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Electrodynamics of an Omega-Band Determined With the Local KRM Method

H. Vanhamäki (1), K. Kauristie (1), O. Amm (1), A. Senior (2), D. Lummerzheim (3), and S. Milan (4)

(1) Arctic Research Unit, Finnish Meteorological Institute, Helsinki, Finland (heikki.vanhamaki@fmi.fi), (2) Department of Communication systems, Lancaster University, Lancaster, UK (a.senior@lancaster.ac.uk), (3) Geophysical Institute, University of Alaska, Fairbanks, USA (lumm@gi.alaska.edu), (4) Department of Physics and Astronomy, University of Leicester, Leicester, UK (ets@ion.le.ac.uk)

We investigate an Omega-band event that took place above northern Scandinavia around 02:00 - 02:30 UT on 9.3.1999. The Omega-band event occurred in the recovery phase of a moderate substorm.

We examine the electrodynamic structure of the Omega-band using a local variant of the well-known KRM method, introduced by Vanhamäki and Amm in 2007. We use ground magnetic measurements together with estimates of ionospheric Hall and Pedersen conductances as input in the calculation method. The first conductance data set is derived from UV images produced with the UVI instrument onboard the POLAR satellite. Together with data from the IMAGE magnetometer network this gives us an over-all picture of the Omega-band event. The second conductance data set is obtained by combining riometer absorption data and all-sky camera pictures of auroral brightness at 557 nm. This gives us a detailed view of the Omega-band as it propagates directly over the observational area.

Previously the ionospheric electric field of Omega-bands has mostly been studied with coherent scatter radars, which may have trouble in resolving small electric fields, such as those that are present in the highly conductive luminous "tongues" of the Omega-band. Both the riometer- and optical image -based conductance estimates used in this study should have their best accuracy in the luminous areas, where electron precipitation is intense and conductances are high. Consequently, high resolution conductance estimates and magnetometer measurements allow us to asses the electric field structure of the whole Omega-band, including the luminous tongues, thus complementing the previous studies.

The local KRM method is a new data analysis tool, and this is the first time it is used in event analysis. Although the method has been validated using several synthetic models of typical meso-scale phenomena in the auroral ionosphere, we wish to asses its performance also using real observational data. For this effect we compared the electric field calculated using the local KRM method with line-of-sight velocities measured by the CUTLASS radar at Hankasalmi. We find good qualitative agreement between the calculated and measured plasma velocities, demonstrating that the local KRM method is a practical tool for studying ionospheric electrodynamics.