

A NOVEL TECHNIQUE FOR MEASURING IONOSPHERIC ELECTRIC FIELDS IN ELECTROJET REGIONS

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Electric fields in the auroral and equatorial ionospheric regions are a critical input to ionospheric and overall global space weather models. Such measurements are extremely difficult and most models rely on the few results acquired by rockets. Backscatter radar measurements operate only for significant values of the electric field and are difficult to interpret since they require measurements of the ambient ionospheric parameters. In this paper we discuss a novel technique for measuring D and E region electric fields in electrojet regions. The technique relies on coincident radar measurements of meteors entering the D and E regions and of the magnetic signature observed by ground magnetometers and electric field sensors. When meteors enter the D and E region ablate generating columns of ionized particles. The interaction of the ionized particles with D and E region electric fields generates transient currents whose electromagnetic signature can be measured by ground based electric and magnetic sensors synchronously with the radar detection of the ablating meteor. Theoretical modeling of these signatures indicates that the electromagnetic signature depends only on the meteor mass and velocity and the ambient electric field, and is independent of the ambient plasma parameters. As a result measurements of the electromagnetic signatures on the ground can be used to determine ambient electric fields in auroral and equatorial regions. In addition to the physics issues the paper will discuss signal to noise and signal processing aspects of the measurements as well as the requirements and predictions for proof-of-principle experiments at equatorial and auroral electrojet regions.

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