Incoherent Backscatter Observations of the F Region during the November 12, 1966 Solar Eclipse

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Simultaneous measurements of electron concentration (N) from 150 to 750 km and electron temperature (T_e) from 150 to 550 km were made from the Jicamarca Radar Observatory during the November 12, 1966 eclipse. Jicamarca was favorably placed in that it lay within the path of ground totality as well as being nearly on the magnetic dip equator. The measurements were made continuously using 5 minute integrations with a 25 km height resolution. The upper and lower 50 km of the two height ranges were often too noisy to be useful; accordingly, the following discussion is restricted to heights of 200 km and above.

Before the eclipse, both the N and T_e profiles were normal, with a peak of N at about 325 km and a peak of T_e at about 250 km. During the eclipse the F2 layer moved upwards with an apparent velocity of about 50 m/sec. Near totality an eclipse F1.5 layer formed in the F1 region. It increased in height and density until by the end of the eclipse it had assumed the role of the normal F2 layer. Thus, during the second half of the eclipse there were two peaks of ionization in the F region, separated by a deep valley.

As the F1.5 layer started to form, the T_e peak first broadened, then moved upward with the valley between the F1.5 and F2 layers, and finally split into two peaks. The lower peak assumed a height near 250 km while the upper peak continued to move upward with the F1.5-F2 valley and finally lost its identity upon reaching a height of about 500 km.

Analysis has shown that below 300 km the variations in N were controlled predominantly by the normal production and loss mechanisms. The derived parameters are of the expected magnitudes; for example, at 260 km $\beta \approx 10^{-3}$ sec^{-1} and $q \approx 750$ $cm^{-3} sec^{-1}$. In the 240-290 km height range the linear form of the loss equation is valid, whereas in the 200-230 km range the transition form must be used.

Above 300 km vertical drift of the electrons becomes increasingly important, and above 350 km it is the controlling factor for the electron distribution.

Preliminary analysis shows that the behavior of T_e is consistent with the theory of electron heating by elastic collisions with fast photoelectrons and cooling by collisions with ions and neutral particles. An attempt is being made to evaluate the heat production function and relate it to the electron production function determined from the N analysis.

The T_e data also show that the neutral temperature decreased by about 100°K during the eclipse.

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