

REPORT
OF THE
METEOROLOGICAL DEPARTMENT
OF
THE BOARD OF TRADE.

1858.

Presented to both Houses of Parliament by Command of Her Majesty.



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1858.

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REPORT.

Board of Trade (and Admiralty)
Meteorological Department,
June 22, 1858.

SIR,

RATHER more than a year has elapsed since I had the honour of submitting to the President of the Board of Trade (then Lord Stanley of Alderley) a Report of the state and progress of the branch department for which I am now responsible to yourself.

That Report was intended to be, not only a statement of what had been done, but a general description of the department and its objects. Without such an exposition it might be inconvenient to persons interested in the subject of meteorology, as well as to the authorities of Her Majesty's Government, to obtain a sufficient knowledge of what is required, and may be expected from this recently established office.

To that Report, therefore,* and especially to letters from the Admiralty, and the Royal Society, which it contains, a reference is earnestly requested, in connexion with the present statement.

It was there stated that when the Meteorological Department of the Board of Trade was established in 1855, certain additional duties were allotted to it on behalf of the Admiralty; and that all the documents sent from stations at which meteorological observations had been recorded, including those sent from Ascension, Bermuda, Halifax, the Cape of Good Hope, Ceylon, and Valparaiso, were handed over to this new office.†

Insufficient establishments of observers and instruments, as well as deficiencies common to every beginning of new and widely separated operations, interfered with regularity and completeness; but instruments of a better kind, and instructions, are now transmitted to those distant stations.

A series of meteorological papers was commenced in 1857, of which the second number is now in the press. It is proposed to continue these papers as frequently as material for them can be duly prepared. There is no deficiency of facts, useful to navigators, and interesting to science; but time, pains, and expense are, of course, indispensable for due publication of even such data as are already collected.

* Report of the Meteorological Department of the Board of Trade, presented to Parliament, in May 1857.

† For the years 1853 (when they were commenced), 1854, and 1855.

Numerous scientific journals and registers kept on board Her Majesty's surveying and exploring ships contain information in manuscript well worth circulating among those to whom it is of value. Scarcely a log-book has been examined in this office, in which remarkable occurrences have not been noted for extracting, with a view to publication in connexion with subjects of the same class or character. Some of the meteorological logs contain notices of remarkable atmospheric changes, cyclones, or other storms, which should be traced and exhibited graphically. Such records are rendered interesting as well as valuable, independently of statistical details, by remarks which resemble the writings of Dampier, and our earlier as well as some of the best later navigators. It would indeed be ill-judged economy to consign such observations to the shelf, instead of placing them speedily within the reach of inexperienced men, just commencing their sea responsibilities.

Better wind and current charts, for all parts of the world, for each month in the year, and for considerably smaller spaces of ocean, are much required. Registers of wind kept only on shore, near the sea, can hardly be relied on like those of ships on the ocean, because land affects wind much;—as is seen in land and sea breezes, and the frequent evening or night calms in a port, or on shore, while a steady breeze prevails in the offing.

The experience of those captains who command clipper ships, and make extraordinary passages, is too valuable to be allowed to pass unrecorded. Such part of it as can be secured by ink and paper is so much gained for their successors; therefore, on this and other accounts, tables of passages for all parts of the world, alphabetically arranged, with concise directions, are required; steamers, and ships *only sailing*, having separate sets of numbers. Such tables are nearly completed, and probably each house connected with shipping, as well as many Government departments, will find them useful.

During the last year much additional information has been collected from various seas, and from many foreign stations on land. From the Pacific as well as from the Atlantic Ocean, from India, and China, a considerable amount of reliable observations has been received.

From more than six hundred selected ships in the mercantile marine, and many men-of-war, so large a supply of materials has been already obtained, or is in progress (besides what has been received from other sources), that the discussion and publication of results is now the principal object of anxiety, while continuing a diminished yearly collection.

These results, it may be mentioned, being derived from good instruments, carefully used and duly compared, should have a permanent value. All our ships of war have now means of making good observations, and although their special duties interfere much with the regular record of them that is desirable; all that are recorded, even in ordinary log-books, are now valuable.

Since the establishment of this office, very large numbers of

tested instruments (hundreds of barometers, and thousands of thermometers and hydrometers) have been sent afloat: of which many have been returned, re-compared, and re-issued. Detailed and exact accounts of all such changes, and comparisons kept regularly, enable the story and employment of every instrument to be recorded, with careful accuracy.

During the first two years (1855–57), a series of wind charts (based on the numerical data published by Maury), that was completed and circulated in the navy and mercantile marine, occupied much time: but while these charts were in progress, and since then, the tabulation and reduction of various observations, extracted from the logs and other documents above mentioned, have been proceeded with, as far as time has permitted.

Wind and weather; pressure and temperature of the air, its humidity and other characteristics; specific gravity of the ocean, its temperature and currents; and magnetism—have filled many manuscript books; and all are so recorded as to be traceable, in each case, to the original observation. Not one entry in an original document has been diminished in value by transposition, and collection with others.

Records of storms, and all special facts of value connected with them; instances of ice met with at sea; notices of “vigia” or unusual appearances—of aurora, electricity, meteors, and other phenomena, are carefully extracted from the original documents, and grouped in books appropriated to each subject separately: reference being always available to the original source.

True it is that this method of record entails an amount of time and pains slightly discouraging—and of which the importance is not evident at first sight. From the reflection, however, that all these records are for the public, and for future, as well as present reference;—that some enquirers seek for special details,—*single* observations only (it may be,—while others ask for *mean* results; the propriety of preserving all details appears to be indisputable.

There is another reason for this arrangement,—perhaps a stronger one,—which is, the *publication* of these data.

To print logs, or other similar original registers, is impracticable, as a *general* arrangement. Such records are too bulky—too numerous—for publication; which, moreover, after their contents are properly extracted, becomes unnecessary, all the logs being kept for reference in the Office. But the printing and circulation of reduced and tabulated results, groups of observations, and individual facts of value, is expected, and may be accomplished satisfactorily.

Such observations being more available if published in considerable numbers, rather than by fragments (which, like those of divided articles in some periodicals, would have an unsatisfactory character), a large number of observations of winds and currents are being collected for a new, and more reliable, as well as more detailed series of wind and current charts of the oceans.

By very numerous trials, the specific gravity of nearly all the

oceanic surface has been ascertained, and it is believed that these results will render further observations of the kind unnecessary, except in peculiar and limited localities, for some special object; the general result being now demonstrated that, except in confined localities, such as the Red Sea (where it is said 1080 has been recorded), or the Indian Archipelago, there is little or no variation in the weight or saltness of the ocean water where unaffected by recent heavy rains, or the vicinity of very large rivers. Distilled water being taken as 1000, the specific gravity of oceanic water is found to be nearly 1027. The lowest temperature hitherto recorded, between 2·300 and 2·500 fathoms below the surface, has been 35° (in the North Atlantic, South Atlantic, and Indian Oceans) and 86° the highest temperature, anywhere *at sea*, on the surface.

After reducing and tabulating a great number of barometrical observations, it appears that within certain limits of latitude, near the equator (or rather at about five degrees of north latitude in the Atlantic Ocean), the *total* pressure on the barometer varies so little throughout the year, that (allowing for the six-hourly change) any ship crossing that part of the sea may actually compare her barometer with a natural standard; invariable within known small limits of two or three hundredths of an inch.*

Possibly when these observations are still farther investigated, and the pressures of *dry* air compared together, a closer agreement *may* be discovered; but as the temperatures and hygrometric indications are strikingly uniform there, much difference in ultimate results is *not now* anticipated.

Besides this *incidental* value of a mass of barometrical observations, the accurate determination of pressures and temperatures, as well as hygrometrical properties, should be mentioned; by which the respective zones of high and low barometer, the greater or less amount of aqueous vapour, the movements of atmospheric waves, and those general laws of the atmosphere, which are yet to be verified, will be further elucidated.

The reductions of an immense mass of hygrometric observations must be a work of time. It is steadily, though slowly, proceeding.

Magnetism has not occupied *much* thought, because it is attended to zealously in other Government departments; but all observations obtained are tabulated for future use.

However, the Report of the Liverpool Compass Committee and three Pamphlets on the Deviation of the Compass were more or less attended to in printing and otherwise in this department of the Board of Trade, whence, indeed, and by the Admiralty, they were stimulated originally.†

Either of the above subjects actively followed up requires

* A margin not greater than that allowable in using a marine barometer afloat after it has been conveyed from the place of exact testing, or verification, on land.

† Two of the pamphlets were written here.

much thought, as well as work of hand, and involves a great amount of monotonous occupation in making gradual progress towards ultimate results.

While these chief branches of public duty have been our regular employment in this Office, other ramifications have been cultivated at times; and to the Report of 1857 reference is again necessary here to show why the following matters have been subjects of anxious attention. They are almost completed, and are now in course of publication.

First. A passage table to show the length of passages between any frequented seaports (by steamers as well as by sailing ships*), and giving the least possible distance that must be traversed between them. This table, arranged in alphabetical order, and accompanied by sailing directions, of a brief and generalized character, may be found, it is hoped, a useful work of reference, especially if corrected periodically, so as to be kept up to the requirements of future years.

Second. Concise and ready methods of applying the principles of Great Circle Sailing *in practice*, for the use of officers afloat, concerned in passages.

Third. A Manual of Instructions for the use of barometers and thermometers as weather glasses, in two forms, one for fishermen and coasters, the other for young officers at sea.

Fourth. A Translation of a Dutch Pamphlet on the Herring Fishery, which shows that herrings seek such parts of the North Sea as are not colder than 54° or warmer than 58° , and tends to show the comparative inutility of casting nets for them where the surface water is not between these limits of temperature.

And, fifth. A Translation, (with conversion of foreign quantities), of Dove's last work on Winds, recently published in Germany.

Much interest having been created by successive developments of the laws of storms, winds, and general circulation of the atmosphere, the Royal Society and British Association requested Government to institute a series of regular and continuous observations at specific points on the Atlantic.†

Three Anemometers (Osler's Self-registering, with Robinson's cups) are nearly completed, which are intended for Bermuda, Halifax, and another place (not yet decided).

In connexion with this interesting subject, a series of atmospheric wind charts‡ is in progress here, intended to exhibit the

* Obtained from logs in this office, and other authentic sources.

† One particular object being the investigation of changes, and order of variation, in currents of the atmosphere.

‡ In these synoptic and dynamic wind charts for six winter months of 1856-7, the direction of the wind is shown by a line drawn (to leeward) from the place of observation, in length proportional to its strength or force.

The unit of scale is one division, or ten miles, of longitude on the chart—and the land notation (1 to 6) is adopted—one of which equals two of the sea, or Beaufort scale of estimated strength of wind.

Directions of wind are laid down by the true meridian, two points of westerly

simultaneous states of atmosphere over the British Islands and adjacent Seas, especially the direction of wind current, and its strength at certain times (9 A.M. and 3 P.M.), rain also, and fog, during six consecutive months (October 1856 to March 1857, inclusive).

Among the results already obtained from these charts (which eventually may exceed three hundred in number) is the true north and south, or meridional direction of certain atmospheric wave lines—(those of the troughs as well as those of the crests*)—the diminution of the wind's strength, or force, over land;†—and evidence of a continuous alternation, or opposition of the great polar and equatorial currents of the atmosphere.

The Board of Trade having sanctioned (by way of experiment) some assistance being given by Government to enable poor fishermen, and those employed on the more exposed shores of our islands, (when unable to afford the expense themselves) to benefit by the use of weather-glasses; steps have been taken towards carrying it into practice. Ten substantial barometers, strongly made, durable, and easy to observe, are already located as experimental loans at the under-mentioned places; and with them, many copies of plain directions for their use have been distributed.

The Scotch Fishery Board has aided, in this matter, materially. In their Eastern district (*only*, as yet) a selection has been made, by the Board of Trade, of the following fishing stations:—Newhaven, Anstruther, Arbroath, Roseheart, Whitehills, Port Easy (or Portessie,) Lybster, Dunbeath, and Lerwick.

In the West of England, the most exposed places are in Cornwall. A barometer is placed therefore near St. Ives, and one will be in Mount's Bay,—as being the greatest resorts of fishermen in that neighbourhood.

Such assistance is urgently needed on the north-west coasts of Ireland—and Scotland;—in the Shetland Isles; and on the East coast of England.

Disaster and loss of life among the fishing population of those places—especially Lerwick, Banffshire, and Innishowen—have been narrated in public prints. Many of these calamities might have been avoided by the judicious use of weather glasses.

variation being allowed. The mean pressure and temperature are shown, and generally the weather; with rain, fog, &c.

Much less discordance appears in the simultaneous directions of wind than has been usually inferred to exist, judging from the Crystal Palace and Lothbury electric telegraph maps; but this is easily explained by mentioning that all observations laid down on these charts were obtained from reliable authorities,—while the directions of the wind shewn by moveable arrows on the maps above mentioned, though sometimes given accurately, were not so always. Many daily communications by telegraph being neglected, the person whose duty it was to set the arrows allowed those for which he had no information to remain as they were (perhaps for days), or shifted some of them as he *thought* they should be.

* Compare with Espy's fourth Report, recently published.

† Shown remarkably at Wrottesly, in Staffordshire.

The addition made by Lord Stanley of Alderley to the space and staff of this Office has enabled us to work more effectively ; and though I earnestly desire to apply more strength, of head and hands, to the reduction and discussion of observations (while rather diminishing their annual collection), and though assured that money would be preferably employed in this direction, I am thankful for the means now available, and have cause to speak much in favour of the support given by my assistants.

I have the honour to be, Sir,
Your obedient Servant,

ROBERT FITZROY.

The Right Honourable
Joseph Warner Henley, M.P.,
President of the Board of Trade.

P O S T S C R I P T.

In America, the originator of national co-operation for the collection and publication of useful maritime knowledge—the celebrated Maury—has indefatigably persevered: and the United States Government has most liberally continued to supply this country with hundreds of copies of his works for gratuitous distribution among those sea-officers who engage to contribute information.

Holland has co-operated largely, and communicated not only her printed results, but much special manuscript information, through the zealous kindness of MM. Buys Ballot and Van Gogh.

France has established an office for similar purposes, aided by our instruments and arrangements, and has published a translation of Maury's Sailing Directions.

Spain, Austria, Denmark, and Portugal have proceeded similarly. Officers from each of those countries have personally visited this Office and the observatories at Greenwich and Kew.*

It is well known on how large a scale Germany and Russia have long been collecting meteorological observations, which have been used by philosophers of the highest reputation. But these records are apart from, though intimately related to, such "meteorological observations at sea" as have been the "speciality" (or more *particular* subject of attention) in this department of the Board of Trade.

* The number of meteorological instruments made in London, tested or verified at Kew, and sent abroad to foreign countries, is usually very considerable. At the present time there are about forty barometers, on trial, for the United States Government; and not long ago there were several under examination for that of Austria. Some opticians send their instruments to Greenwich; but those for foreigners are generally proved at Kew—a private observatory, maintained solely by the British Association.