

The disturbances numbered 1, 2, 8, 11, form a twenty-seven day sequence connected with the spot of September 18-29. Disturbances 7 and 10 form another twenty-seven day sequence also connected with the same spot, unless the evidence of spectroheliograms should show a disturbance independent of the spot region. The moderate disturbances 3, 4, 5, 6 were connected with the birth and rapid development of the two spot groups of September 5-14. It follows that a position of advantage of a spot group for influencing the magnetic state of the Earth may occur on more than one meridian during the same transit of the disc. Nor is there any special importance in a central meridian position. Finally, there is no relation in magnitude between the storm of September 25 and the accompanying solar disturbances.

Stonyhurst College Observatory:
1909 November 8.

A Solar Outburst and a Magnetic Storm.

By C. Michie Smith, Director of the Kodaikánal Observatory.

Cases of undoubted connection between solar outbursts and terrestrial phenomena are sufficiently rare to make it worth while placing on record full details of such a phenomenon.

On the forenoon of September 28, the First Assistant, Mr. Sitarama Aiyar, while examining the spectrum in the region surrounding the large spot, which was then approaching the west limb (approximate position lat. 5° S., long. 307°), observed what he (probably rightly) described as a large prominence overlying the spot. This was at $10^{\text{h}} 30^{\text{m}}$ I.S.T. The spot had already been examined at $8^{\text{h}} 23^{\text{m}}$, when C was found to be reversed on the spot, and a prominence had been observed on the limb at 6° south at $10^{\text{h}} 0^{\text{m}}$. Neither of these features was, however, in any way striking. The eruption seen at $10^{\text{h}} 30^{\text{m}}$, on the other hand, was of a very striking character, for C was so brilliantly reversed that, in spite of a poor sky, the shape of the eruption could be clearly traced with a comparatively wide slit, and it was seen to be changing rapidly.

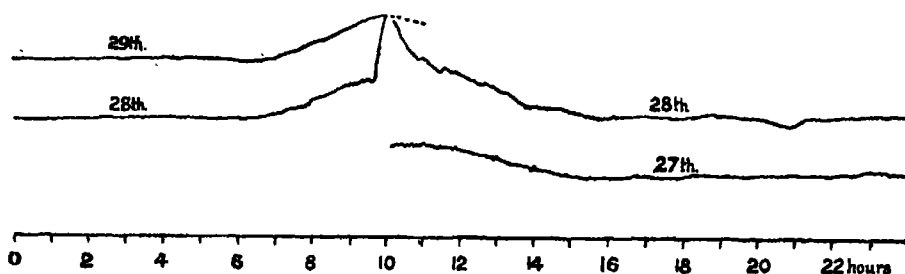
At $11^{\text{h}} 10^{\text{m}}$ the F line was displaced 0.4 \AA to red and 1 \AA to violet; at $11^{\text{h}} 3^{\text{m}}$ the displacement was 1.7 \AA to violet. By 11^{h} the eruption seemed to be less massive than when first seen, but it was still bright, and $D_1, D_2, D_3, b_1, b_2, b_3, b_4$ were all brightly reversed on one of the umbræ. D_3 was very dark over the whole prominence on the limb side of the spot at $11^{\text{h}} 23^{\text{m}}$.

Spectroheliograms taken at $7^{\text{h}} 55^{\text{m}}$ and $8^{\text{h}} 20^{\text{m}}$ showed no peculiarities, and the umbræ of the spot were clear and sharply defined. Another plate, taken at $10^{\text{h}} 39^{\text{m}}$, was quite different. The definition had, as usual, fallen off considerably, but it was good

enough to show quite clearly that a great eruption had taken place, covering practically the whole spot region. The umbræ could now be only faintly traced, and there were, instead, several small regions of intense brilliancy. Clouds prevented farther observations on that day. Next day was also cloudy, but on the 30th. a number of spectroheliograms were obtained, which showed an eruptive prominence of a rather remarkable form issuing from near the spot.

On the development of the magnetograph sheets it was found that a very sudden rise had taken place in the horizontal force at or near the time of the eruption. The rise began at 10^h 3^m and amounted to 154 γ in 20^m, while the curve did not return to its normal position till between 14^h and 15^h. The vertical force and declination curves showed small "kicks" at the same time.

It is impossible to say whether or not the solar outburst and the magnetic disturbance were exactly simultaneous, as the sky near the Sun was covered with clouds between 10^h 3^m and 10^h 30^m, but had the outburst taken place before 10^h it could hardly have been



Horizontal Force, 1909 September 27-29, Kodaikānal Observatory.

overlooked when the prominence on the limb near it was being examined. In confirmation of this it may be mentioned that a photograph of the spectrum of the spot taken at 10^h 1^m showed nothing unusual, while one taken at 11^h 9^m showed very strong reversals in H, K, and H_e.

The disturbance was, of course, small compared with what was recorded in the great storm of the 25th September, when the change in the H.F. was about five times as great. Unfortunately that disturbance began in the afternoon, when the Sun was not under examination, and we have no records to show whether or not it was accompanied by a great solar outburst.

Without venturing to express any opinion as to the nature of the connection between terrestrial magnetic storms and solar conditions, it may be well to point out that, so far as my experience goes, a spot which is spectroscopically active is much more likely to be accompanied by magnetic disturbances than one which is quiet.

Kodaikānal Observatory:
1909 October 7.