Abstracts

Fast multisheet solver for geomagnetic induction in time-domain

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Changing ionospheric currents create induced electric fields and drive currents in the conductive ground, which in turn modify the electric field. Estimating the induced geoelectric field (GEF) at the ground surface from a given time series of the ionospheric currents and a regional 3D ground conductivity model is an important goal in geomagnetic field modeling, and is a prerequisite for predicting and modeling geomagnetically induced currents (GIC) in power grids and other technological systems.

We present a new type of solver for modeling the geomagnetic induction process and for estimating the GEF. The conducting ground is represented with several horizontal thin sheets placed at different depths, with each sheet having a non-uniform conductance distribution taken from the SMAP model for the Fennoscandian region by Korja et al. (2002). Within each sheet the induced electric field and current are represented in terms of Spherical Elementary Current Systems (SECS), which describe the curl and divergence of the vector fields. The ionospheric driver is represented as an equivalent current estimated from the IMAGE magnetometer data. This results in a systems of linear algebraic equations, which can be solved for the amplitudes of the SECS describing the induced fields. The solver works in time-domain, making it ideal for real-time applications, and is fast enough for analyzing several years of IMAGE data. We present first results of the GEF modeling for selected events and compare the results against a more accurate 3D induction modeling carried out by Marshalko et al. (2020).

Observations of the 2020 Pajala Fireball

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Meteoroids entering the Earth's atmosphere are associated with a number of phenomena including ablation, ambipolar diffusion, chemical reactions, and plasma turbulence. A bright daylight fireball observed on 2020-12-04 with two meteor cameras located in Skibotn and Sørreisa allowed the precise entry trajectory of the fireball to be determined. The path of the entering object is approximately between Angeli Finland and Pajala Sweden. Based on the brightness and entry trajectory, it is possible to estimate the approximate mass of the object, and associate it with a meteor shower (Northern Taurids). The effects of the fireball on the atmosphere were detected with a number of radar and radio instruments within the region, including ionosondes, meteor radars, and an all-sky VHF imaging system. These observations allow a detailed study of the atmospheric interaction of a large meteoric body with the Earth's atmosphere to be made. In this talk, we will describe the observations of this fireball and discuss preliminary findings.