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Response of ionospheric electric fields to variations in the interplanetary magnetic field

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Abstract. The STARE system (Scandinavian Twin Auroral Radar Experiment) provides estimates of electron drift velocities, and hence also of the electric field in the high-latitude E-region ionosphere between 65 and 70 degrees latitude. The occurrence of drift velocities larger than about 400 m/s (equivalent to an electric field of 20 mV/m) have been correlated with the magnitude of the Interplanetary Magnetic Field (IMF) components B_z and B_y at all local times. Observation days have been considered during which both southward ($B_z<0$) and northward ($B_z>0$) IMF occurred. The occurrence of electric fields larger than 20 mV/m increases with increases in B_z magnitudes when $B_z<0$. It is found that the effects of southward IMF continue for some time following the northward turnings of the IMF. In order to eliminate such residual effects for $B_z<0$, we have, in the second part of the study, considered those days which were characterized by a pure northward IMF. The occurrence is considerably lower during times when $B_z>0$, than during those when B_z is negative. These results are related to the expansion and contraction of the auroral oval. The different percentage occurrences of large electric field for $B_y>0$ and $B_y<0$ components of the IMF during times when $B_z>0$, clearly display a dawn-dusk asymmetry of plasma flow in the ionosphere. The effects of the time-varying solar-wind speed, density, IMF fluctuations, and magnetospheric substorms on the occurrence of auroral-backscatter observations are also discussed.

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