The Marine Observer

The Review of the
Marine Division of the Meteorological
Office, in co-operation with Voluntary
Marine Observers

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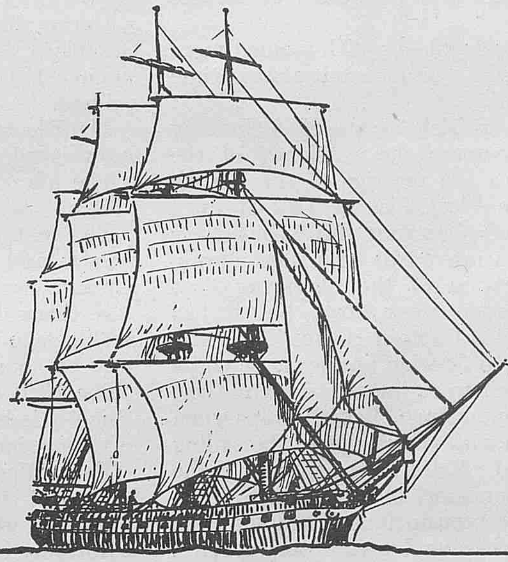

Vol. XII, No. 117. THE MARINE OBSERVER. JANUARY 1935.

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THE MARINE OBSERVER, 1935.

In these notes under the heading "Aims and Objects" in the first number of The Marine Observer, that for January 1924, eleven years ago, we wrote :—

"The functions of The Marine Observer are to provide information useful to navigation concerning winds, weather, climate, currents, derelicts and ice, to stimulate interest in observation and the practice of Meteorology at sea; to promote the use of Wireless Weather reporting for shipping; to provide a means whereby Mariners may give their experiences to others and to foster the traditions of Marine Meteorology upon International Lines."

There was also another aim, the achievement of which seemed more likely if not set down in black and white. To announce it at that time might have been to prevent its fulfilment.

That aim was to knit together the British Corps of Voluntary Marine Observers, and by so doing increase the efficiency of the observing fleet, and so assist to enhance the prestige of the British Merchant Navy. The inclusion of the Fleet List in The Marine Observer with the names not only of observing ships, but their Commanders and Observing Officers, has proved to be a most happy innovation. Not only has this publication of the observing fleet list been a means of acknowledging good work done, but it has tended to improve the fine traditions which Captain Henry Toynbee founded by his example. It has helped to develop an esprit de corps amongst observing officers by making their work known to each other, and has served to make known the Commanders of British Ships when the old custom of publishing their names with their ships in the sailing lists of the Daily Press was discontinued. Latterly the names of the seniors of the youngest branch of the personnel of Merchant Ships—to wit, Wireless Telegraphists—have also been included, and they too are more readily taking their part in furthering this voluntary service. The response of the officers of the British Merchant Navy to all requests made in The Marine Observer has been splendid, so that all the aims are being fulfilled.

It has not always been easy to keep requests within reasonable bounds, for there are many interests served ashore by our service, and we have been pressed to meet their needs. But the efficiency of the methods of the sea has made itself so apparent of late years that we have been able to temper our requests, by making them more in accord with the exigencies of sea service. The organization of the Observing Fleet and Marine Division is now such that by serving those at sea the Corps of Voluntary Marine Observers also serves those ashore.

The keeping of Meteorological Logs and Records and Wireless Weather reporting, by which data are collected, are apt to be considered by some the be all and end all of the work of Marine Observers; and the skillled work of using the information collected, that of professional weather workers.

The officers of the Merchant Navy have ever prided themselves in their resourcefulness and independence, though of recent years modern inventions and organization may have appeared to tend to reduce the opportunities for the exercise of these qualities.

It has always been necessary for seamen to consider what weather they would meet and the likelihood of changes of weather, and it is natural to them in making observations and recording them, to try and foresee.

Hence, though the expert meteorologist may, with the facilities and advantages he has at hand, be able to give great assistance to Mariners, no meteorological service can completely fulfil its functions unless the seamen assisting it are also independently furthering the safe and economical navigation of their ships.

In The Marine Observer we endeavour to assist in developing the weather sense of seamen ; and by showing how statistics are handled, and our methods of research, encourage the study at sea of the currents and their courses, and the weather and its ways by the officers of the Merchant Navy.

In this number, the instructions to British Selected Ships for routine wireless weather reporting, which were clarified and broadened in the January number last year, will be published as usual.

The Corps of Marine Observers is asked to point out to their brother officers throughout the British Merchant Navy, Section 34 of these instructions especially, so that when and where there are not sufficient Selected Ships to provide an adequate service, other British ships in the vicinity may do all that is possible to supply the deficiency, and in doing so conform to our world-wide methods.

It cannot be too strongly stressed that the wave lengths as well as the times prescribed in these instructions should be adhered to as far as possible.

At the present time nearly all British ships fitted with wireless telegraphy can receive long wave C.W., but comparatively few can receive on short wave; hence the wireless operators of "A" Selected Ships who use short waves in making routine weather reports deprive many ships of information provided by the observing officers for the use of ships at sea and the weather forecasting centres ashore.

In a later number we hope to publish an article upon Wireless Communication by an officer who is responsible for the conduct of a great station used by Selected Ships.

During the year the notes on the "History and Development of Organized Marine Meteorology," which were originally published in Volume II during 1925, will be revised and brought up to date in this volume.

The History of Navigation is a subject of absorbing interest to seamen, and this will be dealt with in the first two numbers.

The life of the great explorer Ferdinand Magellan will be dealt with in a later number.

The History of the Mariner's Compass will also be the subject of an article; and as usual there will be articles about currents, sea temperature, weather and ice.

In this volume the currents of the China Seas and the East Indian Archipelago will be charted, so that the Atlas of Indian Ocean Currents may be completed; and it is intended to publish an article entitled "The 1910 to 1934 survey of the currents of the Indian Ocean," in which it is hoped to summarize what we have learned of the currents in that ocean since we commenced to re-chart it in 1929.

The "Marine Observer's Log," with perhaps the exception of the Fleet List, is the most important part of our Journal; and in this number it will be seen that the Corps of Voluntary Marine Observers is not only increasing its skill, but that it is widening its scope.

We wish to give every encouragement to the officers in the British Merchant Navy to write and send in accounts of interesting experiences and observations of unusual phenomena, life in the sea and in the air above the sea.

It will be remembered that in 1929 we asked for certain observations of the speed of porpoises. All we could say at that time was that we were informed that, if the very high speeds at which some fishes and sea mammals—particularly the porpoise—were reported to swim could be substantiated, the information would be of great scientific value. A number of useful observations were received and forwarded to the enquirers. They were also published in due course in The Marine Observer, indicating speeds from about 14 to 24 knots.

We did not however publish the following "observation," the humour of which has served a useful purpose, of which more anon.

Extract from the meteorological log of R.M.S. *Oronsay*, Captain W. S. Shelford, at that time Commodore of the Orient Line, now retired—August 23rd, 1930, 10.30 a.m., in the vicinity of Conjera Lighthouse, South East coast of Spain—"Sea smooth, ship steaming 223°, 16½ knots. Porpoise overtook ship and passed ahead, looking pleased! Dropped back and did it again." Observer, the Captain himself.

A few days ago I had the privilege of visiting the Zoological Laboratory at Cambridge, when the speed of porpoises was referred to quite by chance in conversation; and by telling of this "observation," I learned not only that an airman had gone one better and found the porpoise speed to be *exactly* 29 knots, but learned something from one of the original enquirers.

It appears that in the study of power and speed, it has been discovered that whereas it requires a certain power to propel a vessel at a given speed, it requires less power to propel a porpoise, because the muscular movement of the skin either reduces skin friction or thrusts the water aft. Possibly in due course we shall have authoritative information to publish as an outcome of this work.

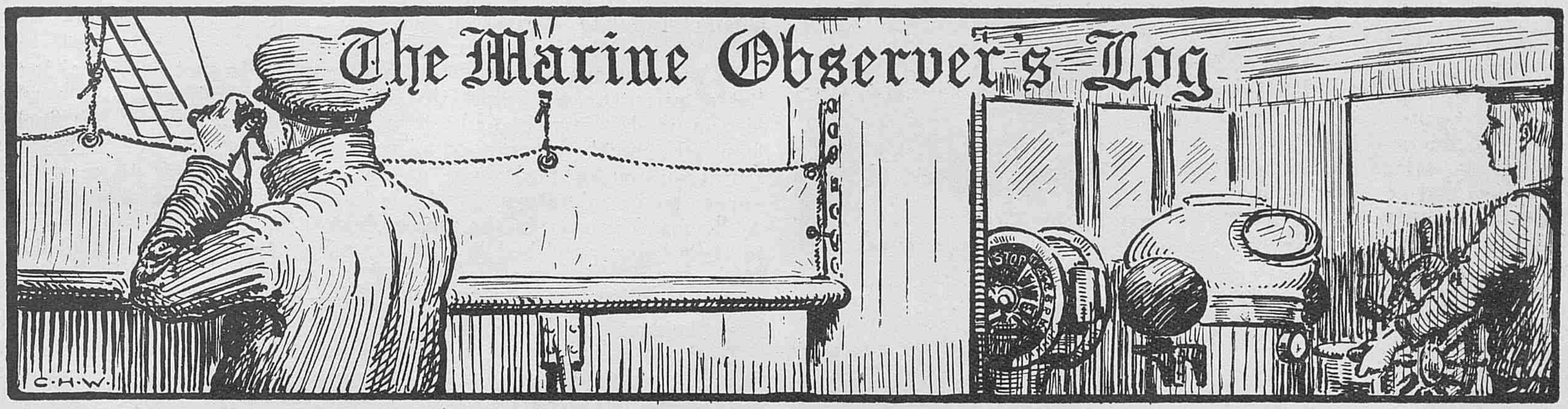
We wish to thank the British corps of voluntary Marine Observers for all they are doing and wish them success in their work, so that the prestige of the British Merchant Navy may be upheld and enhanced, and the British obligation contracted for in Article 35 of the International Convention for Safety of Life at Sea may be fully met. We shall strive in 1935 to make our Journal a seamanlike production, so that it may be a credit to the great service of voluntary work which it is our privilege to encourage and guide.

We wish a very Happy New Year to all our readers.

Marine Superintendent.

London.

22nd October, 1934.



January, February and March.

It is hoped that these pages will be filled each quarter with a selection of the contributions of Mariners in manuscript, or remarks from the Logs and Records of regular Marine Observers.
Responsibility for statements rests with the Contributor.

ICE VISIBILITY.
BIRDS.

The following remarks accompanying the Meteorological Log of R.R.S. *Discovery II*, Captain A. L. Nelson, by Lieutenant L. C. Hill, R.N.R., Chief Officer, and sketches of birds by Able Seaman A. C. Briggs will be of great interest to those who are engaged in navigating ice regions. The original sketches were coloured; only black and white can be given in The Marine Observer.

It is thought that a few remarks on ice visibility at night and in a fog might be of some interest.

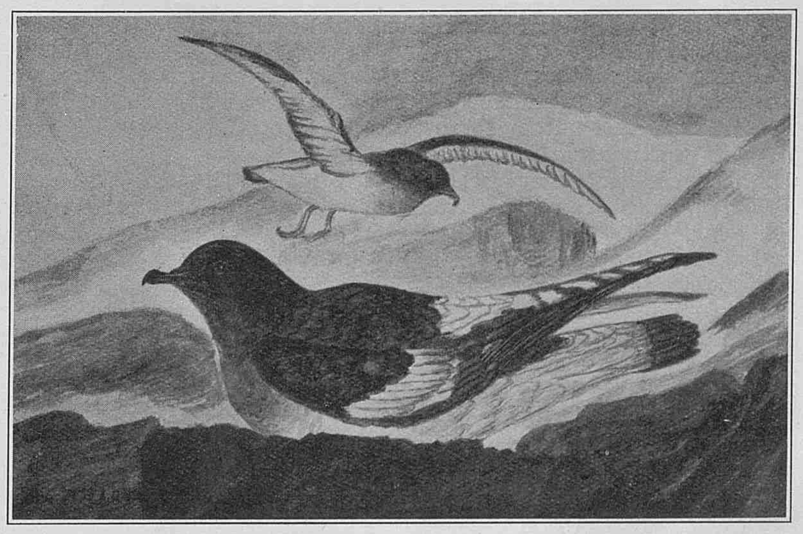
On a dark clear night little difficulty should be experienced in sighting icebergs at a minimum distance of 1 to 2 miles. They might then be picked up as white or dark objects but they should occasion no worry even going at full speed. On such a night when any sea is running growlers are the more pressing danger. If they are sometimes visible on the wave crest and at other times awash or invisible in the trough a reduced speed is the only safe course to follow. As stated by Commander J. Hennessy, R.N.R., in The Marine Observer of April, 1932, the moon according to its age and bearing can be of considerable value or a decided hindrance in ice detection. With the moon ahead bergs are difficult to see. With the moon astern bergs are sometimes visible as far as in daytime. Occasionally with a heavily clouded sky through which the moon appears and disappears ice detection is exceptionally difficult. Heavy passing cloud masses sometimes dim or obscure the object and quite often a berg which has been sighted ahead is lost sight of until seen again when abeam or abaft the beam. On similar evenings fleecy cumulus and cumulo-nimbus clouds have often the appearance of blink. These imaginary bergs produce a very unsatisfactory state of mind which can only be countered by a reduced speed. Despite these drawbacks the moon is very useful and during the circumpolar cruise of the R.R.S. *Discovery II* in 1932, her voyages to the southward were arranged so as to reap the full benefit of the moon.

In fog the use of the steam whistle is definitely of no use for the detection of bergs. Even close alongside we have proved the futility of this suggestion. Similarly, sea temperature has never given any warning of approach to bergs. An efficient look out and a reasonable speed are always necessary.

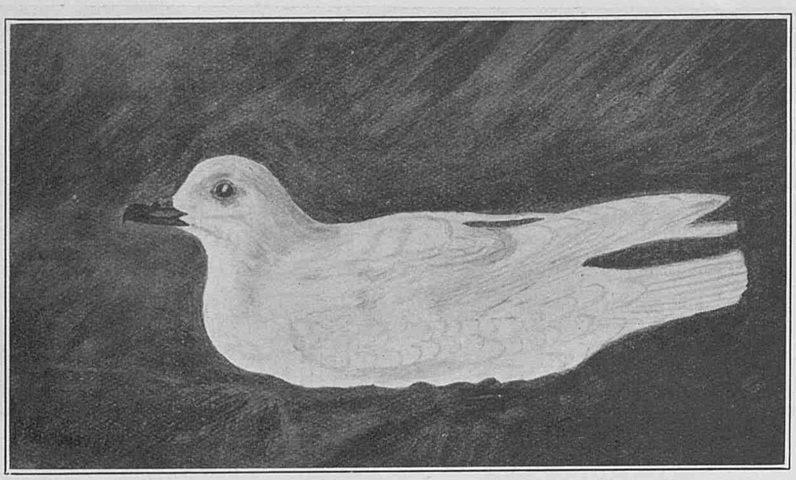
If proceeding slow on a quiet night the sound of breakers may be heard if an iceberg is close to. We have frequently heard such breakers and are constantly listening for them. The sudden meeting with brash ice is a good indication and the appearance of blink is infallibile. If at any time it is necessary to stop, a good look out should be kept to leeward in case the vessel should be drifting on top of a berg (when an astern movement should invariably take the vessel clear).

A berg will first appear out of the fog as a dark and indefinite mass. The blink which next appears above and at the sides of the berg will augment the apparent size of the berg owing to diffusion of light. A feature of Antarctic bergs, especially those in the Weddell Sea sector, is the great number which are stained with a morainic deposit. Frequently black icebergs have been mistaken for rocks. Care should therefore be taken when approaching such bergs or before reporting any supposed rock. Even close alongside doubt might still exist. This doubt can easily be dispelled by soundings.

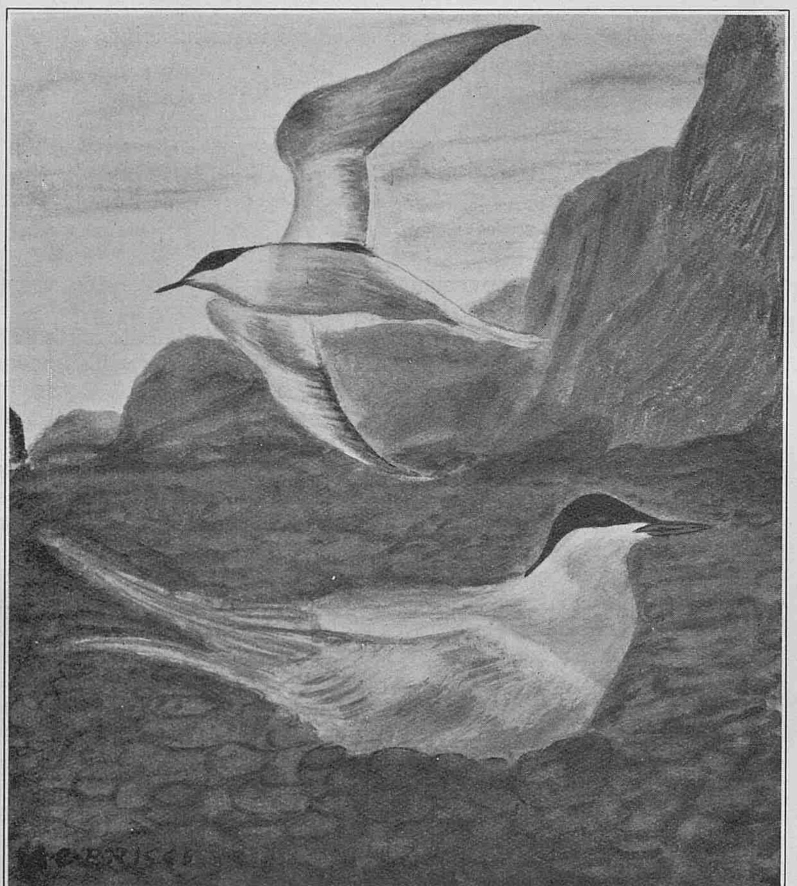
There are many good indications of the approach to pack ice. When nearing pack in the Antarctic the change in bird life is most marked. The Antarctic Petrel, a small brown and white coloured bird, is invariably encountered about 400 miles from the ice-edge. The Snow Petrel, a pure white and dove-like bird, never ventures far from the pack edge, his approximate range being about 100 miles. The Arctic Tern was seen by us on several occasions when on our Pacific Antarctic cruise of this commission. This bird was only seen at the ice edge and never more than 40 miles from it. The Arctic Tern has a very wide range and comes South to the Antarctic in the Northern winter. Observers in the Northern Hemisphere should look out for this bird as an aid to the detection of pack.



Thalassarche Antarctica, Antarctic Petrel.



Pagadroma Nivea, Snow Petrel.



Stern Paradisea, Arctic Tern.

Having sighted these birds one should carefully watch the sea temperature for any marked change. A drop of 3° F. or 4° F. is usually experienced from 10 to 20 miles distant from the ice edge. With these foregoing aids in view a sudden decrease in sea or swell will further indicate the closeness of pack. The final guide will be the ice blink, which is quite unmistakable over solid and extensive pack.

I would like to stress the importance of the change in Antarctic bird life as a factor in ice detection, for I feel that with the surrounding land masses for breeding grounds in the ice regions of the Northern Hemisphere birds should be of considerable help to keen observers.

I am forwarding three paintings done for me by Able Seaman BRIGGS. They show the colouring of the Antarctic Petrel, the Snow Petrel, and of the Arctic Tern, and might be useful for other observers in Antarctic regions.

Arctic Tern.

The following note by Mr. N. B. KINNEAR of the British Museum (Natural History) giving definite evidence of the wide migration of the Arctic Tern as far as from the northern to the southern polar seas, should stimulate interest in the suggestion of observing bird life when approaching ice regions.

In the past, many entries of birds appeared in meteorological logs, but of recent years the practice of logging bird life has been nearly discontinued, owing no doubt to attention having been rather finely focussed upon the observation of weather, currents and ice.

Information of birds seen at sea, and particularly those which appear to be migratory, should be noted in the space provided for Additional Remarks in the meteorological log or record, with a view to their being published in this Journal or forwarded to the British Museum.

The Arctic Tern has a wider range than any other bird and is found from the Arctic to the Antarctic Seas.

In the breeding season it has a circumpolar distribution and nests from 82° north latitude to about 42° north latitude in America, but not so far south in the Old World.

Towards the end of the summer Terns begin to leave their breeding grounds and move southwards. They do not appear to migrate down the coast lines—at least the records do not go to show any marked movements as in the case of other birds. Apart from observations in North America, Arctic Terns have been noted from Santa Lucia, Peru ; Arica, Chile and Mar del Plata, Argentine in September and October, but on the other side of the Atlantic there is only one record of this bird on the coast of Africa, namely a specimen obtained by Sir HARRY JOHNSTONE on the sea-shore below Kamerun Mt. in October 1886.

It has occurred several times on the coast of S. Africa and may be more common there than is supposed. From the East coast of Africa and the Indian Ocean there are no records. It has been recorded twice from Hawai in April and May, and once in New Zealand in December 1929.

Terns, which may have been Arctic, have been observed migrating south in large numbers some 400 miles off the Nantucket Lightship in the end of September, and there is evidence that these graceful sea-birds do not hesitate to cross the Atlantic, since a bird which was marked as a chick a few days old, at Turnavick Bay, Labrador, on July 20th, was recovered at Port Shepstone, south of Durban, on the coast of Natal, on November 14th of the same year ; while another ringed at Maklappas, Sweden, on June 18th was captured at Muizenberg, 15 miles from Cape Town in December, 1926.

We have in the British Museum the skin of an Arctic Tern obtained by Lord CRAWFORD in S.Y. *Venus*, on October 23rd, in Latitude 37° S., Longitude 57° 18′ E.

Sir JAMES ROSS and his surgeon MCCORMICK recorded flocks of Terns flying S.W. in December, 1841, in Latitude 63° 47′ S., Longitude 151° 34′ W., and again in January and March of the following year flocks and single birds were seen between 59° and 65° S., and about 156° W., while on March 2nd, 1843, a single bird was observed in 67° 06′ S., 0° 09′ W. Two specimens obtained in December, 1841, prove that the first record at least refers to Arctic Terns. The German Expedition in the *Gauss* secured specimens in February, 1903, off Kaiser Wilhelm II Land in 66° S., and the Scottish Antarctic Expedition in the *Scotia* records meeting with Arctic Terns in the Weddell Sea and off Coates Land in February and March. Thousands were seen in the Weddell Sea in 72° 31′ S., on March 5th, and skins were brought home. A single Arctic Tern is recorded by Commander WILD, during the voyage of the *Quest* on February 8th, in about Latitude 68° S., Longitude 17° E.

In accepting sight records of the Arctic Tern caution must be exercised since there are at least three other Terns for which it can be very easily mistaken. There is the Kerguelen Tern (*Sterna virgata*) a smaller and darker bird breeding on Kerguelen and other islands of the S. Indian Ocean; the Wreathed (*Sterna vittata*) similar in size to the Antarctic Tern, but with a larger bill and other minor differences, found in the S. Atlantic, S. Orkneys, the Sub-Antarctic Islands, off New Zealand, etc., and the South American Tern (*Sterna hirundinacea*) a distinctly larger bird which is found on the coasts of S. America, and nesting in the Falklands, S. Shetlands, S. Orkneys, etc.

A month or two before the breeding season commences all these Terns, including the Arctic, assume a black cap on the head which, towards the end of the summer, becomes sprinkled with white. Young birds, in their first summer, are very similar to adults in winter and the black cap is not assumed until the spring of the second year. It may be said, therefore, that any Terns seen in the Antarctic between November and January, which have not pure black caps on the head, are probably Arctic Terns, but after that date the colour of the head will not be such a good guide, since the northern birds will be assuming their breeding headdress and the southern ones that of winter.

Any Terns captured at sea would be most gratefully received at the British Museum (Nat. Hist.) London. They need not be skinned but preserved whole in salt, with a label attached, giving position, and date of capture.

BUTTERFLIES AT SEA.

South Atlantic Ocean.

The following is an extract from the Meteorological Record of M.V. *Port Dunedin*, Captain G. W. Hearn, London to Melbourne via Dakar, observer Mr. V. M. Ford, 4th Officer.

March 20th, 1934, at 9 a.m. A.T.S., a number of butterflies were observed to settle on Saloon Deck awnings. The wind had been S.E. by S. force 3, since noon March 17th. The nearest land was St. Helena, S.W. by W., distance 450 miles and Port Alexander E.S.E., distance 700 miles. With the prevailing wind at the time it is highly probable that these insects were blown from the mainland; this would mean that they had been on the wing for at least 70 hours. These insects were still alive and active on the morning of March 21st, having spent the night beneath two separate glass tumblers, in fact one was so active that it damaged its wing due to its activities under the glass. Position of ship, Latitude 11° 56′ S., Longitude 00° 47′ E., Course 142°.

GIANT WATER SNAKE.

Indian Ocean.

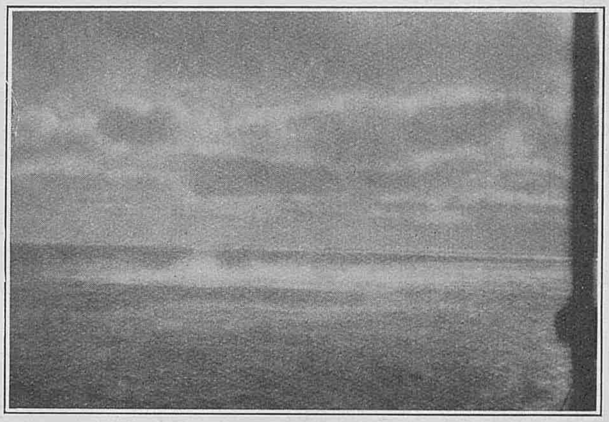
The following is an extract from the Meteorological Record of S.S. *Port Bowen*, Captain A. H. Brown, Fremantle to Perim, observer Mr. R. Bittess, 3rd officer.

On March 2nd, 1934, about 12.40 p.m. while on passage from Fremantle to Perim a large water snake was seen from the bridge of this vessel. When first sighted it was about three hundred yards away, one point aft side the beam on the starboard side. It was travelling along slowly in a direction approximately south-west or at right angles to the course, vessel steering 318°. The head was held about two feet clear of the water while the rest of the body was lying either along or close underneath the surface of the sea. After a few seconds the head dropped and the whole of the snake was then seen lying along the top of the sea. The body was of a dirty yellowish colour with black markings along the back which were not easily discernible even with the aid of binoculars. The forward motion of the snake through the water was evidently supplied by a continuous wriggling movement from the head to the tail, as no fins of any shape or form were visible. Its speed was estimated to be about 2 knots, as the time taken from when it was first sighted to the position where it disappeared just clear of the vessel's wake, was approximately four minutes. The length of the creature was estimated by the observers to be about fifty feet, with a diameter of about two feet. The middle of the body was apparently of greater girth than the head or tail. After apparently diving on approaching the vessel's wake nothing further was seen of it, although a good lookout was kept in case it appeared again. Weather fine and clear with passing clouds. Visibility excellent. Slight sea and S.S.E. swell. Nearest land Danger Island. Chagos Arch., 088°, distant 170 miles. Position of vessel, Latitude 6° 35′ S., Longitude 68° 18′ E.

PHOTOGRAPHS OF MIST RISING ON EDGE OF GULF STREAM.

The accompanying photographs have been received from M.V. *Port Alma*, Captain W. Gilling, Glasgow to New York, and were taken by Mr. A. L. Walton, 4th Officer, on January 22nd, 1934, in Latitude 41° 00′ N., Longitude 65° 00′ W.

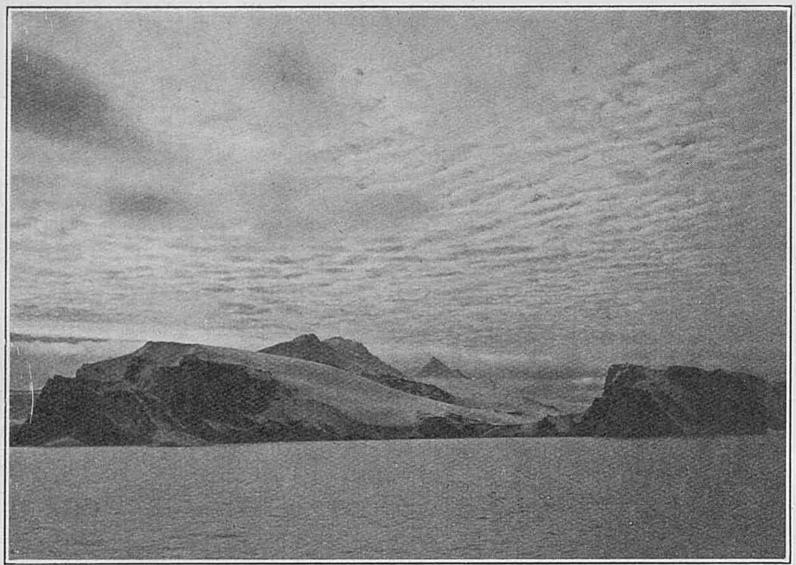
They show the mist rising on the edge of the Gulf Stream, the air temperature being 28° and the sea temperature 59°.



CLOUD PHOTOGRAPHS.

South Orkneys and South Shetlands.

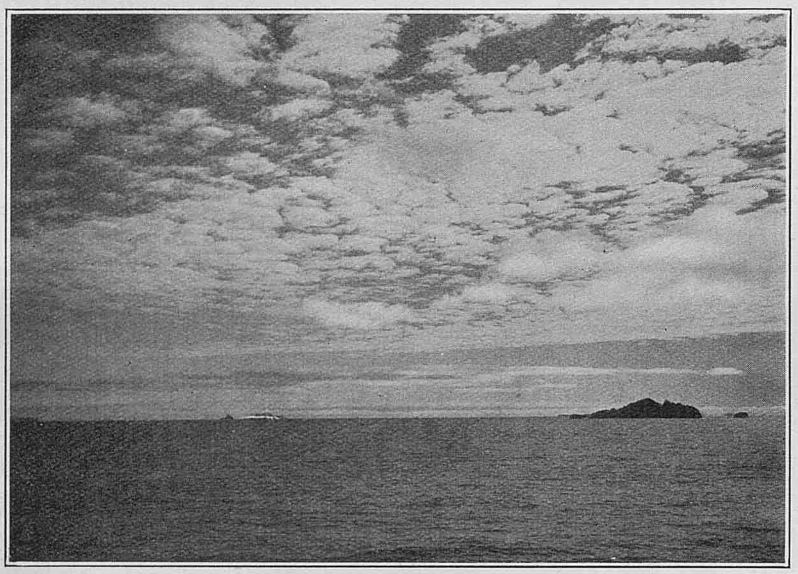
The accompanying photographs are from a series taken by Mr. A. Saunders on board R.R.S. *Discovery II*, Captain W. Carey, observer Mr. R. A. B. Ardley, in January and February, 1933, but received in the Meteorological Office too late for publication last year.



January 11th, 1933, 0711 at ship, 1011 G.M.T.

Latitude 60° 35′ S. Longitude 46° 08′ W., off the western coast of Coronation Island, centre of photograph bearing East, true.

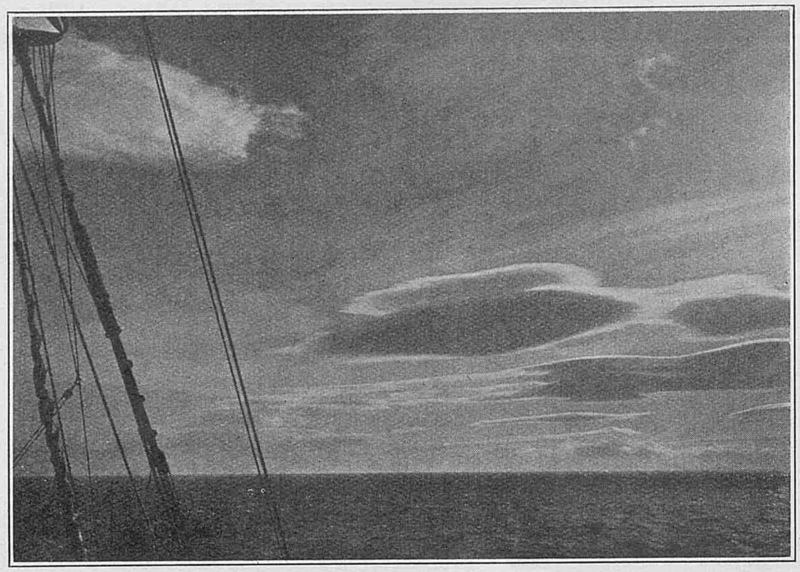
Alto-cumulus, soft and of no great height, which had slowly overspread the sky from the south-west during the preceding two hours. Low strato-cumulus is seen among the mountains of Coronation Island, and ragged fragments of low cloud in the foreground, in the left and centre upper part of the photograph.



January 11th, 1933, 0827 at ship.

Despair Rocks, Coronation Island, in the right foregound of the photograph, bearing N.E. distant one mile.

Soft and ragged alto-cumulus clouds, part of the bank depicted in the first photograph, showing the clouds thinning out to the northward and north-westward, and the bank terminating in a straight line along its leading edge.



February 3rd, 1933, 1830 at ship. 2130 G.M.T.

Latitude 62° 03′ S., Longitude 57° 23′ W.

Cape Melville, King George Island, bearing 275°, distant 6.0 m.

The photograph shows a series of whaleback clouds which had formed over King George Island, and were moving away to the southward. Those over the land, in the right hand lower part of the picture, are the most perfect forms, while the clouds in the centre and left hand are losing their distinctive characteristics. The cloud in the left hand upper corner is rapidly losing its hard lines and is changing into a mass of indeterminate alto-cumulus. The cloud in the centre of the picture had, half an hour before, when in position over the land, consisted of four very perfect small whalebacks tiered one above the other. These slowly coalesced as they drifted clear of the land, thickening into the mass here seen. All these clouds, with the sun behind them, appear in shadow with shining edges.

In the upper right hand half of the picture is seen rippled cirro-cumulus, part of a system of patchy cirro-cumulus and cirro-stratus which at the time partly filmed the upper sky.

In the lower right hand corner, just above the horizon, are heavy masses of cumulus cloud, which were obscuring all the higher parts of the King George Island.

DISCOLOURED WATER.

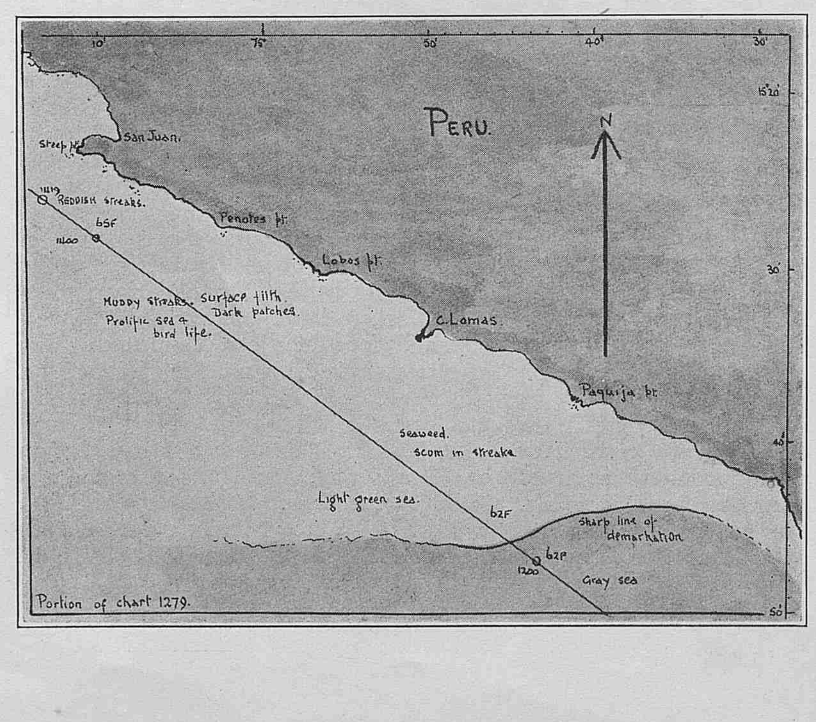
Peruvian Waters.

The following is an extract from the Meteorological Record of S.S. *Orduna*, Captain A. Ridyard, O.B.E., Valparaiso to Balboa, observer Mr. R. Eckford, 3rd Officer.

March 19th, 1934, 1207 M.T.S. the sea suddenly changed colour from grey to light green. The accompanying plan gives some idea of the trend of the line of demarkation as far as could be seen.

As we advanced upon our course we noticed small bits of seaweed and streaks of scum ; bird life becoming more evident.

At 1330 the sea had muddy streaks and dark patches ; the latter due to the presence of shoals of tiny fish resembling whitebait, clearly seen from deck. There was also an abundance of surface filth ; slime intermixed with feathers having a very unclean appearance. Bird and sea life had by now become extremely prolific, among the former



being myriads of cormorants and other smaller divers—probably their young: a few clumsy pelicans and several other species unrecognised. A herd of sea-lions and a school of porpoises made short work of the fish abounding, while two sharks were seen, black and sinister, lazily prowling in search of scraps.

The following sea temperatures were obtained:—at 1200—62° F.; at 1225—62° F.; at 1400—65° F., six miles south of Steep Pt. where the sea was streaked with red.

Passing Steep Pt. the sea imperceptibly regained its normal colour—grey under the clouds; blue under the blue sky. Position of ship, Latitude 15° 46′ S., Longitude 74° 45′ W., course 310°, speed 15 knots.

PHOSPHORESCENT SEA.

Arabian Sea.

THE following is an extract from the Meteorological Record of S.S. *Corfu*, Captain F. E. FRENCH, R.D., R.N.R., Bombay to Aden, observer Mr. C. S. COOKE, 2nd Officer.

February 11th, 1934, at 2000 S.T. the sea ahead was observed to be of a dull phosphorescence and stretching in a N. to S. direction as far as the eye could see.

At 2012 the ship entered a large area of a dull phosphorescent-like glow which, as ship progressed, entirely surrounded her, by 2020 the "glow" being of about the same intensity as the luminous dial of a watch. The wash created and the rush of water down the ship's side showed no outstanding phosphorescent brilliance as is frequently noticeable, and the track left by several porpoises which were around the ship for a few minutes showed only the very least brighter. Only a very occasional bright patch was seen, the whole being of the same intensity and maintaining a uniform dull phosphorescent glow. The greatest brilliance occurred at 2030, after which and until 2133 it varied slightly and at which time the ship passed out of the area, though the glow was to be seen astern for a further 12 minutes. A ship two points on our port bow bound the same way—distant about 4 miles—proved difficult to see when she entered the luminous area, her lights being considerably "dimmed" by the brightness of the water. In a W. by S. to E. by N. direction this phenomenon extended an uninterrupted distance of 23 miles. During the time the phosphorescence continued, the horizon was not definable, but in its place the ship seemed to be enclosed by a "black wall" having a depth of about 3°. Above this the sky and low stars were easily discernible. Position of ship, Latitude 17° 01′ N, Longitude 63° 42′ E., course 257°, speed 16¾ knots.

Arabian Sea and Gulf of Aden.

NIGHT OF FEBRUARY 12TH-13TH. At frequent intervals during the night the ship passed through areas of an intense phosphorescent brilliance unlike the effect of last night, when the whole sea was of one colour, the sea in this case appeared like the sky on a clear cloudless night, the stars being represented (though magnified many times) by the phosphorescent patches which though mainly of small size, at times, extended over area many yards square. These patches could be seen some distance and had a flashing appearance which at times looked like the lights of a ship so much so that the lookouts reported them as such, and it was also noticeable from the bridge. When the wash created by the ship broke, the brilliance was intense, lighting up the ship's side, and being almost of a turquoise blue colour. Approximate position of ship at midnight, Latitude 15° N., Longitude 55° E., Course 256°, speed 16¾ knots.

NIGHT OF FEBRUARY 13TH-14TH. A similar phenomenon to last night occurred again to-night but if anything the brilliance was greater and more spectacular, especially in the colour of the water disturbed by the ship's bow wave. The reflection from this could be noted on the deck head of the navigation bridge (height 70 ft. above sea level). Approximate position of ship at midnight, Latitude 13° N.. Longitude 48° E. Course 257°, speed 16¼ knots.

On both these nights several water samples were taken and on close inspection they proved to be full of countless small "Jelly-fish-like" creatures about the size of a pin's head. On disturbing the water (and in darkness) these countless small fish became brilliantly lighted up a phosphorescent colour. One small fish seen was about ¾ inch long with three or four pairs of legs and apparently transparent as it proved almost impossible to see it in a lighted place. It had eyes well in front of it apparently set in the end of two small "feelers" about 1 millimetre long; down the middle of its back it had a narrow streak of phosphorescence which could be plainly noticed under darkened conditions as it swam around the bucket.

PHOSPHORESCENCE.

Caribbean Sea.

THE following is an extract from the Meteorological Record of S.S. *Inanda*, Captain W. GIBBINGS, Trinidad to Demerara, observer Mr. T. B. LITTLECHILD, 2nd Officer.

February 21st, 1934, at 0300 observed apparently broken water ahead reaching to 4 points on each bow. On approaching this appeared as the twinkling lights of a large town and was casting a diffused glow in the sky.

0315. Observed Demarara Beacon bearing south, distance 17 miles, and at the same time entered a large area of phosphorescent water—the wake of the ship could be seen for a considerable distance and the bow wave causing balls of phosphorescence to break and shine with a very bright light.

0425. Anchored 1½ miles N.E. of Beacon. Phosphorescence still visible but more distinct to seaward. Position of ship at 0030, Latitude 7° 49′ N., Longitude 59° 18′ W., Course S. 37° E., speed 13½ knots.

ST. ELMO'S FIRE.

North Atlantic.

THE following is an extract from the Meteorological Log of S.S. *Rotorua*, Captain C. B. LAMB, Curaçao to London, observer Mr. J. W. GLASSBOROW, 2nd Officer.

January 10th, 1934, 3 a.m. A.T.S. during heavy rainstorm wireless aerial and wind vane became suffused with bluish light of varying intensity. Numerous globules of bright light resembling large rain drops appeared along the entire length of the aerial. Phenomenon lasted for half an hour and was succeeded by vivid lightning and thunder. Wind N.E. 6, very heavy Nb. clouds. Bar 1010·5 steady. Position of ship, Latitude 12° 11′ N., Longitude 68° 35′ W.

HAIL SQUALLS AND ST. ELMO'S FIRE.

North Atlantic Ocean.

THE following is an extract from the Meteorological Record of S.S. *Inanda*, Captain W. GIBBINGS, Antigua to London, observer Mr. W. S. EUSTANCE, 3rd Officer.

March 14th, 1934, 2230 A.T.S. The weather during this day had been remarkable for the frequent hail squalls during which the wind blew with storm force. In the early part of the evening these squalls had been characterised by the vivid lightning above the approaching cloud.

At 10.30 p.m. a hail squall passed over ship and at the onset a faint glow was observed on the wireless aerial. This became brighter and at 10·31 the outline of the aerial could be traced from mast to mast and appeared as a streamer of blue-green lights spaced about two feet apart. The glow was of the same brilliancy as Spica.

At the weather extremity of the signal and light yards a larger ball of light was visible. This phenomenon was visible until 10.35 when the hail was succeeded by rain, the glow gradually disappearing as the rain increased. Temperature fell from 49° to 47° on squall's approach. Squall over at 10.40 p.m.

Another squall passed at 11.45 p.m. and on this occasion the downlead of the aerial was covered with myriads of small lights as well as the horizontal span. The hail in this squall was bigger but not so heavy as in the preceding one, the hailstones being ¼ in. in diameter. Wind backed to W. after this squall.

Although there were many more squalls of hail and rain during the night the phenomenon of St. Elmo's Fire was not visible on other than the two occasions mentioned above. Position of ship, Latitude 46° 38′ N., Longitude 12° 13′ W., Course N. 59° E., speed 12 knots.

FOGBOWS.

North Pacific Ocean.

The following is an extract from the Meteorological Log of S.S. *Protesilaus*, Captain R. G. Sturrock, Yokohama to Victoria, B.C., observer Mr. E. G. Pankhurst.

January 26th, 1934, at noon A.T.S., observed a triple fogbow. Each bow was of the same size and measured about 300 ft. across. The nearest was stepped right alongside the ship and the others apparently 200 and 400 ft. away the combined effect being that of a tunnel, but each separately a perfect fogbow.

Weather at the time. Mist (visibility 5), blue sky. Wind south 4, Sea south 3, Air and Sea temperatures 40° F. Position of ship, Latitude 49° 56′ N., Longitude 154° 02′ W.

ZODIACAL LIGHT.

North Atlantic Ocean.

The following is an extract from the Meteorological Record of S.S. *Duchess of Bedford*, Captain J. Turnbull, C.B.E., R.D., R.N.R., Halifax to Liverpool, observer Mr. L. N. G. Outram, 4th Officer.

March 27th, 1934, 2125 G.M.T., the Zodiacal Light was observed at approximately fifteen minutes after sunset for a period of twenty-five minutes to 2150 G.M.T.

The beam consisted of a brilliant whitish yellow light, with at times a reddish tint, was cone-shaped, and rose to an altitude of 30° on a base of 3°.

This phenomenon appeared after a spell of three days of exceedingly fine weather with very high barometer, seldom experienced in the North Atlantic at this time of the year.

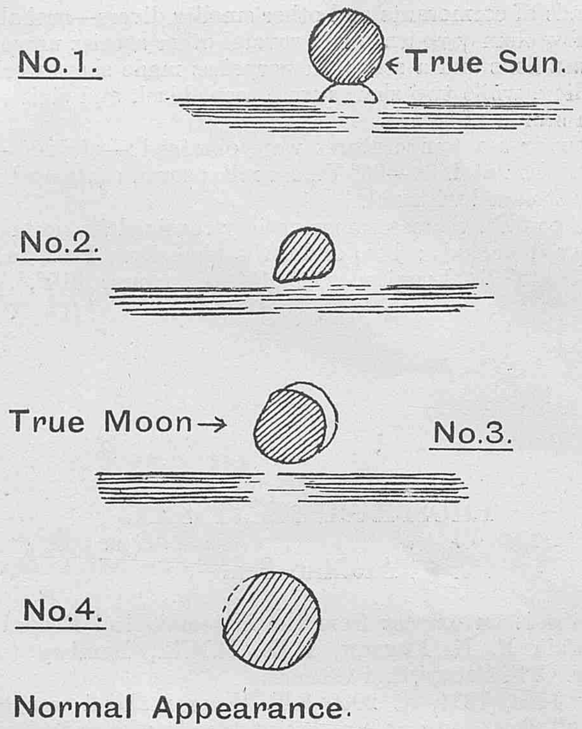
Wind N. by E., Force 2; Barometer 30·82 in. steady. Air 39°; water 41°; Cloudless sky. Position of ship, Latitude 42° 58′ N., Longitude 47° 28′ W. Course 055°, speed 18¼ knots.

REFRACTION, SUN AND MOON.

River Plate.

The following is an extract from the Meteorological Record of M.V. *Lassell*, Captain E. R. Williams, Liverpool to River Plate, observer Mr. R. L. Hagley.

January 3rd, 1934, at 2315 hours when negotiating the buoyed channel to Buenos Aires, and as the sun was setting bearing 242° a double sun accompanied by Green Ray was observed, as in sketch No. 1. Weather conditions at the time were a strong and increasing east wind, rough sea, and clear sky. Temperature of the air 69° F., falling. Position of ship, Latitude 35° 10′ S., Longitude 56° 30′ W.



January 4th, 1934, shortly after sunset at 0·015 hours an abnormal moonrise was observed. The moon appeared above the horizon having an elliptical shape (Sketch 2), and when about 3° above the horizon, had formed into two moons (Sketch 3), gradually assuming normal appearance towards 01·35 hours, when its altitude was approximately 5°. Normal appearance sketch 4. Position of ship, Latitude 35° 09′ S., Longitude 57° 00′ W.

LUNAR HALOS.

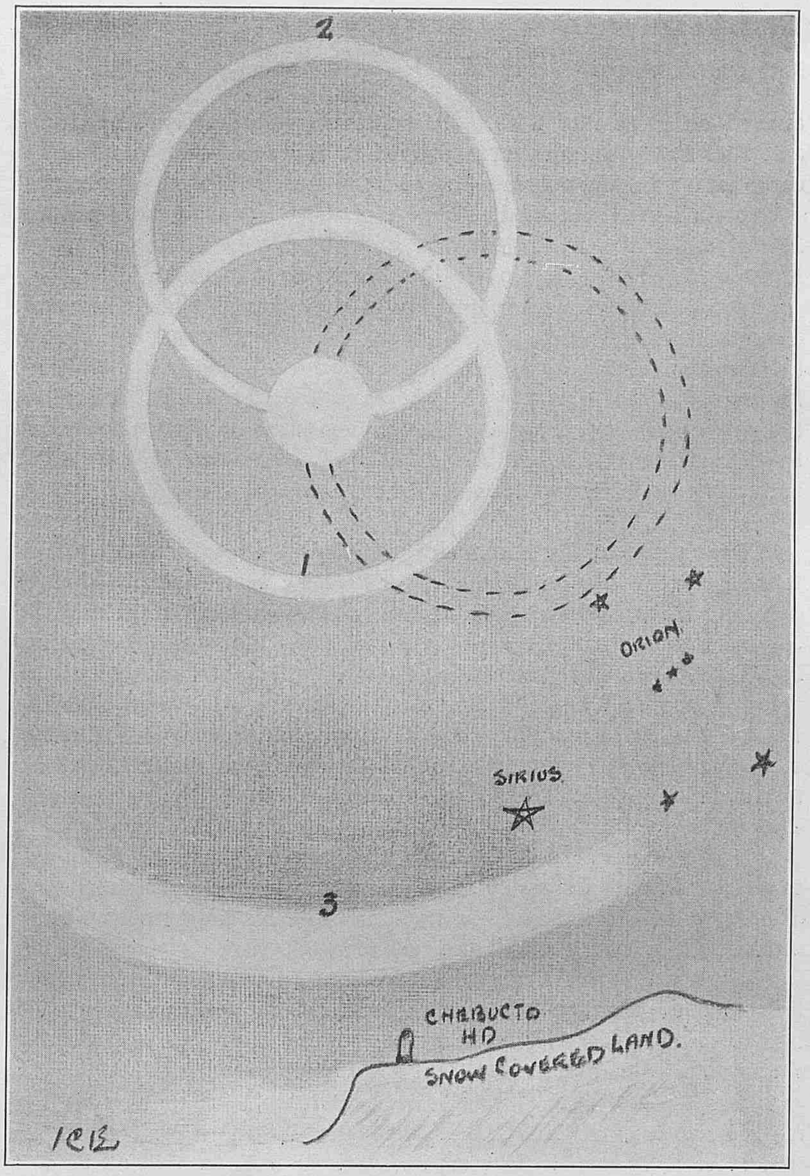
North Atlantic Ocean.

The following is an extract from the Meteorological Record of S.S. *Montcalm*, Captain A. Rothwell, St. John, N.B., to Liverpool, observer Mr. D. Parsons, 4th Officer.

February 26th, 1934, 10 p.m. ship (0200 G.M.T. 26th). Whilst leaving Halifax an unusual lunar halo was observed. The sky seemed to be cloudless when the phenomenon appeared. It consisted of a halo round the moon 23½° in radius with a second ring of greater brilliance passing through the moon and lying to the west of it (see diagram). This second ring measured 47° in diameter, and slowly revolved till it assumed a vertical position over the moon (this moved east) when a third arc appeared showing fairly distinct spectrum colours, red on the upper edge of the arc. This latter arc was 23½° above the horizon and parallel with it. The primary ring (1 in diagram) was whitish and well defined, the second ring (2 in diagram) was also white but more pronounced than the first. The third arc was very brilliant directly under the moon and decreased outwards. The phenomenon lasted 20 minutes, disappearing suddenly. The moon at the commencement was 45 min. west of the meridian bearing 209° True, at an altitude of 68° 20′.

The star Sirius was very conspicuous and 2° above the lower arc. A quantity of brash and slob ice was spread under the moon, also the snow-clad promontory of Chebucto Head.

The whole presented an unusual and beautiful spectacle. Wind W.2, Air Temperature 9° F. Ship's position, 44° 31′ N., 63° 31′ W.



Note.—This is a very interesting and unusual observation. Halo 1 is the halo usually seen, while Halo 3 is part of the well-known but rarer halo of 46° radius. Halo 2 is however one of a very rare type which is seldom bright enough to be seen even when carefully looked for. The special features of this observation are therefore :—(i) that the "secondary" halo 2, centred on a point situated on halo 1, was actually brighter than halo 1. (ii) the rotation of halo 2 around halo 1 to the new position shown.

METEORS.

South Indian Ocean.

The following is an extract from the Meteorological Record of S.S. *Thistleglen*, Captain G. A. Whitfield, O.B.E., Fremantle to Durban, observer Mr. J. Mallan, 3rd Officer.

January 4th, 1934, at 8.45 p.m. A.T.S. an extraordinarily brilliant meteor was observed. Commencing at an altitude of about 50° it travelled from West to East toward the sea surface, disappeared at 10° of altitude. The reflection on the water could be compared with moonlight on a clear night, and the colour of the meteor itself was a very brilliant golden green, green predominating; it was visible for 8 seconds. It did not appear to travel swiftly but seemed to float through the atmosphere. Position of ship, Latitude 29° 20′ S., Longitude 92° 40′ E.

South Pacific Ocean.

The following is an extract from the Meteorological Log of S.S. *Deebank*, Captain J. Robertson, Port Adelaide to Nauru Island, observer Mr. T. C. Cormack, 3rd Officer.

March 11th, 1934, at about 2320 A.T.S., a brilliant greenish white meteor was observed to fall from a position roughly midway between α Crucis and α Pavonis. Estimated altitude at beginning of fall 15°–18° and estimated altitude at end of fall 4°. Duration of fall about 2–3 seconds. Bearing 158°. The meteor was roughly of the size of Venus, and described an almost perpendicular track. The track was broad and well defined becoming attenuated in the middle, then broadening and finally vanishing about 4° above horizon. This meteor was exceptionally brilliant and seemed to light up the heavens as a particularly powerful rocket might. The weather at the time was fine and clear, with very fine cirrus clouds (about 1/10). Atmosphere very damp with very heavy dew. Visibility good. Position of ship by Dead Reckoning, Latitude 33° 06′ S., Longitude 154° 03′ E.

Arabian Sea.

The following is an extract from the Meteorological Record of S.S. *Mandasor*, Captain E. C. Shore, Calcutta to United Kingdom, observer Mr. W. Couling, 3rd Officer.

At 2124 A.T.S., March 15th, 1934, sighted an extraordinarily bright meteor. It first appeared as a white ball of fire at an altitude of 45°, bearing S.W. by W., very close to Sirius, and was about 4 times the size of that star. It fell slowly at first for about 2 seconds to an altitude of about 35° when it commenced to fall rapidly, changing colour meanwhile to a brilliant green, to an altitude of 15° when it appeared to explode into numerous red fragments. In all, the meteor itself was in sight for 5½ seconds, but it left behind it a vivid green tail which was visible for a further 4 seconds. Position of ship, Latitude 10° 48′ N., Longitude 58° 06′ E.

CAPTAIN R. G. LATTA.

By an Old Shipmate.

Robert Gilmore Latta was born at Troon, Ayrshire, on February 18th, 1873. He was educated at Troon Academy, and on leaving school in 1885, he tried various occupations, eventually entering the Troon Post Office as telegraph messenger in 1887. He was promoted to telegraphist and postal clerk in 1888, and transferred to Glasgow as a telegraphist in 1890, retaining this position until 1894, when, owing to an attack of writer's cramp he regretfully resigned his appointment.

Inspired by the fact that most of his family were seafaring, he decided to go to sea, and joined the sailing ship *Ardencraig* as an Ordinary Seaman in June, 1894, sailing from the Tyne on the 29th of that month for San Francisco, arriving there after a long passage of 182 days, seven weeks of which were spent beating round Cape Horn. The *Ardencraig* was a well found ship, ably commanded by Captain T. Gilmore, who had spent his early sea life with the Beaver Line. The *Ardencraig* at that time belonged to Messrs. Edminson & Mitchell, of Glasgow, but in 1897 was sold to Messrs. Crawford & Rowatt, of Glasgow, when Captain Trask was appointed as Commander.

Latta at that time was third mate, and in 1898, when at Newcastle, New South Wales, Captain Trask sent him down to Sydney, N.S.W., to sit for his 2nd Mate's Certificate, which he was successful in obtaining. Arriving home in 1899, Latta decided to transfer to steam, and joined the S.S. *Lismore* belonging to Messrs. James Gardiner & Co., of Glasgow, as 3rd Mate. After a year in this capacity he passed for 1st Mate, and sailed in the S.S. *Kilbride* as 2nd Mate, afterwards passing for Master in 1903. He then joined the same Company's steamer *Gareloch* as Mate, and when offered command decided to throw his lot in with a North Atlantic Company as the Eastern trade did not suit him, so in October, 1904, he joined the Canadian Pacific, when he was appointed 4th Officer of S.S. *Montezuma*, which vessel was at that time commanded by Captain Troop. After serving under Captain Troop for six months, Latta was transferred to another of the Company's vessels, the S.S. *Montreal*, commanded by Captain G. C. Evans, and twelve months later left to sit for Extra Master's Certificate. which he was successful in obtaining in 1906. On rejoining the Canadian Pacific he was appointed 3rd Officer of S.S. *Mount Royal*, and in 1907 was transferred to the S.S. *Lake Erie*, joining the S.S. *Montrose* as 2nd Officer the same year. In 1908 he was transferred to the S.S. *Empress of Ireland*, and in 1909 to the S.S. *Montezuma*. In 1910 Captain Latta was appointed Chief Officer of S.S. *Milwaukee*. He spent five years in that vessel trading to the west coast of South America, and on the outbreak of war in August, 1914, was loading nitrate in Taltal, Chile, and had actually taken on board 7,000 tons when word was received to " stop loading." Later orders came through to discharge cargo, but as there were no means available for landing nitrate in Taltal, and as the nitrate was consigned to Hamburg, three German sailing ships were chartered and the cargo transferred to them by lighter. Four years later, in 1918, those ships were still at anchor in Taltal Roads. After the *Milwaukee's* cargo was discharged, she proceeded to San Francisco and loaded for home. On arrival at Liverpool, after discharging part of the cargo at London, Latta was appointed Chief Officer of the S.S. *Missanabie*, and on arrival at Montreal in June, 1915, was given command of the S.S. *Monmouth* for the run home. He was then appointed as Chief Officer of S.S. *Metagama*, and in 1917 appointed Commander of the S.S. *Monmouth*, which was loading for Archangel. The outbreak of the Russian revolution disorganised things, and Latta was not long in port before receiving orders to leave and make for any port he could reach. November was drawing to a close, and the ice conditions were bad. Having very little coal left, Latta proceeded to Murmansk in the Kola Inlet. This place was also blocked with ice, but a suitable anchorage was reached not far from H.M.S. *Glory*. After replenishing the bunkers, instructions were received to proceed to Lerwick, where he arrived on December 26th. After visiting Stornoway, Tobermory and Red Bay, Captain Latta arrived in Liverpool with most of his cargo intact, having only discharged a few hundred tons at Archangel.

Captain Latta remained in charge of the S.S. *Monmouth* until the Armistice, during which time he visited Salonica, Aden, Durban, Montevideo, Bordeaux, Montreal and home to Manchester.

In succession he was in command of the *Scotian*, *Sicilian*, *Grampian*, *Scandinavian*, *Minnedosa*, *Montclare*, the old *Empress of Britain* (which was subsequently re-named the *Montroyal*), *Empress of Scotland*, *Empress of Australia*, and in 1931 he was appointed to his last command, the new *Empress of Britain*. After three seasons in the St. Lawrence trade, and three World Cruises in that ship, steaming 253,621 miles, he handed her over to Captain Ronald Neil Stuart, V.C., D.S.O., R.D., R.N.R.

When serving in the sailing ship *Ardencraig*, Captain Latta relates that on one occasion he thought his seafaring career was to be of short duration. The *Ardencraig* was running between Cape Horn and the Cape of Good Hope, before a very heavy gale. Every stitch of canvas had been blown away, and the ship was left staggering under bare poles. Time and again during that night the crew were standing waist deep in water on the poop with only the three masts showing, and expecting every moment to feel the ship sink under their feet, but luckily, being well found and a staunch craft, she came safely through.

During the war, although submarines were encountered, mines and torpedoes dodged, Captain Latta was fortunate in escaping any very exciting moments and never saw a man lose his life through enemy action. He however relates the following experience :—

" My first sight of a torpedo was off the Fastnet, when by good fortune I happened to be looking astern and spotted the track made by the torpedo just in time to swing the ship clear, but *only just*, as the torpedo passed under our stern not 10 feet away."

When the *Empress of Britain* was leaving Southampton on her maiden voyage, H.R.H. The Prince of Wales, who, as will be remembered, launched the vessel, visited the ship to wish all aboard good luck, and as the vessel steamed down Southampton Water, he flew over and dipped his 'plane in a farewell salute. On this voyage, when 500 miles from land, a wireless broadcast telephone conversation was successfully accomplished for the first time between a ship and the shore, Commander King Hall being at the microphone in London, and Mr. G. Ward Price and Captain Latta at the microphone on board the ship.

Again in 1932, on Christmas Day, when the *Empress of Britain* was lying at Port Said on a World Cruise, Captain Latta joined in on the Empire Broadcast, which was a great success. This broadcast brought letters to Captain Latta from all parts of the world where friends had been listening in.

During Captain Latta's service with the Canadian Pacific, he has had the honour to sail with three members of the Royal Family, H.R.H. The Prince of Wales, H.R.H. Prince Henry, and H.R.H. Prince George. Celebrities who have travelled with him include The Viceroy of India, Governor Generals, Prime Ministers, Members of Parliament, Dukes and Earls, Maharajahs and Foreign Potentates.

Under the Canadian Pacific flag Captain Latta has sailed between 58° South and 73½° North latitudes, visiting nearly every maritime country in the world.

The Indians of North America appointed him Chief of their tribes, and gave him the title of " Tehoniatarakakowa," meaning " Swiftest Rider of Mighty Waters."

His brother Officers and all who know him wish him continued health and strength to enjoy to the full the greater leisure which will now be his.

J. G.

The Master of the *Empress of Britain* 1931–1934

CAPTAIN R. G. LATTA

NOTES ON THE HISTORY AND DEVELOPMENT OF NAVIGATION.

PREPARED BY COMMANDER M. CRESSWELL, R.N.R.

To trace the use and progress of the Art of Navigation as we know it to-day is an occupation of absorbing interest, and the writer has found it simplest to group the subject under two main headings. Firstly, to show the gradual advance of geographical knowledge and the opening up of the countries of the world by adventurous seamen; and secondly to indicate how the growth of practical aids and methods of navigation has advanced through the ages.

Part I. Historical, Voyages, Discoveries and Developments.

The earliest boats were undoubtedly made from hollowed out trees, followed by a primitive craft fashioned by stretching hides over a wooden framework, which being a more seaworthy vessel must have made coasting voyages possible. In the valleys of great rivers such as the Euphrates, boats must early have become an important means of communication, and it seems natural to suppose that it was from the mouths of rivers that man first ventured out upon the open sea.

Although of great interest it is not intended in these notes to trace the gradual evolution of the ship, except to say that as the need came the ingenuity of man always rose to the occasion, and ships capable of carrying out the hazards of long and dangerous voyages were produced.

The shipping of the ancient world developed in the comparatively tranquil waters of the Eastern Mediterranean, the Red Sea, the Persian Gulf and the Western horn of the Indian Ocean. Boats with oars are represented in the earliest pictorial monuments of ancient Egypt, dating from about B.C. 2500.

The Phoenicians were the first people who made really long sea voyages, and HERODOTUS the renowned Greek historian (born B.C. 484) relates how the Egyptian Pharaoh NECHO of the XXVIth Dynasty (B.C. 600) commissioned some Phoenicians to attempt the circumnavigation of Africa, and that starting from the Gulf of Suez southward, they did finally come back through the Mediterrancean to the Nile delta. They took nearly three years to complete their voyage, and each year they landed and sowed and harvested a crop of wheat before sailing on. This voyage, long doubted, now appears to be supported by some archaeological evidence.

A book written by FLAVIUS AVIANUS, a Roman, about B.C. 400, contains a description of the Mediterranean, and also tells of two Phoenician fleets, commanded by HANNO and HAMILCO which sailed from Carthage (near modern Tunis), about B.C. 450, to explore the western coasts of Africa and Europe. These Carthaginians discovered the Canary Islands and Madeira, and also sailed along the Coast of Lusitania (Portugal) past Cape Finisterre to Britain. Following the destruction of Carthage by the Romans in B.C. 146 the Carthaginian Colonies beyond the Pillars of Hercules (Strait of Gibraltar) were forgotten and the key to their discoveries was lost for many centuries.

The invasion of Britain by the Danes commenced in A.D. 787, and the hardy Norsemen then ventured farther afield, and sailing southward along the coast, entered the Mediterranean. They also explored the Baltic, and in 860 discovered Iceland. Voyaging to the westward Greenland was discovered in 876 and finally in 1001, the shores of America were trodden for the first time by European feet. These adventurous Norse seamen, under Lief ERICSSON, landed at Markland (Nova Scotia) and Vinland (Rhode Island), but their attempt to colonize seems to have failed, and so the continuance of an early North Atlantic trade route via Iceland and Greenland was not maintained.

It was the travels overland from Venice to Cathay (China) made by the Venetian Marco Polo, between 1271 and 1295, which ultimately led to the discovery of new continents by navigators. The immediate result of MARCO POLO's journey was a brisk trade by caravan from China and India, by means of which the fabulous riches of the East were brought to Venice. In the later middle ages Venice became commercially supreme in the Mediterranean, and Venetian galleys loaded rich cargoes at the Levant ports—the road ends of the caravan routes—and took them either to Venice for distribution throughout Central Europe, or made voyages to numerous Mediterranean and Western European ports. Other nations, envying the great wealth of Venice, began to foster and develop their trade. Spain, Portugal and England all extended their purely local trades, and navigators ventured upon increasingly long voyages of discovery.

In 1453 the Near East was overrun by the Turks, who captured Constantinople and stopped all land communication between Europe, India and China. A new route became vitally necessary, by means of which the precious commodities of the East might reach Europe. and all over the continent in the fifteenth century merchants and seamen were speculating about new ways to the East. The Portuguese, unaware that Pharaoh NECHO had solved the problem ages before, were asking whether it was not possible to go round to India, southward, by the coast of Africa. Prince HENRY OF PORTUGAL (1394-1460), known as "Henry the Navigator," sent out exploring expeditions, which between 1445 and 1460 sailed in the long forgotten wake of the Carthagenians, and re-discovered the Canary Islands and Madeira. They also landed at the Azores and Cape Verde. In 1487 a Portuguese, BARTHOLOMEW DIAZ, reported that he had rounded the most southerly point of Africa, but was unable to continue his voyage as his men forced him to return. Even so, the first leg of the route eastward to India had been accomplished.

CHRISTOPHER COLUMBUS, a Genoese, had made several voyages in the Atlantic, he had been to Iceland and perhaps heard of Vinland. He was convinced that the world was a sphere, but he underestimated its size, and the story of the travels of MARCO POLO had given him a very erroneous idea of the extent of Asia, and he supposed therefore that Japan with its reputation for a great wealth of gold, lay across the Atlantic to the westward in about the position of Mexico.

He was a penniless man, but eventually in 1492, helped by some merchants of Palos, he obtained the command of an expedition of three small ships, sailed away into the sunset and returned in 1493, not having found Japan, it was thought, but India. The islands he had discovered were called therefore the West Indies, and so successful was his voyage that he set out again in 1493 with a great expedition of 17 ships and 15,000 men, with the express permission of the Pope to take possession of these new lands for the Spanish Crown.

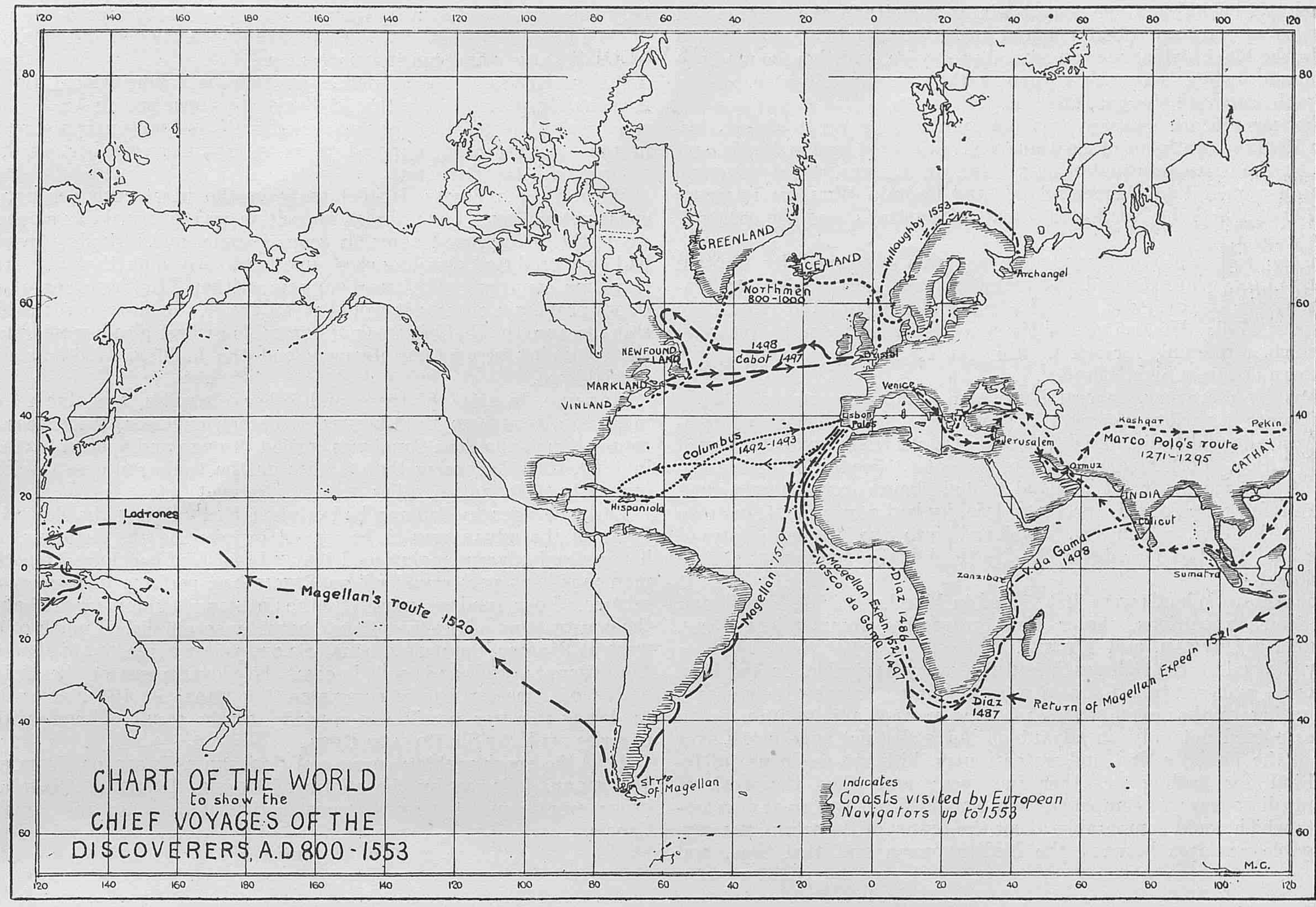
COLUMBUS made in all four voyages across the Atlantic, but it is interesting to note that he died ignorant of the fact that he had discovered a new continent. He believed to his death that he had sailed across the world to Asia.

Another native of Genoa, GIOVANNI CABOTO (JOHN CABOT) had journeyed to Mecca, then the greatest mart in the world for the exchange of goods of the East with those of the West. Filled with the idea that it would be shorter and quicker to bring these goods to Europe by sea, if a route could be found, CABOT in about 1484 came to England, and laid his project before the leading merchants of the port of Bristol. It was decided that he should attempt to reach Asia by sailing to the westward. and in 1497 after 52 days at sea, he reached the northern extremity of what is now known as Cape Breton Island in Cabot Strait. He was, however, convinced that he had landed on the north-eastern coast of Asia, and he took possession of the country in the name of KING HENRY VII of England, reporting on his return that he had reached the country of the Grand Khan.

CABOT intended on his next voyage to follow the coast southward as far as Japan, then placed on medieval charts near the equator, and in 1498 he sailed again, accompanied by his sons, and one LLAVRADOR, after whom the land discovered to the northward was named.

The Portuguese were more successful in the fulfilling of their objective to reach India, as later in the same year as CABOT's first voyage, 1497, VASCO DA GAMA, sailed from Lisbon round the Cape of Good Hope to Zanzibar, and thence with an Arab pilot he ran before the south-west monsoon across the Indian Ocean to Calicut (then a Moorish Settlement) in India. Results soon followed his voyage of discovery as by the year 1515 there were Portuguese ships in Java and the Moluccas.

But the Spaniards had commenced to sail along the East coast of South America, and the Pacific Coast had been sighted by explorers



who had crossed the Isthmus of Panama, so that some hint of the fact that a continent stood to the westward, between Europe and the East, must have occurred to them. Consequently an attempt was soon made upon yet another route, by way of working round to the southward of South America; and this resulted in the first circumnavigation of the globe, which was made by an expedition sent out from Spain under the command of FERNANDO MAGALHAENS (MAGELLAN) in 1519. They sailed down the East Coast of South America, through the Strait of Magellan and so came into the Pacific Ocean. For eight and ninety days Magellan sailed unflinchingly over that vast ocean, during which time the crews suffered great privations, finally reaching the Ladrones. They discovered the Philippines and here Magellan was killed in a fight with the natives. His companions proceeded homeward via South Africa, and three years after leaving Spain one ship out of the five that had started, with a remnant of the company, reached Seville.

Thus within thirty years of the date of the first voyage of Columbus the whole coast of America from Greenland to Cape Horn had been traced, the Pacific Ocean had been traversed, and the world circumnavigated; the coasts of Eastern Africa, Arabia, Persia and India had been visited by the Portuguese, and numerous islands in the Indian Ocean discovered.

The news of these discoveries must have caused great excitement throughout Western Europe, and it spurred on other nations to make further attempts to reach the East by fresh routes, on account of Spain's claim to the "Indies," and the desire to reach India by a shorter route than those of the Cape of Good Hope or Cape Horn; and during the sixteenth century many attempts were made to discover a route to the northward of America, known as a North-west passage, and a route to the northward of Europe and Asia, known as a North-east passage. These attempts signally failed in their primary object, but had the effect of very materially enlarging man's knowledge of the Arctic regions, the most important in their results towards this end being the expeditions of Sir HUGH WILLOUGHBY and Sir MARTIN FROBISHER in 1553 and 1576, JOHN DAVIS in 1585, HENRY HUDSON in 1607 and BAFFIN in 1616.

JAQUES CARTIER, a French navigator, discovered Canada in 1534, and explored the river St. Lawrence, so named because CARTIER discovered it on St. Lawrence's day.

The route from the West Coast of Africa to the West Indies and Brazil was opened up in 1562 by Sir JOHN HAWKINS. In the year 1587 Sir FRANCIS DRAKE captured a richly laden Spanish ship, the *San Philip*. "So rich was this prize that every man in the fleet counted his fortune made." But a richer prize still were the records of trading found among the papers on board, which showed that enormous profits were to be made by voyaging to India. English merchants were prompt to act upon this information and several small squadrons of ships soon set sail for India. One tall ship, the *Edward Bonaventura*, was commanded by JAMES LANCASTER, who thus concludes the narrative of his adventurous voyage :—

"We took passage for Rye and landed there on friday the 24th May, 1594, having spent in this voyage three years, six weeks and two days, which the Portugales perform in half the time, chiefly because we lost our fit time and season to set forth in the beginning of our voyage. We understood in the East Indies, by certain Portugales we took, that they had lately discovered the coast of China to the latitude of nine and fifty degrees, finding the sea still open to the Northward, giving great hope of a Northeast or Northwest passage. Witnesse Master, JAMES LANCASTER."

But the final result of Sir FRANCIS DRAKE's capture was the founding of the celebrated East India Company in 1599, when QUEEN ELIZABETH gave a charter to the Earl of CUMBERLAND and some two hundred knights and merchants, granting them certain trading privileges with India, and the trade to the East thus in time became systematised.

In compiling these notes one remarks that within a few months of the signing of the East India Company's Charter, the same JAMES LANCASTER was ready to lead another expedition to the East, on the

Company's behalf, and one cannot admire sufficiently the courage and strength of purpose which inspired these navigators to go through perils, the like of which we can scarcely conceive, and then be ready to sail again, feeling that each voyage marked another advance, and so was well worth all the hardship and toil.

The seventeenth century was also marked by great discoveries, as in 1606 the continent of Australia was discovered by the Dutch, and also by the Spaniards under Luiz Vaez de Torres. In 1642 Abel Tasman named Van Diemen's land, and Captain William Dampier in 1700 explored the North-west coasts of Australia, and the coasts of New Guinea.

In the eighteenth century, discovery was continued by Captain James Cook, who extended the previous great Australasian explorations by the discovery of New Zealand and many of the Polynesian groups in 1770. He also proved the non-existence of a great Antarctic continent stretching far north into the Pacific, by traversing the Southern Ocean in high latitudes.

Thus by discovery, several European countries achieved spheres of influence in various new parts of the world: England finally obtaining Australia and India, and developing Eastern trade routes by way of South Africa. Both England and France sent settlers to North America, and after a sharp contest England ousted France from Canada, only within a few years of this success to lose, by bad government, her own original holding, which has developed into the United States of America. By these contests the North Atlantic trade routes were developed.

The Antarctic lands were first visited in 1840 by British, French and American expeditions, under their respective commanders Ross, Dumont d'Urville, and Wilkes.

By the end of the eighteenth century, every navigable sea had been explored, and recognised routes were beginning to take their shape, and owing to the great strides made in marine architecture, ocean routes gained not only an advantage but a distinct superiority over any of the land, or land and water routes, hitherto made use of by mankind for trading or other purposes; and when the work of oceanic discovery was completed there remained but two great developments which could comparably affect the routes of the world, namely, navigable passages between the Mediterranean and Red Seas, and between North and South America, and it only became a question of time for canals to be cut, as commerce was developed and organised in a satisfactory and continuous system.

Forty centuries ago a small canal had been constructed by the Ancient Egyptians where that of Suez now runs, and in 1504 a ship canal was projected but not persevered with, as Venice, then supreme in the Mediterranean, opposed it as interfering with her overland trading with the Far East.

When it was finally decided early in the nineteenth century to construct the Suez Canal, great opposition was met with, as steamers were still of unproved value in general trade, and British ingenuity had just produced a sailing ship superior to anything that any other maritime country could launch in competition. In the event of the Canal proving a success it would mean the death blow to the sailing ship, because the Red Sea was not navigable by Sail, also it would mean the scrapping of existing steamers and the building of others of a special type.

However, in spite of these and other obstacles, and due in the main to Ferdinand de Lesseps, a French engineer, the successful completion of the Suez Canal was carried through and opened to traffic in 1869, thus decreasing the distance on the trade route to the East by nearly 4500 nautical miles.

Early voyages to Panama had advised King Philip the Second of Spain of the advantages to be reaped by piercing the Isthmus, but his spiritual advisers maintained that " What God had joined together man must not part asunder," so Philip had perforce to dismiss the scheme. Four hundred years later the de Lessep's Company of France, the constructors of the Suez Canal, actually accomplished much of the work at Panama, but owing to malaria and yellow fever had to abandon the attempt; and, as is well known, the Government of the United States of America finally completed the Canal in 1914, after first rendering the area possible to work in, as the result of medical discoveries made by Sir Ronald Ross.

Thus the epoch making voyages of Columbus, Vasco da Gama and Magellan, followed by the efforts of Drake, Dampier, Cook and others were completed by the construction of the Suez and Panama Canals.

(To be continued.)

DECEPTIONS OF VISION DUE TO ATMOSPHERIC CONDITIONS AT SEA.

Prepared in the Marine Divison by E. W. Barlow, B.Sc.

Deceptions of vision at sea are produced by the abnormal refraction of light, which in the more extreme cases gives rise to the false images of land or ships which are known as mirages. Abnormal refraction is not an easy subject but fairly simple explanations can be given which will cover the types of phenomena most commonly observed.

Refraction of Light by the Atmosphere. Outside the earth and its atmosphere, for example at a point in space between the sun and the earth, light travels in straight lines with a fixed speed which is about 186,000 miles per second. Light also travels in straight lines if it enters the atmosphere in a vertical direction. Thus if the Sun is in the zenith of an observer there is no bending of the rays of light coming to him. In other words there is no refraction, as is well known from the tables of atmospheric refraction. Although there is no refraction, such light, coming from the observer's zenith, suffers a very small diminution in its speed, because the speed of light through any transparent material object is less than it is in interstellar space.

The density of the atmosphere, as is well known, varies according to the height above the earth's surface; speaking generally the density decreases as this height increases. Also at any given height above the earth's surface the density of the air depends on its pressure, temperature and humidity at the time. Now the speed of light varies in air of different densities, the greater the density, the less the speed. Hence in the instance given above with the sun in the zenith the speed of the light received by the observer will be retarded only very slightly in the upper layers of the atmosphere but increasingly in the lower and denser layers.

The difference of the speed of light in air of different densities is the whole cause of atmospheric refraction, which comes into play as soon as a ray of light enters the atmosphere in any direction inclined to the vertical direction through the zenith. It is not easy to explain this without entering into the optical theory of refraction, but whenever a ray of light passes obliquely from a layer of air into a denser layer it suffers a diminution of speed in consequence of which it is bent so as to make a smaller angle with the vertical. Thus in Figure 1, **O** is the observer and **Z** his zenith. The light from a star **S** is shown entering the atmosphere which is represented as consisting of five layers of

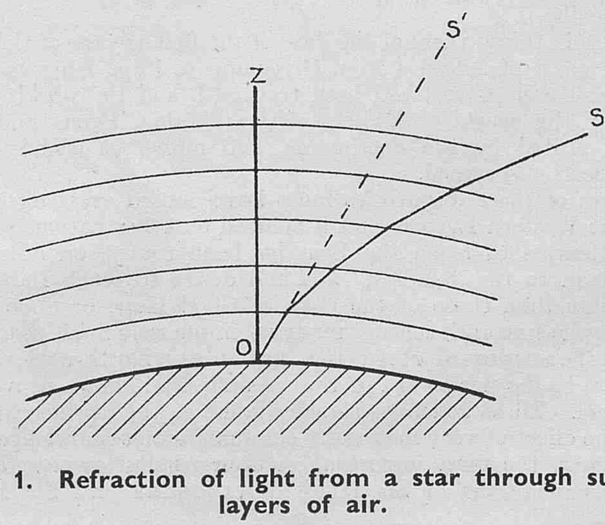


Figure 1. Refraction of light from a star through successive layers of air.

increasing density. The ray of light suffers five successive refractions and the observer sees the star along the line **OS′**, the direction of the ray of light in the lowest layer. Actually the atmosphere consists of a very much greater number of layers of different densities, or more strictly may be regarded as varying continuously in density so that in an actual light ray the successive refractions would blend into a curve such as is shown in Figure 2.

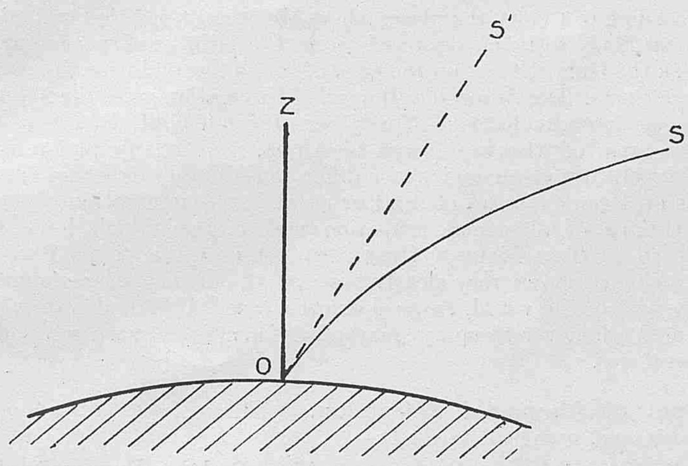


Figure 2.—Curved path of light from a star.

Normal Refraction. It is therefore almost universally true that any object seen, celestial or terrestrial, is viewed by rays of light which have been refracted more or less from the straight line between observer and object. The only exceptions are celestial bodies in the zenith and terrestrial objects very near the observer, in certain circumstances where it may be assumed that there is no change of density in the air between the observer and the object. Such refraction is known as normal refraction and this occurs when the fall of temperature of the air with height above the earth's surface has its average value. The path of rays from a terrestrial object under normal refraction is shown in Figure 3, the object being situated at **AB** and being seen in the direction **A′B′**. Figures 2 and 3 demonstrate the well-known effects of refraction which may be thus summarized :—

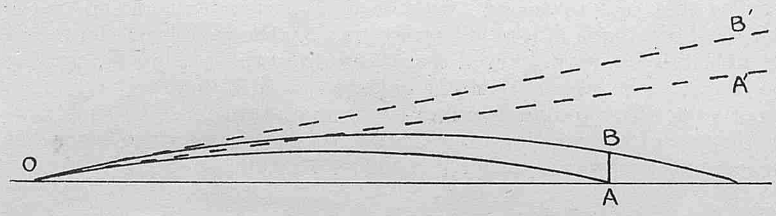


Figure 3.—Normal refraction of a terrestrial object.

(1) Except at the zenith celestial objects are elevated, thus decreasing the zenith distance.

(2) Celestial objects below the observer's geometrical horizon may be brought into his view.

(3) The observer's terrestrial horizon is extended, bringing more distant terrestrial objects into view which would otherwise be below the geometrical horizon.

The tables of refraction given in Inman's Tables and other works are approximate values based upon a formula worked out mathematically by Lord Rayleigh for zenith distances up to 75°. For zenith distances greater than 75° such a formula is not possible and the values are derived from a formula which was obtained experimentally by Bessel from observations of refraction. In some of the older works on navigation the values of refraction are those given by Ivory, but those do not differ appreciably from the values now accepted. The refraction tables are made out for a mean temperature and pressure and separate tables are given to correct the values for other temperatures and pressures. It must be noted, however, that such differences of temperature and pressure do not imply abnormal refraction.

It will be seen from the tables that refraction increases with zenith distance and therefore an object of appreciable size such as the sun or moon appears slightly contracted in a vertical direction, the lower limb being raised a little more than the upper limb. This is so slight however that it is not usually noticed unless the sun or moon is near the horizon. The same thing occurs also with distant terrestrial objects. The more extreme flattening of the sun and moon sometimes observed, with or without distortion, is due to abnormal refraction.

Distinction between Abnormal Refraction and Mirage. There is some confusion with regard to the use of these words which it is necessary to refer to before proceeding further. It would be strictly correct to include all varieties of mirage and abnormal refraction, that is all phenomena observed to differ from those of ordinary normal refraction, under the term "abnormal refraction." This, however, is not in accordance with general usage. The word "mirage" was coined by the French in 1798 during their expedition to Egypt to denote the desert type of mirage which their army had daily opportunities of seeing during their march through that country. The word was derived from the verb "se mirer" meaning "to look at oneself in a mirror." Some writers still confine it to that particular type of mirage, the inferior mirage, the description of which will be given below. The use of the word is now however frequently extended to include other forms of deceptions of vision in which erect or inverted images or marked distortion occurs, such as the superior mirages observed at sea, and this will be done in the present article. The term "abnormal refraction" will be applied to cases where refraction of the same type as normal refraction occurs but in greater degree. Abnormal refraction in this restricted sense is illustrated in Figure 4, which is precisely the same as Figure 3 save that the curvature of the rays from the object is greater and the apparent elevation of the object therefore also greater. Such abnormal refraction occurs when the density of the air decreases more rapidly than usual with height, for example if the air is warmer higher up than near the surface, as when warm air is present over cold water. This definition seems to be in accordance with the usage of seamen. Thus when a ship's position determined by sights is afterwards found to be appreciably in error, the difference is attributed to abnormal refraction even if no mirage, images or distortion of objects, was observed.

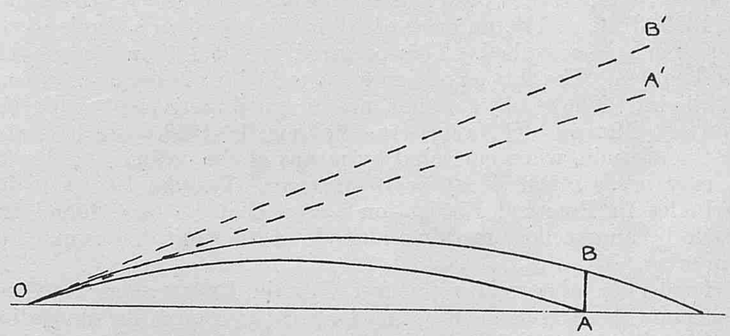


Figure 4.—Abnormal refraction of a terrestrial object.

It will be obvious that the distinction now laid down between abnormal refraction and mirage is only a rough one. The phenomena are often very complex and more than one type may be visible at the same time. Also variable mirages may be observed changing in form and type while under observation. It is difficult to find any account of the subject in which even the types of mirage and refraction more commonly observed are fully set out and it is hoped that the present article will achieve this purpose.

It may be of interest to quote the definitions given by Admiral Smyth in his "Sailor's Word-Book," 1867 :—"Mirage or Loom. A word which has crept into use since the French expedition to Egypt, to express the extraordinary refraction which light undergoes when strata of air, of different densities, extend above each other. The mirage, reflecting objects at a great height, inverts and doubles the image."

"Terrestrial Refraction. The property of the atmosphere by which objects appear to be higher than they really are, and in certain cases producing the effect called 'deceptio visus' and 'fata morgana.'"

The fata morgana is the multiple mirage of the Straits of Messina, so that both the above definitions include mirage. Admiral SMYTH gives no definition of "Abnormal Refraction," but defines "To Loom" as "an indistinct enlarged appearance of any distant object in light fogs, as the coast, ships, etc.; 'that land looms high'; 'that ship looms large'. The effect of refraction."

We have represented normal refraction of a terrestrial object by FIGURE 3 and abnormal refraction by FIGURE 4. It must be clearly understood that the degree of abnormal refraction may be greater or less and that nature being very complex will afford many intermediate values of refraction. In other words normal refraction may pass into abnormal refraction by imperceptible gradations. In both FIGURES 3 and 4 the denser air is nearer the ground so that the path of the light rays by which an object is seen is concave to the denser air.

The more common types of abnormal refraction and mirage will now be described.

Abnormal Refraction. Abnormal refraction may introduce considerable errors in the position of a ship obtained from sights and it is also a frequent source of disagreement between forenoon and afternoon sights. Abnormal refraction produces two main sources of error, the effect on the angle of dip and the effect on altitude. Of these the former is the biggest source of error. It will also of course affect the dip of a shore horizon. Hence the necessity for caution in the use of position lines obtained from sights if there be any suspicion of the presence of abnormal refraction. It is of course for this reason that navigators use three or more position lines obtained from altitudes of bodies on different bearings to fix their position.

Three cases of considerable error in a ship's position owing to abnormal refraction have been published in THE MARINE OBSERVER. In Volume IV, 1927, July, p. 128, an extract from the log of the S.S. *Port Sydney* will be found, showing that while approaching the English Channel the position by sights was 6 miles in error. In Volume V, 1928, January, p. 4, an error of 10 miles in the position of the S.S. *Baron Jedburgh*, off the South Australian coast is described. In Volume VII, 1930, July, p. 148, an error of 16′ in the meridian altitude of the sun at noon is described. This occurred in the Indian Ocean, S.S. *Clan Murdoch*. The ship's position was checked by stellar observations at twilight. These observations are in good agreement with the Admiralty Manual of Navigation, Volume I, 1928, which states that the altitude, when corrected by means of the ordinary tables for dip, may be as much as 10′ or 15′ in error. Captain LECKY in his "Wrinkles in Practical Navigation" says that he once found the latitude by an excellent meridian altitude of the sun to be as much as 14′ in error.

Referring to abnormal refraction Captain LECKY says: "These things point strongly to the necessity for great caution in the navigation of a ship. Nothing 'slapdash' should be allowed in connection with it, nor too much taken for granted. Who can tell how many wrecks might be traced to this cause, which at the time were ignorantly set down to some extraordinary 'jump' of the compasses, or some unlooked for current? Seamen would do well to give this important subject the attention it merits."

In the introduction to Inman's Tables a table of corrections for abnormal refraction is given, the correction being taken according to the observed difference between sea and air temperatures, but there is considerable divergence of opinion as to its value. The best way to minimise this error, if it be suspected, is to make the observations as low down in the ship as possible, say, at a height of eye of 10 feet or so, the bodies observed having altitudes of at least 20°. The difficulty is of course that abnormal refraction, if present, is not always suspected and there is no means of knowing if the displacement of the horizon is equal all round. In this connection reference should be made to the very interesting observation made by S.S. *John Pender* in Spanish waters, published in THE MARINE OBSERVER, Volume IV, 1927, September, p. 171. Here three types of abnormal refraction and mirage were visible simultaneously, the important point being that ships seen to the S.W. and W. were enlarged vertically while those seen to the S.E. and S. were contracted. This was due to the presence of a stratum of warm air over the sea, inclined to the horizontal, and the degree of raising of the horizon must have differed considerably in the two directions.

Captain LECKY quotes an interesting case where uncertainty in the relative position of the Zebayir and Hanish Islands, in the Red Sea, was unmistakeably proved to be due in part, if not wholly, to errors of observation, arising from excessive refraction. In the article on Currents of the Red Sea and the part of the Indian Ocean North of Australia, published in THE MARINE OBSERVER, Volume XI, 1934, October, p. 150, it was shown that no very strong currents set across the central channel of the Red Sea in easterly or westerly directions and it was there stated that in the past there is no doubt that alleged heavy cross sets in the central channel of the Red Sea have been due to false fixes by solar observation caused by refraction.

According to LECKY the places where abnormal refraction and mirage are most likely to be encountered are in the vicinity of warm currents such as the Gulf Stream, on the edge of soundings and near the mouths of large rivers. The Admiralty Manual of Navigation gives the following places as specially liable:—North Sea, Persian Gulf, Red Sea, Gulf Stream area, off the west coast of Africa, also in any region where the temperature of air and water differ considerably or where the sun shines on large expanses of sand or coral. An examination of the 77 observations of abnormal refraction and mirage which have been published in THE MARINE OBSERVER between the years 1927 and 1934 inclusive shows very clearly however that it may be encountered in any part of the world, tropical or otherwise. It should certainly be suspected whenever there are marked differences between sea and air temperatures.

Types of Abnormal Refraction. Three types of abnormal refraction will now be described:—

(1) Simple abnormal refraction, illustrated by FIGURE 4. This occurs when the air at a certain height is warmer than that near the sea, in such a way that the density of the air decreases uniformly with height above the sea. There is usually but not always a slight contraction of the height of the object, especially near the horizon and this type of abnormal refraction may, as noted above, not be suspected. Sometimes the conditions are such that the vertical height of the object is very much contracted, the resulting very flattened appearance being known as "stooping." An example of this was referred to above, when ships were seen diminished in height.

(2) Looming. This is one of the commonest forms of abnormal refraction and it may cause a raising of the horizon to a very considerable extent. There is always some degree of enlargement of the height of objects, hence the name of looming. In extreme cases the effect may be that of "towering," with or without much distortion of the object. Looming is illustrated by FIGURE 5; the rays from the top of the object **B** are more curved than those from the bottom **A**, causing the object to be seen apparently enlarged at **B′A′**, particularly in its upper part. To produce looming the temperature must be such that the density of the air diminishes only very slightly near the surface of the sea but somewhat quicker in a higher stratum.

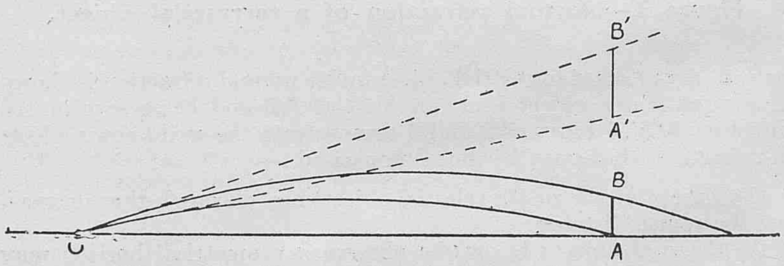


Figure 5.—Abnormal refraction. Looming.

The numerous observations of lights being seen at night far beyond their normal limit of visibility are examples of looming, and other cases will also be found recorded in the Marine Observer's Log. A classical example is the wonderful mirage of a great length of the French coast, raised above the horizon sufficiently to be well visible from the beach at Hastings and neighbouring parts of the English coast, on July 26th, 1798. A similar case where the image of Redonda Island was raised above the horizon was recorded by S.S. *Avelona Star*, in Volume IX, 1932, February, p. 36. Often in this type of mirage the higher parts of the coast or of a ship will be elongated and distorted while the lower parts are invisible.

The numerous observations of great distortion of the sun at sunset are also examples of this type of abnormal refraction.

(3) The conditions may be such that a double image is seen, an erect image in more or less close contact with the object seen directly.

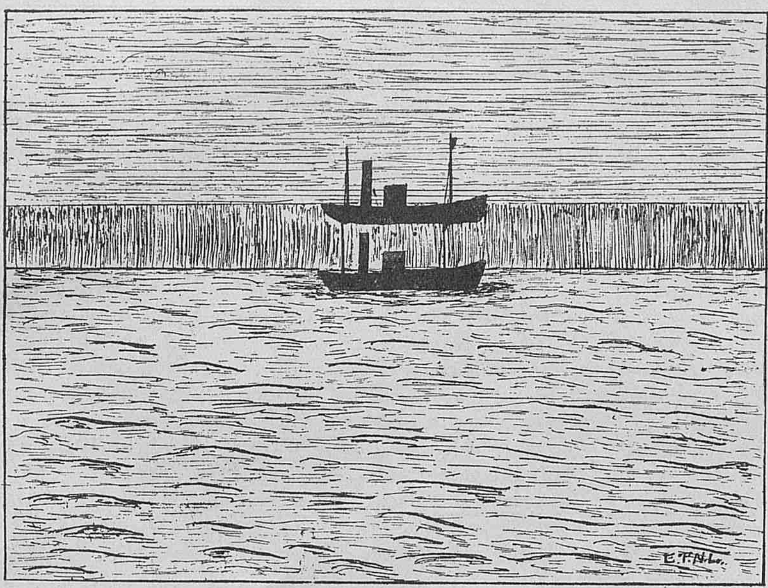


Figure 6.—Abnormal refraction, Double image.

A very striking example of this is shown in FIGURE 6; the observation will be found in full, recorded by S.S. *Port Darwin*, in Volume V, 1928, February, p. 27. The image of the horizon is also well seen.

It must be remembered that effects of abnormal refraction and mirage often depend very much on the height of the observer's eye. A striking example of this was seen by the author while standing in the stern of S.S. *Montrose* just after sunset on September 2nd, 1932, on her voyage from Montreal to Southampton. The ship was a few miles east of the entrance to Belle Isle Strait. Every time the pitch of the ship lowered the stern the Labrador coast showed, marked looming and distortion which entirely disappeared as the stern rose. As the sea was only slight the difference could not have been more than a few feet.

It is a curious fact that of a number of lights in the same locality one may be abnormally refracted while others are not. The explanation must be that there is some local peculiarity of temperature. In THE MARINE OBSERVER, Volume IV, 1927, November, p. 210, will be found an observation of the abnormal refraction of the light of the Pilot Ridge Light Vessel, in Latitude 20° 52′ N., Longitude 87° 53′ E., recorded by S.S. *Lahore*. The light when first seen was at an altitude of 5°–10° and as the light vessel was approached it gradually sank. The Hoogly River Pilot stated on this occasion that other ships had had similar experiences with this light and that it was the only light with which it occurred.

A curious case of abnormal refraction at night is recorded by S.S. *Maloja*, in Volume V, 1928, March, p. 47. The reflection of the moon on the waters of the Mediterranean was extended upwards under the moon to a point above the horizon.

A very remarkable observation by S.S. *Clan Ross* in South African waters will be found in Volume VII, 1930, March, p. 65, a drawing of which is reproduced in FIGURE 7. There was a sudden discontinuity in the height of the horizon, the two portions being joined by a vertical line.

Sometimes a double image of the sun or of a planet is seen at the time of setting, or the complete sun may have a segment of another image of the sun visible above it. FIGURE 8 shows an observation recorded by S.S. *Bendigo* in the South Atlantic Ocean, Volume VI, 1929, May, p. 105. FIGURE 9 shows part of a drawing made on board H.M.S. *Endeavour* in the Red Sea, Volume VII, 1930, April, p. 82.

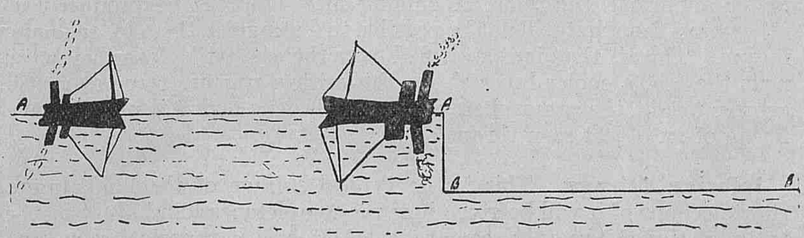


Figure 7.—Unusual abnormal refraction.

Here the sun was greatly distorted at sunset, finishing as a double segment. A double horizon with the sun setting twice over was recorded by S.S. *Mahana* in the South Atlantic Ocean, Volume III, 1926, March, p. 42.

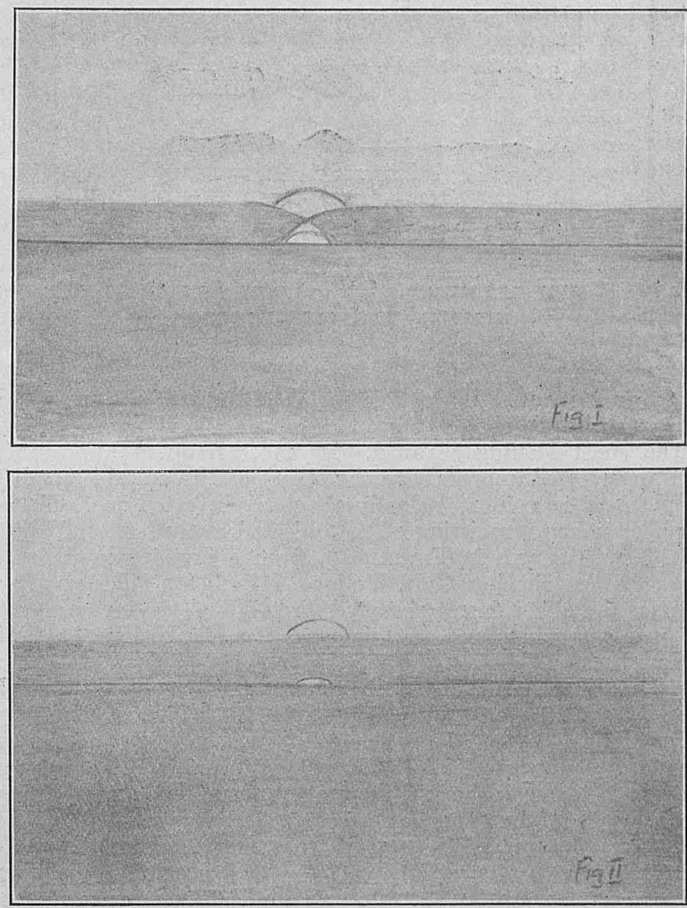


Figure 8.—Double sun at sunset.

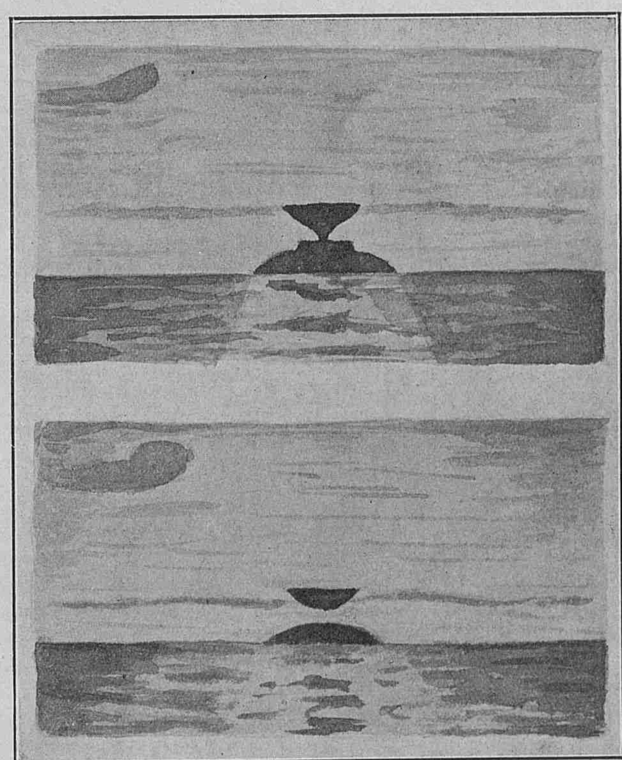


Figure 9.—Double sun at sunset.

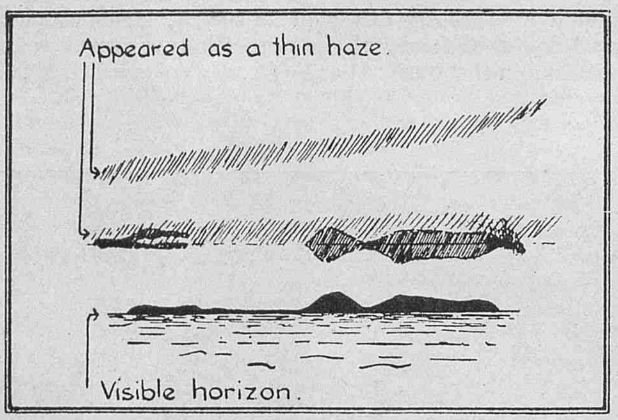


Figure 10.—Superior mirage. Object seen directly together with inverted and erect images.

Superior Mirage. We now come to a form of mirage which is most frequently observed at sea and seldom on land, except of course from the coast looking seaward. Its most frequent appearance is that of an inverted image above the object and in suitable conditions a second image is seen erect closely above the inverted one. The complete phenomenon, consisting of the object directly seen and the two images, is well shown in FIGURE 10, from a drawing made on S.S. *Barpeta*, in the Persian Gulf, Volume III, 1926, February, p. 22. Sometimes the object is not observed directly and the inverted image, or the inverted and upper erect images, of a ship below the horizon may thus be seen.

Superior mirage is not usually seen in low tropical latitudes. It is best and most frequent in Arctic and Antarctic regions but may be observed down to middle latitudes. The condition requisite for its formation is a warm layer of air existing over the sea at a suitable height, that is an inversion of temperature. The only difference between this and the condition necessary for abnormal refraction is that for superior mirage there must be a more sudden change from cooler to warmer air at a certain height. The formation of the inverted image is shown in FIGURE 11. On entering the warm upper layer the rays from the upper and lower parts of the object cross one another.

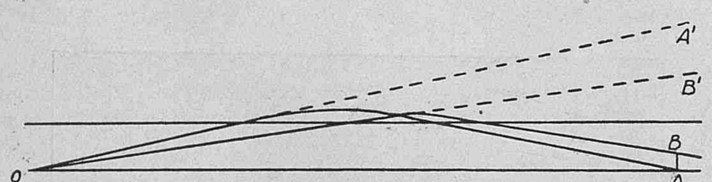


Figure 11.—Superior mirage. Formation of inverted image.

As the actual state of the air above the sea is often very complex as regards temperature, it is quite possible for abnormal refraction and mirage to appear at the same time or for the images and appearances to fluctuate and to change into one another. A fine example of this is the observation recorded by S.S. *Glenandy* in the China Sea, Volume VI, 1929, March, p. 55, when an exceptional variety of mirage was observed all day. No less than four different phenomena can be distinguished in the drawings which were published, (1) abnormal refraction, looming, (2) abnormal refraction, erect image of object above the object ordinarily seen, (3) superior mirage, inverted image of object above the object ordinarily seen, (4) superior mirage as in (3) with the addition of an erect image above the inverted one.

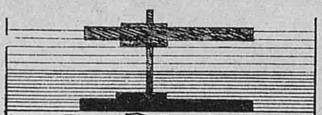


Figure 12.—Superior mirage. Object seen directly with inverted and erect images.

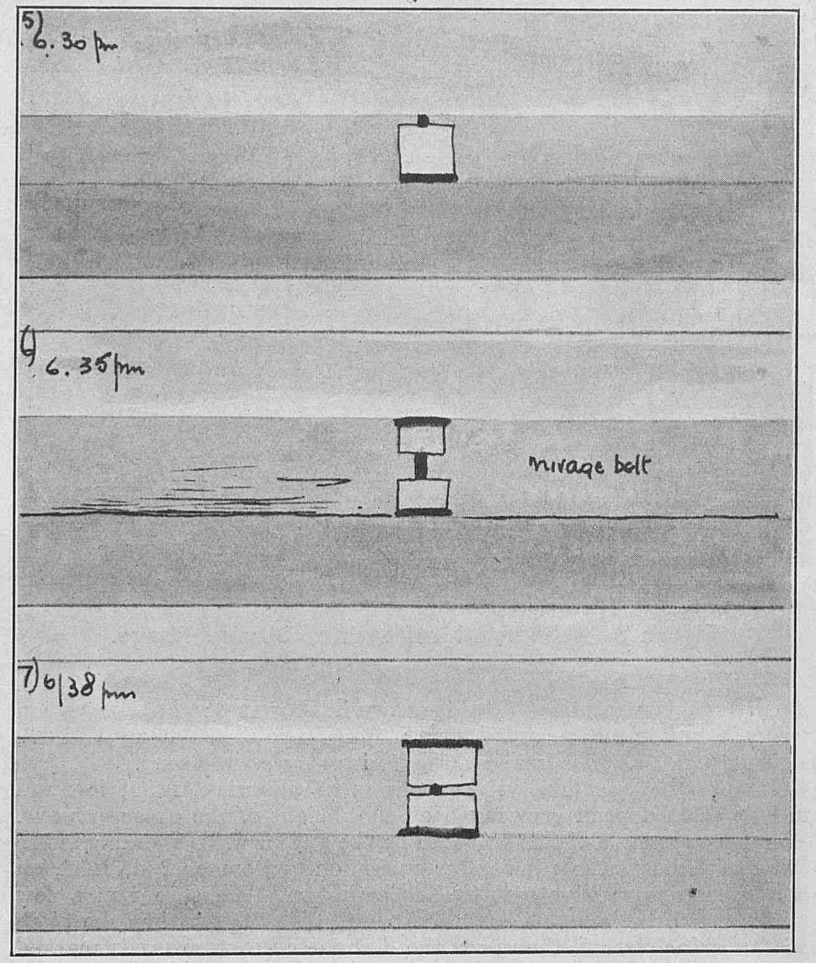


Fig. 13.—Superior mirage with inverted images of ship and horizon.

FIGURE 12 shows part of a drawing made on S.S. *Chindwin* in the Red Sea, Volume IV, 1927, April, p. 65. The steamer is seen directly with inverted and erect images above. FIGURE 13 shows part of a drawing made on S.S. *Stockwell* in the Red Sea, Volume VI, 1929, May, p. 104. Here the inverted image of the horizon is seen as well as that of a steamer. If we compare this with FIGURE 6, which illustrates an erect image of steamer and horizon, we see that a double horizon may arise in two ways.

Still more complex stratification of the air may give rise to additional images, but these are rare. It should be noted that the inverted image of superior mirage is usually somewhat ill-defined, while the erect image above it is clearer.

Relation of Fog to Mirage. We have seen that the condition of relatively warm air over cooler air is necessary to produce abnormal refraction and superior mirage. This condition arises by the presence of warm air over cooler or frozen sea, whereby the layer of air next to the sea is cooled, or by the influx of a shallow layer of cold air between the sea and the warmer air above. These conditions are those which give ordinary sea fog and hence the frequent combination of sea fog and mirage, as may be seen from the logs of ships recording these phenomena. As Sir NAPIER SHAW says, sea mirage and fog " are at least first cousins, if not twin brother and sister."

Looming. The common form of looming has been referred to above under abnormal refraction. Looming may however be produced in other ways though it will not be possible to distinguish these by ordinary means. Thus if the air is stratified over the sea, with a warmer layer next the sea, a cooler layer above this with a warmer layer at a still greater height the atmosphere will act as a lens and will magnify the image of an object seen through it.

Inferior Mirage. This is the typical mirage of the land, but a short account of it will be given here for completeness, and also because two varieties of it may be seen at sea. All forms of abnormal refraction and mirage previously mentioned depend upon the presence of warmer air over cooler air. The formation of inferior mirage is exactly the reverse. It is caused by the presence of a layer of very warm or hot air in contact with the ground, such as is found in desert countries on hot days. The density of the air near the ground is therefore reduced so that density increases with height above the ground. The production of inferior mirage is shown in FIGURE 14. Following the general rule that light rays are concave to the denser air, which is in this case above the object **AB**, they must be convex to the ground, and an inverted image is produced below the ground level and therefore projected on it. The illusion of a stretch of water, so common in desert countries, is produced by the image of the sky near the horizon. Inferior mirage is also well seen in any country if a smooth hard road be viewed on a warm day from a small elevation, say a foot or so above the road. It is easily seen from a car ascending a rise by looking at the line of the highest part of the hill just before the car reaches it.

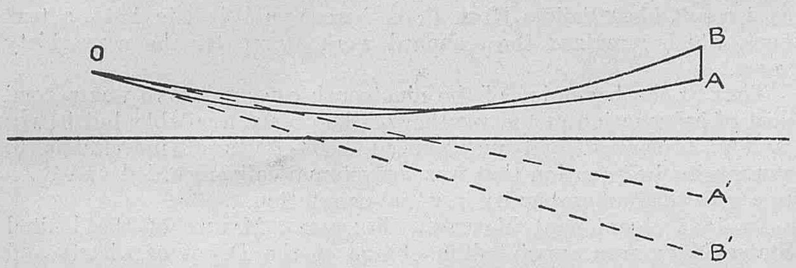


Figure 14. Formation of inferior mirage.

Inferior mirage is often seen at sea near the coast on warm days, taking the form of a whitish streak along the base of cliffs or land, in some cases apparently completely separating the land from the sea. This is an indication that the sea is warmer than the air above it.

Another manifestation of inferior mirage at sea is the phenomenon known as "sinking." This has the opposite effect to abnormal refraction, the distance of the visible horizon being lessened. It also indicates that the sea is warm relatively to the air above it. An instance is quoted below from Captain COOK'S South Polar voyages, where an iceberg disappeared temporarily from view on December 31st, 1773, during the passage of cold air associated with a snow squall. "To-day while we were observing the meridian altitude of the sun a shower of snow came from the west, and passed ahead of the ship; during which a large island of ice, considerably within the visible horizon, and directly under the sun, was entirely hid by it; yet the horizon appeared as distinct, and much the same as it usually does in dark hazy weather. When the shower was over, I found that it required the sun to be dipped something more than his whole diameter to bring his lower limb to the nearest edge of the ice-island, which must have been further off than the visible horizon, during the shower; and yet this would have been taken as the real horizon, without any suspicion, if it had been everywhere equally obscured. Hence may be inferred the uncertainty of altitudes taken in foggy, or what seamen in general call, hazy weather."

A form of mirage known as lateral mirage is sometimes seen on the faces of cliffs or walls on hot days and so would not be observed at sea except perhaps in very narrow waters. It is caused by the stratification of air of different temperatures and densities in vertical layers. All the layers of air we have previously spoken of in connection with mirage and abnormal refraction have been horizontal layers, or nearly so.

Fata Morgana. This is named from the famous multiple mirage of the Straits of Messina, but it is not confined to this locality. It is a phenomenon of narrow waters. There is much distortion and repetition of images. Mirage towers into the air and is also seen upon the surface of the water, with many fluctuations and changes. It is a combination of land mirage (inferior mirage) and sea mirage (superior mirage and abnormal refraction). It is named from Morgan the Fairy, the half-sister of King Arthur, in Arthurian romance. It is observed in other places in Italy and is known in Lecce under the name of "Mutate," that is "changing pictures," and in Apulia as "Lavandaja."

Historical. The desert mirage was observed in very remote times and frequent allusions were made to it in the Indian, Persian and Arabian poets. It is referred to in the Koran. It was scarcely known to the Greeks and Romans, but Diodorius Siculus, a Greek historian contemporary with Julius Cæsar and Augustus, wrote of the mirage of Africa. Records of the Fata Morgana in Italy go back to the second half of the sixteenth century. Captain SCORESBY while sailing the Polar seas in 1822 had been separated by the ice from his father's ship for a considerable time, and he was looking for the ship daily with great anxiety. One evening Captain SCORESBY saw the inverted superior mirage of the ship, in full colour, and by steering towards her was at length enabled to reach her, though a great distance, and masses of ice, separated the vessels. This method of finding each other's ships was, not infrequently, made use of by whalers.

THE HISTORY AND DEVELOPMENT OF ORGANIZED MARINE METEOROLOGY.

PREPARED IN THE MARINE DIVISION BY H. T. SMITH.

I. The First Organization.

THE ability to read aright the portents of the sky has always been an essential qualification of the efficient seaman, but it was not until the middle of the nineteenth century that an endeavour was made to systematically collect observations of weather at sea and utilize them for the help and guidance of navigators.

From the earliest times there had of course accumulated a store of traditional weather prognostics from the experiences of sailors, but it was not until the end of the fifteenth century when navigation gradually became less a matter of chance and more of a science, that weather in company with all other facts that would enhance safe navigation on future voyages, began to be regularly noted in ships' logs and journals.

Early in the next century, schools of navigation began to spring up and manuals of seamanship were published. In one of these, entitled "An Accidence, or the Pathway to Experience for all Young Seamen" by Captain JOHN SMITH, published in 1626, it is interesting to note the names given to the winds; "A calme, a breze, a fresh gaile, a pleasant gaile, a stiffe gaile, it overblows, a gust, a storme, a spoute, a loume gaile, an eddy wind, a flake of wind, a Turnado, a monthsoune, a Herycano." Captain SMITH omits to give any definition of the terms he uses and apparently the young seaman had to learn from practical experience what tradition had ascribed to a "loume gaile."

Various individuals from time to time compiled directories and accounts of their individual experiences on expeditionary voyages and published them for the benefit of their fellow seamen.

As early as 1675, JOHN SELLAR, Hydrographer to the King, published a description of the Trade Winds, which was found in 1807 to substantially correspond with the results obtained by a detailed examination of the logs of the East Indiamen.

DAMPIER (1651–1715), in the accounts of his voyages treats of such subjects as the general Trade Winds at sea; the best time of the year for crossing the Equinoctial; the winds near the Line being commonly uncertain and attended with calms and tornadoes, and how ships homeward bound from the Bight of Guinea should cross the Line.

A vast store of weather knowledge of the East Indian Seas was acquired and passed along mainly by tradition, by the officers of the fleet of the Honourable East India Company which continued uninterrupted from 1599 to 1834. A large number of their logs are still preserved at the India office and although they do not contain any instrumental observations, the direction of the wind is generally entered at intervals during the day and a summary giving a description of the force of the wind and the weather is given for every 24 hours. Some of the old terms given in Captain Smith's book of 1626 were still in use to describe the wind as long after as 1750. These East Indiamen's logs were analysed by Captain James Horsburgh, who was Hydrographer to the Company, and form the basis of his India Directory published 1809–11. This Directory gives a very full description of the winds and weather prevailing on the East India routes.

For the North Atlantic Benjamin Franklin in 1770 produced the first chart of the Gulf Stream which is reproduced in Figure 1.

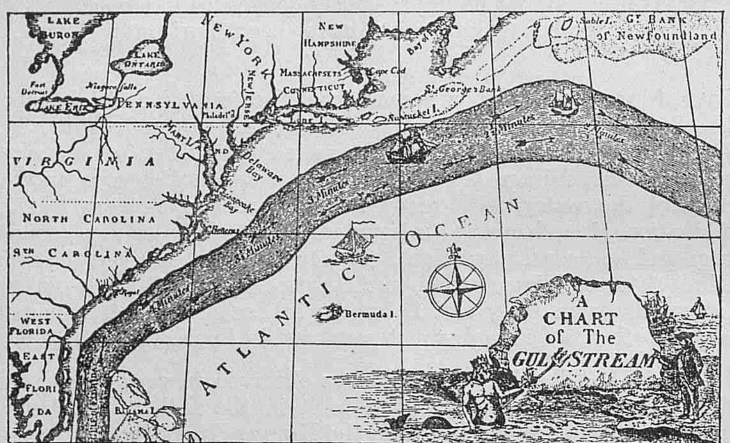


Figure 1. Benjamin Franklin's First Chart of the Gulf Stream.

(Reproduced from "The Depths of the Ocean," by Sir John Murray and Dr. Johan Hjort, through the courtesy of the publishers, Messrs. Macmillan & Co., Ltd.)

The foreign mail service was first established during the reign of Elizabeth, and a packet service to the West Indies, based on Falmouth, was in operation by 1688. By 1770 there was a regular mail service between Falmouth and Boston. It was noticed that the mail packets were often a fortnight longer going from Falmouth to Boston than ordinary merchantmen trading from London to Providence, Rhode Island, and this delay was the subject of a memorial from the Boston Customs to the English Treasury. Dr. Benjamin Franklin, who was connected with the American Postal Service, and who happened to be in England on a diplomatic mission, was asked to investigate the matter. In consultation with Captain Folger, a Nantucket whaler, he discovered the delay was due to the fact that the mail packets kept in the Gulf Stream right across and were thus set back sixty or seventy miles a day, while the traders avoided it altogether. Captain Folger, by means of his knowledge of the whale grounds which existed either side of the Gulf Stream, was able to give Dr. Franklin sufficient data to plot its course and limits. Franklin had the chart engraved, and it remained the standard chart of the Gulf Stream for the next seventy years. The definition of the Gulf Stream was far-reaching in its effect, owing to the peculiar thermal properties of that current. The determination of longitude at sea was still practically an unsolved problem for the mariner. The chronometer invented by Harrison in 1765 and which was to provide the ultimate solution, was still in the experimental stage. The charting of the Gulf Stream, therefore, offered a new method of determining longitude in the North Atlantic, namely by means of the thermometer. This view was brought forward by Dr. Franklin in 1795, the delay in publication being caused by political considerations. There is little doubt that this "Thermometrical Navigation," as it was called, did materially assist in the safe navigation of the Atlantic and not only that, but it diverted trade from the Southern States of North America to the Northern States and considerably shortened passages, for ships were now able to utilize the swift moving current, whereas formerly they had been drifted helplessly out of their course by it.

The first attempt at standardizing observation was made in 1805, when a scale for observing the force of the wind at sea was introduced by Admiral Sir Francis Beaufort. That scale, bearing his name, is still to-day the standard for observing the force of the wind.

By the beginning of the nineteenth century, the barometer was beginning to be recognized as an instrument of some value for the indication of approaching bad weather. Although the barometer had been invented as early as 1643 by Torricelli, it had found little favour at sea. Possibly the fact that weather changes did not always follow the same sequence with the simple rise and fall of the mercury may have caused it to be regarded with suspicion. Early in this century, however, readings of the barometer began to be recorded in logs and Horsburgh in his India Directory describes the flux and reflux of the mercury which occurs twice daily in the Tropics.

Thirty years later there began those investigations to try and explain what happened in the dreaded tropical revolving storms which were a danger to the stoutest ship. The West Indian Hurricanes were studied by both Colonel Reid and William Redfield and in 1838 Reid published his "Law of Storms." In the Indian Ocean, Henry Piddington was working on the cyclones that occur in that ocean and as a result his "Sailors Horn Book" was published in 1848, a text book which remained the standard work at sea for the next thirty years.

Thus at the beginning of the nineteenth century, there was a good deal of information of the weather of the oceans available, but it was largely haphazard and unorganized, the efforts of individuals to summarize information that was unsystematically recorded and open to a great deal of ambiguity in its interpretation.

In 1841, Lieutenant Matthew Fontaine Maury of the United States Navy was appointed in charge of the Depot of Charts and Instruments at Washington, a position he obtained as the result of the marked ability he had shown in a series of articles entitled "Scraps from the Lucky Bag," which dealt in a masterly fashion with such diverse subjects as naval reforms, the Gulf Stream and its causes and terrestrial magnetism. While at sea, he had often felt the necessity for a chart which gave a general idea of the winds and currents prevailing along the trade routes and had visualized the possibilities of such a chart to speed up passages. World trade was entering the competitive stage and already the factor of speed was becoming of prime importance. Consequently, when Maury entered his duties at the Chart Depot he issued an abstract log to the United States Navy and such captains of the Mercantile Marine who cared to co-operate, ruled for recording observations of wind, barometer, current, etc. Further he commenced to extract wind and current data from the old Navy logs stored in the Hydrographic Department.

By these means he obtained sufficient data to produce a wind and current chart on the route New York to Rio de Janeiro, together with a suggested new route for crossing the Equator.

Like most innovations, these charts were at first coldly received. As Maury himself says, when emphasizing that these charts are the combined experience of as many as 700 vessels: "But certain navigators were not disposed to look upon my investigations in this light. Forgetting that they were the results of actual observations, these persons were disposed to consider those results, thus announced, as theories, or matters of opinion of my own; whereas, they are no more matters of opinion, than the fact that the trade winds blow is a matter of opinion. They are nothing more or less than the sum of the experience of some thousands of navigators, as to winds and calms:

"The effect has been that, though many shipmasters have at once perceived the bearing of these results, and the correctness of the conclusions derived from them, and have readily adopted them, still, others have rejected them altogether, or only partially adopted them."

Once their value as an aid to navigation had been demonstrated by the more progressive shipmasters, however, the charts were soon in demand by the navigators of all countries. The charts were supplied free to ships of all friendly Powers who applied for them, the only condition being that an abstract log should be kept and returned to the Chart Depot.

Maury claims that the utility of these charts may be judged from the resulting reduction of passage by those ships who used them. On the new route for crossing the Equator, when bound New York to Rio, the average passage was made in 31 days against 41 days by the old route, and a few years later, when navigators were more practised on the new route, the passage was reduced to 20 days. The route to Australia was also charted and the passage to Australia was reduced from 124 days to 97 days. Probably Maury claimed too much, and there were other contributing factors to these reductions in passage, namely improved ship design, rigging and sails.

Thus Maury initiated the first attempt to organize the collection and compilation of Marine meteorological observations on a national basis and to return to seamen, in a form that was a practical aid to efficient navigation, the results of their voluntary work of observing at sea.

The United States Government were so impressed with the importance of this work and the need for extending the field of operation, that they readily acceded to MAURY'S view that this was work in which all the Maritime nations of the West should participate.

A conference of these nations was therefore called to consider the possibilities of mutual co-operation in this matter and the establishment of a uniform system of observing. This conference, which consisted of representatives from England, America, France, Belgium, Holland, Portugal, Norway, Sweden and Denmark, met at Brussels in 1853. It recommended that each country should establish a system for collecting data, a mutual exchange of data taking place where desirable; also, that tested instruments should be used as far as possible and an agreed form of abstract log kept.

The Brussels Conference may, therefore, be said to mark the birth of marine meteorology as an organized science of sufficient importance to demand State aid, and its inception was undoubtedly due to the untiring effort and practical foresight of MAURY, one of the foremost navigators of his day. It was organized for the express purpose of improving navigation, both from the point of view of safety of life at sea and that of commercial enterprise.

By 1858, all the countries represented at the Conference had established weather services for the collection of observations over the sea.

The British Meteorological Office was established in 1854 as a department of the Board of Trade. Captain (afterwards Admiral) ROBERT FITZROY was placed in charge. FITZROY had done admirable work in the surveys of the South American coast and his interest in weather phenomena had been demonstrated in his accounts of the "Voyage of the Beagle." His appointment was made on the recommendation of the Royal Society and he was given the title of Meteorological Statist to the Board of Trade.

The programme of the new department was drawn up in consultation with the Royal Society and the principal of its functions were agreed as being:

(1) The preparation of monthly, quarterly and annual means of pressure, temperature and humidity, in suitable geographical limits over all oceans.

(2) The careful observation of and enquiry into the temperature of the sea and the temperature, direction and velocity of ocean currents.

(3) An examination of the varying limits of the Trade Winds and Monsoons.

(4) The investigation of the fluctuations of temperature on a large scale.

(5) The collection of statistics of the force and direction of the wind over the Atlantic Ocean.

(6) The establishment of certain specified colonial stations.

It will be seen from this, that the function of the department was primarily a marine one. Its data were to be produced by the co-operation of seamen and the publication of its results would be in the interests of seamen, in accordance with the recommendations of the Brussels Conference.

Captain FITZROY issued a circular letter to Captains of ships in the Mercantile Marine, inviting their co-operation in the work of observing at sea, and, by 1855, 105 ships of the Mercantile Marine and 32 ships of the Royal Navy were equipped with tested meteorological instruments, and meteorological registers, as they were called in those days, began to accumulate.

As far as possible the work was carried out on the lines laid down by the Royal Society. The "geographical limit" was fixed at 10° of Latitude by 10° of Longitude, each 10° square, on Mercators Projection, being numbered in accordance with the plan devised by MARSDEN early in the nineteenth century.

For the purpose of grouping the observations, a further sub-division of the 10° Square into 5° Squares was made. The first method of dealing with the observations adopted by FITZROY was the use of "collection" books and from these to group the observations. One collection book was assigned for each element such as wind, barometer, etc. One page was allocated to each 5° Square, the ship's name or the number of the register and the date being copied with the particular element on the appropriate page. When sufficient observations had been copied for the investigation, the pages of the collection book were gone through and the entries re-copied on to sheets according to months, this process being called "grouping."

This method, of course, entailed the handling of the register many times and an enormous amount of duplication of copying, while at the same time, it was impossible to use the data for any other purpose, except in certain cases where the Latitude and Longitude was extracted with the observations.

Nevertheless several papers and charts were compiled and published. FIGURE 2 is taken from the Board of Trade Wind Charts, published 1859. The wind is shown by wind stars, the arrows represent the current; sea surface temperature, dip and magnetic variation are shown by figures.

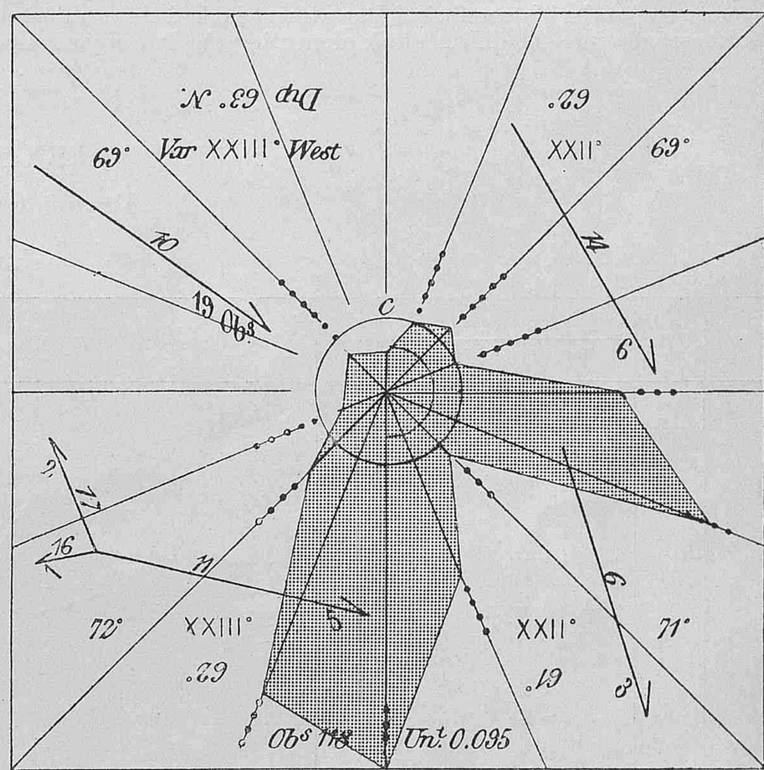


Figure 2.—5° Square (Latitude 35°-40° N., Longitude 10°-15° W.) from Board of Trade Wind Charts, 1859.

The whole diagram is extremely complicated, but it was an attempt to present at a glance information which was of use in navigation.

From 1858 onwards Fishery Barometers were loaned to some of the small fishing villages and seaports on the exposed parts of the coasts, together with small books of instruction for their use in indicating the approach of bad weather.

During 1857, it was arranged that a certain number of stations in the British Isles should make their observations simultaneously each day. These synchronous observations were plotted on synoptic charts. From a study of a number of these charts, FITZROY conceived the possibility of foretelling or as he termed it "forecasting" when a storm was approaching these islands and issuing a warning to the ports for the benefit of shipping.

The idea was not proceeded with at first, but in 1859, the British Association, under the Presidency of H.R.H. the PRINCE CONSORT, decided to approach the Board of Trade and the Admiralty with a view to the institution of some such system of storm warnings. Almost immediately after public opinion was stirred by the total loss of the *Royal Charter* in a storm off our Western coasts in October, 1859.

By the summer of 1860, fifteen stations in the United Kingdom had been established to communicate regularly observations made at a certain specified time, to London by telegraph. At the same time, FITZROY made arrangements for the hoisting of Storm Signals at certain ports. The first Gale Warning was issued on February 6th, 1861, and the same year the first "forecast" of weather was issued to the Daily Press.

The establishment of the Gale Warning service was a definite advance, and it was undoubtedly the means of saving life and property in Home waters, but with the small staff available to the Department, its maintenance did adversely affect the reduction and computation of the observations still being contributed by ships at sea. So much so, that in his annual report for the year 1862, FitzRoy contemplated reducing drastically the observing fleet as there were then sufficient data to occupy the available staff for several years, and he remarks : "To continue accumulating would tend to overwhelm." This policy he carried out, for by 1865, the number of merchant ships equipped with instruments, had been reduced to 16 as against 152 ships in 1858. From FitzRoy's subsequent reports in 1863 and 1864 it is evident that "forecasting" was occupying a large part of the Department's time.

Admiral FitzRoy died in 1865. His health had been impaired by the strain and anxiety of his survey work off South America. On his appointment to the Meteorological Department he had thrown himself wholeheartedly into the difficult task of creating the first organization of weather work at sea and the task of maintaining a Storm Warning service when little or nothing was known of the conditions governing the weather of these Islands. In addition he had made opportunity to devote considerable time to the work of the lifeboat institutions, for whose improvement he laboured unceasingly. FitzRoy was always of a highly strung temperament and the combined strain proved too great, causing him to meet his end at the early age of fifty-nine.

On Admiral FitzRoy's death the Board of Trade considered it expedient that an examination of the work done by the Meteorological Department should be made, in order to determine its future policy. A committee consisting of Francis Galton, Esq., F.R.S., General Secretary of the British Association, Staff Commander Evans, R.N., F.R.S., Chief Naval Assistant to the Hydrographer of the Navy, and T. H. Farrar, Esq., a secretary to the Board of Trade, was appointed in 1865 for this purpose.

(To be continued.)

SOUTHERN ICE REPORTS.

During the Year 1934.

January.

Year.	Day.	Position of Ice. Latitude.	Position of Ice. Longitude.	Description.	Remarks.	Name of Ship reporting.
1934	13	44° 23′ S.	113° 45′ E.	Berg	... ...	M.V. *Orari.*
	1	65° 34′ S.	73° 32′ W.	Small growler	About $\frac{1}{4}$ mile distant	R.R.S. *Discovery II.*
	1	65° 35′ S.	73° 35′ W.	Small growler	... ...	do.
	1	65° 46′ S.	73° 53′ W.	2 small bergs	Irregular and within 10 miles of track	do.
	2	67° 21′ S.	76° 31′ W.	Large berg	Irregular and within 3 miles of track	do.
	2	67° 29′ S.	76° 51′ W.	Pack ice	Loose ice was met with. Later a large extent of ice was encountered which stretched from the S.E. to W.N.W. quadrants for as far as the eye could see. The ice was new and comparatively heavy and the edge was considerably broken by a moderately northerly swell.	do.
	2	From 67° 30′ S. To 67° 19′ S.	77° 16′ W. 77° 24′ W.	Loose pack	The vessel was forced to the North in order to clear the main pack ice. This persisted till second position when the vessel was again set on course.	do
	2	From 67° 02′ S. To 66° 52′ S.	78° 45′ W. 78° 57′ W.	Loose pack	Vessel again forced to North to avoid the pack ice edge. No more ice was seen from second position.	do.
	4	65° 21′ S.	87° 22′ W.	Berg	Tabular	do.
	4	66° 39′ S.	89° 29′ W.	Berg	Medium sized tabular within 6 miles of track	do.
	4	66° 51′ S.	89° 57′ W.	Berg	Medium sized irregular within 7 miles of track	do.
	4	67° 10′ S.	90° 42′ W.	Berg	Medium sized irregular within 4 miles of track	do.
	4	67° 22′ S.	91° 07′ W.	Berg	Large, irregular within 3 miles of track	do.
	5	67° 45′ S.	92° 07′ W.	Berg	Small and irregular within 5 miles of track	do.
	5	From 68° 30′ S. To 68° 50′ S.	94° 04′ W. 95° 12′ W.	44 Bergs	Within 1–5 miles of track. About 20 of these were tabular. One was measured by sextant angles, vertical and depression, and found to be 135 ft. high. This was about the highest seen, an average height of between 100 ft. and 140 ft. being the rule. The remainder were irregular, much sea worn and of various sizes and shapes.	do.
	5	From 68° 50′ S. To 69° 16′ S.	95° 12′ W. 98° 10′ W.	30 Bergs	All within 12 miles of track. About half were tabular, the remainder irregular. No extremely large tabulars were seen, all varying from $\frac{1}{4}$ mile to $\frac{1}{2}$ mile in length.	do.
	5	69° 16′ S.	98° 10′ W.	Pack ice and 40 bergs	Pack ice extending to the South for as far as the eye could see. The ice seemed comparatively heavy and several small bergs were clustered at the inside edge. The vessel stopped at the ice edge and 40 bergs were counted within about 10 miles of the vessel's position to the North.	do.
	6	From 69° 16′ S. To 68° 48′ S.	98° 22′ W. 99° 39′ W.	40 bergs	Within 10–12 miles of track. About 20 low tabular bergs, remainder irregular.	do.
		From 68° 48′ S. To 67° 57′ S.	99° 39′ W. 101° 56′ W.	18 bergs	Within 10 miles of track. Most of these were tabular about 100 ft. high and varying from $\frac{1}{4}$ to $\frac{1}{2}$ mile long.	do.
		67° 51′ S.	102° 12′ W.	Tabular berg	The height measured by sextant angles, vertical and depression, was 100 ft. Its estimated length by distance run was $\frac{3}{4}$ mile.	do.
		From 67° 51′ S. To 66° 59′ S.	102° 12′ W. 104° 18′ W.	20 bergs	Within 10 miles of track. Mostly tabular	do.
	7	From 66° 58′ S. To 67° 12′ S.	104° 22′ W. 108° 42′ W.	5 bergs	All small and irregular and within 5 miles of track	do.
	8	From 67° 14′ S. To 68° 12′ S.	108° 48′ W. 111° 33′ W.	9 bergs	Within 6 miles of track. Seven were irregular and assumed varied shapes. Two large tabular bergs were observed faintly through mist. Their estimated height was 200 ft., length about 1 mile.	do.
	8	From 68° 12′ S. To 68° 58′ S.	111° 33′ W. 114° 00′ W.	15 bergs	Within 10 miles of track. Five of these were tabular between 180 and 200 ft. high by estimation and about 200 yards long. They were very solid with no caves or caverns. The remaining ten were irregular.	do.
	8	68° 58′ S.	114° 00′ W.	9 bergs	Within 6 miles of track. Four tabular 180 ft. high and 200 yards long by estimation.	do
	8	69° 14′ S.	114° 46′ W.	Loose ice streams	Thin streamers of ice with "Blink" to South and West ...	do.
		69° 20′ S.	114° 48′ W.		Vessel cleared isolated streams and entered open water with Blink to South.	do.
	8 9 9 9	From 69° 20′ S. To 69° 10′ S. To 68° 59′ S. To 68° 21′ S.	115° 00′ W. 115° 22′ W. 115° 52′ W. 117° 25′ W.	Loose pack ice and 130 bergs and bergy bits	Vessel navigating through loose pack. The floes were new, last year's ice, and easily broken on contact. At second position the vessel entered a large expanse of open water. This continued until third position when similar loose pack was encountered. The ice continued trending through the western quadrants until fourth position when the vessel's course was altered to 000°. Throughout this whole period the ice was always loose, about 130 bergs were noted, most of them were short tabular ones about 180 ft. high. Several broken down bergs, bergy bits, were also noted.	do.
	9 10	From 68° 18′ S. To 66° 02′ S.	117° 10′ W. 121° 22′ W.	21 bergs. Several growlers and bergy bits	Within 8 miles of track. Two small tabular. The remainder irregular. Bergy bits and growlers becoming common.	do.
	10	From 66° 02′ S. To 65° 38′ S.	121° 22′ W. 123° 10′ W.	8 bergs, numerous bergy bits	Within 6 miles of track. Only one small tabular seen. The remainder irregular. Bergy bits numerous.	do.
	11	From 65° 40′ S. To 66° 43′ S.	123° 15′ W. 125° 52′ W.	5 tabular bergs, numerous small bergs and bergy bits.	Within 5 miles of track. Throughout this period growlers and bergy bits abundant. The tabulars were small and scarce.	do.
	11	From 66° 43′ S. To 67° 52′ S.	125° 53′ W. 129° 28′ W.	35 small bergs, numerous bergy bits and growlers.	Within 5 miles of track	do

Year.	Day.	Position of Ice. Latitude.	Position of Ice. Longitude.	Description.	Remarks.	Name of Ship reporting.
1934	12	From 67° 55′ S. To 68° 13′ S.	129° 39′ W. 130° 41′ W.	18 bergs, numerous bergy bits and growlers. Brash ice.	Within 5 miles of track. Only 4 small tabulars. Remainder small and irregular. The bergy bits and growlers continued numerous. A light stream of brash ice was encountered in last position.	R.R.S. *Discovery II.*
	12	From 68° 13′ S. To 68° 46′ S. To 68° 26′ S.	130° 41′ W. 132° 52′ W. 133° 24′ W.	Numerous small bergs and bergy bits, occasional streams of brash ice.	Within 8 miles of track. Numerous small irregular bergs. Bergy bits and growlers. Only four medium sized irregular bergs were encountered. To these were connected light streams of brash ice which trailed away to leeward. In second position light streams of brash ice were met with.	do.
	12	From 68° 26′ S. To 67° 27′ S.	133° 24′ W. 135° 54′ W.	15 bergs, bergy bits and growlers ...	Within 8 miles of track 10 small irregular and 5 small tabular bergs. Bergy bits and growlers still numerous. In last position a light stream of brash was seen about 3 miles to port and running from south to east.	do.
	13	From 67° 22′ S. To 66° 19′ S.	136° 05′ W. 138° 43′ W.	23 bergs. Many small bergs. Bergy bits and growlers.	Within 7 miles of track. Seven small tabular. Remainder irregular. Small bergs and growlers still abundant.	do.
	13	From 66° 19′ S. To 65° 06′ S.	138° 43′ W. 141° 51′ W.	74 bergs. Few growlers ...	Within 8 miles of track. Ten medium sized tabular. Remainder irregular and of no great dimensions.	do.
	14	From 65° 11′ S. To 65° 34′ S.	142° 04′ W. 143° 12′ W.	4 bergs and bergy bit ...	Within 3 miles of track. 3 medium sized tabular bergs and one small irregular berg.	do.
	14	From 65° 34′ S. To 65° 57′ S.	143° 12′ W. 144° 22′ W.	47 bergs. Several growlers ...	Within 7 miles of track. 7 medium sized tabular. Remainder mostly irregular. Several large growlers.	do.
	14	From 65° 57′ S. To 66° 58′ S.	144° 22′ W. 147° 20′ W.	31 bergs, numerous growlers ...	Within 6 miles of track. Only four tabular. Remainder irregular and much weathered. Growlers still abundant.	do.
	15	From 67° 03′ S. To 67° 54′ S.	147° 35′ W. 150° 09′ W.	30 bergs ...	Within 8 miles of track. Five tabular. Remainder irregular and within eight miles of track.	do.
	15	From 67° 54′ S. To 68° 42′ S.	150° 09′ W. 152° 48′ W.	11 bergs and numerous growlers ...	Within 6 miles of track, eight tabular and three irregular. Growlers still abundant.	do.
	15	68° 42′ S.	152° 48′ W.	1 tabular berg ...	160 feet high, 0·4 mile long. This seemed a perfect sample of the tabular bergs which lately have been appearing more regular. It was perfectly flat on top and all sides were sheer to the water's edge.	do.
	15	69° 09′ S.	153° 47′ W.	3 bergs ...	Within 7 miles of track. Two tabular and one irregular ...	do.
	16	69° 12′ S.	153° 58′ W.	Heavy loose pack ...	Observed to south about 1 mile distant ...	do.
	16	69° 14′ S.	155° 47′ W.	Extensive loose pack ...	Extending from about S.S.E. to west and about 1 mile distant	do.
	16	69° 14′ S.	156° 30′ W.	Extensive loose pack ...	This was comparatively heavy hummocked in places ...	do.
	16	69° 05′ S.	157° 02′ W.	12 bergs ...	Mostly tabular from ¼ to ½ mile long and all new and unweathered.	do.
	16 16 16	From 69° 05′ S. To 69° 18′ S. To 69° 39′ S.	157° 02′ W. 158° 39′ W. 159° 25′ W.	32 bergs, loose pack and light streams of brash ...	Bergs 15 tabular, remainder irregular. Pack similar to that seen earlier in the day. Indication of pack to south ...	do. do. do.
	18	69° 21′ S.	160° 04′ W.	12 bergs ...	Within 3 miles of track. Ten tabular ...	do.
	18	68° 27′ S.	161° 31′ W.	Heavy loose pack. (Floe 15 ft. high by 180 ft. long.)	NOTES.—These floes were remarkable for their pure snowy whiteness and their perfect flatness. The height and length of one floe is given. Other floes were slightly larger and others, again, slightly smaller than this one. These floes appeared to be largely composed of layers of snow, each layer revealing a definite line of demarcation. Nowhere except in the Weddell Sea have floes of such dimensions been seen. There, however, the floes were not graced with the same softness.	do.
	18 18	From 68° 27′ S. To 67° 34′ S.	161° 31′ W. 162° 54′ W.	Numerous bergs.		
	19	From 67° 29′ S. To 66° 36′ S.	163° 01′ W. 164° 21′ W.	10 bergs ...	Within 1 mile of track. One tabular. Remainder irregular.	do.
	19	From 66° 36′ S. To 66° 13′ S.	164° 21′ W. 164° 50′ W.	22 bergs ...	Within 2 miles of track. Thirteen tabular bergs. Remainder irregular, one large irregular berg was very imposing and had obviously calved from a glacier. The central peak of this berg disappeared into the thick prevailing mist.	do.
	19	From 66° 13′ S. To 66° 00′ S.	164° 50′ W. 165° 03′ W.	14 bergs ...	Within 4 miles of track. Eight tabular. Remainder irregular.	do.
		66° 00′ S.	165° 03′ W.	1 tabular berg ...	Height 180 ft. Length 0·38 miles ...	do.
		From 66° 00′ S. To 65° 05′ S.	165° 03′ W. 166° 08′ W.	6 bergs ...	All tabular within 5 miles of track ...	do.
	20	64° 26′ S.	166° 50′ W.	1 irregular berg ...	¼ mile distant in mist ...	do.
		62° 56′ S.	168° 22′ W.	1 irregular berg ...	¼ mile distant in mist ...	

Reports of Ice sighted in the month of January in Years previous to 1934, which have not previously been published in the Marine Observer.

Year.	Day.	Latitude.	Longitude.	Description.	Remarks.	Name of Ship reporting.
1933	1	From 58° 39′ S. To 59° 00′ S.	42° 50′ W. 43° 00′ W.	23 bergs ...	Within 5 miles of track. Ten were tabulars, three being large and well preserved, and each about 1,500 feet long and 150 feet high. The remaining 13 were all weathered and sea-worn, ten of moderate size and three small.	R.R.S. *Discovery II.*
	1	From 59° 00′ S. To 59° 19′ S.	43° 00′ W. 43° 18′ W.	6 bergs ...	Within 7 miles of track. Two large tabulars, both about 2,000 feet long and 180-200 feet high. These were much caverned, and one had an arch cut right through the middle of it, where the berg narrowed to a width of about 100 feet. Of the rest, one was a moderate sized tabular, and the remaining three were all small and much sea-worn.	do.
	1	From 59° 19′ S. To 59° 43′ S.	43° 18′ W. 43° 51′ W.	14 bergs ...	Within 10 miles of track. Seven tabulars of moderate size, and the remainder mainly small and much broken down.	do.
		From 59° 43′ S. To 60° 12′ S.	43° 51′ W. 44° 30′ W.	20 bergs ...	Within 10 miles of track, the majority during latter half of run. Of these, 7 were tabular, the largest perhaps ½ mile long; and all about 150 feet high. All these bergs appeared very old, and were breaking down in places. Of the rest, all were very irregular and rugged; about half of them of moderate size and breaking down, and half small and much sea-worn.	do.
	1 2	From 60° 12′ S. To 7m N.E. of C. Dundas, Laurie Id.	44° 30′ W.	23 bergs ...	Within 6 miles of track. 4 tabulars, two of which were each about 2,000 feet long. The remainder were of various shapes and sizes, none very large, and mainly much weathered and broken-down.	do.

Remarks—R.R.S. Discovery II.

SOUTH ORKNEYS.

JANUARY 1ST TO 7TH, SOUTHERN COASTS OF THE ISLANDS.

South of the whole group, all the way from Cape Dundas on Laurie Island to the western end to Coronation, bergs were clustered in profusion. Within 20 miles of the coasts, it was estimated that 1,500 bergs of all sizes were present, with a plentiful sprinkling of bergy bits, growlers and small ice. When coasting the islands, the southern horizon was always either totally obscured by bergs, or was only visible in small segments. From January 22nd to the 26th, the south shores were again coasted while running survey, and at this time no more than half the bergs previously seen were present. Of these, about 200 were grounded close into the coast, and the thinning was most marked in the offing, the bergs having evidently been drifting away to the eastward.

In Lewthwaite and Washington Straits.

On January 4th, about fifty bergs were present in Washington Strait and twenty in Lewthwaite Strait. On the 30th, no more than half this number were observed. On January 12th, while lying in Ellesen Harbour, several bergs were observed to be moving slowly northward through Lewthwaite Strait, against a moderate north-westerly wind. Some of these bergs were from 80 to 150 feet in height, and as the water they were moving in was only from 50 to 70 fathoms deep, there is further reason to believe that Antarctic tabular bergs of barrier origin float with no more than about three-fourths of their bulk submerged. This conclusion is also borne out by observations off the south coast, where large bergs, 150 feet in height, were definitely remarked to be afloat in 70 or 80 fathoms of water. A reason for this is to be found in the fact that the upper strata of a tabular berg are very much less dense than those of its base and under-water portions. This is seen in the layers of snow deposition, which are evenly laid and broad at the top of a berg, and narrow successively down to the waterline, where they are often compressed to a small fraction of the width at the top, and sometimes contorted by strains.

North Coasts.

On January 11th, the north shore of Coronation Island was coasted. About 150 bergs were present here, within 15 miles of the coast, and fairly evenly distributed, the number increasing slightly to the eastward.

On January 2nd about 150 bergs were present within 15 miles of the north coast of Laurie Island. On January 29th, only seventy were observed, though to the east of the island bergs were still clustered very thickly; these evidently having moved up from the southward of the islands in their general north-easterly drift.

West of Coronation Island.

On January 10th, eighty bergs were present within a 30 mile radius of the western coast. On January 25th, when the Inaccessible Islands were surveyed, this number had decreased to sixty, the rest having evidently moved away to the north-east.

Description.

Of all these bergs, at least 70 per cent. were tabular or of tabular origin. Two very large bergs, each about $1\frac{1}{2}$ miles long and 110 feet high, were seen off the south coast of Coronation, and one tabular a mile long, was present in Jessie Bay, north of Laurie Island. Of the rest, the majority were under 600 feet in length, but they varied between tabulars half-a-mile long to small, low sea-worn bergs.

The highest measured was 285 feet, but one or two of the broken-down tabulars may have reached 300 feet. About 200 bergs in all were 200 feet in height or over, and in all cases these were tabulars in which the softer upper strata had crumbled away, leaving high towers or walls, so that the bergs lightened and tilted. Perfectly preserved level-topped tabulars were never more than 180 feet in height. About fifty bergs, mainly low, seaworn specimens, were noticed to be covered, on one plane, with a jumble of crumbled blocks of ice frozen on to their surface. They were probably remnants of larger bergs which had crumbled down on to a low foot, as is sometimes seen to happen in breaking down tabulars.

Probably only a few of all the bergs, and those few very small specimens, were of local origin. Several were observed loaded with morainic matter of a similar nature to that seen *in situ* on the island ice-faces.

The glacierisation of the islands is not of a type calculated to produce large bergs. There are no true valley glaciers with feet protruding into the sea and no expanded ice-feet or built out barriers. The snow-fields of the higher parts of the land feed large fringing ice-aprons, which, between the steeper mountain masses, fringe the coasts with ice-cliffs from 100 to 180 feet in height. In all cases these ice-cliffs rest on the land; often on a steep beach created by the debris they themselves bring down. Invariably they are too crevassed to stand the necessary strain of being pushed forward and water-borne, and as the pressure above forces them forward, they flake off in fragments. The resulting brash and growlers are common around the island coasts. Occasionally an overhanging portion of cliff may break away in a large fragment and create a small berg, but such a berg would be too much fractured with crevasses to maintain its identity for long.

The longest unbroken stretch of ice-face is the head of Norway Bight, Coronation Island, where the cliff extends for $2\frac{3}{4}$ miles without a break. Several continuous faces between 1 and 2 miles long exist between small rocky outcrops and nunataks on the northern side of Coronation Island. There are several mile long fronts on the south side also, but here, where the land has a very much steeper general gradient, the surfaces of the apron-glaciers are much more crevassed than on the gentler slopes of the northern side. Laurie Island, with its straggling outlines and generally more rugged topography, has fewer long ice-cliffs, and the ice-aprons tend to become more nearly simply fringing shelves formed in situ by drifted snow.

Signy Island is very little glacierised. A small ice-field covering the high land in the centre of the island has its outlet in a practically stagnant glacier fronting Borge Bay. The face of this glacier has receded. Its path to the sea is clearly marked by moraines, but its foot now rests half-a-mile inland.

The only other form of glacerisation on the islands is an armouring of the higher mountains which gives rise to ice-falls of varying magnitude. This armouring which, since winds from the southern semicircle are the chief snow-bearing winds, is most extensive on *the southerly aspects of the land* masses, is most marked on Coronation Island.

In all, twenty-two bergs and growlers partly laden with morainic matter were seen off the islands, several of which were in parts quite black with foreign matter. Probably a few of the smallest of these were of local origin.

Twenty-five partly bottle-green bergs were seen, none of them being very large. From one a sample of ice was obtained and was found to consist of clear, dense ice, free from any included matter. These bergs float very much lower in the water than do their white opaque counterparts, and their ice is considerably harder.

No vestige of sea-ice of any kind was seen round the South Orkneys the whole of January.

Year.	Day.	Position of Ice. Latitude.	Position of Ice. Longitude.	Description.	Remarks.	Name of Ship reporting.
1933	30	From Inaccessible Islands. To 60° 45′ S.	47° 26′ W.	54 bergs	Within 15 miles of track, fairly evenly distributed. Twelve were tabulars, mainly breaking down, and all were of moderate size and appeared old and much weathered.	R.R.S. *Discovery II.*
	30	From 60° 45′ S. To 61° 06′ S.	47° 26′ W. 48° 39′ W.	11 bergs	Within 12 miles of track. Two were large tabulars, and the remainder of moderate size and breaking down. One small bottle-greeny was seen.	do.
	31	From 61° 06′ S. To 61° 38′ S.	48° 39′ W. 50° 26′ W.	78 bergs	Within 7 miles of track, fairly evenly distributed. Two were very large tabulars, each about a mile long and perhaps 100 feet high. Of the rest, about half were tabulars and half rugged and irregular, and all of moderate size or large. The majority of these bergs appeared to be very old, and they were in many cases caverned and deeply sea-worn. Two small partly bottle-green bergs were seen.	do.
		From 61° 38′ S. To 61° 41′ S. To 61° 35′ S.	50° 26′ W. 50° 30′ W. 50° 41′ W.	Pack-ice and drift	At this position, the ragged edge of loose, but fairly heavy pack-ice was met, and was skirted, on various courses, till the latter position, when an ice-free sea to the westward was experienced. This sea-ice was strung out in ragged streams, patches of drift, and detached broken floes along its northern edge. It was not examined closely, but though fairly heavy, did not appear to be very old.	do.

Year.	Day.	Position of Ice. Latitude.	Position of Ice. Longitude.	Description.	Remarks.	Name of Ship reporting.
1933	31	From 61° 38′ S.	50° 26′ W.	52 bergs	Within 15 miles of track, fairly evenly distributed on either side. Twenty of these were among pack-ice to the southward. Fifteen tabulars, the largest about half-a-mile long, and the rest of various sizes and in most cases much weathered and broken down. One small totally bottle-green berg was seen, and one much sea-worn, parti-coloured berg. All the bergs passed this watch appeared to be very old.	R.R.S. *Discovery II.*
		To 61° 32′ S.	50° 59′ W.			
	31	From 61° 32′ S.	50° 59′ W.	104 bergs	Within 15 miles of track, fairly evenly distributed. Of these, 72 were tabulars of various sizes, the largest about 1½ miles long and 120 feet high. The remaining 32 were irregular and mainly small and sea-worn. One small bottle-greeny and one small berg laden with morainic matter were seen. Towards the latter position, a change in the general character of the bergs was remarked, namely, a much larger percentage of fine, level, new looking tabulars, with clean cut fracture planes on their wall-sides and very little evidence of sea-wear. These bergs were of a fairly uniform height, from 110 to 150 feet.	do.
		To 61° 15′ S.	53° 03′ W.			
	31	From 61° 15′ S.	53° 03′ W.	56 bergs	Between positions, within 12 miles of track. Of these, half were tabulars, the largest being about 1½ miles long, and most of them well-preserved. They varied in height between 100 and 200 feet. The rest were irregular in outline and of moderate size or small.	do.
		To 61° 43′ S	53° 41′ W.			

February.

Year.	Day.	Position of Ice. Latitude.	Position of Ice. Longitude.	Description.	Remarks.	Name of Ship reporting.
1934	20	63° 53′ S.	172° 40′ W.	Irregular berg	Medium sized and within 1 mile of track ... ... Note.—This was the first berg sighted since leaving Dunedin.	R.R.S. *Discovery II.*
		66° 01′ S.	170° 19′ W.	Irregular berg	Small and within 2 miles of track	do.
	21	From 66° 19′ S.	169° 57′ W.	10 bergs and numerous growlers	7 small and irregular, 3 small and tabular	do.
		To 66° 44′ S.	169° 23′ W.			
		From 66° 44′ S.	169° 23′ W.	Numerous small bergs and growlers		do.
		To 67° 18′ S.	168° 38′ W.			
		From 67° 18′ S.	168° 38′ W.	23 bergs and numerous small growers ...	Within 10 miles of track. Mostly small and irregular ...	do.
		To 67° 52′ S.	167° 54′ W.			
		From 67° 52′ S.	167° 54′ W.	2 small bergs and 25 bergy bits	Scattered and within 10 miles of track	do.
		To 68° 30′ S.	167° 38′ W.			
		69° 03′ S.	167° 22′ W.	Tabular berg	Small and within 1 mile of track	do.
		From 69° 03′ S.	167° 22′ W.	Ice free.		do.
		To 70° 21′ S.	167° 32′ W.			
	22	From 70° 21′ S.	167° 32′ W.	5 bergs and several small growlers	All within 4 miles of track	do.
		To 71° 26′ S.	168° 36′ W.			
		From 71° 26′ S.	168° 36′ W.	45 bergs and loose flow	About 20 small tabular. Remainder irregular ... ... Note.—At the last position. The sea within a radius of 15 miles was strewn with bergy bits and growlers. Pack ice was not visible although thought to be very near. Many large and low tabular flow were also visible.	do.
		To 72° 01′ S.	171° 26′ W.			
	23	From 72° 01′ S.	171° 26′ W.	14 bergs and many growlers	Five bergs were medium sized tabular, about ½ mile long and 120 ft. high. Remainder irregular.	do.
		To 71° 07′ S.	169° 43′ W.			
	24	From 71° 07′ S.	169° 43′ W.	Ice free	... ...	do.
		To 68° 41′ S.	164° 25′ W.			do.
		From 68° 41′ S.	164° 25′ W.	45 bergs, brash ice and growlers	Within 10 miles of track. Mostly medium sized tabular bergs.	do.
		To 67° 51′ S.	162° 28′ W.			
		From 67° 51′ S.	162° 28′ W.	Numerous bergs and growlers	This area was packed with bergs, a rough estimate being about 250. They were mosty tabular and of no great size. In most cases they seemed comparatively new, with little or no caves.	do.
		To 67° 55′ S.	160° 17′ W.			
	24	From 67° 55′ S.	160° 17′ W.	20 bergs	Mostly tabular and within 15 miles of track	do.
		To 68° 05′ S.	158° 57′ W.			
	25	From 68° 06′ S.	158° 55′ W.	30 bergs	Mostly small and irregular and within 10 miles of track ...	do.
		To 68° 24′ S.	156° 40′ W.			
		From 68° 24′ S.	156° 40′ W.	30 bergs and 2 growlers	Mostly small and irregular. One berg 170 ft. high by sextant angles, ½ mile long.	do.
		To 68° 34′ S.	155° 28′ W.			
		To 68° 40′ S.	155° 01′ W.			
		To 68° 50′ S.	154° 04′ W.			
		From 68° 50′ S.	154° 04′ W.	13 bergs. Several growlers	Within 10 miles of track. Four bergs were large and tabular, about 150 ft. high and ½ mile long.	do.
		To 69° 08′ S.	152° 42′ W.			
	26	From 69° 24′ S.	151° 29′ W.	17 bergs	Mostly small and irregular and within 6 miles of track ..	do.
		To 69° 55′ S.	148° 55′ W.			
		From 70° 11′ S.	147° 26′ W.	25 bergs	Only two tabular. These were about 1 mile long and 100 ft. high. The remainder were weathered and irregular.	do.
		To 70° 28′ S.	145° 55′ W.			
	27	From 70° 31′ S.	145° 48′ W.	8 bergs and several small growlers	All within 10 miles of track. Four medium sized tabular. Remainder irregular.	do.
		To 71° 23′ S.	144° 00′ W.			
		71° 19′ S.	143° 45′ W.	Drift-ice	At this time streams of drift ice were encountered which trailed away from fairly heavy pack extending South as far as the eye could see. Visibility 10 miles.	do.
		From 71° 19′ S.	143° 45′ W.	12 bergs	Within 10 miles of track. These bergs are small and weathered. Typical tabular bergs have been rare for several days.	do.
		To 71° 10 S.	143° 00′ W.			
		From 71° 10′ S.	143° 00′ W.	25 bergs	Within 10 miles of track two small tabular bergs. Remainder small and irregular.	do.
		To 70° 08′ S.	140° 26′ W.			
	28	From 70° 07′ S.	140° 23′ W.	12 bergs	Within 6 miles of track. Seven irregular. Remainder small tabular bergs.	do.
		To 69° 13′ S.	137° 48′ W.			
		From 69° 13′ S.	137° 48′ W.	13 bergs	Within 6 miles of track. Three small tabular. Remainder irregular and weathered.	do.
		To 68° 26′ S.	135° 30′ W.			
		From 68° 26′ S.	135° 30′ W.	16 bergs	Within 6 miles of track, all small and irregular	do.
		To 68° 01′ S.	134° 14′ W.			

Reports of Ice sighted in the month of February in Years previous to 1934, which have not previously been published in the Marine Observer.

Year.	Day.	Position of Ice. Latitude.	Position of Ice. Longitude.	Description.	Remarks.	Name of Ship reporting.
1933	1	61° 44′ S.	53° 41′ W.	Ice-island, 90 bergs and drift-ice	Met an enormous ice-island, and the positions given here contain its limits on three sides. This ice-island had a perfectly level top, and was estimated to be between 80 and 90 feet high. In outline it was very irregular, being marked with a series of deep indentations alternating with sharp points along most of its edge. The bergs seen here were within 15 miles of the "coasts" of the ice-island. Most of them were tabular, and no doubt in many cases were originally parts of the island. Several were between one and three miles long, and they ranged in height from 80 to 160 feet. At intervals round the ice-island, ragged streams and patches of drift-ice were encountered. This ice was fairly heavy but not very old. It was much broken up. No doubt the ice-island was responsible for its presence, by preventing it from coming away to the north, and loose pack was seen to the southward all along the island's southern side. The dimensions of the ice-island recorded above were calculated to be 38 miles long and 12½ miles wide. It was approximately oval in shape, its long axis lying roughly E. by N. and W. by S.	R.R.S. *Discovery II.*
		61° 52′ S.	53° 14′ W.			
		62° 05′ S.	53° 43′ W.			
		62° 00′ S.	53° 55′ W.			
		61° 53′ S.	54° 32′ W.			

Year.	Day.	Position of Ice. Latitude.	Longitude.	Description.	Remarks.	Name of Ship reporting.
1933	1	From 62° 05′ S. To 62° 07′ S. To 62° 04′ S.	54° 38′ W. 54° 44′ W. 54° 42′ W.	Loose pack and drift-ice	Between these positions, the vessel worked through loose, thin streams and patches of drift-ice. Loose pack lay to the southward. The ice consisted of fairly heavy broken up floes, for the most part unpressured, and covered with about 18 inches of snow.	R.R.S. *Discovery II.*
	2	61° 48′ S.	54° 43′ W.	Berg	Of moderate size and tabular	do.
		61° 44′ S.	54° 38′ W.	Berg	Large and tabular	do.
		From 61° 27′ S. To 4m W. of Clarence Id.	54° 43′ W.	14 bergs	Within 7 miles of track. Six tabulars, the largest about 2,000 feet long, and all of old appearance and breaking down; eight small much weathered bergs Three fairly large tabulars were in the strait between Elephant and Clarence Islands.	do.
	2	Elephant Island.		3 bergs	Two large tabulars, each about 2000 feet long, were grounded on the south side of Elephant Island; and one large tabular 12 miles south-west of the island.	do.
	3	14 m. S.W. of O'Brien Id.		2 bergs	Of moderate size and tabular; much broken down	do.
		19m. S.W. of O'Brien Id.		Berg	Tabular about 1,500 feet long and 150 feet high	do.
		16m. N. of Bridgman Id.		Berg	Of moderate size and tabular; much weathered	do.
		From 17m. E.N.E. of C. Melville To 4m. S. of C. Melville		16 bergs	Within 7 miles of track. Of these, only two were tabular, 8 were irregular in outline, and all were much weathered and broken down. The largest was about 1,000 feet long and 200 feet high. The remaining 6 were small, peaked, sea-worn bergs.	do.
	3	Penguin Island.		3 bergs	One a mile to the south, and two, two miles east of Penguin Island. All about 600 feet long and 120 feet high, and of similar character; level-topped tabulars much caverned and sea-worn.	do.
	4	Between Penguin Id. and Telefon Rocks.		14 bergs	Within 15 miles of the south coast of King George Island. All except four close inshore. Three of these bergs were moderate size tabulars, one of new appearance and 80 feet high, two old and caverned. The remaining 11 bergs were mainly small and much sea-worn.	do.
	4	From 10m. S. of Telefon Rocks. To 47m. S. by E. of Telefon Rocks.		11 bergs	Within 8 miles of track, fairly evenly distributed. Of these, 2 were large, well-preserved tabulars, both about 1,200 feet long; two tabulars of moderate size, and 7 weathered bergs, mainly small.	do.
	5	62° 49′ S.	59° 00′ W.	Berg	Small and sea-worn	do.
		62° 46′ S.	59° 19′ W.	Berg	Of moderate size and tabular	do.
		Between Trinity Id. Hoseason Id. and Austin Rocks.		5 bergs	Scattered in this are. Two large tabulars, both about 1,000 feet long but sea-worn and breaking down. The remaining three were of moderate size, and much sea-worn.	do.
		5m. W. of Hoseason Id.		2 bergs	Small and weathered	do.
		2–4m. E. of Low Id.		2 bergs	One of moderate size, one small. Both capsized and much sea-worn.	do.
		5m. N.E. of Low Id.		Berg	High, tilted tabular, about 400 feet long	do.
	22	52° 28′ S.	40° 41′ W.	Berg	Small and weathered, 70 feet high 200 feet long	do.
		52° 34′ S.	39° 20′ W.	2 bergs	Both irregular and weathered; of moderate size. About 120 feet high and 400 feet long.	do.
	24	From 54° 12′ S. To 54° 20′ S.	35° 04′ W. 34° 25′ W.	5 bergs	Within 5 miles of track, evenly distributed, all small and much weathered and broken down. The largest was about 200 feet long.	do.
		54° 26′ S.	35° 08′ W.	Berg	Weathered. 20 feet high, 100 feet long	do.
	25	Off Skrapskjar Rocks.		Berg	One small weathered berg aground	do.

March.

Year.	Day.	Latitude.	Longitude.	Description.	Remarks.	Name of Ship reporting.
1934	1	69° 58′ S.	130° 16′ W.	5 irregular bergs	Within 4 miles of track. All small and irregular	R.R.S. *Discovery II.*
		70° 30′ S.	129° 17′ W.	5 bergs	One tabular berg about ½ mile long and 120 feet high. Remainder irregular.	do.
		70° 26′ S.	129° 17′ W.	Drift ice and pancake ice	Fairly detached and streamed out in all directions. Pancake ice was beginning to form.	do.
	2	From 70° 21′ S. To 69° 34′ S.	129° 02′ W. 127° 00′ W.	7 bergs and several small growlers	Within 7 miles of track. Two small tabular. Remainder irregular.	do.
		From 69° 34′ S. To 69° 16′ S.	127° 00′ W. 125° 56′ W.	7 bergs	All within 6 miles of track	do.
		From 69° 12′ S. To 68° 45′ S.	125° 24′ W. 123° 57′ W.	3 small irregular bergs	Within 6 miles of track	do.
	3	From 68° 42′ S. To 67° 59′ S.	123° 47′ W. 121° 16′ W.	11 bergs	3 small and tabular, remainder irregular. All within 6 miles of track.	do.
		67° 23′ S.	118° 35′ W.	Irregular berg	... ...	do.
	4	66° 52′ S.	116° 35′ W.	1 berg	Irregular, within 5 miles of track	do.
	4	66° 35′ S.	115° 19′ W.	1 berg	Small and irregular	do.
		66° 36′ S.	114° 30′ W.	2 bergs	Small and weatherworn	do.
		66° 32′ S.	114° 10′ W.	1 berg	Small and weatherworn	do.
	5	67° 36′ S.	109° 39′ W.	1 berg	Medium sized irregular	do.
		67° 55′ S.	108° 10′ W.	1 bergy bit	... ...	do.
	6	68° 26′ S.	105° 23′ W.	1 berg	Within 10 miles of track large tabular. Est. length 1 mile.	do.
		68° 29′ S.	105° 04′ W.	1 berg	Medium sized tabular	do.
		68° 30′ S.	104° 52′ W.	1 berg	Small and irregular	do.
		68° 36′ S.	104° 06′ W.	1 berg	Large tabular, within 6 miles of track	do.
		From 68° 39′ S. To 68° 44′ S.	103° 50′ W. 102° 37′ W.	6 bergs	Within 10 miles of track. Four large tabular. Remainder small and irregular.	do.
	6 7	From 69° 08′ S. To 69° 34′ S.	100° 40′ W. 98° 17′ W.	7 bergs	Within 15 miles of track. Three small tabular. Remainder irregular.	do.
		69° 38′ S.	97° 59′ W.	Loose pack	This ice seemed new. Several large floes were to be seen which were joined by light brash and pancake ice. Although the ice was loose at the edge it seemed to tighten up considerably at no great distance in from the edge. The visibility was good and the ice stretched far away to the South.	do.
		From 69° 38′ S. To 69° 41′ S.	97° 59′ W. 97° 03′ W.	4 bergs	Within 10 miles of track. All fairly large and tabular ...	do.
		69° 41′ S.	97° 03′ W.	Loose pack ice	This ice was similar to that met early in the morning and stretched far to the S.W. and E.N.E.	do.
		69° 39′ S.	96° 50′ W.	1 berg	About ten miles off and in the pack	do.
		From 69° 14′ S. To 68° 55′ S.	96° 00′ W. 95° 02′ W.	3 bergs	Within 5 miles of track. 1 small tabular. Remainder irregular	do.
	8	From 68° 55′ S. To 68° 32′ S.	95° 02′ W. 91° 54′ W.	7 bergs	Within 8 miles of track. Two large tabular and two small tabular bergs. Remainder small and irregular.	do.
		From 68° 29′ S. To 68° 06′ S.	91° 17′ W. 89° 52′ W.	Slush and pancake ice	Vessel passed over streams of newly formed slush ice. The surface water was freezing and the tiny ice scales lapping together resembled an oily track of water.	do.
		From 68° 05′ S. To 67° 58′ S. To 67° 46′ S.	89° 51′ W. 89° 23′ W. 89° 23′ W.	Pack ice and 1 berg	At second position heavier pack ice was met and was skirted on a true course of 000°.	do.
		From 67° 46′ S. To 67° 35′ S. To 67° 34′ S.	89° 23′ W. 88° 24′ W. 88° 16′ W.	4 bergs and drift ice	Bergs within 10 miles of track, all small and irregular. Light pack ice streams.	do.
	9	From 67° 34′ S. To 67° 13′ S. To 67° 08′ S.	88° 16′ W. 86° 54′ W. 86° 09′ W.	3 bergs and drift ice	Two irregular bergs and 1 medium sized tabular, isolated streams of drift ice with strong blink to southward.	do.
		67° 15′ S.	83° 33′ W.	1 berg	Small and irregular	do.
	10	67° 49′ S.	79° 49′ W.	1 berg	Small and irregular	do.
		67° 59′ S.	79° 36′ W.	2 bergs	About 4 miles distant. Both small and tabular, about 80 ft. high.	do.
	10	68° 18′ S.	79° 33′ W.	Light ice streams and 1 berg...	Small and tabular	do.
		67° 38′ S.	79° 30′ W.	1 berg	½ mile distant. Small and irregular	do.

Year.	Day.	Position of Ice. Latitude.	Longitude.	Description.	Remarks.	Name of Ship reporting.
1934	11	67° 08′ S.	79° 27′ W.	1 berg	About 3 miles distant. Small and irregular	R.R.S. *Discovery II.*
	30	60° 49′ S.	54° 47′ W.	Bergs	2 small and irregular. First ice seen since leaving Port Stanley.	do.
		60° 45′ S.	54° 18′ W.	Berg	1 very small and irregular	do.
	31	61° 31′ S.	51° 11′ W.	Berg	1 small and irregular	do.
		From 61° 39′ S. To 62° 01′ S.	50° 49′ W. 49° 51′ W.	5 bergs	Within 3 miles of track. All small and irregular	do.
		62° 01′ S.	49° 51′ W.	Berg	Tabular berg, 120 feet high and 600 yards long by sextant angles.	do.
		61° 55′ S.	49° 11′ W.	Berg	About 130 ft. high, 800 yards long	do.
		61° 52′ S.	48° 58′ W.	Berg and 2 growlers	Medium sized tabular	do.

Reports of Ice sighted in the Month of March in Years previous to 1934 which have not previously been published in the Marine Observer.

Year.	Day.	Latitude.	Longitude.	Description.	Remarks.	Name of Ship reporting.
1933	1	54° 18′ S.	35° 47′ W.	Berg	Weathered and pinnacled. 60 ft. high, 200 ft. long	R.R.S. *Discovery II.*
	2	From 55° 05′ S. To 55° 20′ S.	33° 35′ W. 32° 51′ W.	39 bergs	Within 10 miles of track, evenly distributed. Of these, 30 were tabulars, the largest being half-a-mile long. They averaged 100 feet in height, and several were of quite new appearance. The remaining 9 were irregular, weathered and water-worn, probably all capsized or broken down tabulars.	do.
		From 55° 20′ S. To 55° 55′ S.	32° 51′ W. 31° 16′ W.	122 bergs	Within 12 miles of track, fairly evenly distributed. Of these, about 40 were tabulars and the remainder irregular and of various shapes. None was of any great size, the longest perhaps 1,000 feet long; and all were much weathered and broken down. Four small partly bottle-green bergs were seen.	do.
	3	From 55° 59′ S. To 56° 34′ S.	31° 10′ W. 29° 34′ W.	25 bergs	Within 5 miles of track. Nearly all these bergs were broken down and weathered tabulars of moderate size. One small partly bottle-green berg was passed.	do.
		From 56° 34′ S. To 57° 05′ S.	29° 34′ W. 27° 59′ W.	44 bergs	Within 14 miles of track. Three tabulars of moderate size, all the rest much weathered and broken down, about half of them small and half of moderate size. Three small bottle-greenies were seen, and one small pinnacle berg was capped with black ice and was intersected with a stratum of black ice about 2 feet wide.	do.
		From 57° 05′ S. To 57° 26′ S.	27° 59′ W. 26° 48′ W.	9 bergs	Within 12 miles of track. One tabular of moderate size, the rest very old, weathered, and broken-down, and mainly small. One small, partly bottle-green berg was passed.	do.
	4	From 57° 26′ S. To 57° 55′ S.	26° 48′ W. 24° 56′ W.	14 bergs	Within 8 miles of track. Four tabulars of moderate size, sea-worn and breaking down; the rest old, irregular and weathered, and of moderate size and small. One bottle-green growler was passed.	do.
		From 57° 55′ S. To 58° 26′ S.	24° 56′ W. 23° 24′ W.	42 bergs	Within 12 miles of track. About 30 of these bergs were small, and 12 of moderate size. All were much weathered and broken-down. Two bottle-green growlers were seen.	do.
		From 58° 26′ S. To 58° 45′ S.	23° 24′ W. 22° 27′ W.	14 bergs	Within 12 miles of track. One high, tilted tabular, much broken down, the rest irregular and much weathered. Of these, the largest was about 1,000 feet long and 150 feet high, the rest being mainly small, ranging from 70 to 300 feet in length.	do.
	5	From 58° 45′ S. To 59° 10′ S.	22° 27′ W. 20° 25′ W.	7 bergs	Within 10 miles of track. Two tabulars of moderate size, both about 100 feet high, and 5 small much weathered bergs.	do.
		From 59° 10′ S. To 59° 32′ S.	20° 25′ W. 18° 35′ W.	18 bergs	Within 12 miles of track. Two tabulars of moderate size, both about 120 feet high and 600 feet long; the rest all much weathered and sea-worn about half small and half of moderate size.	do.
		From 59° 32′ S. To 59° 49′ S.	18° 35′ W. 17° 19′ W.	10 bergs	Within 10 miles of track. One moderate sized tabular, the rest irregular and weathered and mainly small.	do.
	6	From 59° 49′ S. To 60° 18′ S.	17° 19′ W. 15° 01′ W.	22 bergs	Within 10 miles of track. Five tabulars, of which two were large, about 150 feet high and 1,200 feet long. These tabulars were of new appearance and well preserved. The remaining 17 were all irregular, weathered and sea-worn; 7 were of moderate size and 10 were small.	do.
		From 60° 18′ S. To 60° 45′ S.	15° 01′ W. 13° 11′ W.	22 bergs	Within 12 miles of track. Three tabulars of moderate size. The rest nearly all small and much weathered and broken-down.	do.
		60° 50′ S.	12° 48′ W.	Berg	Weathered and broken-down. 80 feet high, 300 feet long	do.
	7	61° 05′ S.	11° 41′ W.	Berg	Tabular and well-preserved. 100 feet high, 600 feet long	do.
		61° 18′ S.	10° 42′ W.	Berg	Tabular and well-preserved. 110 feet high, 1,000 feet long	do.
		61° 26′ S.	9° 56′ W.	3 bergs	Within 5 miles of position. All of moderate size and much weathered.	do.
	8	62° 10′ S.	6° 36′ W.	2 bergs	One tabular of moderate size and one small pinnacled berg	do.
	8 12	From 62° 10′ S. To 69° 05′ S.	*West.* 6° 36′ W. *East.* 9° 19′ E.	Ice free	No ice at all sighted between these positions. The weather was generally clear.	do.
		69° 05′ S.	9° 19′ E.	Berg	Weathered and saddle-shaped. 80 feet high, 350 feet long	do.
		From 69° 19′ S. To 69° 20′ S. To 69° 16′ S.	9° 27′ E. 9° 29′ E. 9° 39′ E.	Drift ice, pancake ice; light pack and 15 bergs	At first position, met small fragments of light sea-ice, in patches, and streams, with pancake ice. This gradually became heavier and more compact to the southward, and at second position the edge of fairly compact light pack ice was met. The floes composing this were light, and of young ice, and it was much broken up, no floes being more than a few feet in diameter. The bergs were all to the southward of this position, within a 10 miles radius. All of them were of moderate size. Four tabulars of fairly new appearance were remarked, all of about 60 feet in height. The remainder were irregular, weathered and sea-worn bergs.	do.
	13	68° 62′ S.	10° 10′ E.	Berg	Tabular. 80 feet height, 400 feet long	do.
	16	59° 56′ S.	14° 36′ E.	2 bergs	Both small and weathered	do.
		From 59° 10′ S. To 58° 42′ S.	14° 40′ E. 14° 42′ E.	6 bergs	Within 10 miles of track, fairly evenly distributed. All these bergs were small and much weathered. The largest was about 300 feet long.	do.
		From 58° 34′ S. To 57° 55′ S.	14° 42′ E. 14° 43′ E.	8 bergs	Within 10 miles of track. All these bergs were small and weathered in various shapes, mainly pinnacled.	do.
	17	From 57° 18′ S. To 56° 13′ S.	14° 44′ E. 14° 45′ E.	9 bergs	Within 7 miles of track, fairly evenly distributed. One tabular about 30 feet high, the rest all much weathered and irregular. All small, none over 200 feet in length.	do.
		From 56° 13′ S. To 55° 19′ S.	14° 45′ E. 14° 45′ E.	12 bergs	Within 10 miles of track. Three of moderate size, nine small. One broken down, tilted tabular; all much weathered.	do.
		From 55° 19′ S. To 54° 03′ S.	14° 45′ E. 14° 40′ E.	7 bergs	Within 8 miles of track. Three of moderate size, four small. Three broken-down tabulars; all much weathered.	do.
	18	From 53° 30′ S. To 52° 43′ S.	14° 36′ E. 14° 26′ E.	6 bergs	Within 10 miles of track. Of these, four were of moderate size, the largest a weathered tabular about 100 feet high and 600 feet long. The other two were small pinnacled bergs.	do.

Reports of Ice previous to January, February and March 1934, will be found in the Marine Observer, Volume XI, No. 113, p. 24.

MARINE METEOROLOGY AND SAFE NAVIGATION.

Extracts from Merchant Shipping (Safety and Load Line Conventions) Act, 1932.
First Schedule.

International Convention for the Safety of Life at Sea, 1929.

Article 33.
Application.

The provisions of this Chapter referring to ships, unless otherwise expressly provided, apply to all ships on all voyages.

Article 34.
Danger Messages.

The master of every ship which meets with dangerous ice, a dangerous derelict, a dangerous tropical storm or any other direct danger to navigation is bound to communicate the information by all the means of communication at his disposal, to the ships in the vicinity, and also to the competent authorities at the first point of the coast with which he can communicate. It is desirable that the said information be sent in the manner set out in Regulation XLVI.*

Each Administration will take all steps which it thinks necessary to ensure that when intelligence of any of the dangers specified in the previous paragraph is received, it will be promptly brought to the knowledge of those concerned and communicated to other Administrations interested.

The transmission of messages respecting the dangers specified is free of cost to the ships concerned.

Article 35.
Meteorological Services.

The Contracting Governments undertake to encourage the collection of meteorological data by ships at sea, and to arrange for their examination, dissemination and exchange in the manner most suitable for the purpose of aiding navigation.

In particular, the Contracting Governments undertake to cooperate in carrying out, as far as practicable, the following meteorological arrangements :—

(*a*) To warn ships of gales, storms and tropical storms, both by the issue of wireless messages and by the display of appropriate signals at coastal points :

(*b*) To issue daily, by radio, weather bulletins suitable for shipping, containing data of existing weather conditions and forecasts :

(*c*) To arrange for certain selected ships to take meteorological observations at specified hours, and to transmit such observations by wireless telegraphy for the benefit of other ships and of the various official meteorological services; and to provide coast stations for the reception of the messages transmitted :

(*d*) To encourage all ship-masters to inform surrounding ships whenever they experience wind force of 10 or above on the Beaufort scale (force 8 or above on the decimal scale).

The information provided for in paragraphs (*a*) and (*b*) of this Article will be furnished in form for transmission in accordance with Article 31, sections, 1, 3 and 5, and Article 19, section 25, of the General Regulations annexed to the International Radiotelegraph Convention, Washington, 1927, and during transmission "to all stations" of meteorological information, forecasts and warnings, all ship stations must conform to the provisions of Article 31, section 2, of those General Regulations.

Weather observations from ships addressed to national meteorological services will be transmitted with the priority specified in Article 3, Additional Regulations, International Radiotelegraph Convention, Washington, 1927.

Forecasts, warnings, synoptic and other meteorological reports intended for ships shall be issued and disseminated by the national service in the best position to serve various zones and areas, in accordance with mutual arrangements made by the countries concerned.

Every endeavour will be made to obtain a uniform procedure in regard to the international meteorological services specified in this Article, and, as far as is practicable, to conform to the recommendations made by the International Meteorological Organization, to which organization the Contracting Governments may refer for study and advice any meteorological questions which may arise in carrying out the present Convention.

Article 36.
Ice Patrol. Derelicts.

The Contracting Governments undertake to continue a service of ice patrol and a service for study and observation of ice conditions in the North Atlantic. Further, they undertake to take all practicable steps to ensure the destruction or removal of derelicts in the northern part of the Atlantic Ocean east of the line drawn from Cape Sable to a point in latitude 34° N., longitude 70° W., if this destruction or removal is considered necessary at the time.

The Contracting Governments undertake to provide not more than three vessels for these three services. During the whole of the ice season they shall be employed in guarding the south-eastern, southern and south-western limits of the regions of icebergs in the vicinity of the Great Bank of Newfoundland for the purpose of informing trans-Atlantic and other passing vessels of the extent of this dangerous region; for the observation and study of ice conditions in general; for the destruction or removal of derelicts; and for the purpose of affording assistance to vessels and crews requiring aid within the limits of operation of the patrol vessels.

During the rest of the year the study and observation of ice conditions shall be maintained as advisable, and one vessel shall always be available for the search for, and destruction or removal of derelicts.

Article 37.
Ice Patrol. Management and Cost.

The Government of the United States is invited to continue the management of these services of ice patrol, study and observation of ice conditions, and derelict destruction and removal. The Contracting Governments specially interested in these services, whose names are given below, undertake to contribute to the expense of maintaining and operating these services in the following proportions :—

	Per cent.
Belgium	2
Canada	3
Denmark	2
France	6
Germany	10
Great Britain and Northern Ireland	40
Italy	6
Japan	1
Netherlands	5
Norway	3
Spain	1
Sweden	2
Union of Socialist Soviet Republics	1
United States of America	18

Each of the Contracting Governments has the right to discontinue its contribution to the expense of maintaining and operating these services after September 1st, 1932. Nevertheless, the Contracting Government which avails itself of this right will continue responsible for the expense of working up to September 1st following the date of giving notice of intention to discontinue its contribution. To take advantage of the said right it must give notice to the other Contracting Governments at least six months before the said September 1st, so that, to be free from this obligation on September 1st, 1932, it must

* See page 29.

give notice on March 1st, 1932, at the latest, and similarly for each subsequent year.

If, at any time, the United States Government should not desire to continue these services, or if one of the Contracting Governments should express a wish to relinquish responsibility for the pecuniary contribution defined above, or to have its percentage of obligation altered, the Contracting Governments shall settle the question in accordance with their mutual interests.

The Contracting Governments which contribute to the cost of the three above-mentioned services shall have the right by common consent to make from time to time such alterations in the provisions of this Article and of Article 36 as appear desirable.

Article 38.

Speed Near Ice.

When ice is reported on, or near, his course, the master of every ship at night is bound to proceed at a moderate speed or to alter his course so as to go well clear of the danger zone.

Article 39.

North Atlantic Routes.

The practice of following recognised routes across the North Atlantic in both directions has contributed to safety of life at sea, but the working of these routes should be further investigated and studied with a view to the introduction of such variations as experience may show to be necessary.

The selection of the routes and the initiation of action with regard to them is left to the responsibility of the steamship companies concerned. The Contracting Governments will assist the companies, when requested to do so, by placing at their disposal any information bearing on the routes which may be in the possession of the Governments.

The Contracting Governments undertake to impose on the companies the obligation to give public notice of the regular routes which they propose their vessels should follow, and of any changes made in these routes; they will also use their influence to induce the owners of all vessels crossing the Atlantic to follow, so far as circumstances will permit, the recognised routes, and to induce the owners of all vessels crossing the Atlantic bound to or from ports of the United States via the vicinity of the Great Bank of Newfoundland to avoid, as far as practicable, the fishing banks of Newfoundland north of Latitude 43° N. during the fishing season, and to pass outside regions known or believed to be endangered by ice.

The Administration managing the ice patrol service is requested to report to the Administration concerned any ship which is observed not to be on any regular, recognised or advertised route, or which crosses the above-mentioned fishing banks during the fishing season, or which, when proceeding to or from ports of the United States, passes through regions known or believed to be endangered by ice.

Regulation XLVI.

Transmission of Information.

The transmission of information regarding ice, derelicts, tropical storms or any other direct danger to navigation is obligatory. The form in which the information is sent is not obligatory. It may be transmitted either in plain language (preferably English) or by means of the International Code of Signals (Wireless Telegraphy Section). It should be issued **CQ** to all ships, and should also be sent to the first point of the coast to which communication can be made with a request that it be transmitted to the appropriate authority.

All messages issued under Article 34 of the present Convention will be preceded by the safety signal TTT followed by an indication of the nature of the danger, thus; TTT Ice; TTT Derelict; TTT Storm; TTT Navigation.

Information Required.

The following information is desired, the time in all cases being Greenwich Mean Time :—

(*a*) *Ice, Derelicts and other Direct Dangers to Navigation.*

(1) the kind of ice, derelict or danger observed;

(2) the position of the ice, derelict or danger when last observed;

(3) the time and date when the observation was made.

(*b*) *Tropical Storms.* (Hurricanes in the West Indies, Typhoons in the China Seas, Cyclones in Indian waters, and storms of a similar nature in other regions.)

(1) *A Statement that a Tropical Storm has been Encountered.*

This obligation should be interpreted in a broad spirit, and information transmitted whenever the master has good reason to believe that a tropical storm exists in his neighbourhood.

(2) *Meteorological Information.*

In view of the great assistance given by accurate meteorological data in fixing the position and movement of storm centres, each shipmaster should add to his warning message as much of the following meteorological information as he finds practicable :—

(*a*) barometric pressure (millibars, inches or millimetres);
(*b*) change in barometric pressure (the change during the previous two to four hours);
(*c*) wind direction (true not magnetic);
(*d*) wind force (Beaufort or decimal scale);
(*e*) state of the sea (smooth, moderate, rough, high);
(*f*) swell (slight, medium, heavy) and the direction from which it comes.

When barometric pressure is given the word "Millibars," "inches" or "millimetres," as the case may be, should be added to the reading, and *it should always be stated whether the reading is corrected or uncorrected.*

When changes of the barometer are reported the course and speed of the ship should also be given.

All directions should be true, not magnetic.

(3) *Time and Date and Position of the Ship.*

These should be for the time and position when the meteorological observations reported were made and not when the message was prepared or despatched. The time used in all cases should be Greenwich Mean Time.

(4) *Subsequent Observations.*

When a master has reported a tropical storm it is desirable, but not obligatory, that other observations be made and transmitted at intervals of three hours, so long as the ship remains under the influence of the storm.

Examples.

Ice.

TTT Ice. Large berg sighted in 4605 N., 4410 W., at 0800 G.M.T. May 15.

Derelict.

TTT Derelict. Observed derelict almost submerged in 4006 N., 1243 W., at 1630 G.M.T. April 21.

Danger to Navigation.

TTT Navigation. Alpha lightship not on station. 1800 G.M.T. January 3.

Tropical Storm.

TTT Storm. Experiencing tropical storm. Barometer corrected 994 millibars, falling rapidly. Wind N.W., force 9, heavy squalls. Swell E. Course E.N.E., 5 knots. 2204 N., 11354 E. 0030 G.M.T. August 18.

TTT Storm. Appearances indicate approach of hurricane. Barometer corrected 29·64 inches falling. Wind N.E., force 8. Swell medium from N.E. Frequent rain squalls. Course 35°, 9 knots. 2200 N., 7236 W. 1300 G.M.T. September 14.

TTT Storm. Conditions indicate intense cyclone has formed. Wind S. by W., force 5. Barometer uncorrected 753 millimetres, fell 5 millimetres last three hours. Course N. 60 W., 8 knots. 1620 N., 9302 E. 0200 G.M.T. May 4.

TTT Storm. Typhoon to south-east. Wind increasing from N. and barometer falling rapidly. Position 1812 N., 12605 E. 0300 G.M.T. June 12.

WIRELESS WEATHER SIGNALS.

Under the heading "Wireless Weather Signals" it is intended to publish particulars and concise descriptions of Signals and Code used for reporting Weather, Ice and Time, in conformity with the International Convention of Safety of Life at Sea, in four sections.

I. Ships' Wireless Weather Signals.

II. Wireless Weather Signals made from the shore to ships. (Weather Bulletins and Storm Warnings.)

III. Wireless Time Signals.

IV. Wireless Ice Signals.

Sections II, III and IV will be published as far as possible in geographical order, so that the most suitable of these signals for all parts of the world may be as complete as possible in each year's Numbers of THE MARINE OBSERVER.

The International Ships' Wireless Weather Telegraphy Code, which came into force on May 1st, 1930, is given on pp. 38 to 41.

Request for information to Meteorological Services of Maritime Countries.

Invitation is hereby given to send concise descriptions of Weather Signals made for the information of shipping and seamen in all parts of the World, in accord with the International Convention of Safety of Life at Sea, 1929, with a view to publication in the appropriate number of "The Marine Observer." Only limited space is available.

REQUEST TO WEATHER SERVICES OF ALL MARITIME COUNTRIES.

In conformity with the International Convention for Safety of Life at Sea, the State Weather Services of maritime countries in all parts of the world, desiring to receive routine weather reports from British shipping, are invited to forward the names of W.T. stations appointed to receive weather reports from Selected Ships in order that the British Meteorological Office may be enabled to encourage the service specified in Article 35, clause (c) of that Convention, and so fulfil Great Britain's part in this International Contract.

The organization of British Selected Ships has now been worked up to a high state of efficiency and, where necessary, other British ships are invited to complete the desired service as far as possible. It is therefore necessary that the lists of wireless stations detailed to receive or intercept reports from British Selected Ships should be kept up to date and be as complete as possible in "The Marine Observer" so that these lists may be copied in other publications available generally to British shipping. Foreign, British Dominion and Colonial Weather Services are therefore asked—if they desire weather reports from British ships—to forward the following information :—

(1) The name of the receiving station which is appointed to work in conformity with the schedule given on page 32 for Type A.1, C.W. ships, with its call sign, latitude and longitude, similar to that given on page 34 for Portishead, except that the control system is only necessary in areas of great congestion such as the Eastern North Atlantic and North Sea.

(2) The name of the station or stations detailed to intercept or receive reports from "B" Selected Ships, working the schedule given on page 32, for Type A.2, I.C.W., and Type B ships, with call sign, latitude and longitude, similar to that given on p. 36 for Jacobs (Durban).

(3) The telegraphic address of the appropriate meteorological centre should be given in each case, together with the desired groups of the International Ships Wireless Weather Telegraphy Code, Copenhagen, 1929.

(4) It is desirable that the stations appointed to receive reports from British Selected Ships should be well distributed, and as far as possible that one station only should be appointed to serve an area consistent with the wireless range of Selected Ships, which is up to about 1,800 miles for "A" Selected Ships, and upwards from 200 miles for "B" Selected Ships.

I. SHIPS' WIRELESS WEATHER SIGNALS.

WORLD-WIDE SYSTEM OF VOLUNTARY SELECTED SHIPS ROUTINE WIRELESS WEATHER REPORTS.

(1) For the purpose of aiding navigation, in accordance with Article 35, para. (c) of the International Convention for Safety of Life at Sea, 1929, Merchant Shipping (Safety and Load Line Conventions) Act, 1932, First Schedule (see page 28), and to assist the meteorological services of the world with weather intelligence, it is intended that there shall be an agreed number of regularly reporting ships, termed Selected Ships, of all nations, distributed over all oceans, working voluntarily under their national state meteorological institutions.

At present the number agreed upon is 1,000 of all nations.

(2) In order that this work may be fairly distributed amongst the different national merchant navies, and to prevent congestion in wireless communication, it is intended that each national meteorological service should maintain in voluntary service a number of Ships on the register of their own country as Selected Ships, in accordance with their proportion of the world's tonnage of steam and motor vessels of over 100 tons.

The following table gives the world's tonnage and the number of Selected Ships at present desired for each maritime country of the world, including those that are not yet party to the Convention of Safety of Life at Sea.

Total Merchant Tonnage approximate (Steam and Motor) of the World

(Vessels over 100 tons, Lloyd's Register Book, 1934–35)

and Number of Selected Ships required for making W.T. Weather Reports,

in all Oceans, World Wide.

Country.	Steamers and Motor Vessels. Number.	Steamers and Motor Vessels. Gross Tons.	Percentage of World Tonnage.	Number of Selected Ships required.	Approximate Number of Ships fitted for C.W. Long Wave Transmission (July, 1934)
Great Britain and Ireland.	7,107	17,629,548	28·7	287	163
Australia and New Zealand.	543	619,775	1·0	10	0
Canada (excluding Lakes).	629	892,581	1·5	15	22
Hong Kong ...	120	289,295	0·5	5	5
India and Ceylon...	164	213,693	0·3	3	0
South Africa and Other Colonies*.	549	539,349	0·9	9	5
British Empire Total.	9,112	20,184,241	32·9	329	195
America (United States)(excluding Lakes).	2,669	9,874,149	16·1	161	545
Argentine	304	316,153	0·5	5	1
Belgium	192	413,232	0·7	7	8
Brazil	293	494,514	0·8	8	11
Chile	98	152,865	0·2	2	0
China	252	397,712	0·6	6	0
Danzig	41	263,776	0·4	4	0
Denmark	686	1,100,778	1·8	18	27
Finland	295	402,801	0·7	7	0
France	1,459	3,259,594	5·3	53	17
Germany	2,032	3,680,353	6·0	60	46
Greece	550	1,507,260	2·5	25	0
Holland	1,407	2,612,377	4·3	43	22
Italy	1,031	2,875,183	4·7	47	117
Japan	1,949	4,072,707	6·6	66	269
Jugo-Slavia ...	174	356,831	0·6	6	0
Latvia	101	191,140	0·3	3	0
Norway	1,904	3,980,101	6·5	65	15
Panama	71	271,380	0·4	4	13
Portugal	181	240,674	0·4	4	12
Russia (Soviet Union).	489	939,308	1·5	15	0
Spain	782	1,164,489	1·9	19	11
Sweden	1,309	1,597,314	2·6	26	3
Turkey	183	192,683	0·3	3	0
Other Countries ...	683	885,180	1·4	14	9
Total ...	28,247	61,426,795	100·0	1,000	1,321

* Including Dominion of Newfoundland.

(3) Selected Ships are broadly divided into two types, "A" and "B."

"A" Selected Ships are ships fitted for long range W.T. transmission (Type A.1, C.W. apparatus) mostly mail steamers sailing and arriving at dates fixed by advertised programmes.

"B" Selected Ships are ships fitted for comparatively short range W.T. transmission (Type A.2, I.C.W. apparatus), including passenger and cargo liners sailing according to an advertised programme, as well as a number of vessels whose movements are not advertised and may vary from voyage to voyage.

(4) It is necessary that observations reported by wireless telegraphy should synchronize. The International times of observation for weather telegraphy at sea are 0000, 0600, 1200 and 1800 hours G.M.T.

(5) It is necessary that weather reports made for the information of all ships and the meteorological services of the different countries should be in one code, simple and concise, giving only essential information.

Selected Ships use the International Ships' Wireless Weather Telegraphy Code, 1929.

British Selected Ships.

(6) When British ships become regular voluntary observing ships to the Meteorological Office, London, their Commanders volunteer to carry out the duties of Selected Ships when required.

The names of all British observing ships are published in a fleet list at the end of THE MARINE OBSERVER, corrected monthly by supplement.

(7) Selected Ships are selected from this list, according to their sailing schedules and trades to provide distribution, according to their wireless apparatus to ensure efficient communication, and according to the capacity and keenness of their officers to ensure the most accurate information.

(8) When observing ships are detailed as Selected Ships, their commanders are specially notified; and each Selected Ship is identified by a number placed before her name in the fleet list, with symbols indicating the nature of her wireless telegraphic apparatus.

(9) There are 3,472 British ships at present fitted with wireless telegraphy. The proportion fitted with Type A.1 is about 1 to every 14 fitted with Type A.2 or Type B apparatus.

Of the total of 3,472 British ships fitted with W/T.—

163 are fitted for sending Long Wave, C.W.
164 ,, ,, ,, Short Wave, C.W.

Nearly all British ships carrying W/T are capable of receiving on long-wave, whereas far fewer can receive on short wave.

(10) A fairly long range with reliability being desirable, at present long wave, C.W., is the most satisfactory, and British "A" Selected Ships are at present confined to ships so fitted.

Times of Observation.

(11) The following Chart indicates the zones for which the International watch-keeping periods are fixed for wireless operators, all four times of meteorological observation being indicated in each zone.

(12) Many Selected Ships only have one officer in each watch. The first essential for safe navigation is a good lookout kept by the officer of the watch, as well as the lookout man. The officer of the watch is responsible for meteorological observation, and the accuracy of reports. If the officer of the watch at night goes into the lighted chart house to read meteorological instruments and record them, not only does he leave his post of lookout, but he returns to the bridge momentarily blinded.

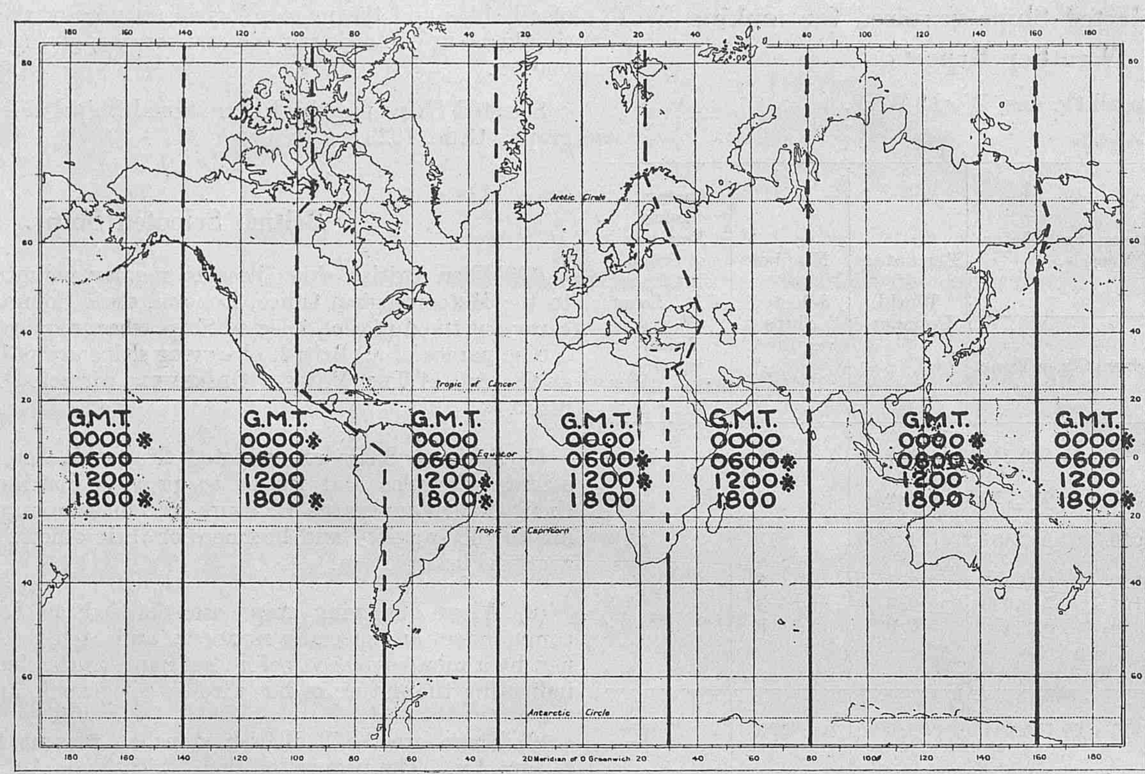
(13) Wireless meteorological reports are not asked for in British Selected Ships during the hours of darkness in which there is only one officer in each watch.

The times of observation which are starred on the chart are those which generally fall during daylight in the different zones, and at these times all British Selected Ships are requested to record observations for reporting by wireless.

(14) In certain parts of the world "A" Selected Ships having two officers in each watch are requested to record observations at all four times, and report them to certain meteorological services.

International Observation Times for Weather Telegraphy at Sea.

* Indicates usually daylight.



Communication.

(15) In order that communication may be effective (that is, that the reports may reach as many ships as possible as well as the appropriate meteorological centres), British Selected Ships work a time schedule for transmitting their reports and use prescribed wave lengths both when addressing specified stations or all ships.

(16) Generally " A " Selected Ships address their reports to specified meteorological centres, making them to specified coast stations, so that they may be intercepted by all ships within range. In parts of the world where coast stations are not detailed to receive routine reports from " A " Selected Ships they broadcast their reports to **C.Q.** (all ships).

(17) The reports of " B " Selected Ships are primarily intended in all parts of the world for the information of all ships.

Generally " B " Selected Ships address and make their reports to **C.Q.** (all ships) so that they may be intercepted by shore stations within range as well as by other ships.

In parts of the world where there may be insufficient " A " Selected Ships, " B " Selected Ships are requested to address their reports to meteorological centres, making them to coast stations.

(18) Great importance is attached to the S.O.S. periods of silence. Therefore the times of transmission for " A " Selected Ships are fixed to commence immediately at the end of the appropriate S.O.S. silence period.

This allows a sufficient interval from the time of observation for recording and coding the observations carefully, and sending the coded messages from the bridge to the wireless house.

(19) Usually the times of commencement of transmission for " A " and " B " Selected Ships are fixed at 18 minutes and 30 minutes respectively after observation time ; but for ships with only one W.T. operator in certain zones, special commencing periods are fixed to accord with wireless watch.

(20) The schedule which follows indicates the times of observation and commencement of times of transmission for both " A " and " B " Selected Ships in the different zones.

Schedule.

All times are G.M.T.

Zones between Greenwich Meridians.	First Weather Report.			Second Weather Report.		
	Times of observations.	Times of reporting by Type A1 (C.W.) Ships.	Times of broadcasting by Type A2 (I.C.W.) and Type B (Spark) Ships.	Times of observations.	Times of reporting by Type A1 (C.W.) Ships.	Times of broadcast ing by Type A2 (I.C.W.) and Type B (Spark) Ships.
30° W.–30° E.	0600	0618 / 0818	0830	1200	1218	1230
30° E.–80° E.	0600	0618 / 0818	0630 / 0830	1200	1218	1230
80° E.–160° E.	0000	0018	0030	0600	0618 / 0818	0830
160° E.–140° W.	0000	0018	0030	1800	1818 / 2018	2030
140° W.–70° W.	0000	0018	0030	1800	1818 / 2018	1830 / 2030
70° W.–30° W.	1200	1218	1230	1800	1818 / 2018	2030

It will be noted that against some of the observation times there are two times of commencement of periods for transmitting. The second of these times, where two occur, are for single operator ships to report, in cases where they would not be keeping wireless watch following the observation hour. It should be remembered that a large proportion of " Selected Ships " carry two or three operators, and they should use the earlier periods for transmission, also repeating for the benefit of ships with one operator during the second period.

In working this schedule, Selected Ships should be careful not to jam each other.

It may be advantageous for " B Selected Ships " generally—and for " A Selected Ships " beyond the region of the Eastern North Atlantic, regulated by Roll Call, and when not reporting to a shore station—when in W/T communication previous to reporting time to arrange the order in which they will transmit their weather reports to **C.Q.** at the next scheduled time.

(21) For " A " Selected Ships the wave length to be used in reporting to shore stations is specified in a list of stations detailed to receive coded weather reports from " A " Selected Ships, published in the latest number of THE MARINE OBSERVER. In the Eastern North Atlantic, north of Latitude 38° N., where there is great congestion of wireless traffic, British " A " Selected Ships work in accordance with a roll call for the day, broadcast from the specified W/T station for the information of all shipping, particulars of which are given in the detailed list of wireless stations above mentioned.

In parts of the world where there are not stations detailed to receive reports from " A " Selected Ships, they make their reports to **C.Q.** on 2100 metres.

(22) " B " Selected Ships use 600 metres wave length throughout the service in all parts of the world.

The names of stations detailed to intercept or receive weather reports from " B " Selected Ships are given in a list following that for " A " Selected Ships in the latest number of THE MARINE OBSERVER.

In the Eastern North Atlantic, north of Latitude 38° N., the roll call will usually indicate that there are sufficient British Selected Ships detailed to perform the service. In this region there is great congestion of I.C.W. communication and broadcasting by " B " Selected Ships has not proved to be always effective and is not generally advocated.

(23) The Chart of the World accompanying the lists of wireless stations detailed to receive or intercept reports from British Selected Ships, at the end of THE MARINE OBSERVER is revised and kept up to date quarterly. It is intended to illustrate the foregoing description by indicating graphically the stations and their approximate range, or the limits of the areas for which they should be used by British Selected Ships, and for which the details are given in the aforementioned lists.

(24) In order that all ships should know when Selected Ships make their reports, and be able to decode them, a pamphlet M.O. 329, entitled DECODE FOR USE WITH THE INTERNATIONAL CODE FOR WIRELESS WEATHER MESSAGES FROM SHIPS has been published since May, 1930. This has been placed on board British ships by their owners, and the schedule of communication is now so well known throughout the sea service that jamming and confusion have been much reduced.

All are asked to help in making this voluntary scheme a success.

(25) No communication charges are made to the ship for Selected Ships' routine wireless weather reports broadcast to all ships, or addressed to meteorological centres specified in the lists in the last number of THE MARINE OBSERVER. Wireless weather reports addressed by ships to meteorological centres not conforming to these instructions may be liable to charges.

(26) The number of messages required for this service is comparatively small, when effectively organized.

Relaying on wave lengths specified in (21), (22), and in the lists of stations in THE MARINE OBSERVER (that is to say, wave lengths used for Selected Ship weather reporting) should not be resorted to.

Every endeavour should be made for the reports in areas in which International W/T link or collective ships, such as the French S.S. *Cuba*, are working, to reach those ships, who will relay them to special shore stations for the information of meteorological centres on a special short wave (long range).

The main object of this system is to make one transmission serve as many ships as possible and the appropriate meteorological centre with the information reported.

(27) While there is congestion in the Eastern North Atlantic and only those Selected Ships indicated by roll call should report, in other parts of the world there may often be insufficient Selected Ships to provide an adequate service of routine reports.

In the regions of heavy weather on the less frequented routes of the Southern Ocean, and particularly in the Hurricane regions during the Hurricane season, British ships other than Selected Ships are asked to assist in this service.

This will be dealt with in (34).

Observation and Coding.

(28) Guidance in observing and recording meteorological elements will be found in the MARINE OBSERVER'S HANDBOOK, Fifth Edition.

(29) The code, and guidance for its use are given on pages 38 to 41. For working purposes a glazed code card Form 138A with Code Tables and schedule for communication is supplied to the commanders of Selected Ships.

Brief Instructions for the Guidance of British Selected Ships.

(30) The work of " A " and " B " Selected Ships is largely interdependent.

It is essential that observing officers should be conversant with communication as well as being skilled in observation, and the application of the meteorological information; and that wireless operators should be conversant with the general purpose and application of the information communicated as well as skilled in this system of communication.

It is therefore essential that all concerned should be familiar with the whole scheme.

The following brief instructions are intended to assist the Commanders of Selected Ships in regulating the work under their command.

All Selected Ships.

(31) **Observing Officers.**—At the times indicated for observation on the chart, see (13) and (14), carefully enter your observations in the record of synchronized observations, Form 911 or 916.

In the Eastern North Atlantic ascertain if the ship is on the roll call for the day or not before proceeding further.

Code these observations on to the Register, Form 138.

If the message is to be broadcast to **C.Q.** the weather information may be conveniently abbreviated to the four universal groups of figures; and instead of using supplementary groups, information of Ice or Set and Drift of current may be given briefly in plain language.

If the message is to be sent to a meteorological centre, ascertain from the list in the latest MARINE OBSERVER what groups are desired, and make out the message accordingly.

Write out the message on Form 139 and address carefully to **C.Q. Weather** or the specified meteorological centre for the part of the world given in the lists in the latest number of THE MARINE OBSERVER. Send it to the wireless operator just before the commencement of the S.O.S. period following the observation time.

Example. For Meteorological centre.—From **GMLJ** to **GKU.** Weather London 20506, 13106, 18603, 88660, 35x08, 54528, 65825.

Example. For all ships.—C.Q. Weather 13167, 55106, 00000,16979. Current from 15N. 52E. to 16N. 54E. 58 degrees one knot Dalgoma.

" A " Selected Ships.

(32) **Wireless Operator.**—Consult the list of stations detailed to receive reports in THE MARINE OBSERVER.

In the Eastern North Atlantic, when on the roll call transmit the weather report to **GKU.** accordingly on the appointed wave length, following the order of the roll call at the schedule time. The reports for 0000 and 1800 hours G.M.T. should be made as soon as convenient after the silence period.

In parts of the world other than the Eastern North Atlantic where the message is addressed to a meteorological centre call the station detailed in THE MARINE OBSERVER at schedule time, see (20), and on the wave length specified, and transmit the report, which will be acknowledged in the ordinary way, remembering that this message is intended for ships within range as well as the shore station.

The message will be addressed to **C.Q.** in parts of the world where there is no station detailed in THE MARINE OBSERVER. Send it out at schedule time on 2100 metres.

Make your transmissions as above with due consideration to circumstances.

"B" Selected Ships.

(33) **Wireless Operator.**—If the message is addressed **C.Q.** broadcast it at or following schedule time given in (20) on 600 metres. When in range of stations indicated in the list given in THE MARINE OBSERVER as detailed to intercept wireless weather reports, the message may be intercepted.

If the message is addressed to a meteorological centre, call the appropriate station indicated in THE MARINE OBSERVER and transmit the message to that station in the usual way.

As far as possible, reports from "B" Selected Ships addressed to a meteorological centre should be made at schedule times, so that they may be intercepted by all ships within range.

If for local reasons these reports addressed to meteorological centres are not made at schedule times and on 600 metres wave length, they should be made also in accordance with schedule to all ships.

Ships' Wireless Weather Reports in Parts of the World where there are not sufficient Selected Ships to provide an adequate Service.

(34) Under Article 34 of the Convention for Safety of Life at Sea, the master of every ship meeting a dangerous tropical storm, is bound by law to report to ships in the vicinity, and to the first point of the coast with which he can communicate (see page 28), but routine wireless weather reporting is **voluntary.**

It is desirable that ships and meteorological centres should as far as possible have routine wireless weather reports in fine as well as in bad weather, so that they may be forewarned.

In the Southern Ocean and in the regions and seasons of tropical revolving storms, British ships which are not Selected Ships are asked to assist in this service, when there are not Selected Ships present to perform it.

As far as possible the International Ships' Wireless Weather Telegraphy Code should be used and the procedure for Selected Ships should be carried out. British ships which are not Selected Ships should only make routine wireless weather reports to the shore through stations which have been detailed to receive weather reports without charge to the ship. Such stations are notified in the lists before mentioned in THE MARINE OBSERVER, and these lists are copied in the Admiralty list of Wireless Signals, and are kept up to date by Admiralty Notices to Mariners.

The masters of all British ships are advised to procure the pamphlet, M.O.329, DECODE FOR USE WITH THE INTERNATIONAL CODE FOR WIRELESS WEATHER MESSAGES FROM SHIPS, published and sold by H.M. Stationery Office, through any bookseller, price 6d.

WIRELESS STATIONS DETAILED TO RECEIVE ROUTINE CODED WEATHER REPORTS FROM "A SELECTED SHIPS."

Request for Information.

THE ATTENTION OF METEOROLOGICAL SERVICES IS INVITED TO THE INVITATION GIVEN ON PAGE 30 OF THIS NUMBER.

Ocean.	Station.	Position.	Call Sign.	Frequency and Wave Length.		Area and limits covered by Station.	Telegraphic address of Meteorological Centre.	Information required—Limit of Groups.	Notes.
				For Station to call up "Selected Ships."	For "Selected Ships" to report to Station.				
North Atlantic and North Sea.	Portishead.	Lat. 51° 28′ 41″ N. Long. 2° 47′ 30″ W.	GKU.	149 kc/s. (2013 metres).	143 kc/s. (2100 metres).	North Sea and Eastern North Atlantic East of Longitude 40° W. and North of Latitude 38° N., but not within 300 miles of station. (*see* Chart of the World.)	Weather London.	Weather only, up to seven groups, preferably No. 3 Supplementary Groups.	Control system. "Selected Ships" chosen to report in given order notified by station daily at 2230, 0330, and 1030 G.M.T. Roll call thus—Weather London—call sign of chosen "Selected Ships" to report through GKU at schedule times on 2100 m.
	Chatham Mass., Sayville N.Y. Thomaston. Jupiter. Palm Beach.	Lat. 41° 43′ N. Long. 70° 47′ W. Lat. 40° 45′ N. Long. 73° 06′ W. Lat. 44° 01′ N. Long. 69° 13′ W. Lat. 26° 42′ N. Long. 80° 02′ W. Lat. 26° 42′ N. Long. 80° 02′ W.	WCC. WSL. WAG. WMR. WOE.		142·9kc/s. (2098 metres).	North Atlantic West of Longitude 40° W.	Observer Washington	Weather only. First four groups of observations taken at 0000 and 1200 G.M.T. only required.	No control. All British "A Selected Ships" within area to address their 0000 and 1200 G.M.T. observations to Observer Washington and their 1800 G.M.T. observations to CQ in accordance with schedule.
Mediterranean and Red Sea.									
South Atlantic.	Slangkop (Cape Town)	Lat. 34° 08′ 46″ S. Long. 18° 19′ 18″E.	ZSC	—	143 kc/s. (2100 metres).	South Atlantic Westward of 25° E. and within a range of about 2,000 miles of station.	Met.	Weather only. Four universal groups and first group of No. 6 Supplementary groups.	No control. Only 0600 G.M.T. observation required. All British "A Selected Ships" within area should report, commencing at 0618 G.M.T.

WIRELESS STATIONS DETAILED TO RECEIVE ROUTINE CODED WEATHER REPORTS FROM "A SELECTED SHIPS."

(Continued.)

Ocean.	Station.	Position.	Call Sign.	Frequency and Wave Length. For Station to call up "Selected Ships."	Frequency and Wave Length. For "Selected Ships" to report to Station.	Area and limits covered by Station.	Telegraphic address of Meteorological Centre.	Information required—Limit of Groups.	Notes.
Indian Ocean.	Jacobs (Durban).	Lat. 29° 55′ 40″ S. Long. 30° 58′ 50″E.	ZSD	—	143 kc/s. (2100 metres).	Indian Ocean S. of 20° S. and Eastward of 25° E. and within a range of about 2,000 miles of station.	Met.	Weather only. Four universal groups and first group of No. 6 Supplementary groups.	No control. Only 0600 G.M.T. observations required. All British "A Selected Ships" within area should report, commencing at 0618 G.M.T.
	Bombay.	Lat. 19° 04′ 55″ N. Long. 72° 49′ 54″E.	VWB	—	143 kc/s. (2100 metres).	Arabian Sea N. of line C. Comorin to Ras Fartak.	Weather.	Weather only. No. 6 Supplementary groups.	All British "A Selected Ships" are requested, when convenient, to report 0000 G.M.T. observations commencing at 0018 G.M.T. in addition to schedule times.
	Madras.	Lat. 12° 59′ 17″ N. Long. 80° 10′ 56″E.	VWM	—	143 kc/s. (2100 metres).	Bay of Bengal N. of line C. Comorin to Achin Head.	Weather.	Weather only. No. 6 Supplementary groups.	All British "A Selected Ships" are requested, when convenient, to report 1200 G.M.T. observations commencing at 1218 G.M.T. in addition to schedule times.
	Colombo.	Lat. 6° 55′ 14″ N. Long. 79° 52′ 46″E.	VPB	130 kc/s. (2300 metres).	143 kc/s. (2100 metres).	Indian Ocean South of a line Ras Fartak, C. Comorin and Achin Head, and within a range of about 1500 miles.	Weather.	Weather only. No. 6 Supplementary groups preferred.	No control—all British "A Selected Ships" within area should report in accordance with Schedule.
	Mombasa.	Lat. 4° 03′ 11″ S. Long. 39° 39′ 49″E.	VPQ	—	125 kc/s. (2400 metres).	From Ras Hafun to Lat. 26° S. when westward of the Colombo area.	Weather Nairobi	Weather only. No. 6 Supplementary groups.	No control—all British "A Selected Ships" within area should report 0600 G.M.T. observations.
	Perth.	Lat. 32° 01′ 51″ S. Long.115° 49′31″E.	VIP	125 kc/s. (2400 metres).	143 kc/s. (2100 metres).	Indian Ocean and Southern Ocean between Long. 105° and 135° E.; but not within 100 miles of the coast.	Weather.	Weather only. No. 6 Supplementary groups.	No control—all British "A Selected Ships" within area should report in accordance with Schedule. Reports not required for observation times not starred on Chart, p. 32, of this number.
North Pacific and China Sea.	Cape d'Aguilar, Hong Kong.	Lat. 22° 12′ 39″ N. Long.114°15′11″E.	VPS.	8330kc/s. (36 metres) or 500 kc/s. (600 metres).	143kc/s.* (2100 metres).	China Sea and North Pacific to about 1,500 miles from station.	Royal Observatory	Weather only, preferably No. 6 Supplementary Groups.	No control—all British "A Selected Ships" within area should report in accordance with Schedule. *Alternatively see particulars on p. 37 and use wave length and times for "B Selected Ships."
South Pacific.	Sydney.	Lat. 33° 46′ 00″ S. Long.151° 03′09″E.	VIS	125 kc/s. (2400 metres).	143 kc/s. (2100 metres).	S. Pacific Coral and Tasman Seas and Southern Ocean between Long. 135° and 160° E.; but not within 100 miles of the coast.	Weather.	Weather only. No. 6 Supplementary groups.	No control—all British "A Selected Ships" within area should report in accordance with Schedule. Reports not required for observation times not starred on Chart, p. 32, of this number.
	New Zealand.	—	—	—	—	—	Weather Wellington.	Weather only, four universal groups.	The Meteorological Office Wellington, will be glad to receive routine reports from British Selected Ships within range of New Zealand W/T Stations through the normal commercial channels.

WIRELESS STATIONS DETAILED TO INTERCEPT ROUTINE CODED WEATHER REPORTS FROM "B SELECTED SHIPS."

In cases where routine weather reports made to CQ might not be received by the appropriate station within range, indicated in this list, they should be made to that station by call sign, but so that they may be readily intercepted by all ships. 600 m. is used throughout.

Ocean.	Station.	Position.	Call Sign.	Telegraphic address of Meteorological Centre desiring information.	Information desired.	Notes.
North Atlantic.						
South Atlantic.	Salinas	Lat. 0° 37′ 00″ S. Long. 47° 23′ 00″ W.	PPL.	Meteoro Rio	Weather only, including supplementary groups.	
	S. Luiz	Lat. 2° 31′ 28″ S. Long. 44° 16′ 30″ W.	PXM.			
	Fortaleza	Lat. 3° 42′ 49″ S. Long. 38° 30′ 56″ W.	PPC.			
	Natal	Lat. 5° 46′ 30″ S. Long. 35° 16′ 20″ W.	PXN.			
	Olinda	Lat. 8° 00′ 55″ S. Long. 34° 50′ 40″ W.	PPO.			
	Amaralina	Lat. 13° 00′ 50″ S. Long. 38° 28′ 27″ W.	PPA.			
	Abrolhos	Lat. 17° 57′ 35″ S. Long. 38° 42′ 00″ W.	PXH.			
	Victoria	Lat. 20° 18′ 52″ S. Long. 40° 19′ 06″ W.	PPT.			
	Rio	Lat. 22° 59′ 19″ S. Long. 43° 11′ 26″ W.	PPR.			
	Santos	Lat. 23° 59′ 22″ S. Long. 46° 18′ 18″ W.	PPS.			
	Floriano-polis	Lat. 27° 35′ 22″ S. Long. 48° 34′ 17″ W.	PPF.			
	Juncçao	Lat. 32° 03′ 22″ S. Long. 52° 08′ 13″ W.	PPJ.			
Indian Ocean	Jacobs (Durban).	Lat. 29° 55′ 40″ S. Long. 30° 58′ 50″ E.	ZSD	Met.	Weather only, 4 universal groups and first group of No. 6 Supplementary groups.	
	Algoa Bay (Port Elizabeth).	Lat. 33° 57′ 16″ S. Long. 25° 35′ 30″ E.	ZSQ	Met.	Weather only, 4 universal groups and first group of No. 6 Supplementary groups.	
	Calcutta.	Lat. 22° 33′ 31″ N. Long. 88° 20′ 16″ E.	VWC.	Weather.	Weather only up to 6 groups, No. 6 Supplementary Groups preferred.	
	Rangoon.	Lat. 16° 45′ 57″ N. Long. 96° 11′ 51″ E.	VTR.			
	Madras.	Lat. 12° 59′ 17″ N. Long. 80° 10′ 56″ E.	VWM.			
	Bombay.	Lat. 19° 04′ 55″ N. Long. 72° 49′ 54″ E.	VWB.			
	Karachi.	Lat. 24° 51′ 05″ N. Long. 67° 02′ 32″ E.	VWK.			
	Matara.	Lat. 6° 01′ 07″ N. Long. 80° 35′ 39″ E.	GZP.			
	Mombasa.	Lat. 4° 03′ 11″ S. Long. 39° 39′ 49″ E.	VPQ	Weather Nairobi.		
	Dar-es-Salaam.	Lat. 6° 50′ 38″ S. Long. 39° 17′ 24″ E.	ZBZ	Weather Nairobi.		
	Mauritius.	Lat. 20° 23′ 41″ S. Long. 57° 35′ 25″ E.	VRS.	Observatory Mauritius.	Weather 4 universal groups and first of No. 6 Supplementary Groups.	
	Geraldton.	Lat. 28° 47′ 15″ S. Long. 114° 36′ 24″ E.	VIN	Weather.	Weather only, including No. 6 Supplementary Groups.	
	Esperance.	Lat. 33° 52′ 40″ S. Long. 121° 53′ 34″ E.	VIE			

WIRELESS STATIONS DETAILED TO INTERCEPT ROUTINE CODED WEATHER REPORTS FROM "B SELECTED SHIPS."

(*Continued.*)

In cases where routine weather reports made to CQ might not be received by the appropriate station within range, indicated in this list, they should be made to that station by call sign, but so that they may be readily intercepted by all ships. 600 m. is used throughout.

Ocean.	Station.	Position.	Call Sign.	Telegraphic address of Meteorological Centre desiring information.	Information desired.	Notes.
North Pacific and China Sea.	Cape d'Aguilar, Hong Kong.	Lat. 22° 12′ 39″ N. Long. 114° 15′ 11″E.	VPS.	Royal Observatory.	Weather only, preferably No. 6 Supplementary Groups.	
South Pacific.	Auckland.	Lat. 36° 50′ 37″ S. Long. 174° 46′ 08″E.	ZLD.	Weather Wellington.	Weather only, four universal groups.	The Meteorological Office, Wellington, will be glad to receive routine reports from British Selected Ships within range of New Zealand W/T Stations through the normal commercial channels.
	Wellington.	Lat. 41° 16′ 26″ S. Long.174° 45′ 55″ E.	ZLW.			
	Awarua.	Lat. 46° 30′ 47″ S. Long.168° 22′ 24″ E.	ZLB.			
	Chatham Island.	Lat. 43° 57′ 28″ S. Long.176° 34′ 25″W.	ZLC.			
	Rarotonga.	Lat. 21° 11′ 52″ S. Long.159° 48′ 52″W.	ZKR.			
	Apia.	Lat. 13° 50′ 17″ S. Long.171° 49′ 42″W.	ZMA.			
	Thursday I.	Lat. 10° 35′ 14″ S. Long.142° 12′ 43″ E.	VII	Weather.	Weather only, including No. 6 Supplementary Groups.	
	Townsville	Lat. 19° 16′ 09″ S. Long.146° 49′ 47″ E.	VIT			
	Brisbane	Lat. 27° 25′ 34″ S. Long.153° 07′ 19″ E.	VIB			
	Melbourne	Lat. 37° 46′ 56″ S. Long.144° 52′ 09″ E.	VIM			
	Adelaide	Lat. 34° 51′ 14″ S. Long.138° 31′ 55″ E.	VIA			

INTERNATIONAL SHIPS' WIRELESS WEATHER TELEGRAPHY CODE

Adopted by the International Meteorological Organization at Copenhagen, September, 1929.

Code and Instructions for Coding Messages.

The International Ships' Wireless Weather Code is a figure code, arranged in groups of five figures.

The first four groups are universal and the remaining groups are in two alternative or supplementary sets of groups. The first figure in the fifth group of message (or first supplementary group) indicates which set of supplementary groups is used.

The first four universal groups should always be used, and the supplementary sets of groups may be omitted, or abbreviated by omitting the last group or groups of the set ; that is, the code figure message may be shortened as necessary, but the order of the figures and groups must always be strictly maintained, otherwise the message is not decodable.

If an observation or element is not available, an X (or the appropriate number of Xs) (▬ ● ● ▬) should take its place in order to maintain the sequence of figures in the groups.

Having entered synchronised weather observations and particulars of set and drift of current and ice in the Ship's Meteorological Record, Form 911, or the Meteorological Log, Form 915 (specially ruled pages at end of book), the observations should be coded, thus—

First. From the list of wireless stations detailed to receive routine coded weather reports from "Selected Ships," ascertain the number of groups and the supplementary groups desired by the shore meteorological services from ships in the part of the world that the ship is in, remembering that the seventh group can only be given completely by ships having a special barograph; and decide on the information to be sent, not forgetting the desirability of information of the set and drift of current, ice, and navigational obstructions being included in reports intended for "all ships," but not through W/T stations for certain meteorological centres. In such cases, brevity being desirable, only the first four or universal groups should be given in code.

Thus ensuring the necessary brevity and information for the meteorological centre, and the necessary information for ships at sea. Do not include information in C.W. reports addressed to meteorological centres which they do not require.

Second. On Form 138, the register for coded "Selected Ships" wireless meteorological reports, in No. 1 column write the address of the Meteorological Centre if your ship is fitted for C.W. transmission, but "All Ships' Weather" if Spark.

Universal Groups.

With the Code Card, Form 138A, from synchronized weather observations entered on Form 911 or 915, code as follows :—

		Key Letters.
Column	2.—Code the Day of the Week. Table I ...	P
,,	3.—Code the Octant of the Globe. Table II ...	Q
,,	4.—Code the Latitude by entering the **whole degrees** (prefixing 0 if necessary to make up two figures); and dividing the minutes by six, neglecting the remainder. Enter the result	LLL
,,	5.—Code the Longitude by entering the **whole degrees** (prefixing 0 if necessary to make up two figures, or omitting the initial 1 if Longitude is 100° or over). Divide the minutes by six, neglecting the remainder. Enter the result	lll
,,	6.—Enter the hours of the Greenwich Mean Time of Observation	GG

From the Code Card Form 138A.

,,	7.—Code the Direction of the Wind. Table III	DD
,,	8.—Code the Force of the Wind, forces 9 and above are entered as 9 but if 10, 11 or 12, add the words Gale, Storm, or Hurricane at the end of the message. Table V ...	F

		Key Letters.
Column	9.—Code the Present Weather. Table VI ...	ww
,,	10.—Code the corrected barometer reading by entering the two last whole figures if a millibar barometer, or coding, if inches, by Table VIII	BB
,,	11.—Enter the Visibility by Scale. Table XII ...	V
,,	12.—Enter the Air Temperature in whole degrees Fahrenheit, omitting the initial 1, if over 100°	TT

No. 3 Supplementary Groups.

If these groups have been decided upon, in Column 13 enter "3" as distinguishing number for the remainder of the coded message.

		Key Letters.
Column	14.—Code type of Lower Cloud. Table XIII ...	C_L
,,	15.—Code type of Middle Cloud. Table XIV ...	C_M
,,	16.—Code type of Upper Cloud. Table XV ...	C_H
,,	17.—Code the total amount of sky covered. Table XVII	N
,,	18.—Subtract the lesser from the greater of the Air and Sea Temperatures and code the result with Table XVIII	t_d
,,	19.—Enter the Swell by Scale. Table XIX ...	K
,,	20.—Code the True Direction of Swell. Table IV	d
,,	21.—Code the Past Weather. Table VII ...	W
,,	22.—Code the proportion of sky covered with Lower Cloud. Table XVII	N_L
,,	23.—Code the course of ship. Table IV	d_s
,,	24.—Code the speed of the ship. Table XX ...	f
,,	25.—Code the characteristic of the Tendency of the Barometer, as shown by barograph Table X	a
,,	26.—Code the Amount of rise or fall of the Barometer in the last 3 hours. Table XI ...	bb

No. 6. Supplementary Groups.

If these groups have been decided upon, in Column 27 enter "6" as distinguishing number for the remainder of the coded message.

		Key Letters.
Column	28.—Enter the Swell by Scale. Table XIX ...	K
,,	29.—Code the True Direction of the Swell. Table IV	d
,,	30.—Code the Predominating type of Cloud. Table XVI	C
,,	31.—Code the total amount of sky covered. Table XVII	N
,,	32.—Subtract the lesser from the greater of the Air and Sea Temperatures and code the result. Table XVIII	t_d
,,	33.—Code the Course of the Ship. Table IV ...	d_s
,,	34.—Code the recorded change of the barometer in the last two, three, or four hours. Table IX	A
,,	35.—Code the Past Weather. Table VII ...	W
,,	36.—Code type of Upper Cloud. Table XV ...	C_H

For messages which are to be broadcast to **C.Q.** or made to shore services indicated in the list of W/T stations in The Marine Observer as requiring such information, in Column 37, enter briefly in plain language the set and drift of current experienced, with position **from** and **to,** Ice or other navigational obstructions.

On no account should such information be entered in messages for shore services that do not require it.

The ship's call sign should be given in the usual way in sending the report.

In Column 38.—After the message has been despatched enter the call sign of the station through which it was sent, with wave length, or **C.Q.,** as the case may be.

In Column 39.—After the message is sent enter the exact time (G.M.T.) of despatch.

Be sure that your message is correctly coded, and that you have not duplicated the Supplementary Groups.

Write out the message on the signal pad (Form 139) provided and send to the wireless operator for despatch in accordance with instructions given in World Wide System of Voluntary Selected Ship Routine Wireless Weather Reports, pages 30 to 34, schedule for which is also given on Code Card Form 138A.

CODE TABLES.

Day and Position.

Table I.

P.—Day of the Week.

Day	Code Figure.	Day	Code Figure.
Sunday	1	Thursday	5
Monday	2	Friday	6
Tuesday	3	Saturday	7
Wednesday	4		

Table II.

Q.—Octant of the Globe.

	Longitude.	Code Figure.
North Latitude.	0° W. — 90° W.	0
	90° W. — 180° W.	1
	180° E. — 90° E.	2
	90° E. — 0° E.	3
South Latitude.	0° W. — 90° W.	5
	90° W. — 180° W.	6
	180° E. — 90° E.	7
	90° E. — 0° E.	8

Compass.

Table III.

DD.—Compass Table for Wind Direction to points.

True Direction.	Code Figures.	True Direction.	Code Figures.
Calm	00	S. by W.	17
N. by E.	01	S.S.W.	18
N.N.E.	02	S.W. by S.	19
N.E. by N.	03	S.W.	20
N.E.	04	S.W. by W.	21
N.E. by E.	05	W.S.W.	22
E.N.E.	06	W. by S.	23
E. by N.	07	W.	24
E.	08	W. by N.	25
E. by S.	09	W.N.W.	26
E.S.E.	10	N.W. by W.	27
S.E. by E.	11	N.W.	28
S.E.	12	N.W. by N.	29
S.E. by S.	13	N.N.W.	30
S.S.E.	14	N. by W.	31
S. by E.	15	N.	32
S.	16		

Table IV.

d and d_s.—Compass Table to Half Cardinal Points.

True Direction.	Code Figure.
No Sea or Swell; or Ship hove to	0
N.E.	1
E.	2
S.E.	3
S.	4
S.W.	5
W.	6
N.W.	7
N.	8
No observation or no information	9

Wind.

Table V.

F.—Wind Force, Beaufort Scale.

Beaufort Number.		Code Figure.
Nought.	Calm	0
One.	Light airs	1
Two.	Light breeze	2
Three.	Gentle breeze	3
Four.	Moderate breeze	4
Five.	Fresh breeze	5
Six.	Strong breeze	6
Seven.	Moderate gale	7
Eight.	Fresh gale	8
Nine.	Strong gale	9
Ten.	Whole gale	9 Gale*
Eleven.	Storm	9 Storm*
Twelve.	Hurricane	9 Hurricane*

* These words to be written at end of weather message.

Weather.

Table VI.

ww.—Present Weather. (Abridged for British Ships.)

	Code Figures.
Cloudless	00
Partly cloudy	01
Cloudy	02
Overcast	03
Haze (but visibility greater than one mile)	05
Distant Lightning	07
Mist	08
Precipitation within sight	10
Thunder, without precipitation at the ship or station	11
Ugly threatening appearance of sky	13
Squally weather	14
Heavy Squalls in last three hours	15
Waterspout seen in last three hours	16
Signs of a tropical storm forming	18
Signs that a tropical storm has formed	19
Precipitation (rain, drizzle, hail, snow or sleet) in last hour, but not at time of observation	20
Dust or Sand storm	30
Fog	40
Moderate fog in last hour	41
Thick fog in last hour	42
Fog in patches	49
Drizzle	50
Drizzle and Fog	57
Slight or moderate drizzle and rain	58
Thick drizzle and rain	59
Rain	60
Rain and fog	67
Slight or moderate rain and snow	68
Heavy rain and snow	69
Snow or Sleet	70
Shower or showers	80
Showers of slight or moderate hail, or rain and hail	88
Showers of heavy hail, or rain and hail	89
Thunderstorm	90

Preference should be given to 18 and 19 when they apply, otherwise to the largest number of this code which applies to the weather at the position of the ship at the time of observation.

Table VII.

W.—Past Weather.

	Code Figure.
Fair (clear or slightly clouded)	0
Variable sky	1
Mainly overcast	2
Fog or thick dust haze (visibility less than five cables) ...	3
Drizzle	4
Rain	5
Snow or sleet	6
Showers	7
Sandstorm or duststorm	8
Thunderstorm	9

Barometer.

Table VIII.

B.—Code Table for corrected barometer readings in millibars and inches.

(Adapted for British Ships.)

Mb.	In.	Code Figs.	Mb.	In.	Code Figs.	Mb.	In.	Code Figs.	Mp.	In.	Code Figs.
925	27·32	25	960	28·35	60	995	29·38	95	1025	30·27	25
926	27·35	26	961	28·38	61	996	29·41	96	1026	30·30	26
927	27·38	27	962	28·41	62	997	29·44	97	1027	30·33	27
928	27·41	28	963	28·44	63	998	29·47	98	1028	30·36	28
929	27·44	29	964	28·47	64	999	29·50	99	1029	30·39	29
930	27·46	30	965	28·50	65	1000	29·53	00	1030	30·42	30
931	27·49	31	966	28·53	66	1001	29·56	01	1031	30·45	31
932	27·52	32	967	28·56	67	1002	29·59	02	1032	30·48	32
933	27·55	33	968	28·59	68	1003	29·62	03	1033	30·51	33
934	27·58	34	969	28·62	69	1004	29·65	04	1034	30·53	34
935	27·61	35	970	28·65	70	1005	29·68	05	1035	30·56	35
936	27·64	36	971	28·67	71	1006	29·71	06	1036	30·59	36
937	27·67	37	972	28·70	72	1007	29·74	07	1037	30·62	37
938	27·70	38	973	28·73	73	1008	29·77	08	1038	30·65	38
939	27·73	39	974	28·76	74	1009	29·80	09	1039	30·68	39
940	27·76	40	975	28·79	75	1010	29·83	10	1040	30·71	40
941	27·79	41	976	28·82	76	1011	29·86	11	1041	30·74	41
942	27·82	42	977	28·85	77	1012	29·89	12	1042	30·77	42
943	27·85	43	978	28·88	78	1013	29·92	13	1043	30·80	43
944	27·88	44	979	28·91	79	1014	29·94	14	1044	30·83	44
945	27·91	45	980	28·94	80	1015	29·97	15	1045	30·86	45
946	27·94	46	981	28·97	81	1016	30·00	16	1046	30·89	46
947	27·97	47	982	29·00	82	1017	30·03	17	1047	30·92	47
948	28·00	48	983	29·03	83	1018	30·06	18	1048	30·95	48
949	28·03	49	984	29·06	84	1019	30·09	19	1049	30·98	49
950	28·05	50	985	29·09	85	1020	30·12	20	1050	31·01	50
951	28·08	51	986	29·12	86	1021	30·15	21	1051	31·04	51
952	28·11	52	987	29·15	87	1022	30·18	22	1052	31·07	52
953	28·14	53	988	29·18	88	1023	30·21	23	1053	31·10	53
954	28·17	54	989	29·21	89	1024	30·24	24	1054	31·13	54
955	28·20	55	990	29·24	90						
956	28·23	56	991	29·26	91						
957	28·26	57	992	29·29	92						
958	28·29	58	993	29·32	93						
959	28·32	59	994	29·35	94						

NOTE.—It will be seen that the code figures may represent two values of barometric pressure, but this only takes place with a very high or a very low barometer, so that recipients of a message will be able to decide which value is intended.

Table IX.

A—Change of Barometer in last 2, 3 or 4 hours.

(Adapted for British Ships.)

(The change in 3 hours should be given if possible.)

	In 2 hours.	In 3 hours.	In 4 hours.	Code Figure.
Barometer **steady**—Has not risen or fallen more than	0·3 mb. (·01 in.)	0·5 mb. (·01 in.)	0·7 mb. (·02 in.)	0
Barometer **rising slowly**—Has risen.	0·7–1·0 mb. (·02–·03 in.)	1·0–1·5 mb. (·03–·05 in.)	1·3–2·0 mb. (·04–·06 in.)	1
Barometer **rising**—Has risen	1·4–2·4 mb. (·05–·07 in.)	2·0–3·5 mb. (·06–·10 in.)	2·8–4·8 mb. (·08–·14 in.)	2
Barometer **rising quickly**—Has risen.	2·6–4·0 mb. (·08–·12 in.)	4·0–6·0 mb. (·12–·18 in.)	5·2–8·0 mb. (·15–·24 in.)	3
Barometer **rising very rapidly**—Has risen.	over 4·0 mb. (·12 in.)	over 6·0 mb. (·18 in.)	over 8·0 mb. (·24 in.)	4
Barometer **falling slowly**—Has fallen.	0·7–1·0 mb. (·02–·03 in.)	1·0–1·5 mb. (·03–·05 in.)	1·3–2·0 mb. (·04–·06 in.)	5
Barometer **falling** — Has fallen.	1·4–2·4 mb. (·05–·07 in.)	2·0–3·5 mb. (·06–·10 in.)	2·8–4·8 mb. (·08–·14 in.)	6
Barometer **falling quickly**—Has fallen.	2·6–4·0 mb. (·08–·12 in.)	4·0–6·0 mb. (·12–·18 in.)	5·2–8·0 mb. (·15–·24 in.)	7
Barometer **falling very rapidly**—Has fallen.	over 4·0 mb. (·12 in.)	over 6·0 mb. (·18 in.)	over 8·0 mb. (·24 in.)	8

Barograph.

Table X.

a.—Characteristic of changes of the Barometer in the last three hours.

(Adapted for British Ships.)

	Description of Changes.	Code Figure.
Net result, Barometer same or higher.	Barometer rising at first, then falling by a smaller or like amount	0
	Barometer rising at first, then steady or rising less quickly...	1
	Barometer unsteady, but generally rising or stationary	2
	Barometer steady or rising	3
	Barometer falling or steady at first, then rising by the same or larger amount ... ... Barometer rising, at an increasing rate	4
Net result, Barometer lower.	Barometer falling at first, then rising by a smaller amount	5
	Barometer falling at first, then steady or falling less quickly	6
	Barometer unsteady, but falling	7
	Barometer falling	8
	Barometer steady or rising at first, then falling by a larger amount ... ... Barometer falling, at an increasing rate	9

NOTE.—These changes can generally only be given by ships which have special barographs on board.

For illustration of these characteristic changes and guidance see MARINE OBSERVERS HANDBOOK, 5th Edition.

Table XI.

bb.—Amount of Rise or Fall of the Barometer in the last three hours.

(Adapted for British Ships.)

Amount of Rise or Fall. Mbs.	Amount of Rise or Fall. Inches.	Code Figs.	Amount of Rise or Fall. Mbs.	Amount of Rise or Fall. Inches.	Code Figs.	Amount of Rise or Fall. Mbs.	Amount of Rise or Fall. Inches.	Code Figs.	Amount of Rise or Fall. Mbs.	Amount of Rise or Fall. Inches.	Code Figs.
0·2	·01	01	4·6	·14	23	9·0	·27	45	13·4	·40	67
0·4	·01	02	4·8	·14	24	9·2	·28	46	13·6	·41	68
0·6	·02	03	5·0	·15	25	9·4	·28	47	13·8	·41	69
0·8	·02	04	5·2	·16	26	9·6	·29	48	14·0	·42	70
1·0	·03	05	5·4	·16	27	9·8	·29	49	14·2	·43	71
1·2	·04	06	5·6	·17	28	10·0	·30	50	14·4	·43	72
1·4	·04	07	5·8	·17	29	10·2	·31	51	14·6	·44	73
1·6	·05	08	6·0	·18	30	10·4	·31	52	14·8	·44	74
1·8	·05	09	6·2	·19	31	10·6	·32	53	15·0	·45	75
2·0	·06	10	6·4	·19	32	10·8	·32	54	15·2	·46	76
2·2	·07	11	6·6	·20	33	11·0	·33	55	15·4	·46	77
2·4	·07	12	6·8	·20	34	11·2	·34	56	15·6	·47	78
2·6	·08	13	7·0	·21	35	11·4	·34	57	15·8	·47	79
2·8	·08	14	7·2	·22	36	11·6	·35	58	16·0	·48	80
3·0	·09	15	7·4	·22	37	11·8	·35	59	16·2	·49	81
3·2	·10	16	7·6	·23	38	12·0	·36	60	16·4	·49	82
3·4	·10	17	7·8	·23	39	12·2	·37	61	16·6	·50	83
3·6	·11	18	8·0	·24	40	12·4	·37	62	16·8	·50	84
3·8	·11	19	8·2	·25	41	12·6	·38	63	17·0	·51	85
4·0	·12	20	8·4	·25	42	12·8	·38	64	17·2	·52	86
4·2	·13	21	8·6	·26	43	13·0	·39	65	17·4	·52	87
4·4	·13	22	8·8	·26	44	13·2	·40	66			

Visibility.

Table XII.

V.—Visibility.

	Code Figure.
Dense fog. Objects not visible at 50 yards.	0
Thick fog. Objects not visible at 1 cable	1
Fog. Objects not visible at 2 cables	2
Moderate fog. Objects not visible at $\frac{1}{2}$ mile (nautical) ...	3
Mist or haze, or very poor visibility. Objects not visible at 1 mile (nautical)	4
Poor visibility. Objects not visible at 2 miles (nautical) ...	5
Moderate visibility. Objects not visible at 5 miles (nautical)	6
Good visibility. Objects not visible at 10 miles (nautical) ...	7
Very good visibility. Objects not visible at 30 miles (nautical)	8
Excellent visibility. Objects visible more than 30 miles ...	9

Clouds.

Table XIII.

C_L.—Form of Low Cloud.

Form of Cloud.	Code Figure.
No low clouds	0
Cumulus of fine weather	1
Cumulus (Large, without anvil)	2
Cumulo-Nimbus	3
Strato-Cumulus (spread from Cumulus)	4
Stratus or Strato-Cumulus (in layer)	5
Nimbus	6
Cumulus **and** Strato-Cumulus of fine weather	7
Cumulus, large (or Cumulo-Nimbus) **and** Strato-Cumulus	8
Cumulus, large (or Cumulo-Nimbus) **and** Nimbus	9

Table XIV.

C_M.—Form of Middle Cloud.

Form of Cloud.	Code Figure.
No middle cloud	0
Alto-Stratus, typical thin	1
Alto-Stratus, typical thick (Sun or Moon invisible)	2
Alto-Cumulus or high Strato-Cumulus, single layer	3
Alto-Cumulus, in bands, decreasing	4
Alto-Cumulus, in bands, increasing	5
Alto-Cumulus, spread out from Cumulus	6
Alto-Cumulus with Alto-Stratus ; or Alto-Stratus with parts resembling Alto-Cumulus	7
Alto-Cumulus Castellatus (Alto-Cumulus in ragged fragments)	8
Alto-Cumulus in several layers, generally with fibrous veils and chaotic appearance of sky.	9

Table XV.

C_H.—Form of Upper Cloud (Cirrus Cloud).

Form of Cloud.	Code Figure.
No upper clouds (cirrus type)	0
Cirrus, fine, not increasing ; scarce	1
Cirrus, fine, not increasing ; plentiful, but not a continuous layer	2
Cirrus, anvil	3
Cirrus, fine, increasing	4
Cirrus or Cirro-Stratus increasing, below 45° altitude	5
Cirrus or Cirro-Stratus increasing, and reaching above 45° altitude	6
Cirro-Stratus veil covering whole sky	7
Cirrus-Stratus, not increasing, and not covering whole sky	8
Cirro-Cumulus predominating, and a little Cirrus	9

Table XVI.

C.—Predominating Form of Cloud.

Form of Cloud.	Code Figure.
Cirrus	1
Cirro-Stratus	2
Cirro-Cumulus	3
Alto-Cumulus	4
Alto-Stratus	5
Strato-Cumulus	6
Nimbus	7
Cumulus or Fracto-Cumulus	8
Cumulo Nimbus	9
Stratus or Fracto-Stratus	0

Table XVII.

N. and (N_L).—Amount of Cloud.

Proportion of Sky covered, in tenths.	Code Figure.
0	0
Less than 1	1
1	2
2 to 3	3
4 to 6	4
7 to 8	5
9	6
More than 9, but with openings	7
10, completely covered	8
Sky obscured by fog, duststorm or other phenomenon	9

Temperatures.

Table XVIII.

t_d.—Difference between Air and Sea Surface Temperature.

	Code Figure.
Air Temperature **higher** than Sea Temperature.	
More than 9° Fahrenheit	0
6° to 9° „	1
3° to 6° „	2
1° to 3° „	3
0° to 1° „	4
Air Temperature **lower** than Sea Temperature.	
0° to 1° Fahrenheit	5
1° to 3° „	6
3° to 6° „	7
6° to 9° „	8
More than 9° „	9

Swell.

Table XIX.

K.—Swell.

	Code Figure.
No swell	0
Low swell, short or average length	1
Low swell, long	2
Moderate swell, short	3
Moderate swell, average length	4
Moderate swell, long	5
Heavy swell, short	6
Heavy swell, average length	7
Heavy swell, long	8
Confused swell	9

Speed.

Table XX.

f.—Speed of Ship.

Speed in Knots.	Code Figure.
Ship stopped	0
1 to 3 knots	1
4 to 6 „	2
7 to 9 „	3
10 to 12 „	4
13 to 15 „	5
16 to 18 „	6
19 to 21 „	7
22 to 24 „	8
More than 24 knots	9

PERSONNEL.

The Marine Superintendent will be glad to receive information of distinctions gained and retirements, &c., of Marine Observers.

Captain F. A. Frank, D.S.O., R.D., R.N.R.

Captain F. A. FRANK, commander of the R.M.S. *Homeric*, has retired from active service afloat after 35 years' service with the White Star Line.

Joining the White Star Line in 1899 as a Fourth Officer he rose to the command of the S.S. *Gallic* in 1925, since when he has commanded several of the largest vessels in the White Star (now White Star Cunard) Fleet including the *Megantic*, *Majestic*, *Calgaric*, *Britannic*, and *Homeric*.

Captain FRANK won his D.S.O. when on active service in 1917.

Commander A. H. Hignett, R.D., R.N.R.

Captain A. H. HIGNETT, commander of the Peninsular and Oriental Steam Navigation Company's R.M.S. *Ranchi*, has retired from active service afloat after 39 years' service with that company.

Captain HIGNETT served his apprenticeship in the famous clipper ship *Thomas Stephens* before entering the service of the P. and O. company.

Captain G. F. McCombie.

Captain G. F. McCOMBIE, commander of the Canadian Pacific Steamship Company's R.M.S. *Duchess of Atholl*, has retired from active service afloat after nearly 45 years at sea.

After serving his apprenticeship in the sailing vessels of Messrs. Craig & Co. of Glasgow he became a junior officer in the steamers of Messrs. Elder Dempster & Co., and later transferred to the London Line of Belfast. In 1906 he joined the Canadian Pacific Steamship Company and rising through the different grades was promoted to command in 1924. Since then he has commanded several vessels of the C.P.R. Fleet, including the *Brandon*, *Berwyn*, *Brecon*, *Bolingbroke*, *Metagama*, *Minnedosa*, *Beaverburn*, *Montrose*, *Montclare*, and *Duchess of Atholl*.

Commander O. Siggers, R.D., R.N.R.

Captain O. SIGGERS, commander of the Peninsular and Oriental Steam Navigation Company's R.M.S. *Chitral*, has retired from the sea after 43 years afloat, 36 years of which were spent in the P. and O. service.

Commencing his sea career in 1891 he served five years apprenticeship in sail and on obtaining his 2nd mate's certificate sailed as 2nd mate of the barque *Craig Elvan*. On this voyage he was awarded the Royal Humane Society's certificate for saving the life of an apprentice who had fallen overboard.

He then transferred to steam as second officer of the S.S. *Stork* sailing to the River Obi, Siberia, in a convoy of five ships, via the North Cape.

In 1898 he joined the P. and O. Company's service as fifth officer and after passing through the various grades was appointed to his first command in 1924.

In 1925 when in command of the *Sardinia* he received the " Order of the Excellent Crop " from the Chinese Government for his services in rescuing 145 persons from a derelict junk in the China Sea.

Commander F. F. Summers, R.D., R.N.R.

Captain F. F. SUMMERS, commander of the R.M.S. *Georgic*, has retired after 44 years' service afloat.

Captain SUMMERS commenced his apprenticeship in 1890 in the Ship *Ellesmere*.

On obtaining his second mate's certificate he served as second mate of the Barque *Cordelia*, and on obtaining his Master's certificate in 1899 joined the White Star Line as a junior officer.

Since rising to command he has had charge of several ships of the White Star (now White Star Cunard) Fleet, including the *Gallic*, *Belgic*, *Megantic*, *Ceramic*, *Persic*, *Doric*, *Britannic*, and *Georgic*.

Commodore J. Turnbull, C.B.E., R.D., R.N.R.

Commodore J. TURNBULL, commander of the R.M.S. *Duchess of Bedford*, has retired from active service afloat. Commencing his sea career in 1889 as an apprentice in the Barque *Iredale* he later served as mate of the Barque *Cambrian*, before transferring to steam in 1897, when he joined Messrs. Elder Dempster & Co., where he rose to the command of their S.S. *Iboden*.

He later transferred to the Beaver Line and was serving as Chief Officer of the *Lake Megantic* when the company was absorbed by the Canadian Pacific Steamships Ltd. In 1911 he obtained command of the *Montrose*, since when he has had in his charge several vessels of the Canadian Pacific Fleet including the *Melita*, *Montlaurier*, *Metagama*, *Montroyal*, *Montnairn*, *Empress of Scotland*, *Montclare*, and *Duchess of Bedford*.

For his services during the war as a Port Convoy Officer, Commodore TURNBULL was made a Commander of the Order of the British Empire.

OBITUARY.

The death of Captain H. A. L. BOND, commander of the Cunard White Star S.S. *Alaunia*, which took place at Southampton on October 31st, from double pneumonia, is noted with regret.

Before his appointment to the *Alaunia* Captain BOND had previously held command of several Cunarders including the *Aurania*, *Antonia* and *Lancastria*. He had also served as Staff Captain of the *Berengaria* and *Aquitania*.

The death of Captain N. J. HAYNES, commander of the Clan Line steamer *Clan Mackellar*, which took place recently is noted with regret.

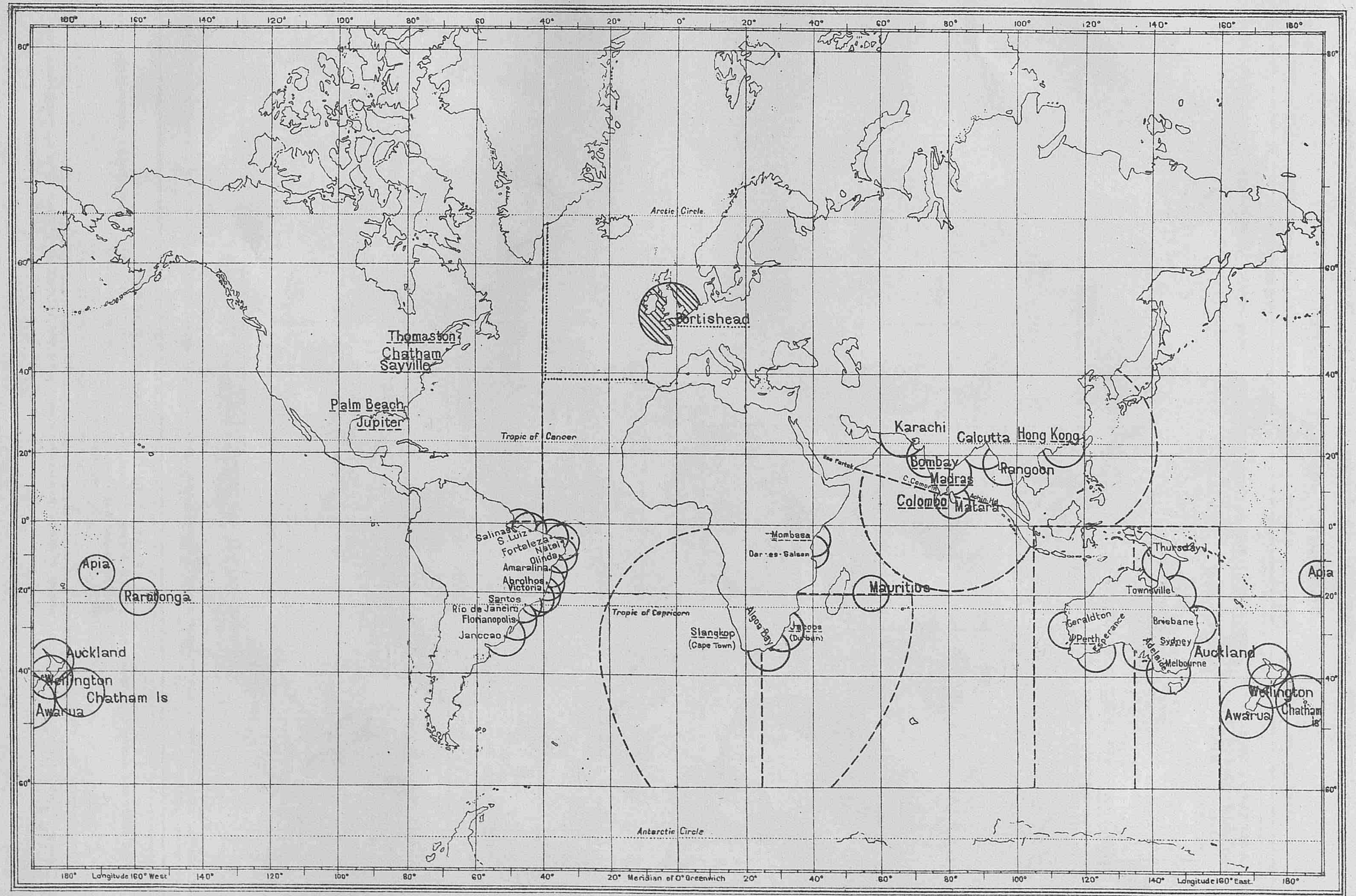
Captain HAYNES died on board his ship when on a voyage from Greenock to Mauritius and was buried at sea.

The death of Captain JOHN LOW at the age of 86, which took place on December 6th, 1934, at Watford, is noted with regret.

Commencing his sea career in 1865, Captain LOW served chiefly in square-rigged ships sailing out of or owned in Dundee and had held command of the Barques *Calcutta*, *Dundee*, *Glencora* and *Juleopolis*, the latter ship being better known as the *Garthpool*.

He had been in retirement for some years when on the outbreak of hostilities he volunteered his services and commanded several steamers during the war period. He was an old member of our Voluntary Corps of Marine Observers, having first kept a Meteorological Log as far back as 1889.

SHIPS' WIRELESS WEATHER SIGNALS.
CHART OF THE WORLD.
Stations for Reception of Routine Wireless Weather Reports from "Selected Ships".



The dotted line indicates the area in which British "A Selected Ships" report under control to Portishead.

A pecked line indicates the reporting area round stations in other countries to which British "A Selected Ships" should report. The names of such stations being underlined with a pecked line.

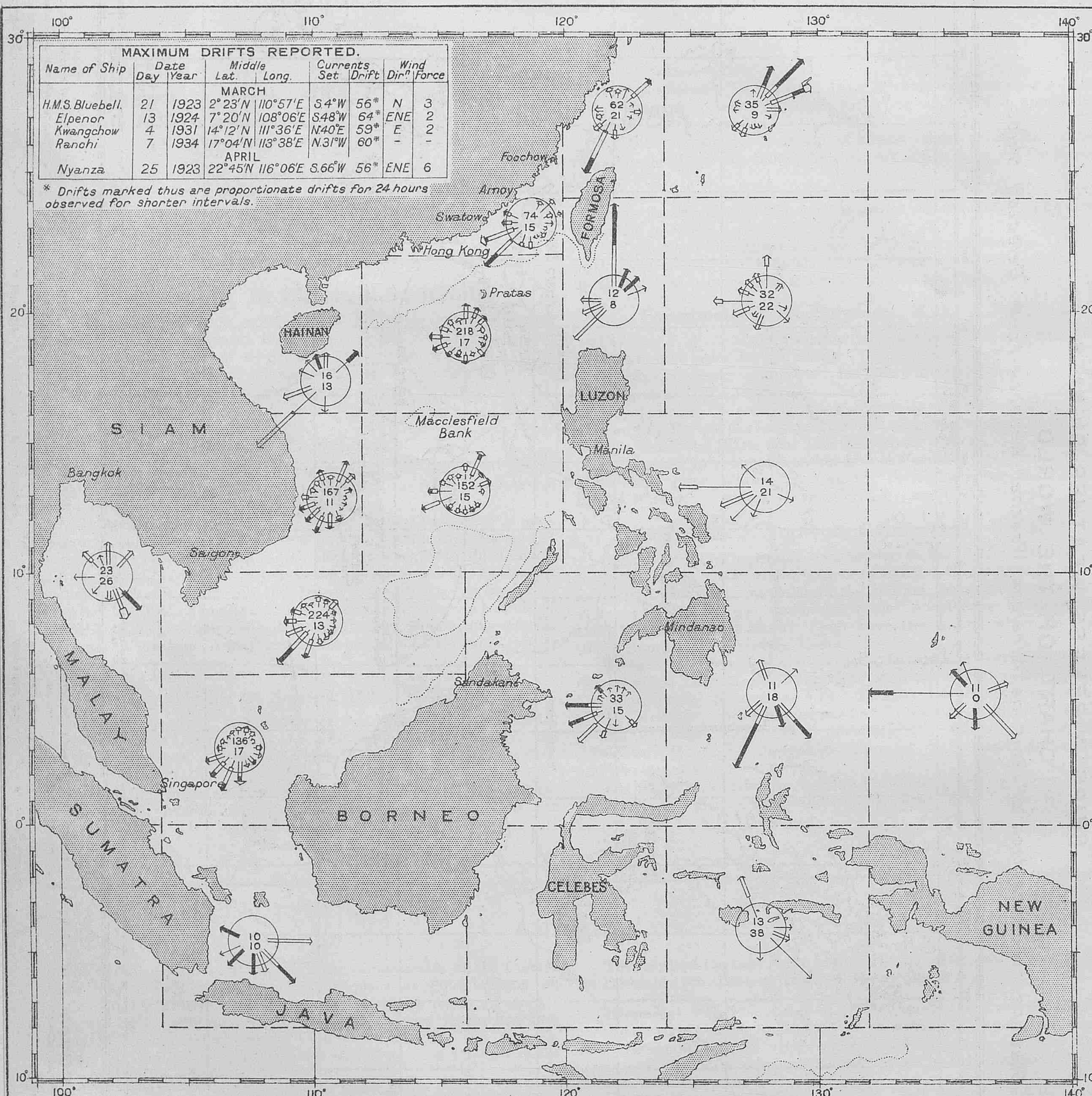
The small shaded areas round stations detailed to receive reports from "A Selected Ships" indicate where these ships should not report on account of congestion.

The full circles indicate the areas round islands and coast stations which are detailed to intercept "B Selected Ships" reports made to C.Q. on 600 metres.

Currents in the China Seas and East Indian Archipelago.

FEBRUARY MARCH and APRIL.

Observations of ships regularly observing for the British Meteorological Office, 1910 - 1934.



MAXIMUM DRIFTS REPORTED.

Name of Ship	Date Day	Date Year	Middle Lat.	Middle Long.	Currents Set	Currents Drift	Wind Dirn.	Wind Force
			MARCH					
H.M.S. Bluebell.	21	1923	2° 23′ N	110° 57′ E	S. 4° W	56*	N	3
Elpenor	13	1924	7° 20′ N	108° 06′ E	S. 48° W	64*	ENE	2
Kwangchow	4	1931	14° 12′ N	111° 36′ E	N. 40° E	59*	E	2
Ranchi	7	1934	17° 04′ N	113° 38′ E	N. 31° W	60*	-	-
			APRIL					
Nyanza	25	1923	22° 45′ N	116° 06′ E	S. 66° W	56*	ENE	6

* Drifts marked thus are proportionate drifts for 24 hours observed for shorter intervals.

EXPLANATION OF CURRENT ROSES.

The current roses are drawn from observations within the pecked lines. Arrows flow with the current, length represents frequency, thickness strength,—

6-12 miles per day, ⟶ , 13-24 miles per day ⟹ ,
25-48 " " " , ➞ , 49-72 " " " ⟹ ,
73 miles per day and above ➞ .

Distance from tail of arrow to circle represents 5%. Scale 0 10 20 30 40 50%.

The upper figure in centre of rose gives total number of observations, the lower figure the percentage frequency of currents less than 6 miles per day.

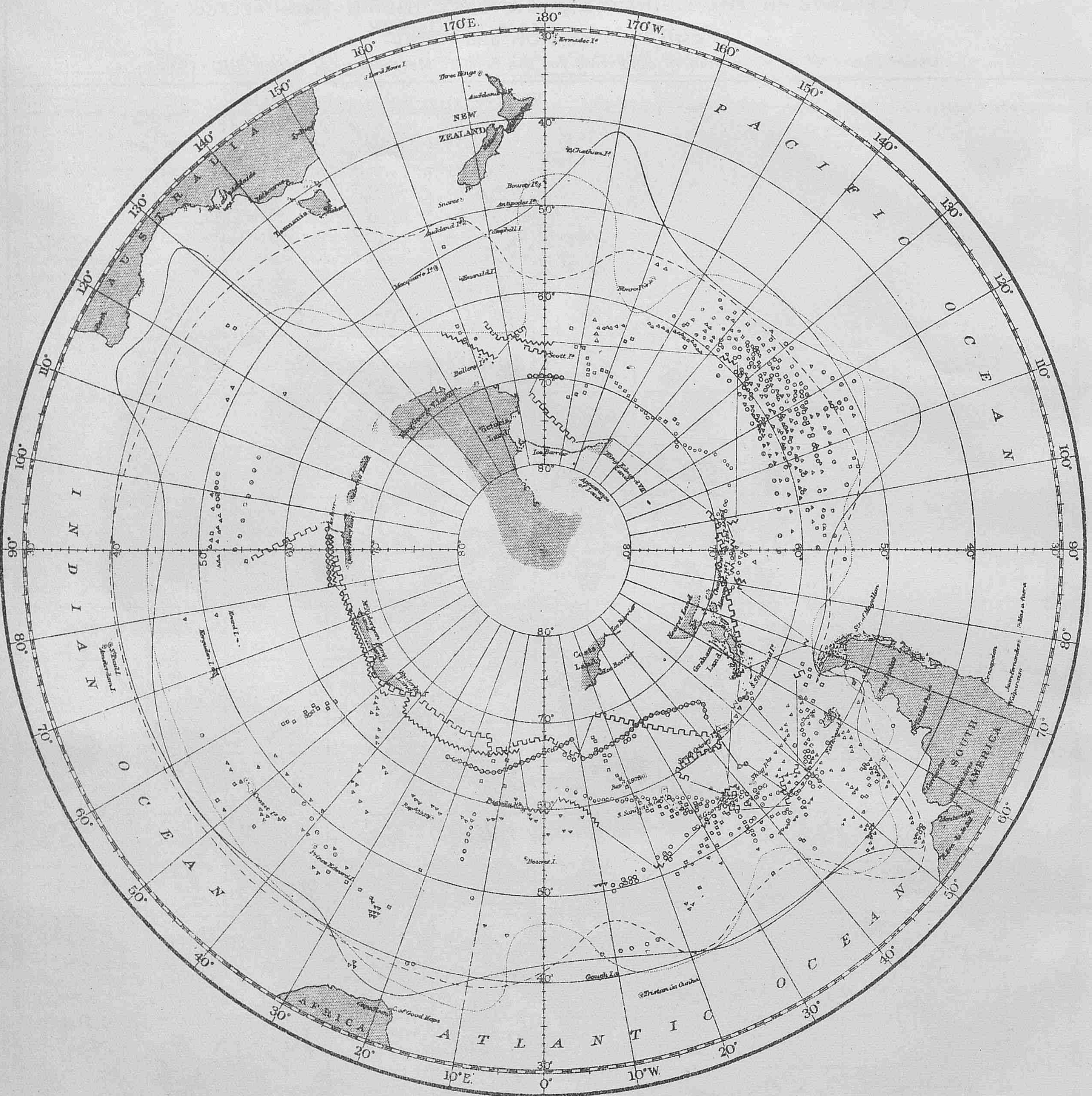
Currents in the China Seas and East Indian Archipelago.

FEBRUARY MARCH and APRIL.

Observations of ships regularly observing for the British Meteorological Office, 1910-1934.

EXPLANATION OF CURRENT ARROWS.

The arrows flow with the current and represent the resultant of currents observed within the pecked lines. The centre of each arrow lies in the mean position of observation. The figures above the arrows give the velocity of current in miles per day; the figures below the arrows the number of observations. In cases where the arrows drawn to scale are inconveniently long the symbol is substituted.



ICE CHART OF THE SOUTHERN HEMISPHERE,

JANUARY, FEBRUARY and MARCH.

EXPLANATION.

The symbols used to distinguish the ice of each of the three months are as follows:-

	Bergs, 1902-1934	Position of northernmost pack ice actually observed 1885-1934	Extreme limit of all ice, 1772-1934
January.	△	wwwwwwwwww	————————
February.	□	⊓⊓⊓⊓⊓⊓⊓⊓⊓⊓	– – – – – – – –
March.	○	–o–o–o–o–o–o–	················

Note — The symbols for pack ice are joined by hair line where desirable.

The coast line of the Antarctic continent as shown on this chart is not completely corrected to accord with the latest survey information. It is intended in a later volume of The Marine Observer, after the Admiralty Ice chart of the Southern Hemisphere Nº 1241 has been revised, to again publish this chart in The Marine Observer with coast lines as complete as possible and to bring the ice information up to date annually.

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