



METEOROLOGICAL CHARTS
OF THE
SOUTHERN OCEAN
BETWEEN THE
CAPE OF GOOD HOPE & NEW ZEALAND
THIRD EDITION

MET 10/1/3/67/6



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M.O. No. 123. (1917.)

METEOROLOGICAL OFFICE.



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THIRD EDITION.

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Twelve Charts of Wind, Barometer, Air-Temperature and Fog, Latitude 30° S. to about 50° S., Longitude 10° E. to 180° E., showing the average distribution for each month, January–December.

Twelve Charts of Surface Currents and Distribution of Ice for the same region, showing average Currents for each month of the year; extreme northern limits of Ice ~~and the positions of Icebergs~~ in each month, January–December, as ^{and the limits for} reported during the period 1902–191⁸.

Twelve Charts of Sea Surface Isotherms for the same region: three Charts on each sheet, showing the average results for each month, January–December, and indicating the areas over which the extreme range of Temperature has been 20° or upwards.

PREFACE.

These Charts were originally published in 1899 when the Office was directed by the Meteorological Council. Of the members of the Council, Rear-Admiral Sir William Wharton, K.C.B., F.R.S., Hydrographer of the Navy, was most closely concerned with the direction of the Marine Division, of which, at that time, Lieut. Baillie, R.N., was Superintendent. The meteorological material was obtained mainly from the logs of H.M. Ships and the Meteorological Registers of ships of the Mercantile Marine, all using instruments which the Office supplied in accordance with the programme of the Meteorological department of the Board of Trade, established under Admiral Fitz Roy's superintendence in 1854.

The method of presenting the material was the outcome of the prolonged experience of the Office in work of this character and it has been followed in subsequent publications of the Office, of which the atlas of Charts of pressure and wind over the South Atlantic Ocean, the monthly issue of Meteorological Charts of the Indian Ocean, recently extended to include the China Seas, and those of the Mediterranean Sea, are the chief examples.

A new edition in *facsimile* of the original charts, but on a smaller scale, was published in 1907.

The present edition is a re-issue of the edition of 1907 with such slight modifications as the correction of the values of pressure for the variation of gravity from that of latitude 45° which has now become an accepted practice in accordance with international agreement, and the alternative expression of pressure in units of pressure based on the C.G.S. system. In this system 1000 millibars corresponds with the pressure of 29·53 inches of mercury at the freezing point of water in latitude 45° and thus differs little from the standard atmosphere. Particulars of this method of expressing pressure, and tables for conversion are given in the introduction to the Computer's Handbook, M.O. 223.

A peculiarity of the original edition, which is still preserved, is the projection used for the maps. The area represented is a long narrow strip reaching from west of the Cape of Good Hope to east of New Zealand. Mercator's projection is the one generally used for marine charts, but in this case the area of the map on Mercator's projection was too narrow for the representation of pressure and winds; consequently the north to south scale was expanded as compared with the west to east scale. No difficulty

arises in consequence of this peculiarity so long as the Charts are used for geographical purposes such as determining the normal pressure and the normal distribution of winds in the several latitudes; but since the second edition of the charts was published a new departure has been taken with regard to the Meteorology of the Southern Ocean. In connexion with the late Captain Scott's first expedition 1901–1904, international co-operation was sought in aid of the collection of meteorological data from the southern hemisphere south of 30° S., and these data have been put together in the form of daily charts in a volume prepared in the Meteorological Office for publication as a contribution to the results of the expedition. This enterprise leads us at once to consider the behaviour of cyclonic depressions in southern latitudes,—in a special sense the home of cyclonic depressions. When we approach this subject the shapes of isobars become a matter of importance and it is easily realised that the alteration of the north-to-south scale makes considerable distortion of the shapes of isobars. On the Charts for the Cape to New Zealand it is only, of course, mean isobars that are represented and the distortion is therefore less distracting than it would be on isochronous charts: but mean isobars are related to mean winds and on a distorted chart the real direction of any line except the pair joining opposite cardinal points is not easily read. Distortion is as bad for pressure charts as it would be for track charts.

A cyclonic depression with circular isobars would be transformed into an elongated elliptic form, just as a circular island would appear as an elongated strip of land. Thus the recent progress of dynamical meteorology points very definitely against the use of projection with angular distortion for representing a quantity like pressure, with the distribution of which winds are so closely associated.

But with the Charts of the area from the Cape to New Zealand there is no alternative to the distorted outline except to redraw the charts and recast the form of the publication, and as a fresh issue is required without delay, the charts are reproduced in their original form.

METEOROLOGICAL OFFICE, NAPIER SHAW,
July, 1917. Director.

PREFACE TO THE ORIGINAL EDITION.

In the preparation of these Charts observations relating to the prescribed district have been used, for each four hours, from about 2,000 logs kept for the Meteorological Office between the years 1855 and 1895, as well as from about 450 logs of Her Majesty's Ships, which were all that were available, and also from numerous logs of private Shipping Companies.

The Charts are bounded in Latitude by the parallels of 30° and 60° S., and in Longitude by the meridians of 10° and 180° E.

The Charts show for each month of the year the Wind, in direction and force, for areas of 3° of Latitude by 10° of Longitude; also the Barometrical Pressure by isobars, and the Temperature of the Air and Sea Surface by isotherms. The regions of excessive range of Sea Surface Temperature are indicated by shading.

The amount of Fog is shown by percentages of the total number of weather observations, and also, graphically, by curves.

The Currents are given in separate monthly charts.

No use has been made in these Charts of the readings of the Wet Bulb Thermometer, or of any of the following elements: Sea Surface Direction and Disturbance, Clouds, and Specific Gravity of the sea water.

It is hoped that the publication now issued, which adds considerably to the information hitherto available for this part of the ocean, may be found useful to navigators.

ROBERT H. SCOTT,

Secretary to the Council.

Meteorological Office, May 1899.

REMARKS ON THE CHARTS.

Barometer.—The broad features of the barometric systems exhibited on the series of Monthly Charts in this volume are the following:—

1. An area of high barometer lies over the sea, between the African Continent and Australia, throughout the year. It alters its position, slightly, from month to month, and, generally, the central portion of the system, which is sometimes divided into two parts, is situated more to the East and South during the six Months November to April than in any of the other months.

2. Over the relatively small region of the Great Australian Bight, there is also evidence of a seasonal variation in the distribution of pressure, but the changes are not so regular as over the open sea. In the summer months, December to March, the barometer is lower over the land than over the sea, but during the winter the contrary is generally the case.

3. In the Tasman Sea, the changes from month to month are of a much less defined and regular character than those to the westward. Usually, the barometer is highest over the northern parts of the region, anticyclonic systems appearing in February and March.

4. In the far South the barometer is comparatively low throughout the year.

Winds.—The winds of the Southern Indian Ocean are subject to very similar seasonal movements as the areas of high and low barometer.

South of the parallel of about 35° S. the winds are mainly the result of cyclonic systems travelling to the eastward. As the centres of depressions are generally far to the southward the resulting winds in the portion of the ocean shown on these charts are principally from the Western quarter.

As in similar latitudes in the North Atlantic and Pacific, the actual track of the depression may be considerably to the North or South of East, their rates of progression will vary, and the shape of the depression will greatly affect the veering of the wind, so that while one vessel may carry a wind from the West for great distances, another may experience constant shifts as comparatively small depressions moving in different tracks pass her in her course.

The high pressure areas being farthest North during the winter months, winds from points in the western half of the compass generally prevail from May to November. Off the African coast, however, North-easterly winds are experienced in nearly all months but they are least marked in June and July.

As the high pressure areas move southward, the winds over the northern part of the sea, in the neighbourhood of about lat. 30° , become more variable in direction. By December, however, North-easterly and South-easterly winds are increasing in frequency, and in the first three months of the year they are the prevailing winds between the 30th and 36th parallels of latitude.

This is therefore the best period for attempting a homeward voyage round the Cape of Good Hope. The winds off Cape Leeuwin are also, usually, favourable at this time.

In April the Easterly winds, although still experienced, are not so prevalent, and they do not extend so far South as in the preceding months. In May they are North of latitude 30°.

In the Tasman Sea, during the summer months, January to March, winds blow from every quarter of the compass, but off the Australian coast the prevailing winds are Northerly to North-easterly and off Bass Strait and Tasmania, South-westerly. On the New Zealand side of the sea Southerly to Easterly winds prevail. During the remaining nine months of the year the winds over this region are very variable in direction.

In all months, and practically all over the ocean, by far the greater proportion of winds are those ranging in force from 4 to 7 of Beaufort's Scale, and calms are comparatively rare. During the summer months light winds are common over the northern parts of the sea.

Gales are not of frequent occurrence in January, and those encountered are mainly confined to the southern parts of the sea, South of about lat. 42°. As the year advances, however, they become more frequent, and they are experienced further North, until in June and July they are met with up to the 30th parallel. They then recede about as regularly southward to the end of the year.

Wind Observations South of Latitude 60°.

(The number of observations is given in ordinary type, the percentages underneath in italics.)

DECEMBER.

| Areas. | N. | N.E. | E. | S.E. | S. | S.W. | W. | N.W. | Calms. | Total No. of Obs. |
|--|-----------------|----------------|---------------|-----------------|------------|-----------------|-----------------|-----------------|-----------------|----------------------|
| Latitude 60° to 63° S. Longitude 170° „ 180° E. | 1 <i>2</i> | 6 <i>13</i> | 2 <i>4</i> | 10 <i>22</i> | ... ... | 11 <i>25</i> | 2 <i>5</i> | 12 <i>27</i> | 1 <i>2</i> | 45 ... |
| Latitude 60° „ 66° S. Longitude 160° „ 170° E. | 25 <i>21</i> | 5 <i>4</i> | 5 <i>4</i> | ... ... | ... ... | 17 <i>44</i> | 11 <i>9</i> | 43 <i>36</i> | 14 <i>12</i> | 120 ... |
| Latitude 66° „ 67° S. Longitude 170° „ 180° E. | ... .. | ... ... | ... ... | 6 <i>12</i> | ... ... | ... ... | 22 <i>46</i> | 20 <i>42</i> | .. ... | 48 ... |

JANUARY.

| | | | | | | | | | | |
|--|----------------|-----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|------------|
| Latitude 63° to 72° S. Longitude 170° „ 180° E. | 12 <i>5</i> | 30 <i>13</i> | 11 <i>5</i> | 35 <i>15</i> | 7 <i>3</i> | 44 <i>19</i> | 25 <i>11</i> | 50 <i>21</i> | 20 <i>8</i> | 234 ... |
| Latitude 72° „ 78° S. Longitude 170° „ 180° E. | 1 <i>1</i> | 5 <i>5</i> | 4 <i>4</i> | 16 <i>15</i> | 31 <i>29</i> | 39 <i>37</i> | 1 <i>1</i> | 1 <i>1</i> | 8 <i>7</i> | 106 ... |
| Latitude 75° „ 78° S. Longitude 160° „ 170° E. | 1 <i>8</i> | .. ... | ... ... | 2 <i>15</i> | ... ... | 2 <i>15</i> | 3 <i>23</i> | 5 <i>39</i> | ... ... | 13 ... |

FEBRUARY.

| Areas. | N. | N.E. | E. | S.E. | S. | S.W. | W. | N.W. | Calms. | Total No. of Obs. |
|--|-----------------|-----------------|---------------|-----------------|----------------|----------------|---------------|----------------|---------------|----------------------|
| Latitude 60° to 66° S. Longitude 40° „ 60° E. | 10 <i>17</i> | 16 <i>28</i> | 3 <i>5</i> | 10 <i>17</i> | 3 <i>5</i> | 3 <i>5</i> | 1 <i>2</i> | 9 <i>16</i> | 3 <i>5</i> | 58 ... |
| Latitude 60° „ 63° S. Longitude 60° „ 70° E. | ... ... | ... ... | ... ... | ... ... | 5 <i>28</i> | 7 <i>54</i> | 1 <i>8</i> | ... ... | ... ... | 13 ... |

MARCH.

| | | | | | | | | | | |
|---|---------------|----------------|----------------|-----------------|---------------|-----------------|----------------|-----------------|---------------|-----------|
| Latitude 60° to 63° S. Longitude 70° „ 100° E. | 2 <i>4</i> | 7 <i>15</i> | 3 <i>7</i> | 13 <i>28</i> | 3 <i>6</i> | 13 <i>28</i> | ... ... | 3 <i>6</i> | 3 <i>6</i> | 47 ... |
| Latitude 60° „ 63° S. Longitude 130° „ 140° E. | 2 <i>9</i> | 9 <i>43</i> | 5 <i>24</i> | 2 <i>10</i> | ... ... | ... ... | ... ... | 1 <i>5</i> | 2 <i>9</i> | 21 ... |
| Latitude 63° „ 66° S. Longitude 140° „ 160° E. | 1 <i>2</i> | 5 <i>11</i> | 2 <i>4</i> | 12 <i>25</i> | 4 <i>9</i> | 13 <i>28</i> | 2 <i>4</i> | 5 <i>11</i> | 3 <i>6</i> | 47 ... |
| Latitude 63° „ 69° S. Longitude 160° „ 170° E. | 5 <i>7</i> | 6 <i>9</i> | 5 <i>7</i> | 12 <i>18</i> | 2 <i>3</i> | 12 <i>17</i> | 7 <i>10</i> | 18 <i>26</i> | 2 <i>3</i> | 69 ... |

Air Temperature.—The general distribution of air temperature is very similar to that of the sea water, being fairly uniform throughout the year in the neighbourhood of Kerguelen, while in the more northern latitudes there is a difference of about 10° between the summer and winter mean temperatures. Over these northern localities, however, the temperature of the air is generally lower than that of the sea to the extent of a few degrees.

Fog.—Only the most northern parts of the sea are free from fog. South of about Lat. 40°, over the western part of the sea, in the neighbourhood of the areas where the range of sea surface temperature is great (coloured blue on the charts), fog is of frequent occurrence, amounting to as much as 10 per cent. of the weather observations. South of New Zealand, from November to April, and also in August, fog is often experienced.

Ice.—No attempt has been made to construct an ice chart. The Admiralty have for many years published an Ice Chart of the Southern Hemisphere (No. 1241), and for some years information has been collected by the Hydrographical Department relative to the condition of the Ice in the tracks of vessels, from which the following remarks have been compiled.

1. Between the Cape of Good Hope and Tasmania ice is seldom met with North of the parallel of 40° S. and then only scattered bergs. During the last 50 years only three bergs have been reported North of this parallel and they were in the immediate vicinity of the Cape.

2. Between the parallels of 40° and 45° South latitude, icebergs are most frequently met with between the meridians of 40° and 60° East longitude. They have also, though rarely, been seen between the meridians of 85° and 100° East longitude and the meridians of 120° and 135° East longitude.

3. Between the parallels of 45° and 50° South latitude, ice may be met with anywhere West of the meridian of 90° E. Eastward of this meridian it is much rarer.

4. The amount of ice reported in different years varies considerably. Thus, in 1891 no ice was seen between the Cape and Tasmania. In 1892 a few scattered bergs were met, but in 1893 a large number of bergs were met North of the parallel of 45° and between the meridians of Greenwich and Cape Agulhas. In 1894 these bergs appeared between the parallels of 43° and 52° S. latitude and the meridians of 10° and 70° East longitude. In 1895 they were reported between the same meridians and the parallels of 42° and 47° S., but few vessels went South of 47° S.

In 1896 icebergs were reported between the parallels of 42° and 50° South latitude and the meridians of 35° and 90° East longitude. In 1897 these bergs appear in much the same position, though a little further eastward.

In 1898 comparatively few were reported, but the records have not yet been all plotted.

From the fact that many icebergs, some of very large dimensions, were reported North-east of the Falkland Islands before 1892, and that as ice was reported in increasing quantities, first West of the meridian of the Cape and then East of it, so the ice North-East of the Falklands became less, and finally disappeared, it seems not improbable that most of the ice reported in the last nine years in the Southern Indian Ocean had drifted East from the area near the Falklands. If this was so, some idea of the life of a berg in temperate climates may be formed. It certainly cannot be considered as less than 10 years, and its destruction is probably due more to wave action than increased warmth.

The foregoing remarks will show that the liability to encounter ice is much increased the further the ship goes South of the parallel of 40° S., and while the length of the summer days, in high latitudes, decreases the chances of running into danger in the dark, still the prevalence of fog, snow, and thick weather, makes it quite possible for a ship to get foul of an iceberg even in the day time and mariners are cautioned accordingly.

Currents.—The currents are reproduced from the Current Charts of the Indian and Pacific Oceans, published by the Hydrographical Department of the Admiralty, from material collected and collated by the Meteorological Office.

Sea Temperature.—The mean temperature of the sea surface, in the more southern latitudes, does not undergo any very important change during the year, the temperature near Kerguelen being approximately 40° in all months, but further North there is greater variation, depending on the season.

From January to March, the temperature of the sea surface off the West Coast of Australia, is about 5° lower than on the East Coast, and the difference ranges from 5° to 10° in October, November, and December, but there is little or no difference during the six months, April to September.

The difference in the temperature on the western and eastern sides of New Zealand is less marked, but there is a general tendency for a somewhat higher temperature down the East Coast of North Island, and lower up the East Coast of Middle Island.

Throughout the year the temperature off Cape Colony is about 10° lower on the West Coast than it is on the East Coast.

The regions of greatest range of temperature, 20° and upwards, are situated West of the 70th meridian between the latitudes of about 39° and 45° S.

In January, February, and March, areas of great range are also found along the South Coast of Cape Colony, and in May there is a similar small area off Sydney, New South Wales.

Meteorological Office,
May, 1899.

C. W. BAILLIE,
Marine Superintendent.

Additional Remarks; December, 1906.

The information relating to ice is given by graphic representation. It shows the extreme limits at which ice had been seen since the beginning of the last century, and exhibits for each month of the year the general distribution of ice, as reported during the past twenty years.

These Charts of the Southern Ocean are intended to enable the navigator to determine the parallels, normally most favourable, for running down the easting, according to the season of the year.

Since the publication of the Atlas, in 1899, the route homeward from Australia via the Cape of Good Hope has been largely adopted, as an alternative to the route via the Suez Canal.

It will be seen by examining the wind roses on these Charts that, in all months of the year, a track may be found between Cape Leeuwin and the Cape of Good Hope on which conditions are favourable for making the passage to the westward, under steam, without unduly lengthening the distance to be traversed from point to point. But, during the months December to March, inclusive, winds will be found favourable on a track lying, for the most part, south of the 30th parallel of south latitude; and in these months the passage homeward via Cape of Good Hope may be used with advantage by sailing vessels as well as steamships.

Throughout the four years 1892-1895 numerous icebergs were observed in the Southern Ocean, some of them in latitudes unusually far north. In June 1892 the remnant of a berg was observed, from the deck of a steamer, when only twenty miles south of Cape Leeuwin. In August 1895, seven bergs, estimated as ranging from 70 to 200 feet in height, were seen fifty-five miles south-east of Cape Agulhas.

During the decade 1896-1905 comparatively few bergs were met with on the trade routes between the Cape of Good Hope and Australasia. Since the close of 1905, however, reports of ice observed in the neighbourhood of Cape Horn, and between that Cape and the Falkland Islands, have been increasingly frequent; and in recent months a large number of bergs have been seen as far as three hundred miles north of the Falklands.

It is, therefore, not improbable that, at no distant date, ice, in large quantities will again make its appearance in the South Indian Ocean, and seamen are cautioned accordingly.

A number of the bergs which have been seen in the vicinity of Cape Horn and in the South Atlantic Ocean, have been remarkable for their great size; many of them being estimated at from 300 to 700 feet high, and from 1 to 10 miles long. A berg observed near Cape Horn in July last was reported to be 1,000 feet in height, and 1 mile in length.

It is difficult, even under favourable circumstances, to estimate accurately the dimensions of a passing berg; and therefore the height and extent of some of the ice islands reported may have been over estimated. It is, nevertheless, an undoubted fact that the icebergs, which have been seen this year in the localities referred to, have been abnormally large, even for southern bergs.

M. W. CAMPBELL HEPWORTH,
Marine Superintendent.

SUPPLEMENTARY NOTES

by Captain CAMPBELL HEPWORTH, R.N.R., C.B., R.D.

1. The Normal paths of the Centres of Cyclonic Depressions
(based upon information collected for the years of International Meteorological Co-operation, 1901-1904).
2. Currents.
3. Ice.

Supplementary Remarks; May, 1917, Third Edition.

NOTES ON THE AVERAGE PATHS OF THE CENTRES OF CYCLONIC DEPRESSIONS BASED UPON INFORMATION COLLECTED FOR THE YEARS OF INTERNATIONAL METEOROLOGICAL CO-OPERATION, 1901-1904.*

In grouping the paths for seasons, the months of September, October, November are selected to represent Spring; December, January, February: Summer; March, April, May: Autumn; and June, July, August: Winter.

The results obtained are as follow:—The average path of all central areas of depression charted for the entire period, October, 1901, to March, 1904, is found to have been in about the 52nd parallel. Between the meridians of 26° E. and 150° E., that is to say, over the South Indian division of the Southern Ocean, it was between the 49th and 50th parallels; and between 150° E. and 70° W., the South Pacific division, in about the 55th.

The South Atlantic division of the Ocean, embraced by the meridians 70° W. and 20° E., is rarely visited by ships, except on the western side; the observations relating to that portion of the Southern Ocean are, therefore, limited almost exclusively to that side; and to that side only the average paths estimated for this division of the ocean refer.

During each of the seasons the centres of depression after passing the meridian of Joinville Island, about 56° W., either struck eastward or south-eastward; or moved east-north-eastward or north-eastward.

In the Spring of the year the average path taken by centres of depression is found to have been between the 49th and 50th parallels in the South Indian division, and between the 54th and the 55th in the South Pacific. The centres entered the South Atlantic division on, or near, the 58th parallel, thence about one-third of them moved north-eastward, and the remainder passed between Danco Land and the South Orkneys. During the Summer months the 53rd was the average parallel along which the centres travelled eastward in the South Indian division, and they followed a path between the 56th and 57th in that of the South Pacific. After passing the 56th meridian of W. longitude, about half the central areas of depression travelled East-south-east between Palmer Land and Danco Land and the South Orkneys, and the other half passed away to the north-eastward. During Autumn and Winter the paths were confined to zones

* National Antarctic Expedition, 1901-1904, Meteorology, Part II., Comprising Daily Synchronous Charts, 1st October, 1901, to 31st March, 1904. London: Published by the Royal Society, 1913.

between 48° S. and 49° S. in the South Indian division, and between 55° S. and 56° S. in the South Pacific. After entering the South Atlantic division, rather less than one-third of the centres moved east-south-eastward or eastward across Danco Land, or between Danco Land and the South Orkneys, the remainder passing east-north-eastward or north-eastward into the South Atlantic. A few crossed Tierra del Fuego or the southern extremity of Patagonia.

The paths of cyclonic centres are found to have been more scattered during the Autumn and Winter months than in Spring and Summer in all parts of the Southern Ocean.

Cyclonic storms, presumably of tropical origin, are represented on each of the charts on which the central positions of Summer and Autumn depressions were plotted, but they are confined to the western portion of the South Pacific division of the Southern Ocean. These appear to have moved into the Tasman Sea from the north-westward, one in the Summer of 1901 and one in each of the Autumns of 1902 and 1903.

The centre of the 1902 storm moved south-eastward to the north-west coast of New Zealand, thence south, passing through Cook Strait, and subsequently zigzagged to the eastward. It can be identified on the daily charts from a position in about 34° S., 169½° E., on the 12th December to a position in about 54½° S., 148½° W., on the 19th of that month, representing a travel of 2187 nautical miles at an average rate of translation of 312 nautical miles per day.

The cyclones of the Autumns of 1901 and 1903 moved east-south-eastward after crossing the 30th parallel, but cannot be traced to the eastward of the 180th meridian.

The tropical disturbance of December, 1901, above mentioned, is not the only cyclonic depression that can be traced on the daily charts for a number of days consecutively. Similar instances of identification, day after day, of such systems after their initial location can be cited as follow:—

| Year. | Month. | Period. | From | | To | | Total Miles. | Miles per diem. |
|-------|------------|---------|------|---------|------|----------|--------------|-----------------|
| 1902 | March | 7-15 | s. | 146° W. | s. | 80° W. | 2243 | 280 |
| 1902 | May | 2-10 | 56° | 102° E. | 53° | 175° E. | 2840 | 355 |
| 1902 | May & June | 29-5 | 47½° | 17° E. | 60° | 83° E. | 2433 | 348 |
| 1902 | Sept. | 2-9 | 57° | 80° E. | 47° | 131½° E. | 2510 | 359 |
| 1903 | May | 16-23 | 54° | 131° W. | 58° | 72° W. | 1995 | 285 |
| 1903 | Sept. | 21-29 | 47½° | 89° E. | 50½° | 130° E. | 1625 | 203 |
| 1903 | Dec. | 10-17 | 40° | 130° E. | 55° | 171° E. | 1890 | 270 |
| 1904 | Feb. | 8-15 | 40° | 154° E. | 52½° | 166° W. | 1825 | 261 |

WIND: From the following table referring to the number of Wind Observations utilized and the percentage of gale frequency, it appears that, roughly stated, the maximum percentage of frequency, between 10 per cent. and 20 per cent., occurs between the parallels of 36° S., and 51° S., in the nine months April to December.

The absolute maximum percentage is shown between 42° S. and 45° S., during the month of August, for which month there are no fewer than 7,159 observations.

CAPE OF GOOD HOPE TO NEW ZEALAND.

Number of Wind Observations.
Percentage Gale Frequency, in Areas of 3° of Latitude, during each month.

| | | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|----------|-----------------------------|------|------|--------|--------|------|-------|-------|--------|-------|------|------|------|
| 30°-33°S | { No. of Wind Observations | 3872 | 3189 | 3728 | 3304 | 3524 | 3527 | 3513 | 3935 | 3341 | 3700 | 3305 | 4272 |
| | { Percentage Gale Frequency | 2.5 | 2.1 | 2.4 | 3.0 | 4.9 | 6.7 | 6.9 | 4.2 | 4.6 | 3.2 | 3.2 | 1.2 |
| 33°-36°S | { No. of Wind Observations | 5536 | 4460 | 5479 | 5227 | 4395 | 4582 | 4738 | 4687 | 4585 | 5044 | 4406 | 5350 |
| | { Percentage Gale Frequency | 1.6 | 3.6 | 3.0 | 3.6 | 8.2 | 11.3 | 10.2 | 8.0 | 7.1 | 5.2 | 3.6 | 3.5 |
| 36°-39°S | { No. of Wind Observations | 4671 | 4535 | 6216 | 4526 | 4746 | 4752 | 5388 | 6164 | 5709 | 4857 | 5059 | 5733 |
| | { Percentage Gale Frequency | 3.7 | 4.6 | 4.7 | 7.7 | 12.1 | 15.5 | 15.2 | 13.7 | 11.5 | 11.7 | 7.2 | 4.9 |
| 39°-42°S | { No. of Wind Observations | 8464 | 7381 | 8976 | 6525 | 7176 | 7862 | 8916 | 11,358 | 9498 | 9276 | 9138 | 9841 |
| | { Percentage Gale Frequency | 5.9 | 6.1 | 7.7 | 8.7 | 12.7 | 15.1 | 15.7 | 16.6 | 15.4 | 14.8 | 11.0 | 9.6 |
| 42°-45°S | { No. of Wind Observations | 7173 | 6403 | 5606 | 5788 | 4942 | 4275 | 5283 | 7159 | 5835 | 6490 | 6253 | 8242 |
| | { Percentage Gale Frequency | 9.4 | 7.1 | 8.8 | 12.3 | 13.3 | 15.7 | 15.5 | 19.8 | 15.3 | 13.3 | 13.6 | 11.7 |
| 45°-48°S | { No. of Wind Observations | 4833 | 3308 | 3226 | 3140 | 3005 | 2345 | 2286 | 2220 | 2353 | 2892 | 3556 | 4679 |
| | { Percentage Gale Frequency | 8.0 | 10.2 | 9.7 | 13.0 | 11.9 | 13.7 | 17.0 | 14.1 | 15.8 | 13.5 | 12.4 | 11.8 |
| 48°-51°S | { No. of Wind Observations | 2071 | 1087 | 1079 | 804 | 1260 | 832 | 754 | 669 | 797 | 964 | 1534 | 2090 |
| | { Percentage Gale Frequency | 9.5 | 13.8 | 12.2 | 14.9 | 13.3 | 11.2 | 16.5 | 10.2 | 18.7 | 9.2 | 11.8 | 11.3 |
| 51°-54°S | { No. of Wind Observations | 332 | 183 | — | — | 156 | — | 94 | 220 | 117 | 153 | 317 | 444 |
| | { Percentage Gale Frequency | 10.2 | 5.5 | — | — | 12.2 | — | 0.0 | 9.1 | 6.1 | 2.7 | 8.7 | 7.9 |
| 54°-57°S | { No. of Wind Observations | — | — | — | — | — | — | — | — | — | — | — | — |
| | { Percentage Gale Frequency | — | — | — | — | — | — | — | — | — | — | — | — |

CURRENTS: Between the meridians of 20° W. and 140° E. the set of the current is chiefly to westward, but inclines towards the north.

Off the eastern, and southern, coasts of South Africa, the warm Mozambique current follows the contour of the land, and meets in about the 20th meridian, off Cape Agulhas the cool easterly drift current, and a cold Polar current, when they combine, and flow northward in a joint stream.

Off the east coast of Australia, a branch of the warm South Equatorial current runs southward, past Gabo island; while the eastward-running, relatively cool drift current divides off Cape Leeuwin. Part of the current sets northward, following the direction of the land, the other part continues its course towards the east, until, at about the 150th meridian, off Gabo island, it again divides: one branch turning in a north-easterly direction, the other to the south-eastward.

In the Tasman Sea the circulation is characterized by the continued flow of these two branches; but the latter turns southward, for the most part, south of latitude 40°, and off the West of New Zealand a current of Polar origin sets northward.

ICE: The information relating to ice is represented on maps of a Polar projection, on which are shown the extreme limits at which ice has been reported since the year 1738, principally, however, since the beginning of the last century. They also exhibit the general distribution of ice reported in each month of the year, during the period 1902-16, inclusive.

The estimated heights, and lengths of the loftiest, and longest bergs, respectively, that have been observed, and reported since the commencement of the year 1884, are given in the tables that follow:—

BERGS, estimated to be not less than 1,000 ft. in height, reported since beginning of 1884.

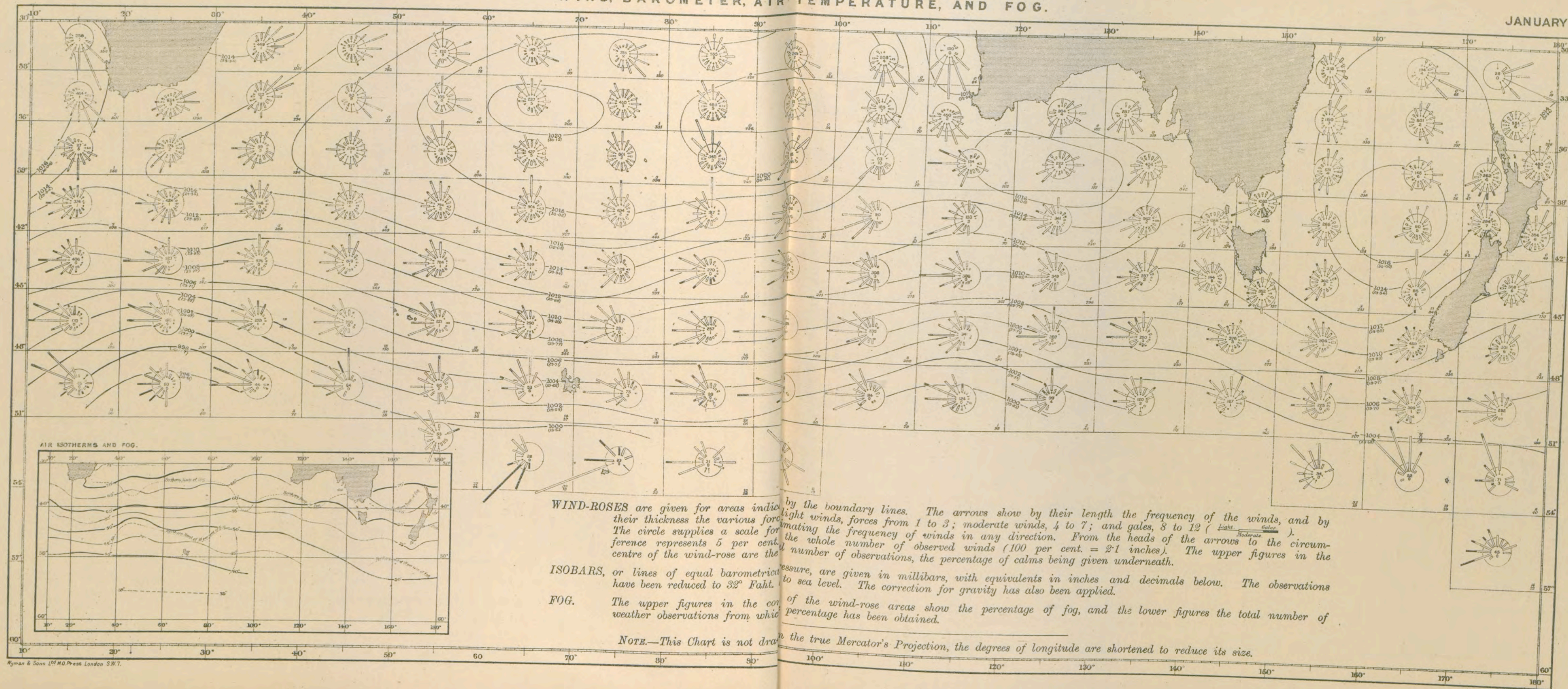
| Year. | Month. | Position. | | Height. Feet. | Length Miles. | Name of Ship reporting. |
|-----------------|-----------|-----------|--------|------------------|------------------|----------------------------|
| | | Lat. S. | Long. | | | |
| 1884 | June | 44 | 49 E. | 1,700 | — | Emil Julius |
| 1890 | October | 50 | 118 W. | 1,000 | — | Noel |
| 1891 | February | 53 | 141 " | 1,000 | 10 | Marianna |
| 1892 | April | 46 | 36 " | 1,000 | — | Cromdale |
| " | May | 44 | 30 " | 1,000 | 40 | Strathdon |
| 1893 | January | 50 | 45 " | 1,500 | 3 | Loch Torridon |
| " | February | 50 | 47 " | 1,000 | — | Cutty Sark |
| " | March | 50 | 45 " | 1,200 | — | Turakina |
| " | April | 49 | 51 " | 1,000 | 2 | Brier Holme |
| " | May | 50 | 52 " | 1,000 | — | Charles Racine |
| " | September | 43 | 5 " | 1,000 | — | Loch Eck |
| 1896 | December | 45 | 50 E. | 1,500 | — | Charles Racine |
| 1901 | September | 50 | 130 W | 1,000 | — | Loch Katrine |
| 1902 | September | 56 | 67 " | 1,000 | ½ | Sokoto |
| " | October | 44 | 31 " | 1,000 | — | Curzon |
| 1904 | November | 52 | 44 " | 1,500 | 7 | Zinita |
| 1906 | May | 57 | 64 " | 1,000 | — | Belen |
| " | July | 56 | 67 " | 1,000 | 1 | Bossuet |
| 1908 | August | 49 | 42 " | 1,300 | 10 | Cognati |
| 1909 | December | 50 | 47 " | 1,000 | — | Walden Abbey |
| 1910 | February | 57 | 133 " | 1,000 | — | Invertay |
| " | August | 52 | 57 " | 1,000 | — | Halewood |
| 1911 | May | 51 | 131 " | 1,000 | — | Wynford |
| 1912 | August | 56 | 63 " | 1,000 | 5 | Metropolis |
| Maximum 1884 | June | 44 | 49 E. | 1,700 | — | Emil Julius |

BERGS, estimated to be over ten miles long, reported since beginning of 1884.

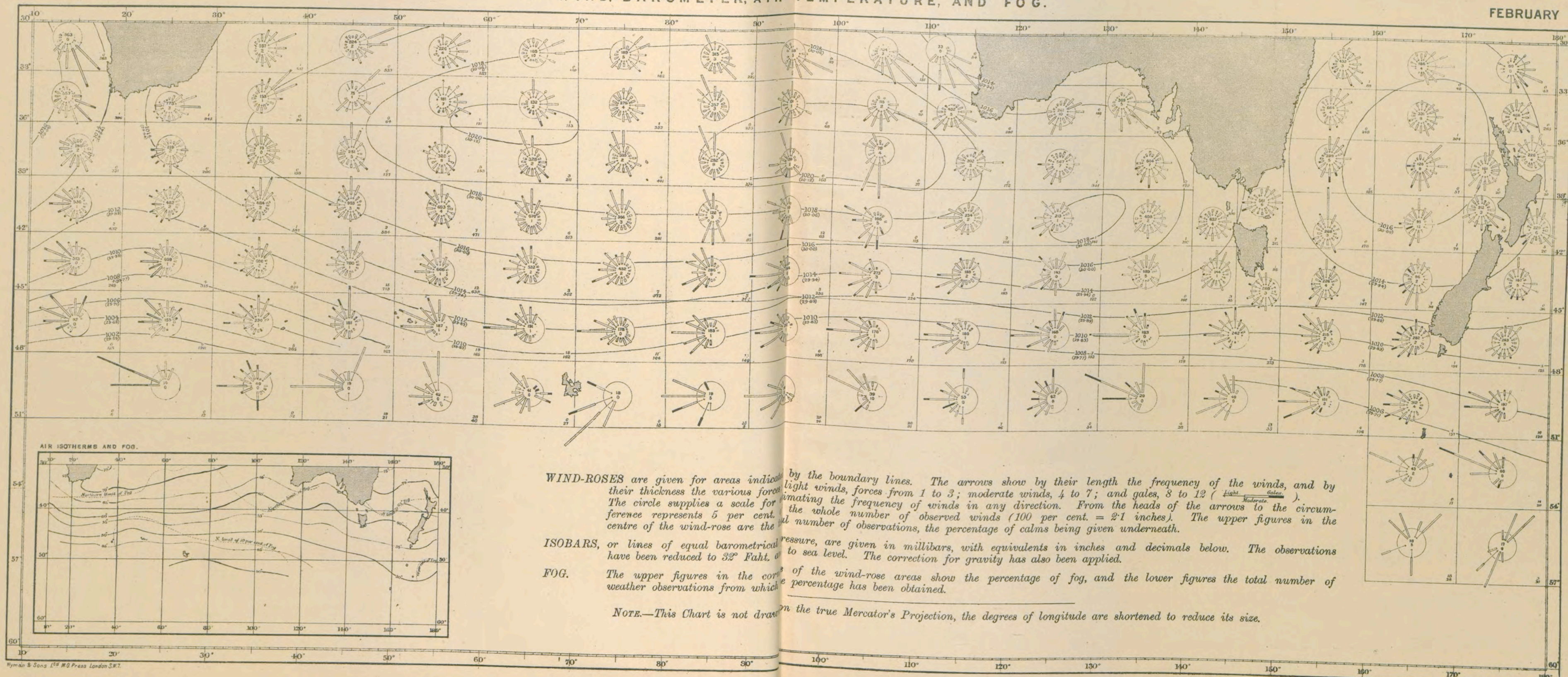
| Year. | Month. | Position. | | Length Miles. | Height. Feet. | Name of Ship reporting. |
|-----------------|-----------|-----------|---------|------------------|------------------|----------------------------|
| | | Lat. S. | Long. | | | |
| 1892 | May | 44 | 30° W. | 40 | 100 | Strathdon |
| " | June | 44 | 33 " | 40 | — | Alice |
| " | " | 41 | 35 " | 40 | — | Parsee |
| " | July | 41 | 32 " | 12 | 500 | Kinfauns |
| " | December | 48 | 44 " | 25 | 350 | Drumcraig |
| 1893 | January | 50 | 45 " | 50 | — | Loch Torridon |
| " | " | 50 | 45 " | 30 | — | Ariadne |
| " | February | 50 | 45 " | 25 | — | Hurunui |
| " | " | 50 | 47 " | 19 | — | Cutty Sark |
| " | March | 51 | 50 " | 82 | — | Æthelberht |
| " | " | 50 | 49 " | 16 | 30 | Persian Empire |
| " | " | 50 | 50 " | 15 | 300 | Chili |
| " | December | 45 | 42 " | 18 | 350 | Beechwood |
| 1894 | November | 58 | 178° E. | 70 | 60 | Antarctic |
| 1906 | June | 59 | 65° W. | 20 | — | Pythomene |
| " | August | 55 | 58 " | 12 | 200 | Rhuddlan Castle |
| 1908 | March | 50 | 51 " | 11 | 280 | Dumfriesshire |
| " | September | 49 | 50 " | 50 | 250 | Dee |
| " | " | 49 | 50 " | 60 | 250 | Lakemba |
| " | " | 48 | 40 " | 20 | — | Francois d'Amboise |
| 1910 | June | 49 | 46 " | 50 | — | Foohng Suey |
| 1913 | January | 64 | 159° E. | 21 | — | Terra Nova |
| 1916 | August | 53 | 36° W. | 30 | 100 | Ramleh |
| Maximum 1893 | March | 51 | 50° W. | 82 | — | Æthelberht |

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WINDS.
JANUARY.



WINDS.
FEBRUARY.

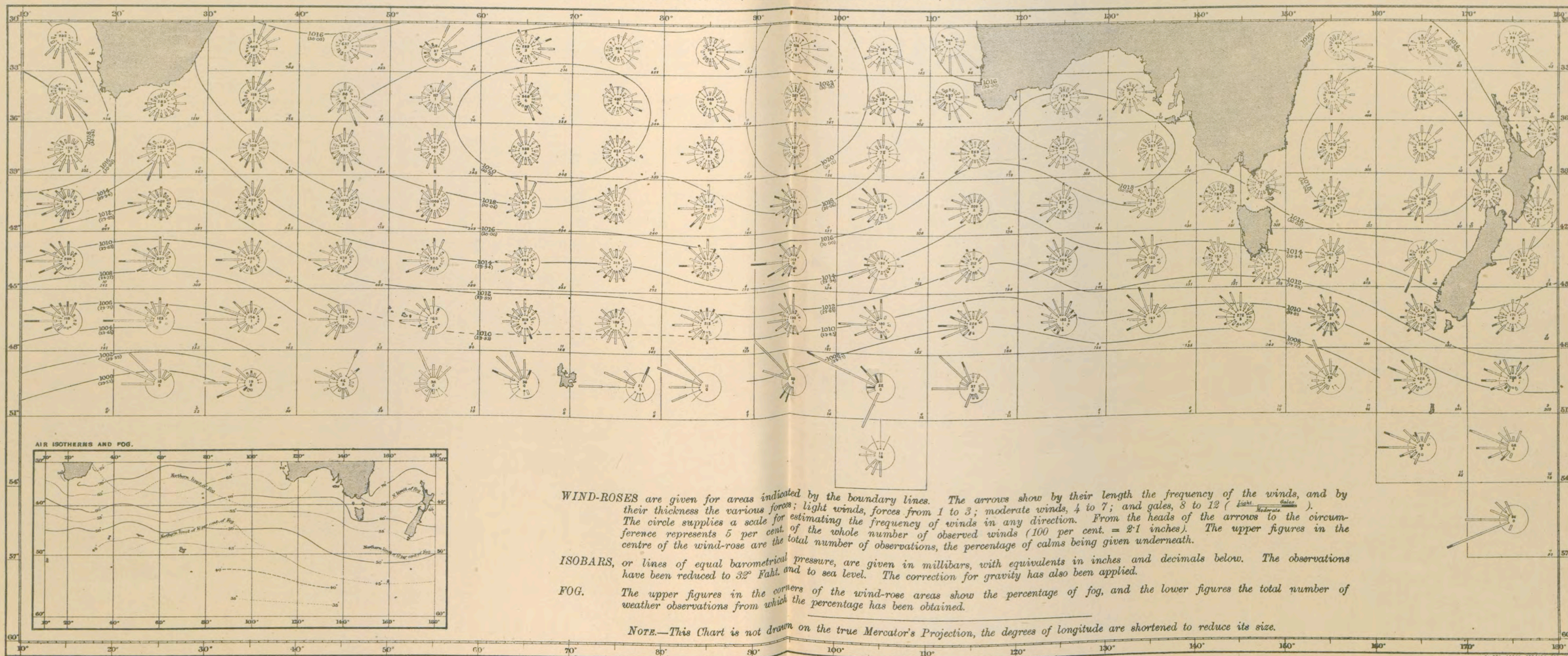


WINDS.
MARCH.

MARCH

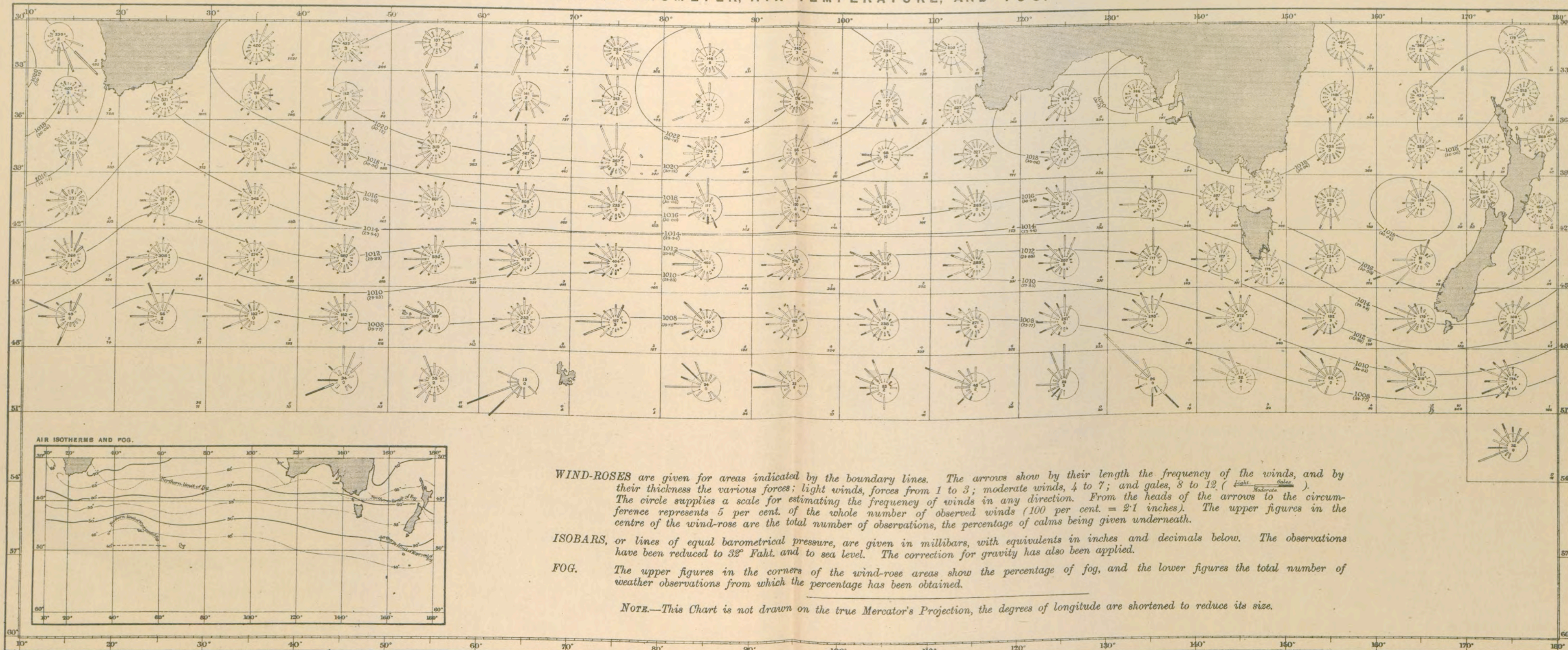
WIND, BAROMETER, AIR TEMPERATURE, AND FOG.

MARCH



WINDS.

APRIL.



WIND-ROSES are given for areas indicated by the boundary lines. The arrows show by their length the frequency of the winds, and by their thickness the various forces; light winds, forces from 1 to 3; moderate winds, 4 to 7; and gales, 8 to 12. (Light Moderate Gale). The circle supplies a scale for estimating the frequency of winds in any direction. From the heads of the arrows to the circumference represents 5 per cent. of the whole number of observed winds (100 per cent. = 21 inches). The upper figures in the centre of the wind-rose are the total number of observations, the percentage of calms being given underneath.

ISOBARS, or lines of equal barometrical pressure, are given in millibars, with equivalents in inches and decimals below. The observations have been reduced to 32° Fahr. and to sea level. The correction for gravity has also been applied.

FOG. The upper figures in the corners of the wind-rose areas show the percentage of fog, and the lower figures the total number of weather observations from which the percentage has been obtained.

NOTE.—This Chart is not drawn on the true Mercator's Projection, the degrees of longitude are shortened to reduce its size.

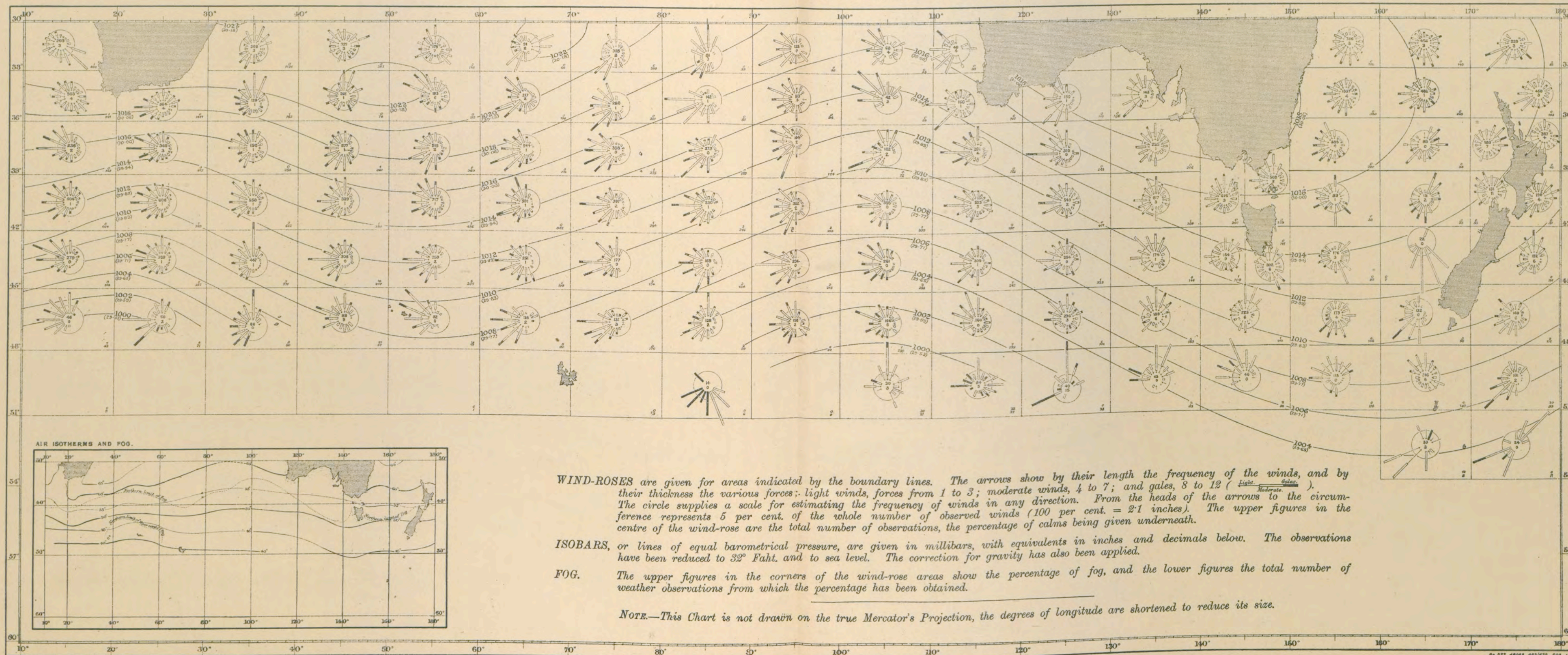
WINDS.

MAY.



WINDS.

JUNE.



WIND-ROSES are given for areas indicated by the boundary lines. The arrows show by their length the frequency of the winds, and by their thickness the various forces: light winds, forces from 1 to 3; moderate winds, 4 to 7; and gales, 8 to 12 ($\frac{\text{light}}{\text{moderate}} = \frac{1}{2}$). The circle supplies a scale for estimating the frequency of winds in any direction. From the heads of the arrows to the circumference represents 5 per cent. of the whole number of observed winds (100 per cent. = 2.1 inches). The upper figures in the centre of the wind-rose are the total number of observations, the percentage of calms being given underneath.

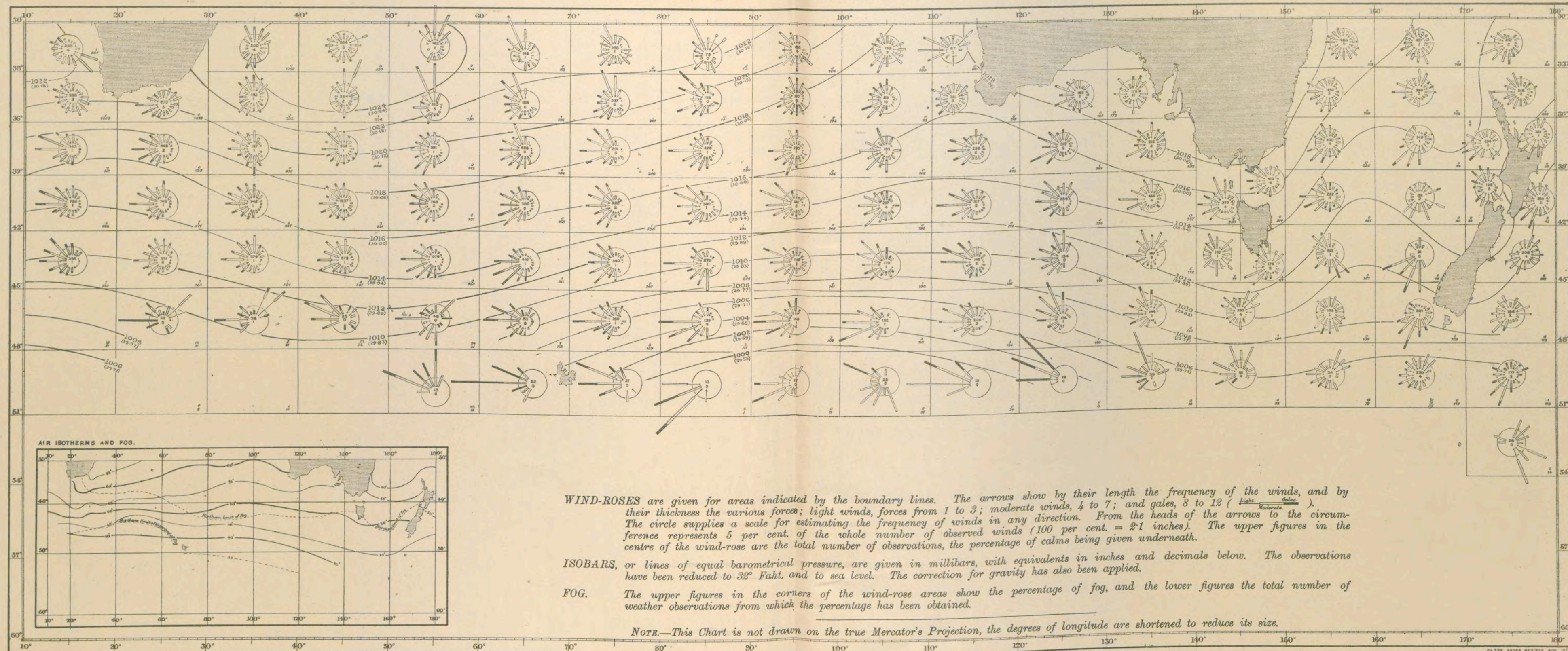
ISOBARS, or lines of equal barometrical pressure, are given in millibars, with equivalents in inches and decimals below. The observations have been reduced to 32° Fahr. and to sea level. The correction for gravity has also been applied.

FOG. The upper figures in the corners of the wind-rose areas show the percentage of fog, and the lower figures the total number of weather observations from which the percentage has been obtained.

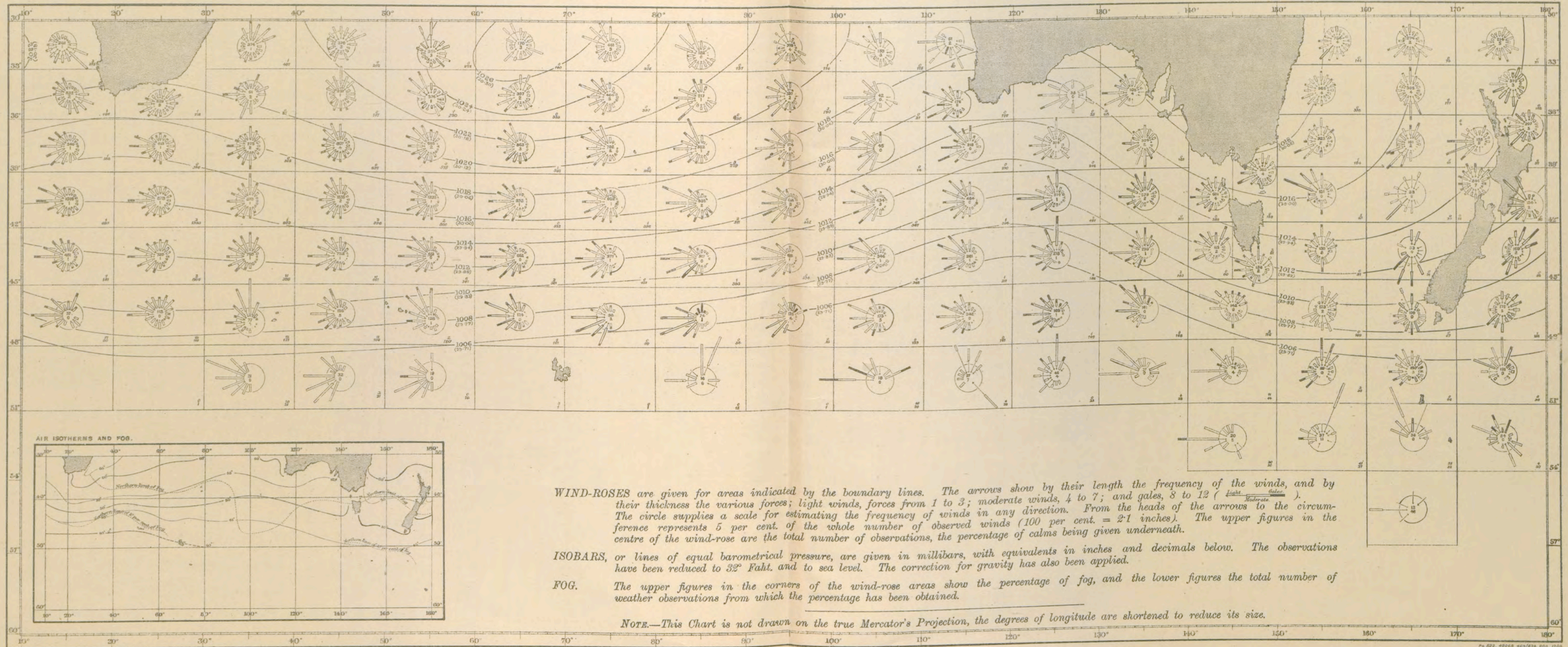
NOTE.—This Chart is not drawn on the true Mercator's Projection, the degrees of longitude are shortened to reduce its size.

WINDS.

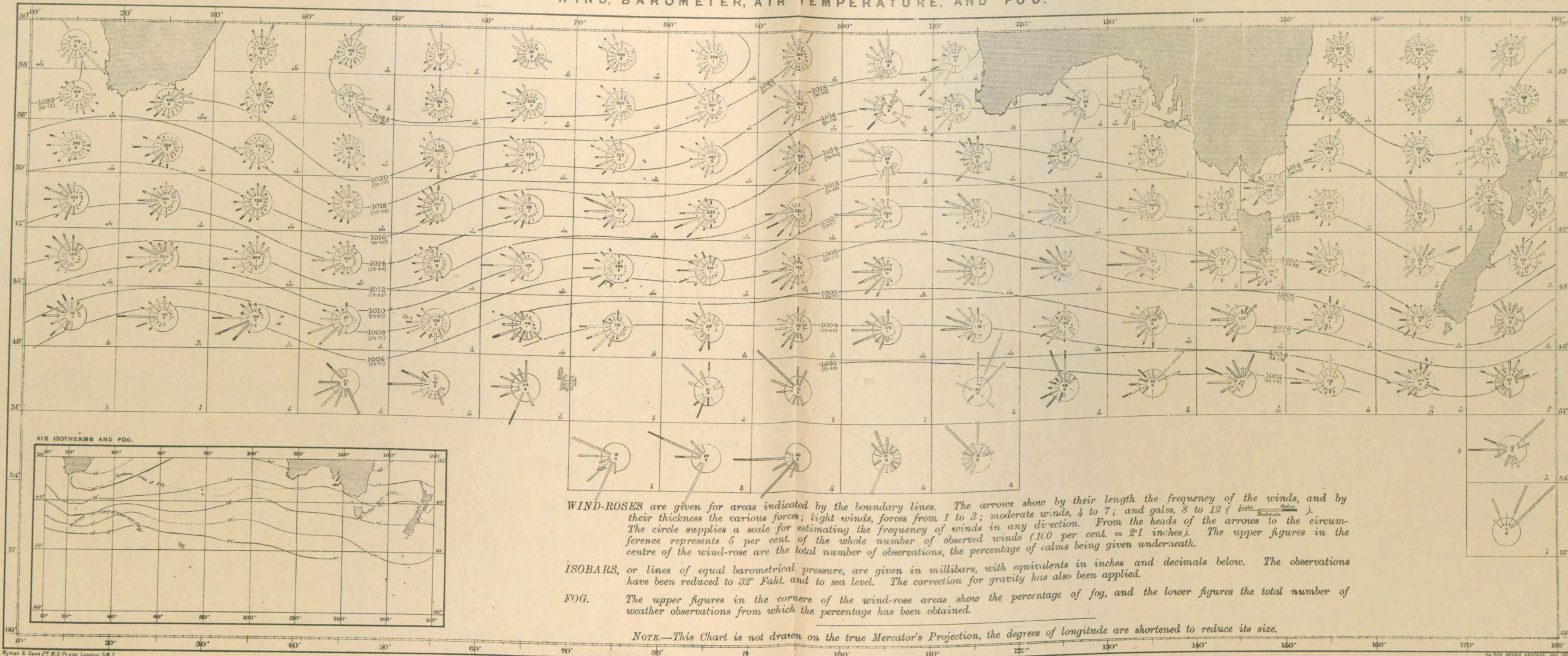
JULY.



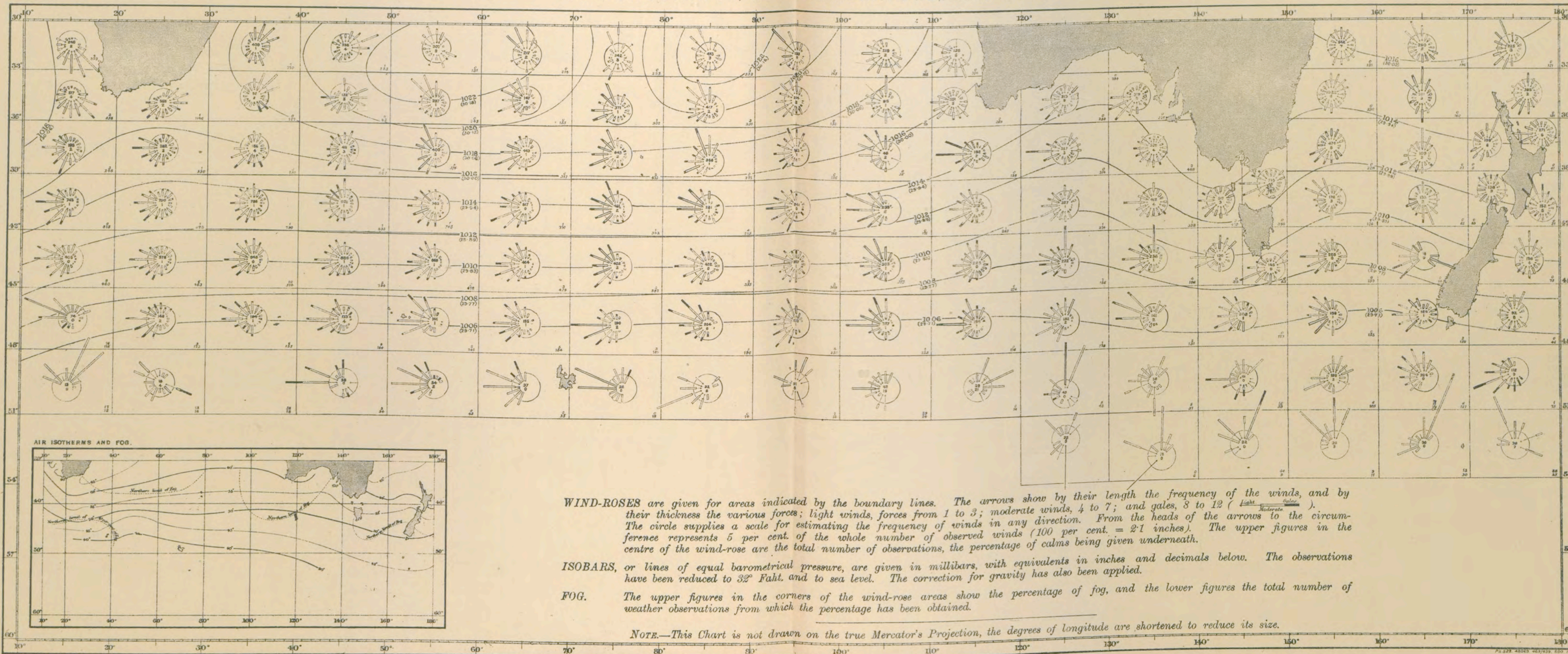
WINDS.
AUGUST.



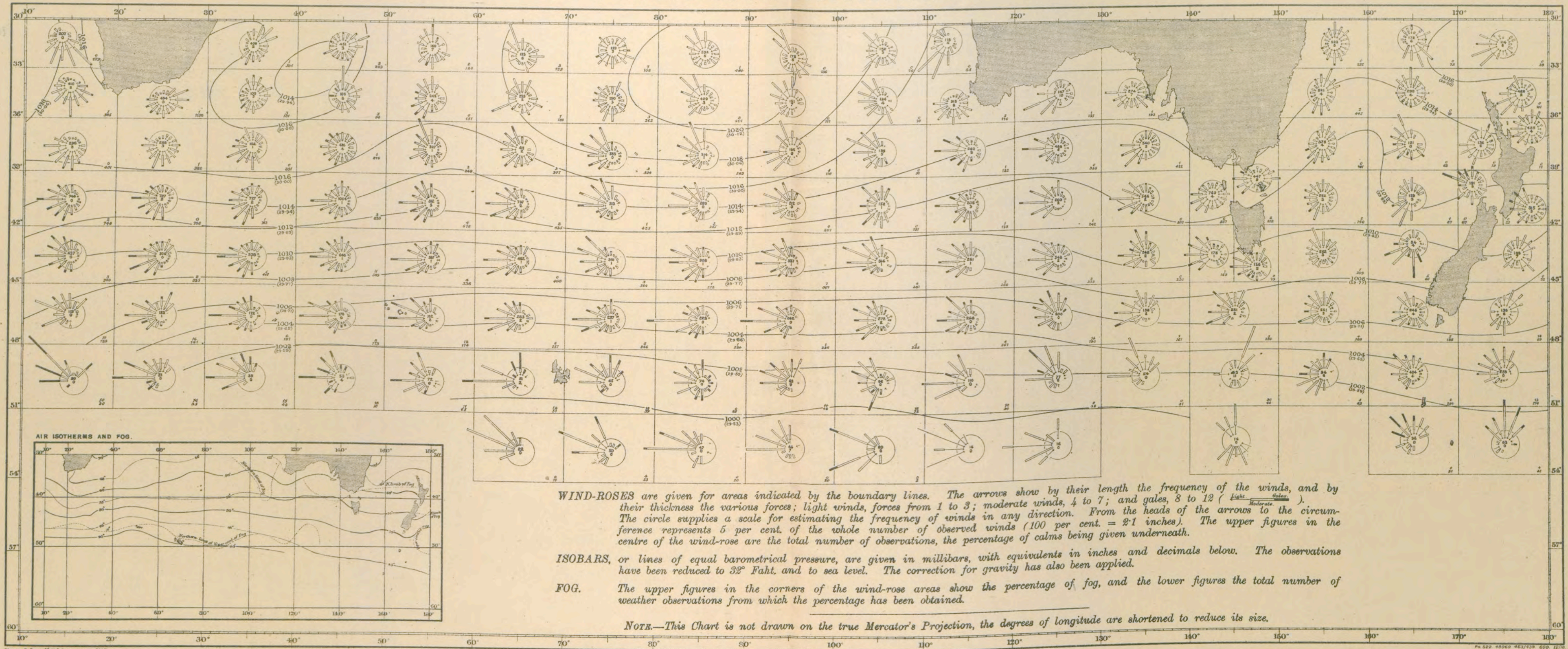
WINDS.
SEPTEMBER.



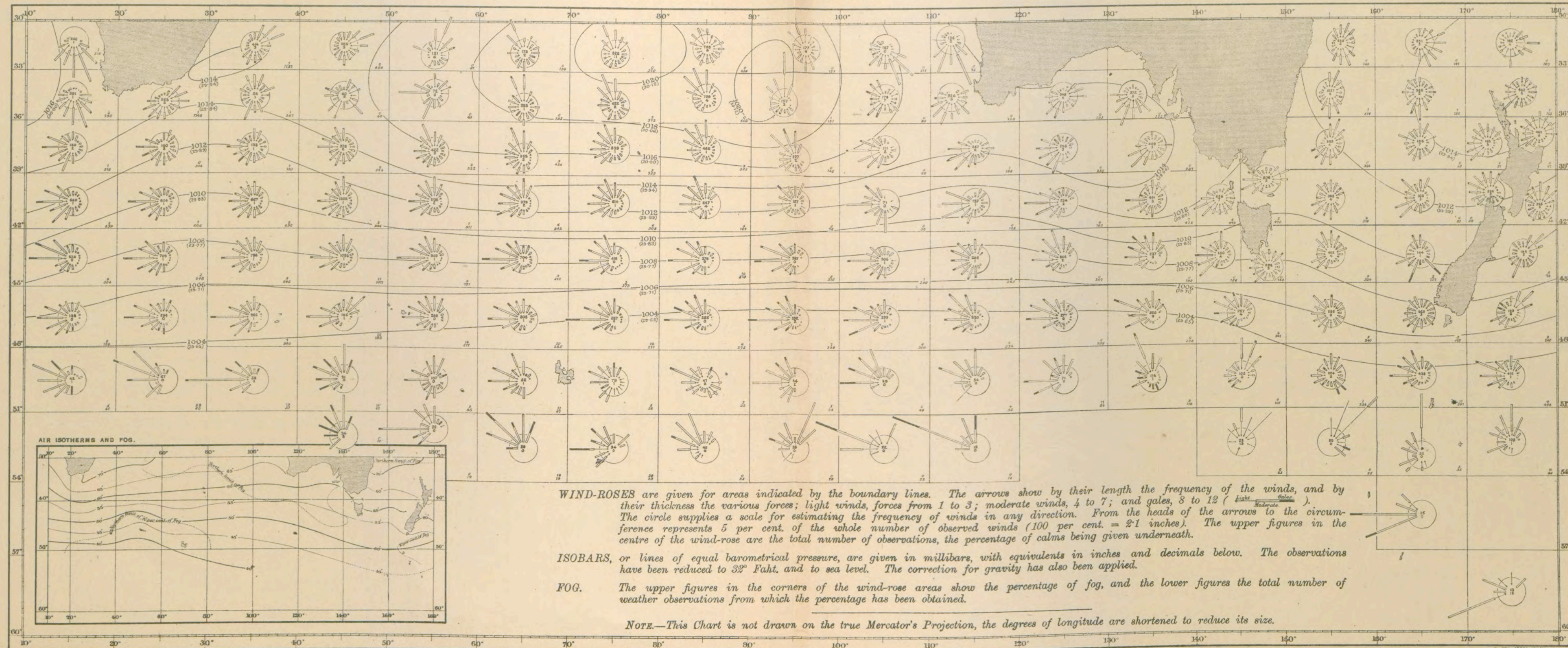
WINDS.
OCTOBER.



WINDS.
NOVEMBER.

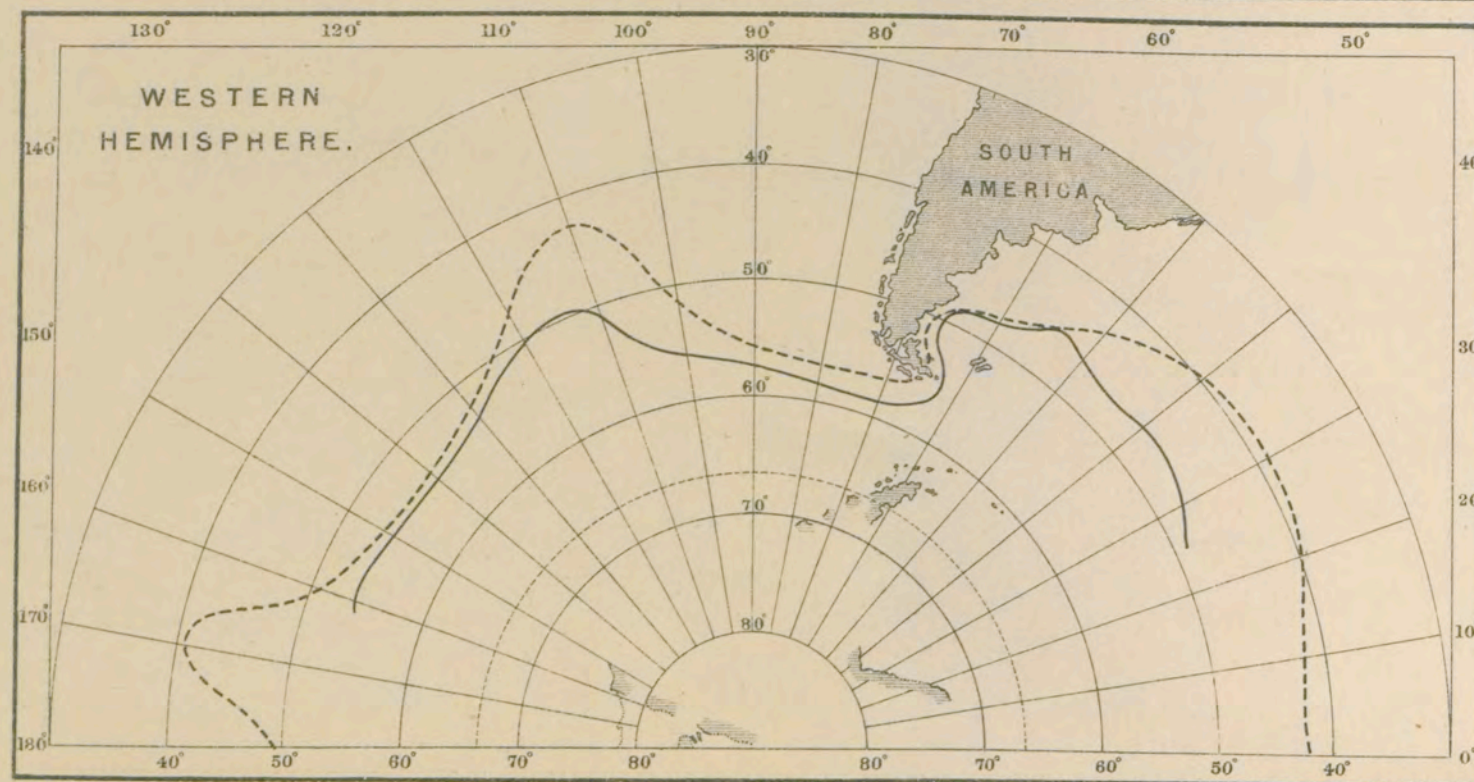


WINDS.
DECEMBER.



CURRENTS & ICE.

JANUARY.

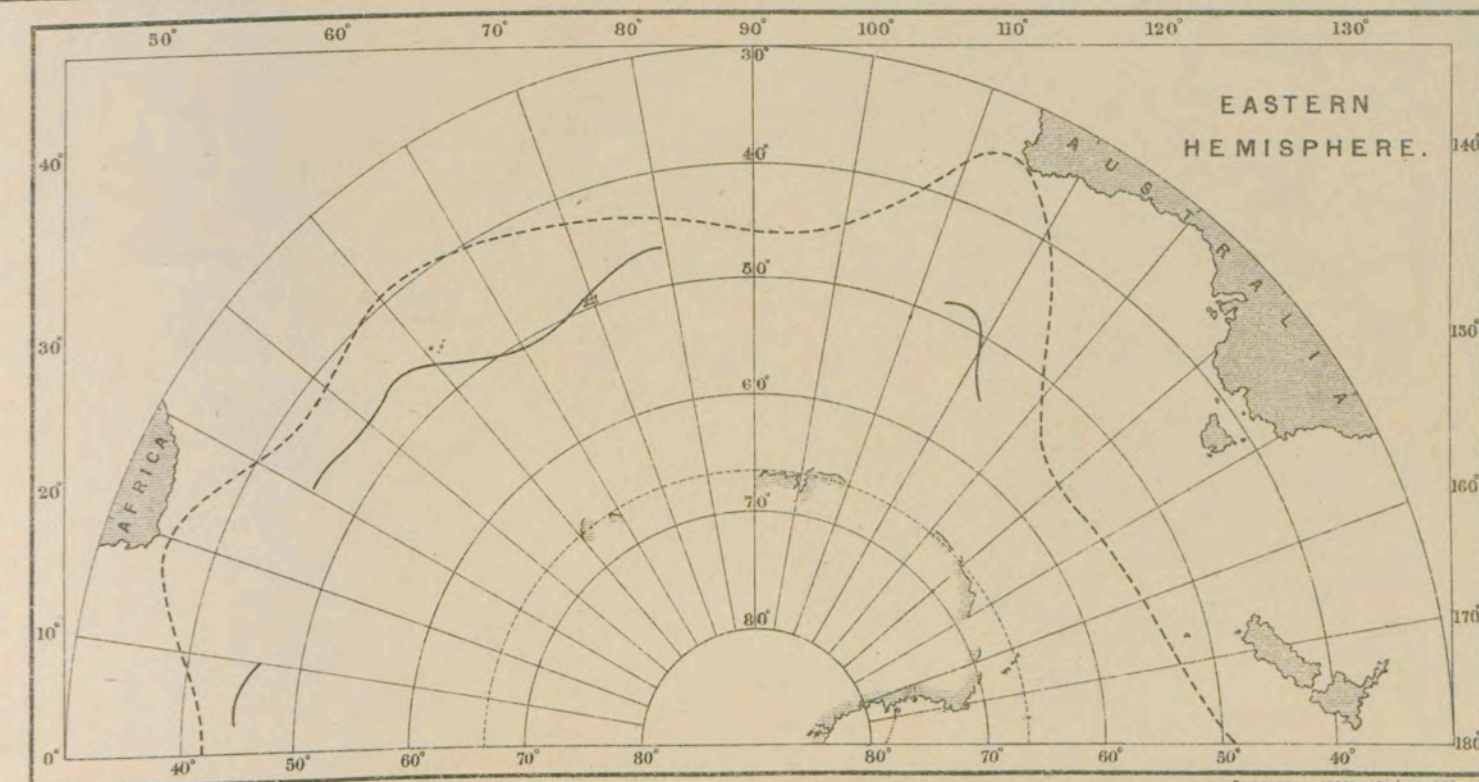


CURRENTS.

The length of the arrows is approximately proportional to the mean amount of current, the figures attached to the arrows being the maximum and minimum amount of set for 24 hours in nautical miles, generally recorded near the spot. When no figures are given with the arrows, the direction of the set only is indicated. Areas where no appreciable current may be expected are indicated by \odot . The very short arrows are the result of comparatively few observations.

LIMITS AND DISTRIBUTION OF ICE.

The extreme northern limit of Ice in the Southern Ocean reported during the 17 years' period, 1902-1918, is indicated by a plain line. The pecked line refers to the extreme limit of Ice reported since the year 1772.



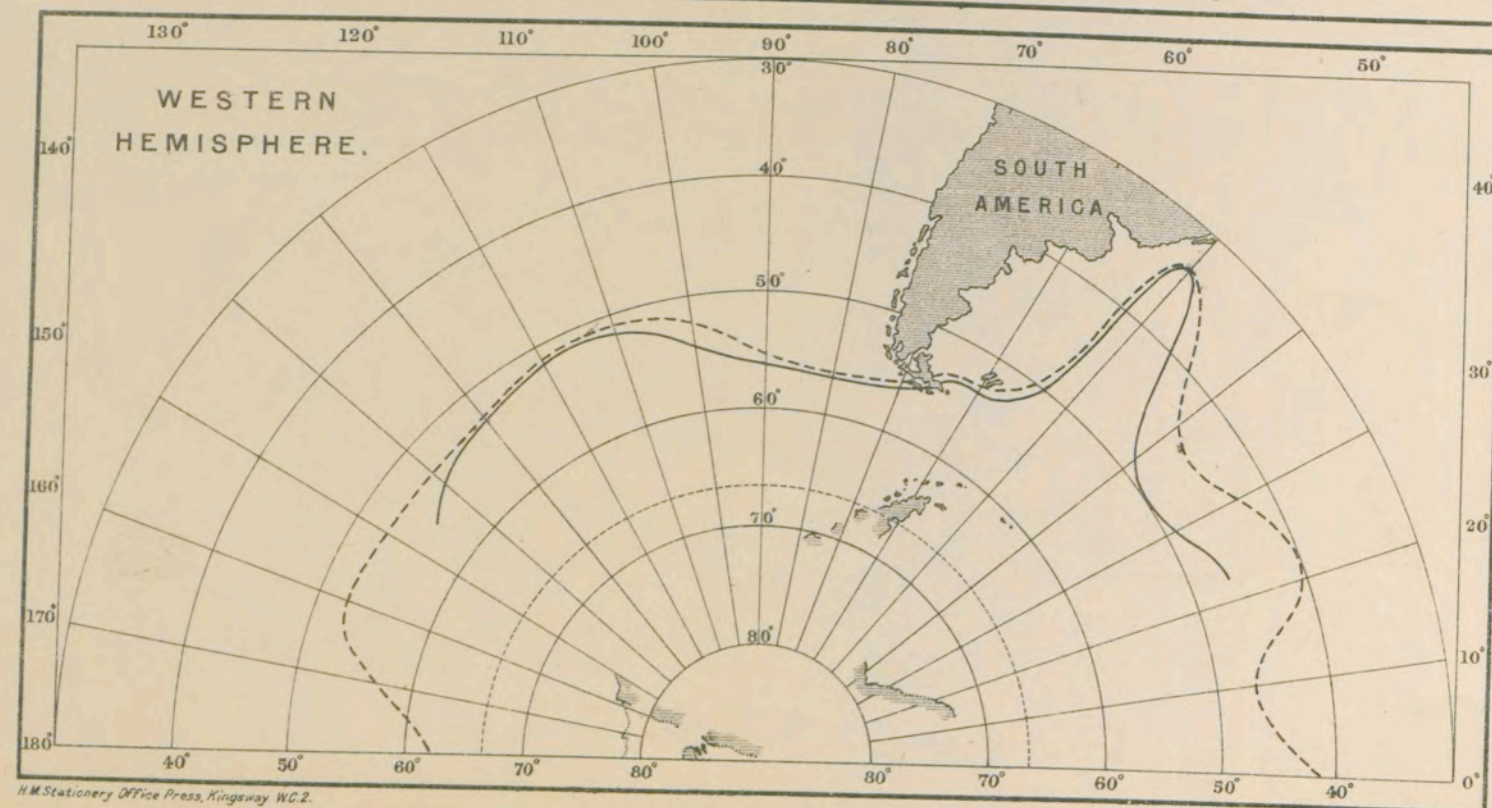
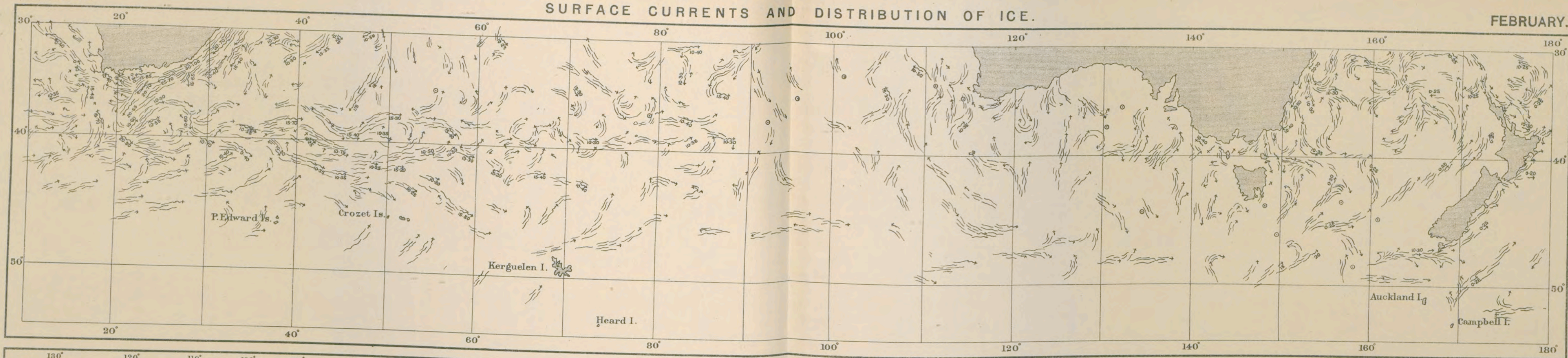
CURRENTS & ICE.

FEBRUARY.

FEBRUARY.

SURFACE CURRENTS AND DISTRIBUTION OF ICE.

FEBRUARY.



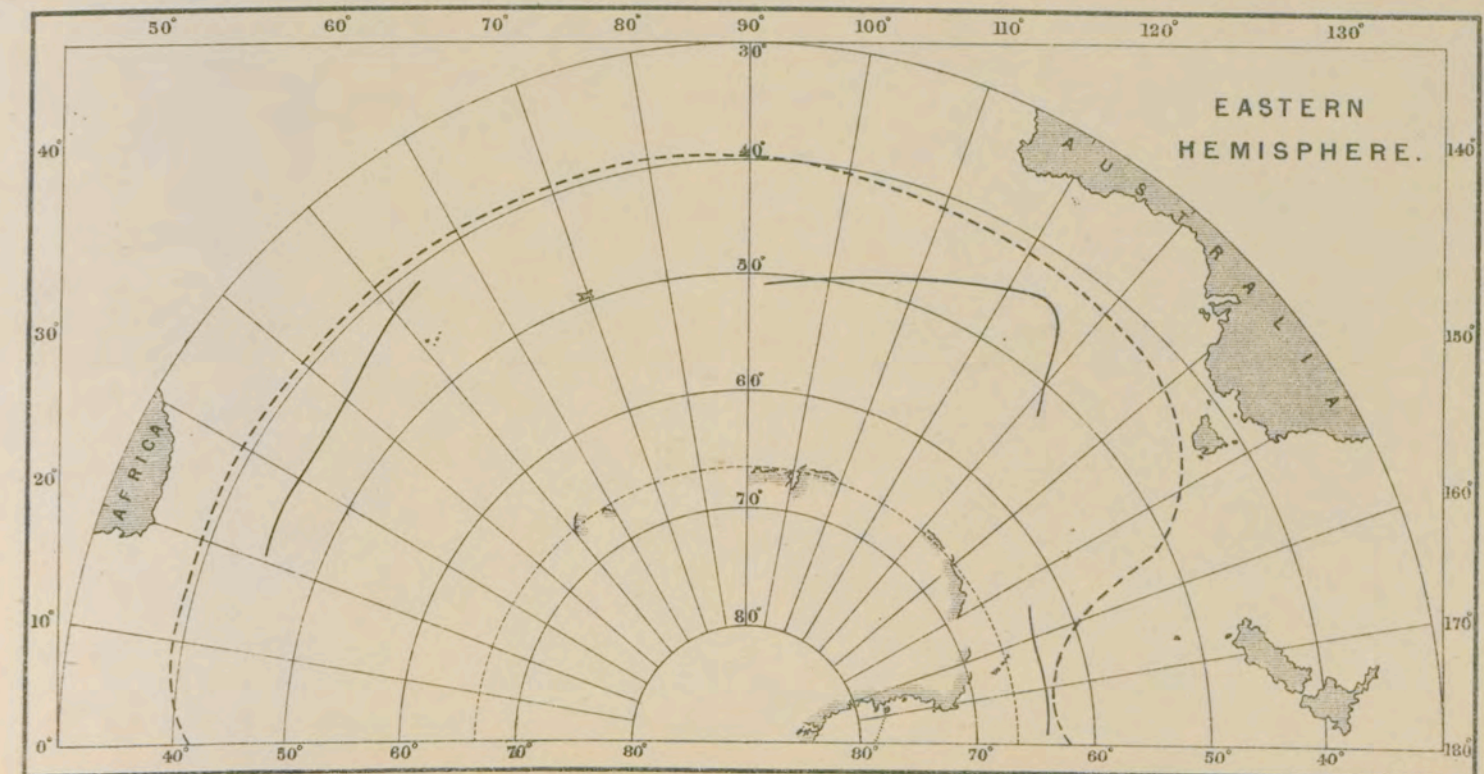
H.M. Stationery Office Press, Kingsway W.C.2.

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PA 3512/121 48023 453/423 600 5/20

CURRENTS & ICE.

MARCH.

CURRENTS & ICE.

APRIL.

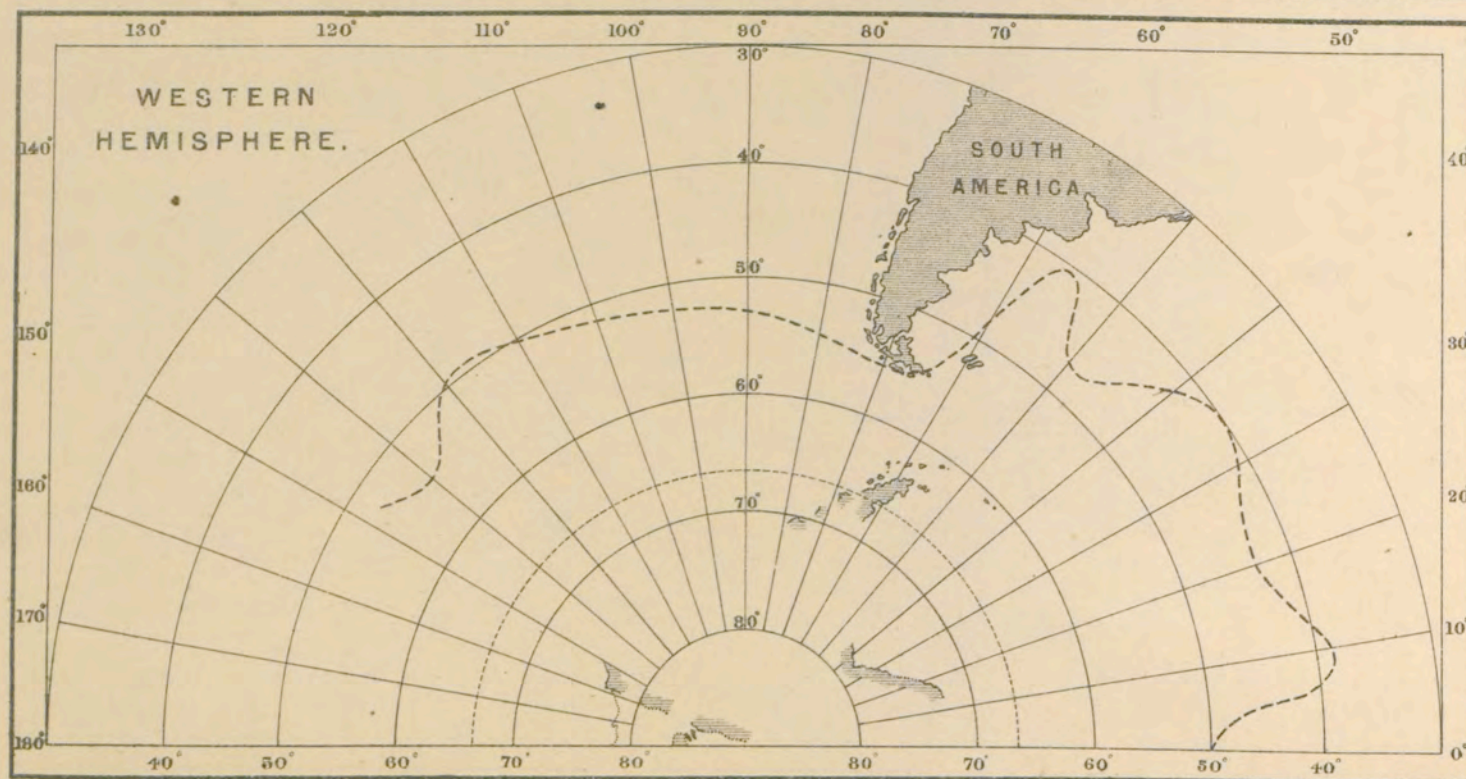
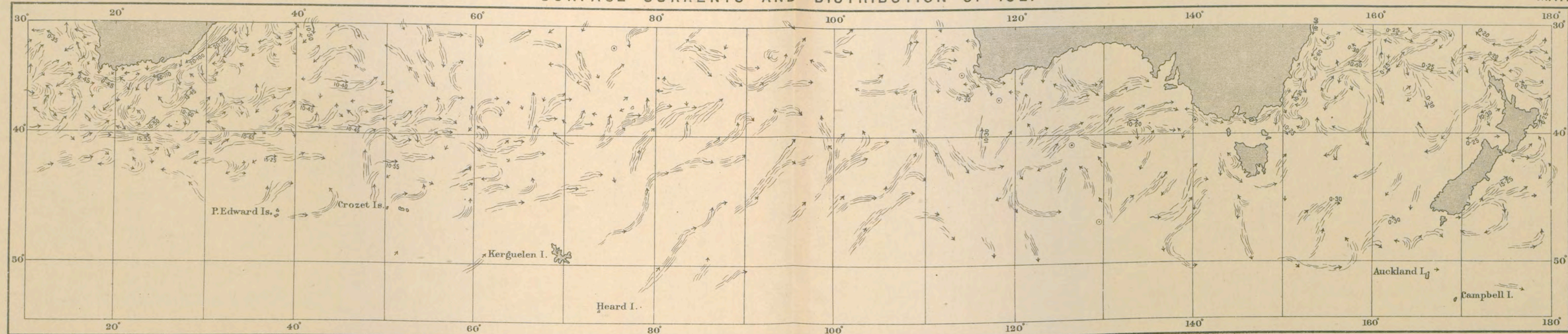
CURRENTS & ICE.

MAY

MAY.

SURFACE CURRENTS AND DISTRIBUTION OF ICE.

MAY.



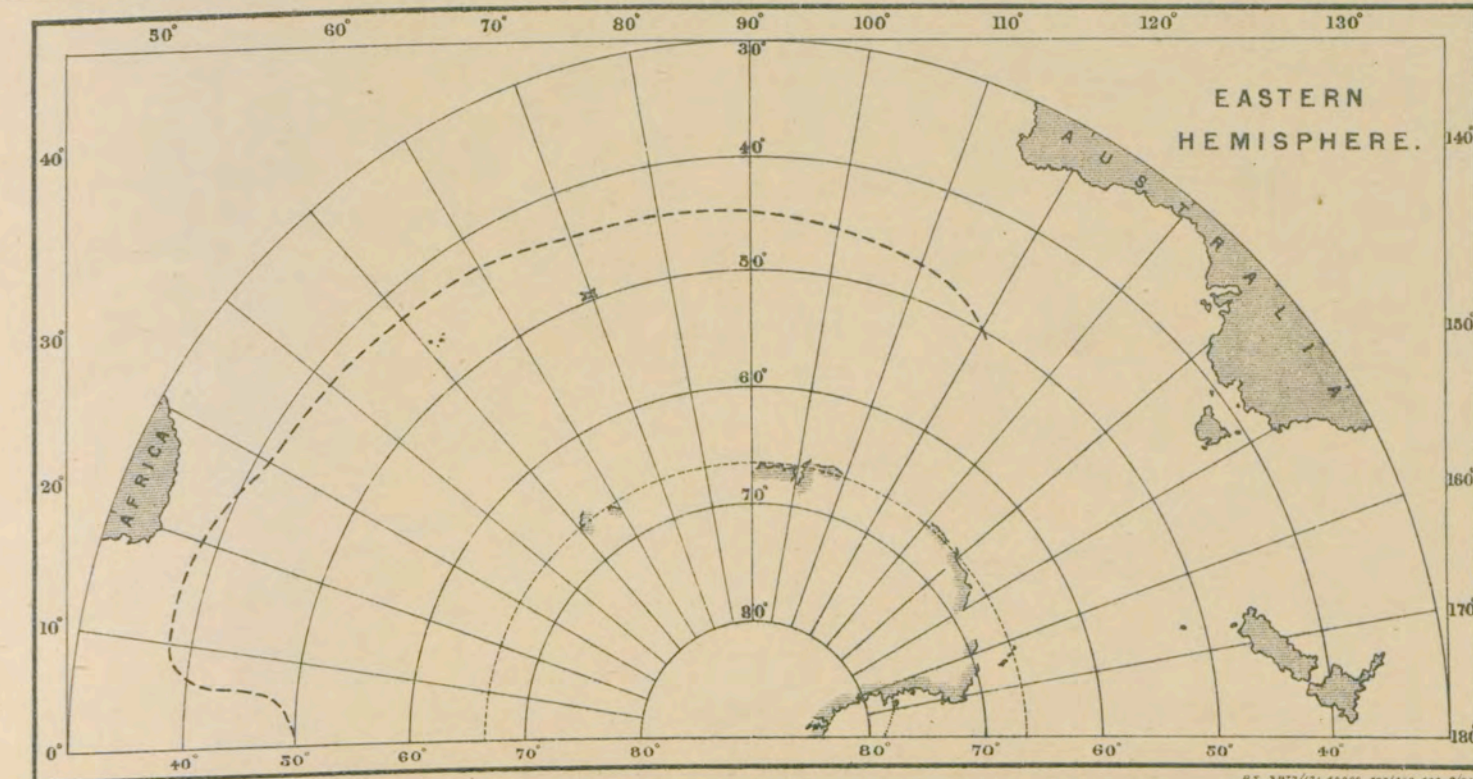
H.M. Stationery Office Press, Kingsway, W.C.2.

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H.S. 3072/12. 48012. 403/412. 600. 8/20.

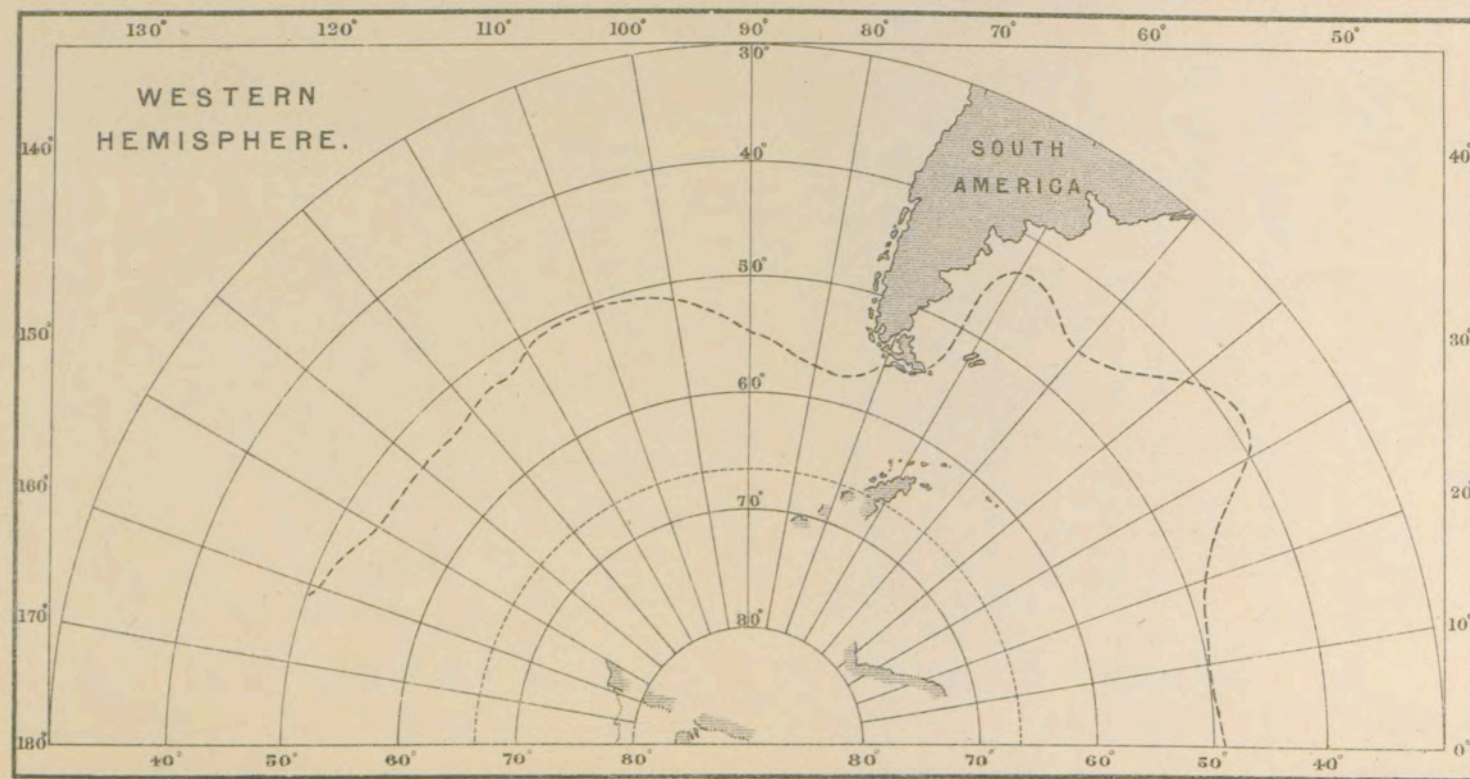
CURRENTS & ICE.

JUNE

JUNE.

SURFACE CURRENTS AND DISTRIBUTION OF ICE.

JUNE.



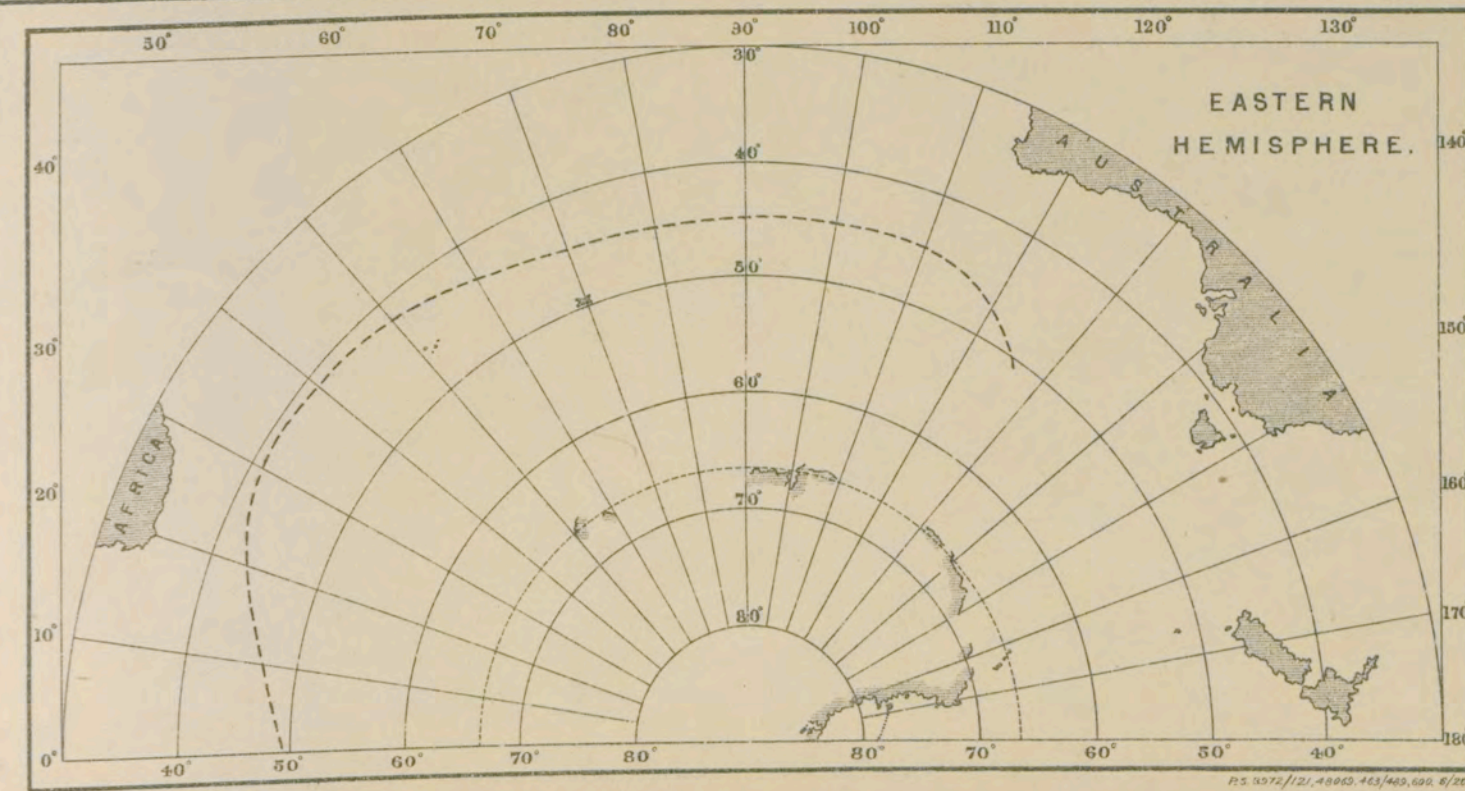
H.M. Stationery Office Press, Kingsway, W.C.2.

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P.S. 5372/121, 48863, 463/469, 600, 8/20

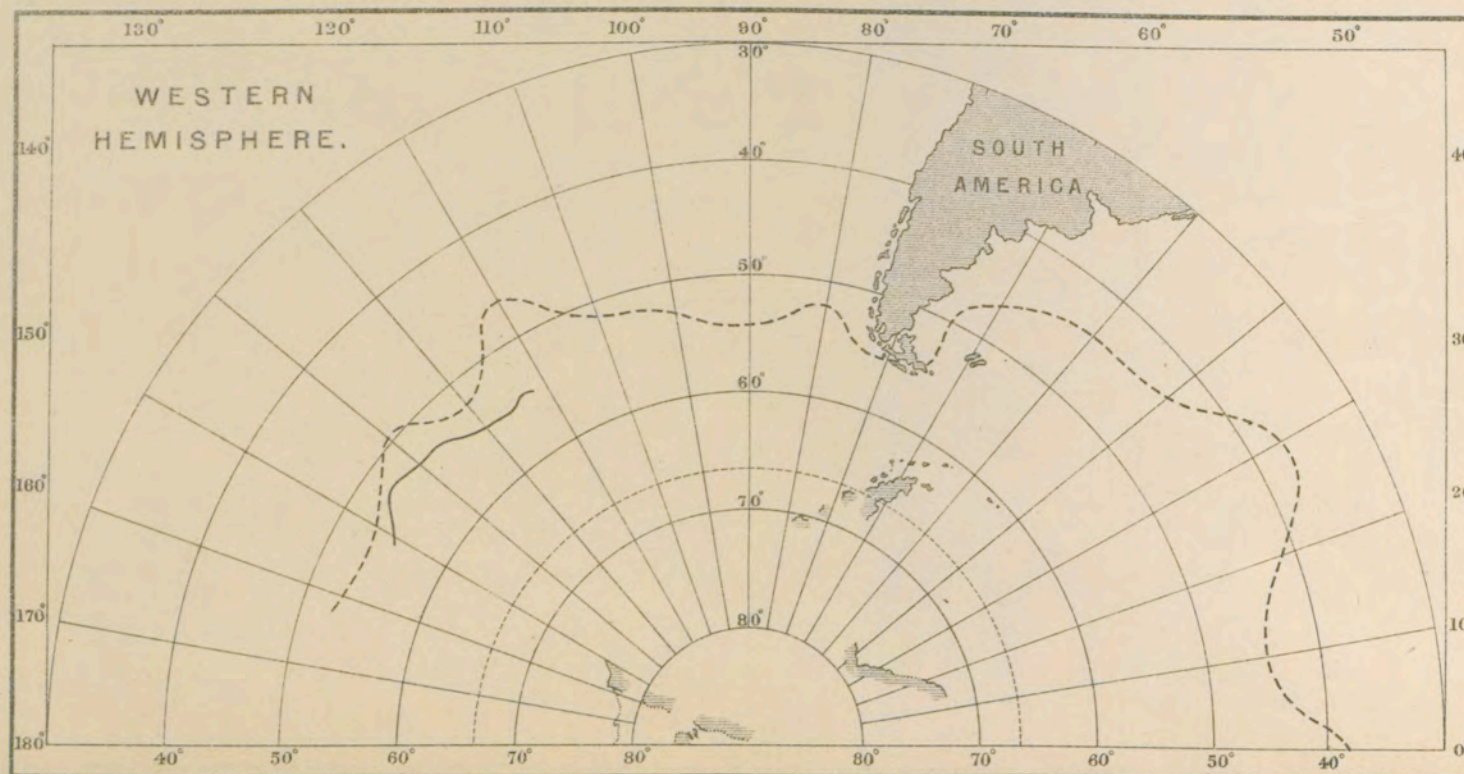
CURRENTS & ICE.

JULY.

JULY.

SURFACE CURRENTS AND DISTRIBUTION OF ICE.

JULY.



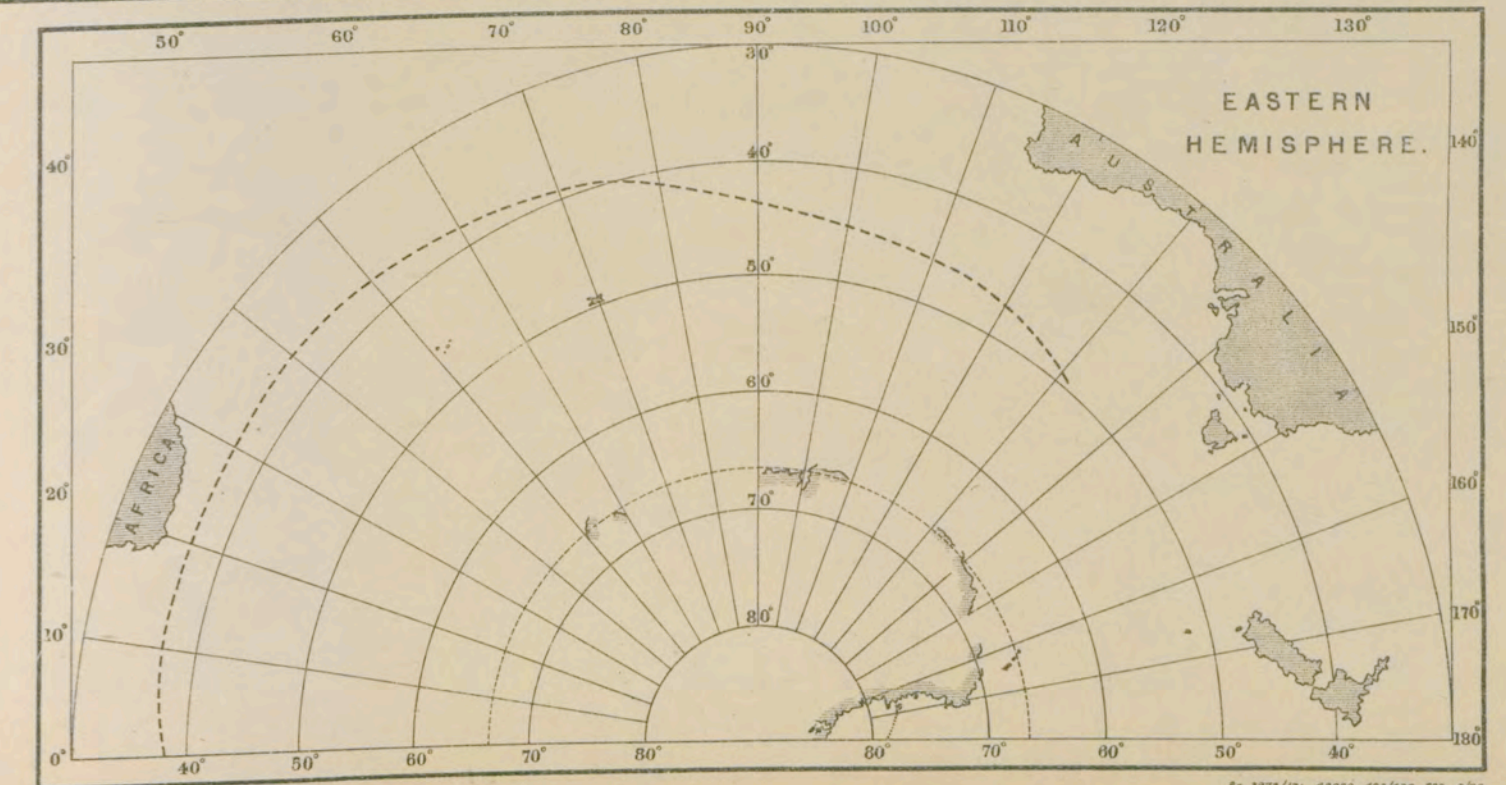
H.M. Stationery Office Press, Kingsway W.C.2.

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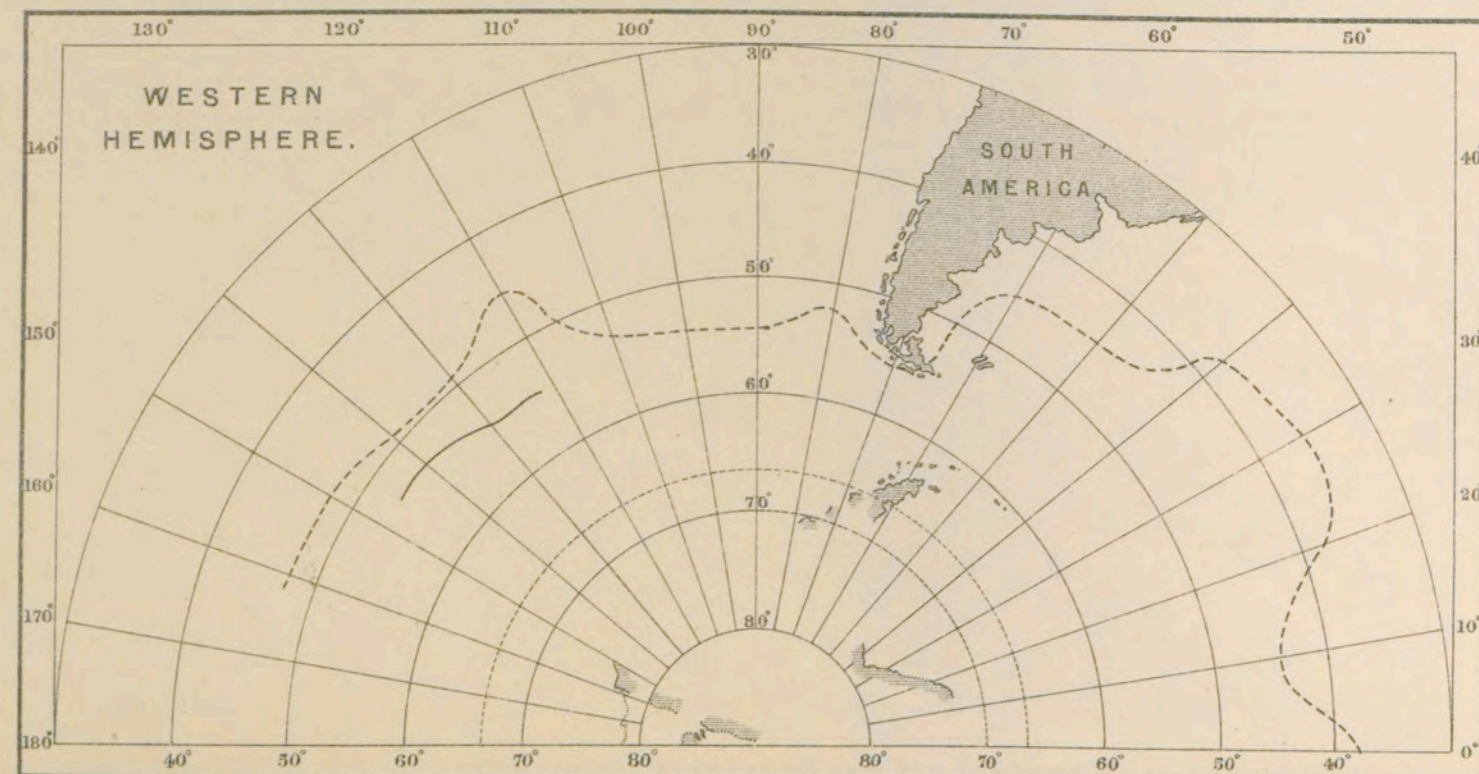


P. 3972/121. 46063. 462/423. 600. 6/20

CURRENTS & ICE.

AUGUST

AUGUST.

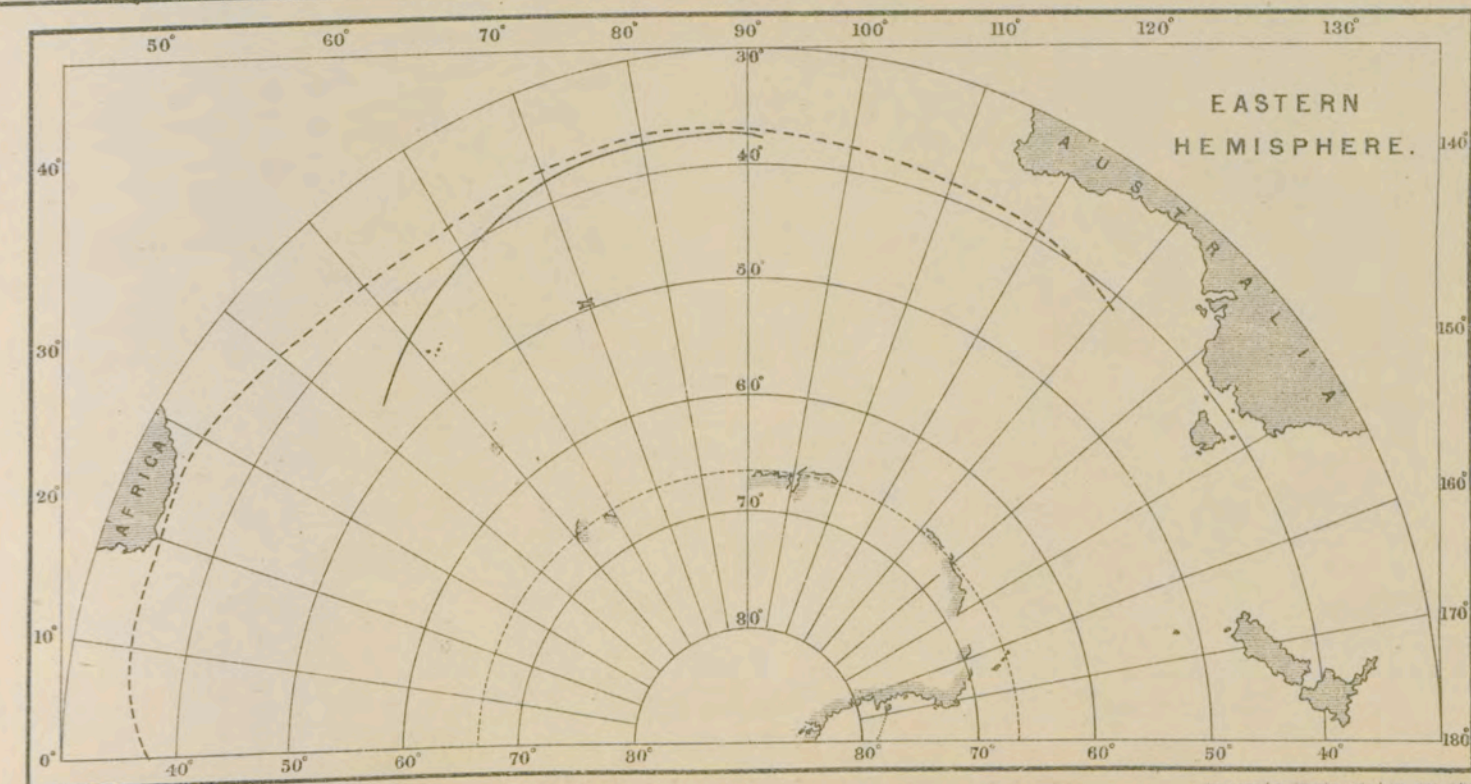


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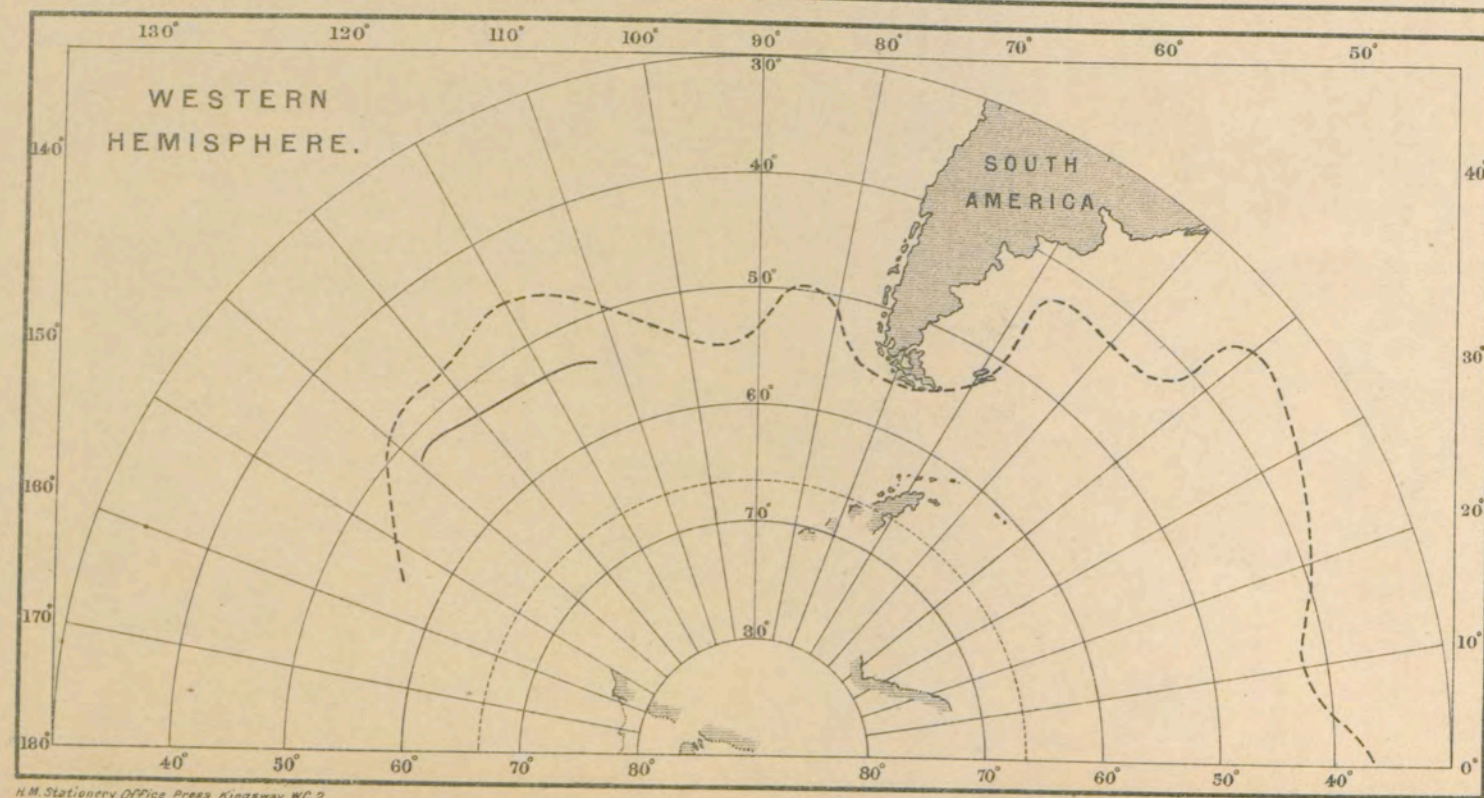
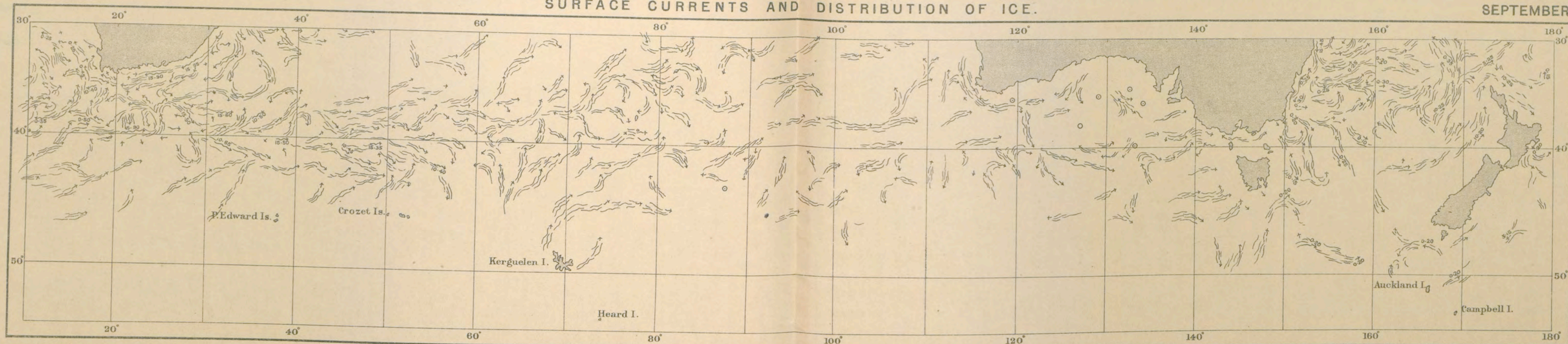
CURRENTS & ICE.

SEPTEMBER.

SEPTEMBER.

SURFACE CURRENTS AND DISTRIBUTION OF ICE.

SEPTEMBER.



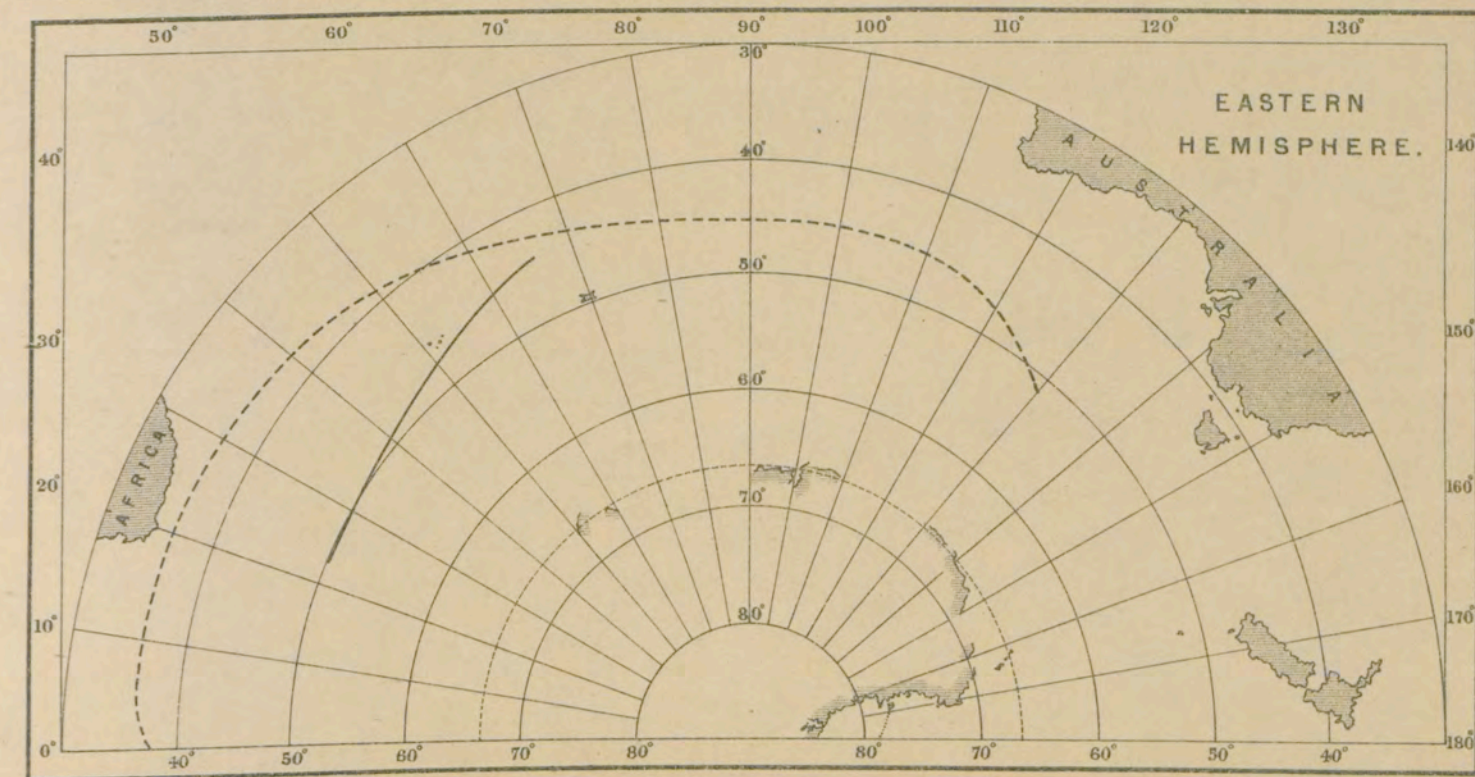
H.M. Stationery Office Press, Kingsway W.C.2.

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Pa. 3872/10. 4808A. 482/483. 600. 6/20

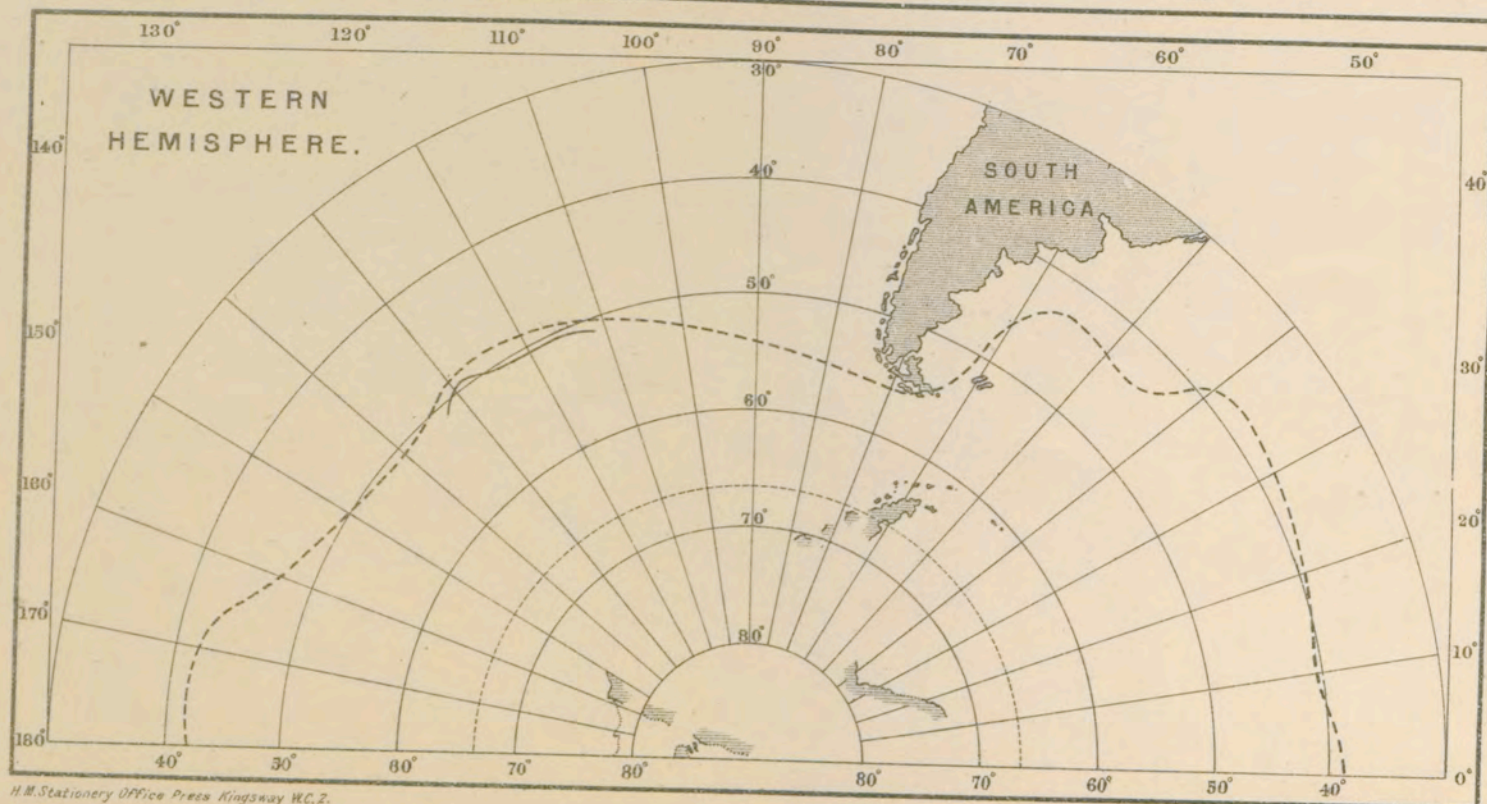
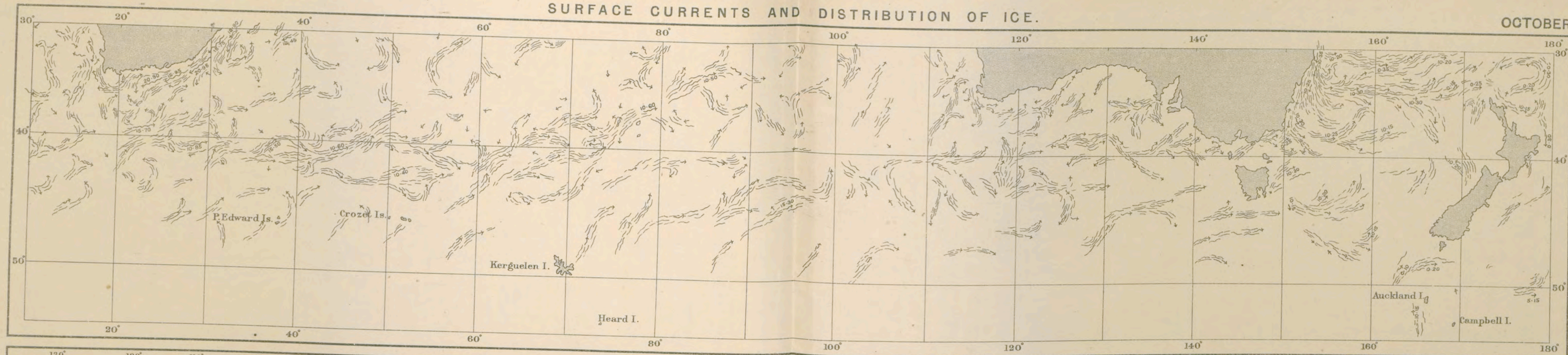
CURRENTS & ICE

OCTOBER.

OCTOBER.

SURFACE CURRENTS AND DISTRIBUTION OF ICE.

OCTOBER.



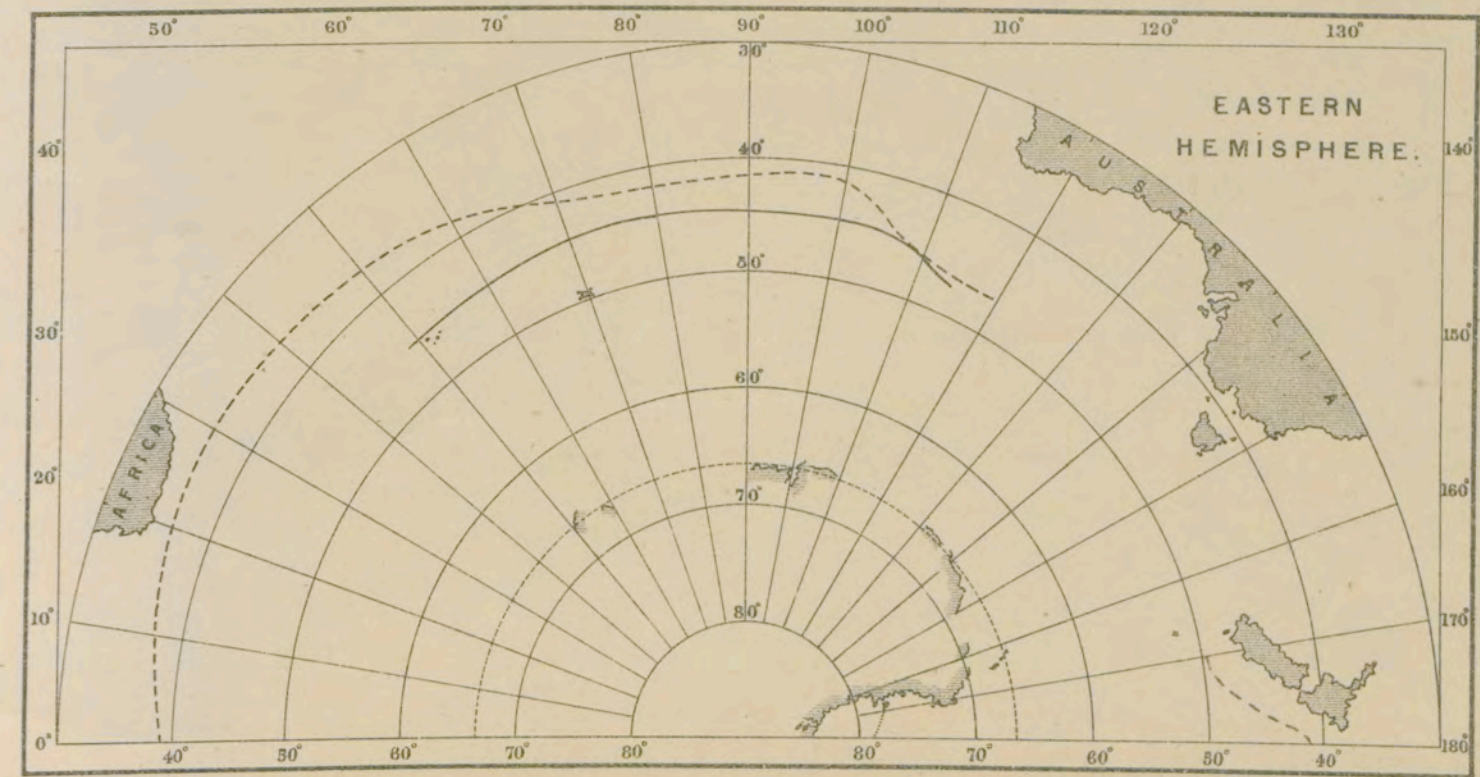
H.M. Stationery Office Press, Kingsway, W.C.2.

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P.S. 2072/121. 48059. 442/439 800. 1/20

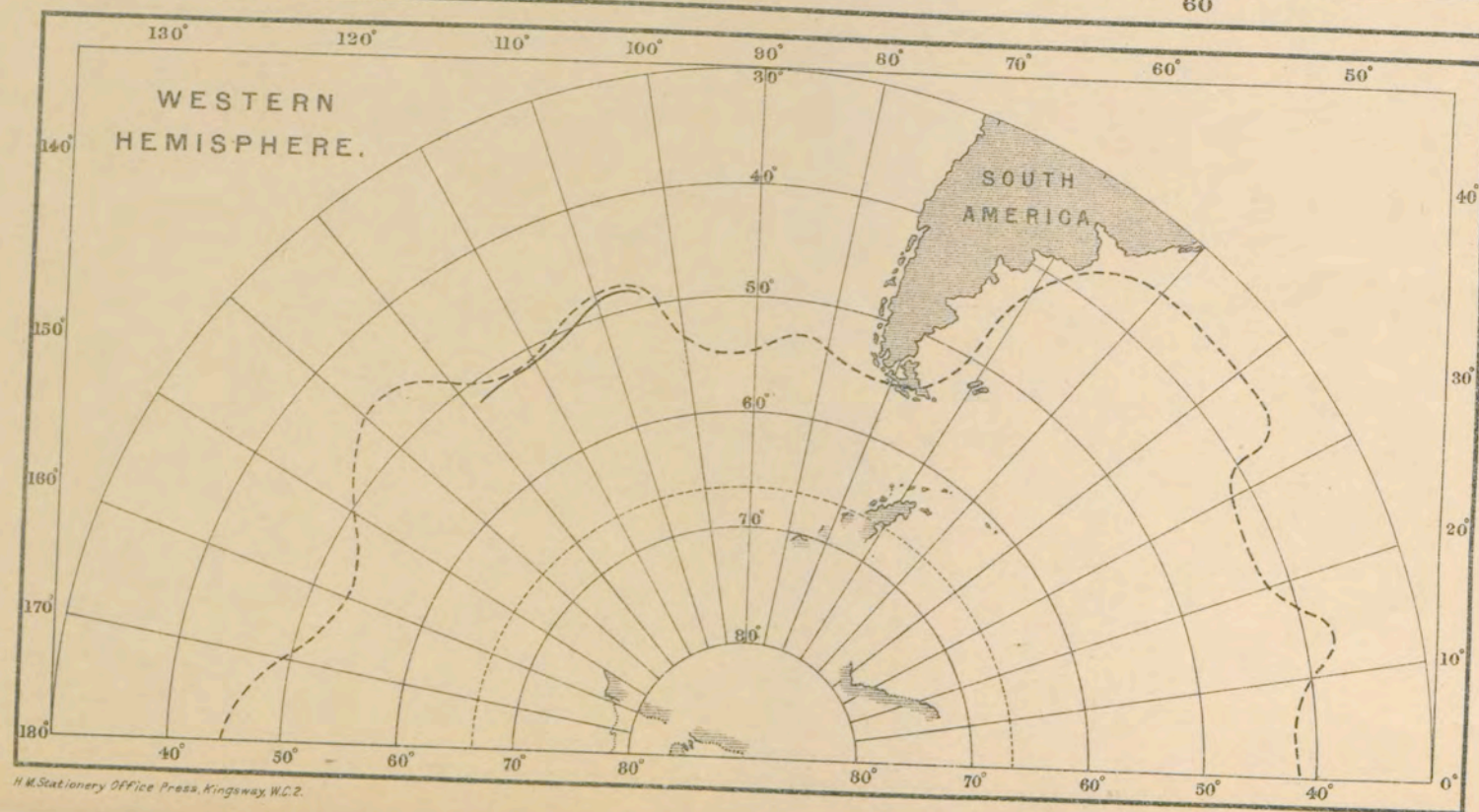
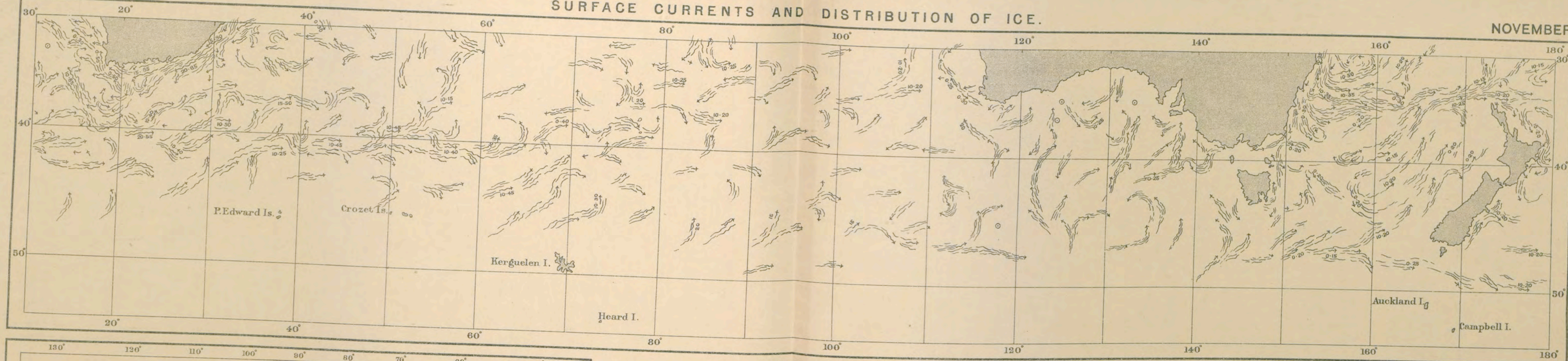
CURRENTS & IC

NOVEMBER.

NOVEMBER.

SURFACE CURRENTS AND DISTRIBUTION OF ICE.

NOVEMBER.



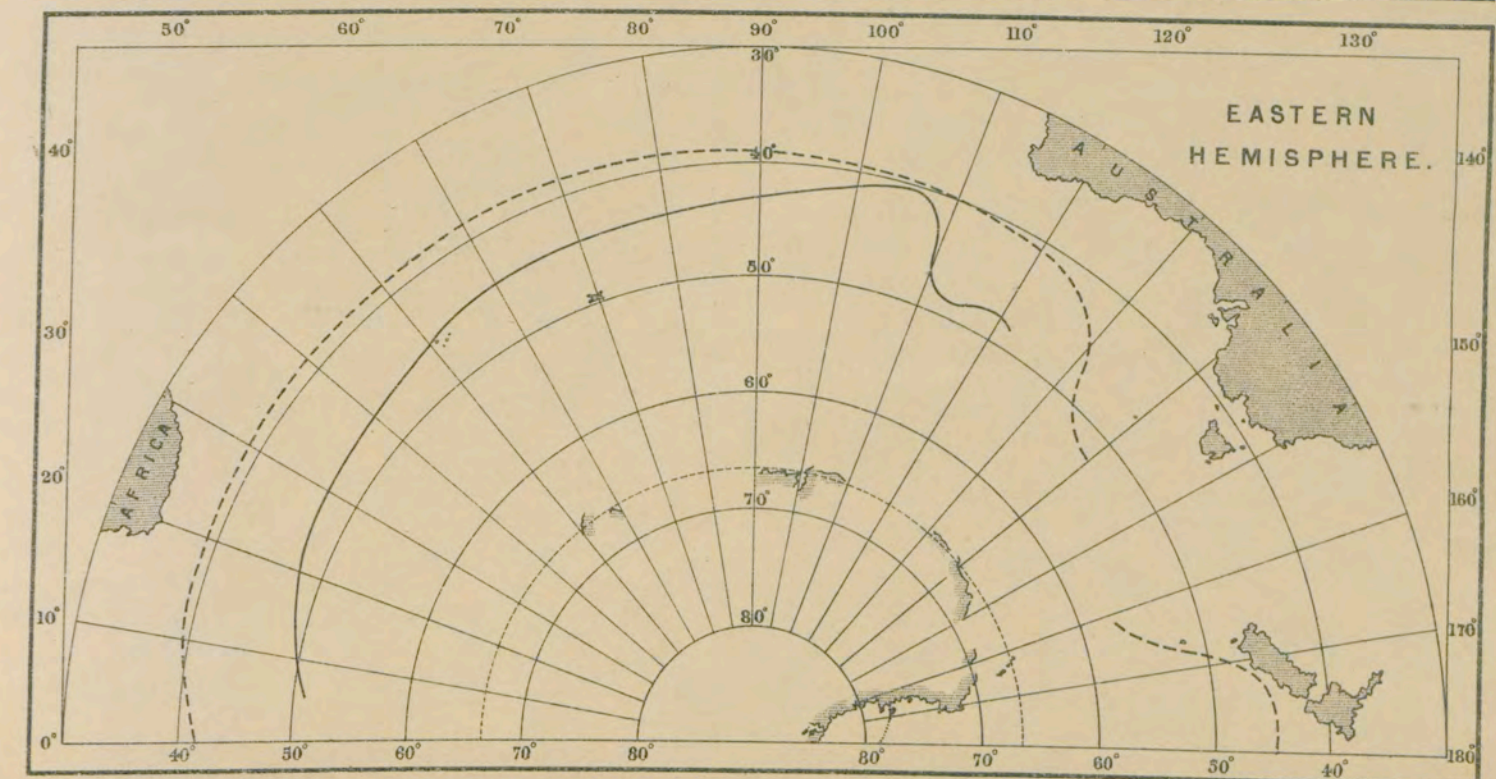
H.M. Stationery Office Press, Kingsway, W.C.2.

CURRENTS.

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LIMITS AND DISTRIBUTION OF ICE.

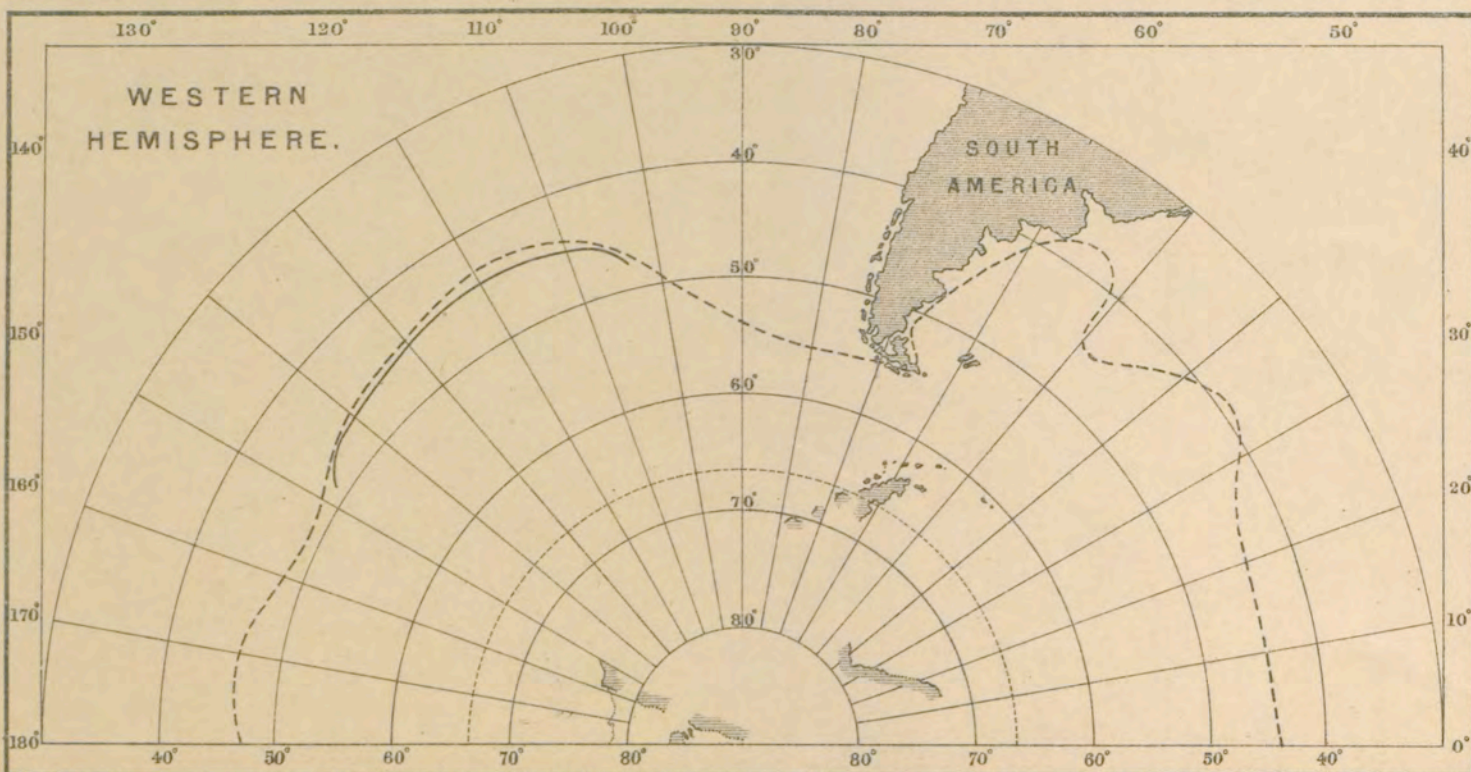
The extreme northern limit of Ice in the Southern Ocean reported during the 17 years' period, 1902-1918, is indicated by a plain line. The pecked line refers to the extreme limit of Ice reported since the year 1772.




Pr. 3572/01. 48063 463/439 600 6/20

CURRENTS & ICE

DECEMBER.



CURRENTS.

The length of the arrows is approximately proportional to the mean amount of current, the figures attached to the arrows being the maximum and minimum amount of set for 24 hours in nautical miles, generally recorded near the spot. When no figures are given with the arrows, the direction of the set only is indicated. Areas where no appreciable current may be expected are indicated by . The very short arrows are the result of comparatively few observations.

LIMITS AND DISTRIBUTION OF ICE.

The extreme northern limit of Ice in the Southern Ocean reported during the 17 years' period, 1902-1918, is indicated by a plain line. The pecked line refers to the extreme limit of Ice reported since the year 1772.

