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Anomalous conductances caused by plasma turbulence in the high-latitude ionosphere[1] YAKOV DIMANT, MEERS OPPENHEIM, Boston University — During periods of intense geomagnetic activity, strong electric fields penetrating from the Earth's magnetosphere form electrojets and excite plasma instabilities in the high-latitude E-region ionosphere. These instabilities give rise to plasma density turbulence coupled to electrostatic field fluctuations. This turbulence induces nonlinear currents, while the field fluctuations cause strong electron 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 simulations, allows one to quantify energy deposits in the electrojet, particle heating, and anomalous conductivities. Our estimates show that during strong geomagnetic storms the inclusion of the 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.

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