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Estimation of F-region plasma parameters using perpendicular-to-B spectral measurements with AMISR14 at Jicamarca

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Abstract

Incoherent scatter spectral measurements pointing perpendicular to the geomagnetic field can be conducted with the AMISR14 radar that is located at the Jicamarca Radio Observatory in Lima, Peru. Such observations show relatively narrow spectra with side peaks at the lower hybrid resonance frequency for a magnetized plasma. In order to model these measurements, we have followed the general framework of the incoherent scatter theory described in Kudeki & Milla [2011] and Milla & Kudeki [2011]. The model accounts for the effects of Coulomb collisions as described by a simplified Fokker-Planck collision model with constant friction and diffusion coefficients. In addition, since the measured spectra are the result of contributions coming from different directions illuminated by the radar beam, we have to consider the beam shape in order to weight and integrate the modeled spectra along the direction in which the magnetic aspect angle varies. Based on this model, we have conducted spectral fittings of the radar measurements in order to obtain estimates of the magnetic field intensity and of the electron and ion temperatures as functions of range and time. The estimations obtained are in agreement with the values expected for the geomagnetic field intensity and for the plasma temperatures at F-region ionospheric heights. In this work, we will describe the spectral incoherent scatter model applied to fit the radar measurements, as well as, the results obtained with this procedure.

References

[1] E. Kudeki and M. A. Milla, "Incoherent scatter spectral theories–Part I: A general framework and results for small magnetic aspect angles," IEEE Transactions on Geoscience and Remote Sensing, vol. 49, pp. 315–328, January 2011, doi: 10.1109/TGRS.2010.2057252.

[2] M. A. Milla and E. Kudeki, "Incoherent scatter spectral theories–Part II: Modeling the spectrum for modes propagating perpendicular to B," IEEE Transactions on Geoscience and Remote Sensing, vol. 49, pp. 329–345, January 2011, doi: 10.1109/TGRS.2010.2057253.