Electron precipitation energy spectra derived from EISCAT observations

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Several different techniques have been developed for estimation of primary energy spectra of auroral electron precipitation. These include e.g. SPECTRUM [Kirkwood, 1988] and more recent implementations by [Semeter and Kamalabadi, 2005] and [Dahlgren et al., 2011]. We have continued development of the model used in Dahlgren et al., and we now have a solver suitable for routine analysis of suitable EISCAT data. The software uses height profiles of electron density, ion and neutral compositions, and temperatures as input, and estimates the primary energy spectrum by means of integrating the electron continuity equation. From the estimated energy spectra, we calculate also estimates of field-aligned current density and auroral particle precipitation power. Shape of the energy spectrum is not pre-determined, but it is modeled as an exponential of a spline. The number and location of nodes is determined as part of the analysis process by means of the Akaike information criterion. Modeling the high-energy precipitation is challenging, since ion composition in the lower ionosphere is poorly known, which makes reliable modeling of the ion recombination challenging. We introduce the analysis technique, compare our estimates of field-aligned currents to satellite observations, and discuss the effect of inaccurate recombination models.

References

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