Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Macroscopic effects of E-region turbulence: Anomalous plasma heating and conductivity[1] YAKOV DIMANT, MEERS OPPENHEIM, Boston University — During periods of intense geomagnetic activity, strong electric fields penetrate from the Earth's magnetosphere to the high-latitude E-region ionosphere where they form electrojets and excite plasma instabilities. These instabilities give rise to plasma density turbulence coupled to electrostatic field fluctuations, causing a nonlinear current and anomalous heating. These two effects increase ionospheric conductivities that play an important role in magnetosphere-ionosphere coupling. A quantitative understanding of turbulent conductivities and energy conversion is important to accurately model magnetic storms and substorms. Our theoretical analysis, supported by fully kinetic 3-D particle-in-cell simulations, allows one to quantify energy budget in the electrojet, anomalous plasma heating and conductivities. Our recent theoretical analysis and computer simulations allow one to quantify the energy deposition in the ionosphere, particle heating, and effects of the anomalous conductivities. Our estimates show that during strong geomagnetic storms the inclusion of the instability-induced anomalous effects may nearly double the total Pedersen conductance. This helps explain why existing global MHD codes developed for predictive modeling of space weather systematically overestimate the cross-polar cap potentials by approximately a factor of two.

[1]Work supported by NSF Grants ATM-0819914 and ATM-1007789.

Yakov Dimant
Boston University

Date submitted: 12 Jul 2011 Electronic form version 1.4