds for cabling, high structures and the maximum 100-year values, the probable pattern and effects of pollution in a sea or coastal chemical plant development, the choice of sites for new developments, the architectural limits and land reclamations, these are all matters for which marine meteorology and related services provide an early basis, and should play a full part in planning and studies and, later, be closely involved in continuing support.

Economic developments carry many implications for trade and food production. The marine meteorological services of today provide world-wide support to international shipping and to fishing industries. Thanks to the World Weather Watch (WWW), the international exchange of data, including all reports from ocean areas, has been established. This today also includes data from satellites scanning the oceans, aircraft and buoys at sea, combining both surface and upper-air information for the marine meteorologists to use in producing warnings, forecasts and detailed special support, as required. The costs of fishing operations, for instance, must be minimized, and services aid trawlers to choose good fishing grounds, know their predicted movement, and avoid weather which would interrupt fishing. As the need for natural resources to be carefully used increases, the support services will be called upon for more specialized and detailed advice, both for planning and operations, as is now the case for the energy industry offshore.

The capability of the WWW Global Data-processing System (GDPS) for ocean-wide analysis and forecasts, with the use of numerical prediction techniques on the marine meteorological data originating in the WWW Global Observing System (GOS) and collected by the WWW Global Telecommunication System (GTS), which supports all these marine activities, also provides for a further service of economic importance. This is 'ship routeing' for long ocean passages of passenger and cargo vessels. Vessels may need the quickest total passage time, avoiding head seas, strong winds and currents and icebergs, may need calm and dry conditions throughout to protect cargo, or to be certain to reach a port at a specific time. Specialist marine meteorological ship-routeing officers evaluate storm movements and predicted paths, waves, swell and surface currents, as they affect the particular vessel concerned, and knowing its physical characteristics, and knowing the ship's requirements, advise the ship's master before and during the voyage. Savings of one or two days per vessel per passage can be obtained and the total benefit to the costs of operating a major vessel are highly significant. The growth of world trade can be expected to place greater demands upon this type of service over the next decade.

It is clear that the applications and services now being provided from the meteorological and oceanographic data arising from past and present marine activities are making a positive contribution to many aspects of social and economic development. In the future, these services will need to be certain that they can expand and become more specially tailored to meet demand, as the economic needs of the world are themselves established. With the ever-growing use of automated observation systems at sea and in the atmosphere, the advances foreseen in data-processing technology, telecommunications, and the techniques of prediction, there should be no doubt that marine meteorology will do so. As the oceanic regions will no doubt be unlikely ever to give up their majestic authority, so mankind must continue to look to the sea, but must ensure they have the fullest understanding and use it to the greatest possible extent.

INDIAN EXCELLENT AWARDS

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

During the year 1979–80 there were 271 ships on the strength of the Indian Voluntary Observing Fleet (IVOF), of which 33 were Selected, 206 were Supplementary and 32 were Auxiliary vessels. Six new ships were added to the strength of the IVOF and nine were deleted during the year. The 1311 meteorological logbooks received during the year contained about 16 000 observations.

It is essential that the observations made by the ships are transmitted as expeditiously as possible to the nearest coastal radio stations to facilitate their reception on a real-time basis at the forecasting offices, to help the forecasters in locating and tracking storms. The ships *Nancowery, Lokmanya Tilak, Vishva Anand, Arbindo, Jay Narayan Vyas* and *Chhatrapati Shivaji* sent in observations when a severe cyclonic storm was forming and when it was intensifying. Due recognition, in the form of certificates, is given to ships which transmit important and urgent observations.

The work of the IVOF during the year has been assessed taking into account the quality and quantity of observations and the percentage of recorded observations which were actually transmitted to the coastal radio stations. Allowance has been made in the assessment for the actual number of days spent at sea by the ships.

As usual the number of ships selected to receive Excellent Awards in the form of books is 15 and 66 officers of these ships have been awarded books. Certificates of Merit have been awarded to 10 ships. This year the amount of money available for Excellent Awards has been raised from Rs 5000 to Rs 14 000.

The co-operation extended by the shipowners and their officers during the year is very much appreciated and it is hoped that it will continue in times to come to our mutual benefit.

The names of the ships which received Excellent Awards are as follows:

Name of Ship	Owner
Jalamani	Scindia Steam Navigation Co.
Lokpalak	Mogul Line Ltd.
Vishva Mamta	Shipping Corporation of India
Nancowery	Shipping Corporation of India
Vishva Vibhuti	Shipping Corporation of India
Jalazad	Scindia Steam Navigation Co.
Mizoram	Shipping Corporation of India
Gaveshani	National Institute of Oceanography
Lokmanya Tilak	Shipping Corporation of India
Chennai Selvam	South India Shipping Co.
B.R. Ambedkar	Shipping Corporation of India
Jalakendra	Scindia Steam Navigation Co.
State of West Bengal	Shipping Corporation of India
Harshvardhana	Shipping Corporation of India
State of Madhya Pradesh	Shipping Corporation of India

Certificates of Merit have been awarded to the following ships:

State of Gujarath
Vishva Anurag
Vivekanand
Maratha Melody
Jalamatsya
Netaji S. Bose
State of Mysore
Aradhana
Jalamayur
Jalakirti

The Excellent Awards were distributed at the National Maritime Day function held on 5 April 1981 at Bombay. The Certificates of Merit were handed to the Shipping Companies concerned for onward transmission to the eligible officers.

AURORA NOTES OCTOBER TO DECEMBER 1980

By R. J. Livesey
(Co-ordinator of Auroral Observing, the Solar Section of the British Astronomical Association)

Marine observations for the period are given in the accompanying table.

October began with some quiet activity reported on the 6th and 9th at high altitudes followed by a more general storm on the 10th, the glow of which was seen in the south of Scotland. Further isolated reports came in for the 15th, 22nd and 31st of the month. In accordance with the usual practice isolated reports of suspected glows, although coming from reliable sources, have been omitted where no confirmation was received from other observers. Radio auroral activity was reported on the 4th, 7th, 10th, 18th, 23rd, 25th and 31st. Magnetic field disturbances exceeding the value of 5 on the planetary index K_p were noted on the 10th, 11th, 23rd and 31st.

November was quieter with visual activity reported on the 11th, and on the 27th to 30th. Radio aurorae were reported on the 7th and 23rd. There was no major magnetic activity but disturbance tended to be greater at the end of the month when the visual storms were occurring in the higher latitudes, south of the auroral zone.

December began with quiet aurorae on the 5th, 6th and 7th followed by isolated reports on the 19th, 21st, 22nd, 25th and 26th. The year ended with aurorae of a relatively quiet nature on the 29th, 30th and 31st. Radio aurora was reported on the 19th. Magnetic disturbance on the 19th related directly to auroral activity reported in the southern hemisphere followed by northern hemisphere reports on the 21st and 22nd. An interesting point was that during the visual aurorae of the 5th to the 7th the index of magnetic disturbance declined dramatically. The reporting of aurorae when the magnetic index is low is not uncommon.

From time to time photographs of the polar aurora are received from land and marine observers. For example, Mr P. G. Powell of the *Singularity* sent in two colour photographs of a rayed band taken with an exposure of 1·5 seconds at *f*1·8 and a film speed of 200 ASA. Mr Powell admitted that other exposures were imperfect because of the ship's movement. The need to have a steady platform for the camera is a problem in auroral photography because of the requirement for time exposures. However, Mr Powell's results show what can be achieved in the way of photography from a ship.

Any camera may be used for auroral photography where the largest available aperture is greater than *f*2·8. In order to shorten the exposure the largest aperture possible should be used and professional patrol cameras go up to *f*1·4. Because of the great variability of the auroral brightness and also in the rate of change of form, the photographer has to be prepared to vary his exposure very much as a result of experience. The motion of a ship may limit the range of photography that may be successfully accomplished at sea. Mr Powell has succeeded with a short exposure by using a large aperture, but on land observers frequently use an aperture of *f*2·8 and exposures of between 10 and 60 seconds at increments of 10 seconds, depending on the conditions. A long exposure required to capture a faint aurora can lead to fogging of the image, especially when there is moonlight, or cause fuzziness if the aurora is changing.

Black-and-white photographs of the aurora should not be despised as they have greater sensitivity than colour film. However, because of their different sensitivities to colours relative to that of the human eye, colour films can show features of the aurora which are not visible to the naked eye. For instance, a photograph of a green rayed band or arc may reveal that the base of the structure possesses a faint red border. This may well indicate that a strong stream of electrified particles is penetrating far down into the lower layers of the atmosphere thereby causing impacts with different types of molecules and hence a change in the quality of light emitted due to these impacts. Similarly, the locations and colours of the variations throughout the auroral form give some clues to the processes in hand.

It is worth-while to remember that much of the pioneer work on the location and height of auroral phenomena was carried out by Carl Störmer in Norway using twin cameras placed many miles apart which took simultaneous pictures of the same structures. Many thousands of these stereo pairs were made, the locations of the cameras together with the known positions of the stars appearing on these photographs being used as the basis for computation of the positions of the boundaries of the auroral forms. Nowadays, cameras with fish-eye lenses are used to photograph the whole sky at regular intervals to detect the presence of the aurora.

The casual observer may not wish to photograph the aurora for technical reasons but good colour slides well projected, which have been taken of an important aurora must surely rate as a worth-while and pleasurable art-form depicting one of the most awe-inspiring of natural phenomena.

Date 1980	Ship	Geographic Position		Time (GMT)	Forms
7 Oct.	*C.P. Discoverer*	52° 43′N	52° 53′W	0000–0300	hA.R.G.RA.R.P
10	*C.P. Discoverer*	59° 06′N	13° 34′W	2210–2240	G.C.R.P.G
22/23	*Dover Universal*	57° 00′N	38° 00′W	2240–0130	C.P.R.RA.G
17 Nov.	*Lackenby*	67° 41′N	11° 49′E	2150–2315	G.R.hB.C
30	*Lord Mount Stephen*	57° 32′N	1° 14′E	0135–0150	pG.R
11 Dec.	*Serenia*	58° 46′N	2° 19′E	0000–0020	G.RA
31	*British Resolution*	60° 50′N	0° 10′W	0128	qRdA

KEY: A=arc, a=active, B=band, C=corona, G=glow, h=homogeneous, N=unspecified form, P=patch, p=pulsating, q=quiet, R=ray, Rd=rayed.

Marine Aurora observations October to December 1980

Figure 1 compares solar, magnetic and auroral activity for the years 1976–80. The annual relative frequency with which aurorae might be seen at various geomagnetic latitudes, given cloud-free conditions, may be calculated from the observations received. The curves for the above years are given in Figure 2. It is assumed that an aurora observed at any particular latitude will have moved southward to that position from the auroral zone and would therefore have been visible at some time at all intervening latitudes. The dotted sections of the curves indicate an insufficiency of observers to the north to maintain an adequate watch.

The curves in Figure 2 are subjective in that they depend on the number and locations of observers, and on weather conditions. They do show that auroral activity increased and pushed further southward during the period 1976–79, followed by a recession in 1980. The general activity seemed to change after the peak of the sunspot cycle which took place about October of 1979.

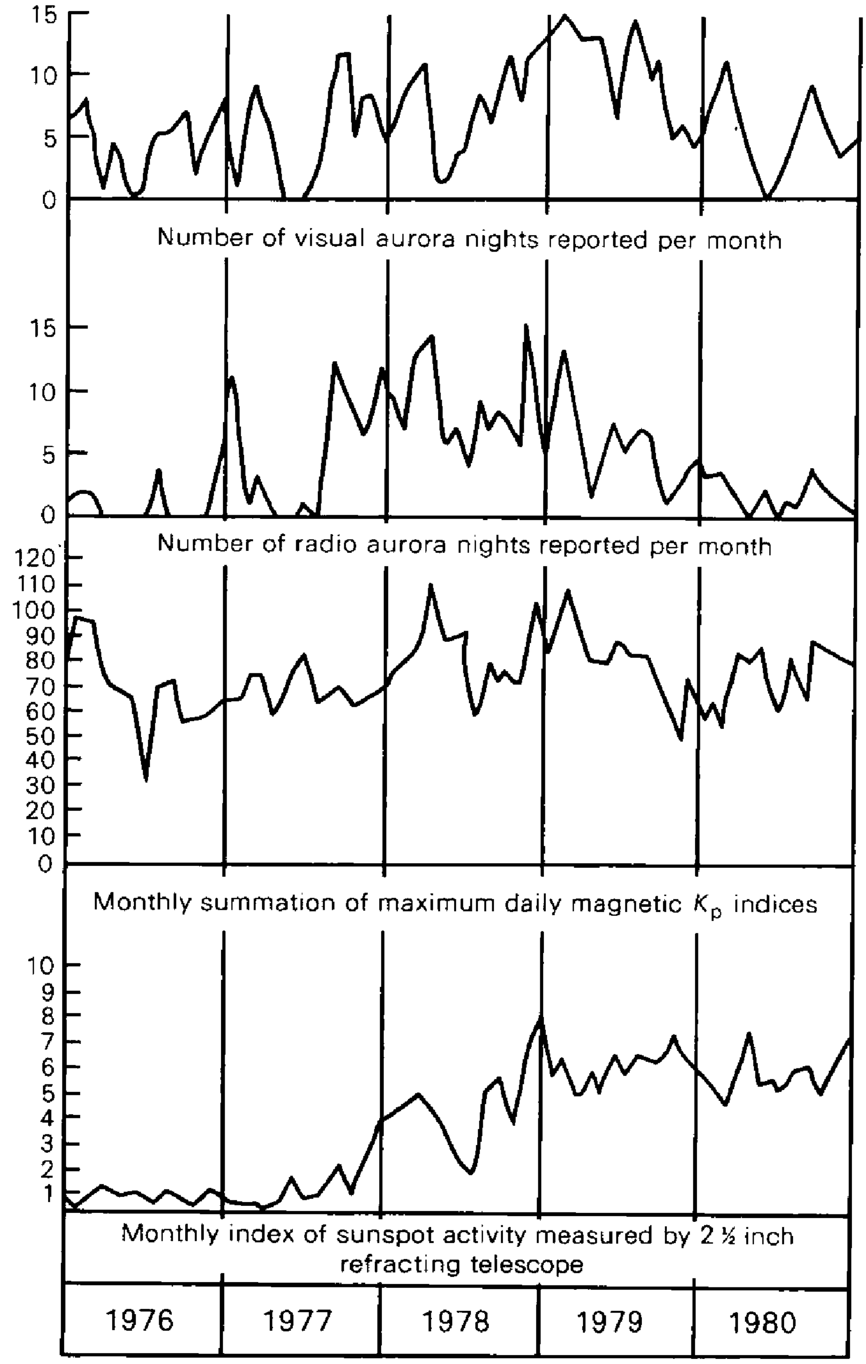


Figure 1. Comparison of solar, magnetic and auroral activity for the years 1976–80.

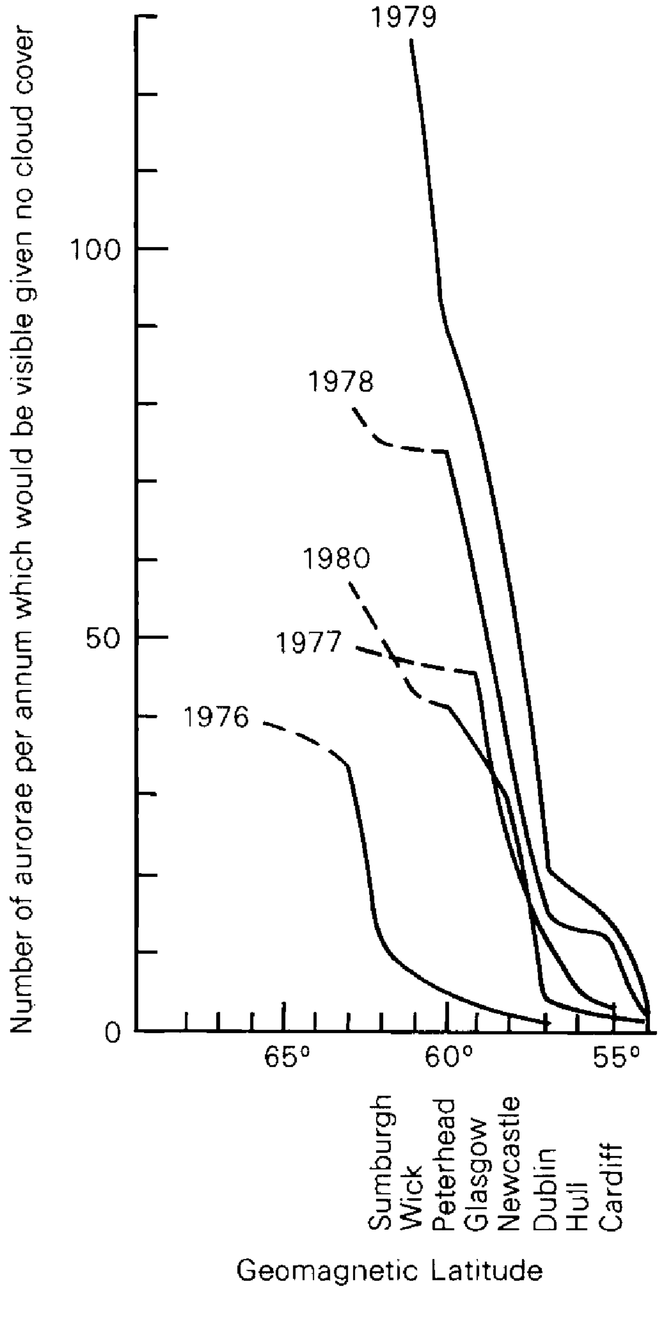


Figure 2. Annual relative frequency of aurora at various geomagnetic latitudes, given cloud-free conditions.

ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN FROM MARCH TO MAY 1981

The charts on pages 209 to 211 display the actual and normal ice edges (4/10 cover), sea-surface and air temperatures and surface-pressure anomalies (departures from the mean) so that the abnormality of any month may be readily observed. (The wind anomaly bears the same relationship to lines of equal pressure anomaly as wind does to isobars. Buys Ballot's law can therefore be applied to determine the direction of the wind anomaly.) Southern and eastern iceberg limits will be displayed during the iceberg season (roughly February to July). In any month when sightings have been abnormally frequent (or infrequent) this will be discussed briefly in the text.

The periods used for the normals are as follows. Ice: 1966–75 (Meteorological Office). Surface pressure: 1951–70 (Meteorological Office). Air temperature: 1951–60 (US Department of Commerce, 1965). Sea-surface temperature: area north of 68°N, 1854–1914 and 1920–50 (Meteorological Office, 1966), area south of 68°N, 1854–1958 (US Navy, 1967).

March

Over Canada a weak anomaly for easterly winds replaced the south-westerlies of February but the weather continued mild into March. Break up of ice in the Gulf of St Lawrence and north-east of Newfoundland continued well ahead of normal and a large deficit developed south of Davis Strait. There was still a surprisingly large deficit in the Greenland Sea with only patches of thin ice forming seaward of the Arctic pack. An anomaly for cold easterly winds over the Barents Sea resulted in ice extending farther to the south-east than usual.

April

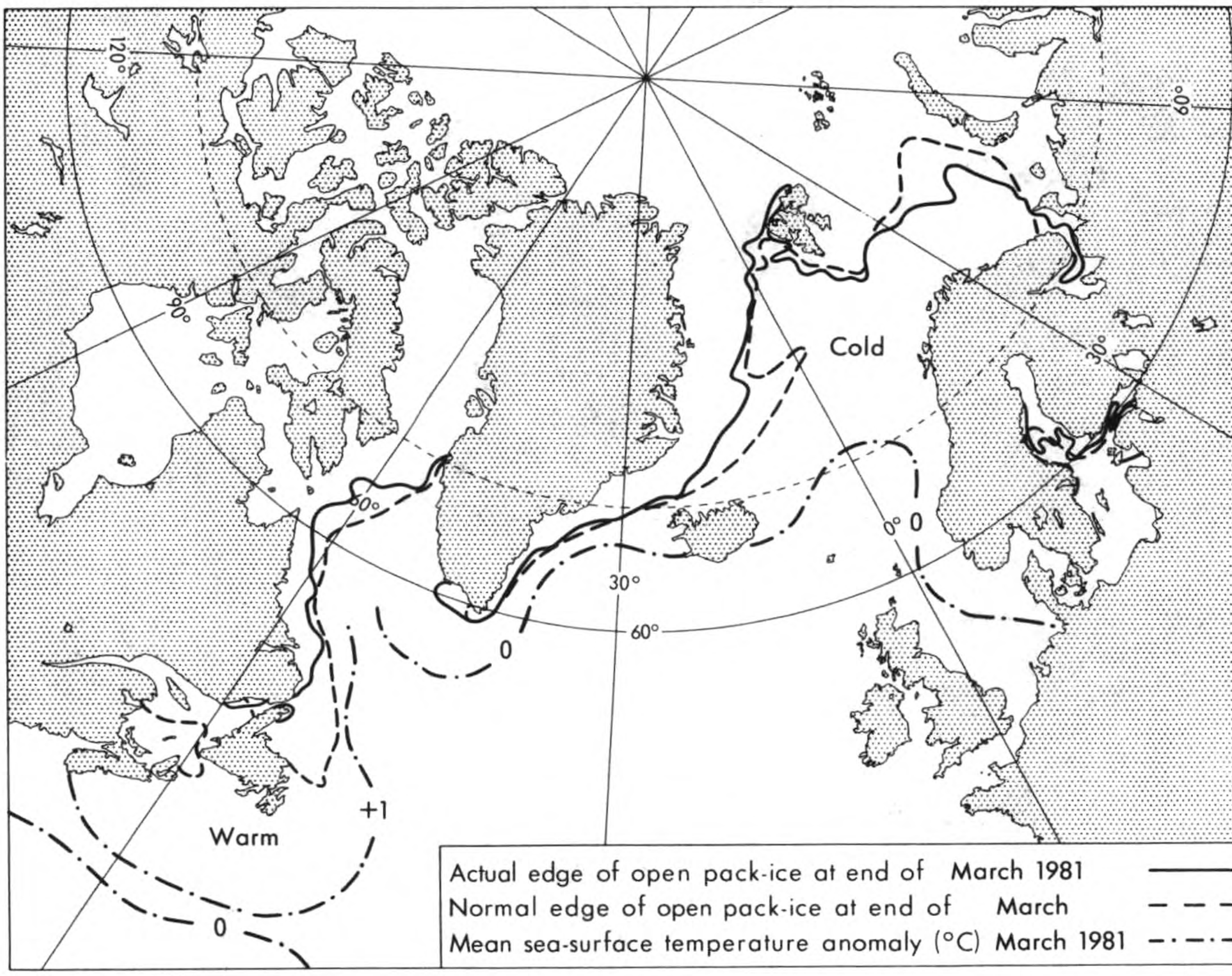
Pressure and temperature anomalies were rather small. The retreat of the ice off eastern Canada during April was only slight but with the earlier disintegration of ice during February and March a substantial deficit still remained by the end of April. The previous deficit of ice in the Greenland Sea was reduced and there were alternating areas of excess and deficit along the edge of the east Greenland pack. With an anomaly for northerly winds the excess of ice in the Barents Sea continued largely unchanged. The seasonal break up of ice in the White and Baltic Seas was much as normal.

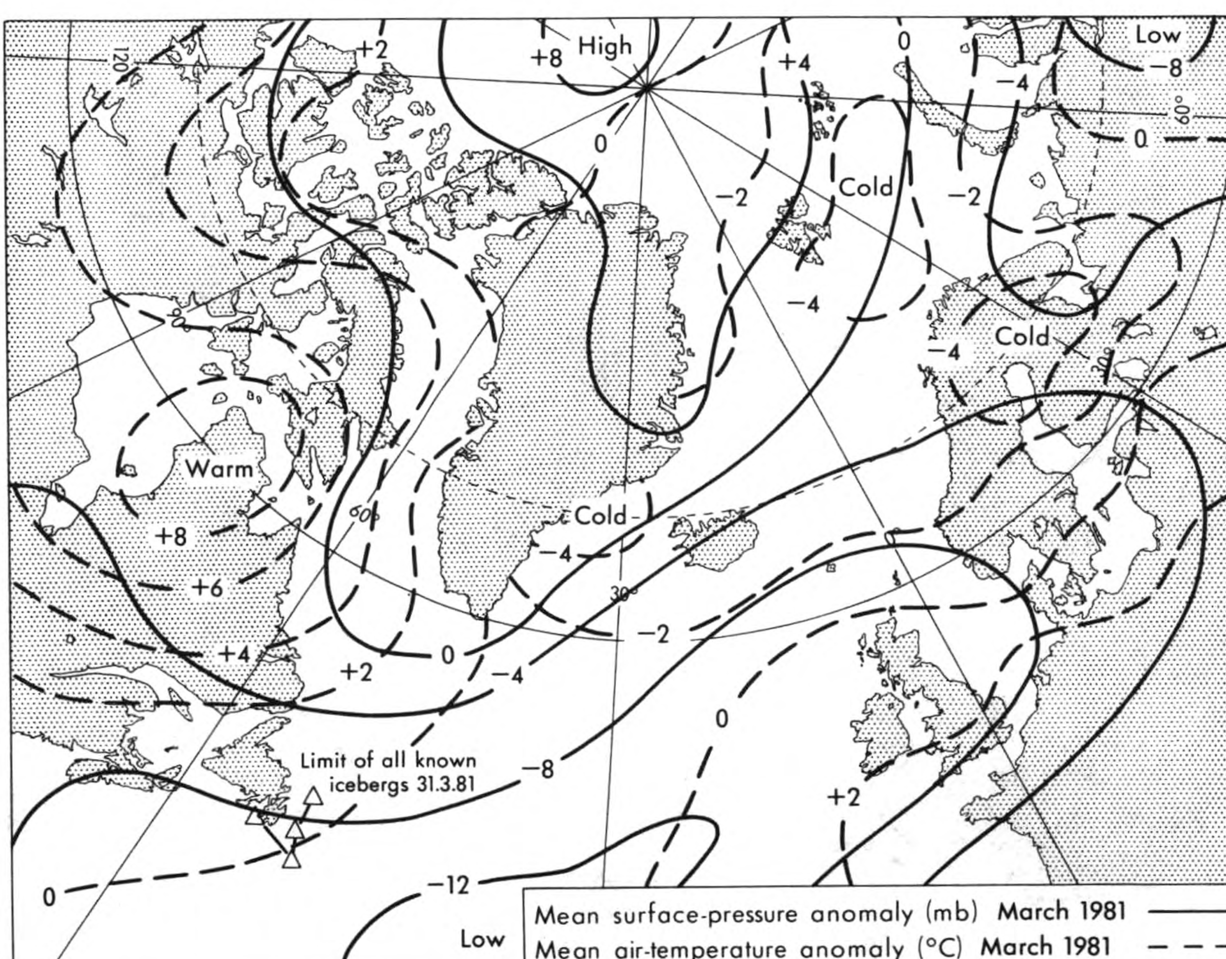
May

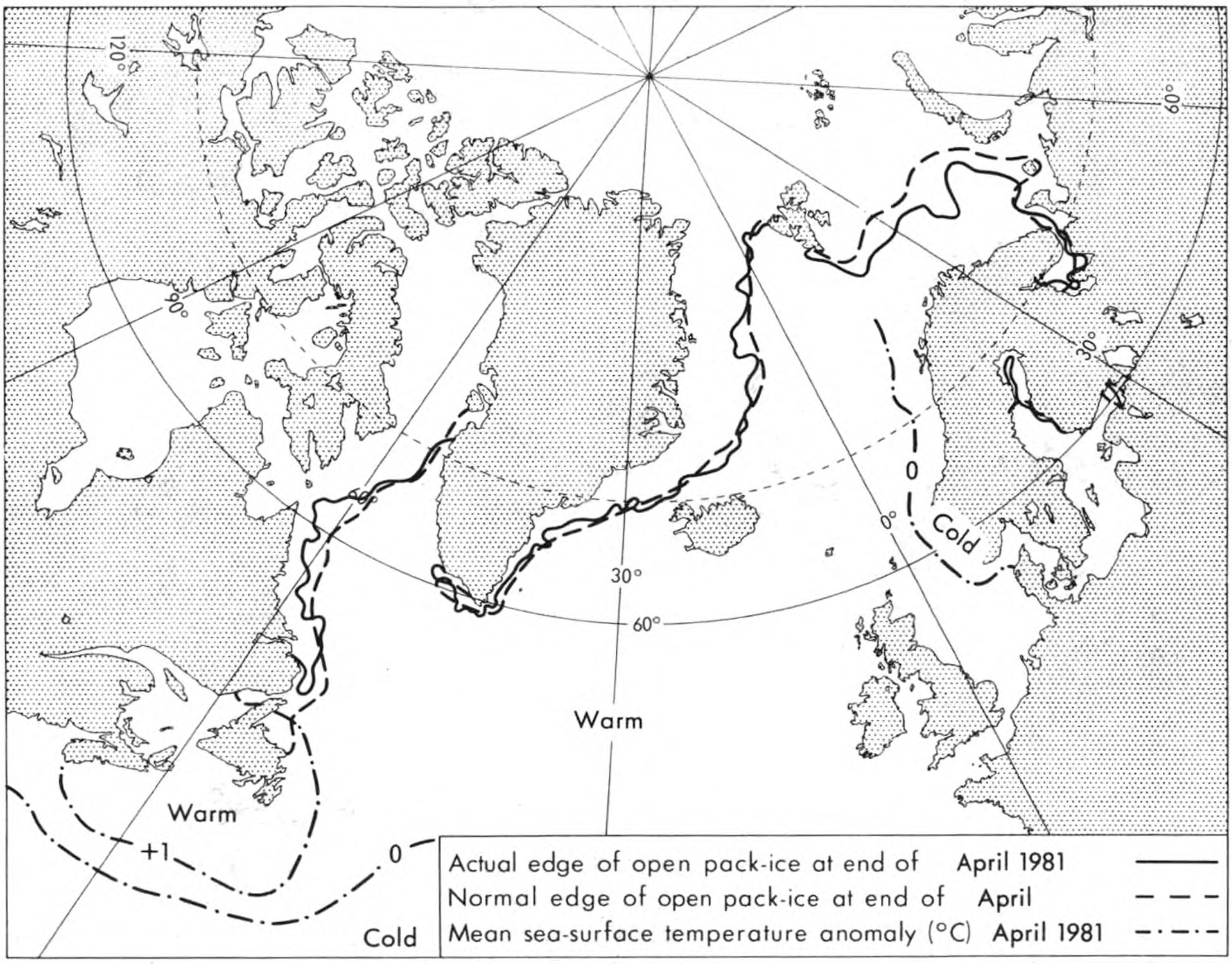
Pressure and temperature anomalies were again weak. Off eastern Canada and Greenland the ice edge reverted to near the normal position for the time of year. However, there was a tendency for the inner pack ice amongst the Canadian Arctic Archipelago to disintegrate earlier than usual. East of Spitsbergen there was an anomaly for westerly winds with the result that breaks in the ice appeared earlier than usual but the ice edge in the Barents Sea remained well south of normal with a continuance of the previous excess.

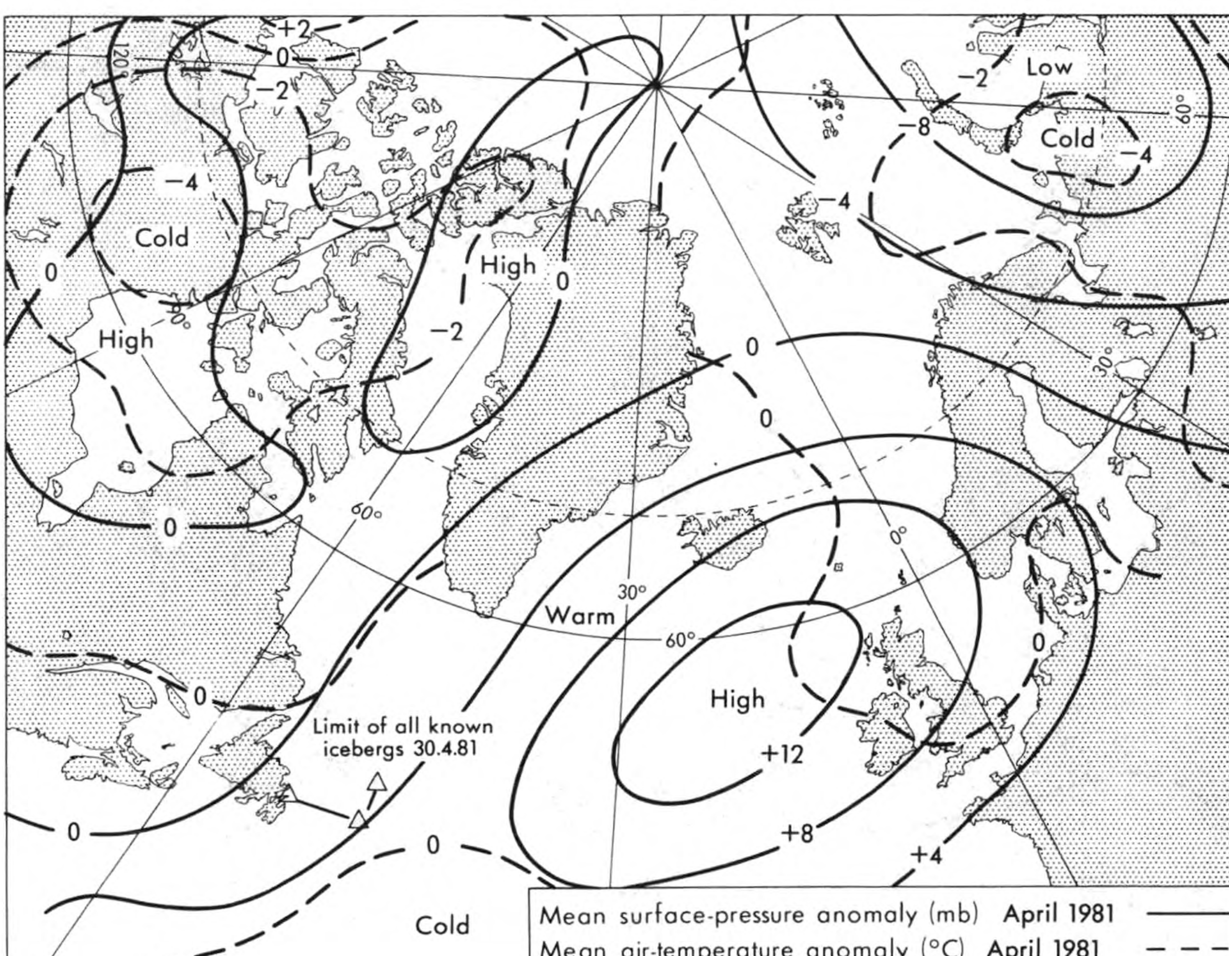
REFERENCES

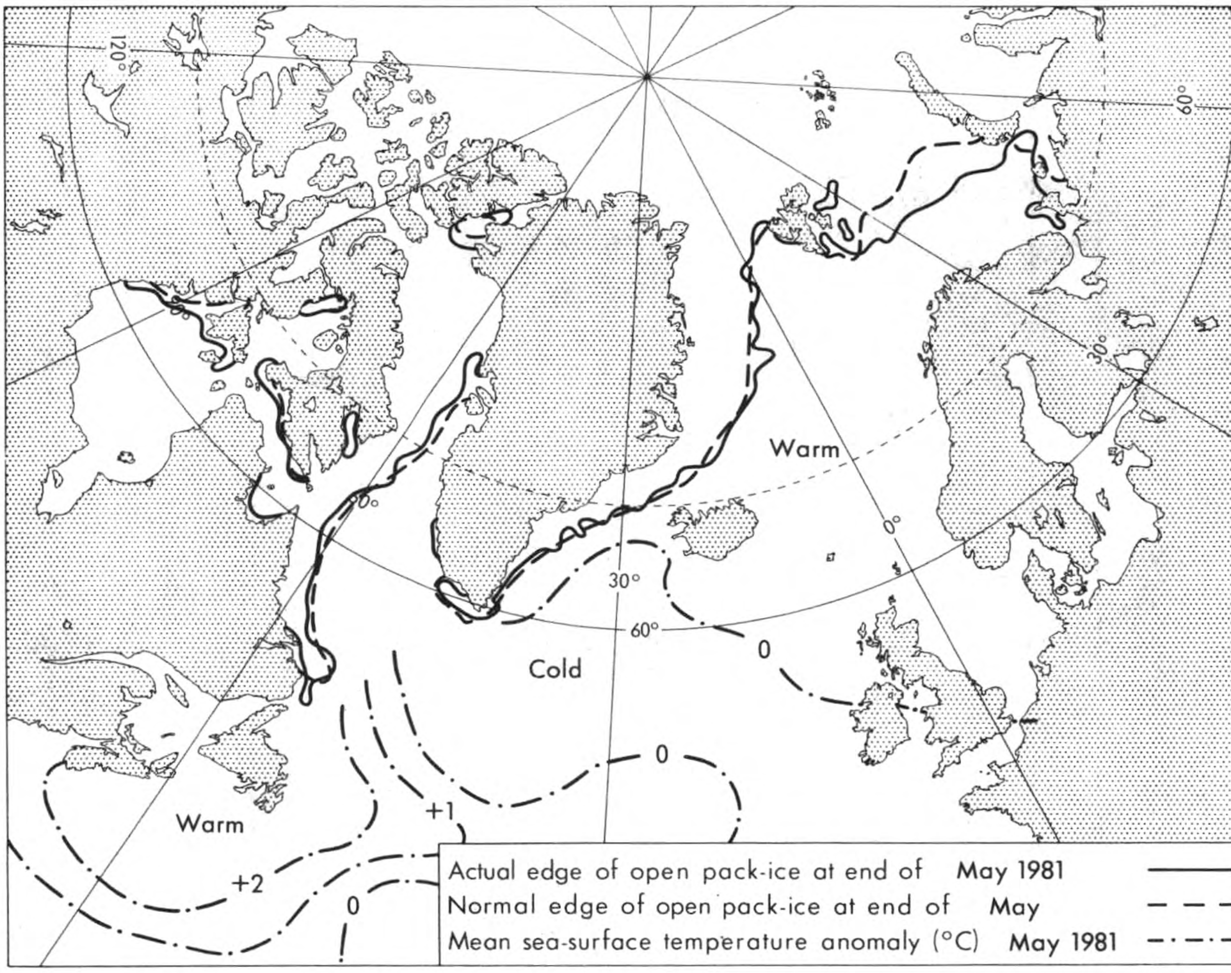
Meteorological Office, London	1966	Monthly meteorological charts and sea surface current charts of the Greenland and Barents Seas.
	—	Sea ice normals (unpublished) and various publications.
US Department of Commerce Weather Bureau, Washington, D.C.	1965	World weather records, 1951–60. North America.
US Naval Oceanographic Office, Washington, D.C.	1967	Oceanographic atlas of the North Atlantic Ocean, Section II: Physical properties.

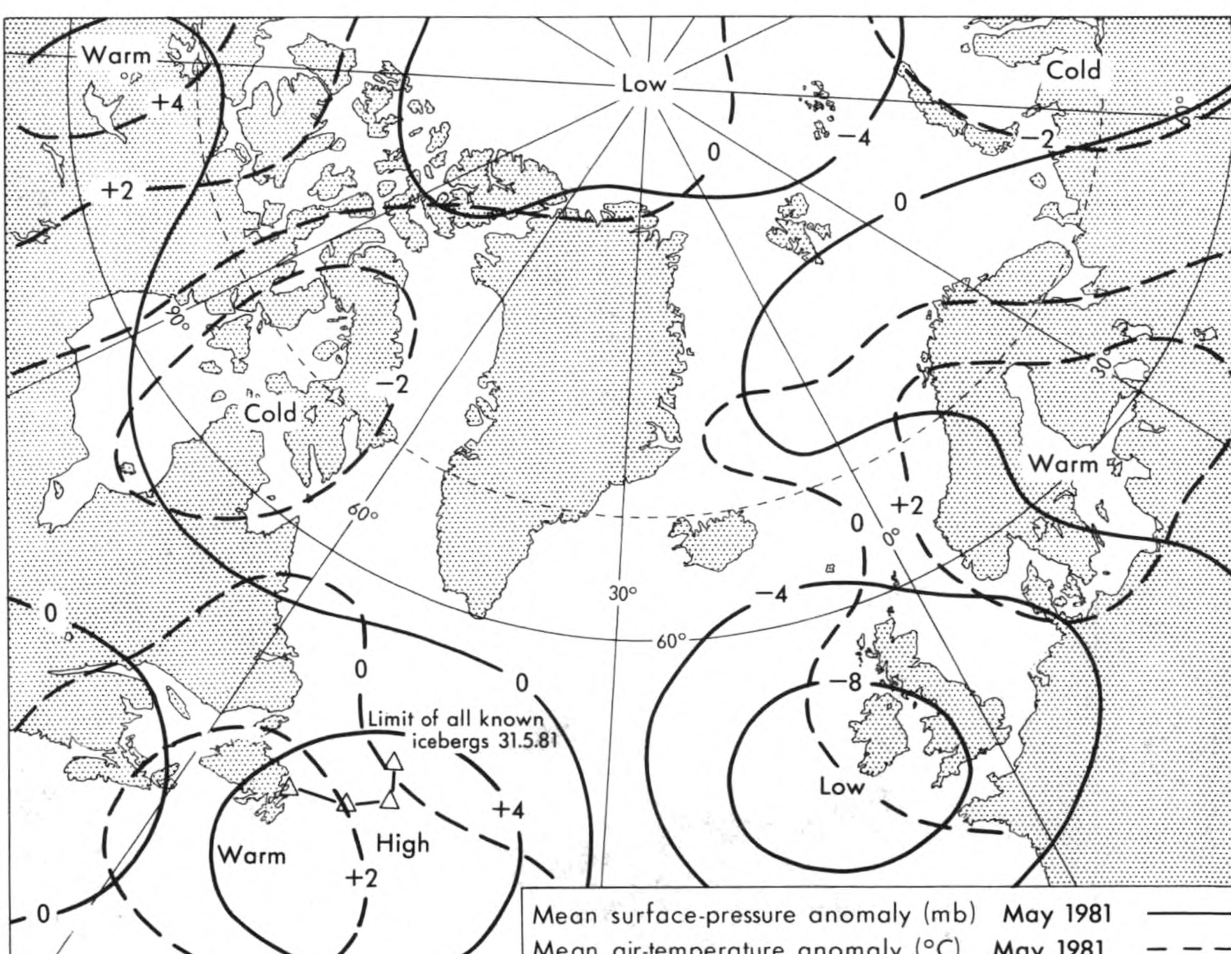

120°
90°
60°
30°
0°
Cold
Warm
+1
0
Actual edge of open pack-ice at end of March 1981
Normal edge of open pack-ice at end of March
Mean sea-surface temperature anomaly (°C) March 1981


High
Low
Cold
Warm
Cold
Cold
+8
+2
+4
0
−2
−4
−8
+6
−12
Limit of all known icebergs 31.3.81
Mean surface-pressure anomaly (mb) March 1981
Mean air-temperature anomaly (°C) March 1981


120°
90°
60°
30°
0°
30°
60°
0
Cold
Warm
Warm
+1
0
Cold
Actual edge of open pack-ice at end of April 1981
Normal edge of open pack-ice at end of April
Mean sea-surface temperature anomaly (°C) April 1981


+2
0
−2
−4
Cold
0
High
High
−2
0
−2
Low
Cold
−8
−4
−4
0
0
0
0
Warm
High
+12
+8
+4
0
0
0
Limit of all known icebergs 30.4.81
Cold
Mean surface-pressure anomaly (mb) April 1981
Mean air-temperature anomaly (°C) April 1981


Warm
Cold
Warm
30°
60°
0
0
+1
+2
0
120°
60°
30°
0°
Actual edge of open pack-ice at end of May 1981
Normal edge of open pack-ice at end of May
Mean sea-surface temperature anomaly (°C) May 1981


Warm
+4
+2
Low
Cold
-4
-2
0
0
Cold
-2
Warm
+2
0
0°
-4
-8
Low
0
0
0
Limit of all known icebergs 31.5.81
+4
High
Warm
+2
0
30°
60°
Mean surface-pressure anomaly (mb) May 1981
Mean air-temperature anomaly (°C) May 1981

Baltic Ice Summary: March–May 1981

No ice was reported at the following stations during the period: Visby, Göteborg, Emden, Bremerhaven, Hamburg, Flensburg, Kiel, Lübeck, Rostock, Stralsund, Stettin, Gdansk, Copenhagen, Aarhus, Oslo, Kristiansandsfjorden.

Station	March									April									May								
	Length of Season		Ice Days			Navigation Conditions			Accumulated Degree Days	Length of Season		Ice Days			Navigation Conditions			Accumulated Degree Days	Length of Season		Ice Days			Navigation Conditions			Accumulated Degree Days
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
Luleå	1	31	31	31	0	0	31	0	—	1	30	30	30	0	0	30	0	—	1	20	20	14	0	7	0	0	—
Skellefteå	1	31	31	31	0	0	31	0	—	1	15	15	15	0	0	21	0	—	0	0	0	0	0	0	0	0	—
Bredskar	1	31	31	12	7	20	10	0	—	1	13	13	0	9	9	0	0	—	0	0	0	0	0	0	0	0	—
Sundsvall	1	31	31	31	0	5	26	0	—	1	14	14	12	0	14	0	0	—	0	0	0	0	0	0	0	0	—
Sandarne	1	31	31	0	31	14	17	0	—	1	11	11	6	0	1	6	0	—	0	0	0	0	0	0	0	0	—
Oxelösund	16	22	7	0	0	7	0	0	—	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—
Kalmar	6	9	4	0	0	4	0	0	—	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—
Stockholm	1	31	31	31	0	31	0	0	513	1	15	15	1	12	13	0	0	—	0	0	0	0	0	0	0	0	—
Helsinki	1	31	31	28	3	0	30	1	740	1	8	8	1	2	0	8	0	—	0	0	0	0	0	0	0	0	—
Turku	1	31	31	31	0	6	25	0	696	1	13	13	12	0	6	6	0	—	0	0	0	0	0	0	0	0	—
Mariehamn	4	31	28	23	0	28	0	0	—	1	12	12	3	2	11	0	0	—	0	0	0	0	0	0	0	0	—
Mäntyluoto	1	31	31	26	0	1	30	0	—	1	19	19	9	10	0	19	0	—	0	0	0	0	0	0	0	0	—
Vaasa	1	31	31	31	0	0	31	0	963	1	27	27	27	0	0	30	0	—	0	0	0	0	0	0	0	0	—
Norrskär	1	31	31	0	26	0	31	0	—	1	23	23	0	17	0	23	0	—	0	0	0	0	0	0	0	0	—
Oulu	1	31	31	31	0	0	31	0	—	1	30	30	30	0	0	30	0	—	1	12	12	12	0	0	19	0	—
Roytta	1	31	31	0	31	0	31	0	—	1	30	30	0	30	0	30	0	—	1	31	31	0	26	0	31	0	—
Leningrad	1	31	31	31	0	0	31	0	770	1	27	27	2	13	12	12	0	—	0	0	0	0	0	0	0	0	—
Vyborg	1	31	31	31	0	0	31	0	—	1	30	30	30	0	0	30	0	—	1	8	8	1	1	7	1	0	—
Tallin	1	31	31	3	19	8	18	0	—	1	14	14	0	12	1	12	0	—	0	0	0	0	0	0	0	0	—
Riga	1	30	20	5	0	14	0	0	—	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—
Pärnu	1	31	31	31	0	0	0	31	—	1	25	22	13	7	6	2	12	—	0	0	0	0	0	0	0	0	—
Ventspils	1	18	12	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—
Klaipeda	1	27	19	0	0	5	0	0	—	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	—

CODE

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

* These figures give a rough measure of the first probability of the formation of sea ice, and later the progress of the growth and its thickness. They are derived from daily averages of temperature (00+06+12+18 GMT) and are the sum of the number of the degrees Celsius below zero experienced each day during the period of sustained frost.

Personalities

OBITUARY.—It is with great regret that we record the sudden death of CAPTAIN E. D. STEWART whilst in command of m.v. *Ardmore* on 28 January 1981.

Eric Stewart was born in London in May 1928 and received his pre-sea training at the London Nautical School. In 1944 he was indentured as Apprentice with the Hain Steamship Company and remained with them after obtaining his 2nd Mate's Certificate in 1947.

Captain Stewart obtained his Master's Certificate in July 1953 and was promoted to Master in 1960, his first command being that of the *Trewellard.* When the Hain Steamship Company was absorbed into the P. & O. Group, he commanded several P. & O. bulk carriers until his untimely death onboard the *Ardmore*.

Captain Stewart sent us his first meteorological logbook from the *Trevelyan* in 1954. Since then we have received a further 49 logbooks bearing his name of which 17 were classed as Excellent. He received Excellent Awards in 1963, 1965, 1968, 1973 and 1980.

We extend our sincere condolences to his widow and two sons.

OBITUARY.—It was with great regret that we recently learned of the sudden death of CAPTAIN E. BEE on 2 August 1980 whilst in command of m.v. *New York Star* berthed at Odessa in Russia.

Edward George Bee was born in November 1936 at Darjeeling in India. He was educated at St Paul's School, Darjeeling and received his pre-sea training in H.M.S. *Conway*. In 1953 he joined Blue Star Line as Cadet and sailed in the *Australia Star*. He remained with Blue Star Line for the whole of his career at sea, obtaining his Master's Certificate in June 1962. He was promoted to Master in July 1974 and appointed to command m.v. *Hobart Star*. Captain Bee was a very conscientious Officer and Master and always took a great pride in the ships in which he sailed.

We received the first meteorological logbook bearing Captain Bee's name from the *Rhodesia Star* in 1956. Since then he sent us a further 23 logbooks of which eight were classed as Excellent. He received Excellent Awards in 1959 and, posthumously, in 1980.

He leaves a widow, two daughters and a son to whom we extend our sincere condolences.

RETIREMENT.—CAPTAIN A. C. DAVIES, Marine Manager of P. & O. General Cargo Division, retired on 1 June 1981.

Colin Davies received his pre-sea training in H.M.S. *Worcester* from 1939 to 1942. He then joined the New Zealand Shipping Company and sailed in the *Dorset* as a Cadet. On his first voyage the ship took part in operation 'Pedestal' carrying sorely needed supplies to Malta. Only a few hours before the convoy was due to reach the Maltese Islands, the *Dorset* was attacked by enemy dive-bombers and eventually sank. However, a Royal Navy destroyer escort rescued every member of the ship's company before securing alongside the tanker *Ohio* and towing that vessel into Valetta Harbour. After some weeks under siege in Malta, the crew of the *Dorset* were returned to Gibraltar in H.M. Submarine *Clyde* and thence repatriated in a small Danish coaster.

Captain Davies remained with New Zealand Shipping Company for the whole of his career at sea. He obtained his Master's Certificate in January 1952 and was promoted Master in October 1955.

In October 1957 Captain Davies was appointed Assistant Marine Superintendent of the New Zealand Shipping Company and in October 1971 transferred to the P. & O. General Cargo Division as Assistant Marine Manager. He was promoted to Marine Manager in January 1979. Captain Davies is a Warden of the Honourable Company of Master Mariners and a Member of the Nautical Institute.

Captain Davies sent us his first meteorological logbook from the *Rakaia* in 1949. Before he took up a shore appointment we received a further 18 logbooks bearing his name of which 12 were classed as Excellent. He received Excellent Awards in 1960 and 1965. In his shore appointments Captain Davies continued to be of the greatest assistance to the Marine Division of the Meteorological Office.

We wish him a long, healthy and happy retirement.

RETIREMENT.—MR J. W. KENNY, Radio Officer, recently retired after serving nearly 40 years at sea.

John Kenny was born in Dublin in 1921 and after serving for 2½ years in the Irish Marine Service, joined Marconi International Marine Company as Radio Officer in March 1944. During his early days he served in vessels of the Irish Shipping Company but from 1962 to 1975 he served continuously in ships of the Ben Line. Latterly, he was Radio Officer onboard the North Sea ferry *Norsky* for a time before serving in Ellerman Wilson Line's *Surrey* immediately prior to his retirement.

We received the first meteorological logbook bearing Mr Kenny's name from the *Novelist* in 1951. Since then his name has appeared in a further 25 books. He received Excellent Awards in 1965, 1966 and 1968.

We wish him a long and healthy retirement.

Notice to Marine Observers

NAUTICAL OFFICERS OF THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE, GREAT BRITAIN

Headquarters.—Captain G. A. White, Marine Superintendent, Meteorological Office (Met. O. la), Eastern Road, Bracknell, Berks RG12 2UR. (Telephone: 0344 20242, Ext. 2456)
Captain G. V. Mackie, Deputy Marine Superintendent. (Telephone: 0344 20242, Ext. 2543)
Mr J. D. Brown, Nautical Officer. (Telephone: 0344 20242, Ext. 2461)
Captain C. R. Downes, Nautical Officer. (Telephone: 0344 20242, Ext. 2738)

Mersey.—Mr W. G. Cullen, Master Mariner, Port Meteorological Officer, Room 218, Royal Liver Building, Liverpool L3 1HU. (Telephone: 051–236 6565)

Thames.—Captain R. C. Cameron, Port Meteorological Officer, Movement Control Building, South Side, Victoria Dock, London E16 1AS. (Telephone: 01–476 3931)

Bristol Channel.—Captain J. H. Jones, Port Meteorological Officer, Cardiff Weather Centre, Southgate House, Wood Street, Cardiff CF1 1EW. (Telephone: 0222 21423)

Humber.—Captain J. Bentley, Port Meteorological Officer, c/o Dept. of Trade, Posterngate, Hull HU1 2JN. (Telephone: 0482 223066, Ext. 26)

Clyde.—Captain S. M. Norwell, Port Meteorological Officer, 118 Waterloo Street, Glasgow G2 7DN. (Telephone: 041–248 4379)

Forth.—All enquiries to Glasgow above.

Southampton.—Captain D. R. McWhan, Port Meteorological Officer, Southampton Weather Centre, 160 High Street, Southampton SO1 0BT. (Telephone: 0703 20632)

Tyne.—Captain D. H. Rutherford, Port Meteorological Officer, 1–2 Osborne Road, Newcastle upon Tyne NE2 2AA. (Telephone: 0632 811616)

Ship Routeing Service. (Telephone: 0344 20242, Ext. 2577)
Captain A. Phillips, Nautical Officer.
Captain P. B. Hall, Nautical Officer.
Captain C. A. S. Borthwick, Nautical Officer.

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Subjects of *Book Reviews, Editorial, Notices to Marine Observers*, photographs and persons named in *Retirement* and *Obituary notices* are indexed under these general headings.

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