2.6D NIGHTTIME MESOSPHERIC RETURNS ASSOCIATED WITH A LARGE SOLAR FLARE EVENT

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Since the source of mesospheric returns in MST radar is the formation of irregularities in electron concentration in the D region, radar measurements from the mesosphere are not available at night. However, magnetic storms associated with large flares can give D-region ionization. Special measurements were made at night during April 1982, to evaluate the nature of mesospheric returns obtained under storm conditions.

A sudden commencement was reported from Boulder at 2016 UT on April 24, 1982, followed by a magnetic storm through to 1500 UT on April 25 (i.e., 1416 CST April 24 to 0900 CST April 25). The Urbana MST radar therefore made measurements during the night of April 24-25.

Under normal circumstances, no scattered power is seen apart from sporadic meteor returns. However, on the night in question echoes were seen as indicated in Table 1. In this table, five periods of time are tabulated varying in length from 20 min to 60 min, at which scattered power was observed above the noise level. The 3-hr values of Kp corresponding to the five periods are also given, as is the mean power over noise observed.

Table 1

Times (CST)	Altitudes (km)	Mean Power (dB)	Mean 3-hour Kp
1930 - 2010	84 - 87	1	4
2245 - 2320	78 - 82.5	6	6
0005 - 0025	81 - 82.5	2	7-
0030 - 0130	78 - 82.5	10	7-
0215 - 0300	78 - 79.5	2	7-

The nature of the data is illustrated by Figures 1 and 2, which show the variation of scattered power during the night at intervals of 1.5 km. Comparing these with Figure 3, a record from the previous day, reveals that the scattered powers at 78-81 km were comparable with those observed during the day, indicating that a similar ionization density was present, of several thousand cm^{-3}. The velocity data (Figure 4) for the night period show the presence of normal gravity-wave activity in the height range from which scattered power is returned.

There is a curious difference between the appearance of the day and night data. The peak power levels are approximately the same in both cases; but whereas the night data come from an essentially zero background, the day data arise from a substantial level of background scatter. Assuming that there is no statistical difference between incidences of turbulence by day and by night, this implies that the periods indicated in Table 1 are the only times at which any substantial particle precipitation was taking place; and that the consequent ionization was confined to the height region shown. It is possible, of course, that ionization at lower altitudes is being produced, but that the electrons form negative ions and therefore become invisible to the radar.

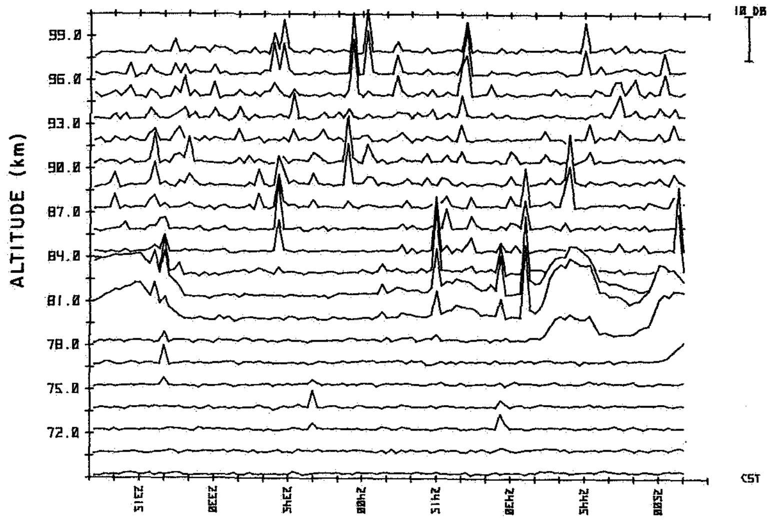

Figure 1. Logarithmic plot of scattered power on April 24-25, 1982.

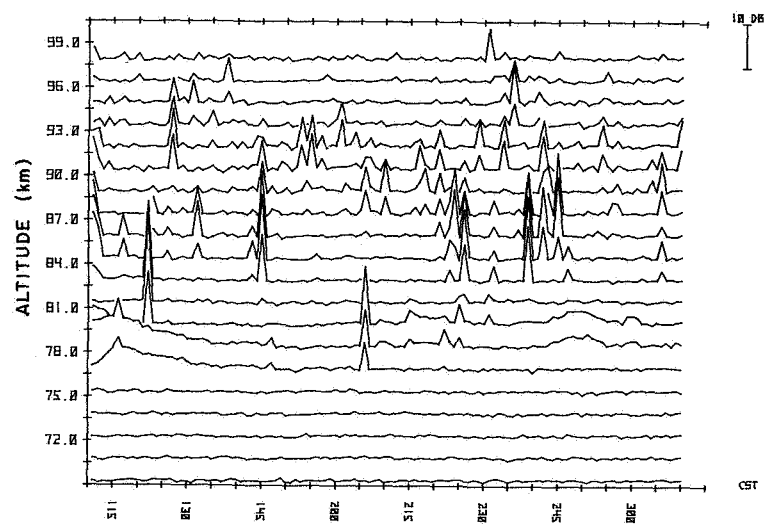

Figure 2. Logarithmic plot of scattered power on April 25, 1982.

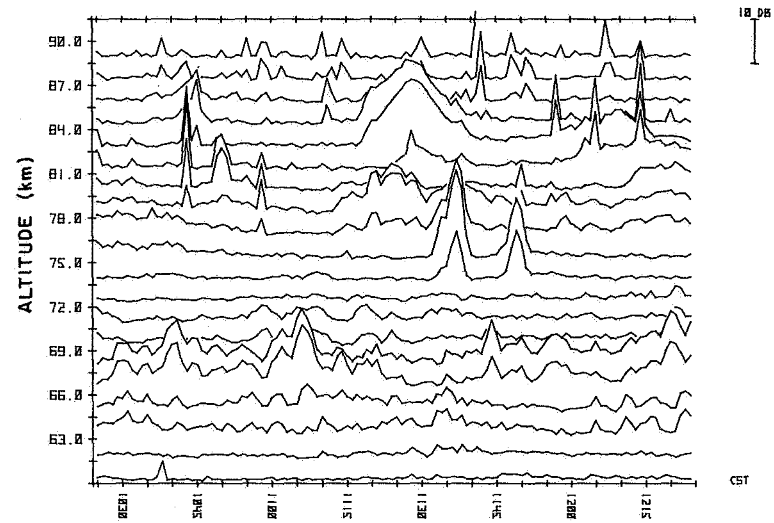

Figure 3. Logarithmic plot of scattered power on April 24, 1982.

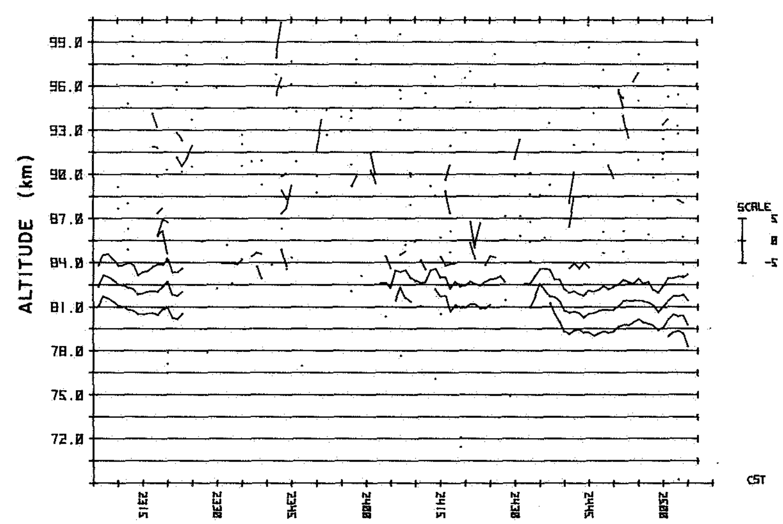

Figure 4. Line-of-sight velocities (m/s) for April 24-25, 1982.

It appears that careful use of the MST radar technique may aid in determining the altitude at which nighttime magnetic storm ionization is produced.

ACKNOWLEDGMENTS

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