2022 Workshop: GC: Poynting Flux

Long title
Grand Challenge: Understanding the Electromagnetic Energy Input to Earth's Atmosphere
Grand Challenge
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Description

White paper Link:

https://docs.google.com/document/d/1Tpd536JHHUUwkSHlAGSrG231rlxgzYt_9lW...

At high latitudes, electromagnetic energy from the Solar wind and magnetosphere flows into the upper atmosphere through the ionosphere (e.g. Gary et al., 1994). This is quantified in terms of Poynting flux. During active magnetic periods, this energy source can be larger than Solar radiation (Luhr and Liu, 2006) and is certainly harder to characterize at all times. The Poynting flux is transformed into thermal or kinetic energy through particle acceleration in the magnetosphere and Joule/frictional heating in the upper atmosphere (e.g. Thayer and Semeter, 2004). Despite the obvious importance of this energy source to the coupled Ionosphere-Thermosphere-Mesosphere (ITM) system, an accurate global picture of the Poynting flux at relevant spatio-temporal scales remains elusive. Current models of the ITM typically still rely on empirical models based on historic datasets (e.g. Heelis et al., 1982; Weimer, 2005) to estimate this forcing. Recent major advances in modeling from the ground up to 600-km (e.g. WACCM-X, WAM, GAIA) and, separately, from the Solar wind down to the ionosphere (e.g. GAMERA, BATS-R-US) essentially meet here.

The science question driving this Grand Challenge is: What is the electromagnetic energy input into the Earth’s atmosphere? This topic is aligned with the strategic

thrusts outlined in the CEDAR strategic vision. It explores an exchange of energy between all of the space-atmosphere-interaction region (SAIR), it merges many geoscience datasets and models, and it synthesizes knowledge from several disciplines of the solar-terrestrial sciences. Therefore, this Grand Challenge is expected to have a major impact on a large segment of the CEDAR research community.

Agenda

15 minute talks with 5 minutes for questions

Tuesday 21 June (all times in CDT, GMT-5)

10:00 Yue Deng: Joule heating - Mesoscale E-fields and Altitude distribution

10:20 Dan Billett: Poynting flux statistics with SuperDARN, AMPERE, and Swarm

10:40 Andrei Demekhov: Poynting Flux of VLF Chrous Emissions in the Earth's Magnetosphere

11:00 Gang Lu: Poynting Flux, Joule heating, and Energy Dissipation in the IT system

11:20 - 12:00 White paper preparation

13:30 Russell Cosgrove: Poynting Flux Findings from FAST using Empirical Models

13:50 Rob Pfaff: Dynamics Explorer-2: Some New Analysis of Electric fields and Magnetic Field Measurements including Poynting Flux Computation

14:00 Wenbin Wang: Longitudinal Dependence of Ionospheric Poynting Flux in the Northern Hemisphere During Quiet Times

14:30 Aaron Ridley: GITM Densities & Winds & CAPE

14:40 Sheng Tian: Substorm aurora and Poynting Flux

14:50 - 15:30 White paper preparation

Justification

This is the second full year of an already-selected Grand Challenge.

Related to CEDAR Science Thrusts:
Encourage and undertake a systems perspective of geospace
Explore exchange processes at boundaries and transitions in geospace
Workshop format
Short Presentations
Keywords
poynting flux, electrodynamics, ionosphere, magnetosphere
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