

EGU2020-1166

<https://doi.org/10.5194/egusphere-egu2020-1166>

EGU General Assembly 2020

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## Multi-scale Analysis of Electromagnetic Energy Input using Swarm: Quantifying Key Scales in Magnetosphere-Ionosphere Coupling

Ivan Pakhotin<sup>1</sup>, Ian Mann<sup>1</sup>, Kai Xie<sup>1</sup>, David Knudsen<sup>2</sup>, and Johnathan Burchill<sup>2</sup>

<sup>1</sup>University of Alberta, University of Alberta, Department of Physics, EDMONTON, Canada (i.p.pakhotin@gmail.com)

<sup>2</sup>University of Calgary, Calgary, Alberta, Canada

Electromagnetic energy transfer in magnetosphere-ionosphere coupling (MIC) is an inherently multiscale process, where the relative contributions of various scale sizes, linked to various auroral phenomena, are largely unknown. While work in previous decades has largely focused on large scales, in recent years with the development of new instrumentation smaller scale electromagnetic disturbances have once again come into focus. Recent work by the authors has demonstrated evidence that small-scale processes appear to be so important as to potentially account for a global interhemispheric asymmetry in ionospheric energy input. This study attempts to statistically quantify the contribution of energy at the small and mesoscales using Poynting flux, calculated using the unprecedented ESA Swarm mission dataset of simultaneous electric and magnetic field measurements at 16 Hz, with statistics now spanning several years. We find important contributions at small scales to the total energy budget, while at the same time noting that there appears to be a limit above which energy content tends to drop off. In the context of previous observations from other spacecraft this may shed light on key small-scale processes happening in and around the auroral acceleration region, in particular discrete arcs and Alfvén wave reflection from the ionosphere, which are important in forming inputs to coupled magnetosphere-ionosphere-thermosphere modelling studies.