Interhemispheric asymmetries (IHA) and impact on the global I-T system

Conveners

Yue Deng, Qingyu Zhu, Yun-Ju Chen, V. Lynn Harvey, Astrid Maute, Aaron Ridley

Justification:

- IHAs exist in ionospheric and thermospheric neutral and plasma characteristics, in particle precipitation and conductivity, auroral patterns, substorm occurrence and locations, field-aligned currents, ionospheric electric potentials, and lower atmospheric waves
- IHAs exist despite considering seasonal offsets and magnetic field geometries
- IHA temporal scales range from hours to seasonal.
- IHAs arise due to forcing from above (M-I coupling) and below (PWs, GWs, tides).
- Despite the importance and ubiquity of IHAs, **their properties have not been documented**.
- The **lack of IHA input to models** prevents simulations that study impacts on the global I-T.

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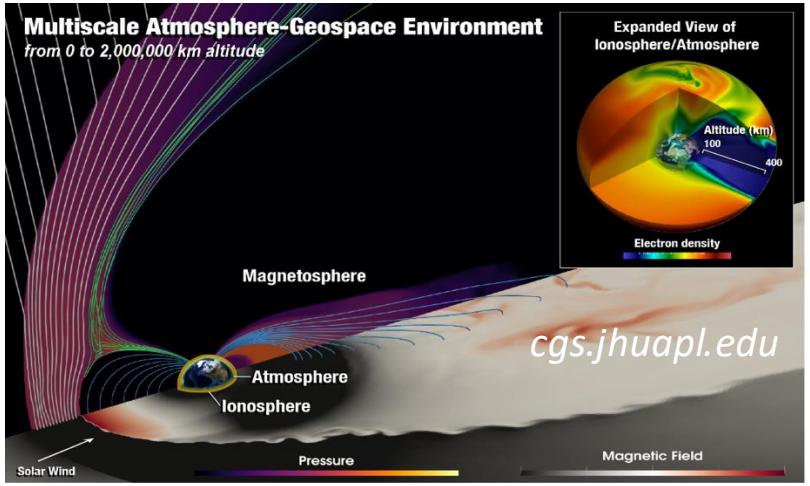
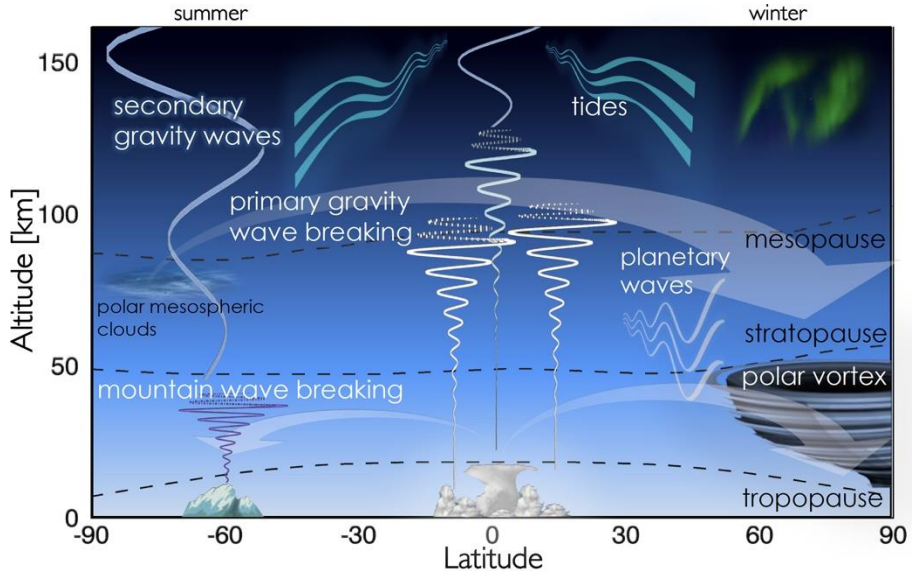
Goals:

- Document IHA characteristics.
- Determine if IHAs different during quiet and storm times.
- Determine the significance of IHAs on the M-I-T system and space weather.
- Better understand how IHAs in I-T system are forced from both above and below.
- Input IHAs into models and quantify their impact on the global I-T system.
- Identify the difficulties to measure IHAs and how these gaps might be closed.





McCormack et al, 2021

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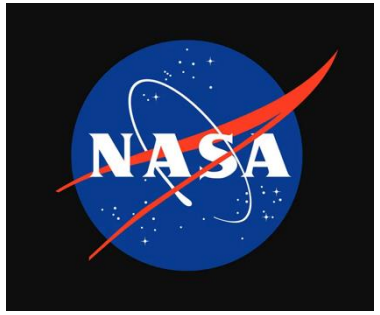
Synergies:

- **Complement NASA 2020 LWS FST** on "Caused and Consequences of IHAs in the M-I-T system" led by V. Lynn Harvey
  - 7 PIs: V. Lynn Harvey, Yun-Ju Chen, Anthea Coster, Hyomin Kim, Naomi Maruyama, Astrid Maute/Gang Lu, Kevin Pham, + ~ 40 other members
- Complement NSF GEM focus group from 2018-2024 on "Interhemispheric Approaches to Understand M-I coupling (IHMIC)" led by Hyomin Kim
- Complement ISSI Team "Understanding Interhemispheric Asymmetry in MIT Coupling" led by Hyomin Kim



Understanding Interhemispheric Asymmetry in MIT Coupling

ISSI Team led by Kim H.

2023

Scene setting talks (~15 min)

Gang Lu: IHA in the IT system driven from above

Katrina Bossert: Lower to upper atmosphere coupling

Lightening talks (~5min)

1. Sophie Phillips*: Observing GW Coupling and Day-to-Day Variability Over the Polar Vortex
2. Nathaniel Frissell: TIDs and their Connection to the Lower and Middle Atmosphere
3. Dogacan Ozturk: Untangling the Interhemispheric Response to Solar Wind Drivers with Inthermispheric Asymmetry Index
4. Yu Hong*: Relative contribution of high-latitude electrodynamic forcing to IHAs in the I-T
5. Zihan Wang: Hemispheric Asymmetries in Thermospheric Composition and Temperature: GOLD Observations and GITM simulations
6. Austin Smith*: IHA in Modeled Joule Heating During the 2013 and 2015 St. Patrick's Day Storms
7. Qingyu Zhu: IHA in the thermospheric neutral mass density response to the September 2017 storm

2023

Scene setting talks (each ~15 min)

Delores Knipp: IHAs in FAC and Poynting flux observations

Quan Guan: IHAs in GOLD

Lightening talks (each talk ~5min)

1. Jintai Li: Lidar observations of fishbone structures at 50 km and 90 km
2. Edwin Mierkiewicz: Interhemispheric AtmosphericHydrogen variability from dawn to dusk
3. Daniel Billett: Thermospheric densities and ionospheric conditions during the Starlink Destruction event
4. Rachel Frissell: Statistical and planned studies of the magnetospheric Open-Closed Boundary using ULF wave observations from Antarctic Ground magnetometers combined with conjugate NH stations
5. Bhagashree Waghule*
6. Marc Hairston: Penetration electric fields during various March storms (2013, 205, 2023)
7. Michael Hartinger: Exploring interhemispheric asymmetries through distributed Antarctic ground-based measurements
8. Yun-Ju Chen: The Hemispheric Difference in Electric Potential and Electron Precipitation observed by DMSP

Tuesday 13:30-15:30 Pacific A&B

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

(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 + 2-min Q&A)

(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

~30 minutes Discussion

Friday 10:00-12:00 Pacific A&B

Invited talks: (15-min + 3-min Q&A)

(1) Erich Becker: IHAs in 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 + 2-min Q&A)

(1) V. Lynn Harvey: IHAs 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

~30 minutes Discussion