Met.O. 914

# 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

Vol. XLVIII

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

VOL. XLVIII No. 259 JANUARY 1978

CONTENTS



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# Editorial

'Man's yesterday may ne'er be like his morrow
Naught may endure but mutability'
P. B. Shelley

Despite the happy recollections of Her Majesty's Silver Jubilee and the recapture of the Ashes from the Australian cricketers, memories of the summer of 1977 are unlikely, meteorologically speaking, to be particularly exhilarating for those who spent it in England. At the time of writing statistical comparisons with other years are not available but, after the sun-soaked summer months of 1975 and 1976, this past year has appeared particularly dismal.

Whenever one season appears in sharp contrast to those of other years, the question 'Is our climate changing?' is raised. That the earth's climate does change is a fact beyond dispute. During the past 1000 million years, less than a quarter of the earth's age, there have been at least four periods when ice covered major portions of the globe. Even during man's written history the climate has changed. Civilization as we know it has risen almost entirely in the 10 000 years since the great ice sheets melted last. Some 8000 years ago average temperatures in the Northern Hemisphere ranged a degree or two above today's. During this warm period that area of land between the Nile and the Euphrates became the lush regions of the 'fertile crescent' in which man learned to write, to farm and to travel. Between B.C. 3000 and 2200 much drier conditions prevailed and these areas turned to desert. This, in turn, was succeeded by cooler and wetter periods and then again, between B.C. 500 and A.D. 400, it became warm and dry. During this latter time Greece and Rome had their golden age—but periods of drought returned.

Thereafter it turned colder and wetter until, between A.D. 1000 and 1200, the climate again grew warmer. At this time vines were grown in England further north than at any time until the present century. But the cold returned. The Baltic froze over in the winter 1422–23 and from thence until the middle of the 19th century occurred what has become known as the 'Little Ice Age'. Readers may recall Dr Manley's article '1684—The Coldest Winter in the English Instrumental Record' which was reproduced in the April 1977 edition of this journal. Around the mid-1800s the climatic trend changed once more and the northern temperate zone became markedly warmer; indeed the century 1875–1975 has been quoted by some as the warmest for 4000 years. In it the world's population more than doubled and agriculture and fishing expanded to keep up with food requirements. For example, Canada's wheat line extended 100 miles northward during the period.

After 1940 there was a distinct drop in average global temperatures and, for a time, there was some conjecture that we might be at the end of a cycle and entering a cooler period. Britain's annual growing season diminished by 9–10 days in the decade 1950–60 and sea-ice returned to Iceland's coasts after an absence of almost 40 years. More recently, however, it appears that this cooler trend has been arrested for, in certain areas of the world, recent winters have been warmer than for many decades.

Until we know why climate varies, it is impossible to predict whether a climate change is likely. Not long ago scientists identified periodic changes in the earth's orbit around the sun to be in cycles of the order of 100 000 years which are the fundamental causes of ice ages. Basically, the earth's long term climate is governed by the flow of energy over different parts of the surface. The atmospheric 'heat engine' is driven by the energy radiated from the sun and, in turn, the earth re-radiates the energy back to space. Energy received by the earth's surface must equal the energy radiated off otherwise the planet would get progressively warmer or colder. The problems now of concern are—is the earth now entering into another ice age or is the steady build-up of carbon dioxide in the high atmosphere caused by industry retaining that heat which would normally escape to space and thus causing the earth's surface to grow steadily warmer? Alternatively, do these particles thrown up by man reflect and scatter the incoming sun's energy and thus are actually causing the earth to cool down? There are many other theories.

There are many ways of determining the climate of the past. Growth rings on trees can indicate the weather of a region year by year for centuries. Moraines—the debris left behind by ancient glaciers—can reveal the date of the ice passage. Fossil pollens and seeds found in lake bottom sediments and peat beds indicate what type of flora grew when and where. Examination of deep-sea drill cores reveal the shells and skeletons of small sea creatures which, in turn, give an indication of sea temperatures in bygone ages.

Now, as never before, with the introduction of meteorological satellites and the establishment of large computers dedicated to meteorological purposes, we have the equipment to greatly expand our knowledge of the vagaries of climate. An understanding of the general circulation of the atmosphere is of basic importance towards understanding how pollutants resulting from human activities spread around the earth and how possibly the world's climate is changing or will be changing in the future. During the 1960s, under the sponsorship of the World Meteorological Organization (WMO) and the International Council of Scientific Unions (ICSU), the outlines of a Global Atmospheric Research Program (GARP) were drawn up. This is defined as:

'a program for studying those physical processes in the troposphere and stratosphere that are essential for

(a) the transient behaviour of the atmosphere as manifested in the large scale fluctuations which control changes of the weather, and
(b) the factors that determine the statistical properties of the circulation of the atmosphere.'

The former would lead to increasing the accuracy of forecasting and the latter to a better understanding of the physical basis of climate.

Since a better understanding of the meteorology of the equatorial belt was necessary before embarking on a global observational project, a GARP Atlantic Tropical Experiment (GATE) was conducted during July, August and September 1974. Ships of the Voluntary Observing Fleet played an important role in this Experiment which extended over the Atlantic Ocean and the African and South American Continents between the latitudes of 20° North and 10° South.

The data acquired during the Atlantic Experiment paved the way for the First GARP Global Experiment (FGGE) which began its build up phase last December. The operational phase will commence in December of this year and extend through to November 1979. During this period there will be two special observing periods, each of two months in January/March and May/June 1979. This Experiment will be an unprecedented international effort which will require the full resources of the world's observing systems. These will include observations from land stations, ships and aircraft together with the use of polar orbiting and geostationary satellites, balloons and expendible drifting buoys.

Whilst the FGGE is mainly directed towards the first GARP objective, i.e. to improve forecasts, emphasis is also given to the fact that much of the data acquired will be a valuable contribution towards the second objective—the understanding of climate.

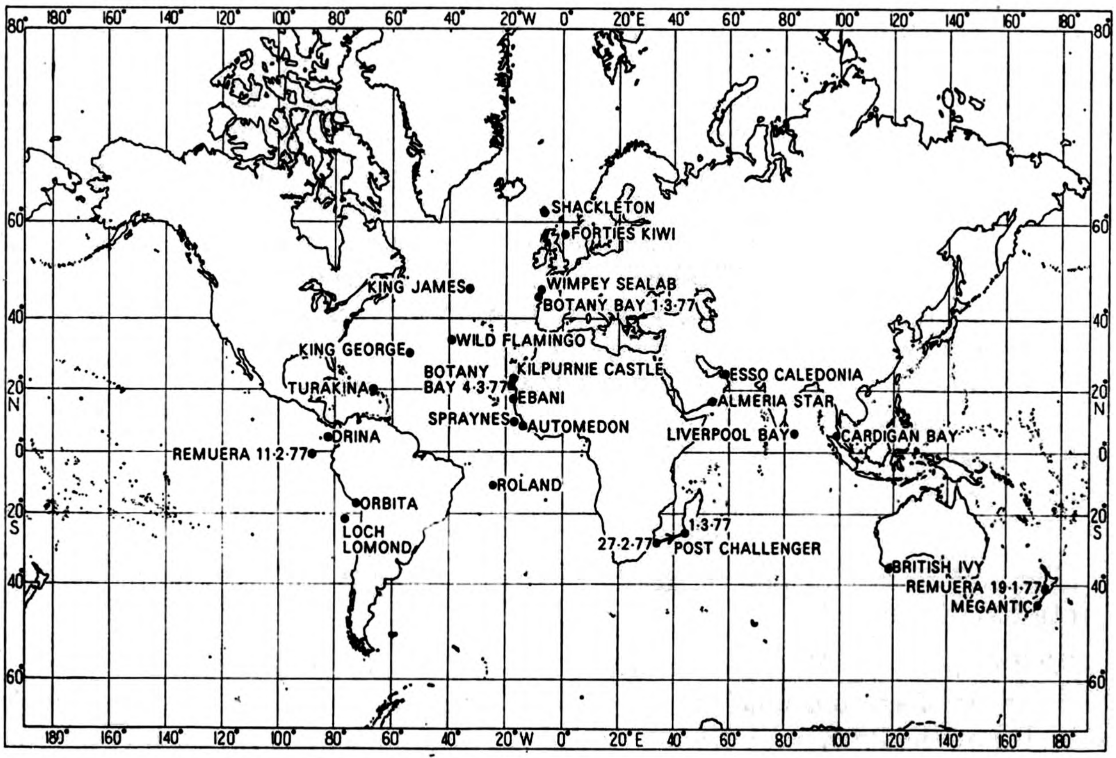
Horace Walpole (1717–97) wrote:

'The way to ensure summer in England is to have it framed and glazed in a comfortable room!'.

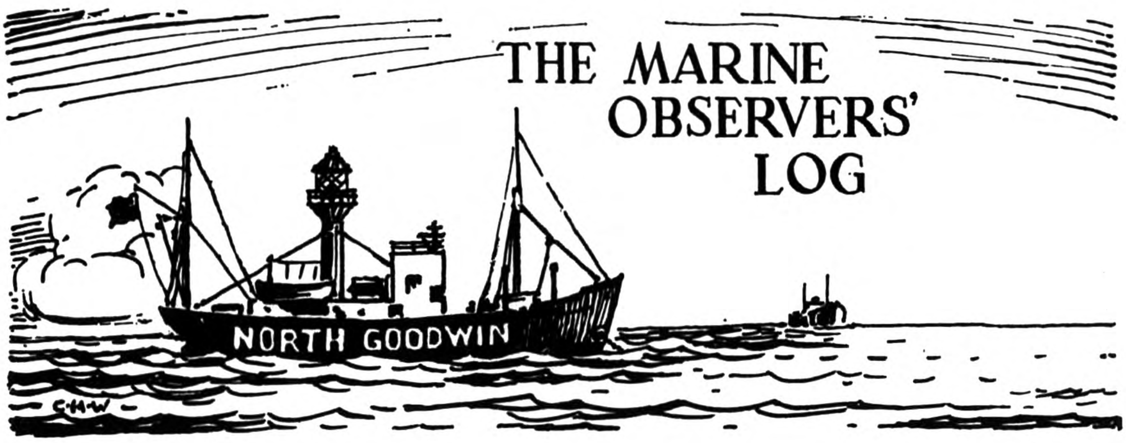
Whilst the Global Atmospheric Research Program may not make this observation obsolete, it is not too much to hope that, with the increased knowledge made available by the Program it may be possible to determine the whys and wherefores of climatic differences and of climatic change.

Whatever the climate may bring in 1978, we extend to all our readers, whether ashore or afloat, seasonal greetings and best wishes for the year.

C.R.D.




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




## January, February, March

*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.

### CYCLONE 'HERVEA'

#### Indian Ocean

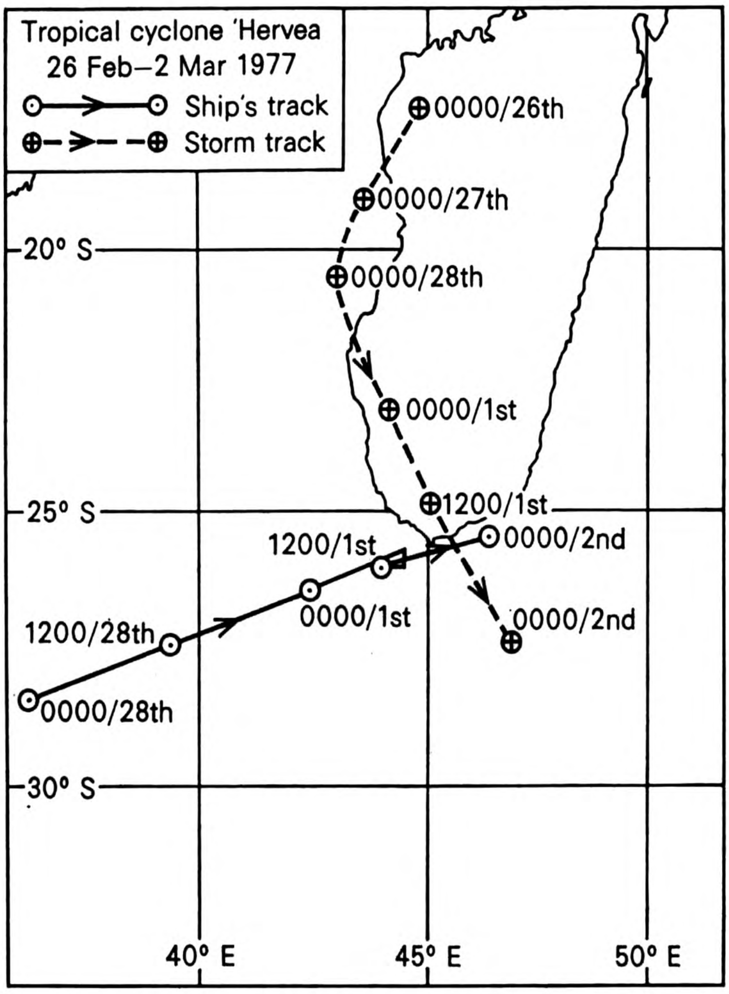
m.v. *Post Challenger*. Captain J. Rickard. Durban to Port Louis. Observers, the Master, Mr P. R. Gray, 3rd Officer and all watchkeepers.

27 February to 1 March 1977. The vessel sailed on 27 February from Durban and the weather forecast warned of two cyclones in the direction we intended to sail. Cyclone Io was moving away to the east, but Hervea was moving down the Moçambique Channel and threatened trouble. On this morning the winds were generally E'ly, there was also a low E'ly swell present.

By the morning of 28 February the barometric pressure had begun to fall steadily at a rate of about 1·5 mb per watch. The latest weather report showed Hervea, central pressure 1005 mb, to be in position 21° 30'S, 42° 00'E and it was hoped that, as it was slow-moving, the vessel would be able to pass ahead of it.

At 0300 GMT on 1 March the pressure had fallen to 1004 mb and the wind had veered to the SSE and increased to gale force; there was still only a long low E'ly swell at this time. The weather forecast predicted a slow S'ly movement for Hervea, but observations at the ship indicated that the cyclone had recurved across the land and was heading towards our course. By 0900 the wind had increased to force 9, the pressure had fallen another 2 mb, the sky was heavily overcast and heavy rain showers were experienced. About one hour later the pressure fell suddenly to 998 mb and rose, within the space of one hour, to 1001 mb. The wind had increased to storm force 10 and the sea and swell had become much heavier, the swell now being SSE'ly. Heavy rain and spray reduced the visibility to 2–3 n. mile.

It was decided that the storm centre was only a few miles ahead so we altered course firstly to the south and then to the west thus putting the wind on our port quarter. Two hours later at 1200 the wind had decreased to force 7 and the seas had gone down, so it was assumed that the cyclone had passed and we resumed course and continued our passage. From this time the pressure rose steadily to 1010 mb and the swell increased from the SW. The absence of a swell from the direction of the




cyclone was attributed to the fact that the storm must have crossed the land earlier than predicted.

We were expecting to make a landfall soon after the time when the weather was at its worst, but later when we crossed the 100-fathom line, we found we were some 20 n. mile astern of our anticipated position. We had slowed down to ease the vessel at 0600 but our actual speed was 2–3 knots slower than our log speed. This was probably due to the strong head winds and also, possibly to a current setting along the south coast of Madagascar in a W'ly direction.

Position of ship at 1800 on 27 February: 28° 54′S, 34° 24′E.

Position of ship at 1200 on 1 March: 26° 00′S, 44° 12′E.

*Note.* Hervea was first detected just west of Diego Garcia on the 18th February, moving eastward. She attained hurricane intensity on the 20th and by the 22nd, when Hervea reached the Malagasy Republic, winds near her centre were estimated at over 100 knots. After recurvature on the 28th, see diagram, Hervea filled rapidly.

It is very probable that E'ly winds ahead of Hervea temporarily increased the rate of the normal west-going current south of Madagascar from one knot to two or three knots.

## SEVERE DEPRESSION

### North Atlantic Ocean

m.v. *King James.* Captain A. T. Campbell. New Orleans to Ghent. Observers, the Master and ship's company.

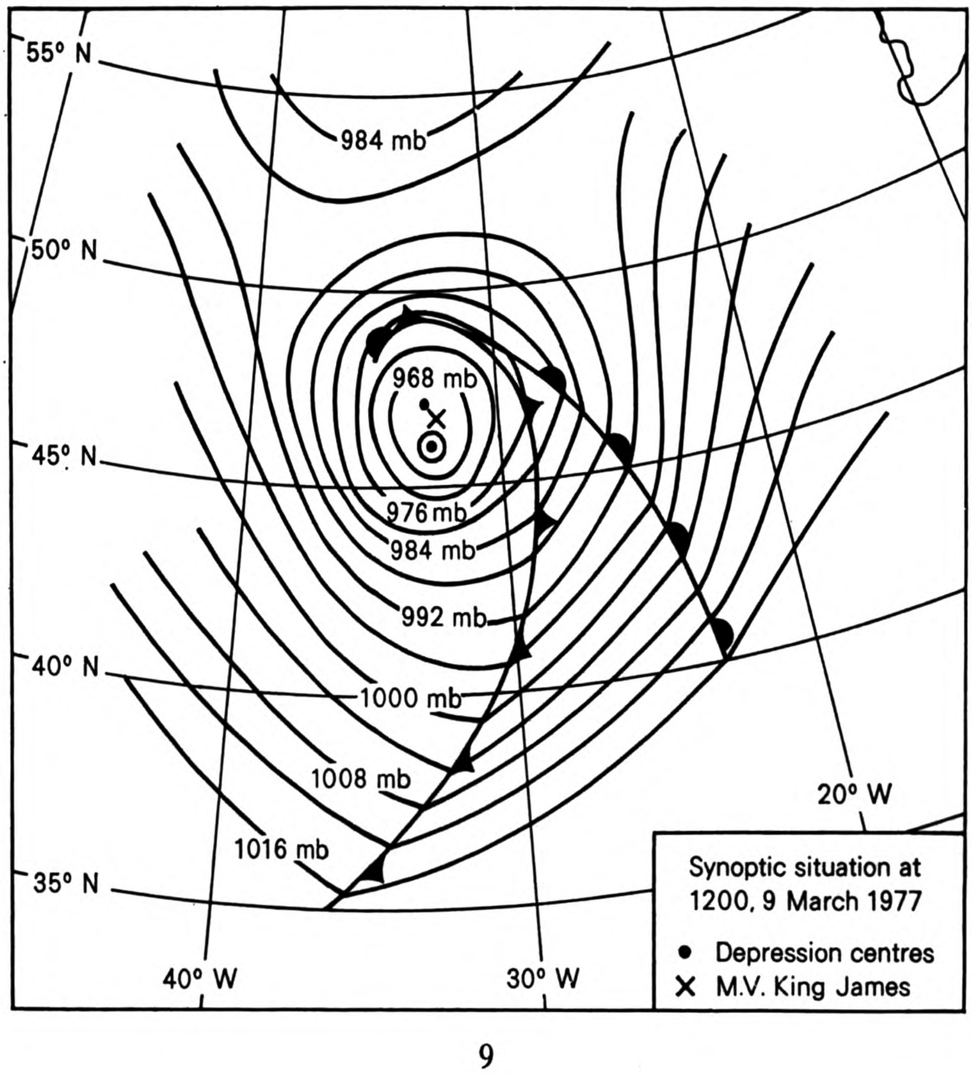
9 March 1977. At 0500 GMT the barometric pressure was 982·7 mb and the wind SE'ly, force 10. The vessel was taking heavy seas over the main deck and hatches

and was rolling heavily in a NW'ly swell. Over the next four hours the pressure continued to fall and had reached 968·7 mb by 0930; the wind during this period was mainly E'ly, force 10 with gusts at times to force 12, but had decreased by 0930 to gale force 8 and to force 7 by 1000. The decrease in wind speed continued until 1300 when it was S'ly, force 3. The vessel was now rolling very heavily in the confused sea although the sky had cleared and the sun was shining. With the winds so light it was obvious that the vessel was near the centre of a depression and that the weather would deteriorate rapidly in the afternoon. At 1345 the lowest pressure, 965·7 mb, was recorded but the wind was still S'ly, force 3. All this time the vessel was on a course of 069°T.

Shortly afterwards the wind veered sharply and increased in strength until at 1415 it had become NNW, force 10, the barometric pressure now read 969·8 mb. By 1500 the wind had reached force 11 with gusts to force 12, the air was filled with spray and the visibility was considerably reduced. At 1800 the wind was a steady force 12 and the vessel was now pitching and rolling very heavily in a very rough NNW'ly sea and very heavy, confused swell.

At 1800 course was altered to 080°T and then to 150°T at 1850 as the vessel had been taking very heavy seas over the length of the foredeck. By 2000 the wind had decreased slightly, the air was still full of spray and the seas seemed to be more mountainous than before. By 2100 the wind had become NW'ly, force 11, barometric pressure was 988·9 mb and the air temperature 12·0°C. Thereafter the wind gradually decreased and by 0030 on the 10th it was NW'ly, force 9. The vessel was rolling violently in a very rough NW'ly sea and heavy swell.

At 0100 the vessel resumed its course, 080°T, as the wind continued to decrease



and the pressure to rise. Throughout the remainder of the day the wind remained at WNW, force 7 or 8 and by 2100 the barometric pressure was 1002·8 mb.

Position of ship at 1200 on the 9th: 46° 48′N, 32° 36′W.

*Note.* The *King James* was affected by a severe depression which formed on a waving cold front east of Cape Hatteras on the 6th. The depression moved ENE, deepening rapidly and becoming complex. The position of the vessel in relation to the centres at 1200 on the 9th is shown in the accompanying diagram. Subsequently the depression became stationary west of Scotland and filled slowly.

## DISCOLOURED WATER

### Great Australian Bight

m.v. *British Ivy*. Captain J. Barclay. Kwinana to Port Kembla. Observer, Mr J. H. Miller, 3rd Officer.

11 March 1977. At 0430 GMT large patches of a light-brown substance in the form of large particles were observed on the surface. The patches took the form of long narrow strips 10 to 20 metres in width and anything up to half a nautical mile in length. On closer inspection it was observed that there were fine layers of the particles between the long narrow strips; there did not appear to be any great depth to the particles. The strips lay along the direction of the predominant swell from 150°T to 330°T and when the vessel passed through them they broke up but did not appear to sink. The dense strips were visible throughout the afternoon until sunset but gradually became more isolated. The following morning there was no sign of the discolouration.

It was thought at first that the substance might have been sand or dust which had been carried out to sea by the wind. This, however, would not explain how the strips were formed. It was later suggested that the particles may have been a form of marine life.

Weather conditions at 0430 on 11 March were: dry bulb 18·9°C, wet bulb 14·9, sea temp. 20·0, wind SE, force 3.

Position of ship at 0430 on the 11th: 35° 23′S, 118° 04′E.

## EARTHQUAKE

### New Zealand waters

s.s. *Remeura*. Captain K. E. Howard. At Wellington. Observers, the Master and ship's company.

18 January 1977. At approximately 0500 GMT whilst the vessel was lying alongside the Container Terminal in Wellington with no cargo work being undertaken, a powerful vibration rocked the vessel. This vibration was noticed by all the ship's company and lasted for about 10 seconds, sending all the officers scurrying for the engine room and deck to check the machinery and moorings. However, everything seemed normal and within minutes an emergency broadcast was issued on the radio to the effect that there had been an earthquake. Later it was discovered that this had been the most powerful in this region for many years and that some damage had occurred ashore. The centre of the earthquake was approximately 30 miles inland of the vessel and measured 6 on the Richter Scale. It was difficult to decide whether the vibration was transmitted to the vessel through the fendering on the quay or whether the vessel was affected by shock waves passing through the water.

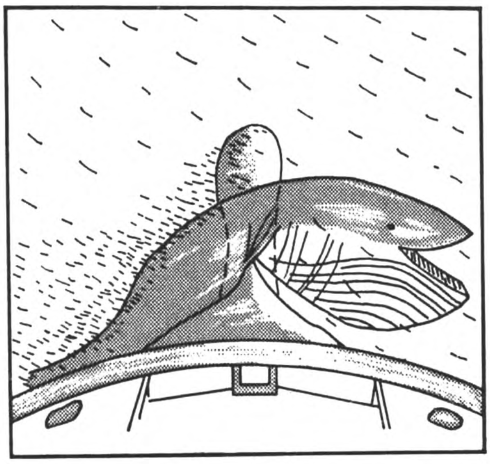
Position of ship (approx): 41° 17′S, 174° 47′E.

## COLLISION WITH WHALE

### North Atlantic Ocean

s.s. *Botany Bay*. Captain J. D. Thompson. Rotterdam to Sydney. Observers, Mr P. Pritchard, 2nd Officer, Mr P. S. E. Cave, 3rd Officer and ship's company.

4 March 1977. At 1535 GMT a marked increase in the after hull vibration was felt. The propellor shaft revolutions remained steady but our speed was reduced from 22 to 20·5 knots. At 1538 a whale was observed impaled on the bow a metre below the water line above the bulbous bow, see sketch. Between 1548 and 1554 the vessel was manoeuvred astern to free the whale which drifted clear one minute later sliding tail first to port of the bulbous bow.



The body of the whale was about 9 metres long, it had a dark grey topside and longitudinal ridges running from below the lower jaw to the centre of the underside. From the first observation at 1538 no apparent life such as venting or flipper, tail, eye or mouth movements were observed. On sliding clear of the bow, the body sank, tail first, taking in water through the 1·5 metre gash in its right flank and through the mouth. It was thought that this was a Blue Whale.

The depth of the water at the place where the whale sank was 300 fathoms. Several Russian trawlers fishing on the 100-fathom line south of Cabo Corveiro had just been passed.

Position of ship: 21° 14′N, 17° 48′W.

## TURTLES

### North Pacific Ocean

m.v. *Drina*. Captain M. Larrive. Port Chalmers to Balboa. Observers, Mr E. T. Hawkins, 2nd Officer, Mr K. B. Thorpe, 3rd Officer and Mr T. McGill, Radio Officer.

1 January 1977. At 1340 GMT a number of turtles were observed. There were 17 in all and their sizes were estimated to be one metre from head to tail and a little less across. All appeared to be heading in a SW'ly direction and nothing it seemed would make them deviate from their course. On two separate sightings a turtle was seen to be giving a large black and white sea-bird a free ride. A third turtle's path appeared to be barred by a length of broken vegetation, possibly mangrove, but it neither swam under nor around this obstruction, it seemed quite determined to continue on the same course by pushing the obstacle aside.

We thought from our position and the general direction in which the turtles were travelling that their destination may well have been the Galapagos Islands (possibly to breed?). Weather details were: air temp. 29·5°C, sea 28·0, wind light and variable.

Position of ship: 04° 53′N, 82° 35′W.

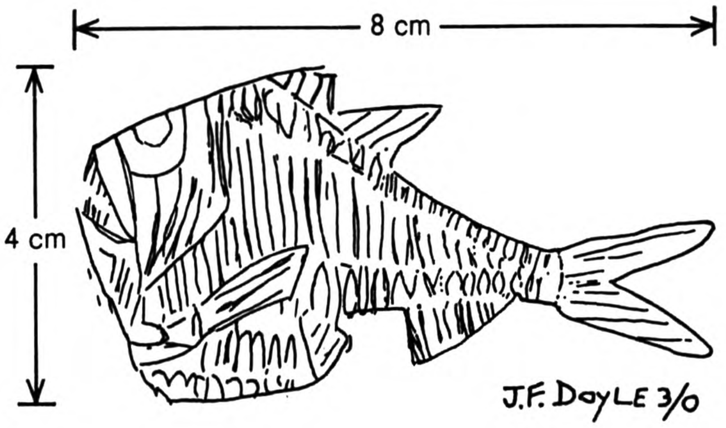
## FISH

### Bay of Biscay

m.v. *Wimpey Sealab.* Captain A. J. Stewart. South Shields to Rio de Janeiro. Observers, the Master, Mr T. Maloney, 2nd Officer, Mr J. Doyle, 3rd Officer and Mr E. Peterson.

26 February 1977. At 1100 GMT a small fish with teeth, see sketch, was found on the Monkey Island. The weather was reasonable and as the fish did not have wings, it was assumed that it had been dropped onto the vessel by a seagull. It was thought that it could not have been lying on the vessel for any length of time as it was still fresh and had not dried or hardened.

Position of ship: 46° 31′N, 07° 02′W.




*Note.* Mr P. J. Whitehead of the Department of Zoology, British Museum (Natural History), comments:

'This is a hatchetfish *Argyropelecus olfersi* (Family Sternoptychidae).

'These fish are mesopelagic and live in the deeper waters (400–600 metres) but come up to 200–300 metres at night. It must be assumed that it was picked up by a bird and dropped, possibly because it was dead—although only recently so to judge by its condition.'

## MARINE LIFE

### New Zealand waters

m.v. *Megantic.* Captain M. E. Musson. At anchor off Timaru. Observers, the Master and ship's company.

20 January to 3 February 1977. During this period areas of water in the harbour were seen to have a reddish tint to them, on closer inspection this colouration was found to be caused by large quantities of small crustaceans identified as krill. At dusk flocks of sea-gulls alighted on the ship's side and on the water and gorged themselves on the seemingly inexhaustible supply of these marine creatures.

Trouble aboard was caused when vast numbers of krill were drawn into the refrigerating machinery's salt-water intake thus blocking the cooling pipes with their corpses.

Krill were continuously observed along the vessel's side eating the marine growth thereon. On preceeding to deep sea it was observed that the vessel was making a greater daily average speed.

Position of ship: 44° 24′S, 171° 19′E.

# BIRDS

## North Atlantic Ocean

m.v. *Automedon*. Captain A. J. Palmer. Middlesbrough to Apapa. Observer, the Master.

27 February 1977. During daylight hours whilst passing Freetown, Sierra Leone, we were followed by 12 Pomarine Jaeger sea-birds. It was thought by the Master that they may have discovered, and become interested in, the pigeons we were carrying in a loft on the poop.

'Having had the pleasure of sailing for a long time with the Chinese,' the Master writes, 'I thought when I first saw the pigeons that they were being fattened for the Chinese New Year Celebrations. This, however, was not so—an enthusiastic Greaser had been acquiring pigeons from various dock-side sheds.

'These pigeons were by no means aristocrats, though from time to time a lost aristocrat would join us on its way across the Channel; this may have raised the tone but had no effect on the numbers as rapidly changing climates play havoc with potential romances.'

Position of ship at 1800 GMT: 08° 12′N, 14° 36′W.

## North Atlantic Ocean

m.v. *Turakina*. Captain F. S. Angus. Cristobal to Avonmouth. Observers, Mr D. Moorhouse, 2nd Officer, Mr L. G. Copeman, 3rd Officer and Mr Beeskeen, Carpenter.

16 January 1977. At 0300 GMT the ship's carpenter found a medium sized sea-bird on the deck. It was easily caught and appeared to have no objection to being handled. There was nothing to indicate that the bird had been injured so it was assumed that it was exhausted after a long flight or from battling against a storm. A towel was wrapped around the bird for warmth then it was placed in a box and left to rest in the chart room.

The following morning the bird was very quiet and so was left to continue its rest. During the early afternoon it showed more signs of life and was then taken in the box to the boat-deck to be photographed and measured. The box was inclined at an angle of about 45 degrees to allow the photographer to take his shots—it was assumed that the bird would be unable to affect a take-off in that position.

The bird remained quiet for a moment then, just as we thought it would stay, it went into a long clean take-off across the boat deck over the rail. It seemed a little unsteady for a while in its flight but then turned to the south-west and disappeared from sight.

The bird was predominantly white, the top of the wings and body were touched with light grey. It had a long straight orange beak (about 6 cm) and long tail feathers (about 25 cm). A thin orange-brown stripe ran down the centre of the tail feathers There was a small black patch around each eye.

Position of ship at 0300: 20° 00′N, 66° 21′W.

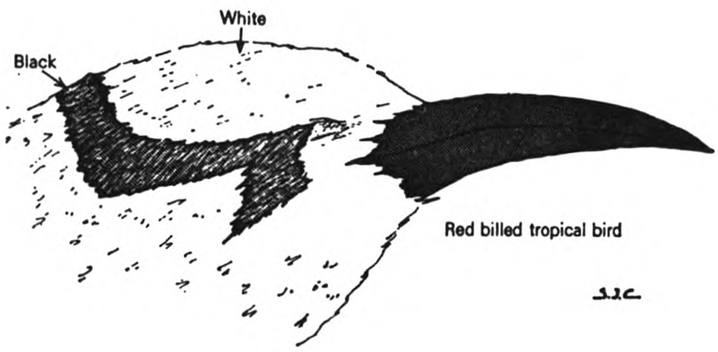
*Note.* Captain G. S. Tuck, D.S.O., R.N., Chairman of the Royal Naval Birdwatching Society, comments:

'This is the Red-billed Tropic-bird.'

## Eastern South Pacific

m.v. *Loch Lomond*. Captain J. F. T. Houghton. Valparaiso to Balboa. Observers, the Master and ship's company.

27 March 1977. At 0230 GMT a dead bird was found on the after-end of the Bridge Deck. It had broken its neck and it was thought to have flown into a stanchion during the hours of darkness.




The bird, see sketch, was identified as a Red-billed Tropic-bird. Its body length was 40·5 cm, tail plumes 20·5 cm, wing span 103 cm, beak 8 cm and it weighed 560 grams, approximately.

It was coloured white below with white and black primaries and inner rear wing coverts. The back was white with slate-grey lateral speckles below the crown, tending to be more black than white in the tail fan which carried two long white slender tail plumes. The feet and toes were yellow with black webbing and claws. The remarkable bill was a pure brick-red. The horizontal black eye stripe ran back and around the crown like a partial halo.

Position of ship: 21° 22′S, 76° 12′W.

*Note* 1. Captain Tuck commends the observers on a very good description of the bird and the artist on a very good sketch.

*Note* 2. Captain Tuck commented on a previous similar observation to the effect that these birds are quite often found on the decks of ships as they follow them at night in search of squid thrown up by the ship's wake. The birds become confused by the lights, hit some part of the structure and fall to the deck dazed or stunned (or in this case, dead), where they are found next morning.

## INSECTS

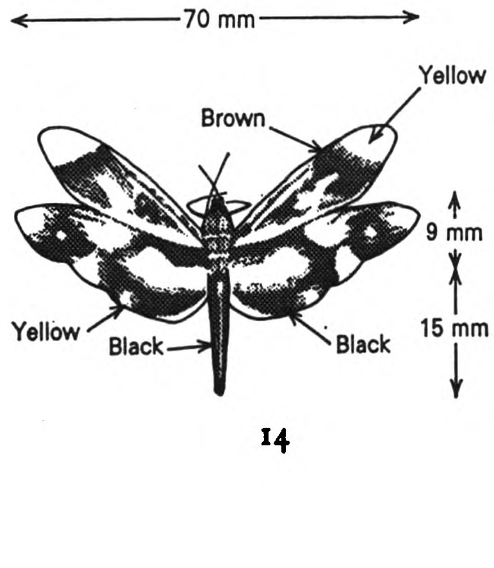
### Indian Ocean

s.s. *Liverpool Bay*. Captain R. Moore. Suez to Port Kelang. Observers, the Master and Mr S. T. Houldsworth, 2nd Officer.

22 February 1977. At approximately 0600 GMT, what appeared to be a small dragonfly was found floating in the swimming pool. On retrieval it was found to be in too delicate a condition to be kept and forwarded on, therefore, a sketch, was made in the hope of possible identification.

The fly appeared to have six legs and the wings were slightly transparent, whether this was due to immersion in the pool, however, is not known.

Position of ship at 0600: 05° 52′N, 83° 32′E.



*Note.* Dr E. A. Jarzembowski, Department of Entomology, British Museum (Natural History), comments:

'I cannot provide a certain identification in the absence of a specimen, but your insect may well be a libellulid dragonfly of the species *Rhyothermis variegata* Linnaeus. The colour pattern in your sketch agrees quite well with specimens in our collection, but the yellow tip to the forewing is a little unusual.'

### North Sea

m.v. *Forties Kiwi.* Captain G. Barber. On station, Forties Field. Observers, Mr A. A. Beattie, Chief Officer and Mr H. Benson, Radio Officer.

6 March 1977. At approximately 0600 GMT a small ladybird was found on board. Very strong w'ly winds were experienced at the ship the previous day with gusts up to 60 knots. The ladybird was dull in colour with few spots. It was still in the wheel house on the afternoon of 8 March. Another live ladybird had also been found on board in mid-February. We are curious to know how these insects have survived the winter.

Position of ship: 57° 48'N, 00° 54'E.

*Note.* Dr R. D. Pope, Department of Entomology, British Museum (Natural History), comments:

'These creatures manage to survive the winter by entering a kind of hibernation. They feed in the early and late summer on aphids and related insects. Some of the food is converted into fats within the body and is used up as the insect goes on living 'at a low ebb' during hibernation. Most species seek out sheltered places in which to pass the winter, but some are found in relatively exposed places on hillsides.'

'Some species enter houses and other buildings—presumably ships as well. If the building, or whatever, is heated, the ladybirds may emerge from hibernation thinking spring has come.'

## BIOLUMINESCENCE

### North Atlantic Ocean

m.v. *Spraynes.* Captain A. W. Ritchie. Cape Town to Rotterdam. Observer, Mr J. E. Edkins, 3rd Officer.

13 February 1977. At 2200 GMT large areas of bioluminescence were encountered for about 1½ hours.

Individual patches appeared to be about 7½ cm long and 1½ cm wide—these dimensions may be slightly in error due to the bright light given off by the patches.

Several small specimens were obtained by means of a sea-temperature bucket and collected in a jar. The water in the jar, when stirred, gave off small flashes up to a period of two hours after the specimens were caught.

Whilst passing through the patches the Aldis lamp was switched on and off at regular intervals, this, however, produced no effect. When the sides of the jar were tapped there was, again, no effect.

The sea temperature dropped suddenly shortly after the vessel had passed through the bioluminscence.

Three hours before this observation three whales, one sword-fish, many flying fish and hundreds of Portuguese men-of-war were observed around the vessel.

Position of ship at 2200: 09° 00'N, 16° 37'W.

*Note.* Dr P. J. Herring of the Institute of Oceanographic Sciences, comments:

'The "pieces" of bioluminscence sound like small Pyrosomas, but the water sample clearly contained some other smaller planktonic organism, perhaps dinoflagellates.'

### South Atlantic Ocean

m.v. *Roland.* Captain J. K. Schofield. Swansea to Rio de Janeiro. Observers, Mr B. George, 3rd Officer and Mr D. Lees.

8 February 1977. At 0815 GMT an unusually large amount of bioluminescence was observed ahead of the vessel. It took the appearance of long white streaks in the water running in the north-south direction. After approximately 15 minutes the sea around the vessel began to 'bubble' as described in the *Marine Observer's Handbook*—'upwelling of sub-surface water breaking into vivid luminosity at the surface'. The phenomenon lasted for about 15 minutes before disappearing. Five minutes later it returned with greater intensity—this time it lasted for about 20 minutes before disappearing completely.

Position of ship: 11° 10'S, 24° 00'W.

*Note.* Dr P. J. Herring comments that this is not identifiable although the *Roland's* observations of bubbling water are unusual.

## Peruvian waters

m.v. *Orbita*. Captain R. K. C. Thomas. Callao to Matarani. Observers, Mr S. J. F. d'Arcy, Chief Officer and Mr P. M. Gregson, 2nd Officer.

27 January 1977. At 0630 GMT a lighter patch of sea was observed some distance ahead. As the vessel approached the area it was observed that several square nautical miles, much larger than previously thought, were affected by bioluminescence.

The whole of the vessel's side stood out as though it were being illuminated from below the surface and the normally contrasting whiteness of the bow wave and the wake could not be seen. A few small bands of darker water were observed running parallel to the coastline.

The phenomenon lasted for about 15 minutes, after which time the brighter-than-usual bioluminscence along the vessel's side and in the bow wave and wake, together with many bright streaks moving away from the vessel were observed.

Weather conditions at the time were as follows: air temp. 22·1°C, sea temp. 21·2, barometer reading 1012·0 mb, wind calm and sky overcast.

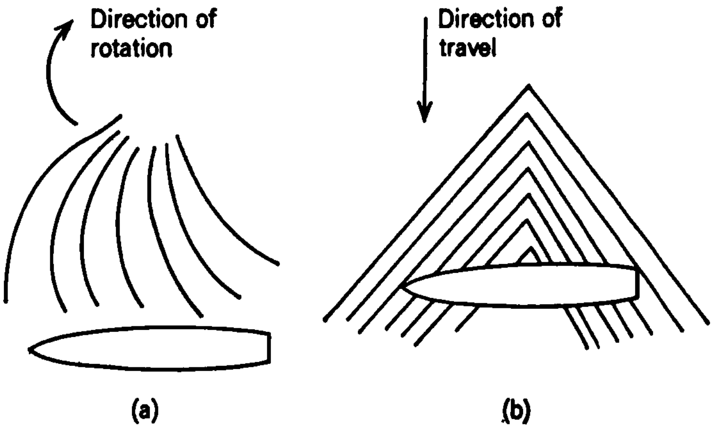
Position of ship: 16° 46'S, 72° 49'W.

*Note.* Dr P. J. Herring agrees that this was a very large patch of bioluminescence and adds that the bright streaks were probably fish.

## Malacca Strait

s.s. *Cardigan Bay*. Captain J. Banna. Suez to Port Kelang. Observer, Mr C. D. Grahame, Senior 2nd Officer.

14 February 1977. At 1900 GMT a large phosphorescent wheel was observed on the starboard side of the ship rotating quickly in a clockwise direction. At the centre of the wheel the spokes were slightly curved and of a pale milky-white colour. The spokes at the ship were approximately 3 metres in width, between 7·5 and 9 metres apart and the centre of the wheel was over one n. mile from the ship although no 'hub' was observed, see sketch (a).




(a) (b)

Individual small patches of bioluminescence of varying sizes were, in addition, observed to flash as the spokes passed over them. These patches were slightly brighter than the spokes, but were only discernible close to the ship and each one flashed at the rate of approximately three times per second.

Soon afterwards a change in the pattern was observed, see sketch (b). The spokes had formed an inverted V-shape with the apex pointing away from the ship and were rushing towards the ship's starboard side, reappearing on the port side and moving away. The pattern then changed twice more in quick succession; first to an anti-clockwise revolving wheel and then to a clockwise wheel, both times with the centre to starboard. As the vessel steamed past the latter wheel, a further wheel was seen ahead revolving anti-clockwise—the spokes of this wheel overlapping those of the other.

The pattern changed twice more; first, back to the V-shape but moving in the opposite direction and finally to an anti-clockwise revolving wheel with the centre to starboard.

By this time the phenomenon was rapidly fading and soon disappeared altogether. The display lasted 10 minutes.

Position of ship: 05° 04′N, 98° 07′E.

*Note.* Dr P. J. Herring of the Institute of Oceanographic Sciences, comments:

'A fascinating account of a phosphorescent wheel complex. The details of the changes in appearance and direction of rotation of the wheel are particularly valuable as this kind of information helps to distinguish between the various suggestions that have been put forward to account for these phenomena. The cause which is currently most generally accepted is that of submarine earth quakes or other seismic activity. Shock waves radiate from the bottom to the surface and are reflected back again so that they interfere to produce moving wheels of light as they stimulate the luminous organisms. A requirement of this theory is that they only occur in relatively shallow water and that the rotation direction changes very readily as in this report.'

## Arabian Sea

s.s. *Esso Caledonia.* Captain J. M. Phillips. Persian Gulf to Singapore. Observers, the Master and ship's company.

22 February 1977. At 0600 GMT the vessel passed through a band of orange-coloured water; it was observed to be about 5–6 metres wide and lay across the track of the vessel in a north–south direction. During the next few hours similar bands, gradually increasing in width, were encountered.

By 0930 the bands had increased in size so much that the sea surrounding the vessel was completely orange-coloured although by now the colour had diminished in intensity. About this same time a very unpleasant smell was observed, this lasted for about ten minutes after which the vessel cleared this particular band and the sea reverted to its normal colour. It was, however, now observed that as the vessel moved through the water, so the orange colour returned to the surface. We concluded, therefore, that the cause of the phenomenon lay beneath the surface.

The phenomenon was continuously observed until 1500. Weather conditions then were: dry bulb 23·0°C, wet bulb 20·6, sea temp. 21·7, barometer reading 1015·6 mb, sea 'glassy' with light ripples and sky clear.

About 1500 bioluminescence of great intensity was observed, high-intensity flashes of phosphorescence were seen in the bow wave and wake. Luminous bands were also observed around the hulls of passing vessels.

Position of ship at 0600: 24° 19′N, 58° 25′E.

*Note.* Dr P. J. Herring comments:

'This is a typical account of dense dinoflagellate concentrations discolouring the water and giving a characteristic smell with concomitant high-intensity luminescence especially in the disturbed water.'

### Arabian Sea

m.v. *Almeria Star*. Captain J. Calabrase. Bandar Abbas to Aden. Observer, Mr K. Lumby, 3rd Officer.

26 February 1977. At 2030 GMT after the moon had set, bioluminescence was observed in the area through which the ship was passing. There was only a small amount but it came in two distinct types. The first was roughly circular in shape with a diameter of about 3 metres and was milky in appearance when initially observed. After it passed the beam about 7 metres from the ship it appeared to be composed of worm-like particles which were moving rapidly and randomly. Its brightness was comparable to that of the brighter stars.

The second type observed was snake-like in appearance and in lengths of up to 10 metres. It moved rapidly on the surface of the sea like a streamer in the wind, twisting about and crossing itself. It did not appear to 'like' the ship and would shoot away from the bow wave, easily out-running it even though the ship's speed was 21 knots. It appeared to be made up of the same particles as the former.

Weather at the time was: Air temp. 24·9°C, pressure 1015·4 mb, wind calm and sea smooth with no appreciable swell. Two oktas of thin altocumulus were observed.

Position of ship: 16° 02′N, 53° 48′E.

*Note.* Dr P. J. Herring comments:

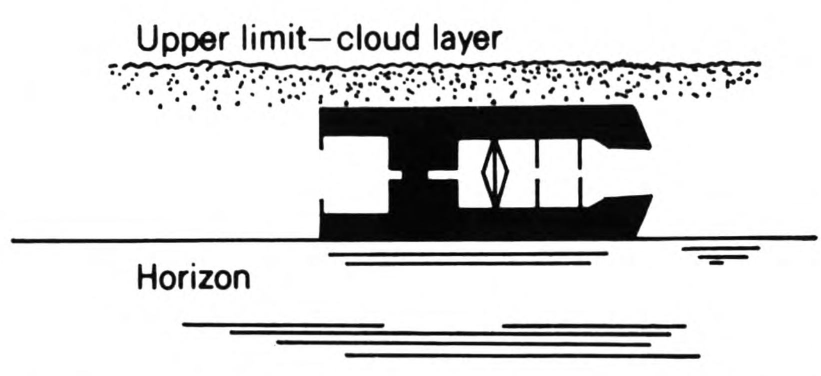
'The worm-like particles were probably the luminous trails caused by a small school of fish at the surface. The longer snake-like type was undoubtedly a luminous trail produced by either a larger fish or a dolphin.'

## ABNORMAL REFRACTION

### Bay of Biscay

s.s. *Botany Bay*. Captain J. D. Thompson. Rotterdam to Sydney. Observers, Mr P. Pritchard, 2nd Officer and Mr J. Roberts.

1 March 1977. At 1600 GMT three vessels were observed at a distance of about 9 n. mile on the north-eastern horizon with inverted images above, see sketch.




Weather details at the time of the observation were as follows: dry bulb 14·0°C, wet bulb 12·5, sea temp. 11·0, barometer reading 1029·4 mb, wind E'S, force 1–2.

Position of ship: 45° 06′N, 08° 13′W.

## HALO AND CORONA

### North Atlantic Ocean

m.v. *Wild Flamingo*. Captain P. Lay. Cristobal to Le Havre. Observer, Mr A. J. Dodd, 3rd Officer.

1 January 1977. At 2330 GMT a halo encircling the moon was observed; the moon, at the time, was at an altitude of approximately 75° on the starboard beam, the vessel's course being 059°T.

About 10 minutes later a second 'halo', closer to the moon and more pronounced, was observed. This smaller circle of light gradually extended until the colour spectrum could be seen showing clearly the primary colours. A layer of cirrostratus cloud and a trace of transparent altocumulus cloud were present at the time. As the lower layer of cloud drifted away, an almost perfect halo was seen to encircle the moon.

Position of ship: 34° 00'N, 39° 00'W.

*Note* 1. The *Wild Flamingo* was a Canadian Selected Ship at the time of the observation.
*Note* 2. The term halo is applied to a circle produced by refraction through ice crystals and such a halo is a good indication that cirrostratus cloud is present.

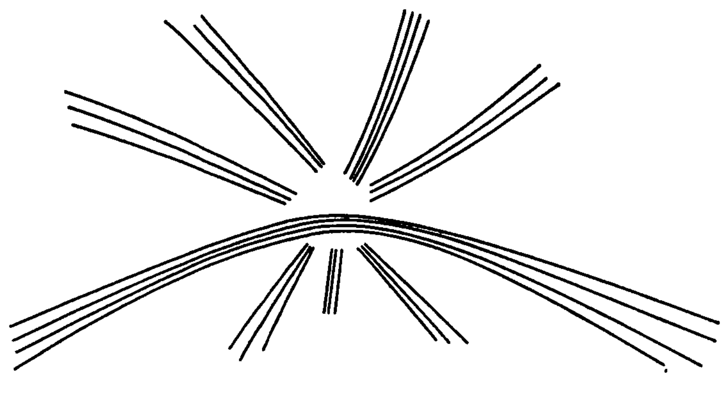
A corona is a series of coloured rings surrounding the sun or moon and this seems to be what was observed and described as the 'smaller circle of light'. The corona is produced by diffraction of light by water droplets—in this case—the altocumulus cloud.

## AURORA

### Norwegian Sea

*R.R.S. Shackleton.* Captain G. H. Selby-Smith. At anchor Vaag Fjord, Faeroe Islands. Observers, Mr K. J. Moore and scientific personnel.

9 March 1977. At 2115 GMT aurora in the form of a glow was observed to the north. Five minutes later the form changed to several rays and then to a rayed arc in active form with moderate brightness; elevation of the lower edge was about 30°. At 2140 coronal rays centred directly overhead formed, see sketch. This phenomenon was observed for about 10 minutes when the form changed again to rays and then to patches before disappearing completely at 2200.



Weather conditions at the time were as follows: dry bulb 6·4°C, wet bulb 5·2, sea temp. 6·0.

Position of ship: 61° 27'N, 06° 47'W.

*Note.* Auroral rays overhead always appear to converge to a point called the magnetic zenith which is displaced from the overhead zenith towards the equator by an amount depending on the distance from the geomagnetic axis pole. For the British Isles, for example, the magnetic zenith is about 20° south of the overhead zenith. When rays surround this point they are said to be coronal.

## RADAR ECHOS AND BIOLUMINESCENCE

### North Atlantic Ocean

m.v. *Ebani*. Captain A. W. Richards. Freetown to Liverpool. Observers, the Master and ship's company.

18 March 1977. Throughout the day various spurious echoes had periodically appeared on the radar screen. The echoes, which resembled those of small clusters of fishing vessels, rarely closed the vessel to less than a range of 8 n. mile before disappearing from the screen. At 2200 another such cluster appeared on the radar screen directly ahead at a range of 10 n. mile. This cluster began to spread out on either side of the bow and a number of stronger echoes appeared in it until it gave an impression similar to that expected from a coastline. The echoes behaved as stationary objects and closed to a range of 5·5 n. mile when they again began to spread out until the ship was at the centre of a complete circle of echoes, none of which closed to within less than 5 n. mile of the ship. The radar appeared to be functioning normally throughout.

At about this time, the sea took on a milky-white colour and the beam from the Aldis lamp revealed a mass of luminescent organisms each about the size of a flash-light bulb—yet each clearly distinguishable from the other. This phenomenon continued for about 45 minutes after which time both the luminescence and the various spurious radar echoes disappeared.

Throughout the day, and particularly during the period when these phenomena were observed, there was a strong fishy smell.

Weather conditions at the time of the observations were as follows: dry bulb 23·0°C, sea temp. 20·8, barometric pressure 1010·4 mb, wind NW, force 2, visibility 6 n. mile owing to haze, slight sea and moderate to low NNW'ly swell.

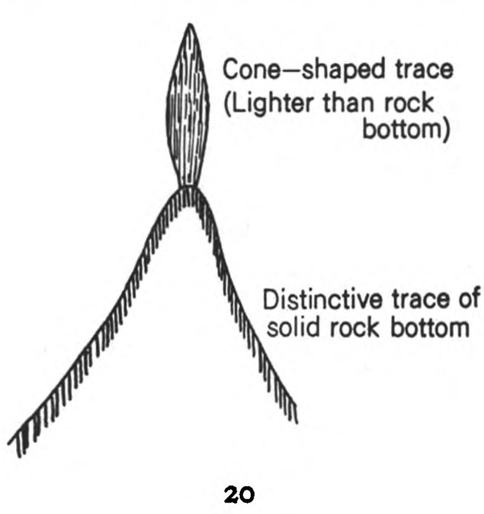
Position of ship at 2200: 16° 46'N, 17° 43'W.

## SOUNDINGS IN A VOLCANIC AREA

### South Pacific Ocean

s.s. *Remuera*. Captain K. E. Howard. Auckland to Panama. Observers, the Master, Mr C. R. Short, Chief Officer, Mr N. J. Shearman, 3rd Officer and Mr R. P. Bate, Radio Officer.

11 February 1977. Whilst passing to the south of Española Island in the Galapagos Group we were running our echo sounder; this particular echo sounder gives a very distinct trace of the sea bed to a depth of 600 fathoms. Between 1130 and 1430 GMT we were receiving a very detailed trace of the sea bed which was extremely undulating, rising in sharp peaks and falling again; this general picture left no doubt in our minds that it was volcanic in origin. We were interested to note that occasionally where the trace reached a peak, in the region where the crater would be expected, there rose a faint but distinctly elongated cone-shaped trace on the echo sounder



paper. This we did not take to be solid bottom as the trace of rock could be clearly seen. Within the period, about five of these were noted, some being large and others small, see sketch.

We suggest that these phenomena could be either volcanic action or thermal activity due to the volcanic nature of the bottom. Any thermal activity would change the density of the water, thus being received as an echo and traced on the paper.

Throughout this passage a continuous watch was kept on the sea temperature hopefully to find a variation in it but it remained a steady 26·4°C. The sea surface at the time was rippled by a SE'ly force 1–2 wind and there was a low SW'ly swell, and no disturbance was noticed whilst passing over this phenomenon. However, a fall of two degrees in the sea temperature was observed when the area had been cleared at 1730.

Position of ship: 00° 24'S, 88° 06'W.

## ROCKET

### North Atlantic Ocean

m.v. *King George*. Captain P. C. Byrne. Amsterdam to Mississippi. Observer, Cadet S. P. Bennett.

15 February 1977. At 2315 GMT a bright light was observed rising rapidly from behind a patch of low cloud one point on the starboard bow. It continued to climb at an angle of about 70° until it reached the altitude of Venus when it started to recurve earthwards. As the object reached the southernmost part of its turn it separated into two parts, the first part, now not so bright, continued its downward spiral, and the second and much dimmer part proceeded quite rapidly around the sky climbing at an angle of about 15° to the horizontal.

The second part resembled a heavenly 'bow-tie'. It had a brighter central body, oblong in shape, and a dim white fan-shaped light, bright enough to obscure the stars, behind it, spreading out sideways from the short sides of the central body. The 'bow-tie' became dimmer as it moved and eventually faded out near Sirius—about five points on the port bow. It was assumed that this was a rocket as it appeared to come from the direction of Cape Kennedy.

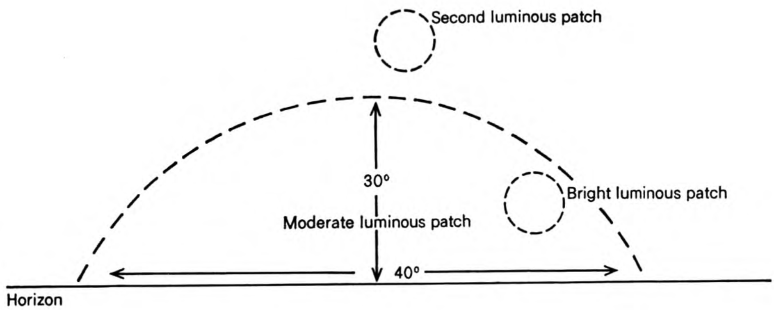
Position of ship: 30° 40'N, 54° 00'W.

## UNIDENTIFIED PHENOMENON

### North Atlantic Ocean

m.v. *Kinpurnie Castle*. Captain M. Brackenbridge. Cape Town to Antwerp. Observers, the Master, Mr C. A. Neave, 3rd Officer and Mr T. J. Martel, Radio Officer.

24 March 1977. At 0855 GMT the look-out observed what appeared to be a searchlight shining downwards for about 10 seconds on a bearing of 300°T and 20° above the horizon. This light was extinguished and was replaced by a luminescent patch of approximately one degree in diameter. A semi-circular area of overall moderate




luminosity formed about the luminescent patch. This took about three minutes to form and the dimensions are shown in the sketch.

When this had formed another luminescent patch was also observed above the semi-circular area and after a total period of seven minutes the phenomenon dispersed completely.

Weather conditions were as follows: dry bulb 19·0°C, wet bulb 17·0, barometer reading 1016·7 mb, good visibility, no cloud.

Position of ship: 23° 05′N, 17° 25′W.

551.510.42:551.556.4

# Aeolian Dusts

By Dr L. R. Johnson
(Department of Mineralogy, British Museum (Natural History))

## Introduction

Sea haze, a phenomenon caused by wind-transported (Aeolian) dust, has been known to mariners for several centuries. One of the earliest known observations was made by the Arabian geographer Edrisi in the twelfth century, and only occasional scientific interest has been shown since Charles Darwin's reports in the 1840s. The scientific study of Aeolian dusts over the oceans only began in earnest within the last few decades. Aeolian dust consists largely of fine-grained mineral particles blown off land surfaces and also, *inter alia*, cosmic dust, organic debris, salt particles and man-made pollution.

Aeolian dust clouds are at their thickest over the source area or at sea in the immediate vicinity of off-shore winds from arid regions. Mariners most frequently encounter sea haze off the west coast of Africa in the vicinity of the Cape Verde Islands where visibility is often limited to less than one n. mile by reddish-brown dust blown out to sea after dust storms in the region of the Sahara Desert. Visual observations by mariners over the years have enabled 'frequency-of-occurrence' maps to be made for the distribution of maritime Aeolian dusts, see Figure 1. It can be seen that dust is frequently transported over Britain, particularly during the summer months by winds blowing northwards from the Sahara Desert. These dusts result in reports of 'red dust falls' or 'blood rains' over the Alps, western Europe and occasionally, as in 1968, over Britain.

## Generation and transportation of Aeolian dust

From Figure 1 it can be seen that sea hazes only occur to any major extent where prevailing winds blow off arid land areas.

In order for the wind to pick up dust there must be a land surface of loose, fine-grained soil free of vegetation. Even grassland or scrub such as occurs in the tropics severely reduces the velocity of the wind at the soil surface and hence its effectiveness as an eroding and transporting agent. Similarly, in temperate regions, the generally damper soils and increased vegetation, or even snow cover, reduce the potential 'erodability' of the land virtually to zero. These and other effects are clearly revealed by the data gathered over the last few years concerning the actual quantity of dust occurring in the atmosphere over the oceans. Figure 2 for example shows the average dust-loadings found over the Atlantic Ocean for each $5° \times 10°$ rectangle or $10° \times 10°$ square. The dust-loading is simply the weight of dust per unit volume of air and is expressed in millionths of a gram per cubic metre ($\mu g/m^3$). Notice the similarity between this map and Figure 1.

The wind must have a certain velocity in order to initiate significant movement of the soil surface. Indeed, one of the criteria on the Beaufort Scale for force 6 winds is that 'dry dust commences to be raised from the ground surface'. The 'transporting capacity' of the wind is proportional to the sixth power of its speed, i.e. doubling the wind speed increases its effectiveness as a transporting agent not two-fold, but sixty-four fold. Turbulent wind is much more effective in raising dust than a smooth laminar air-flow. Air turbulence can be increased locally by rough terrain, buildings, land form, et cetera. Similarly tornadoes or the smaller desert 'dust-devils' are very effective in localized regions. Dusts over deserts may be raised to an altitude of several kilometres, but it is rare for Aeolian dusts to be raised above the troposphere, the inner atmospheric shell below about 10 km., and in which our winds blow. Land-derived dusts are occasionally raised into the stratosphere by nuclear or

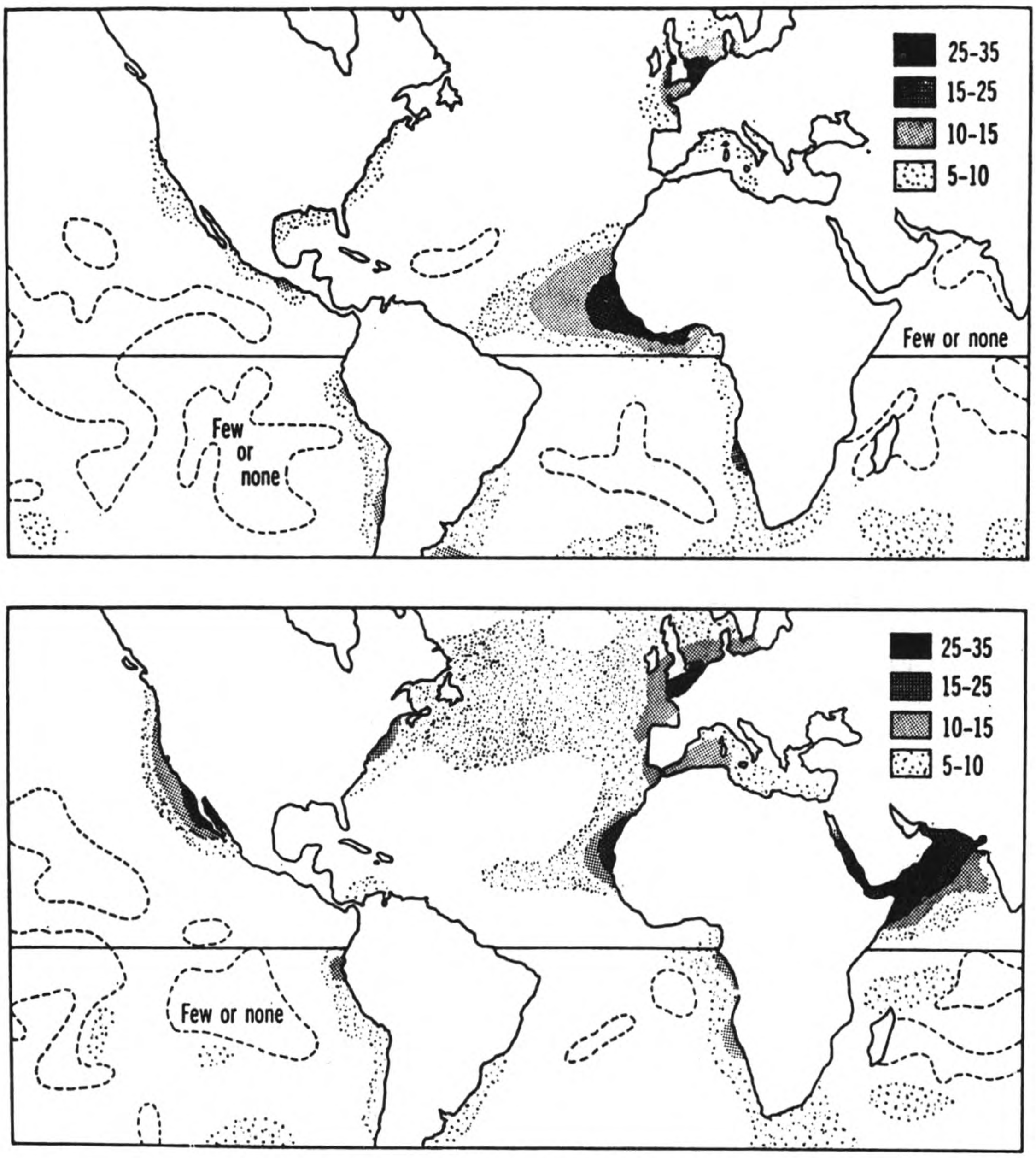



**Figure 1. Atmospheric transport of Aeolian dust as indicated by the average haze frequency during the northern winter (upper map) and summer (lower map). Frequencies are given as percentage of total number of observations (after G. Arrhenius)**

volcanic explosions such as that of Krakatoa in 1883 which led to a world-wide distribution of dust and associated phenomena such as vivid red sunsets visible for several months after the event.

To the generation and transport of 'natural' Aeolian dust from land surfaces may be added a .smaller but nevertheless important contribution resulting from the effects of man on the environment.

The more direct man-made effects have been noted in many areas where dust collections have been made. The presence in the atmosphere of the mineral talc, not particularly common in soils, is taken as indicative of crop dusting where it is used as a carrier for the active ingredients. In fact, D.D.T. and many other man-made organic chemicals have now been identified as trace constituents of Aeolian dusts in many areas. Various forms of urban pollution from sulphur and carbon smoke particles to lead from motor vehicle exhausts and foundry metal particles have been monitored, analysed and studied for many years in our towns and cities,

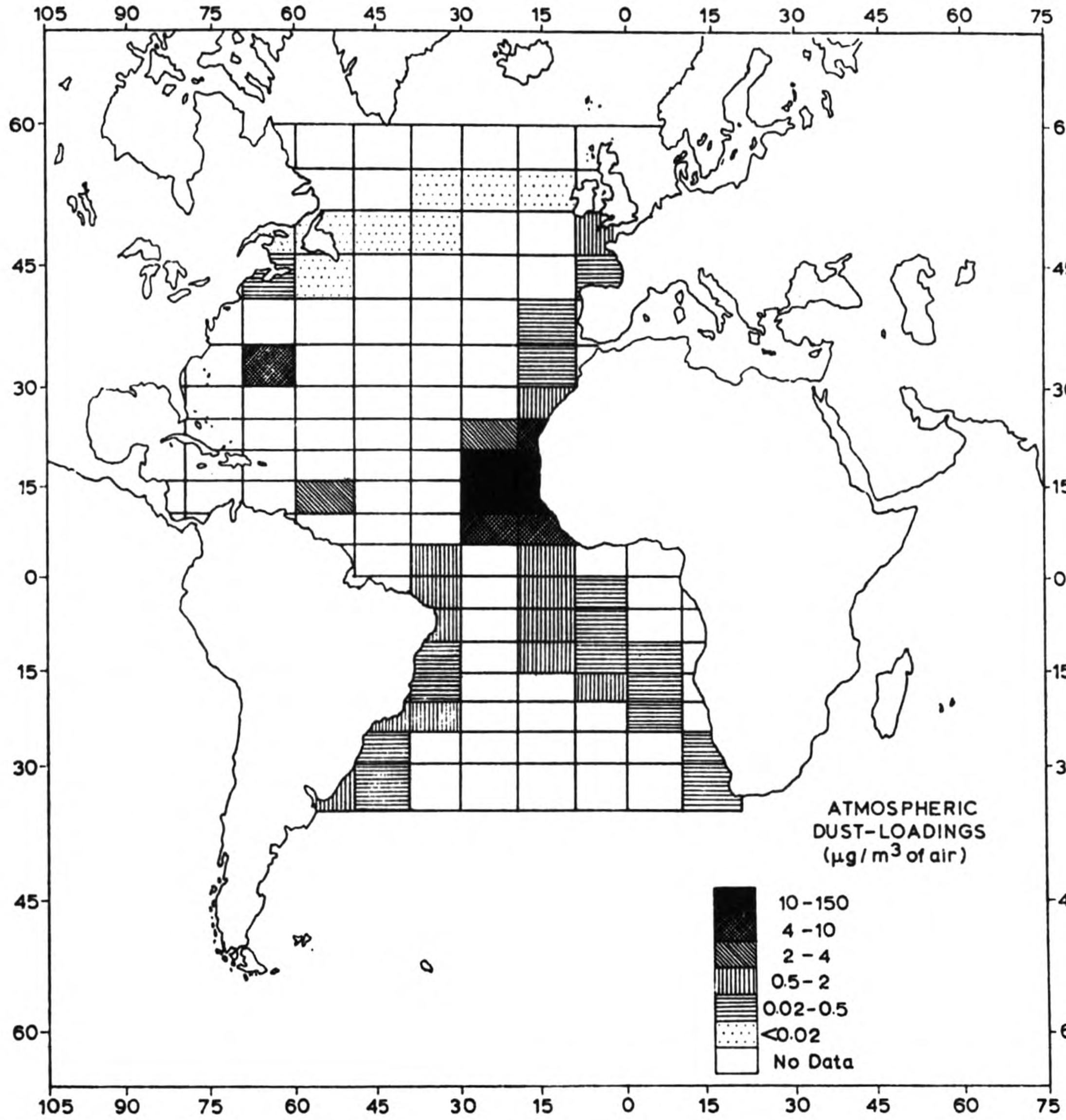



**Figure 2. The distribution of Aeolian dust in the lower atmosphere over the Atlantic Ocean**

but some forms of pollution can equally well be found in the supposedly cleaner maritime atmosphere. This is more noticeable in the Northern Hemisphere Westerlies where industrialization is greatest and natural Aeolian dusts are at a minimum. Here particles from ships' smoke occur frequently in the samples, mostly in the form of open structured coke-like balls a few tens of microns ($\mu$m) in size. During one cruise to the USA in the summer of 1969 unusually high dust-loadings were encountered off New York and Boston and found to consist largely of carbon particles and fly-ash spherules; this plume of urban pollution could be traced for a considerable distance across the Atlantic Ocean. The atmospheric concentration of fly-ash spherules is given in Figure 3 and clearly shows a marked increase towards the coast of North America.

## Particle size distribution of Aeolian dusts

The particle sizes and particle size distribution (the distribution by weight or number of particles of the different size ranges in a particular sample) are important parameters in understanding the generation and transport of Aeolian dusts. When initially being raised from the soil surface, there is no distinct dividing line between those particles which are trundled along the soil surface (surface creep), those

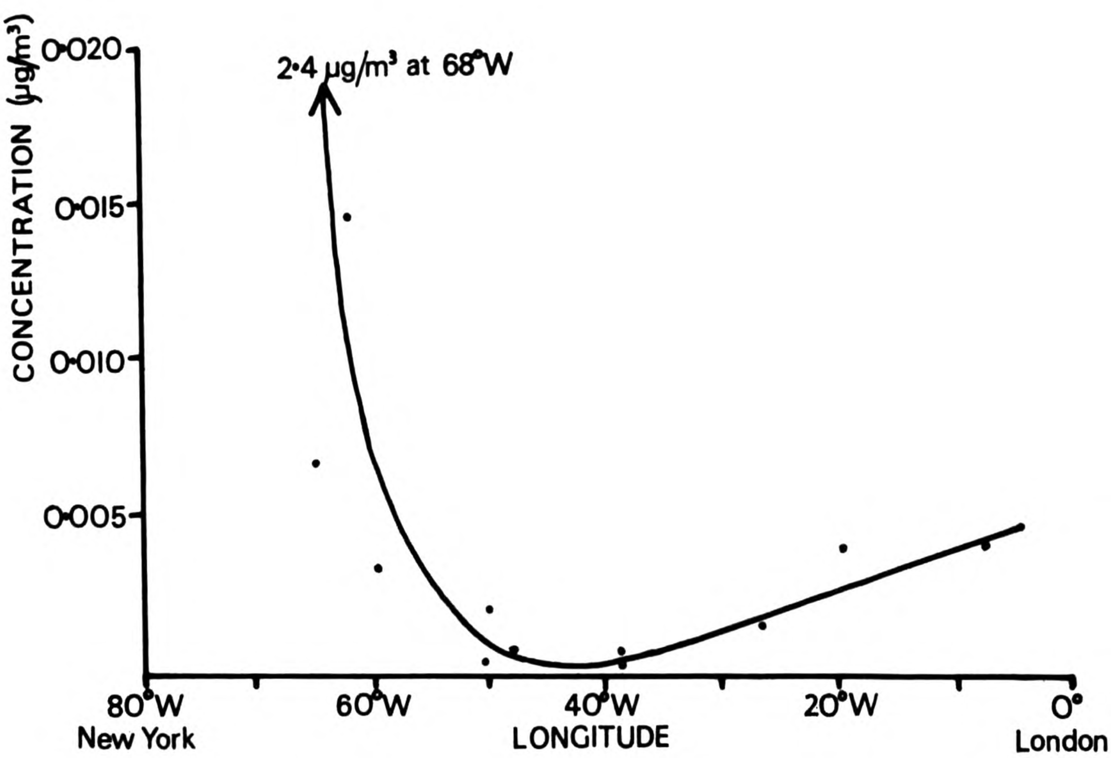



**Figure 3. The atmospheric concentrations of fly-ash spherules in the North Atlantic Westerlies. The curve represents the average of all data for each 10° of latitude**

travelling in a bouncing motion (saltation) and those that are truly air-borne. Particles larger than 100μm (=0·1 mm), unless a dust storm is encountered, tend to travel by surface creep or saltation and hence are not considered to be Aeolian.

As might be suspected, the smaller the particles become the easier it is, up to a point, for the wind to move them because of their decreasing weight. However, as their size and weight decrease, so does their cross-sectional area as presented to the wind force, which decreases with the square of their size. Thus, although their size may only decrease to half, the effective force on them decreases to one quarter. The minimum wind velocity (relative to size) required to entrain a particle in a wind stream (the critical shear velocity) has been demonstrated in the laboratory to be minimal for typical soil particles of about 100μm. Thus it becomes more difficult initially to entrain particles below this size because of the decreasing wind forces acting upon them, whilst it is also more difficult to keep particles above this size in suspension because of their rapidly increasing weight.

In the immediate vicinity of a dust source area considerable winnowing occurs owing to the larger particles rapidly falling out under the influence of gravity leaving the finer grades remaining preferentially in suspension. In a thick dust storm over land the dust-loading can be as high as 1 000 000 $\mu g/m^3$ with many particles larger than 1000 μm, i.e. one mm. This is rapidly reduced by gravitational fall-out of particles above 100 μm, so that over the open ocean dust-loadings are usually less than 10 $\mu g/m^3$, with particles mostly smaller than 5 μm. The rapid reduction in the particle size of Aeolian dusts as they leave the source area is shown in Figure 4.

## Aeolian dust over and under the oceans

Once the dust cloud has left the source area and the larger size fractions have been deposited out of the atmosphere, gravitational fall-out becomes of lesser importance. It can be seen from Figure 4 that typical particle sizes of Aeolian dusts over the open ocean are only a few μm, and particles of this size fall out so slowly that they could be carried completely round the globe before falling to earth, again under the

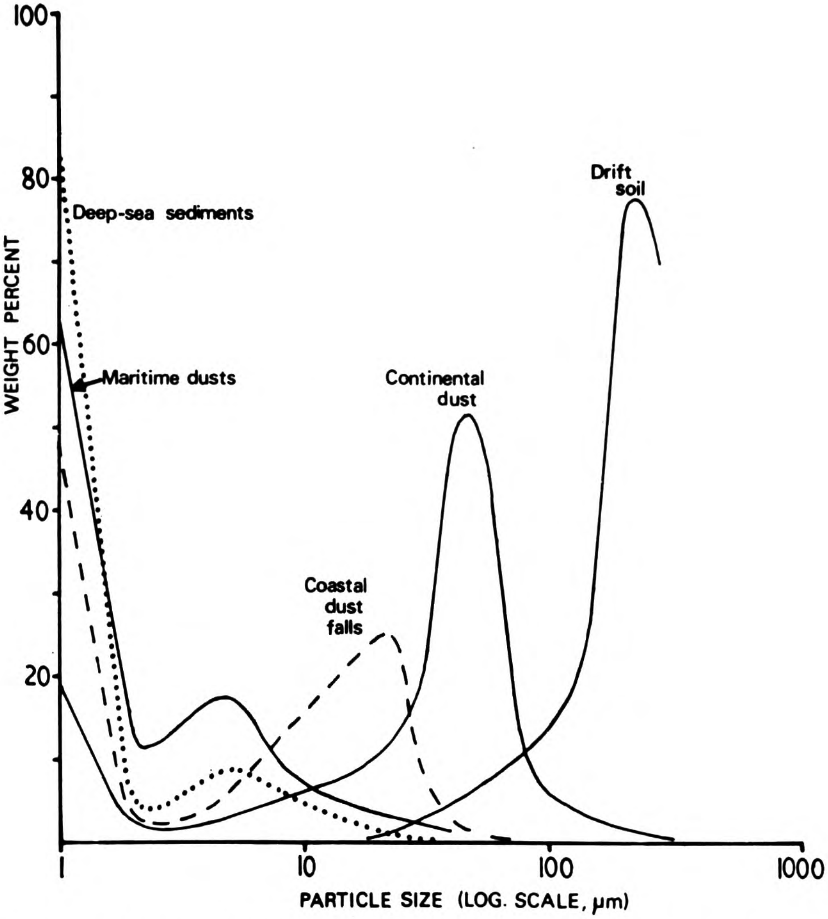



**Figure 4. Particle size distribution in dust samples measured at various stages along their atmospheric transport path**

influence of gravity alone. In practice this does not usually happen. For particles less than about 20 μm, the main agent returning them to the Earth's surface is rainfall. The average global frequency of rainfall is about every 10 days and hence a dust cloud leaving the west coast of North Africa still has a good chance of travelling across the Atlantic and reaching the Bahamas or Bermuda, a journey which takes a similar time, where measuring stations have been set up.

The recent interest in measuring quantitatively the amount of dust transported in the atmosphere is largely the result of work carried out in Barbados by Dr D. W. Parkin of Bath University. Originally, Dr Parkin was interested in cosmic spherules, the rain of very fine debris resulting from the fragmentation of the meteorites which continually enter the outer atmosphere of the Earth. To this end he set up a collecting station on Barbados in 1965 in the belief that the North-East Trade Winds arriving there would be relatively clean after their journey of some 5000 n. mile across the Atlantic, and hence that the spherules, which occur very sparsely, would not be 'drowned' in a deluge of local Earth debris. In practice, however, he collected large quantities of reddish-brown dust which was subsequently proved, partly on the evidence of its fresh water diatom content, to be of African origin. Since then collections made over several years have demonstrated the quantity of dust blown across the Atlantic and also the marked seasonal variation (about a tenfold reduction in winter) and the loss during transport (again about a tenfold reduction on crossing the Atlantic). However, the similar composition and particularly the particle size distribution of dust leaving the African coast and reaching the other side of the Atlantic, both support the conclusion that loss during transport is due to rainfall rather than gravitational fall-out.

The present author's interest in Aeolian dust is not so much in its meteorological aspects but in its importance in the formation of deep-sea sediments. There are three major components of oceanic sediments which can loosely be defined as: 'authigenic'—sediments which have been formed out of soluble components in the water, 'lithogenous'—those which are formed from the solid particulate detritus from the continents and usually transported to the ocean via rivers but also as Aeolian dust, and 'biogenous'—the most important fraction which consists of the tests or tiny skeletons of oceanic plankton, usually formed of calcium carbonate or, in cooler waters, of opaline silica. The rate of deposition onto the sea-bed of the organic fraction varies greatly with the concentration and productivity of the living plankton in the surface waters. Despite dissolution of the shells in the deeper waters, below what is known as the calcium carbonate compensation depth or 'lysodine' at about 4000 fathoms, deposition of these organisms is several centimetres per thousand years, whereas that of the land-derived fraction is only about one millimetre per thousand years.

Thus a sediment core a few metres long taken from a calcium carbonate-free area may 'record' several million years of depositional history. Much of this sediment is derived from rivers, but the study of Aeolian dusts over the last few years has shown that in areas of high dust production, they may provide a significant fraction of the sediments. For instance, in the Atlantic Ocean, semi-quantitative calculations based on the average dust-loadings, the average dust cloud 'ceiling' (taken as 3·5 km) and the average atmospheric dust 'residence time' (taken to be 10 days, the same as rainfall intervals) indicate that whereas in the South Atlantic Aeolian dusts contribute less than 10 per cent of the lithogenous material in the sediments, in the North Atlantic, under the North-East Trade Winds, the contribution may well be over 50 per cent.

## Some problems of scientific interpretation

This account has given only a brief resumé of our knowledge of Aeolian dusts as they may affect the mariner. To the scientist several problems remain. Firstly, mineralogical, chemical and particle size analyses of dusts, sea-water detritus and underlying sediments in any one area are frequently very similar, and hence it is very difficult to distinguish between the different origins and transport mechanism of the various fractions. However, we are somewhat fortunate in the North Atlantic where there is a considerable output of Aeolian material from the arid regions of North Africa but only limited river output. Thus, if the Aeolian dusts were to have, say, a mineral assemblage distinguishable from the other sediment sources in the North Atlantic, it ought to be possible to trace their distribution patterns, if any, within the oceanic sediments. Again we are fortunate in this area in that the Aeolian dusts from North Africa are rich in quartz when compared with the average deep-sea sediment and also contain trace amounts of dolomite (magnesium-calcium carbonate), a mineral appearing to originate from a fairly restricted area round the Spanish Saharan coast. The distribution maps for these two minerals are shown in Figures 5 and 6; both clearly show a 'balloon' off the West African coast under the path of the North-East Trades.

Dolomite is a good indicator of the influence of the North-East Trade Winds,

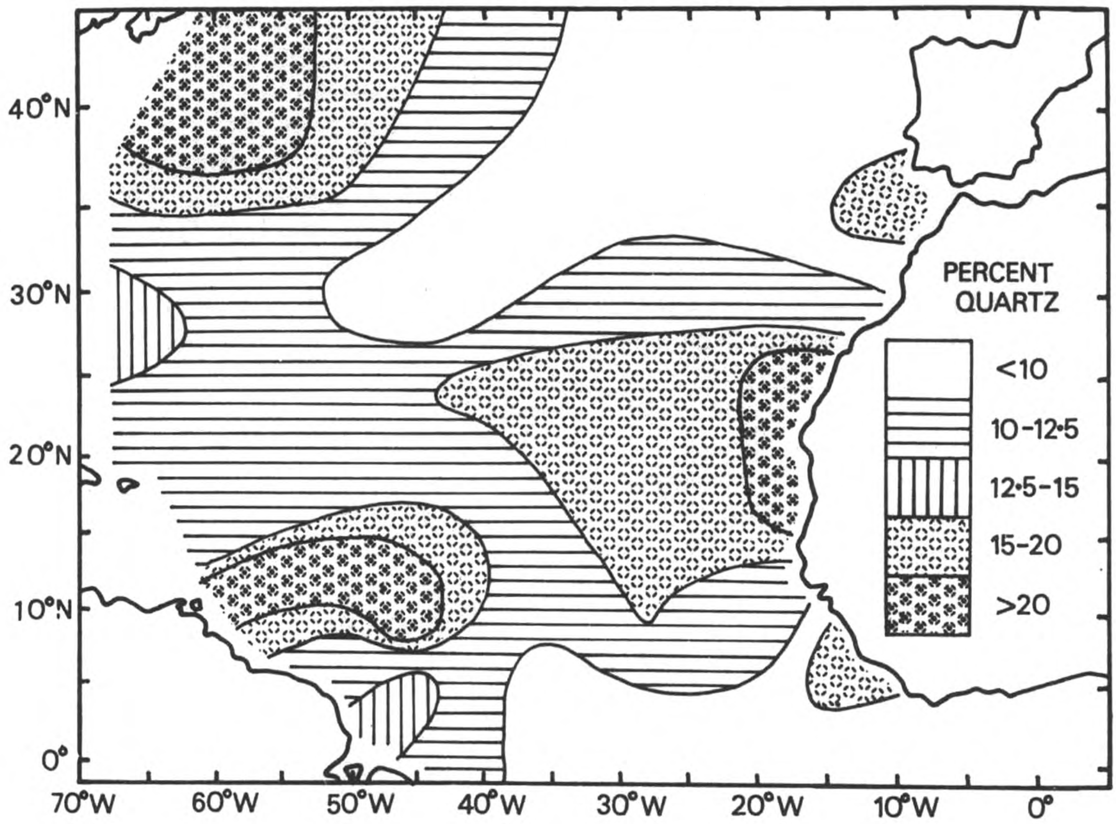



**Figure 5. Distribution of quartz in the North Atlantic**

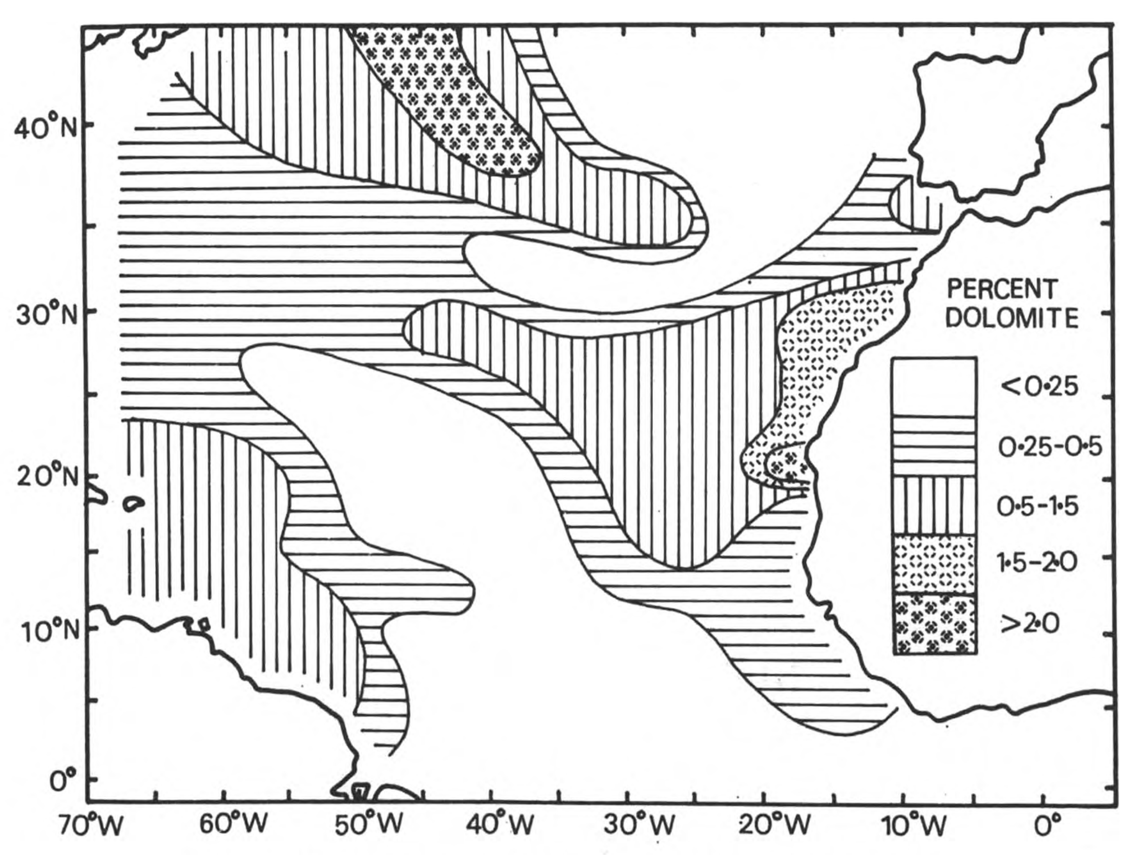



**Figure 6. Distribution of dolomite in the North Atlantic**

there appearing to be no other source in this area of the North Atlantic. However, its concentration is close to the minimum detection limits of the analytical method and theoretically it could also be formed authigenically in sea-water. Similarly, although the contribution of Aeolian quartz is quite clear from Figure 5, there is in addition a 'background' including a large contribution from the Amazon and Orinoco outflow systems. In order to extract more useful information from such mineralogical analyses, it is possible to calculate a 'coefficient of similarity' between the composition of each sediment sample and that of an average dust. This has been done by the author using the analyses of the minerals quartz, total clay minerals, dolomite and plagioclase feldspar as references. The results are presented in Figures 7 and 8. Figure 7 compares the sediments to an average airborne dust collected by the mesh technique (see 'Methods of collection') over the mid-Atlantic, whereas Figure 8 compares the sediments to the average composition of dusts which fall-out under gravitation on ships near the coast. The closer the coefficient is to unity then the closer the similarity of the compositions. As might be expected, the truly airborne dust corresponds closest to deep-sea sediments off North Africa, whereas the gravitationally deposited dust corresponds closest to the near-shore sediments. This work, together with consideration of the sedimentation rates of the deep-sea sediments in this area, supports the conclusion that this source of sedimentary material is quantitatively as important as river-borne sediments at this latitude.

A second problem concerns the very existence of mineralogical distribution patterns within the sediments which are difficult to explain. A typical sediment particle of 2 $\mu$m falls through sea-water at approximately 0·3 metres per day or about 110 metres per year, thus taking something like 30 to 40 years to reach the bottom of the average oceans. Within this time one would expect the suspended sea-water detritus to be completely mixed so that no distribution patterns would be

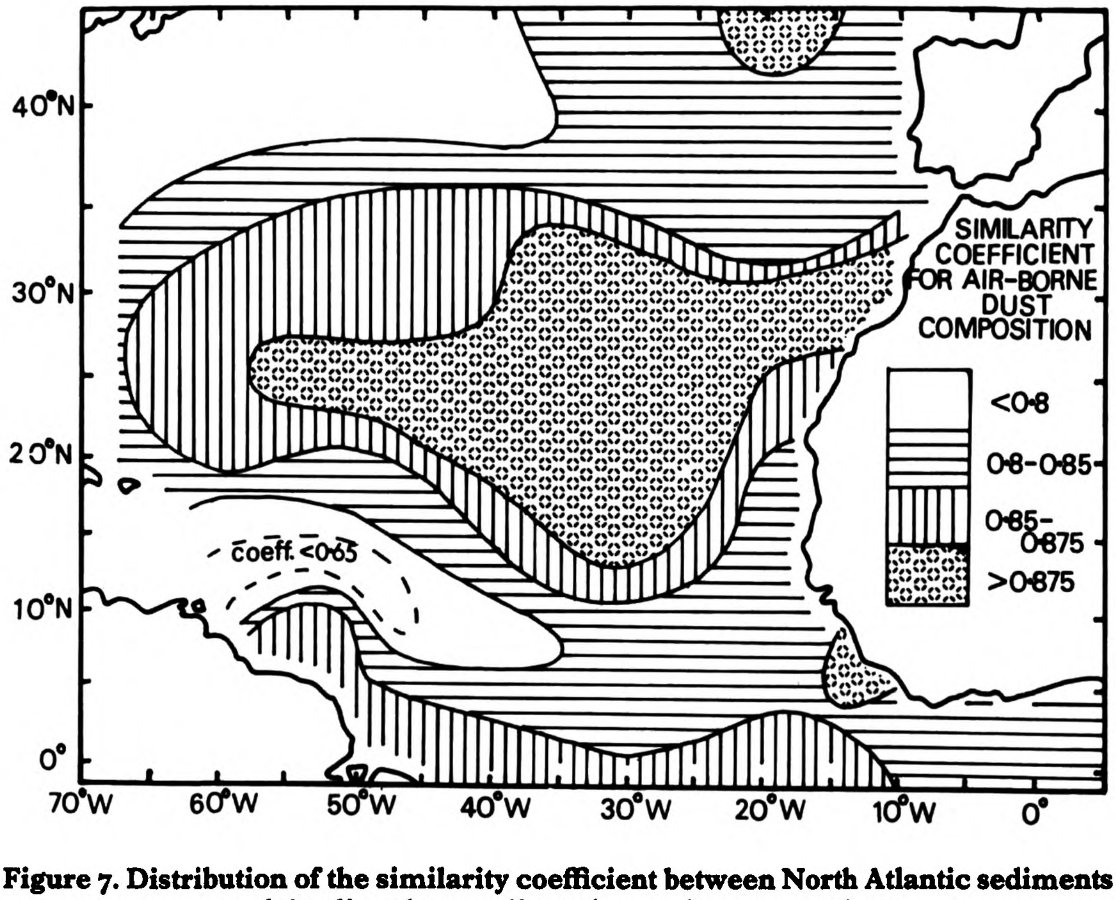



**Figure 7. Distribution of the similarity coefficient between North Atlantic sediments and Aeolian dusts collected over deep-sea regions**

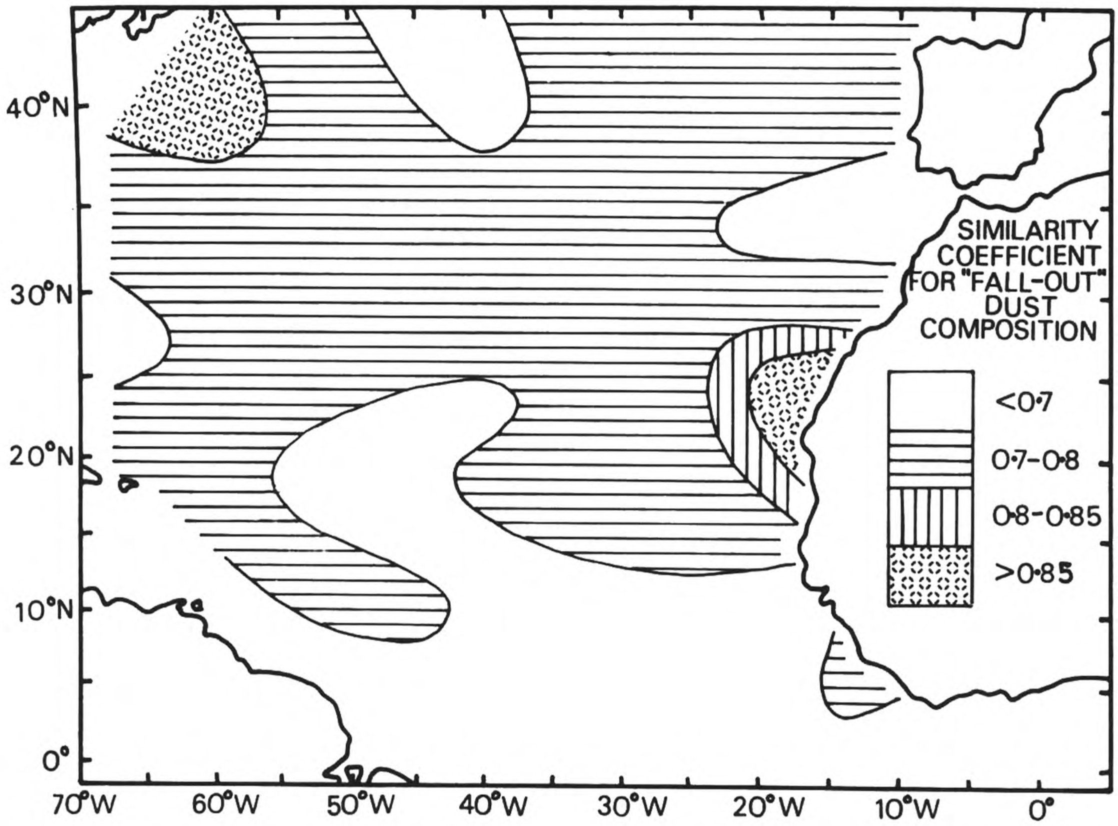



**Figure 8. Distribution of the similarity coefficient between North Atlantic sediments and Aeolian dust-falls collected on ships off the North African coast**

discernible within the sediments. Thus it has been concluded that the particles must be settling considerably faster than they would under gravity alone, and mechanisms suggested to explain this include aggregation into larger particles and the formation of faecal pellets by bacteria. This problem requires considerably more research.

**Methods of collection**

The collection of Aeolian dust at sea can usually only be carried out on board ships and this imposes serious limitations on collection methods. Because most vessels are commercially operated and hence must remain continually steaming, a sample of reasonable size (about one gram) has to be collected in the few hours before one air stream is left and another encountered; further, the equipment must be robust and portable. For this reason air pumps and filters are not adequate, although they may be useful in high dust-loading areas on land. In fact, small portable air pumps and filters are used by the Health and Safety Executive to monitor air pollution in factories.

The usual shipboard method of collection is to suspend one metre-square panels of woven 0·33 mm monifilament man-made fibre with a 0·59 mm mesh suspended at least 3 metres above the bows in the undisturbed air stream. Approximately half the air incident on the mesh passes directly through the holes. The remaining half of the air is forced to veer round the fibres whilst the particles contained in it, because of their momentum, tend to continue straight on their flight path and strike the fibres to be retained by the thin film of saline moisture which quickly develops at sea. Thus, the collection method is a process of impingement and retention rather than filtration. The meshes can then be stored carefully and the dust washed off in clean water back in the laboratory. The volume of air that has passed through the meshes is monitored by an anemometer, and with the weight of the dust collected, the dust-loading can be calculated. Although up to one million cubic metres of air may be sampled thus in half a day, in the North Atlantic Westerlies only 5 milligrams may be collected whereas in the North-East Trades 50 or 100 grams might be recovered.

Although the mesh method of collection is very useful and can sample very large volumes of air in a relatively short time, it does suffer from its efficiency being to some extent particle-size dependent. Particles smaller than 6 $\mu$m tend increasingly to veer around the mesh fibres with the general air stream rather than be captured (Figure 9), although in practice collection efficiency is slightly better than this owing to some aggregation. Practical tests indicate that for most dusts the overall collection efficiency is around 50 per cent.

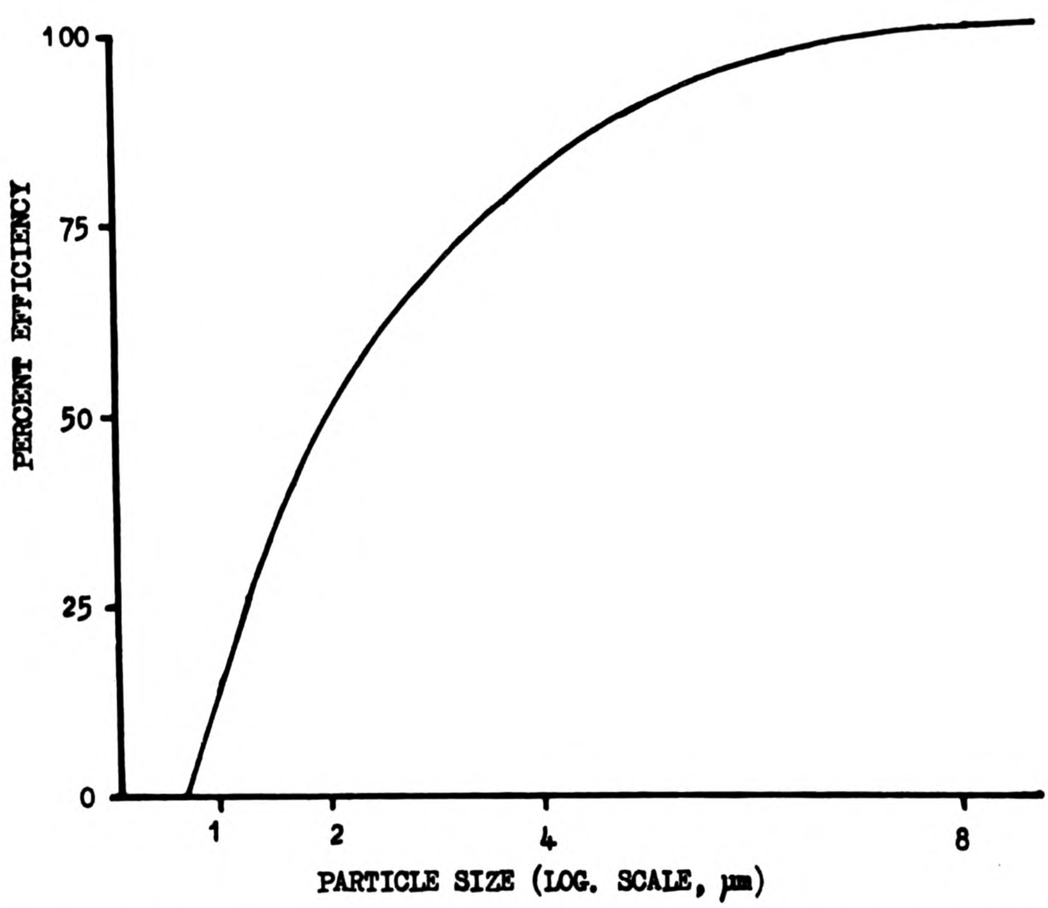



**Figure 9. Curve showing the percentage efficiency of collection for different particle sizes using the mesh collection technique**

## Collections made by ships

Reports or even collections of dust that have fallen on ships during sea-hazes and made by the simple expedient of washing or wiping them off the paintwork are frequently passed on to us by ships' complements. Although this method is scientifically rather more crude than that described above, it has provided much useful information to the 'dust-collector' or 'koniologist'. Such collections are usually made off the coast in the wake of land dust-storms and contain mostly gravitationally settled material, and hence are coarser than the remaining atmospheric dust-load. These samples are always of value and are most welcome. Together with the sample we receive much necessary information such as the wind force and direction, collection locality and other meteorological information such as the wet- and dry-bulb thermometer readings. Such collections can be of considerable size, a sample recently received from m.v. *Strathbrora* collected off the west coast of Africa weighed 40 grams. Visibility is another useful piece of information which can be used as a rough indication of the amount of dust in the atmosphere. Obviously an inverse relationship exists between visibility and dust-loading and it has been shown on land that a visibility of one mile is indicative of a dust-loading of about 20 000 $\mu g/m^3$. It is also valuable to be told the size of the surface area from which the sample was collected and the duration of the collection. From this a sedimentation rate can be calculated for the dust-fall and related to its particle size distribution. To this end, when entering a dust-haze, a simple but useful collection method is to spread out a clean plastic sheet—held down with tape or weights—which can then be subsequently folded up and packed in an envelope.

The author would like to take this opportunity to thank all the owners, masters and crews of the merchants ships who have assisted in our research by allowing us to collect samples on passage aboard the ships and for collecting dusts themselves and for forwarding them, with much useful information, to this Museum.

551.509.58:551.467:629.12

# What Constitutes a Modern Ice Information Service?

By W. F. Ganong

(Atmospheric Environment Service, Canada)

(Paper presented at the World Meteorological Organization (WMO) Technical Conference on the Applications of Marine Meteorology to the High Seas and Coastal Zone Development. November 1976. Reproduced by kind permission of WMO.)

Canada is a country that has to contend with sea ice as a major barrier to shipping. My purpose here is to outline the basic framework that has been developed to provide an ice information service in support of shipping, an important factor to the year-round economy and development of a large portion of Canada's coast.

## Nature of the problem

The climate of the Arctic produces sea ice which covers most of the marine Arctic areas in the wintertime. During the summers, particularly in the areas close to large land masses, the ice melts and breaks up to the extent that normal shipping is possible through much larger areas. Winter and summer ice cover is delineated in Figure 1 by W. E. Markham. This sea ice, in some cases, can act as a floating bridge, but basically it is an obstacle to shipping, particularly in areas where pressure ridges have formed. However, it can be readily shown that with the availability of accurate and detailed ice information and its intelligent use, movement of ice-strengthened ships in many Arctic areas is possible and will be a key factor in future resource extraction from northern areas.

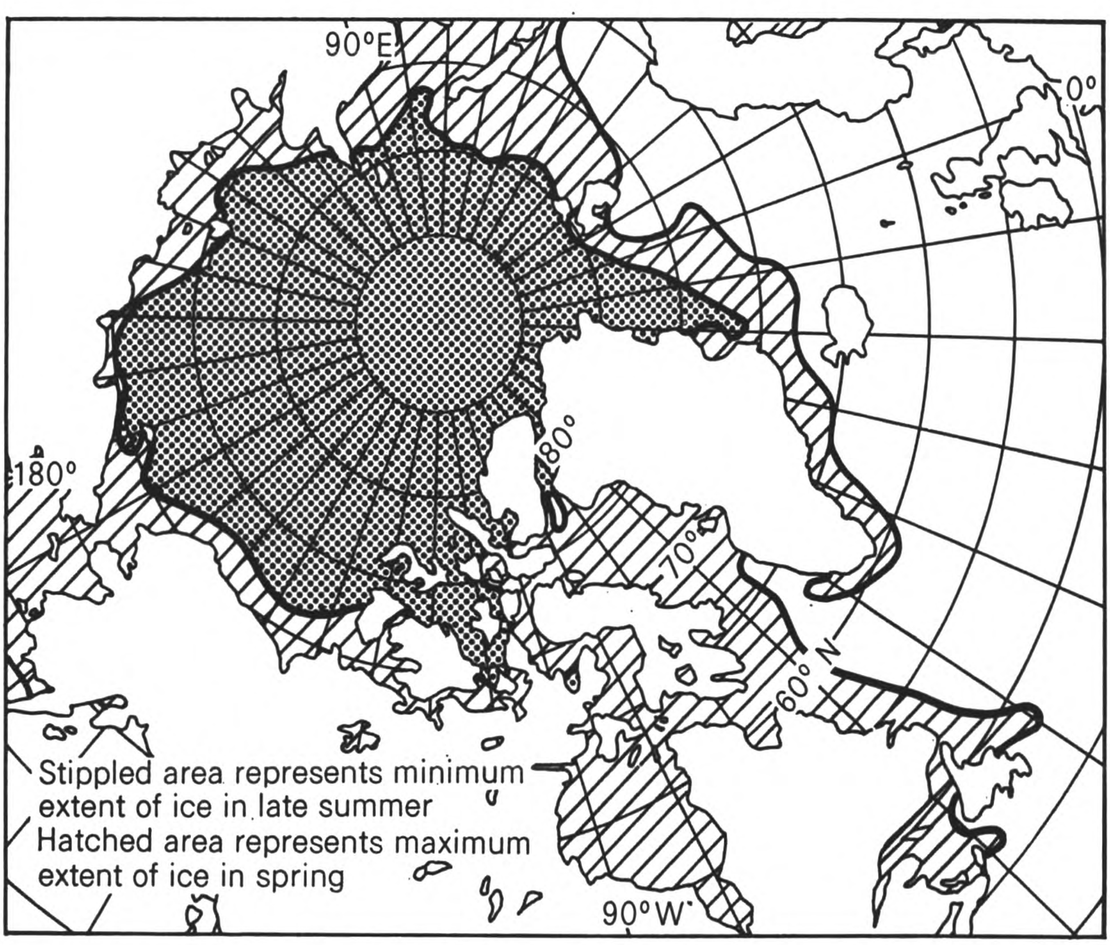



**Figure 1. Extent of winter and summer ice cover by W. E. Markham**

Although first-year ice, formed during one season, constitutes a barrier to shipping, multi-year ice, which has eliminated most of its brine content, is tougher than first-year ice and is even more difficult for ships to penetrate, even with ice-breaker support. The North American Arctic contains both first-year and multi-year ice. The islands of the Arctic Archipelago cause irregular distribution of the ice in the melt season. The degree of melt, and consequently the degree of clearing, varies from year to year as indicated in Figure 2 by W. E. Markham. In the open coastal areas, such as along the north coast of Alaska, the ice generally melts in the summer, leaving a period during which navigation can usually take place near the coast with the Arctic ice pack remaining some distance to the North; similar conditions prevail north of the USSR. Further south, over Hudson Bay and the Gulf of St Lawrence, first-year ice only is encountered; the same applies to the Baltic Sea. Ocean currents cause some anomalies, perhaps the two most striking being (a) the movement of heavy ice and icebergs down the Labrador coast where they become a menace to shipping as far south as Newfoundland waters, and (b) the Gulf Stream and prevailing winds that keep the Norwegian coast virtually ice-free.

## Data acquisition

Apart from local observations from ships and shore locations, the present prime method of obtaining ice data is by aerial ice reconnaissance. The present Canadian vehicle is the Electra aircraft equipped with visual observing facilities, ground-mapping radar, a camera array, an airborne radiation thermometer, a thermal mapper or infra-red line scanner and a laser profilometer. With the aid of these sensors an experienced ice observer can chart detailed ice coverage, including amount present, distribution, age, floe size, estimated thickness and extent of

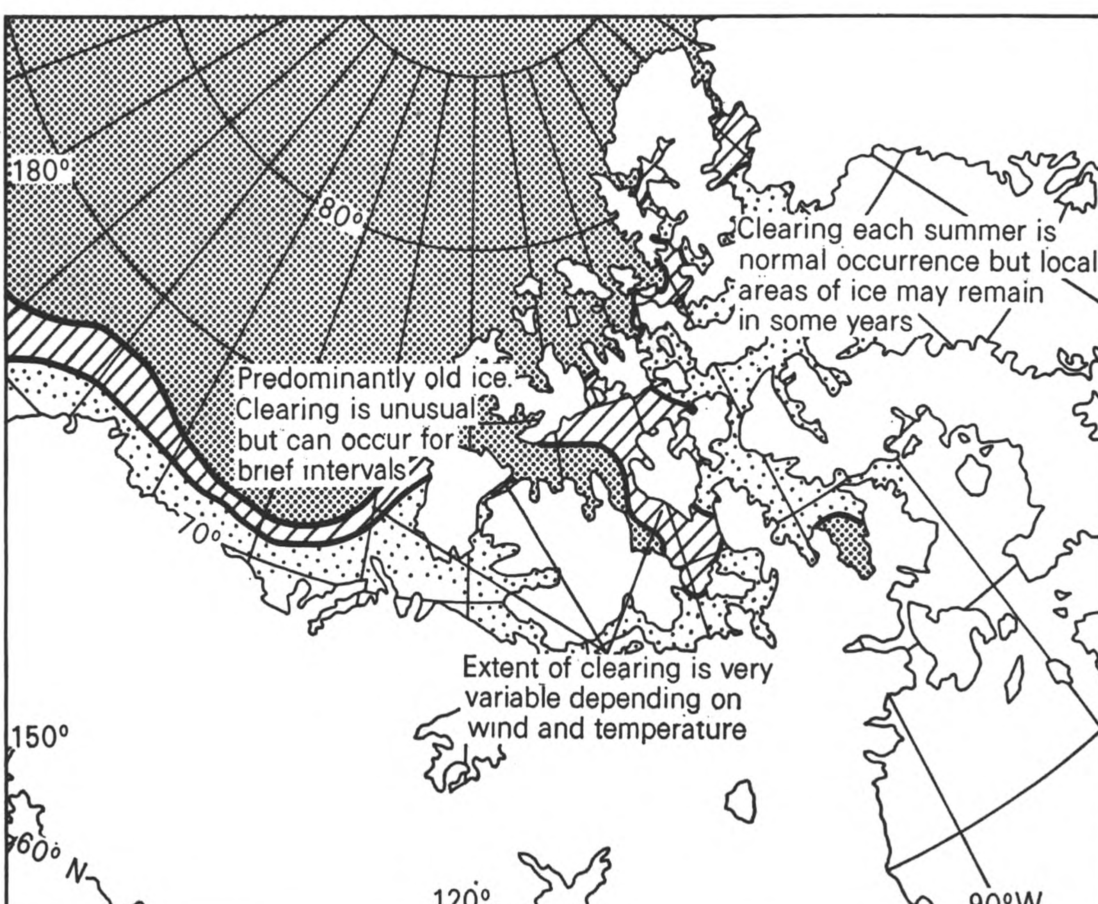



**Figure 2. Degree of clearing during melt season by W. E. Markham**

ridging and puddling, all of which are required by the ship operating in ice. As part of the ice observation it is fundamental that the aircraft navigation or positioning be of high calibre. In Canada, we find that dual Inertial Navigation Systems and dual Omega receivers give the required accuracy of aircraft navigation even in high latitudes.

A powerful new tool coming into use is the earth-orbiting satellite. When cloud and fog are not present, it provides excellent information on ice distribution. With refinement and with development of microwave sensing, it should, during the late 1980s, achieve the ability to collect virtually all the data on ice that is now acquired by aircraft. Sideways-Looking Airborne Radar (SLAR) is another powerful tool which has been used by the military and which several US agencies now are applying to the acquisition of ice data. In Canada we hope to add this system to the ice reconnaissance aircraft in late 1978. For purposes of ice reconnaissance, we are looking at resolution of about 20 metres out to a range of 30 n. mile which can be achieved by synthetic or coherent systems. It should be recognized that this is an expensive system, but because of the wide swath of coverage possible in both good weather and bad, it will cut data acquisition costs from approximately 40 Canadian cents per square nautical mile to an estimated 20 Canadian cents per square nautical mile.

The main deficiency in aerial ice reconnaissance data acquisition is a method to measure thickness of sea ice from the aircraft. Research and development is going on in Canada in this area and it looks as if we may have a suitable operating system in a few years.

### Data transmission and information distribution

In the area of communications it seems appropriate to address at one time the initial transmission of acquired data and also the information distribution to the ultimate user of the service. In some ways this is adequate, in others it is the weakest link in the ice information system. Usually ice is found in complex patterns which are frequently difficult to describe properly by words or a brief code for a small area. Add to this characteristics of leads, thickness, age, pressure and ridging conditions, and a pictorial method becomes essential. Facsimile systems now in use can transmit ice chart data which has been processed either by the ice observer or forecaster. It is excellent for passing observed ice charts for tactical purposes from the aircraft to the ship which it is supporting. However, as the area of data coverage becomes larger, limitations in present communications dictate a compromise between total area of coverage and the detail provided. Satellite data and SLAR imagery will provide such detailed information that real effort must be put into communicating this detailed intelligence directly to the data processing facility. Photo facsimile systems have been used in some cases, however, the most promising systems, at least for SLAR imagery, appear to be the digitization of the data and transmitting it in digitized form.

Passing detailed near real-time ice information to the user is the weakest link in the present system and will probably continue to be for some time to come, primarily because the high priority real-time user is the ship operating in ice. Although ground equipment is now expensive, communications satellites show some promise. The direct transmission of SLAR imagery to ships from a US ice reconnaissance aircraft is being followed with interest in Canada.

### Data processing (Forecasting)

Up to the present, ice forecasting has been carried out primarily by hand processes involving considerations of present ice distribution and its comparison with norms, ocean temperatures and currents, past, present and future weather conditions with particular emphasis on winds and heat transfer from the atmosphere to earth's surface, or vice versa.

The inter-relation of ice with weather is indeed strong at all times. The significant difference is that ice is usually slower changing than the weather and consequently the time frame of action for ice is roughly an order of magnitude slower. In a somewhat similar manner oceanography affects ice growth, movement and decay.

Weather forecasting is going through the change to becoming highly automated and numerical methods have been used for some time for analysis and prognosis of meteorological charts. With continued development, numerical methods are likely soon to become the broad scale basis for ice forecasting.

This year (1976) there is an interesting development of mesoscale weather and ice forecasting to support oil drilling in the Beaufort Sea near the coast in the Mackenzie Delta area. Here drilling is planned in the summer season when the ice has melted and moved off shore. A high-quality detailed and localized weather and ice formation service can provide the margin of safety for drilling to continue without risking catastrophe due to a sudden storm and/or the ice suddenly moving into the area and causing a major oil spill. Traditional ice-forecasting methods will continue, but detailed local wind forecasts produced by numerical methods will make available ice drift forecasts (based on wind) to augment the regular system. In developing this system, wind forecasts (and hence ice drift) will be updated every hour. Hopefully, before long, this system can be proven and adapted elsewhere in order that such detail can be provided anywhere it may be required.

**Data processing (Climatological)**

In addition to the availability of real-time data, there is a growing need for information on ice condition norms and departures from norms. These relate to development of the North, in particular to ship design, harbour development and pipeline crossing. Concentration of ice by types can be published in atlases. However, there is significance to occurrence, orientation and size of pressure ridges and characteristics which should also be processed. The problem is to find a storage and retrieval system capable of taking data from the various sources, including sensors, and storing it in such a way that it can be retrieved as required; this can only be done effectively by computer methods. Thus, we seem to be moving to a mix of standard atlases for broad-scale data portrayal and a live retrieval system by computer for more detailed information.

**Services to users**

In Canada and in WMO service to users is an important aspect. Our basic ice service to ships is by time-sharing of high-powered radio facsimile broadcasts from Halifax and Edmonton. Smaller regional radio facsimile transmissions take place during the summer shipping season from Frobisher and Resolute Bay in the Canadian Arctic. The Meteorological Office in Gander, Newfoundland is prepared to provide briefing services as required by the fishing industry along the north-east coast of Newfoundland. In addition, coastal marine radio stations provide scheduled plain language summaries of ice information and for the past ice season, one public radio station in Newfoundland has made these ice summaries a daily feature of its public service.

From an international point of view some standardization is necessary. Ice codes for passing ice reports are already accepted WMO codes. International standardization of ice representation on facsimile charts is a step necessary in order that foreign ships entering ice-infested waters may make use of existing services.

## ICE CONDITIONS IN AREAS ADJACENT TO THE NORTH ATLANTIC OCEAN FROM JULY TO SEPTEMBER 1977

The charts on pages 39 to 41 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: 1966–73 (Meteorological Office). Surface pressure: 1951–70 (Meteorological Office). Air temperature: 1951–60 (U.S. 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 (U.S. Navy, 1967).

### July

There were no marked anomalies of pressure or air temperature. In sections where the melting of ice had been ahead of normal during the previous month or two this trend was maintained, notably in the Kara Sea and the Denmark Strait. In the Greenland Sea and parts of the Barents Sea, where there had been excesses of ice, the ice edge by the end of July still lay beyond its normal position. The melting and disintegration of ice in the Arctic Archipelago of Canada continued ahead of normal.

### August

Again anomalies of pressure and temperature over the month were rather small. In the Kara Sea, where some re-freezing occurred towards the end of the month, conditions reverted to near normal. In the Barents Sea the ice edge remained mainly south of its normal position. Over much of the Greenland Sea the excess of ice (which had been a feature for several months) was almost eliminated, but disintegrating ice drifting southward with the current maintained on excess off Greenland near 70°N. Over northern Canada break-up of ice continued mainly ahead of normal though there was some persistent ice near Victoria Island and in the approaches to Smith Sound and also icebergs were a hazard to shipping in Hudson Strait. Ice was slow to clear off Baffin Island.

### September

The main anomaly was for high pressure in the vicinity of Hudson Bay which gave a tendency for westerly or north-westerly winds over the eastern part of the Arctic Archipelago and Baffin Bay. Ice spread east ahead of normal in the various channels of the Archipelago. A substantial amount of ice remained east of Baffin Island by the end of the month when this area is normally clear. In other areas changes of ice deficit or excess during the month were only slight.

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| | | |
|---|---|---|
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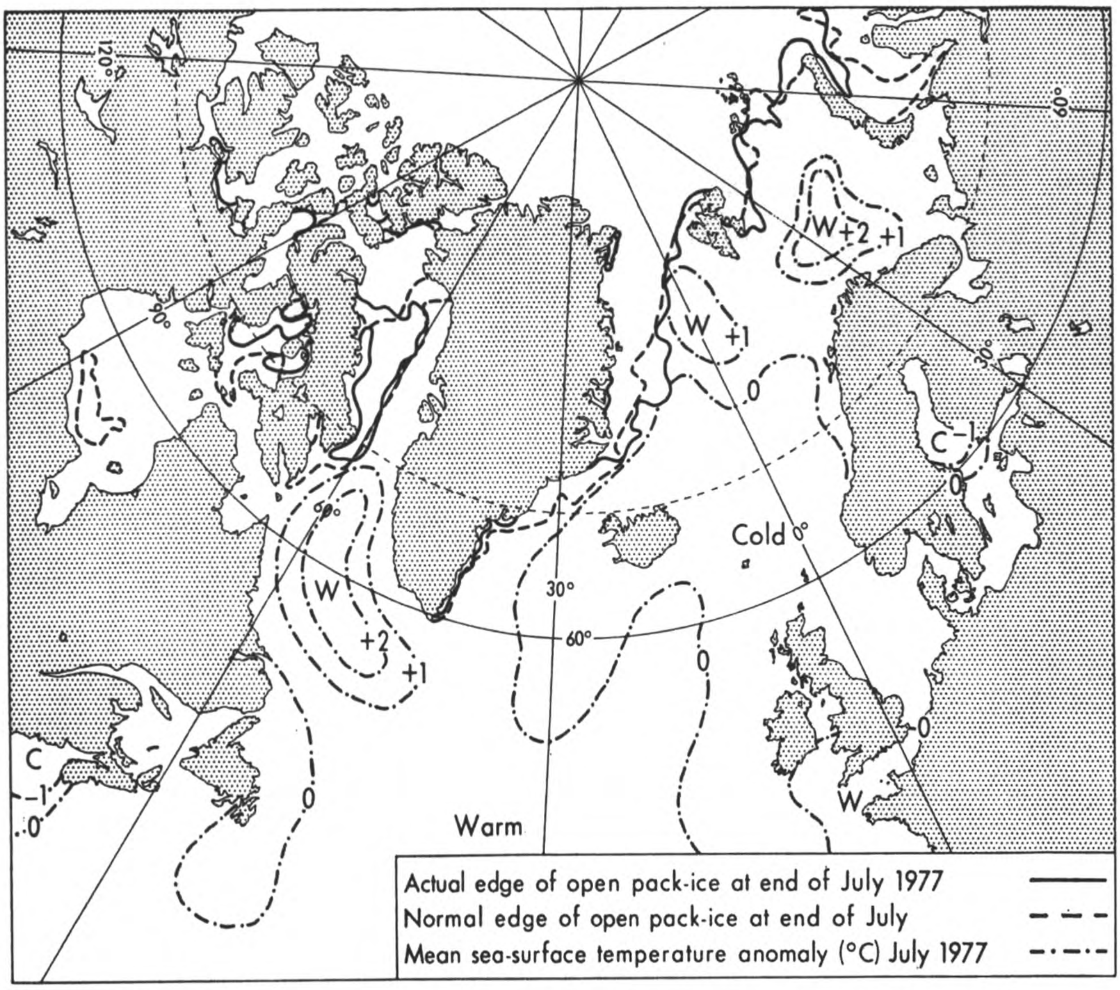
120°
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C
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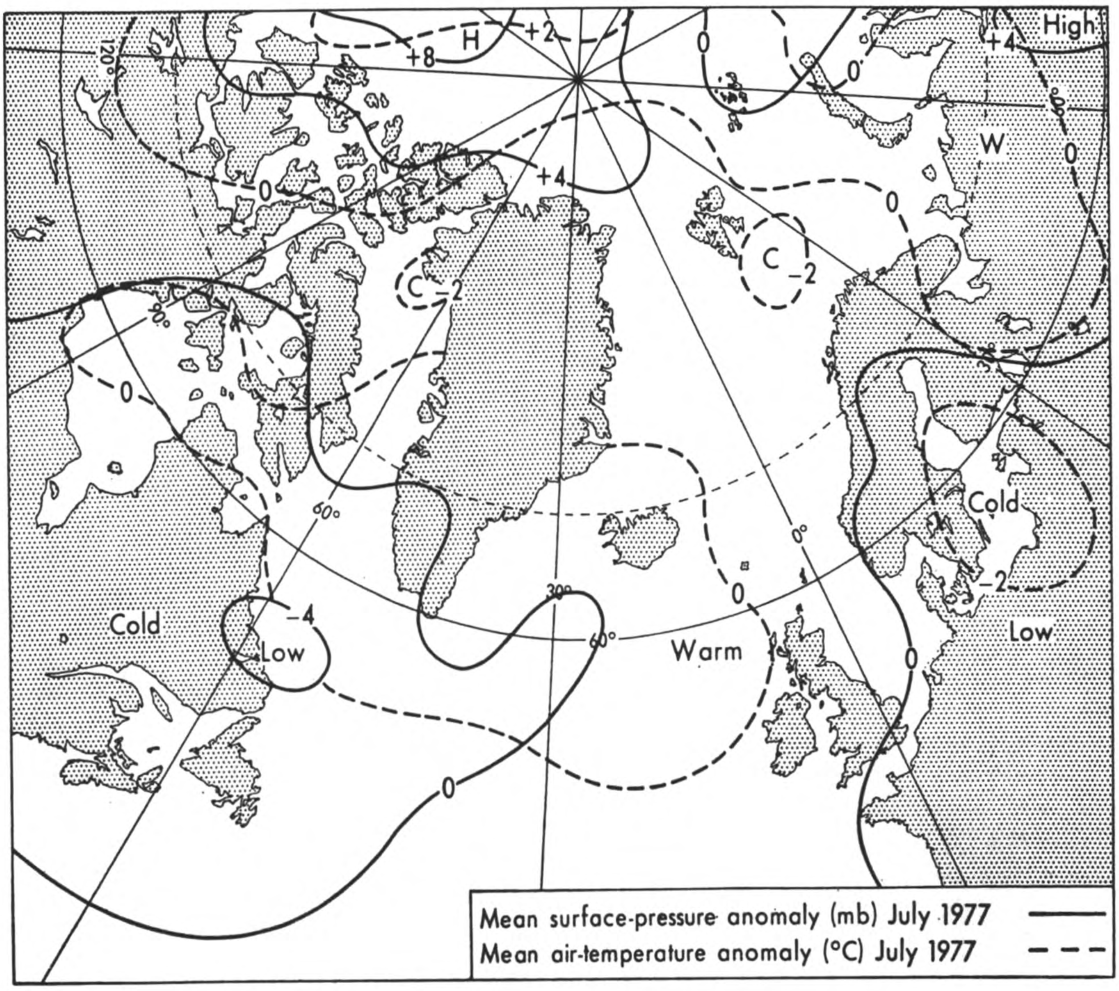
Warm
Actual edge of open pack-ice at end of July 1977
Normal edge of open pack-ice at end of July
Mean sea-surface temperature anomaly (°C) July 1977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C -2
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Cold
-2
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Cold
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30°
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Warm
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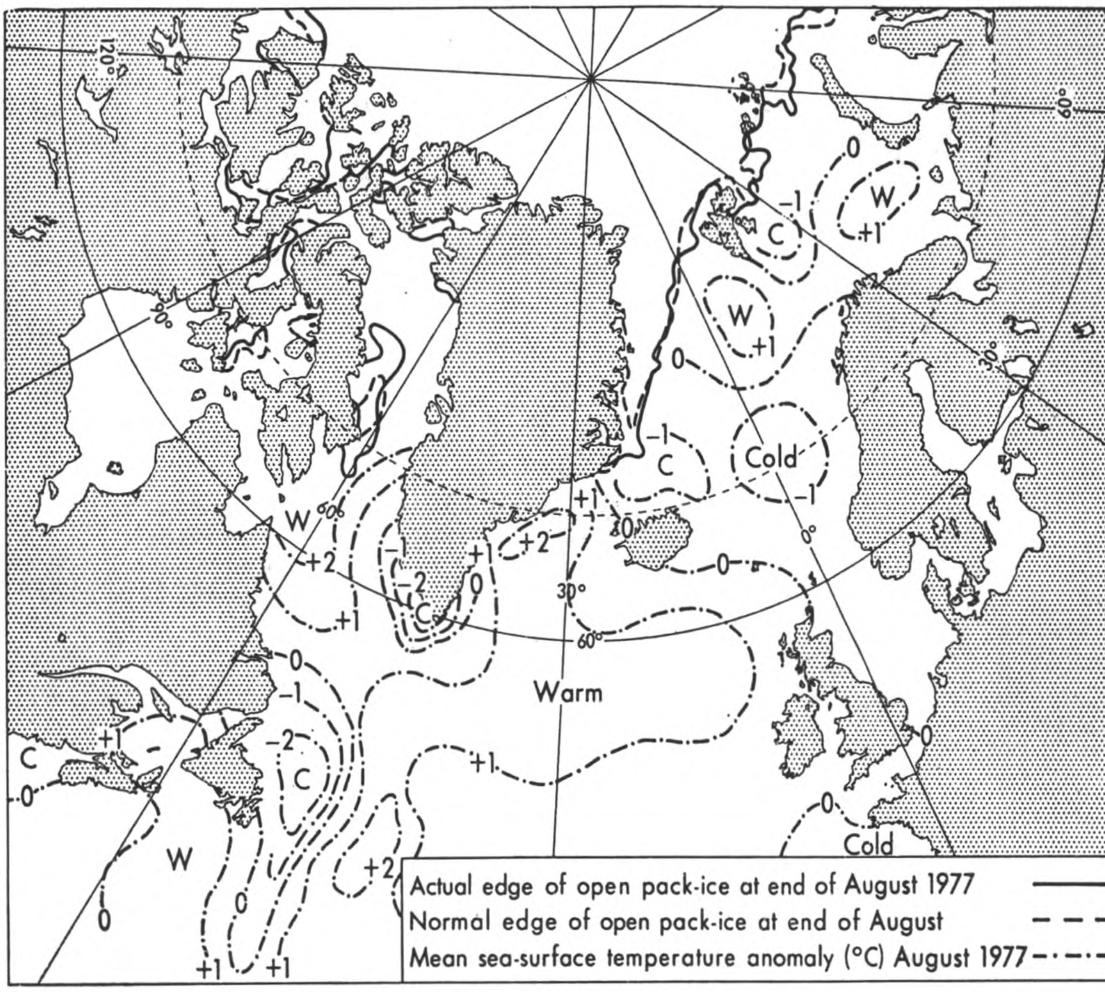
Mean surface-pressure anomaly (mb) July 1977
Mean air-temperature anomaly (°C) July 1977


Actual edge of open pack-ice at end of August 1977
Normal edge of open pack-ice at end of August
Mean sea-surface temperature anomaly (°C) August 1977
Warm
Cold
120°
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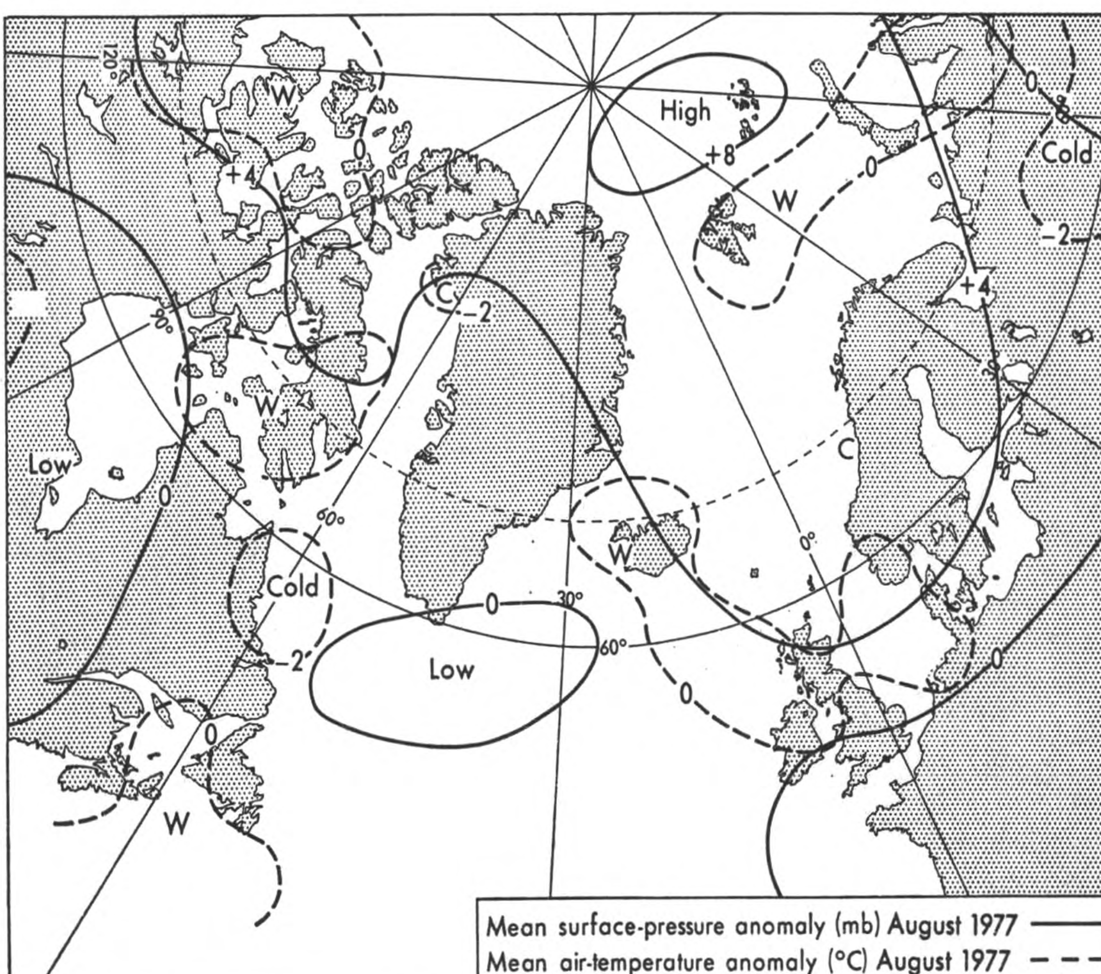
Mean surface-pressure anomaly (mb) August 1977
Mean air-temperature anomaly (°C) August 1977
High
Low
Cold
120°
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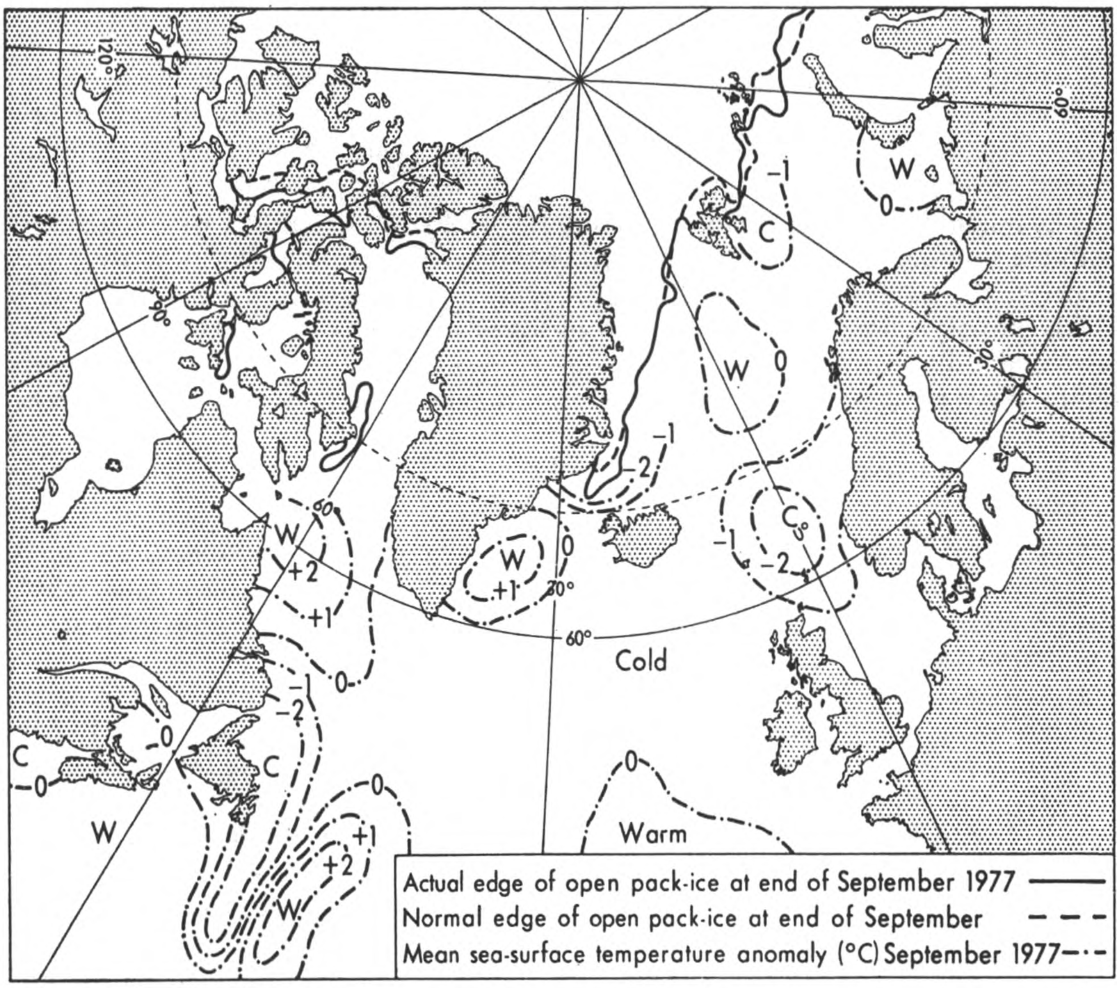
60°
30°
0°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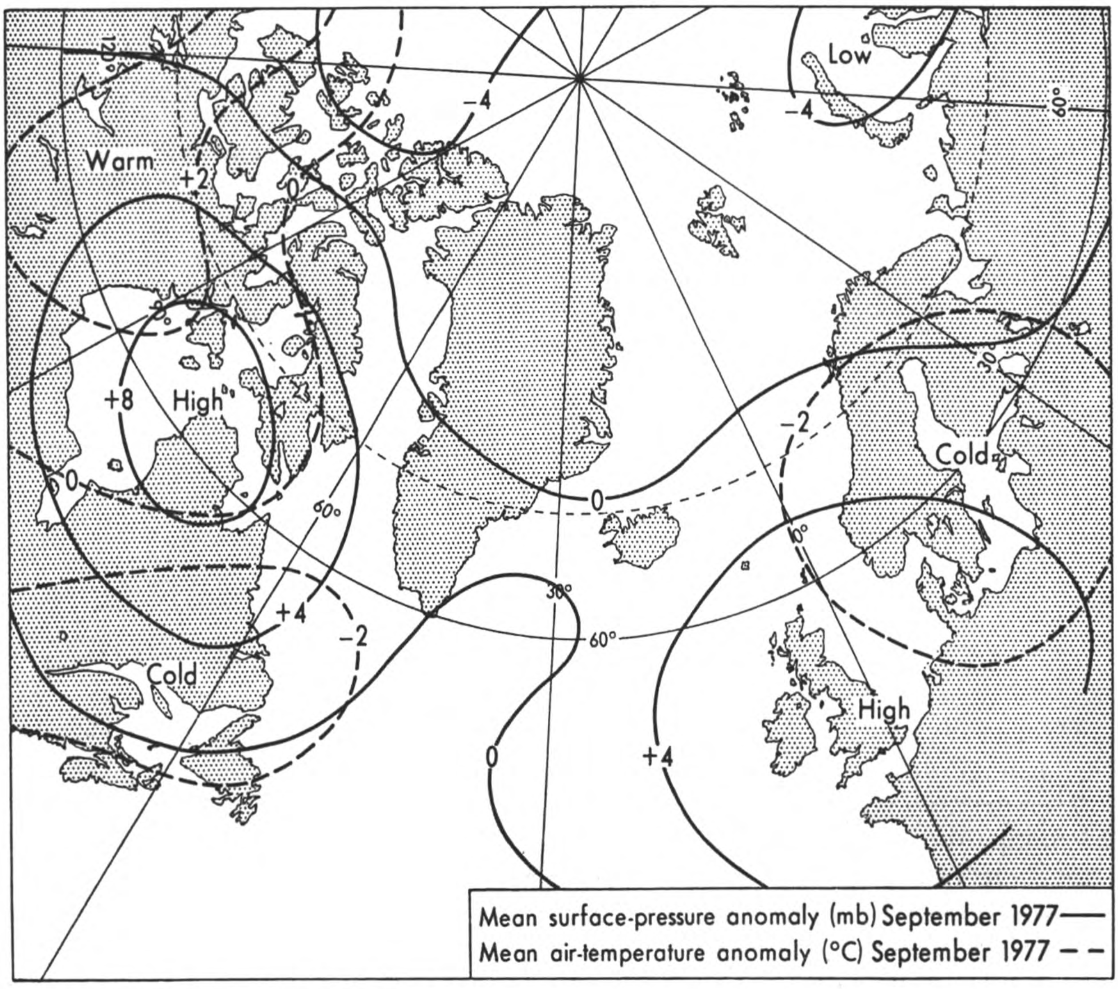
Warm
Actual edge of open pack-ice at end of September 1977
Normal edge of open pack-ice at end of September
Mean sea-surface temperature anomaly (°C) September 1977


Low
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Warm
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High
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60°
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-2
Cold
-2
+4
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60°
Cold
0
High
+4
Mean surface-pressure anomaly (mb) September 1977
Mean air-temperature anomaly (°C) September 1977

## SPECIAL LONG-SERVICE AWARDS

Following the practice inaugurated in 1948 the Director-General of the Meteorological Office has made four Special Long-Service Awards each year to officers whose zealous voluntary observing at sea, on our behalf, has qualified them for special recognition.

The qualifications required are a minimum of 15 years observing, which, together with the number and quality of their records over the period, determines the order of priority.

The period considered for the following awards is taken up to the end of the year 1976 and from our records we have a list of 120 possible qualifiers. The 15 years required are rarely, if ever, consecutive and frequently cover periods of 30 years or more.

The Director-General is pleased to make Special Awards to the following shipmasters:

1. Captain E. T. Rowland of P. & O. Lines, whose first meteorological logbook was received here in 1949 from s.s. *Leicester* (Federal Steam Navigation Company), has provided us with a total of 28 meteorological logbooks during his 23 years of voluntary observing.
2. Captain J. Cosker of Container Fleets Limited sent us his first meteorological logbook in 1952 from s.s. *Tongariro* (New Zealand Shipping Company). During his 22 years observing Captain Cosker has provided 49 meteorological logbooks.
3. Captain W. W. Newport has spent his whole observing sea career with Shaw Savill Line, sending in his first book in 1951 from s.s. *New Australia*. During his 19 years of observing Captain Newport has provided 42 meteorological logbooks.
4. Captain T. B. Hancock has spent his whole observing sea career with Manchester Liners Limited; his first book arrived here in 1952 from s.s. *Manchester Division*. During Captain Hancock's 24 years observing he has provided 54 meteorological records.

The awards will, as usual, be in the form of appropriately inscribed barographs and we congratulate these four shipmasters on this recognition of many years of outstanding voluntary observing at sea.

The masters will be notified of the awards and of the arrangements to be made for their presentation.

J.D.B.

# Personalities

OBITUARY.—It is with much regret that we record the sudden death of CAPTAIN M. A. YARROW of Shell Tankers (UK) Limited on 21 June 1977.

Maurice Yarrow was indentured as apprentice to Eagle Oil Company in December 1946 and his first ship was the *San Gasper*.

After promotion through the ranks he was promoted Master in 1966 and appointed to command of s.s. *Helcion*. Thereafter he served in a number of the Company's vessels, his last command being s.s. *Geomitra*.

Captain Yarrow sent us his first meteorological logbook from the *San Veronico* in 1956. Since then we have received a further 13 logbooks bearing his name.

We extend our deep sympathy to his wife and family.

OBITUARY.—It is with great regret that we have to record the death of CAPTAIN N. COULL on 15 August 1977.

Norman Coull commenced his sea career in November 1949 as an apprentice with Anglo-Saxon Petroleum Company. After being promoted through the ranks he obtained his Master's Certificate in 1959.

In 1970 he took up a temporary assignment with the Fleet Management of Shell Tankers (UK) Limited. He returned to sea in 1972 when he was appointed to command of s.s. *Haustellium*. He served in many of the Shell Company's vessels and his last command was that of s.s. *Fusus*.

Captain Coull sent us his first meteorological logbook from the *Zaphon* in 1974 and since then we have received a further three logbooks bearing his name.

We extend our sincere condolences to his wife and family.

RETIREMENT.—CAPTAIN D. A. DOYLE of Shell Tankers (UK) Limited retired on 30 September 1977 after serving 36 years with the Company.

Desmond Arthur Doyle joined Eagle Oil and Shipping Company as a Cadet in September 1941 and was appointed to the s.s. *San Roberto*.

He was promoted Master in December 1959 and appointed to command of s.s. *San Castro*. Since then he has been in command of many of the Company's vessels, including the 'G' class engaged in the LNG trade between Brunei and Japan.

We received the first meteorological logbook bearing Captain Doyle's name from the *San Adolfo* in 1954. Since then he has sent us a further 27 records and logbooks. He received an Excellent Award in 1972.

We wish him a long, healthy and happy retirement.

RETIREMENT.—CAPTAIN C. OWSTON retired on 31 May 1977 after completing 29 years service with Shell Tankers (UK) Limited.

Charles Owston joined the Anglo-Saxon Petroleum Company in 1948 as 3rd Officer.

In 1954 he was Chief Officer of the *Liparus* when she was involved in the rescue of the crew of the *Tressillian*. For his actions in this incident he was awarded the Silver Medal for gallantry at sea and also received awards from the Royal Society of Arts and his own company.

He was promoted Master in 1960 and appointed to command of m.v. *Antonia*. In recent years he commanded lightening vessels for V.L.C.C.'s and his last command was that of s.s. *Drupa* when she made the first lifting of an oil cargo from the Brent Spar Buoy.

Captain Owston sent us his first meteorological logbook from the *Clydefield* in 1947. Since then we have received a further five logbooks bearing his name.

We wish him a long and happy retirement.

RETIREMENT.—MR A. E. HOLMAN, Radio Officer, recently retired from the sea.

Alfred Edward Holman served with Ocean Transport and Trading Company for the whole of his career commencing in the vessels of the Blue Funnel Line, then in those of the Glen Line and finally—as he puts it—'for five happy years in the magnificent ships of Overseas Containers Limited'.

We received the first logbook bearing Mr Holman's name from the *Diomed* in 1951. Since then he has been mentioned in a further 28 logbooks of which no less than 25 were classed as Excellent—a remarkable record and for which he received Excellent Awards in 1975, 1976 and 1977.

We wish him a long and happy retirement in Liverpool.

# Notice to Marine Observers

## APPOINTMENT OF NEW PORT METEOROLOGICAL OFFICER

Captain Derek Harrison Rutherford has been appointed Port Meteorological Officer in Hull to succeed Mr P. M. Swan who has taken up an appointment with Cable and Wireless Limited.

Captain Rutherford received his pre-sea training at the School of Navigation, Southampton and, in February 1944, was apprenticed to the Anglo-Saxon Petroleum Company.

He remained with this Company—later to become Shell Tankers (UK) Limited—for the whole of his sea-going career. He obtained his Master's Certificate in 1952 and was promoted to Master in 1965. He retired owing to ill-health from Shell Tankers (UK) Limited in June 1976.

In January 1977 he took up an appointment as Nautical Officer in the Marine Division of the Meteorological Office and was attached to the Ship Routeing Service until his recent transfer to Hull.

# Fleet Lists

Corrections to the list published in the July 1977 number of *The Marine Observer*.
Information regarding these corrections is requested by 30 September each year. Information for the July lists is required by 31 March each year.

## GREAT BRITAIN (Information dated 1.10.77)

The following coasting vessels ('Marid' ships) have been recruited:

| NAME OF VESSEL | MASTER | OWNER/MANAGER |
|---|---|---|
| *Arco Severn* .. .. | I. J. Constance .. .. .. | A.R.C. (Marine) Ltd. |
| *Duke of Lancaster* .. | J. A. Mason .. .. .. | British Rail |
| *St. Clair* .. .. | A. Georgeson .. .. .. | P. & O. European & Air Transport Division |
| *St. Colomba* .. .. | J. E. Milburn .. .. .. | British Rail |
| *St. Modan* .. .. | J. Boldan .. .. .. .. | J. & A. Gardner Co. Ltd. |
| *Sumburgh Head* .. | H. Mackay .. .. .. | Christian Salvesen (Shipping) Ltd. |

The following vessels have been deleted:
*Moyle, Rosemarkie, Sarnia, Somersetbrook.*

The following skippers and radio operators have been added to the Trawler Fleet List:

| SKIPPER | RADIO OPERATOR | TRAWLER OWNER/MANAGER |
|---|---|---|
| G. Kent .. .. | N. H. Willis .. .. .. | Boyd Line Ltd. |
| H. Peterson .. .. | J. Salkeld .. .. .. .. | J. Marr & Sons Ltd. |
| D. P. Platten .. .. | E. Morrow .. .. .. .. | T. Hamling & Co. Ltd. |
| M. Redfearn .. .. | E. Willey .. .. .. .. | Hudson Bros. Trawlers Ltd. |
| H. Waudby .. .. | M. Allison .. .. .. .. | Boyd Line Ltd. |

## GREAT BRITAIN (*Contd.*)

The following ships have been recruited as Selected or Supplementary Ships:

| Name of Vessel | Date of Recruitment | Master | Observing Officers | Senior Radio Officer | Owner/Manager |
|---|---|---|---|---|---|
| *Act 7* | 6.7.77 | D. M. McPhail | A. I. Middleton, M. R. Atkinson, T. J. Morcom-Harneis | J. Ramsey | Associated Container Transportation Ltd. |
| *Ardmore** | 26.4.77 | C. S. Robinson | J. A. Nott, R. K. Boydon, D. M. Springett | D. M. Rex | P. & O. S.N. Co. |
| *Algol* | 30.4.77 | H. R. L. Morgan | S. A. Telford, A. J. Younger, M. I. Smith | R. A. Wilson | Silver Line Ltd. |
| *Anco Duchess* | 19.4.77 | E. W. Hughes | D. Smith, M. Royall, J. Burns | O. J. Culleton | Panocean-Anco Ltd. |
| *Arctic Troll* | 25.5.77 | J. D. Gray | B. P. Longbottom, R. H. Carson, S. Pottinger | B. Buckingham | J. & J. Denholm Ltd. |
| *Atholl Forest* | 22.3.77 | D. R. Perry | J. Jackson, H. Murray, A. S. Macdiarmid | F. Wilson | J. & J. Denholm Ltd. |
| *Aurora* | 24.6.77 | J. Hodgson | K. Scott, J. Burton, J. Woods | A. R. Watt | P. & O. S.N. Co. |
| *British Dragoon* | 17.5.77 | D. O. W. Jones | J. G. Worthington, D. J. Archer, M. R. Nelms | I. Price | B. P. Tanker Co. Ltd. |
| *British Laurel* | 29.4.77 | D. Dwight | M. G. Dawes, G. Lovatt, P. D. Seaman | C. Kelly | B. P. Tanker Co. Ltd. |
| *British Pioneer* | 17.8.77 | H. E. Brown | A. M. Rhodes, R. Marsh, P. Poulton | C. Handel | B. P. Tanker Co. Ltd. |
| *British Promise* | 14.6.77 | J. Lambert | | | B. P. Tanker Co. Ltd. |
| *British Renown* | 13.6.77 | J. S. Allen | D. Wickes, J. MacHardy, R. Frankis | T. A. Strickland | B. P. Tanker Co. Ltd. |
| *British Tenacity* | 15.6.77 | P. Mannem | J. C. Clark, C. Amos, B. Dobson | S. M. McFaul | B. P. Tanker Co. Ltd. |
| *Cable Venture* | 18.7.77 | P. R. Shaw | K. Muttitt, J. Anderson, K. Moore | J. Gallagher | Cable & Wireless Ltd. |
| *Dunelmia* | 16.7.77 | A. Stuart | M. Heslop, C. Kay, G. Morrison | A. Jones | J. & J. Denholm Ltd. |
| *Egidia* | 19.8.77 | D. Lamont | K. Hunter, P. J. Donnelly, R. Hargreaves | | Walter Runciman & Co. Ltd. |
| *Erskine Bridge* | 29.6.77 | W. Macrae | I. F. Mackay, D. Wood, D. W. Miller | J. Morris | J. & J. Denholm Ltd. |
| *G. A. Raey* | 10.8.77 | G. Clark | P. McKay | | Torrey Research Station |
| *Garmula* | 9.8.77 | J. O. Spence | | | P. & O. S.N. Co. |
| *Helenus* | 13.7.77 | H. K. Timbrell | I. S. R. Bell, J. G. D'Araujo, B. Cushman | L. M. Sells | Ocean Transport & Trading Ltd. |
| *Heythrop* | 25.7.77 | | | | P. & O. S.N. Co. |
| *Ibn Abdoun** | 24.3.77 | W. N. Seybold | A. M. Arshad, Y. Alkhanderi, I. S. Dow | G. P. Carew | United Arab Shipping Co. |
| *Kuristan* | 19.7.77 | W. Box | C. McMeekin, M. Carrigan, G. Clarke | L. Thurston | Common Bros. Ltd. |
| *London Baron* | 3.6.77 | R. B. Tarbuck | P. J. Wade, R. Patmore, N. Gemmicken | | London & Overseas Freighters Ltd. |
| *London Bombardier* | 10.8.77 | A. Armstrong | C. Bailey, D. Gibbs, J. Attwater | D. Corby | London & Overseas Freighters Ltd. |
| *London Earl* | 9.9.77 | R. Nelson | C. L. Delisle, G. Hicks, D. Prosser, S. Hyms | D. Moorhouse | London & Overseas Freighters Ltd. |
| *Manchester Vanguard* | 29.4.77 | P. D. Cullen | R. J. Leather, W. E. Lowe, D. Burgess | W. E. Harrison | Manchester Liners Ltd. |
| *Matco Thames* | 7.4.77 | D. Anderson | M. McFarlin, R. Frankland, J. Parkinson | A. King | Mobil Shipping Co. Ltd. |
| *Nessbank* | 20.9.77 | A. E. Newton | W. Langton, P. Drinkwater, H. Fogarty | | Bank Line Ltd. |
| *Riverbank* | 24.5.77 | A. McGregor | P. Hull, J. Steel, P. Locke | –. Neale | Bank Line Ltd. |
| *Roland** | 10.8.77 | J. K. Schofield | B. George, A. Milligan, M. Moorhouse | H. A. Chambers | Blue Star Line Ltd. |
| *Ros Castle** | 21.9.77 | A. Clish | J. J. Sharp, P. Duffin, B. F. Rodgers | P. White | W. A. Souter & Co. Ltd. |
| *Ross Sirius** | 1.9.77 | D. Whiting | J. Wells | | British United Trawlers Ltd. |
| *Rubens** | 22.10.76 | J. Cooper | A. Hannell, I. Woodier, J. Parmley | R. Hall | Bolton Steam Shipping Co. Ltd. |
| *Silverclyde* | 11.7.77 | A. A. Walker | M. Holbrook, R. Despon, P. F. Watkins | C. Jenkins | Silver Line Ltd. |

## GREAT BRITAIN (*Contd.*)

The following ships have been recruited as Selected or Supplementary Ships:

| Name of Vessel | Date of Recruitment | Master | Observing Officers | Senior Radio Officer | Owner/Manager |
|---|---|---|---|---|---|
| *Singularity* | 23.6.77 | W. G. Hunt | D. Golding, P. L. G. Walledge | | F. T. Everard & Sons Ltd. |
| *Temple Arch** | 5.10.76 | L. W. Tait | A. V. Bhandarkar, D. W. Kirkby | D.V. Large | Whitco Marine Services Ltd. |
| *Trojan Star* | 5.4.77 | E. C. Smith | R. S. Emerson, J. A. H. Gray, G. J. Rawding | G. C. Simmons | Blue Star Line Ltd. |
| *Varda** | 18.4.77 | M. J. Wharf | I. D. Smith, H. R. Vyas | J. O'Brien | Haverton Shipping Ltd. |
| *Vegaman* | 3.6.77 | A. M. Andrews | E. Morrison, L. Strauss, M. Blight | R. Fosser | C. Rowbotham & Sons Management Ltd. |
| *Wellpark* | 6.4.77 | G. Anderson | | | J. & J. Denholm Ltd. |
| *Welsh City* | 15.9.77 | D. L. G. Jones | J. Henderson, M. Bellamy | A. Coppell | Sir Wm. Reardon Smith & Sons Ltd |
| *Welsh Voyager* | 25.3.77 | J. G. Tunnicliffe | G. L. Conlon, R. B. Ibalio, A. M. Grant | D. R. McGovern | Welsh Ore Carriers Ltd. |
| *Wild Flamingo* | 9.6.77 | D. E. Moran | M. R. Gould, M. J. Winterbottom, A. W. Noble | A. E. H. Jones | P. & O. S.N. Co. |
| *Wild Gannet* | 20.7.77 | F. S. Angus | W. E. Male, S. C. Richardson, D. Macdonald | M. Charlton | P. & O. S.N. Co. |

* Missing from the July 1977 Fleet List.

The following Selected and Supplementary Ships have been deleted: *Automedon, Baltic Jet, Bamburgh Castle, Baron Inchcape, Benattow, Bendoran, Benlomond, Cameronia, Cheviot, City of Canberra, City of Famagusta, City of Limassol, Clement, Cuthbert Discoverer, Drina, Ebani, Eden Bridge, Esso Mercia, Finnamore Meadow, Glenfalloch, Glenlyon, Glenogle, Hazelmoor, Kelt, Lord St. Vincent, Mahout, Mahronda, Maihar, Manipur, Mercury Mobil Energy, Nina Bowater, Norse Trader, Orenda, Philosopher, Port Launceston, Raphael, Ross Implacable, Ross Orion, Severn Bridge, Strathairlie, Strathinch, Strathlauder, Strathnairn Strathnaver, Trentwood, Turakina, Windsor Castle.*

# BRITISH COMMONWEALTH

## INDIA (Information dated 1.4.77)

(This complete list was not available for the July 1977 number)

| Name of Vessel | Owner |
|---|---|
| Selected Ships | |
| *Akbar* | Mogul Line Ltd. |
| *Andamans* | Shipping Corporation of India |
| *Chidambaram* | Shipping Corporation of India |
| *Daman* | Damodar Bulk Carriers |
| *Dwarka* | MacKinnon Mackenzie & Co. Ltd. |
| *Graveshani* | National Institute of Oceanography |
| *Indian Reliance* | India Steamship Co. |
| *Indian Renown* | India Steamship Co. |
| *Indian Security* | India Steamship Co. |
| *Indian Success* | India Steamship Co. |
| *Jag Kisan* | Great Eastern Shipping Co. |
| *Jaladhanya* | Scindia Steam Navigation Co. |
| *Jaladharma* | Scindia Steam Navigation Co. |
| *Jaladuhita* | Scindia Steam Navigation Co. |
| *Jaladhruv* | Scindia Steam Navigation Co. |
| *Jalaganga* | Scindia Steam Navigation Co. |
| *Jalagirija* | Scindia Steam Navigation Co. |
| *Jalagouri* | Scindia Steam Navigation Co. |
| *Jalajyoti* | Scindia Steam Navigation Co. |
| *Jalakanta* | Scindia Steam Navigation Co. |
| *Jalakrishna* | Scindia Steam Navigation Co. |
| *Jala Moti* | Scindia Steam Navigation Co. |
| *Jalapalaka* | Scindia Steam Navigation Co. |
| *Jalavikram* | Scindia Steam Navigation Co. |
| *Jalazar* | Scindia Steam Navigation Co. |
| *Jaljawahar* | Scindia Steam Navigation Co. |
| *Lok Sevak* | Mogul Line Ltd. |
| *Mohammedi* | Mogul Line Ltd. |
| *Mozaffari* | Mogul Line Ltd. |
| *State of Assam* | Shipping Corporation of India |
| *State of Bihar* | Shipping Corporation of India |
| *State of Gujarat* | Shipping Corporation of India |
| *State of Kutch* | Shipping Corporation of India |
| *State of Maharashtra* | Shipping Corporation of India |
| *State of Orissa* | Shipping Corporation of India |
| *State of Punjab* | Shipping Corporation of India |
| *State of Tamil Nadu* | Shipping Corporation of India |
| *State of Travancore Cochin* | Shipping Corporation of India |
| *State of Uttar Pradesh* | Shipping Corporation of India |
| *Vishnu Sagar* | Parekh Ocean Carriers Ltd. |
| *Vishva Anurag* | Shipping Corporation of India |
| *Vishva Maya* | Shipping Corporation of India |
| *Vishva Prabha* | Shipping Corporation of India |
| *Vishva Sudha* | Shipping Corporation of India |
| *Vishva Vir* | Shipping Corporation of India |
| Supplementary Ships: | |
| *Annapurna* | Shipping Corporation of India |
| *Anupama* | Shipping Corporation of India |
| *APJ Ambika* | Surendra Overseas Ltd. |
| *APJ Anjali* | Surendra Overseas Ltd. |
| *APJ Sushma* | Surendra Overseas Ltd. |
| *Aradhana* | Shipping Corporation of India |
| *Bailadila* | Shipping Corporation of India |
| *Barauni* | Shipping Corporation of India |
| *Bellary* | Shipping Corporation of India |
| *Bhagat Singh* | Shipping Corporation of India |
| *Bhaskar* | Shipping Corporation of India |
| *B.R. Ambedkar* | Shipping Corporation of India |
| *Chanakya* | Shipping Corporation of India |
| *Chatrapati Shivaji* | Shipping Corporation of India |
| *Chennai Jayam* | South India Shipping Corporation |
| *Chennai Muyarchi* | South India Shipping Corporation |
| *Chennai Ookkam* | South India Shipping Corporation |
| *Chennai Perumai* | South India Shipping Corporation |
| *Chennai Selvam* | South India Shipping Corporation |
| *Desh Bandhu* | Shipping Corporation of India |
| *Devaraya* | Shipping Corporation of India |
| *Gauri Shankar* | Himalaya Shipping Co. Ltd. |
| *Harsha Vardhana* | Shipping Corporation of India |
| *Indian Endurance* | India Steamship Co. |
| *Indian Fame* | India Steamship Co. |
| *Indian Freedom* | India Steamship Co. |
| *Indian Industry* | India Steamship Co. |
| *Indian Prestige* | India Steamship Co. |
| *Indian Progress* | India Steamship Co. |
| *Indian Prosperity* | India Steamship Co. |
| *Indian Resolve* | India Steamship Co. |
| *Indian Resource* | India Steamship Co. |
| *Indian Splendour* | India Steamship Co. |
| *Indian Strength* | India Steamship Co. |

| NAME OF VESSEL | OWNER |
|---|---|
| Selected Ships | |
| *Indian Tradition* | India Steamship Co. |
| *Indian Tribune* | India Steamship Co. |
| *Indian Triumph* | India Steamship Co. |
| *Indian Trust* | India Steamship Co. |
| *Indian Valour* | India Steamship Co. |
| *Indian Venture* | India Steamship Co. |
| *Jag Anjali* | Great Eastern Shipping Co. |
| *Jag Dev* | Great Eastern Shipping Co. |
| *Jag Dharma* | Great Eastern Shipping Co. |
| *Jag Doot* | Great Eastern Shipping Co. |
| *Jag Jawan* | Great Eastern Shipping Co. |
| *Jag Jiwan* | Great Eastern Shipping Co. |
| *Jag Jyoti* | Great Eastern Shipping Co. |
| *Jag Manek* | Great Eastern Shipping Co. |
| *Jag Prakash* | Great Eastern Shipping Co. |
| *Jag Ravi* | Great Eastern Shipping Co. |
| *Jag Rekha* | Great Eastern Shipping Co. |
| *Jag Shakti* | Great Eastern Shipping Co. |
| *Jag Shanti* | Great Eastern Shipping Co. |
| *Jagat Neta* | Dempo Steamship Co. |
| *Jagat Swamini* | Dempo Steamship Co. |
| *Jagat Vijeta* | Dempo Steamship Co. |
| *Jainarayan Vyas* | Shipping Corporation of India |
| *Jala Bala* | Scindia Steam Navigation Co. |
| *Jaladharati* | Scindia Steam Navigation Co. |
| *Jaladhir* | Scindia Steam Navigation Co. |
| *Jaladurga* | Scindia Steam Navigation Co. |
| *Jaladuta* | Scindia Steam Navigation Co. |
| *Jalagomati* | Scindia Steam Navigation Co. |
| *Jalagopal* | Scindia Steam Navigation Co. |
| *Jalajaya* | Scindia Steam Navigation Co. |
| *Jalakala* | Scindia Steam Navigation Co. |
| *Jalakendra* | Scindia Steam Navigation Co. |
| *Jalakirti* | Scindia Steam Navigation Co. |
| *Jalamangala* | Scindia Steam Navigation Co. |
| *Jalamani* | Scindia Steam Navigation Co. |
| *Jalamatsya* | Scindia Steam Navigation Co. |
| *Jalamayur* | Scindia Steam Navigation Co. |
| *Jalamohan* | Scindia Steam Navigation Co. |
| *Jalamokambi* | Scindia Steam Navigation Co. |
| *Jalamorari* | Scindia Steam Navigation Co. |
| *Jalapankhi* | Scindia Steam Navigation Co. |
| *Jalarajan* | Scindia Steam Navigation Co. |
| *Jalarashmi* | Scindia Steam Navigation Co. |
| *Jalaratna* | Scindia Steam Navigation Co. |
| *Jalataranga* | Scindia Steam Navigation Co. |
| *Jalavallabh* | Scindia Steam Navigation Co. |
| *Jalaveera* | Scindia Steam Navigation Co. |
| *Jalavijaya* | Scindia Steam Navigation Co. |
| *Jalayamini* | Scindia Steam Navigation Co. |
| *Jalayamuna* | Scindia Steam Navigation Co. |
| *Jameela* | Kerala Lines Ltd. |
| *Jana Priya* | Mogul Line Ltd. |
| *Jana Vijaya* | Mogul Line Ltd. |
| *Jawaharlal Nehru* | Shipping Corporation of India |
| *Kanishka* | Shipping Corporation of India |
| *Kedarnath* | Himalaya Shipping Co. Ltd. |
| *Laxmi* | Shipping Corporation of India |
| *Lal Bahadur Shastri* | Shipping Corporation of India |
| *Lok Adhar* | Mogul Line Ltd. |
| *Lok Nayak* | Mogul Line Ltd. |
| *Lok Palak* | Mogul Line Ltd. |
| *Lok Sahayak* | Mogul Line Ltd. |
| *Lok Vihar* | Mogul Line Ltd. |
| *Lok Vinay* | Mogul Line Ltd. |
| *Mahabhakti* | South East Asia Shipping Co. |
| *Mahabharat* | South East Asia Shipping Co. |
| *Mahabir* | South East Asia Shipping Co. |
| *Maharashmi* | South East Asia Shipping Co. |
| *Mahavijay* | South East Asia Shipping Co. |
| *Maratha Progress* | Chowgule Steamships Ltd. |
| *Maratha Providence* | Chowgule Steamships Ltd. |
| *Mizoram* | Shipping Corporation of India |
| *Nan Cowary* | Shipping Corporation of India |
| *Nanda Kala* | Essar Construction and Carrier Ltd. |
| *Netaji Subhas Bose* | Shipping Corporation of India |
| *Onge* | Shipping Corporation of India |
| *Prabhu Daya* | Tolani Shipping Co. |
| *Rafi Ahmed Kidwai* | Shipping Corporation of India |
| *Ratna Kirti* | Ratnakar Shipping Co. |
| *Ratna Nandini* | Ratnakar Shipping Co. |
| *Ratna Shobhana* | Ratnakar Shipping Co. |
| *Ratna Usha* | Ratnakar Shipping Co. |
| *Sagar Deep* | Shipping Corporation of India |
| *Saga Samrat* | Oil & Natural Gas Commission |
| *Samudra Gupta* | Shipping Corporation of India |

| Name of Vessel | Owner |
|---|---|
| Selected Ships | |
| *Sanchi* | Shipping Corporation of India |
| *Sarojini Naidu* | Shipping Corporation of India |
| *Satya Kamal* | Seven Seas Transportation Co. |
| *Satyamurti* | Shipping Corporation of India |
| *Satyapadam* | Seven Seas Transportation Co. |
| *Satya Sohan* | Seven Seas Transportation Co. |
| *Shahajahan* | Shipping Corporation of India |
| *Shompen* | Shipping Corporation of India |
| *State of Himachal Pradesh* | Shipping Corporation of India |
| *State of Kerala* | Shipping Corporation of India |
| *State of Madhya Pradesh* | Shipping Corporation of India |
| *State of Meghalaya* | Shipping Corporation of India |
| *State of Mysore* | Shipping Corporation of India |
| *State of Rajasthan* | Shipping Corporation of India |
| *State of West Bengal* | Shipping Corporation of India |
| *Tamilanna* | Poomphur Shipping Corporation |
| *Teesta* | Mackinnon Mackenzie & Co. |
| *Vaishnavi* | Hind Shipping Co. |
| *Varun Yan* | Thakur Shipping Co. |
| *Vishva Abha* | Shipping Corporation of India |
| *Vishva Aditya* | Shipping Corporation of India |
| *Vishva Ajay* | Shipping Corporation of India |
| *Vishva Amber* | Shipping Corporation of India |
| *Vishva Amitabh* | Shipping Corporation of India |
| *Vishva Apurva* | Shipping Corporation of India |
| *Vishva Asha* | Shipping Corporation of India |
| *Vishva Bandhan* | Shipping Corporation of India |
| *Vishva Bhakti* | Shipping Corporation of India |
| *Vishva Bindu* | Shipping Corporation of India |
| *Vishva Chetana* | Shipping Corporation of India |
| *Vishva Dharma* | Shipping Corporation of India |
| *Vishva Jyoti* | Shipping Corporation of India |
| *Vishva Kalyan* | Shipping Corporation of India |
| *Vishva Kanti* | Shipping Corporation of India |
| *Vishva Karuna* | Shipping Corporation of India |
| *Vishva Kaushal* | Shipping Corporation of India |
| *Vishva Kirti* | Shipping Corporation of India |
| *Vishva Lalita* | Shipping Corporation of India |
| *Vishva Madhuri* | Shipping Corporation of India |
| *Vishva Mahima* | Shipping Corporation of India |
| *Vishva Mamta* | Shipping Corporation of India |
| *Vishva Mandal* | Shipping Corporation of India |
| *Vishva Marg* | Shipping Corporation of India |
| *Vishva Nayak* | Shipping Corporation of India |
| *Vishva Nidhi* | Shipping Corporation of India |
| *Vishva Pratap* | Shipping Corporation of India |
| *Vishva Pratibha* | Shipping Corporation of India |
| *Vishva Prayas* | Shipping Corporation of India |
| *Vishva Prem* | Shipping Corporation of India |
| *Vishva Raksha* | Shipping Corporation of India |
| *Vishva Sandesh* | Shipping Corporation of India |
| *Vishva Seva* | Shipping Corporation of India |
| *Vishva Shakti* | Shipping Corporation of India |
| *Vishva Shobha* | Shipping Corporation of India |
| *Vishva Siddhi* | Shipping Corporation of India |
| *Vishva Suman* | Shipping Corporation of India |
| *Vishva Tarang* | Shipping Corporation of India |
| *Vishva Tej* | Shipping Corporation of India |
| *Vishva Tirth* | Shipping Corporation of India |
| *Vishva Umang* | Shipping Corporation of India |
| *Vishva Usha* | Shipping Corporation of India |
| *Vishva Vandana* | Shipping Corporation of India |
| *Vishva Vibhuti* | Shipping Corporation of India |
| *Vishva Vijay* | Shipping Corporation of India |
| *Vishva Vikas* | Shipping Corporation of India |
| *Vishva Vinay* | Shipping Corporation of India |
| *Vishva Vivek* | Shipping Corporation of India |
| *Vishva Yash* | Shipping Corporation of India |
| *Vevekenand* | Shipping Corporation of India |
| *Visvesvaraya* | Shipping Corporation of India |
| *Yerewa* | Shipping Corporation of India |
| *Zakir Hussain* | Shipping Corporation of India |

Auxiliary Ships:
India has 31 Auxiliary Ships

The corrections as shown hereunder were received after the list above was prepared.

The following ship upgraded from Supplementary to Selected category:
*Jalamangala* (Scindia Steam Navigation Co.)
The following have been recruited as Supplementary Ships:
*Archana* (Shipping Corporation of India)
*Jagat Samrat* (Dempo Steamship Co. Ltd.)
*Kairala* (Kerala Shipping Corporation Ltd.)
*Karnataka* (Karnatak Shipping Co. Ltd.)

*Lokmanya Tilak* (Shipping Corporation of India)
*Prabhu Gopal* (Tolani Shipping Co. Ltd.)
*Rishi Vishvamitra* (Garware Shipping Corporation Ltd.)
The following ships have been deleted:
*Jaljawahar, Jameela*
The name of the Selected Ship *Jalavikram* has been changed to *Laxmi Sagar* and her ownership changed to Parekh Ocean Carriers.

## CANADA (Information dated 9.9.77)

The following have been recruited as Selected Ships:
*Alaska* (Pacific Maritime Agencies)
*Borgnes* (Jebsen (UK) Ltd.)
*Cape Roger* (Government of Canada)
*Fjellnes* (Reederei J. Jost, West Germany)
*Gulftide* (Mobil Oil Ltd.)
*Lady Johnson II* (Maclaren Atlantic Ltd.)
*Leda* (Seaboard Shipping Ltd.)
*Nordkap* (Norden Steamship Co. Ltd.)
*Pandora II* (Chemco Leasing Ltd.)
The following ships have been deleted:
*Achatina, Antenor, Canmar Explorer, Canmar Explorer III, H. R. MacMillan, London Pride, Pacific Logger, Sedco H, Wild Flamingo.*
Canada now has 79 ocean-going Auxiliary Ships and 73 Auxiliary Ships on the Great Lakes and inland waters.

## HONG KONG (Information dated 14.10.77)

The following ships have been recruited:
*Bali* (P. N. Pengerukan)
*Bangkok Star* (—)
*Hong Kong Container* (Orient Express Container Services Inc.)
*Lamma Island* (Hong Kong Ocean Shipping Co. Ltd.)
*Lycaon* (Ocean Transport and Trading Co. Ltd.)
*Menelaus* (—)
*Oriental Chief* (Chinese Maritime Transport Ltd.)
*Star Procyon* (Cia. de la Paloma S.A.)
*Tagaytay* (Wilh. Wilhelmsen Ltd.)
*Tarantel* (Wilh. Wilhelmsen Ltd.)
*Tema* (—)
*Trianon* (Wilh. Wilhelmsen Ltd.)
The following ships have been deleted:
*Chengtu, Hallvard, Pabloeverett, Tatra, Theben, Towarda, Toyo, Tulane.*

## NEW ZEALAND (Information dated 1.8.77)

The following have been recruited as Selected Ships:
*Union Lyttelton* (Union S.S. Co. N.Z. Ltd.)
*Union Rotoiti* (Union S.S. Co. N.Z. Ltd.)
The following have been recruited as Supplementary Ships:
*Columbus Victoria* (Columbus Line)
*Columbus Virginia* (Columbus Line)
*Torrens* (Scanzeal)
The following ships have been deleted:
*Maheno, Union Sydney, Union Trans Tasman.*
New Zealand also has a fleet of 14 Auxiliary Ships currently reporting.

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