Meteorology, sea-side, English Channel, winter / by W.G. Black.

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Meteorology, Sea-Side, English Channel—Winter. By W. G. Black, F.R.C.S.E., F.R.M.S.* (With Four Plates.)

It occurred to me after investigating the climatal reasons why people go to the sea-side in summer, to ask myself why another set of people frequent the *coast resorts* in the *winter* in these days of changing of airs and scenes.

Now, the *former set* will consist chiefly of tourists and travellers, but the latter have a large mixture of *valetudinarians* and invalids, who, one would think, would be better advised to stay at home.

The same *portable instruments* were used as in the former inquiry, and the observations were taken morning and evening as before, both in the hotel as well as in the open air, and on the sea beaches or piers, and in all weathers, fine and stormy.

The *observations* were plotted out into *curves*, and this proceeding makes more visible and apparent the manifestation of *climatal* phenomena than any amount of reading figures from manuscript-tables.

The *curves* for all the instruments exhibit considerable oscillations, more than in summer; but those for the *sea data* continue steady all along notwithstanding the fluctuations of the air above it, and at once give the *clue* to the reason why certain people go to the sea-side in *winter* from their grimy cities.

The *winds* may blow warm or chilly, and the *sun* may shine or be obscured, and the weather may be wet or dry, yet the *temperature* and specific gravity *of the sea* continues steady all through, but only slightly on the decline in warmth, to the end of the year.

This *homogeneous* medium acts as a *governor* to the vagaries of the terrestrial climate, and soothes its asperities by the vapour and warmth given off by the sea during the process of evaporation by winds.

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* Read and illustrated with Diagrams and Instruments before the Society, 13th February 1893.

In stormy weather, this *compensation* is specially increased by the *spray* from the surf and waves being carried inwards from the sea, which is then much warmer than the air inland, and continues so till the end of the year.

During the summer the *temperature* of the sea is *lower* than that of the air, but in the winter the *reverse* is found to be the case, and there is then a set period when these two phenomena *cross each* other.

In the eastern part of the Channel it would seem to come about the end of *October*, some weeks after the equinoctial period, and the *permanent crossing* seems to be maintained by the occurrence of northerly and easterly winds in the *anti-cyclonic weather* of the late autumn, after the equinoctial gales are over.

Further, the *warmth of the sea* is maintained on to the end of the year by the irruption of *SW. gales* into the Channel in winter bringing up warmer seas and warmer airs from the Atlantic Ocean.

The temperature of the *air on the beach* will be found to be a mean between that in the street in the town and the sea outside, and the fluctuations of the former seem much reduced the nearer the observation is made to the sea.

Hence, the climatal utility of *hotels and houses* being situated on *esplanades* and marine *parades* rather than inland, and at the back of the town, even though they may be not exposed at the other site to the storms and winds.

Waves and Surf.

At this time of the year all *sea-bathing* has ceased, since the beginning of October on the coast, owing to the increasing coldness and rawness of the air, and the increased action of the *surf* on the beaches.

But instead of this recreative and healthy exercise at the sea-side, it becomes appreciated now by visitors indulging in *promenading* the piers and esplanades and sea walls, in the enjoyment of brisk sea breezes and flashing sunlight, and the spectacle of lively waves and plunging surf.

In order to identify the waves for general recognition everywhere, the *waves* seen off a pier have been classified

into four sets—viz., ripple, round waves, crested waves, and storm surge—and the *surf* has been called *light*, belonging to the two first sets, and *heavy*, to the two last sets.

Further, *special winds* have been associated with these sets of waves as light breeze, fresh breeze, and high winds and gales, so that on a person seeing the sea front agitated by "crested waves" he would say at once that there was a "high wind" blowing.

The appearance of the *colour of the sea* itself is also a point of interest to the marine climatologist, as it will be seen to get very muddy far out from the beach in weather producing heavy surf, especially in southerly gales, when the *storm surge* is driven straight on to the beach.

On the other hand, the sea will get *clarified* again when the wind blows offshore even strongly, and become *transparent*, this being due to the wave accumulation of the former condition being replaced by a wave depression—or, in fact, because the subaqueous currents are reversed—above and below.

There will, therefore, be no abrading of the beach by the backwash, and no silt stirred up by its descent, and instead there will be created a *reverse current* to the storm one, whereby the *bottom water* will seek to rise up the beach to the high-water mark, and then arrived, will be subject to the *offshore wind*, and be driven off on the surface of the sea to the offing.

So that then on seeing the *sea dirty*, we may conjecture that the winds are southerly (E. or W.) on the Channel coasts, and if it be clear, that they are northerly (E. or W.) on the same shores.

The spectacle of the *curling surf* on the beach in a gale is a very popular and entertaining one, and is due to be gazed at by hundreds of sightseers at the sea walls, who are also *mesmerised* by the thundering crash of the cataract and the rattle of the backwash in its descent.

The *height of the surf* or breaker in a heavy gale, it may be borne in mind, is deceptive to the stranger, as seen in full magnitude, as he imagines it corresponds to a wave at sea in the open.

But really it would appear to be *twice the height* of the wave outside, as the whole *interior* of the revolving billow is then displayed, which on the open is submerged to its half diameter in the surface of the sea.

The crash of the *cataract* of water, however, at once displays the immense *potential power* there lies in the action of the revolving wave, slowly moving though it may in solemn grandeur; but the real *energy* is centred not in that motion, but in the revolution round its axis.

It may be likened to the *potential power* there lies in the spent *round shot* from a cannon rolling along the grass, which would break a man's leg if he attempted to stop it with his foot in front of its revolution on its axis, or to the momentum lodged in the periphery of the fly-wheel of a stationary steam-engine.

The observations of the phenomena of the sea were considered necessary to be carried out alongside of the observations of the air of marine health-resorts, in order to arrive at a proper estimate of the causation of the sea-side climate.

This marine influence does not appear to have entered into the programme of meteorological observations at all generally at these places, as I have only met about a couple of observers of the sea at the numerous sea-side resorts I have visited round the coasts of the United Kingdom.

Morning Observations at Hastings, from October 24 *to November* 21, 1888.

1. *Barometer* exhibited a mean of 29·92 in. for the morning and evening observations for four weeks in October and November 1888, and its oscillations consisted of two sets of elevation above 30·00 in. about Oct. 27 and Nov. 15, and two sets of depression below 30·00 in. about Nov. 1, and when SE. winds occurred, and Nov. 13, when SW. gale prevailed.

2. The *thermometer* in the air outside at this time, after the equinox, commonly fluctuates above and below 50°, and had a mean of 50·8° for the four weeks, and exhibited a deep depression on Nov. 7 during N.E. winds, when it had been cold weather for some days, with land fogs.

3. The manifestation of *ozone* by Moffat's papers showed much variation, and a *diminished* intensity as the winter went on, and had an amount of 59, or a mean of 1·1 per diem, but was totally absent for eight days during *anticyclonic* winds from SE. and SW. and NW.

4. *Evaporation* of water in a cup showed much fluctuation from day to day, owing to the variation in the *winds*, from this side or that, as it was now less dependent on the heat of the sun to keep it at a steady rate.

The *amount* for four weeks was 1·15 in. or ·04 in. per diem, and it was absent altogether on nine days, owing to misty drizzle or wet weather.

5. The *temperature* of the *air* on the piers or beach followed closely that of the street, but with less curves, and had a mean of 51°; and the same extreme depression occurred on Nov. 7 owing to NE. winds blowing from the land.

6. The *spectroscope* could now only be used in the mornings, and showed much variation in the intensity of the dark vapour lines from 1, on Nov. 1 and 2, with dry easterly winds, to 4 on Oct. 26, during SW. winds with rain; and 3 on Nov. 13 and 14, during south-westerly gales and rain.

7. *Rain fell* on twelve mornings and twelve evenings in the twenty-eight total days, or about half; and, of course, was most prevalent during southerly and SW. and NW. gales about the end of October and middle of November.

8. The *temperature of the sea* in the mornings had a mean of 52·4° per diem, 1·4° higher than that of the air, and kept steady above 50° till Nov. 5, when it went below to 48° during easterly winds. It did not rise again above 50° till the 11th and 12th, when SW. winds returned to blow up the Channel, bringing in warmer seas from the Atlantic Ocean.

9. The *specific gravity* for the four weeks had a mean of 10·30, which was high, and especially during the end of October and beginning of November, when dry easterly winds prevailed and cold, dry weather.

10. Several *gales* occurred in the four weeks, one of anticyclonic type on Nov. 3 and 4, with SE. and NE. winds, and one continuous and strong *cyclonic period* beginning

about Nov. 12, with deep depression of the barometer to 29·41 in., and lasting nearly a fortnight.

In other parts of the kingdom it culminated in a *critical* general *storm* about Nov. 15 and 16, when much damage was done and reported in the newspapers, but none occurred at this place.

11. The most prevalent *winds* were, as are usual in the autumn, from the SW. direction (12), the next in amount were from the SE. (9), and the third in rate were from the NW. (6).

Curiously enough, the *SE. winds* were connected with low barometer, and with the cyclonic disturbances from the westward, just as south-westerly winds sometimes are connected with anticyclonic systems, this being dependent on their position in the special quadrant of the circle of movement.

The *estimation of force* gave more in the evenings (89) than in the morning (84), and this seemed chiefly to be due to the occurrence of three calm mornings and only one calm evening. Otherwise, the *forces* of the SW. winds were about equal to those of the SE. winds, which may be due to their being part of cyclonic systems themselves, but in different quadrants.

12. *Cloud observation* was well displayed, and was more prevalent in the evenings than the mornings by 225 to 207, which was due to drizzle and mist winding up the day, during the prevalence of E., SE., and NE. winds down the Channel and off land.

It may also be conjectured that some part of it *was wafted from London* and the Thames basin as a fog by the northerly and north-westerly winds right across the Wealden Hills of Surrey, as could be seen any day on going to the rise and viewing the country inland covered by a black smoke bank.

This anomalous difference was known by the mornings being much clearer by eight bright ones to three bright evenings, and from there being a continuous series of *dark evenings* for sixteen days without a break in November.

13. The estimation of *wave-motion* amounted to 80 for the mornings and 93 for the evenings, which was coincident with the wind forces of 84 and 89 at the same time.

The highest amounts occurred in the latter half of November during the prevalence of the *stormy weather* from the SW. on the 12th and afterwards, and the *lowest* degrees were observed in the beginning of November during the SE. breezes that came in, especially about the few days of Oct. 30 to Nov. 3, when calm occurred in the mornings.

Morning Observations at Eastbourne, from November 23 to December 21, 1888.

1. *Barometer* exhibited two main depressions during the four weeks, on Nov. 29–30 connected with *stormy weather* on the 27th, when a *cyclone* passed across Ireland, going eastward, and, again, on Dec. 21, when a *cyclone* passed through the Irish Channel; the mean was 30·056 in.

For the most of December the indications were above 30·00 in. with cold, dry anticyclonic weather.

2. The *thermometer* outside in the air had now got below the 50°, but rose above it only during the gales of Nov. 27 and Dec. 3 from the SW., and went below 40° during the dry, cold weather of the middle of December, and it had a mean reading of 46·4° for the four weeks.

3. The manifestation of *ozone* was flickering and uncertain, but rose to 4 and upwards during the SW. gale of Nov. 27, 30, Dec. 3, 5, and 21, but was seen to be *absent* on eleven days out of the twenty-eight during NW. to NE. breezes and in calms, especially in the *anticyclonic* weather of the middle of December; the total amount registered came to 70, or 2·5 per diem.

4. *Evaporation* of water in the cup was likewise very flickering, from ·17 in. on Dec. 12 and 13 to ·15 in. on Dec. 4 and 8 during SE. dry winds and sunny weather to *zero*, on six occasions, when the weather was wet, misty, or calm.

5. *Temperature of the air* on the piers and beaches fluctuated similarly to that in the street, but with less ranges, and was noted at 50° and higher on sixteen days than in the latter for ten days, and had a mean of 48·1° for the four weeks, or 2° above the mean (46°) of the street.

6. *Spectroscopic* amounts fluctuated considerably, from

being as high as 4 on five days during SW. and southerly weather, and as low as 1 on five days during misty, dark, damp days and calms.

This shows that the *maxima* are more likely to be seen in clear, transparent air, containing *invisible vapour*, than where it is floating in a visible atomic state, causing obscuration of light.

The total estimation amounted to 69, or 2·4 per diem.

7. *Rain* fell only on seven *days* during the four weeks, and was absent entirely in the middle of December, which made the piers and parades tolerable for visitors to promenade on, and confirmed the *raison d'etre* of going to the sea-side in the early winter.

8. The *temperature of the sea* continued to remain above the 50° till Dec. 10, though the temperature of the air had begun to go below it on Nov. 27, and the mean reading came to 49·6°, or 3° *warmer* than the air in the town.

9. The *specific gravity* of the sea, on the other hand, seemed to *rise* instead; due, probably, to absence of rain and increase of evaporation from the surface of the sea producing coldness and increased density, and the mean came to 1031.

10. The number of *gales* were fewer than in last month by two to five, and were only two, one on Nov. 27 from the SW. lasting one day, when the portable anemometer showed a pressure of $2\frac{1}{2}$–$3\frac{1}{2}$ lbs. per sq. foot, or 26–28 miles per hour, at the pier-head. The *other* happened at the close of the long anticyclone on Dec. 21 with S. and SW. gales and wet weather.

There were some days of *high winds* during this fine period from the S. and SE., especially on Dec. 12 and 13 which raised a *rough sea* and surf on the beaches.

11. The most *prevalent winds* were from the SW. direction (12), and the next from the NW. (6), and the third from S. and SE. (5); the former occurring during the first fortnight and the latter during December in the anticyclonic weather.

The force of wind estimated was, of course, more for the SW. winds, or above (2), till Dec. 5 when the figures went below, and so continued for the month at a low rate, except during the high SE. winds of Dec. 12–13.

There were six *calm* days in December, and there was more wind in the afternoons than in the morning by 86 to 79, as is generally personally experienced.

12. The estimation of *cloud* was singularly varied, and showed more dark mornings than dark evenings, by 204° to 106°, which was due to the morning mist and drizzles, which cleared off as the sun rose.

There was the pleasant enumeration of thirteen absolutely brilliant *evenings*, or half of the time, without a cloud in the sky to obscure the *splendid sunsets*, which would justify anyone in going for change to the sea-side in the early winter from the foggy town.

13. The estimation of *wave-motion* amounts showed a total of 79, which belonged chiefly to the first half of the period, when south-westerly winds were prevalent up to Dec. 5, after which the wave agitation declined to 2 and below it, except on the SE. windy days of Dec. 12 and 13.

It may be added, finally, that the *hand anemometer* discovered that the winds were found to be of greater force in the streets and esplanades of the town than at the head of the piers; so that, what looked like a strong gale on land turned out to be only a *fresh breeze* on the sea.

This is seen to be due to the obstruction of the solid terraces and villas and crescents to the horizontal flux of the wind, which is forced to escape round the corners of streets, or over the roofs of the houses, at a much exaggerated and accelerated speed over the normal velocity on a flat.

Winter at Sea-Side Resorts—Hygienic Considerations.

In reviewing this sketch of the characters of a *winter climate* that are attractive to a certain class of visitors, it may be alleged that one reason may be stated that does not belong to the station at all itself, but to the one they *come from.*

This is the increasing intensity and extent of the *smoke fogs* of the cities, particularly of the manufacturing class, which now regularly take possession of them in October, November, and December, and drive all valetudinarians out of them to seek refuge in the *clearer air* of the coasts.

After the *equinoctial gales* are exhausted by the middle of October, there sets in a calmer state of the winds, and some *anticyclonic weather*, which permits fogs to gradually accumulate in the valleys and basins of rivers and estuaries.

The *smoke* of the towns is not blown away horizontally, but is driven downwards again to the earth by the *cold air* descending from the upper atmosphere in the anticyclone. This also chills the *aqueous vapours* ascending from warmer rivers and lakes, and also from chimneys in towns, the result of combustion in furnaces and fires.

In November 1884 in London there were 21 foggy days, but none in December of much account; in October 1885 there were 5 foggy days out of 17, and in November 1885, 8 foggy days out of 14.

In 1886 there were 12 fogs in October for the month, and 11 in November entire, and 7 in December entire.

In 1887 there were 17 fogs for 25 days of November, and 14 fogs in 24 days of December.

In 1889 there were 23 foggy days out of 28 days of November and 16 in December out of 21 days.

About the end of December, or after the winter solstice of December 21, the *frosts and snows* commence, accompanied with some stormy weather; and these succeed in precipitating the fogs, or driving them away.

The *town* atmosphere thus becomes *purified* again from its autumnal miasmata and darkness, and more fit for the *residence* of the valetudinarians, and so they begin to *return* again to their homes about Christmas and the New Year from the coasts.

And now a different change in climatal conditions of the *sea-side resorts* commences in the sea *becoming chilled* down to the land degrees of coldness by the Arctic currents driven down from the N. by the NW. and NE. gales or blizzards into the Channel.

The *sea* therefore becomes no longer able to impart *warmth* to the coast climates, and the air has settled down to a raw and damp condition, which continues well on to the spring and summer months, and renders residence then at the sea side uncomfortable.

The *invalid* by coming to the coast during the months of October, November, and December from the cities and inland towns *escapes the fogs*, calms and mists, and malaria of the autumn; and experiences instead a fresher and warmer air—more breeze, more ozone, and more sunlight.

He also is aware that he may *promenade* the sea-walls and piers day after day, in fine weather or stormy weather, with invigorating effect on his constitution by the winds, and exhilaration to his mental system by the spectacle of various lively marine phenomena.

The freedom of the sailor from colds in all weathers at sea is reproduced in the *visitor* to the *sea-side* in autumn, who also knows that he could not expose himself so much to wet or windy weather in the streets of his inland town without peril to his health.

The greater amount of evaporation at the sea-side than there is in a town also promotes a useful hygienic result, by increasing at the same time the transpiration from the human frame, and thus promoting the clarifying of the *blood* of the noxious ingredients acquired in the polluted air of towns.

TABLE I.

MORNING OBSERVATIONS — WEATHER — OCTOBER — NOVEMBER — 1888 — HASTINGS.

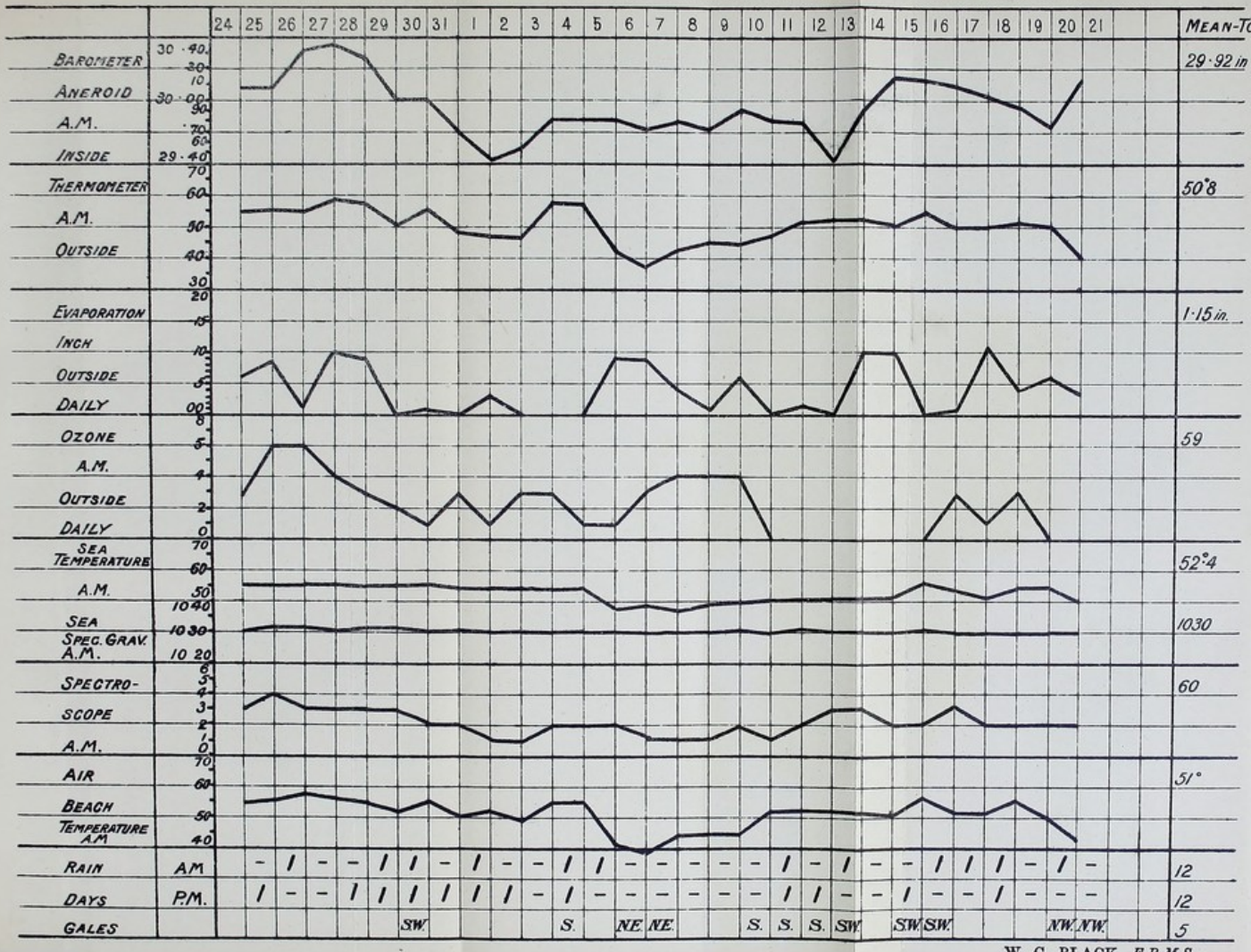

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TABLE II.

EVENING OBSERVATIONS — WEATHER — OCTOBER — NOVEMBER — 1888 — HASTINGS.

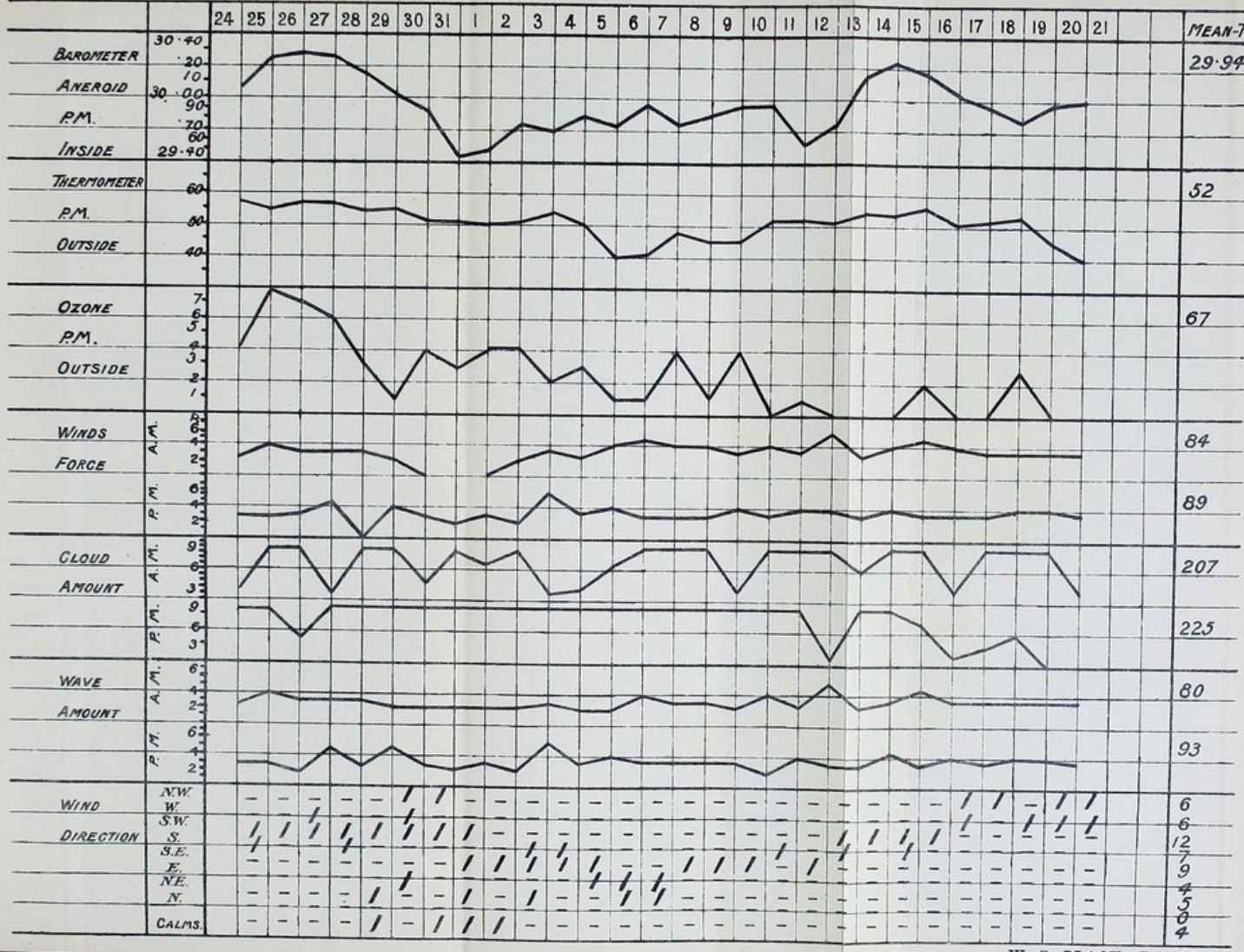

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TABLE III.

MORNING OBSERVATIONS — WEATHER — NOVEMBER — DECEMBER — 1888 — EASTBOURNE.

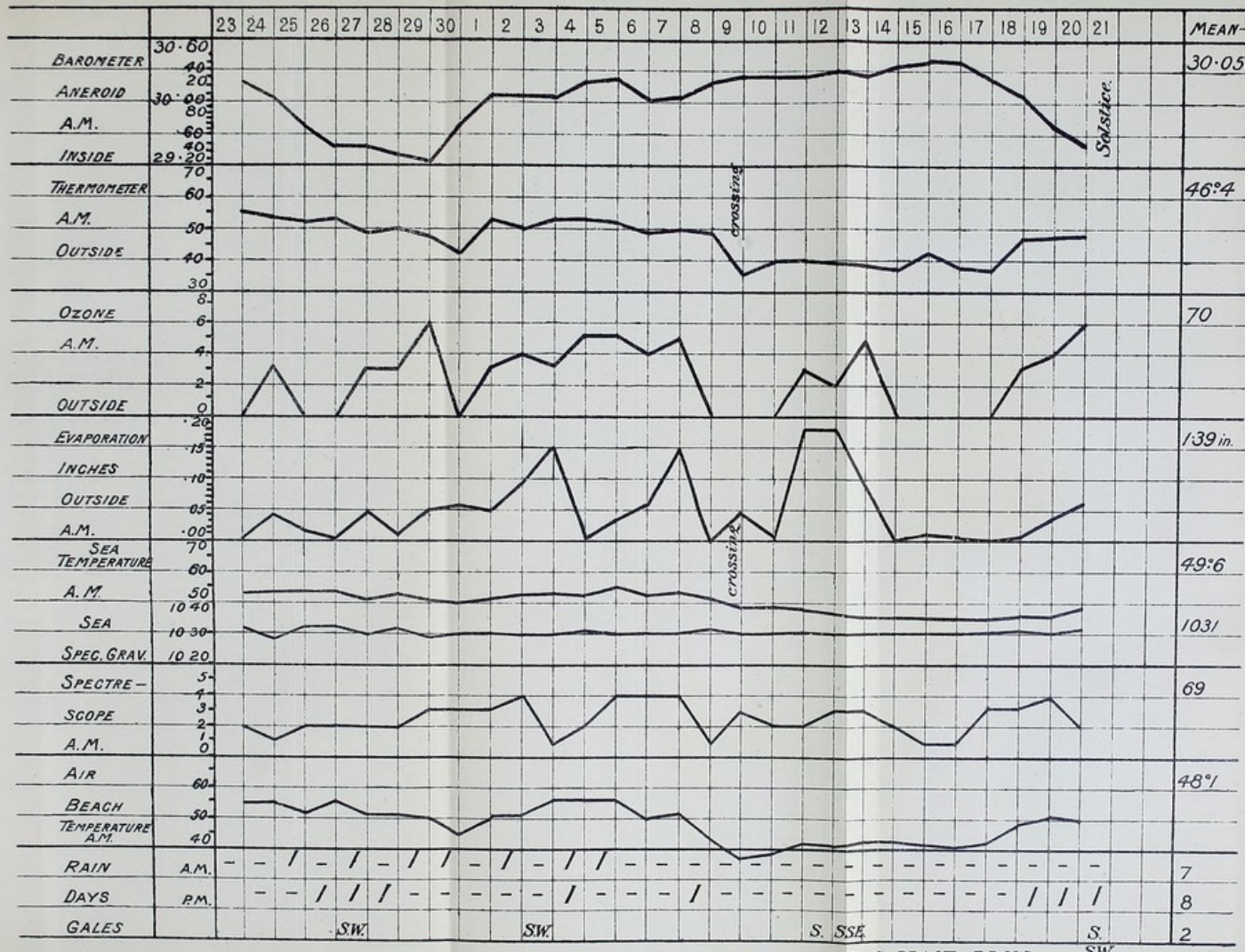

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TABLE IV.

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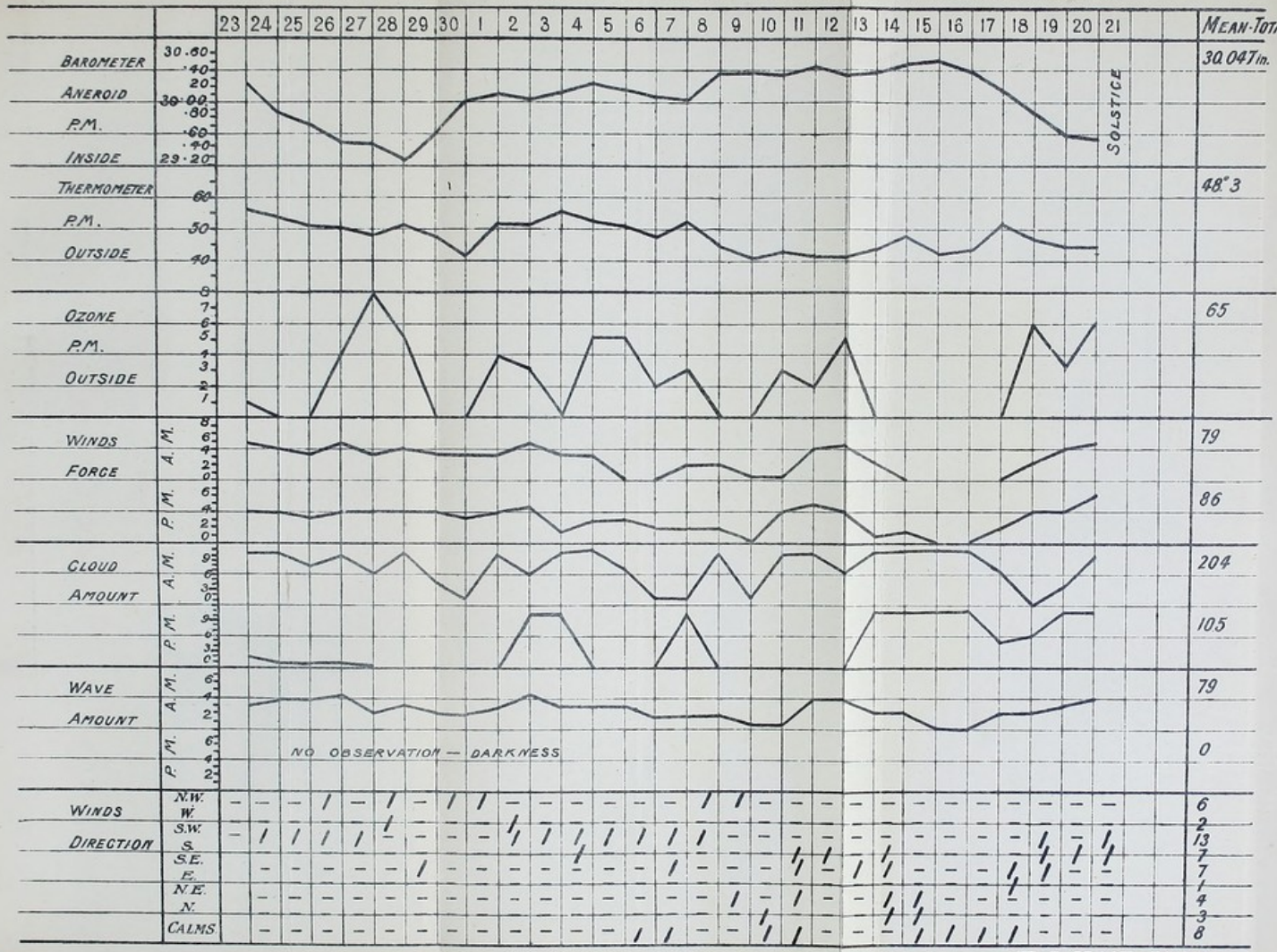

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