2021 Workshop: New Results In Subauroral Science

Long title
Magnetosphere, ionosphere, and atmosphere coupling at subauroral latitudes: Recent advances and open questions
Conveners
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Description

This session will advance community understanding by featuring the latest advances in modeling of these tight subauroral dynamic feedback signatures and new analysis of ground-based and in situ observations. We welcome contributions that address sub-auroral ionosphere and thermosphere dynamic and chemical changes in neutral wind and composition, electrodynamically driven ionosphere variations in the plasmasphere boundary layer, traveling atmosphere and ionosphere disturbances, relative driving roles of internal and external M-I-T system forcing, and related topics. Especially relevant to this session are multi-faceted studies that combine observations and modeling tools in order to elucidate the relative importance of various forcing terms and their implications for coupled dynamic response. Both event studies and statistical / climatological studies are welcome.

Agenda

1) Phil Erickson, Introduction to the session: Remembering Stan Sazykin
2) Naomi Mauryama, Unsolved problems and future challenges in the sub-auroral Ionosphere-Thermosphere -- Stan Sazykin's legacy
3) Joe Huba, The SAMI3/RCM coupled model
4) Bea Gallardo-Lacourt, Measuring the subauroral region: Links to Stan Sazykin’s work

5) Greg Starr, Enabling Statistical Analysis of the Main Ionospheric Trough with Computer Vision
6) Gang Lu, On the Subcorotation of SED Plume
7) Toshi Nishimura, Multi-scale structure of the SED plume
8) Anthea Coster, Developing a Modeling Framework for understanding Hemispheric Asymmetries via Model-Data Comparisons
9) Larry Lyons, Direct Connection Between Auroral Oval Streamers/Flow Channels and Equatorward Traveling Ionospheric Disturbances
10) Carlos Martinis, Coupling the Inner Magnetosphere with the sub-auroral ionosphere
11) Joseph Baker, Stan Sazykin: Wish You Were Here
12) Ercha Aa, Statistical and case analysis of SAPS
13) Dong Lin, SAPS simulation with Multiscale Atmosphere Geospace Environment (MAGE) model.

Justification

Mid-latitude and sub-auroral regions in Earth’s upper atmosphere feature strong coupling dynamics and process signatures highlighting the critical role of atmosphere - ionosphere - magnetosphere interactions in the dynamic plasmasphere boundary layer, site of significant energy and momentum exchange. This area remains a dynamic and vital research focus for the geospace community, with well known electrodynamic and wave driven signatures such as storm enhanced density (SED), subauroral polarization streams (SAPS), main ionospheric trough, decameter scale irregularities, traveling ionospheric disturbances, neutral wind disturbances, and two-way coupled instability feedback mechanisms.

Recent work on coupled atmosphere and magnetosphere modeling efforts such as TIME-GCM, OpenGGCM / IPE, and GITM continue to advance in sophistication, providing new and powerful tools to investigate the relative role of physical drivers. These are matched by new observational results at sub-auroral latitudes that provide excellent challenges for these intercoupled models. These include for example the presence of significant and very geoeffective SAPS and SED structures during relatively minor geomagnetic disturbances, interrelated SAID fast ion velocity flows and STEVE fine scale multispectral emissions, neutral wind surges during SAPS events, and space weather dynamics of traveling ionospheric disturbances as viewed in e.g. GNSS total electron content and other radio/radio techniques.

The general topic area of the session relates directly to a key CEDAR science goal of understanding system response within the coupled Space-Atmosphere Interaction Region (SAIR). The proposed workshop addresses CEDAR Strategic Thrust #2: Explore Exchange Processes at Interfaces and Boundaries, and its interdisciplinary content bridges the CEDAR and GEM communities.

Progress will be measured by new collaborations that emerge from information at this workshop.

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