2024 Workshop: Interhemispheric asymmetries (IHA)

Long title
Interhemispheric asymmetries (IHA) and impact on the global I-T system
Grand Challenge
Conveners
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Description

The state of ionosphere-thermosphere (IT) is hardly ever a mirror image of the other hemisphere even when considering differences due to season and Earth's magnetic field. Among others, neutral wind and density, composition, ion drift, and plasma distribution, exhibit interhemispheric asymmetries (IHA) on temporal scales from hours to seasonal. Forcing from both magnetosphere-ionosphere (MI) coupling and lower atmosphere can contribute to IHA but it is still not well understood what constitutes a significant asymmetry and their cause. The effect of the strong high latitude energy deposition on the IT system can be modulated by the background atmospheric state which is strongly affected by the vertical coupling to the lower atmosphere. Meanwhile, during meteorological disturbed conditions, strong spatial and temporal variations in the wave spectrum and the background conditions lead to significant changes in the mesosphere-lower thermosphere (MLT) and IT system. In this workshop we will discuss causes and effects of IHA in the upper atmosphere. We solicit contributions examining IHA in the MLT and IT regions to improve our understanding of the generation and impacts of interhemispheric asymmetries.

Agenda

(1) Tue. 13:30-15:30 PT:

Moderators: Yue, Lynn & Astrid

Invited talks (15-min presentation + 3-min Q&A for each)

(1) Aaron Ridley: Update of MAAX satellite mission

(2) Cesar Valladares: Observations for the IHA of the post-sunset EIA during SSW events

Lightning talks: ***(5-min presentation + 2-min Q&A for each)***

(1) Marc Hairston: DMSP observations during the May 2024 superstorm.

(2) Qian Wu: HIWIND Arctic and ground-based FPI in Antarctica comparison

(3) Mukta Neogi: Atmospheric tides in the ionosphere-thermosphere system: Forcing from above versus forcing from below

(4) Yu Hong: Inter-hemispheric asymmetry in the magnetosphere-ionosphere-thermosphere system during the December 4 2021 solar eclipse: MHD-GCM coupled simulations

(5) Joe Huba: Storm Studies with SAMI3-RCM

(6) Yun-Ju Chen: The Hemispheric Difference in Plasma Density Enhancements in the Polar Cap Region

(7) Astrid Maute: IHA in the TI system during geomagnetic storms

(8) James Fox: Detection of SuperDARN-Observed MSTIDs in the SH

Discussion: ~30 minutes

***Teams meeting link*:**

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(2) Fri. 10-12 PT:

Moderators: Yue, Yun-Ju & Aaron

Invited talks: ***(15-min presentation + 3-min Q&A for each)***

(1) Erich Becker: Interhemispheric asymmetries associated with multi-step vertical coupling by primary and higher-order gravity waves

(2) Yining Shi: interhemispheric asymmetries in large magnetic field residuals

Lightning talks: ***(5-min presentation + 2-min Q&A for each)***

(1) V. Lynn Harvey: Interhemispheric asymmetries in lower atmosphere waves entering the heliosphere due to the polar vortices

(2) Aaron Bukowski: Longitudinal and Hemispherical Asymmetries in the Global Distribution of LSTIDs as Modeled by SAMI3/GITM

(3) Shreejan Khanal: TAD propagation from GOLD temperature data analysis and its interhemispheric asymmetry

(4) Joon Myeong Kim: reconstructed 3D full components (vertical + horizontal) of neutral wind using tri-static SDI line of sight observations

(5) Nicholas Bartel: hemispherical asymmetry of field-aligned currents

(6) Kristina Collins: Interhemispheric comparison of geomagnetic disturbance/ULF waves during magnetosheath jet events

(7) Yulu Peng: Interhemispheric asymmetry of EIA and SED during April 2023 storm

Discussion: ~30 minutes

***Teams meeting link*:**

Join the meeting now

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Justification

In the I-T system, interhemispheric Asymmetries (IHA) take many forms. Observations have revealed that IHA manifested via particle precipitation and conductivity, auroral patterns, substorm occurrence and locations, field-aligned currents, ionospheric electric potentials, magnetic field geometries, ionospheric and thermospheric neutral and plasma characteristics, and atmospheric waves from the lower atmosphere. Understanding IHA is critical for understanding the IT system to the forcing from both above and below.
Despite the now-known importance and ubiquity of IHA, their properties have not been thoroughly examined or documented. The lack of IHA input to models has prevented simulations from testing their impact on the global I-T system. Also simulation capabilities for handling IHA are significantly limited. Furthermore, impacts of IHA have not been quantified or reproduced. This workshop focuses on quantifying interhemispheric differences observed in the IT system and understanding their causes and importance for the upper atmosphere. With the available observations and sophisticated numerical modeling capabilities we are in a better position now to study the IHA. Meanwhile, this workshop is complementary to the NASA 2020 LWS FST on “Caused and Consequences of Hemispherical Asymmetries in the M-I-T system”. This research is also timely in preparation for the upcoming Geospace Dynamic Constellation (GDC) mission. The proposed activities will be coordinated with NSF GEM focus group on “Interhemispheric Approaches to Understand M-I coupling (IHMIC)” by bringing their knowledge and holding joint campaigns

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Workshop format
Short Presentations
Keywords
interhemispheric asymmetries, geomagnetic energy, atmospheric waves, I-T system
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