

In a letter to you last week Mr. W. H. Preece called attention to a sudden appearance of earth-currents on the 19th between 10.15 and 10.20 p.m. G.M.T., traces remaining until 10.50. A magnetic storm was in progress at the time, and had commenced shortly after 4 p.m. The declination magnet moved at first slightly towards the west; but the most rapid movement was towards the east, and commenced at 9.40, attaining its absolute minimum, or greatest E. elongation, at 10.9. It then returned as rapidly westward until 11 p.m., but the absolute westerly maximum was only reached at 6.50 the next morning. The whole range of the declination magnet was 53°.

The H.F. magnet was not much disturbed, but the chief irregularities occurred between 9.50 and 10.55.

The V.F. magnet showed more clearly the action of the disturbing force, with a maximum at 7.45 p.m., and a minimum at 3.40 the next morning. The V.F. magnet was tremulous between 10.0 and 10.40 p.m., with a slight minimum at 10.15.

S. J. PERRY

Stonyhurst Observatory, Whalley, January 29

THE magnetographs at this observatory registered a small magnetic disturbance during the evening and night of January 19, which lasted over an interval of time considerably greater than the earth-currents observed by Mr. Preece.

The magnets were tolerably quiescent until about 4.35 p.m. G.M.T., when the declinometer became disturbed, and the bifilar indicated a gradual diminution of horizontal force, vertical force at the same time increasing. The latter attained its maximum deviation from the average value at about 8.0 p.m., whilst the horizontal intensity indicated its lowest at the same time. The declination after slightly rising, however, continued to diminish, and between 9.30 and 10.15 p.m. it became reduced 20'7 minutes of arc. Between 10.15 and 11.0 it rapidly moved in the contrary direction 19'0, after which it gradually rose to a position of maximum at 6.50 a.m. on the twentieth, when the needle stood about 10' to the westward of its normal position at that hour. From that point it gradually fell away, and after 11.45 a.m. it only oscillated slightly about its usual place.

The movement between 9.30 and 11 p.m. of the bifilar indicated an augmentation of intensity followed by an equally abrupt fall, whilst the vertical-force instrument showed that component of terrestrial magnetism to have been but slightly affected.

As is usual in such cases the abrupt disturbance, or as it is called from the aspect of the curves, the peak, under notice was repeated or echoed on several subsequent days.

On the 20th, about half an hour after midnight very faintly, on the 21st it was stronger, and occurred between 9.20 and 9.50 p.m. On the 22nd between 7.50 and 9.40 p.m., its extent then being 10', and finally on the 23rd, from 9.0 to 10.10 p.m., showing then about the same amount.

The daily weather charts for the 20th report bright aurora seen on the 19th in Scotland and Norway.

Kew Observatory, January 30

G. M. WHIPPLE

REFERRING to Mr. Preece's letter of the 24th inst., it may be interesting to note that in the Daily Weather Chart for the 20th inst. bright aurora is recorded as having appeared in North-West Europe on the evening of the 19th, the day when the earth-currents were observed.

J. PARNELL

Upper Clapton, January 30

#### Variations in the Sun's Heat

ALL lovers of science, and more especially those devoted to the study of atmospheric physics, must rejoice to learn that the Government of India has sanctioned Mr. Blanford's proposal to send a properly qualified observer with good instruments to Leh, for the purpose of directly measuring the sun's heating power from day to day.

Meanwhile, as we shall have to wait for another decade before it can be settled with any certainty, how much, and in what way the sun's heat varies, it may be as well to notice the latest and hitherto most valuable indirect evidence, furnished with respect to this question by India.

That country has long been regarded as exceptionally well placed for reflecting in its meteorological phenomena with comparatively little complexity the secular changes in solar radiation,

and the only drawback hitherto, has been the lack of good and continuous observations over a large area. This has now been remedied by the excellent organisation introduced by Mr. Blanford, by which the observations made at upwards of 100 regular observatories and more than 350 rainfall stations, are collected and discussed at one central office, and published in one volume. With these it is possible to arrive at average results, in which local variations are eliminated, and which may be accepted with confidence as representing the general conditions over the whole area. In a recent *Pioneer* Prof. Hill gives the following table of the abnormalities in the chief meteorological elements for the whole of India during the past few years, which, if indirect evidence is to be trusted, most decidedly favours the hypothesis Prof. Hill and myself have all along regarded as the best working hypothesis, viz. that the sun radiates *most* heat to the earth in the years of *fewest* spots.

#### Variations of certain Meteorological Elements from their mean Values

Year.	Excess temperature of black bulb thermometer.	Annual mean air temperature.	Mean pressure of water vapour.	Mean proportion of cloudy sky.	Mean annual rainfall.
				Tenths.	"
1875	- '76	- '29	- '004	- '03	+ 3'66
1876	- '33	- '08	- '017	- '20	- 4'37
1877	+ '19	+ '17	+ '011	+ '31	- 2'97
1878	+ '44	+ '62	+ '020	+ '09	+ 5'66
1879	- '36	- '13	- '014	- '06	+ 1'97

Prof. Hill appends the following remarks to this table:—

"The radiation, as measured by a thermometer with a blackened bulb, rose gradually until 1878, and then fell off in intensity; the temperature of the air, which seems the next simplest and most direct effect of the sun's heat among those given in the table, also increased until 1878, and then diminished; the vapour tension and cloud—more remote effects—show a similar, but not so closely coincident variation, and finally, the rainfall, the most distant effect of all, appears to lag just about a year behind; for observations made before the commencement of Mr. Blanford's reports for all India indicate that there was a wave of heat in 1873-74, immediately preceding the cold period at the top of the table."

Now while there is no doubt, as Mr. Blanford has recently shown in the *Journal* of the Asiatic Society of Bengal, and elsewhere, that the temperature at the earth's surface is very decidedly influenced by rainfall and cloud, we see from this table that the year of highest temperature was actually that in which *most* rain fell, and Prof Hill has found that the excesses of temperature and rainfall, though not strictly contemporaneous, were most decided in the *same* regions of the country. It is scarcely necessary perhaps to add that the actual sun-spot minimum occurred in the middle of 1878, in order to show the important bearing of these facts on our hypothesis.

Tunbridge Wells, January 24

E. DOUGLAS ARCHIBALD

#### Solar Observations

I INCLOSE two letters which I have recently received from Mr. W. A. Holland, chief officer of the ship *Sarah Bell*, and which I think will interest your readers. It is to be hoped that other observers, whether on land or sea, may have important information to communicate on the subject, which they may be induced to give you for publication.

WILLIAM THOMSON

The University, Glasgow, January 23

Havre, January 10, 1882, Ship "*Sarah Bell*"

SIR,—Being at Sea last November 22 and 23, and our position at noon being lat., 18° 58' S., long. 1° 53' W., and lat. 17° 32' S., long. 3° 39' W. respectively; and while observing the sun's meridian altitude, I noticed a very remarkable dark spot on the sun's disc; it was about one-third of the sun's diameter, and bearing south-east from ☉ centre. On the following day it appeared one-fourth of ☉ diameter, and of bearing west-north-west from centre; by putting down the proper shades of my sextant I could see it very distinctly. I called the captain's attention to the fact at the time, and he says he never saw such a phenomenon in his life; he is a gentleman who has spent his life at sea since the year 1840. Almost at the same time I read from the June number of *Good Words* for 1879 your very valuable article on Terrestrial Magnetism and the Mariner's Compass; but the latter part of the article treating on sun-spots caused me to take this bold step of addressing you, trusting I have not been