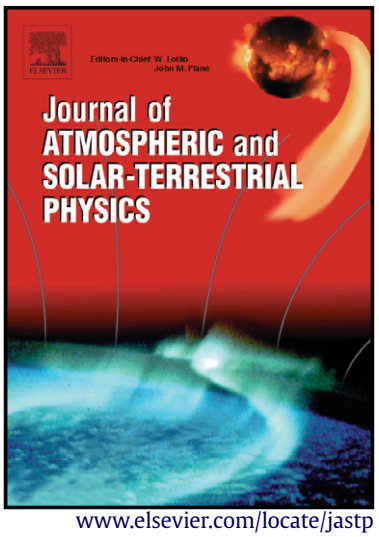

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A multi-beam incoherent scatter radar technique for the estimation of ionospheric electron density and T_e/T_i profiles at Jicamarca

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Abstract

A multi-beam incoherent scatter radar technique has been developed at the Jicamarca Radio Observatory in order to maximize the number of ionospheric parameters that can be estimated simultaneously. The technique interleaves radar observations with antenna beams pointing perpendicular and oblique to the Earth's magnetic field. For the estimation of the ionospheric parameters, we have modeled the magnetic aspect angle variations of the signal power and cross-correlation data measured in multiple directions. The data model, formulated in terms of soft-target radar equations, was built based on the theories of incoherent scattering and magneto-ionic propagation. Applying a nonlinear least-squares inversion algorithm, we have succeeded in measuring simultaneously ionospheric electron densities N_e, electron-to-ion temperature ratios T_e/T_i as well as vertical and zonal plasma drifts. In the past, radar users had to choose between either perpendicular-to-$\mathbf{B}$ or oblique modes, thus, the application of this technique extends the current capabilities of the Jicamarca radar.

Keywords: Incoherent scatter, equatorial ionosphere, remote sensing

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