2014 Workshop: The high latitude geospace system

Long title
Grand Challenge: The high latitude geospace system
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Description

At high latitudes, the convergent magnetic field serves as a lens, projecting solar wind-magnetosphere-ionosphere-thermosphere interactions to a limited latitudinal range. These interactions can, nonetheless, drive geospace dynamics at all latitudes. Owing to a growing network of distributed sensors, we are poised to develop a comprehensive empirical description of geospace dynamics in the open magnetic field region. Our arsenal of sensors now includes the first ever incoherent scatter radars deployed to the geomagnetic polar region (RISR-N and RISR-C), and two new satellite missions (e-POP and SWARM) that will provide constraints above and within the ITM volume probed from the ground. Complementing the observational perspective are modeling efforts aimed at enhancing the scientific efficacy of this growing body of diagnostic information.

The purpose of this grand challenge workshop is to advance our knowledge of the high-latitude geospace system by synthesizing ideas, perspectives, analyses, and modeling efforts currently being pursued by separate groups. The following science questions will guide discussions at the inaugural session: 1. How do solar wind-magnetotail-ionosphere coupling and attendant auroral processes affect the structure and composition of the polar ionosphere? 2. What are the effects on the neutral atmospheric, and what is the range of influence of these disturbances? 3. What governs the internal structure and RF wave propagation characteristics within plasma patches? 4. How do the aforementioned processes affect ion outflow,

including impacts on global magnetospheric configuration? To address these questions, the workshop includes technical objectives to develop strategies for data assimilation, and to optimize future experiments for sensor selection, sensor placement, and operating modes. Our objectives are also tightly connected with the GEM initiative, in the sense of understanding how to optimally apply distributed ionospheric measurements to understand solar wind-magnetosphere interactions. We welcome contributions in the form of short presentations aimed at eliciting group discussion.

Justification

The objective of this workshop is to exploit new ground- and space-based evidence in order to develop a comprehensive description of geospace dynamics poleward of the open-closed field line boundary. Our challenge includes understanding the ionospheric projection of solar wind-magnetosphere interactions in this region (relevant to joint CEDAR-GEM initiatives), as well as the basic aeronomy of the region, which has been unexplored prior to the advent of the RISR facilities. Coupled with the launch of SWARM and e-POP, we will acquire fundamentally new constraints for addressing the targeted science questions described below.

Although we have made substantial progress in our understanding of solar wind-magnetosphere-ionosphere-thermosphere interactions in the geomagnetic polar regions over the previous decades (using HF radars, all-sky imagers, optical interferometers, and opportunistic satellite conjunctions), the intrinsic variability of the polar ionospheric remains virtually unexplored. With the development of the RISR-N and RISR-C facilities, and the launch of the SWARM and e-POP satellite missions, we have an unprecedented opportunity to investigate the system drivers and the system response. This workshop will span the nominal acquisition lifetimes of these platforms, with the objective of developing a comprehensive description of the polar geospace system.

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