International Association of Geodesy (IAG), Commission 4 Symposium

Postsdam, Germany

September 5 - 8, 2022

The Joint Study Group (JSG T.27) of the *IAG GGOS* Focus Area Geodetic Space Weather Research: **Coupling Processes between Magnetosphere, Ionosphere, and Thermosphere**

Presented by

Ayomide Olabode

on behalf of the JSG

JOINT STUDY GROUP: MIT COUPLING

Implemented at International association of Geodesy (**IAG**) Inter-Commission Committee on Theory (**ICCT**); joint with IAG Global Geodetic Observing System (**GGOS**), Focus Area on Geodetic Space Weather Research (**FA-GSWR**); **IAG Commission 4 Positioning & Applications**; and **IAG Sub-Commission 4.3 Atmosphere Remote Sensing**.

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5. Astrid Maute (High Altitude Observatory, USA).
6. Yury Yasyukevich (Russian Academy of Sciences, Russia).
7. Gang Lu (High Altitude Observatory, USA)
8. Olawale S. Bolaji (University of Tasmania, Australia).
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10. Oluwaseyi Emmanuel Jimoh (Adeleke University, Nigeria).
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13. Naomi Maruyama (University of Colorado, USA)
14. Toyese Tunde Ayorinde (Instituto Nacional de Pesquisa Espacial, Brazil).
15. Charles Owolabi (Federal University of Technology Akure, Nigeria)
16. Emmanuel Abiodun Ariyibi (Obafemi Awolowo University, Nigeria).
17. Ayomide Olabode (Obafemi Awolowo University, Nigeria)

https://ggos.org/about/org/fa/geodetic-space-weather-research/groups/jsg1-coupling-processes/

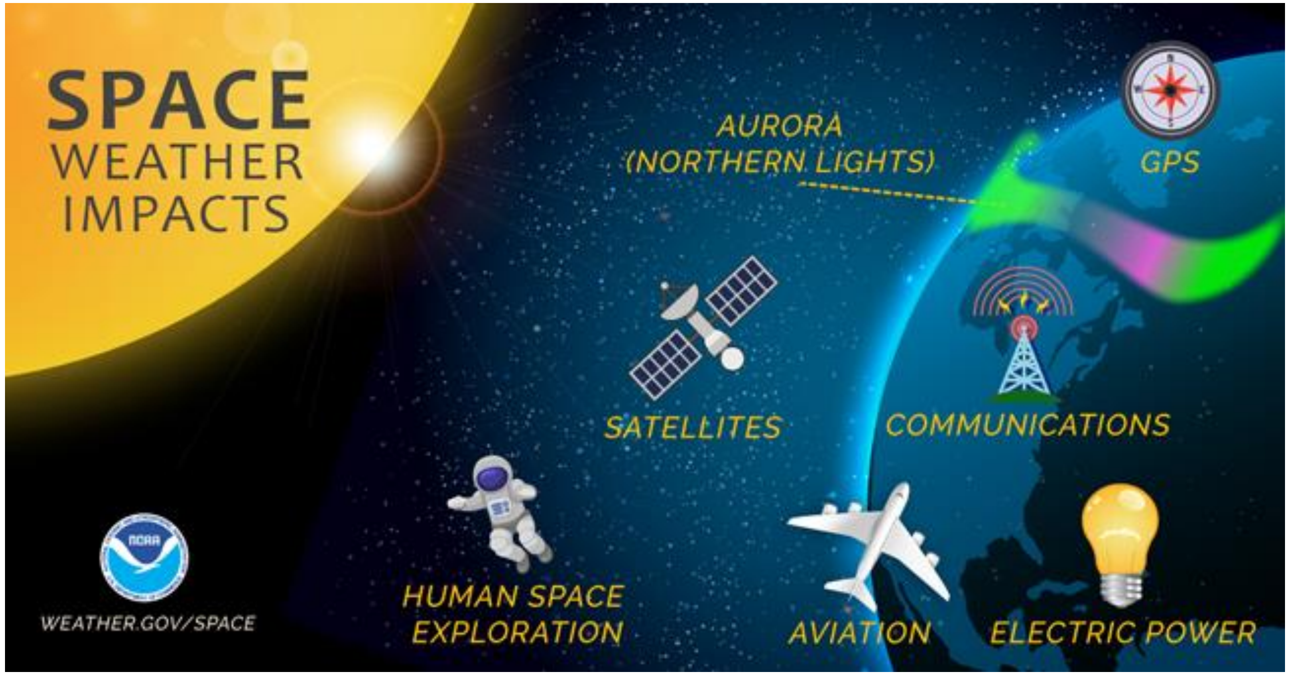
OUTLINE

1. Problems & Motivation
2. Introduction state-of-the-art
3. Strategy
4. Selection of Achievements in last 2 years
5. Invitations
6. Acknowledgments

PROBLEMS & MOTIVATION

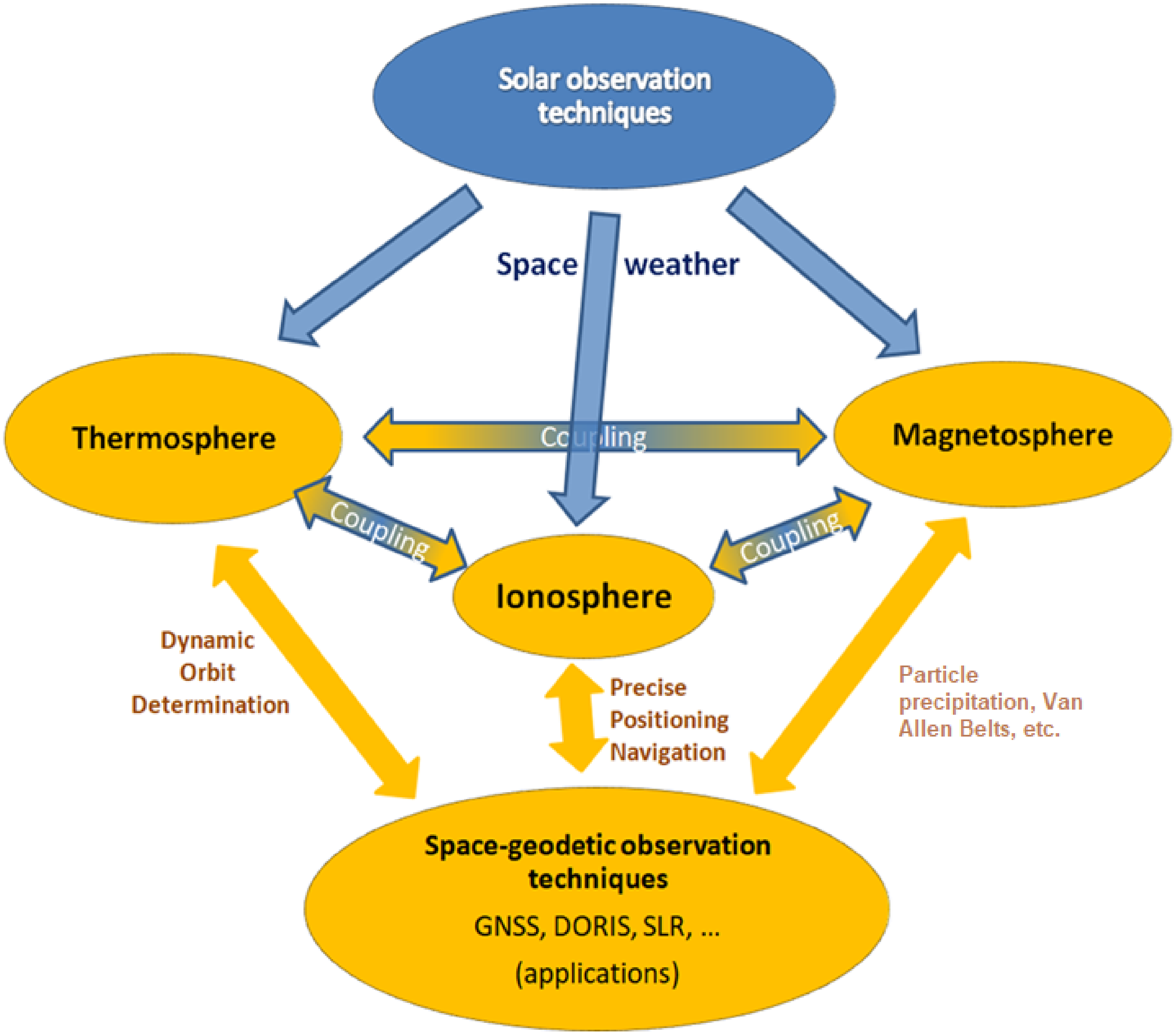
SPACE WEATHER IMPACTS

- **Radio signal propagation** in the ionosphere, affecting GNSS, communications, etc.;
- **Drag force** on **Low Earth Orbit** (LEO) satellites; and
- **Power and internet outages** due to intense **electric currents** induced during geomagnetic storms, **killer electrons**, etc.

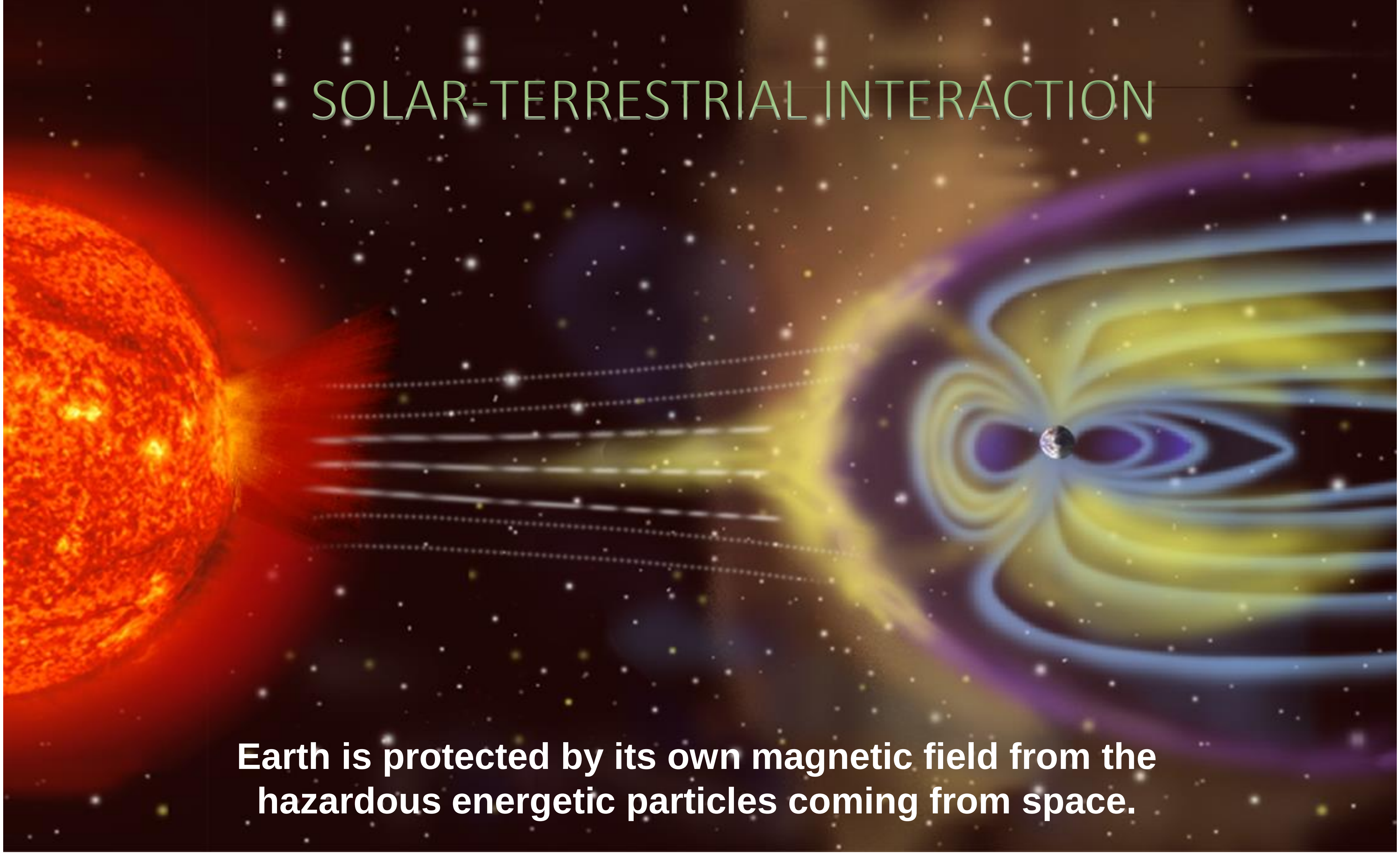


GEODETIC SPACE WEATHER RESEARCH

Research on upper atmosphere aims to contribute for a better **understanding** of Space Weather phenomena within the coupled MIT system, and for the formulation of **predictive models** of the near-Earth space environment.

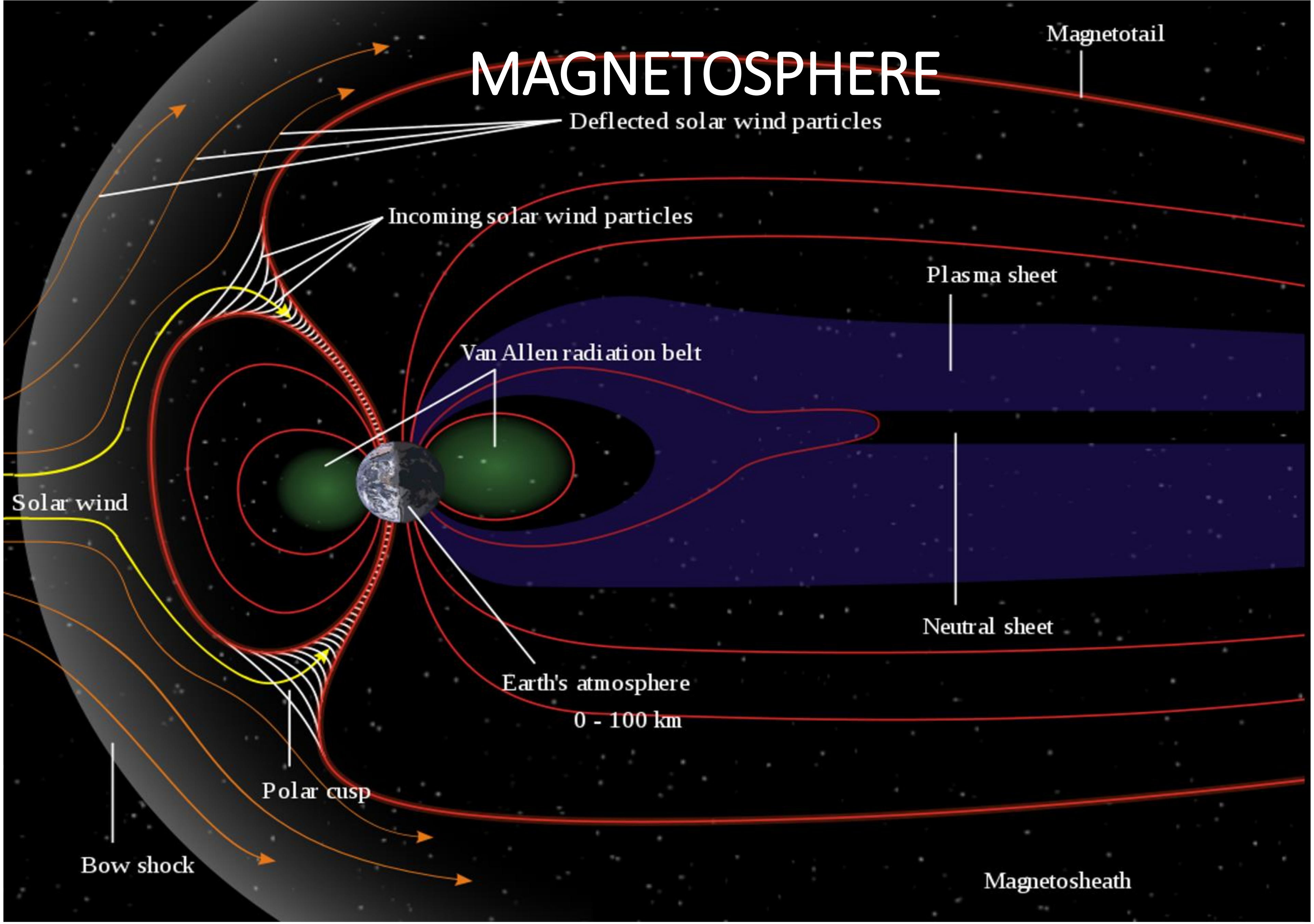


INTRODUCTION
STATE-OF-THE-ART



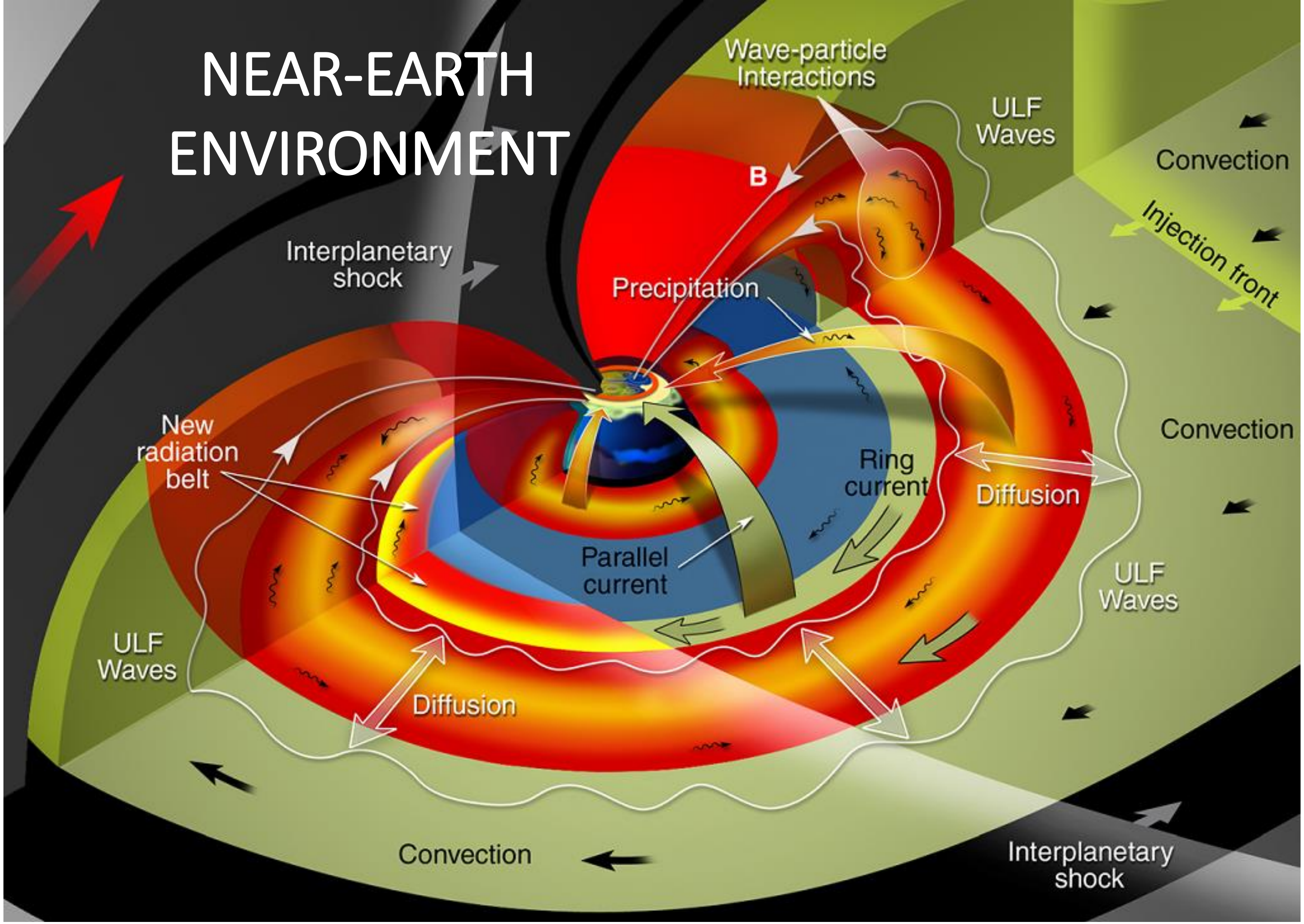
http://sec.gsfc.nasa.gov/popscise.jpg

MAGNETOSPHERE



http://science.nasa.gov

NEAR-EARTH ENVIRONMENT

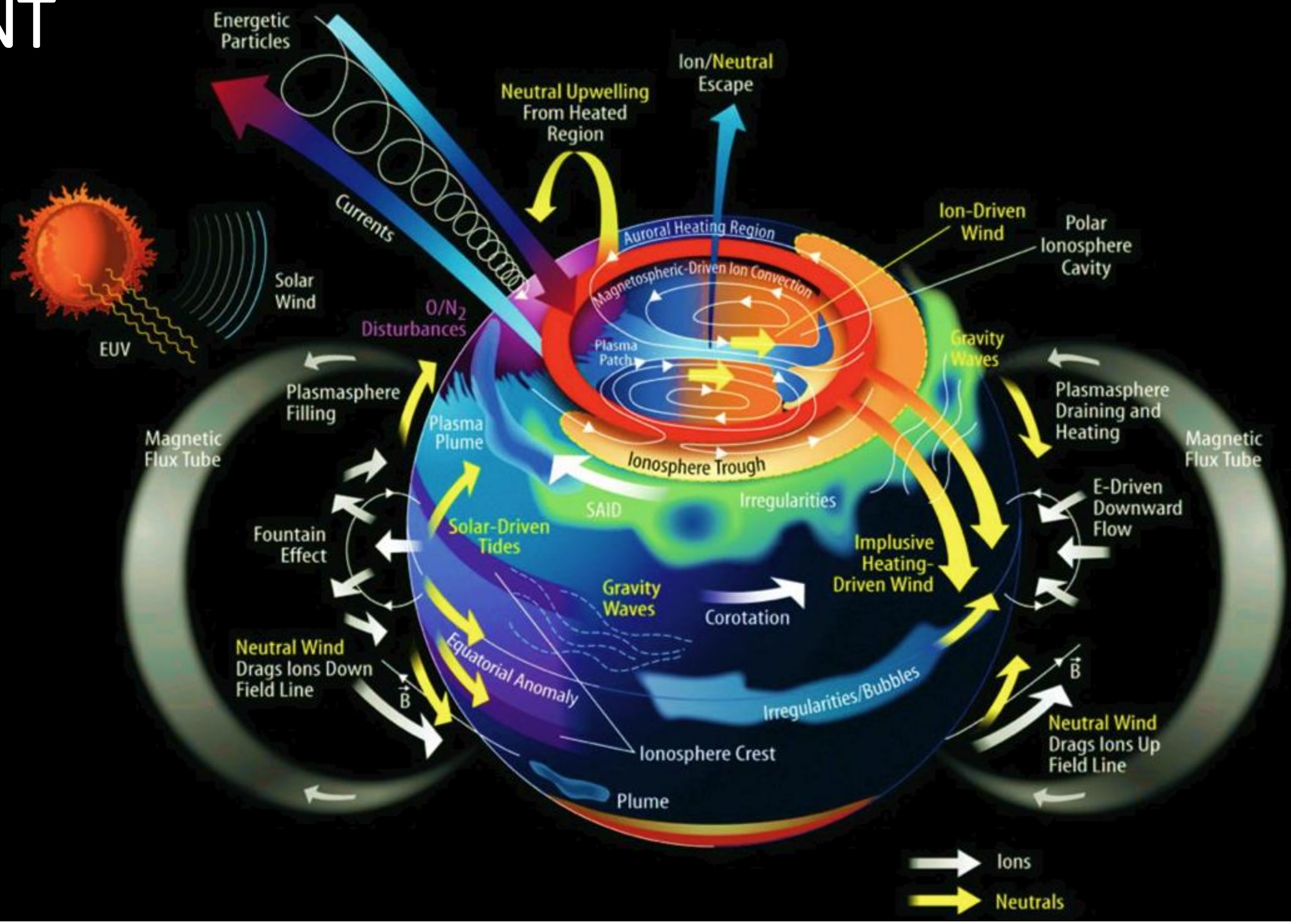


Mauk et al. (2013)

NEAR-EARTH ENVIRONMENT

The understanding of coupled processes in the Magnetosphere-Thermosphere-Ionosphere (**MTI**) is still a <u>challenge</u>.

Variations in the upper atmosphere are strongly influenced by <u>solar and magnetospheric forcing</u>.



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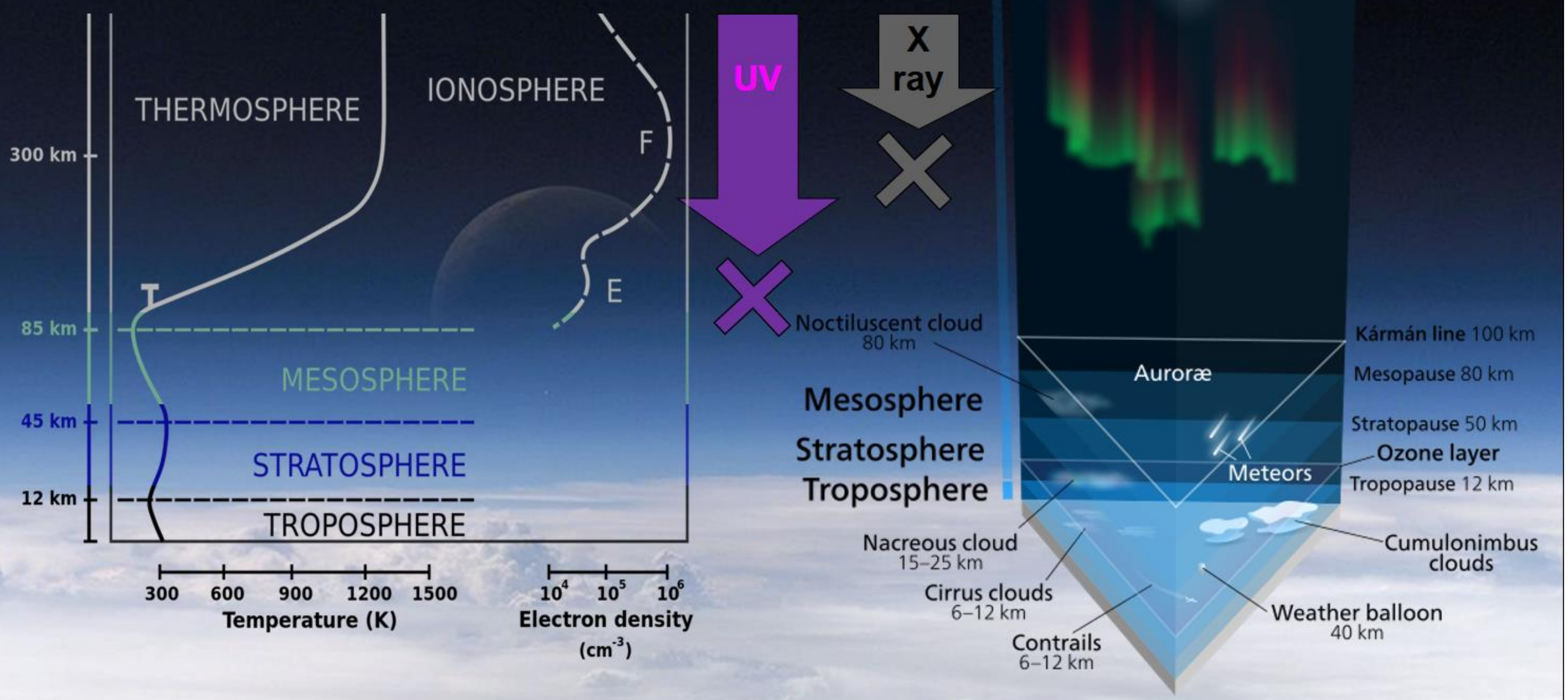
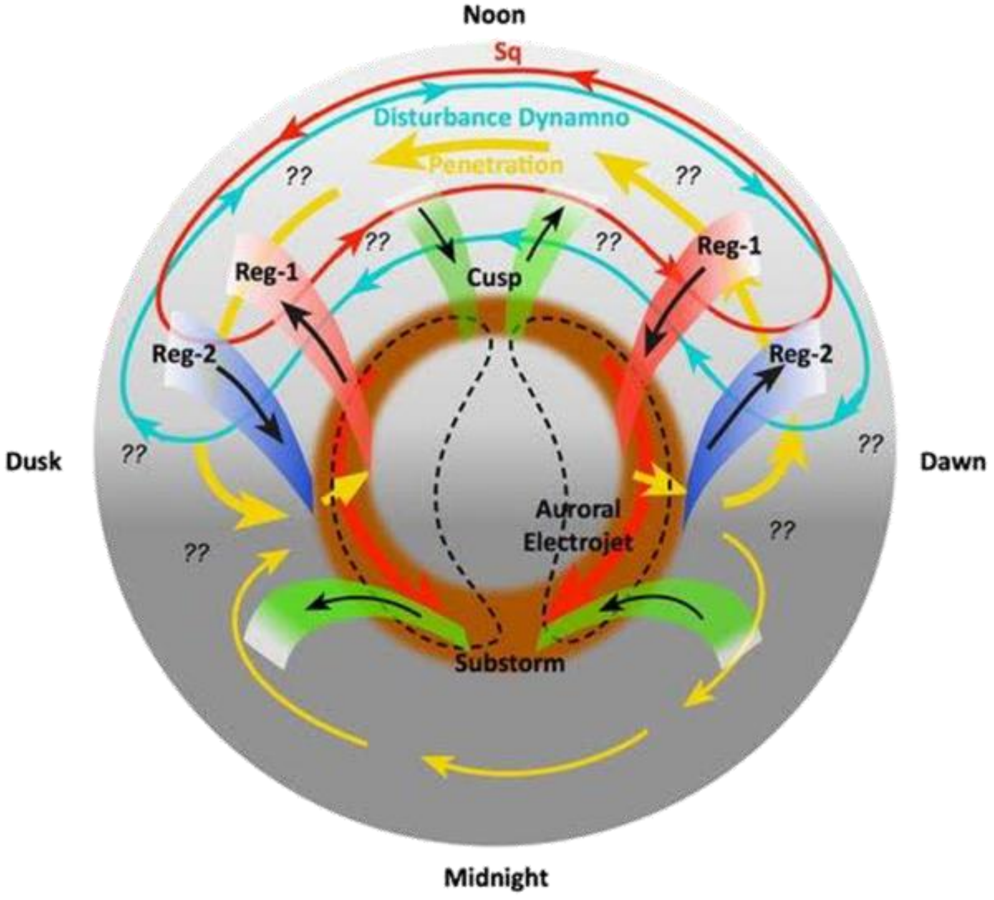
ATMOSPHERIC COUPLING



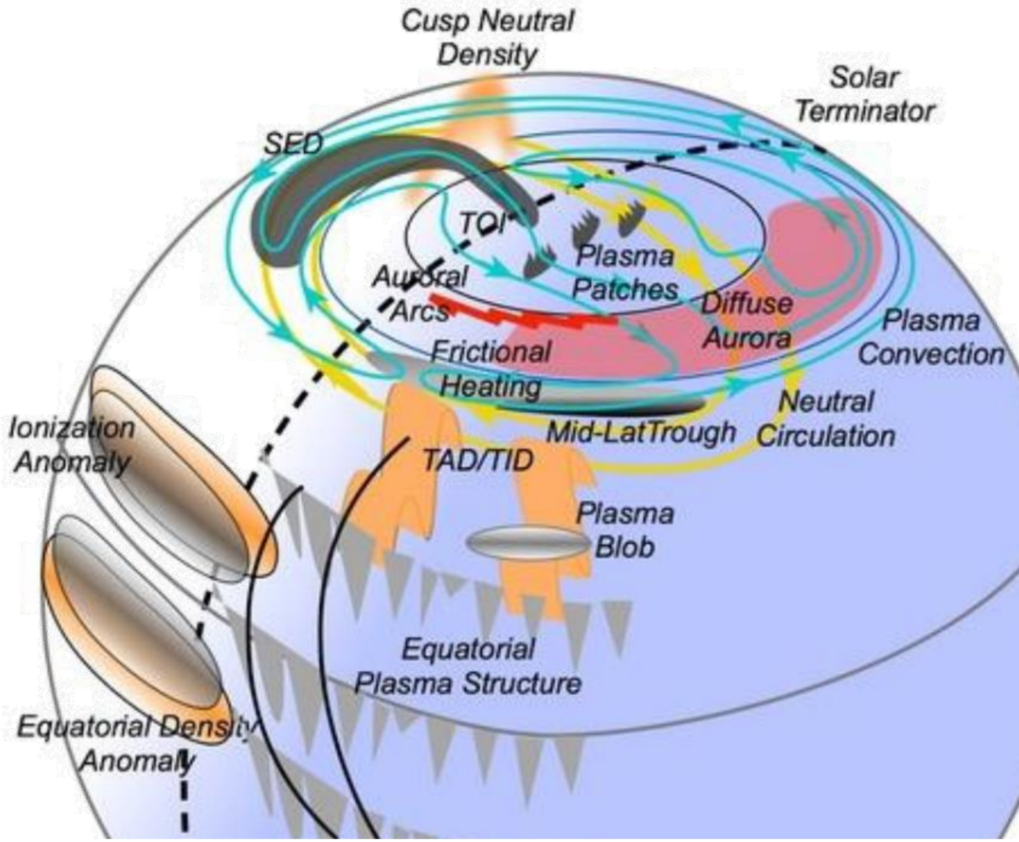
On the one side, highly energetic **solar radiation is absorbed in the thermosphere**, through ionization/dissociation of molecules, and thus **creating the ionosphere**.

ATMOSPHERIC COUPLING

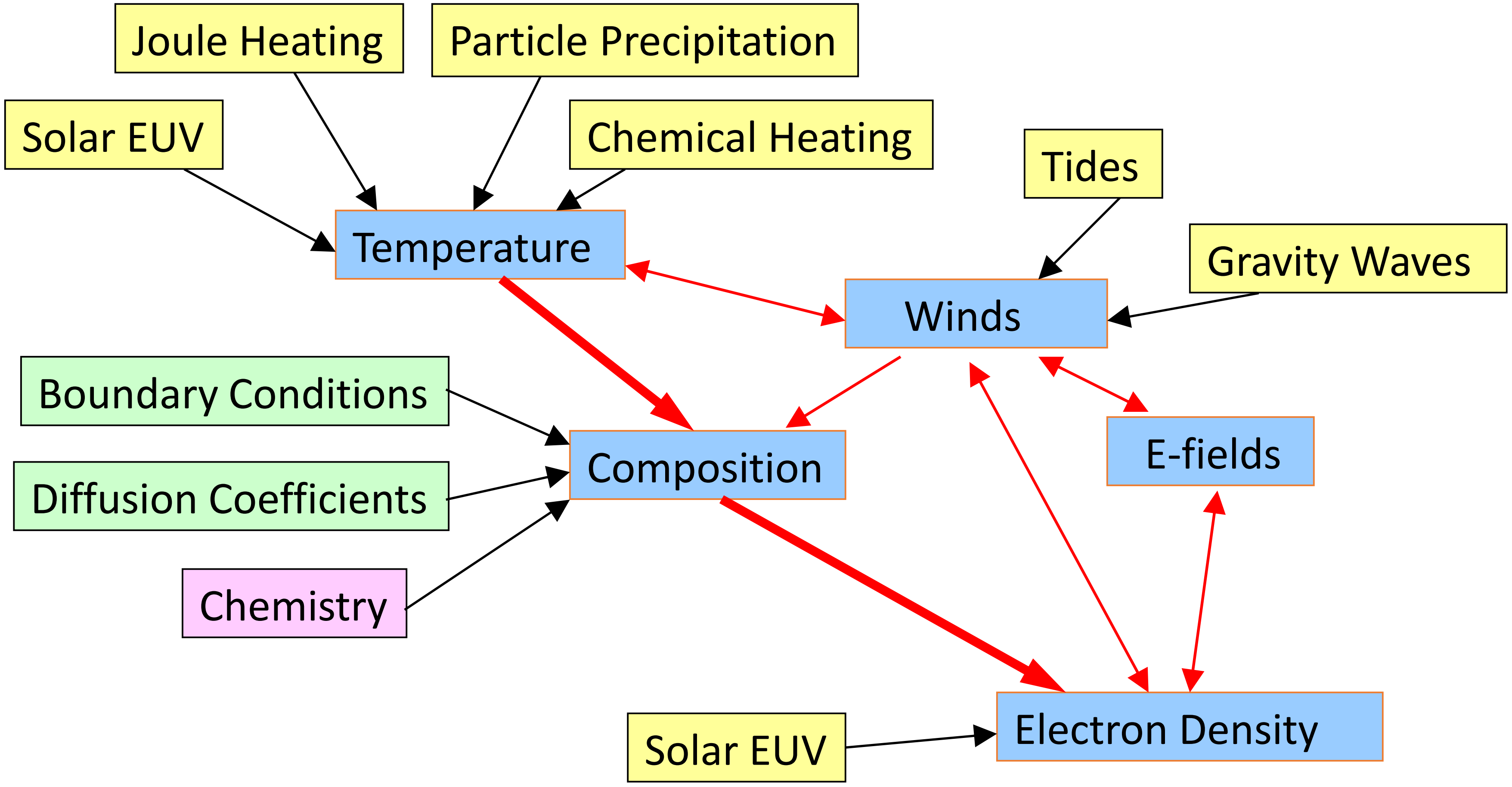
On the other side, MTI is strongly influenced by **wave motions from the lower atmosphere**, and is coupled through **energetic particle precipitation and field-aligned currents**.



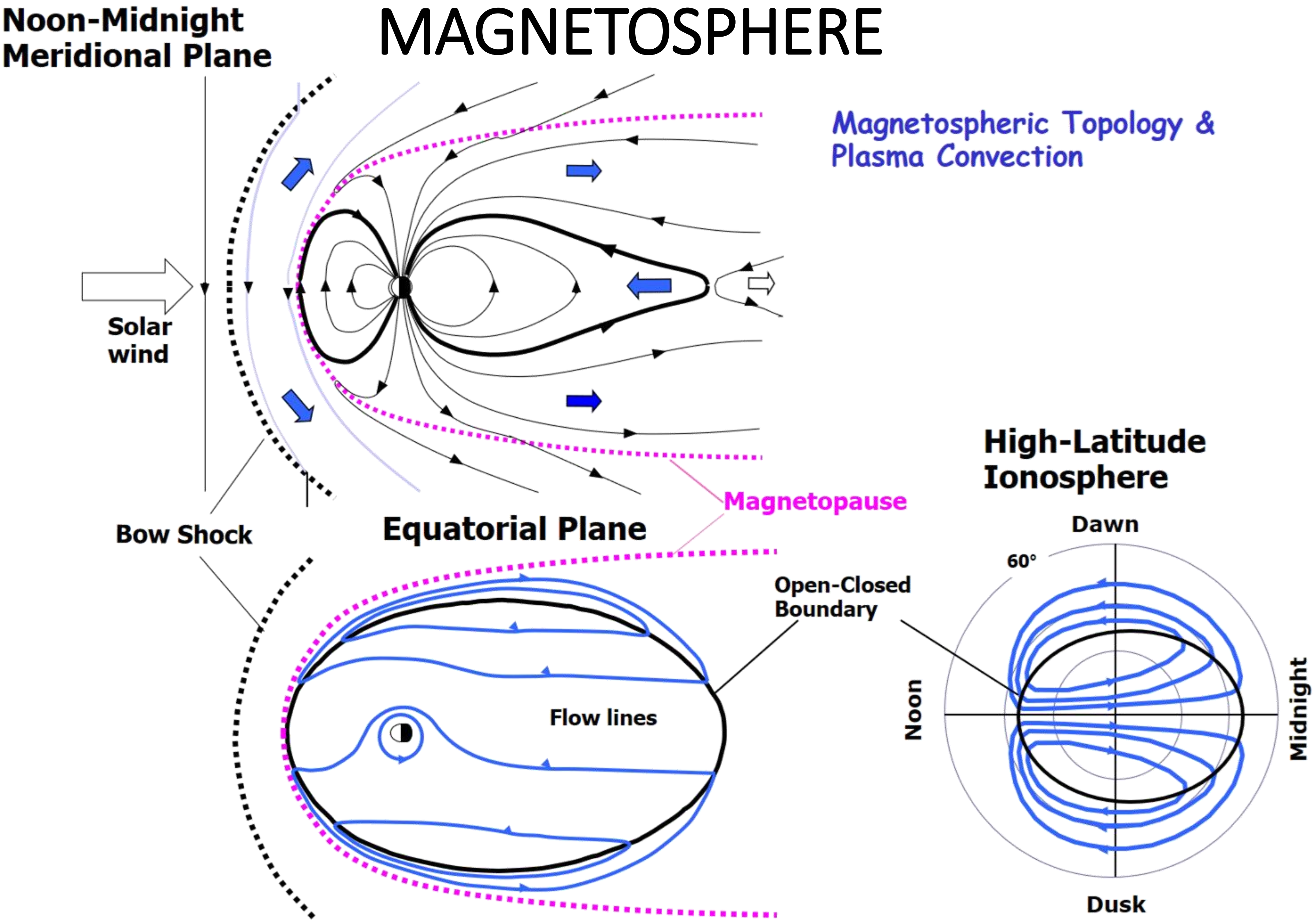
Heelis and Maute (2020)



UNDERSTANDING PHYSICS-BASED MODELS

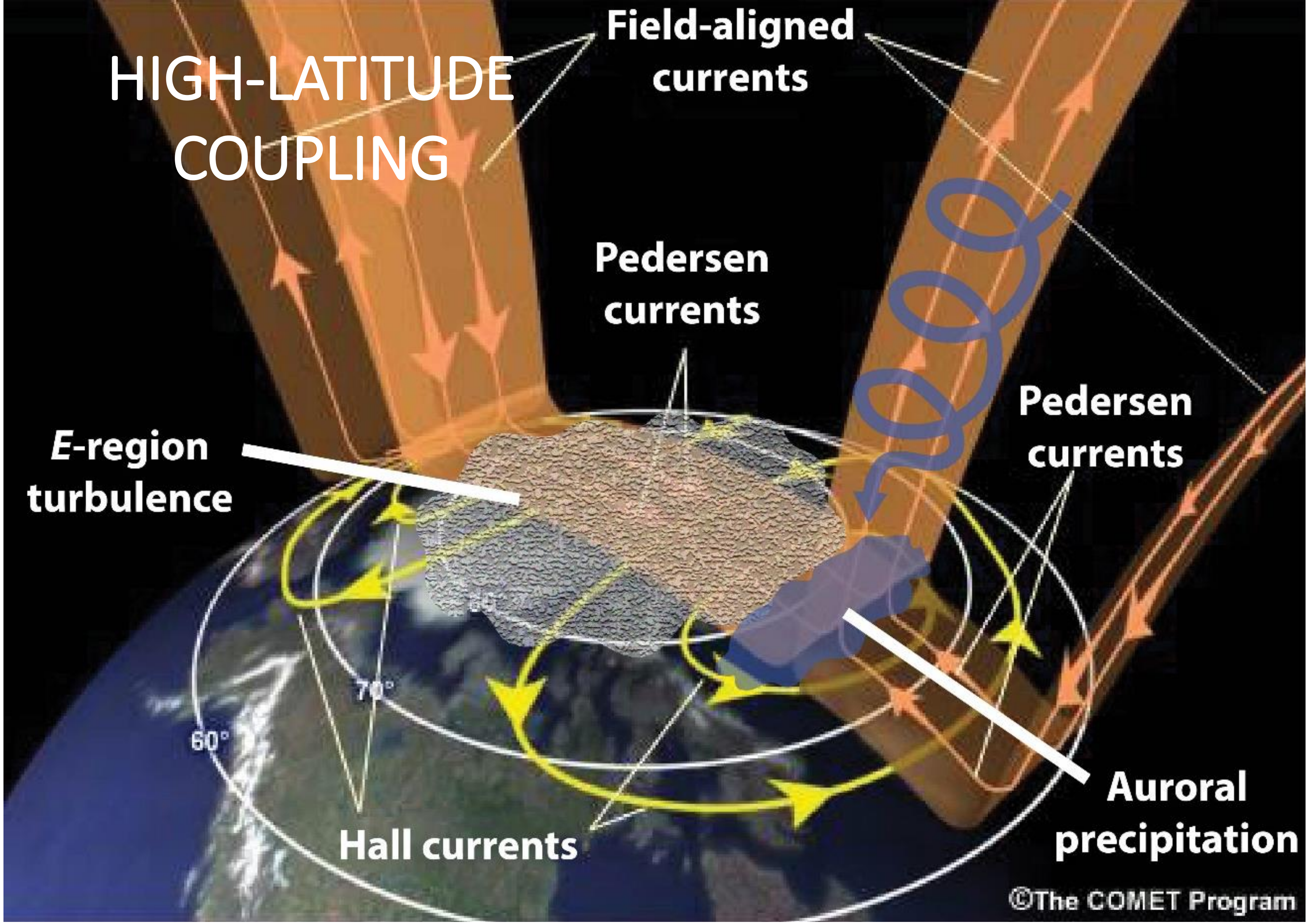


MAGNETOSPHERE



Lu, G (2007) Summer School

HIGH-LATITUDE COUPLING



UPPER-ATMOSPHERE PHYSICS

Atmospheric Density column under Hydrostatic Equilibrium (above ~100 km):

$$N(z_0) = \int_{z_0}^{\infty} n(z_0) \exp\left[-\frac{z - z_0}{kT / m_i g} \right] dz = Hn(z_0)$$

z is altitude
g(z) is acceleration of gravity
r is mass density
k is Boltzmann's constant
m_i is molecular weight of species

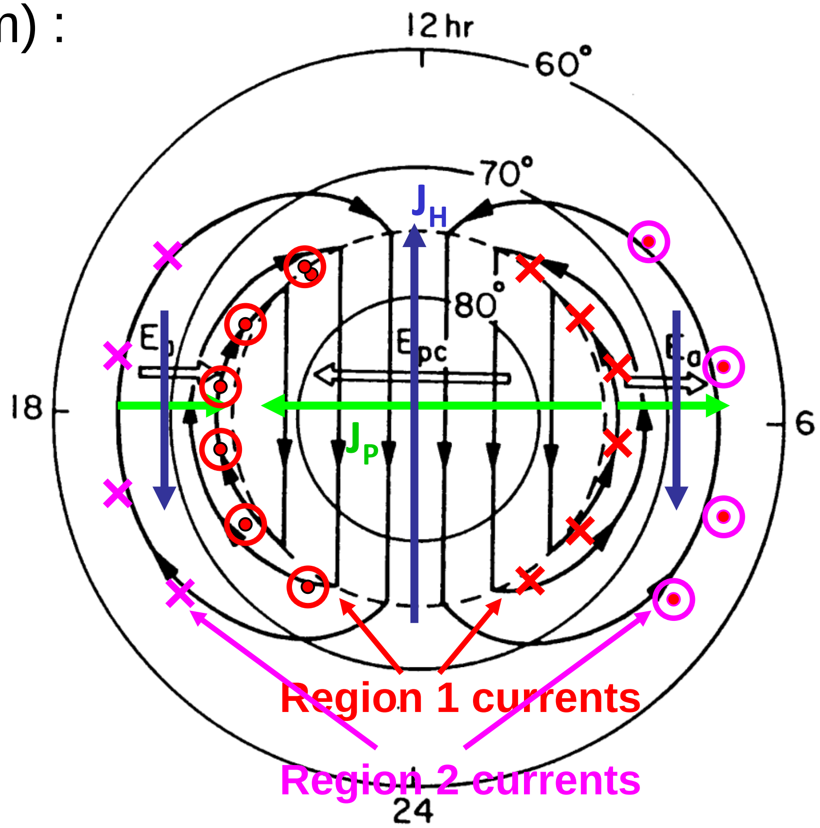
Electromagnetic Energy Dissipation (Poynting's theorem) :

$$\vec{J} \cdot \vec{E} = \underbrace{\left(\Sigma_P \vec{E} + \Sigma_H \vec{b} \times \vec{E} \right)}_{\text{Horizontal current}} \cdot \vec{E} = \underbrace{\Sigma_p E^2}_{\text{Joule heating}}$$

Field-aligned Current: $j_{||} = -\nabla \cdot \vec{J}$

E including neutral wind is:

$$\vec{E} \rightarrow \vec{E}' = (\vec{E} + \vec{U} \times \vec{B}) = -(\underbrace{\vec{V}}_{\text{Plasma drift velocity}} - \underbrace{\vec{U}}_{\text{Neutral wind velocity}}) \times \vec{B}$$



Lu, G (2007) Summer School

UPPER-ATMOSPHERE PHYSICS

Thermodynamic equation:

$$\frac{\partial T_n}{\partial t} = \underbrace{\frac{ge^z}{p_0 C_p}\frac{\partial}{\partial Z}\left\{\frac{K_T}{H}\frac{\partial T_n}{\partial Z} + K_E H^2 C_p \rho\left[\frac{g}{C_p} + \frac{1}{H}\frac{\partial T}{\partial Z}\right]\right\}}_{\text{Molecular conduction}} - \underbrace{\mathbf{v}_n \cdot \nabla T_n}_{\text{Advection}} - \underbrace{W\left(\frac{\partial T_n}{\partial Z} + \frac{R^* T_n}{C_p \bar{m}}\right)}_{\text{Adiabatic}} + \underbrace{\frac{Q^{\exp} - e^z L^{\exp}}{C_p}}_{\text{Heating}} - \underbrace{L^{imp} T_n}_{\text{Radiation}}$$

Momemtum equations:

Zonal velocity

$$\frac{\partial u_n}{\partial t} = \underbrace{\frac{ge^z}{p_0}\frac{\partial}{\partial Z}\left[\frac{\mu \partial u_n}{H \partial Z}\right]}_{\text{Viscosity}} + \underbrace{f^{corr} v_n}_{\text{Coriolis}} + \underbrace{\lambda_{xx}\left(v_{ExB,x} - u_n\right) + \lambda_{xy}\left(v_{ExB,y} - u_n\right)}_{\text{Ion drag}} - \underbrace{\mathbf{v}_n \cdot \nabla u_n}_{\text{Horizontal advection}} + \underbrace{\frac{u_n v_n}{R_E}\tan\lambda}_{\text{Mommentum}} - \underbrace{\frac{1}{R_E \cos\lambda}\frac{\partial \Phi}{\partial \phi}}_{\text{Pressure gradient}} - \underbrace{W\frac{\partial u_n}{\partial Z}}_{\text{Vertical advection}} - \underbrace{hd_u}_{\text{Horizontal diffusion}}$$

Meridional velocity

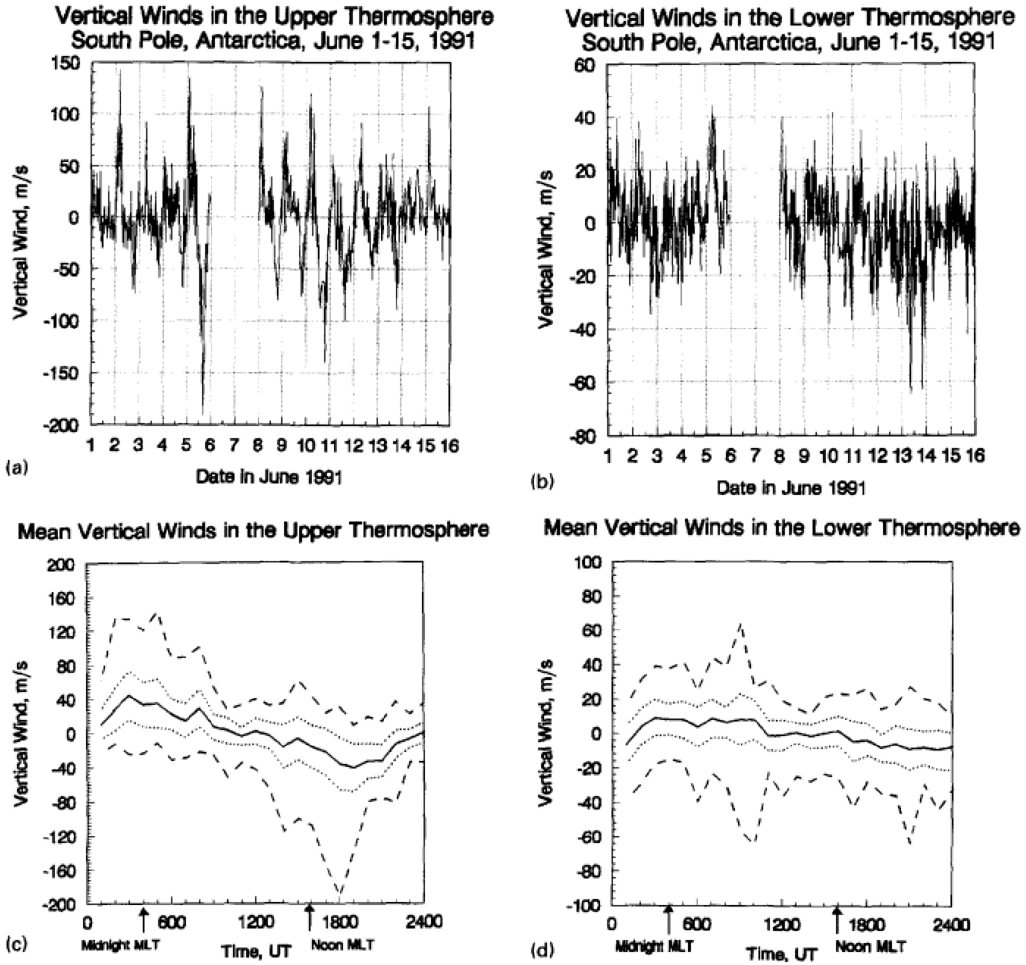
$$\frac{\partial v_n}{\partial t} = \underbrace{\frac{ge^z}{p_0}\frac{\partial}{\partial Z}\left[\frac{\mu \partial v_n}{H \partial Z}\right]}_{\text{Viscosity}} - \underbrace{f^{corr} v_n}_{\text{Coriolis}} + \underbrace{\lambda_{yy}\left(v_{ExB,x} - u_n\right) + \lambda_{xy}\left(v_{ExB,y} - u_n\right)}_{\text{Ion drag}} - \underbrace{\mathbf{v}_n \cdot \nabla v_n}_{\text{Horizontal advection}} + \underbrace{\frac{u_n v_n}{R_E}\tan\lambda}_{\text{Mommentum}} - \underbrace{\frac{1}{R_E}\frac{\partial \Phi}{\partial \lambda}}_{\text{Pressure gradient}} - \underbrace{W\frac{\partial v_n}{\partial Z}}_{\text{Vertical advection}} - \underbrace{hd_v}_{\text{Horizontal diffusion}}$$

Continuity equation:

$$\frac{d\Psi}{dt} = \underbrace{-e^z \tau^{-1}\frac{d}{dz}\left\{\frac{m}{m_{N_2}}\left(\frac{T_0}{T}\right)^{0.25}\alpha^{-1} L\Psi\right\}}_{\text{Molecular diffusion}} + \underbrace{e^z\frac{d}{dz}\left\{K(z)e^{-z}\frac{d\Psi}{dz}\right\}}_{\text{Eddy diffusion}} - \underbrace{V \cdot \nabla\Psi}_{\text{Horizontal advection}} - \underbrace{\omega\frac{d\Psi}{dz}}_{\text{Vertical advection}} + \underbrace{S - R}_{\text{production and recombination}}$$

Maute, A (2018)

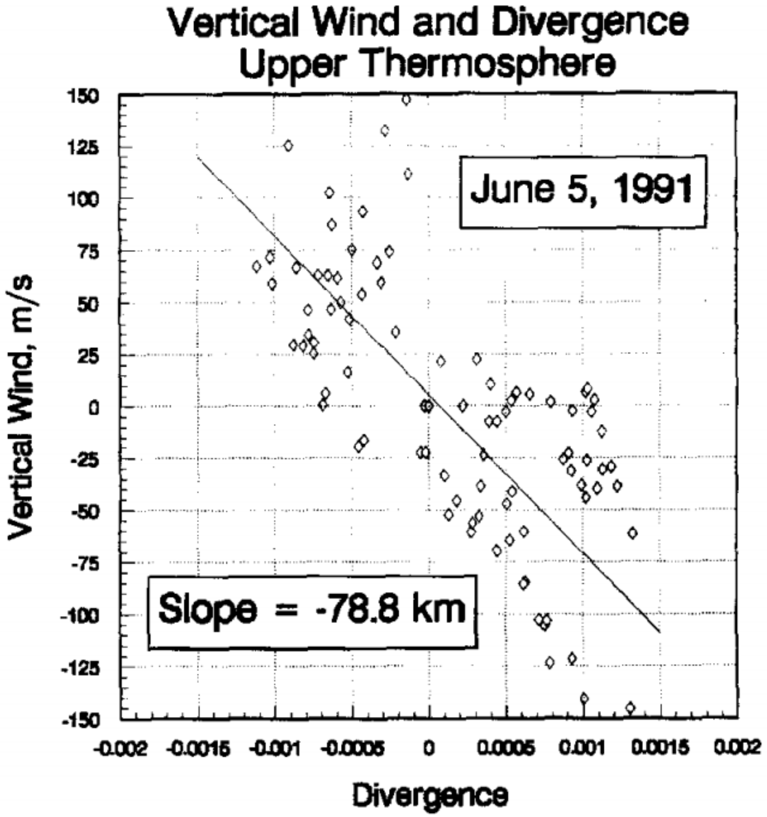
VERTICAL WINDS



$$\frac{\partial p}{\partial t} = -g\int_h^\infty \left[\frac{\partial(\rho u)}{\partial x} + \frac{\partial(\rho v)}{\partial y}\right] dz + g\,(\rho w)_h$$

$$u_r = H\,div(\boldsymbol{u_h}) \qquad T \gg \tau = \frac{H}{w}$$

* Burnside et al., 1981, JGR



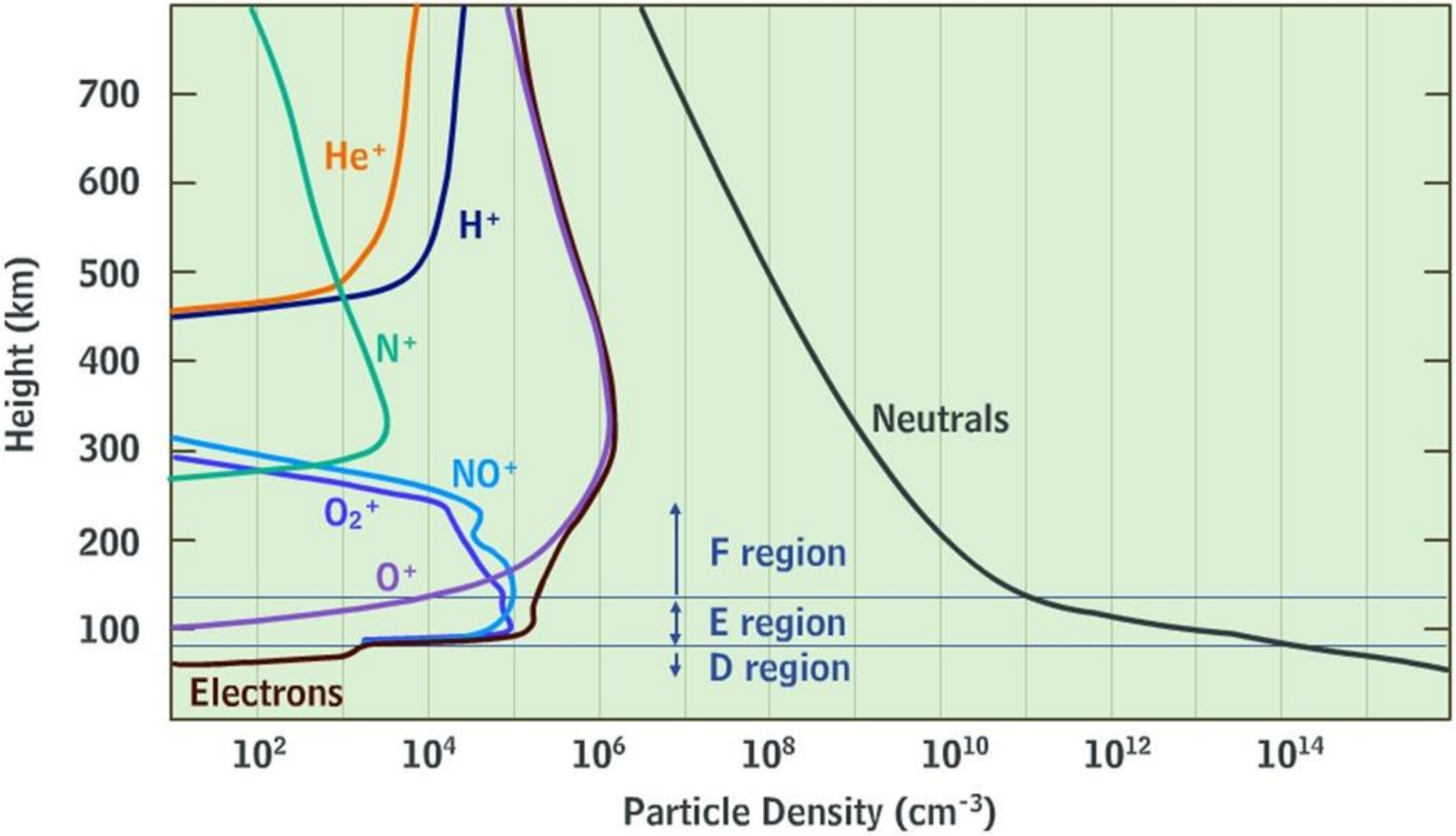
$$\frac{\partial u_r}{\partial r} = \frac{u_\theta \partial u_r}{u_r r \partial\theta} + \frac{u_\varphi \partial u_r}{u_r r\cos\theta\partial\varphi} \sim \frac{u_\theta}{l_\theta} + \frac{u_\varphi}{l_\varphi} \sim div(\boldsymbol{u_h})$$

$$E = \rho u^2 = const \rightarrow u_r \sim e^{\frac{z}{2H}} \rightarrow \frac{\partial u_r}{\partial r} \sim \frac{u_r}{2H}$$

$$u_r \sim -2H div(\boldsymbol{u_h})$$

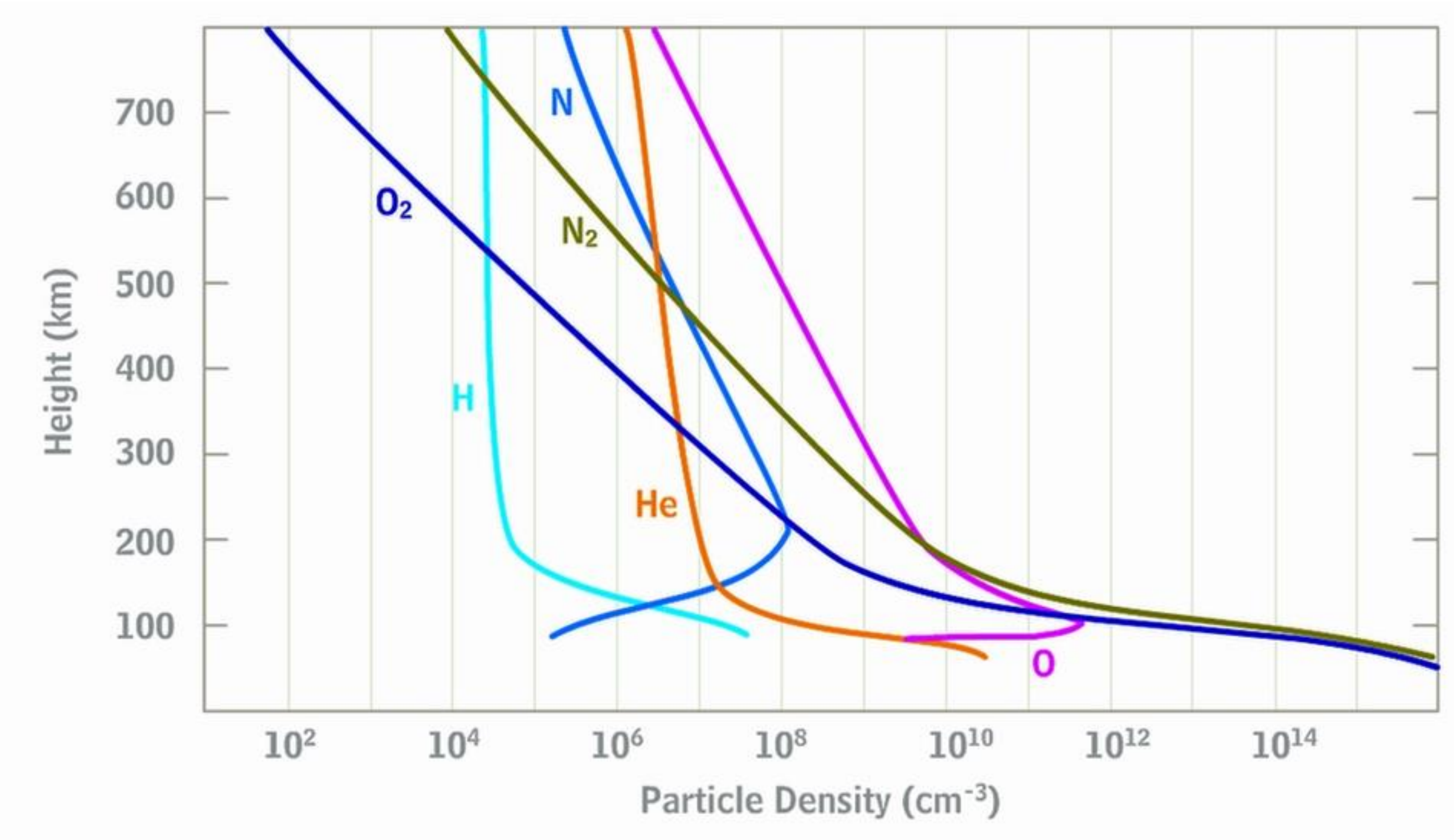
* Smith and Hernandez, 1995, JASTP

UPPER ATMOSPHERE COMPOSITION



http://www.meted.ucar.edu

NEUTRALS



http://www.meted.ucar.edu

UPPER-ATMOSPHERE CHEMICAL PROCESSES

Photoionization:

$h\upsilon + O \Rightarrow O^+ + e^-$

$h\upsilon + O_2 \Rightarrow O_2^+ + e^-$

$h\upsilon + N_2 \Rightarrow N_2^+ + e^-$

Collisional Ionization:

$e^- + O \Rightarrow O^+ + 2e^-$

Charge Exchange:

$H + O^+ \Rightarrow H^+ + O$

$O_2 + O^+ \Rightarrow O_2^+ + O$

$N_2 + O^+ \Rightarrow N_2^+ + O$

Conversion:

$N_2^+ + O \Rightarrow NO^+ + O$

$N_2 + O^+ \Rightarrow NO^+ + O$

Recombination:

$O + O + N_2 \Rightarrow O_2 + N_2$

Dissociative Recombination:

$O_2^+ + e^- \Rightarrow O + O$

$N_2^+ + e^- \Rightarrow N + N$

$NO^+ + e^- \Rightarrow N + O$

Radiative Recombination:

$O^+ + e^- \Rightarrow h\upsilon + O$

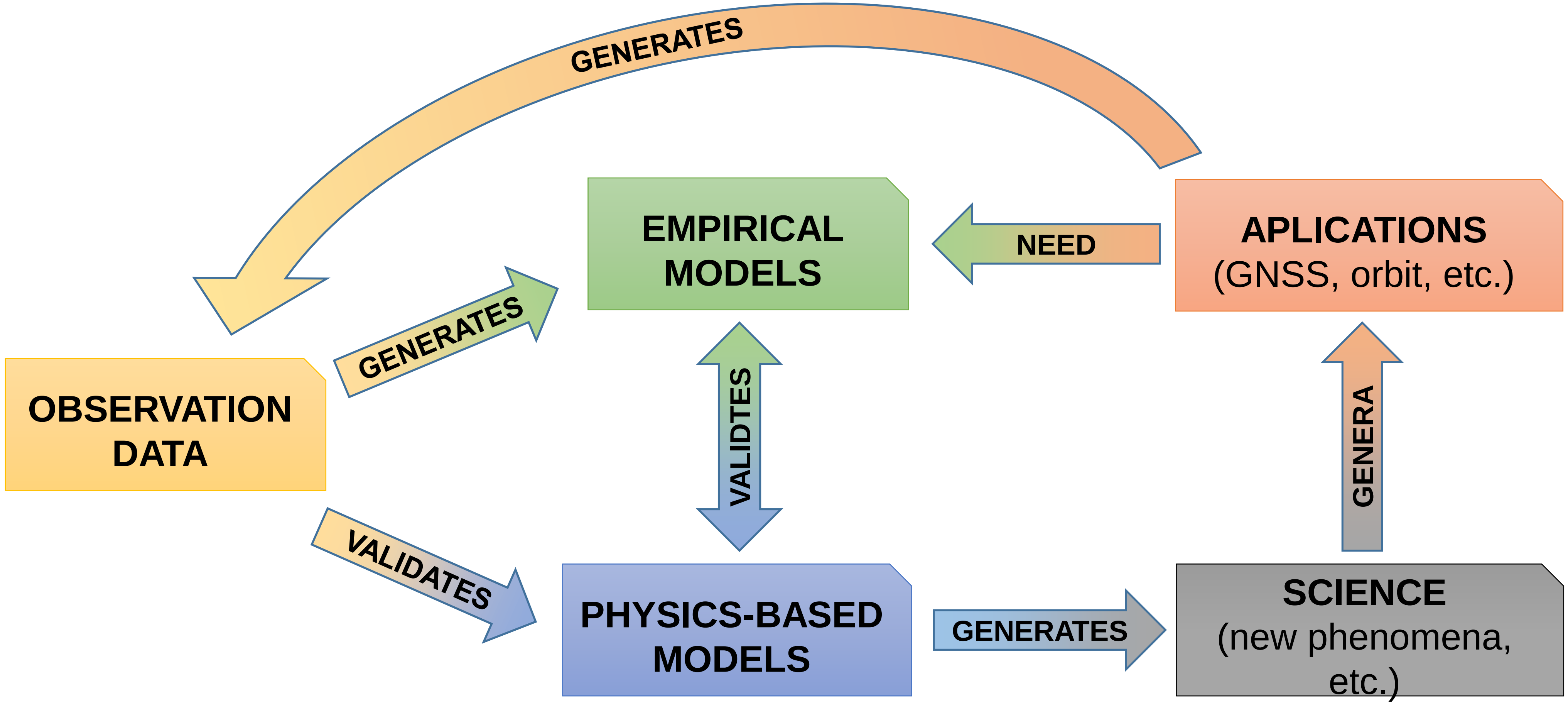
STRATEGY

A CHALLENGE TO UNDERSTAND THE MIT SYSTEM

Addressing the challenges related to the coupled MIT system requires significant advances in **geodetic observations** of plasma and neutral density, “compositions”, and “velocities”, observations of energetic particles and “magnetic field perturbations” both in space and on ground, as well as **advanced theoretic and numerical modeling** capabilities.

GENERAL DIAGRAM

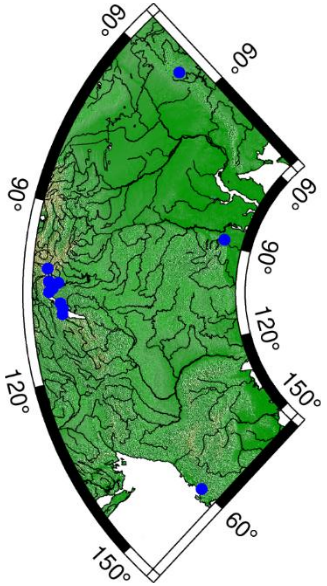
General flow diagram and interrelations between the data, models, applications, and science.



SELECTION OF ACHIEVEMENTS IN LAST **2 YEARS**

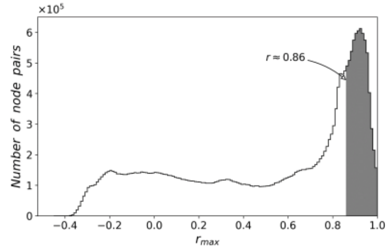
SibNet GNSS network for 1Hz phase and pseudo range observations

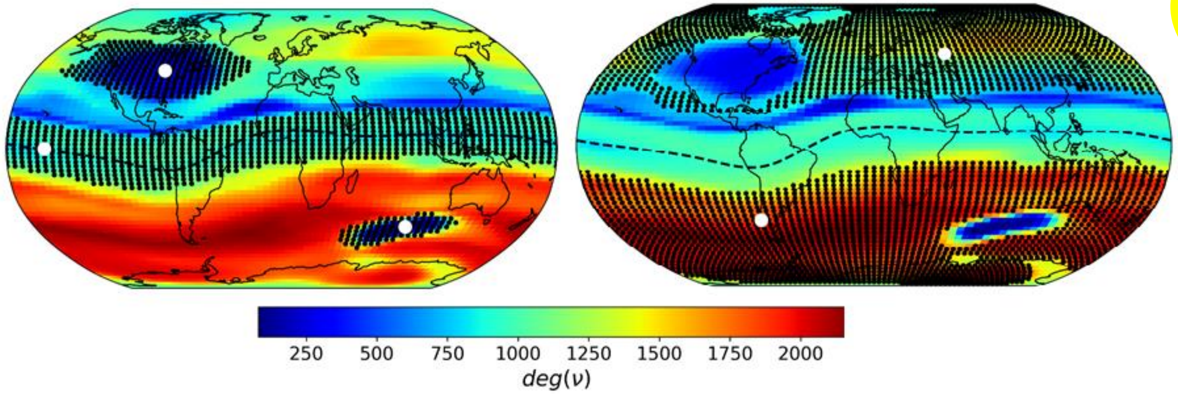
Yury Yasyukevich



Network theory to reveal ionospheric anomalies

Yury Yasyukevich

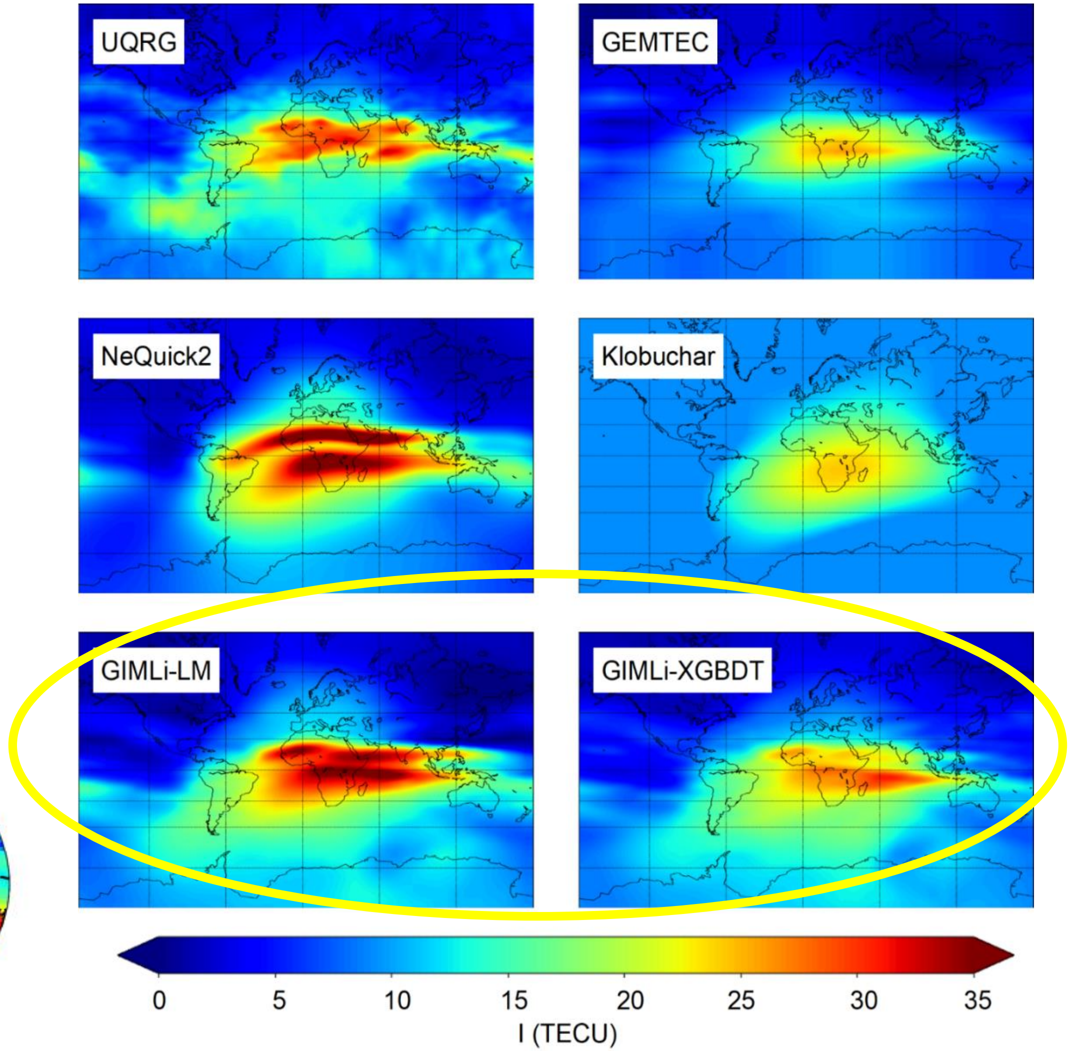




GIMLi

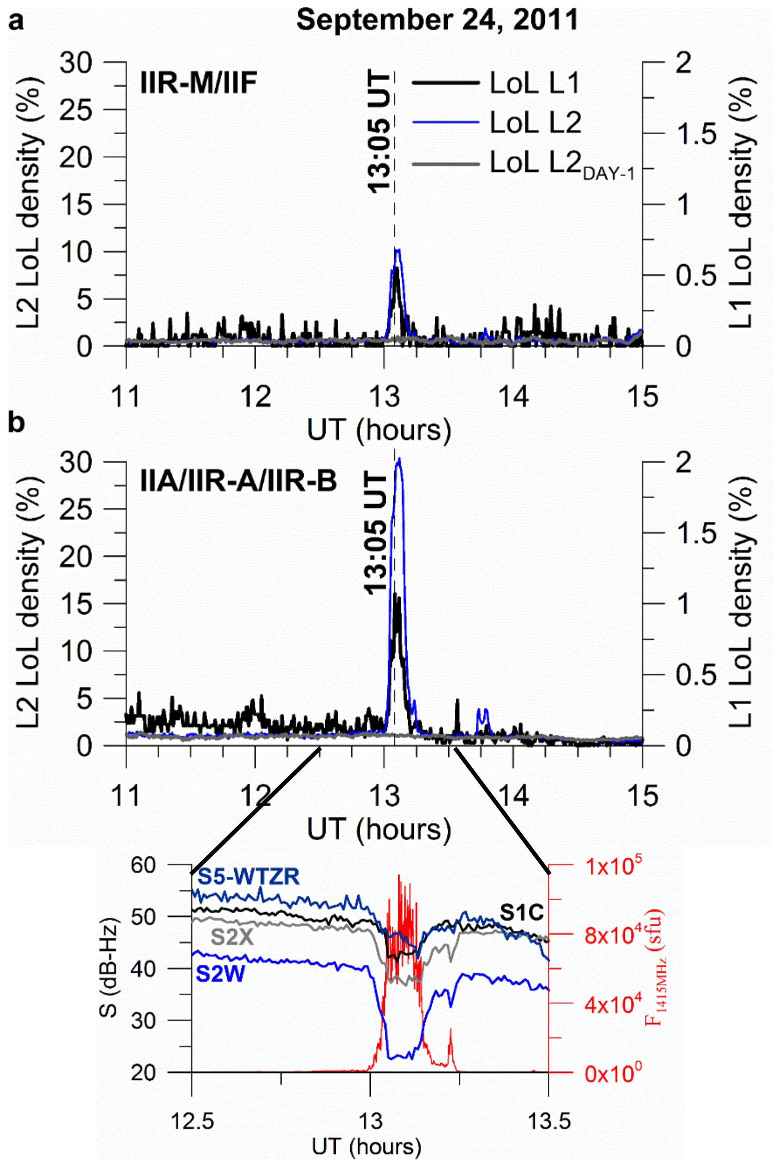
Global TEC Model based on Machine Learning

Yury Yasyukevich



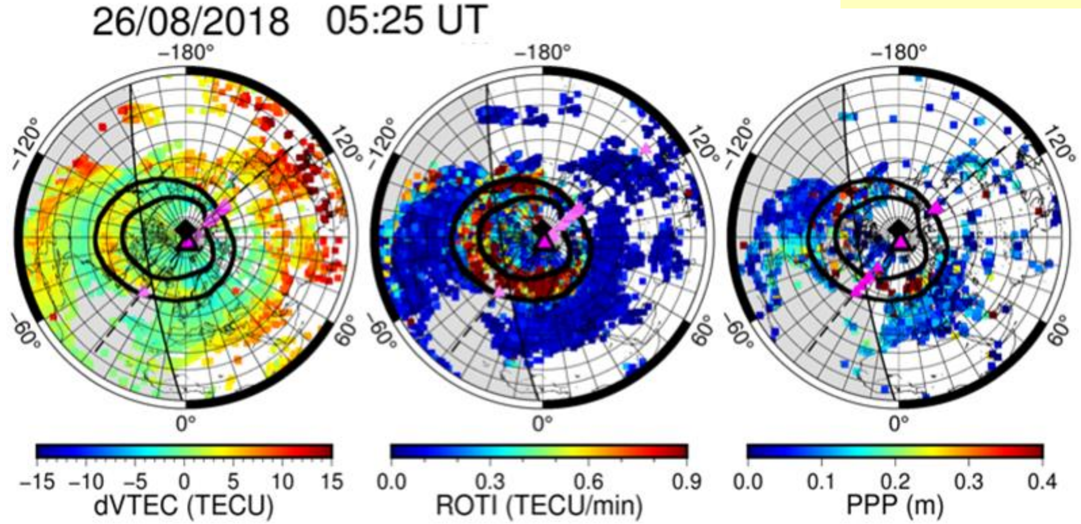
New GNSS signals enhance the system performance during solar radio bursts

Yury Yasyukevich



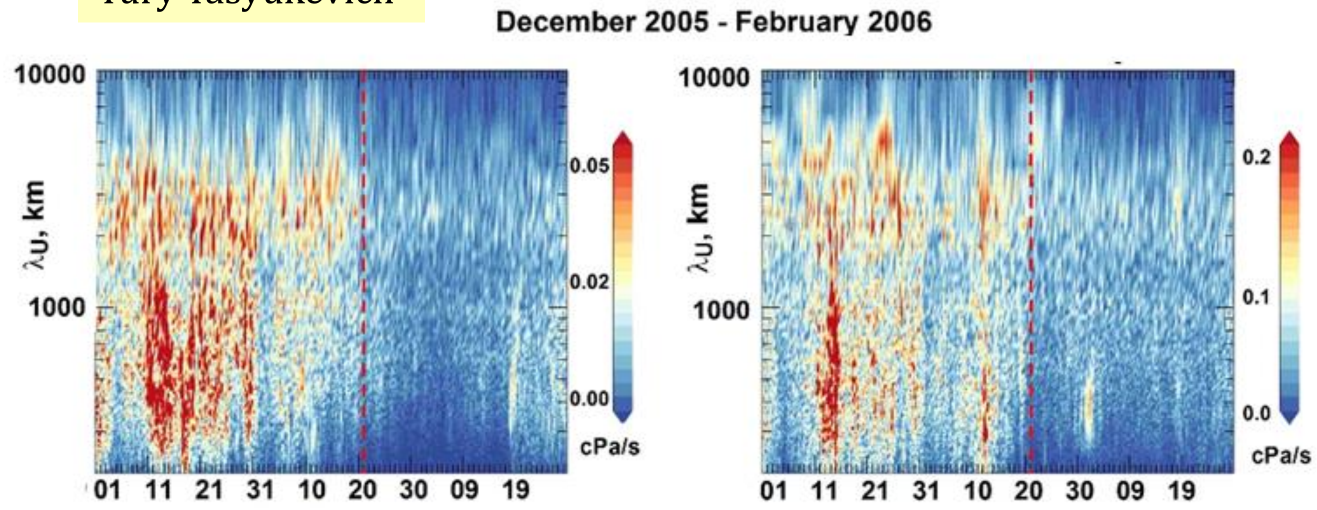
Ionospheric disturbances and irregularities during the 25-26 August 2018 geomagnetic storm.

Yury Yasyukevich



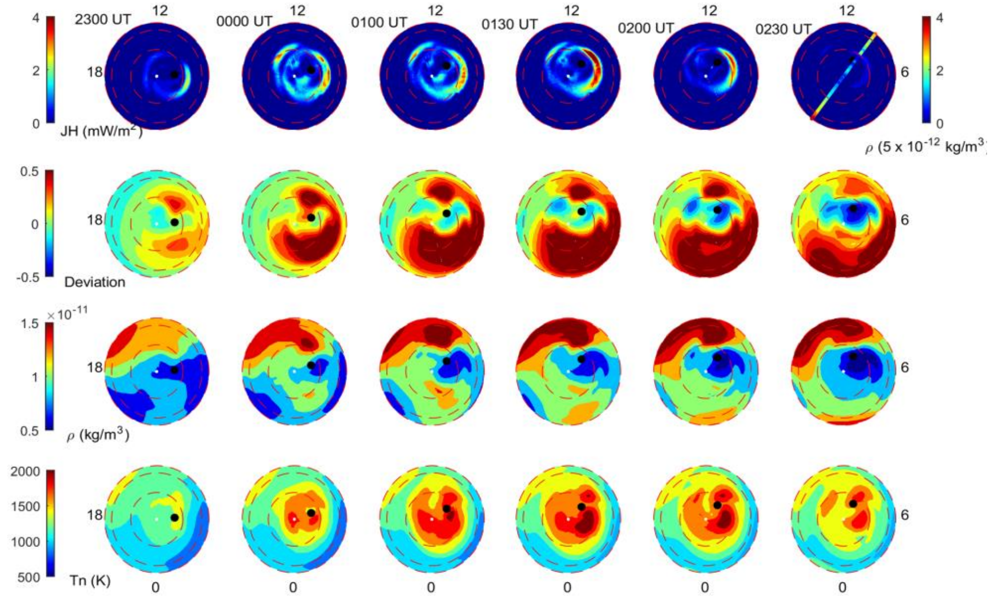
Sudden stratospheric warming influence ionospheric internal acoustic gravity waves.

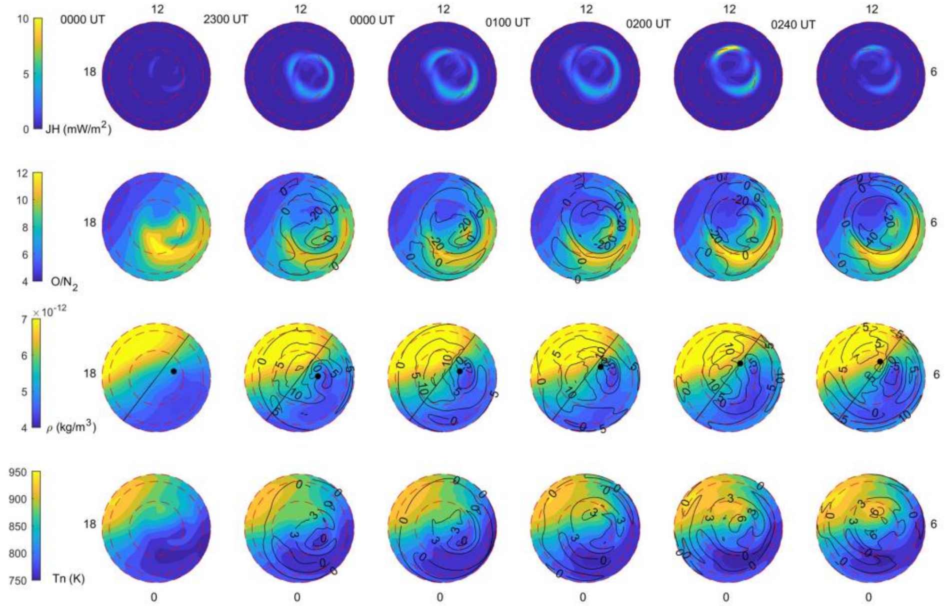
Yury Yasyukevich



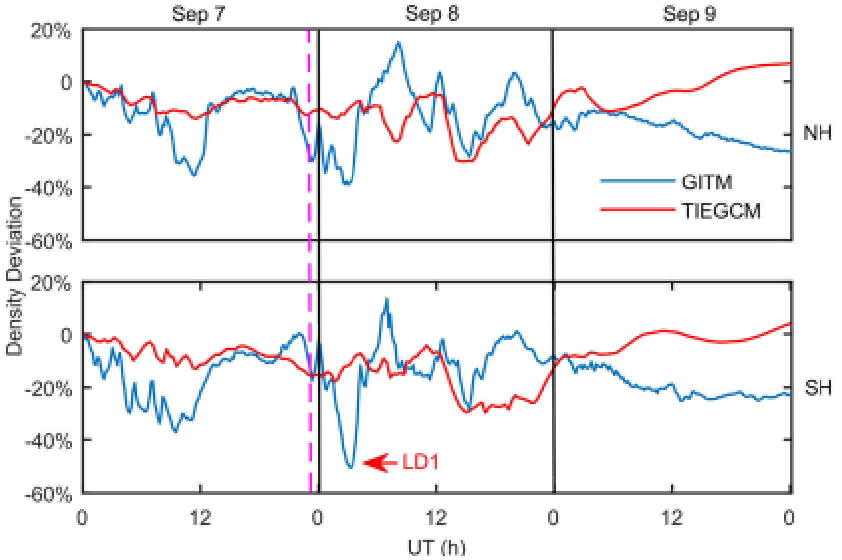
Physics-based models comparisons: GITM vs TIEGCM

LiangLiang Yuan

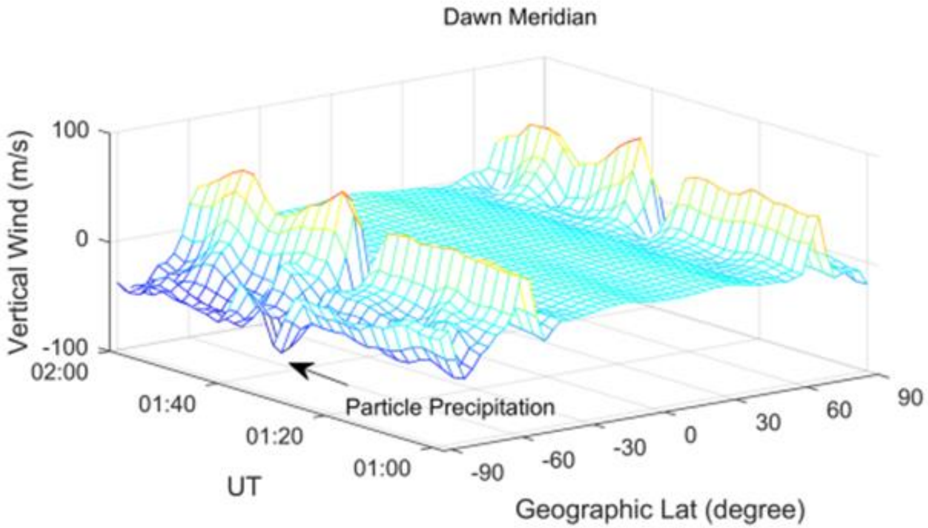




Vertical wind and density deviation from Physics-based models during geomagnetic storms



LiangLiang Yuan



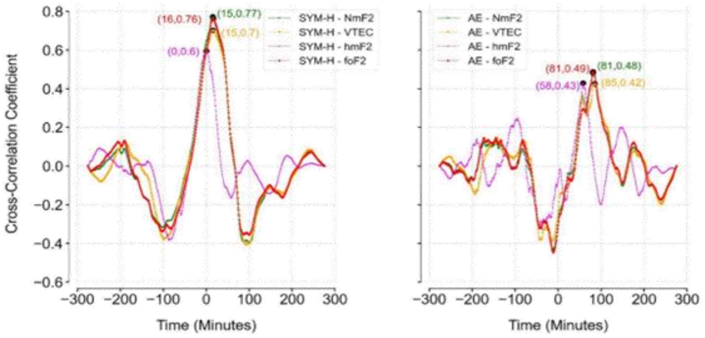
Radio Science
AGU ADVANCING EARTH AND SPACE SCIENCE
RESEARCH ARTICLE
10.1029/2022RS007430

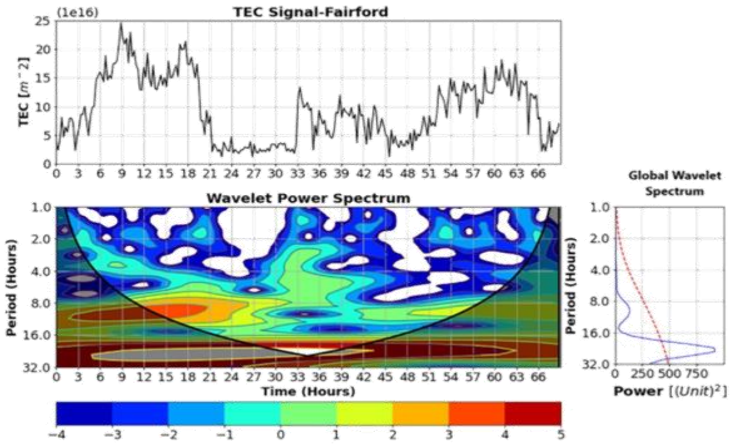
Ionospheric Signatures During G2, G3 and G4 Storms in Mid-Latitude

Subodh Dahal[1], Binod Adhikari[2], Anil Kumar Khadka[1], Ashok Silwal[3], Suresh Kumar Gupta[1], and Narayan Prasad Chapagain[4]

Key Points:

- During the negative phase of the G4 storm, the highest decrease in ionospheric variables (foF2, total electron content, and NmF2) was seen
- We observed noticeable power shifts in the signal of the ionospheric parameters toward the lower Fourier period band during negative phase
- The correlation between the Symmetric H-component and auroral electrojet indices varies according to geomagnetic storm strength and interplanetary origins





Brazilian Journal of Physics (2022) 52:156
https://doi.org/10.1007/s13538-022-01160-1
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GENERAL AND APPLIED PHYSICS
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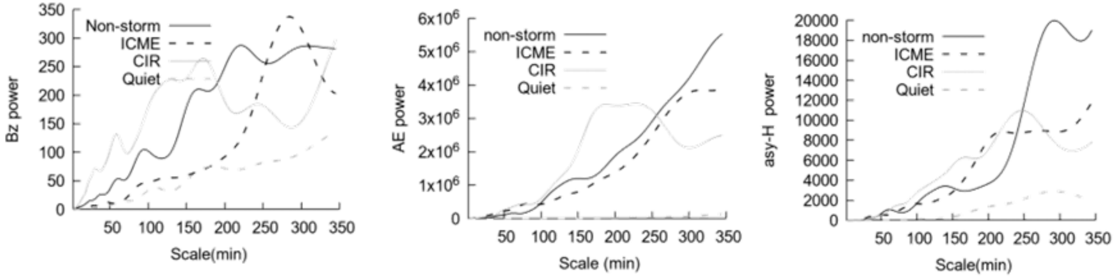
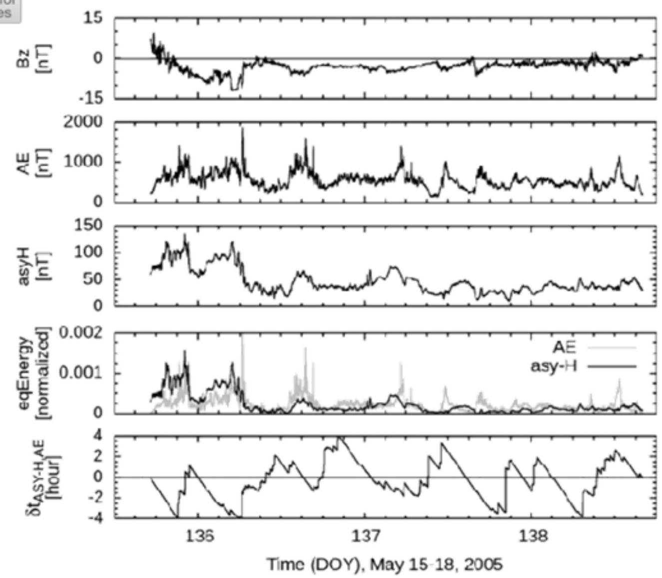
Interrelationships of Similar Magnetic Effects at Low and High Latitudes During High-Intensity Long-Duration Auroral Activity Events: Case Studies

Odim Mendes[1] · Binod Adhikari[2,3] · Margarete Oliveira Domingues[1] · Ezequiel Echer[1] · Rodrigo Seo Takeshi[1]



(c) ICME



A study of vTEC above Nepal exploring different calibration techniques, including a comparison with the NeQuick-2 model

P. Poudel, A. Silwal, B. D. Ghimire, S. P. Gautam, M. Karki, N. P. Chapagain, B. Adhikari, D. Pandit & C. Amory-Mazaudier

Astrophysics and Space Science **367**, Article number: 41 (2022) | Cite this article

remote sensing MDPI

Signatures of Equatorial Plasma Bubbles and Ionospheric Scintillations from Magnetometer and GNSS Observations in the Indian Longitudes during the Space Weather Events of Early September 2017

by Ram Kumar Vankadara [1], Sampad Kumar Panda [1,*], Christine Amory-Mazaudier [2,3], Rolland Fleury [4], Venkata Ratnam Devanaboyina [1], Tarun Kumar Pant [5], Punyawi Jamjareegulgarn [6], Mohd Anul Haq [7], Daniel Okoh [8,9] and Gopi Krishna Seemala [10]

Remote Sens. **2022**, *14*(3), 652; https://doi.org/10.3390/rs14030652

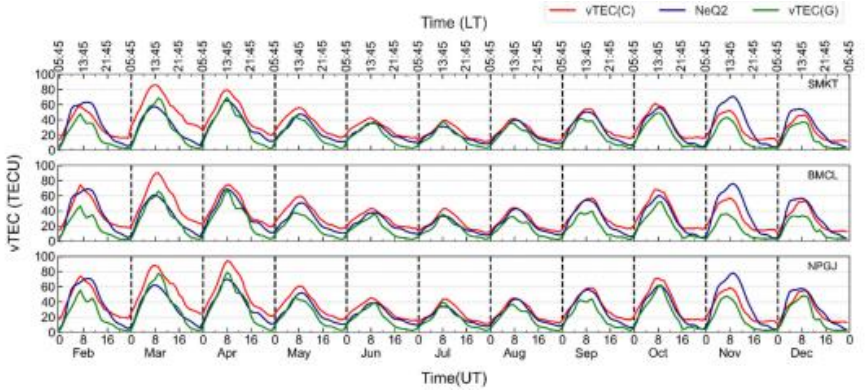
ELSEVIER

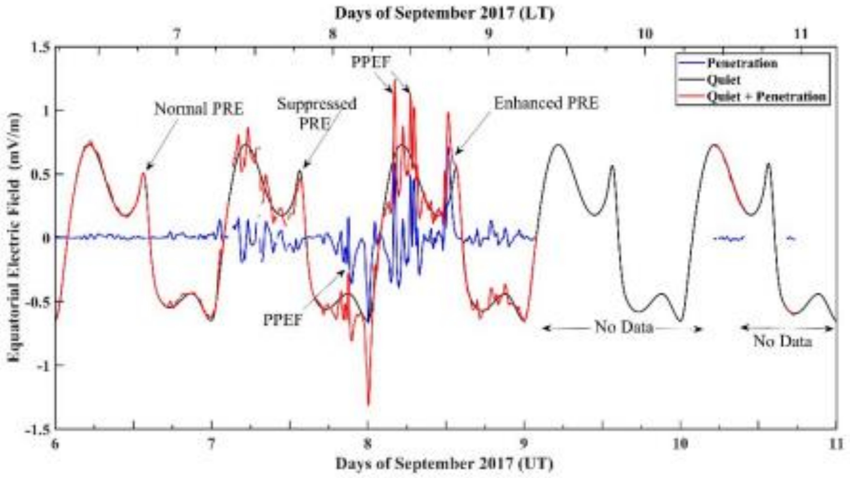
Advances in Space Research

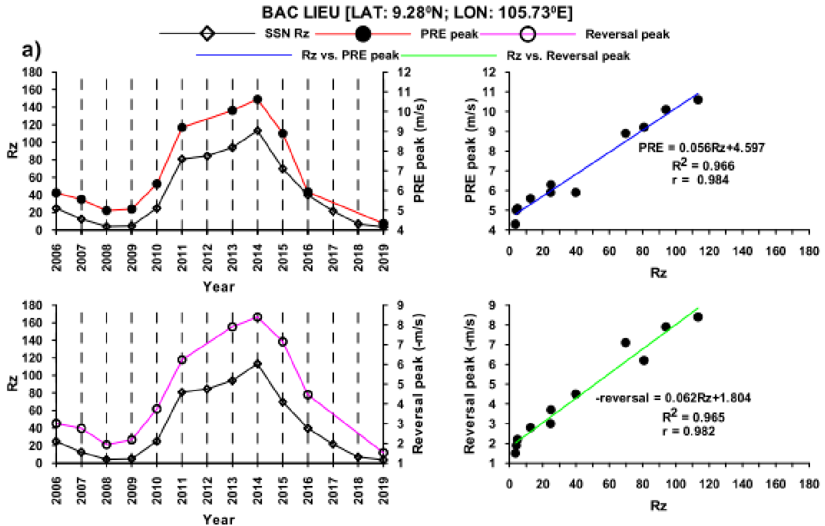
Volume 70, Issue 2, 15 July 2022, Pages 411-426

Nighttime morphology of vertical plasma drifts over Vietnam during different seasons and phases of sunspot cycles

Hong Pham Thi Thu [a, b], Christine Amory Mazaudier [c], Minh Le Huy [a, b], Susumu Saito [d], Kornyanat Hozumi [e], Dung Nguyen Thanh [a, b], Ngoc Luong Thi [a]







Advances in Space Research
Volume 69, Issue 1, 1 January 2022, Pages 220-235

Middle and low latitudes hemispheric asymmetries in ∑O/N2 and TEC during intense magnetic storms of solar cycle 24

Waqar Younas [a], Majid Khan [a], C. Amory-Mazaudier [b, c], Paul O. Amaechi [d], R. Fleury [e]

sensors MDPI

B2 Thickness Parameter Response to Equinoctial Geomagnetic Storms

by Yenca Migoya-Orué [1], Katy Alazo-Cuartas [1], Anton Kashcheyev [2], Christine Amory-Mazaudier [1,3], Sandro Radicella [1,*], Bruno Nava [1], Rolland Fleury [4] and Rodolfo Ezquer [5]

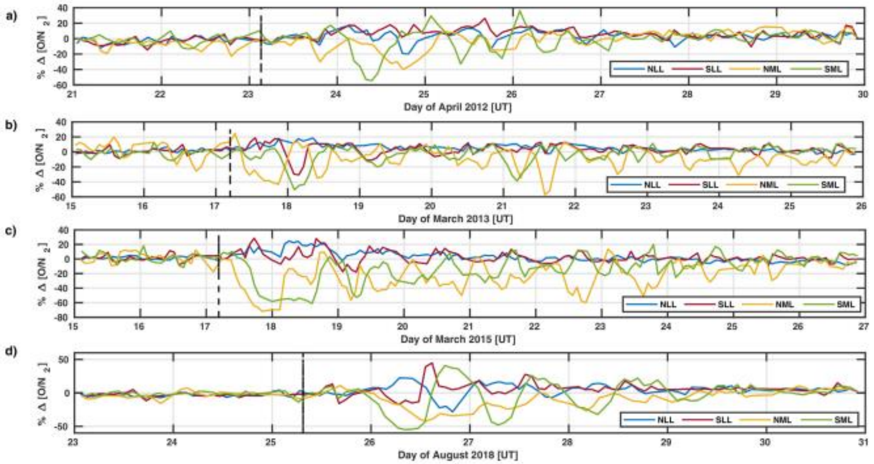
Sensors **2021**, *21*(21), 7369; https://doi.org/10.3390/s21217369

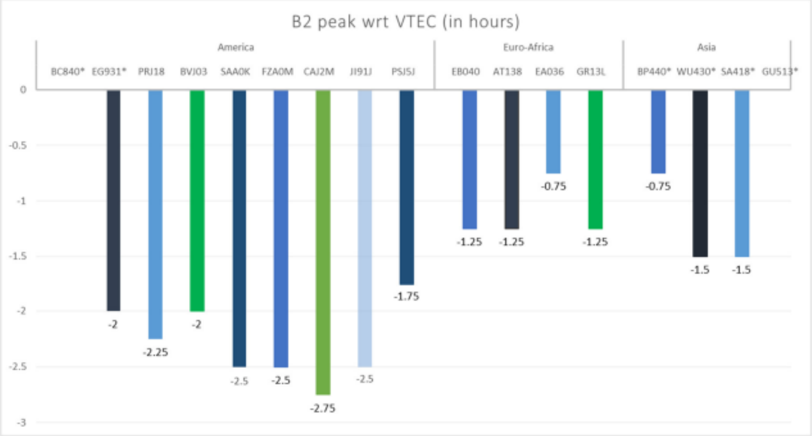
atmosphere MDPI

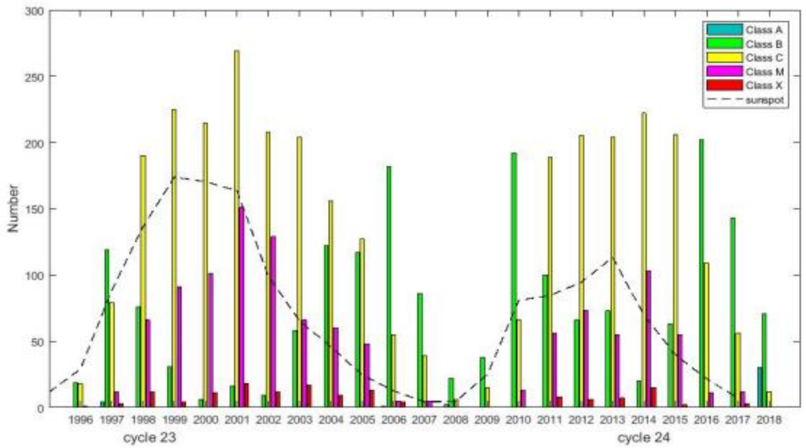
A Study of Solar Flare Effects on the Geomagnetic Field Components during Solar Cycles 23 and 24

by Oswald Didier Franck Grodji [1,*], Vafi Doumbia [1,*], Paul Obiakara Amaechi [2,3,*], Christine Amory-Mazaudier [4,5,6], Kouassi N'guessan [1], Kassamba Abdel Aziz Diaby [1], Tuo Zie [1] and Kouadio Boka [1]

Atmosphere **2022**, *13*(1), 69; https://doi.org/10.3390/atmos13010069







Journal of Scientific and Engineering Research

Effects of Ionospheric Plasma Irregularities at the Equatorial Zone on GPS Signal

Amath NDAO[1], Idrissa GAYE[1]*, Rolland Fleury[2], Cheikh SARR[1], Christine Amory Mazaudier[3]

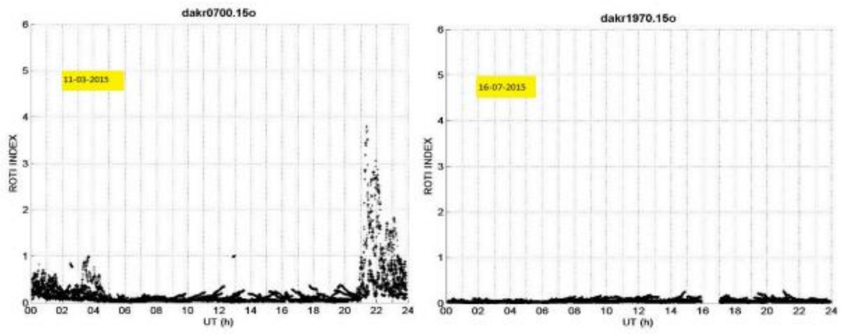


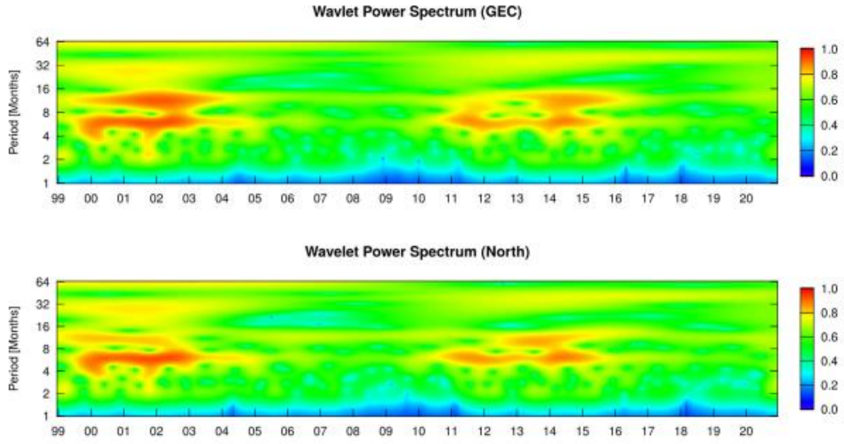
Figure 5a *Figure 5b*

Plots of ROTI index variation respectively for March 11th 2015 and July 16th 2015 of the Dakar station (DAKR)

Advances in Space Research

Climatology of global, hemispheric and regional electron content variations during the solar cycles 23 and 24

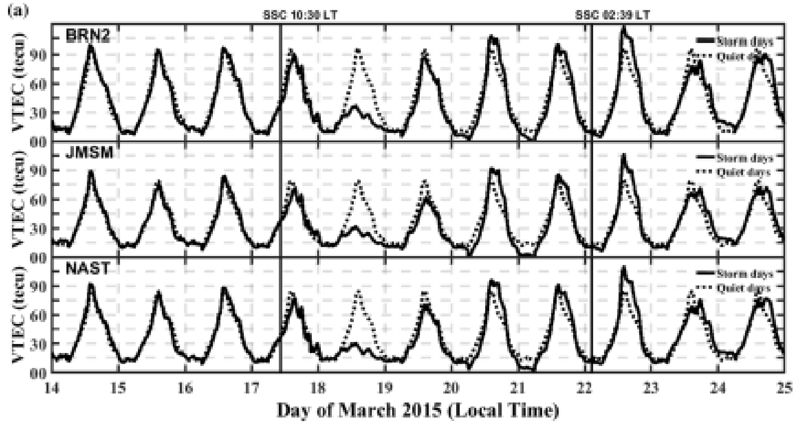
Waqar Younas [a], C. Amory-Mazaudier [b,c], Majid Khan [a,*], Paul O. Amaechi [d]



Indian J Phys

VTEC observations of intense geomagnetic storms above Nepal: comparison with satellite data, CODE and IGSG models

D Pandit[1,6]*, C Amory-Mazaudier[2,3], R Fleury[4], N P Chapagain[5] and B Adhikari[6]



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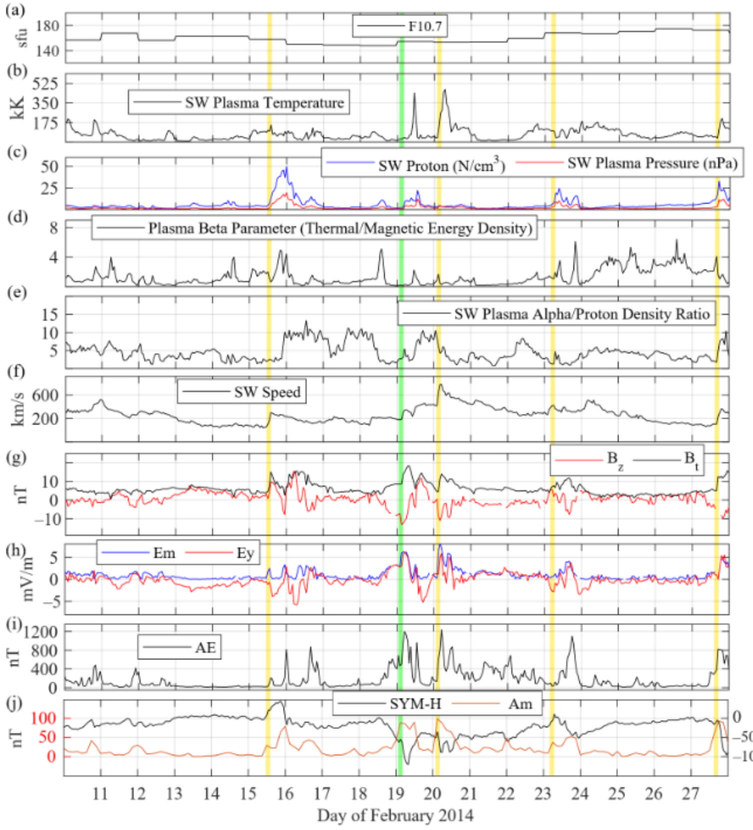
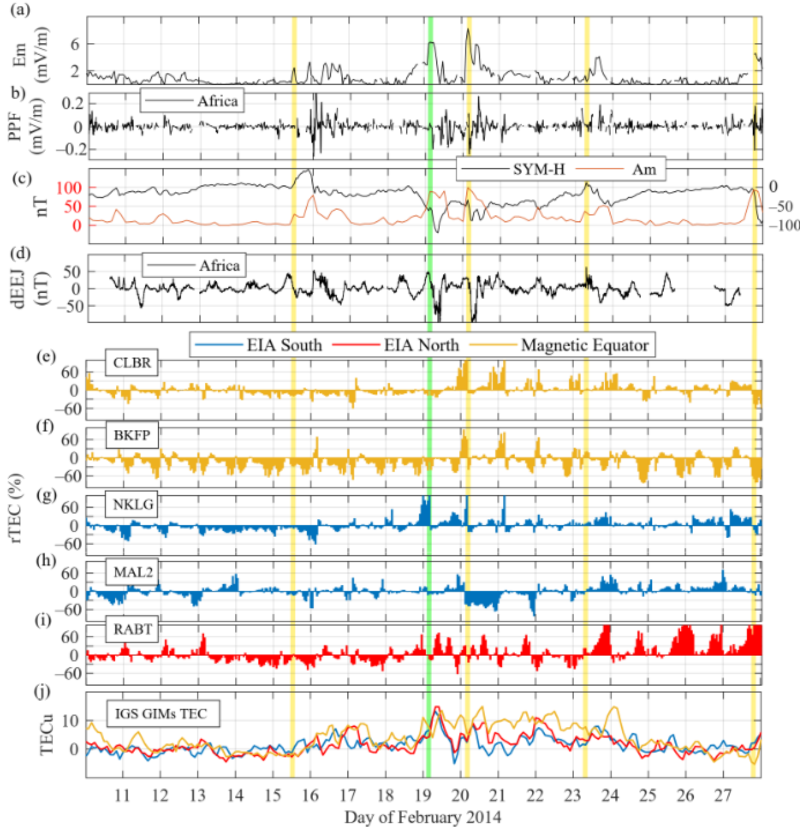
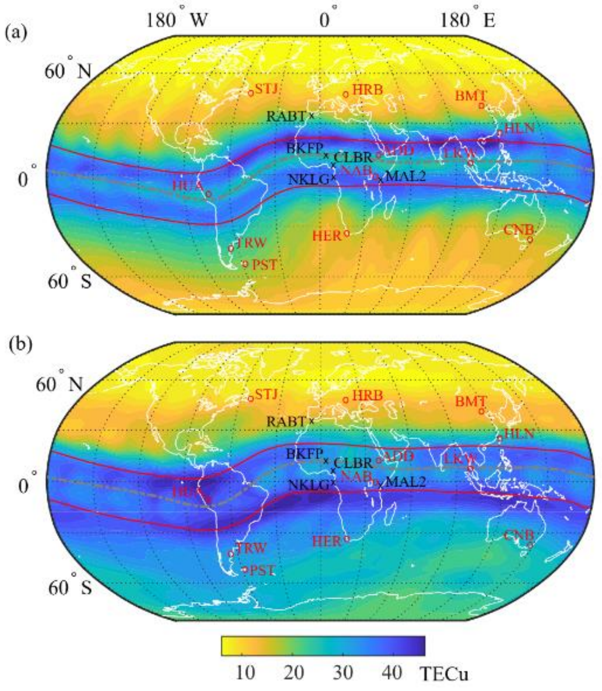
Article

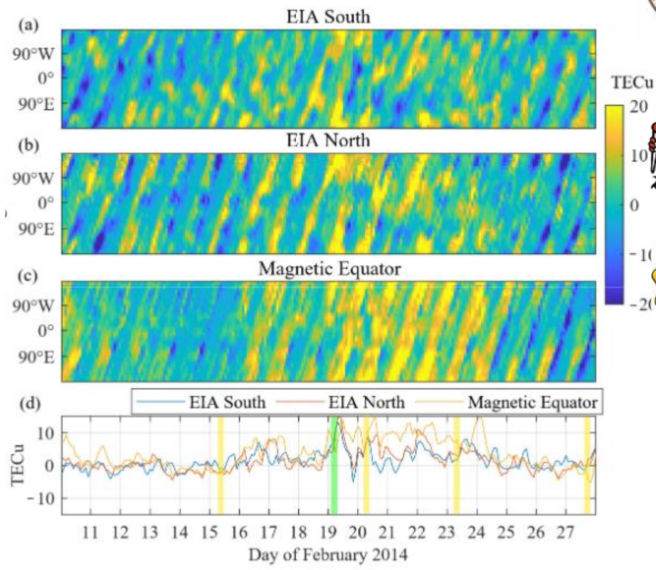
Low-Latitude Ionospheric Responses and Coupling to the February 2014 Multiphase Geomagnetic Storm from GNSS, Magnetometers, and Space Weather Data

Andres Calabia [1,2], Chukwuma Anoruo [3], Munawar Shah [4], Christine Amory-Mazaudier [5], Yury Yasyukevich [6], Charles Owolabi [7,8] and Shuanggen Jin [1,9,10,*]









Space Weather

AGU ADVANCING EARTH AND SPACE SCIENCE

RESEARCH ARTICLE
10.1029/2020SW002645

Special Section:
Small Satellites for Space Weather Research and Forecasting Workshops

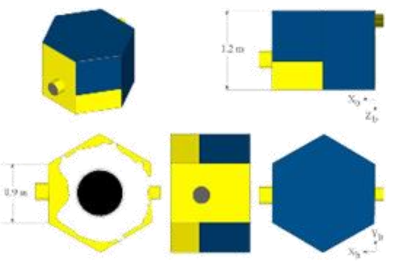
Upper-Atmosphere Mass Density Variations From CASSIOPE Precise Orbits

Andrés Calabia[1,2] and Shuanggen Jin[1,3]

[1]School of Remote Sensing and Geomatics Engineering, Nanjing University of Information Science and Technology, Nanjing, China, [2]School of Land Surveying, Geodesy and Mapping Engineering, Universidad Politécnica de Madrid, Madrid, Spain, [3]Shanghai Astronomical Observatory, Chinese Academy of Sciences, Shanghai, China

Key Points:

- Thermospheric mass densities are estimated from CAScade SmallSat and IOnospheric Polar Explorer precise orbits
- The detailed thermospheric mass density responses are obtained during the February 2014 geomagnetic storm
- CASSIOPE-derived thermospheric mass density is better than the NRLMSIS-00 model to reflect responses to the storm



JGR Space Physics

RESEARCH ARTICLE
10.1029/2021JA029540

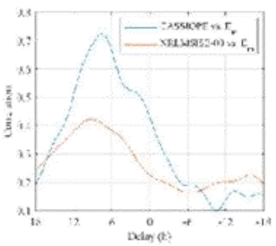
Thermospheric Mass Density Disturbances Due to Magnetospheric Forcing From 2014–2020 CASSIOPE Precise Orbits

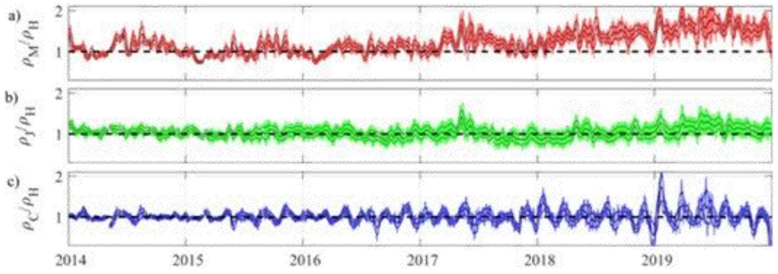
Andrés Calabia[1] and Shuanggen Jin[1,2]

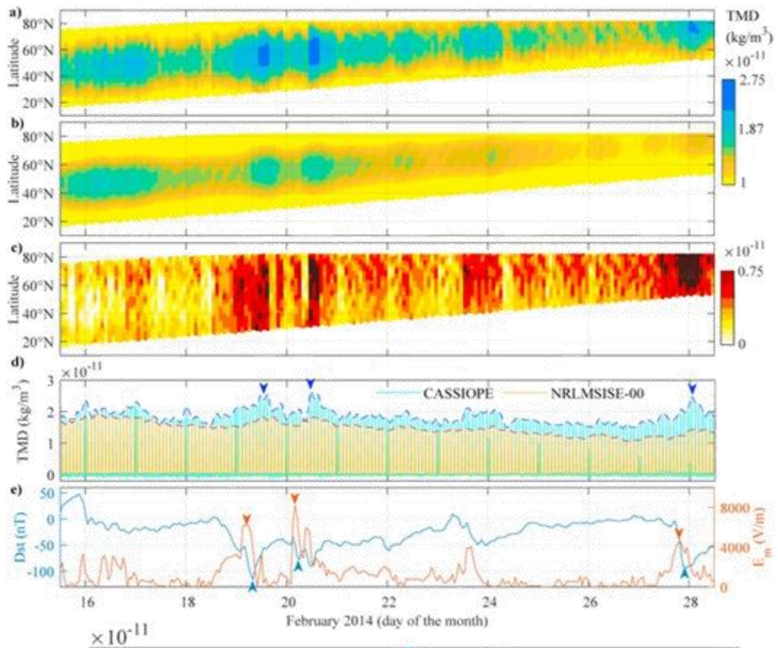
[1]School of Remote Sensing and Geomatics Engineering, Nanjing University of Information Science and Technology, Nanjing, China, [2]Shanghai Astronomical Observatory, Chinese Academy of Sciences, Shanghai, China

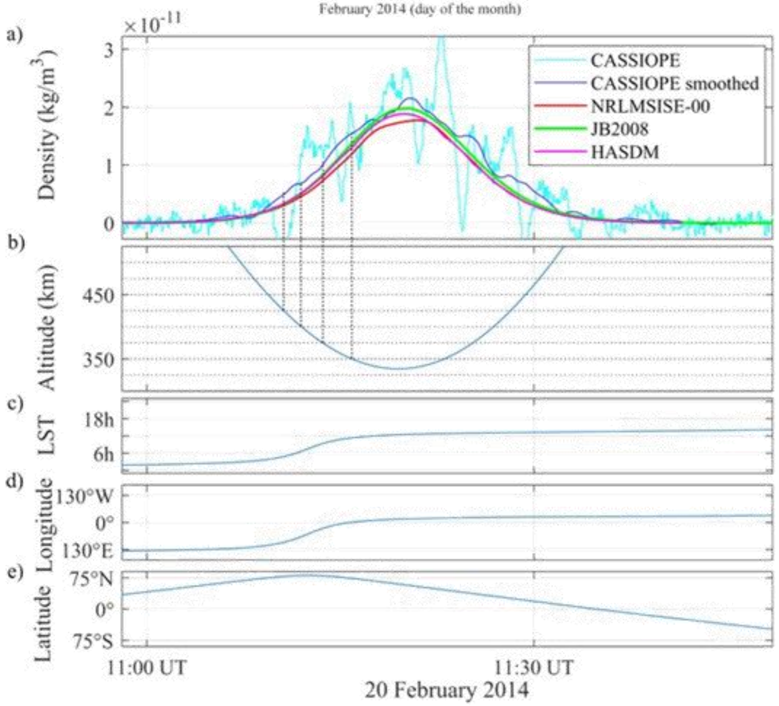
Key Points:

- Thermospheric mass densities from 2014 to 2020 are estimated from CAScade SmallSat and IOnospheric Polar Explorer Global Navigation Satellite System (GNSS) precise orbits
- The high-resolution thermospheric mass densities inferred from commercial-off-the-shelf GNSS receivers are validated
- The density disturbances due to magnetospheric forcing are investigated for correlations and time-delay responses to models and indices









JGR Space Physics

AGU100 ADVANCING EARTH AND SPACE SCIENCE

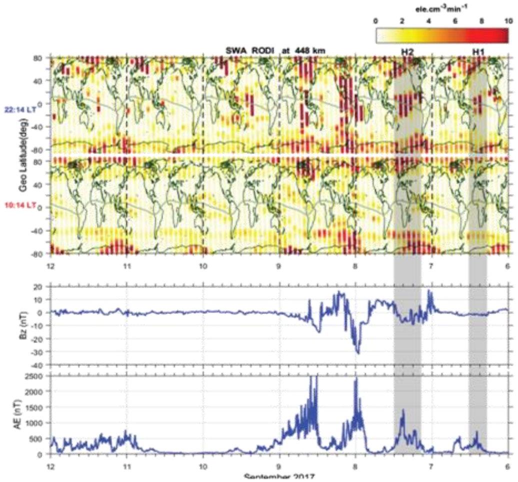
RESEARCH ARTICLE
10.1029/2019JA026590

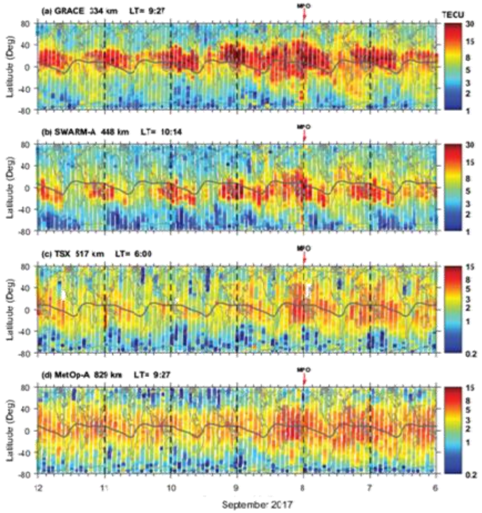
Topside Ionospheric Conditions During the 7–8 September 2017 Geomagnetic Storm

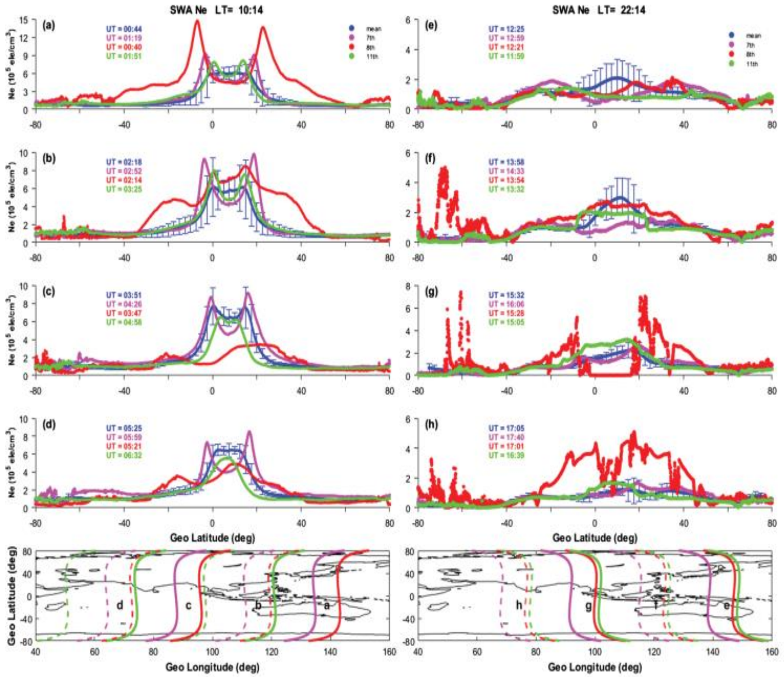
Oluwaseyi Jimoh[1,2], Jiuhou Lei[1,3], Jiahao Zhong[4], Charles Owolabi[1], Xiaoli Luan[1], and Xiankang Dou[1]

Key Points:

- Long-duration depletion of topside TEC recovery was observed during the morning and evening local times in this event
- Enhancements of ionospheric irregularities were presented at night with wide latitudinal range during the two main phases of the storm
- Ionospheric electric field disturbances due to B_z fluctuations probably triggered topside ionospheric irregularities before the main phases







JGR Space Physics

AGU ADVANCING EARTH AND SPACE SCIENCE

RESEARCH ARTICLE
10.1029/2020JA029073

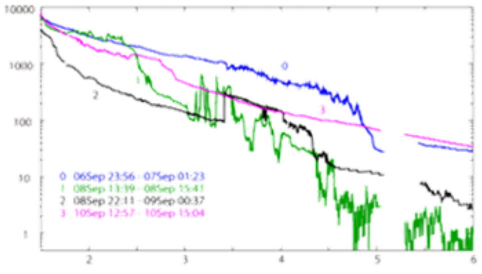
Special Section:
Geospace multi-point observations in Van Allen Probes and Arase era

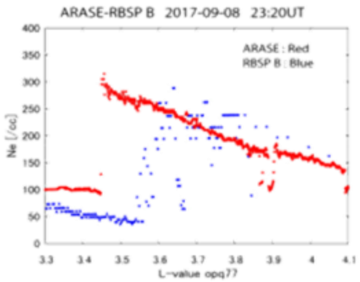
Field-Aligned Electron Density Distribution of the Inner Magnetosphere Inferred From Coordinated Observations of Arase and Van Allen Probes

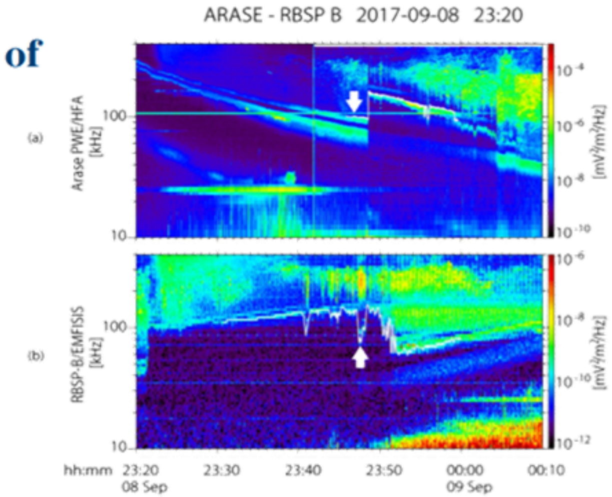
Yuki Obana[1], Yukinaga Miyashita[2,3], Naomi Maruyama[4,5], Atsuki Shinbori[6], Masahito Nosé[6], Masafumi Shoji[6], Atsushi Kumamoto[7], Fuminori Tsuchiya[8], Shoya Matsuda[9], Ayako Matsuoka[10], Yoshiya Kasahara[11], Yoshizumi Miyoshi[6], Iku Shinohara[9], William S. Kurth[12], Charles W. Smith[13], and Robert J. MacDowall[14]

Key Points:

- Using in situ measurements of the electron density from Arase and Radiation Belt Storm Probes, we estimated the density distribution along the magnetic field lines
- The power-law index of the electron density distribution was 4~7, ~0, and −2~−1 for the trough, plume, and partially refilled plasmasphere
- This is the first estimation of the power-law index using the data from different spacecraft projects



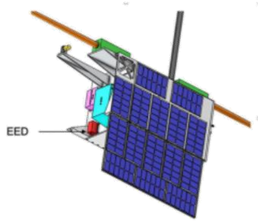




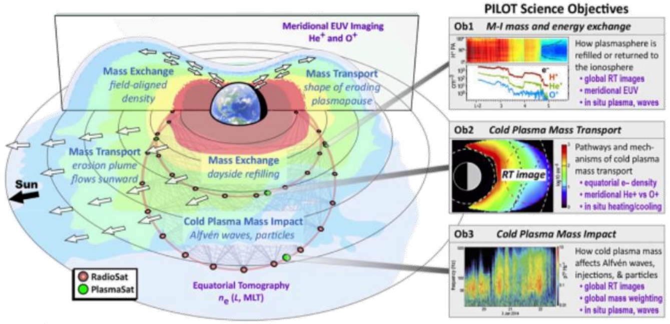
frontiers | Frontiers in Astronomy and Space Sciences
ORIGINAL RESEARCH
published: 17 June 2022
doi: 10.3389/fspas.2022.910730

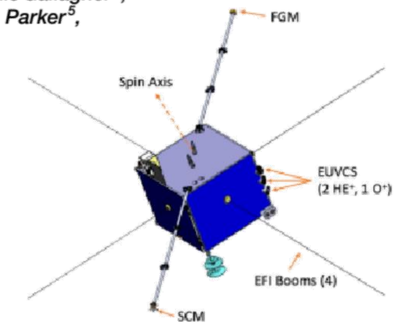
Plasma Imaging, LOcal Measurement, and Tomographic Experiment (PILOT): A Mission Concept for Transformational Multi-Scale Observations of Mass and Energy Flow Dynamics in Earth's Magnetosphere

Check for updates



David Malaspina[1,2], Robert Ergun[1,2], Jerry Goldstein[3], Constance Spittler[2], Laila Andersson[2], Joseph Borovsky[4], Xiangning Chu[2], Lauren De Moudt[5], Dennis Gallagher[6], Vania Jordanova[7], Solène Lejosne[8], Jason Link[2], Naomi Maruyama[2], Jeffery Parker[5], Scott Thaller[2], Bryce Unruh[2] and Brian Walsh[9]*





frontiers in Astronomy and Space Sciences
ORIGINAL RESEARCH
published: 17 February 2022
doi: 10.3389/fspas.2022.823695

Radial Transport of Energetic Electrons as Determined From the "Zebra Stripes" Measured in the Earth's Inner Belt and Slot Region

Check for updates

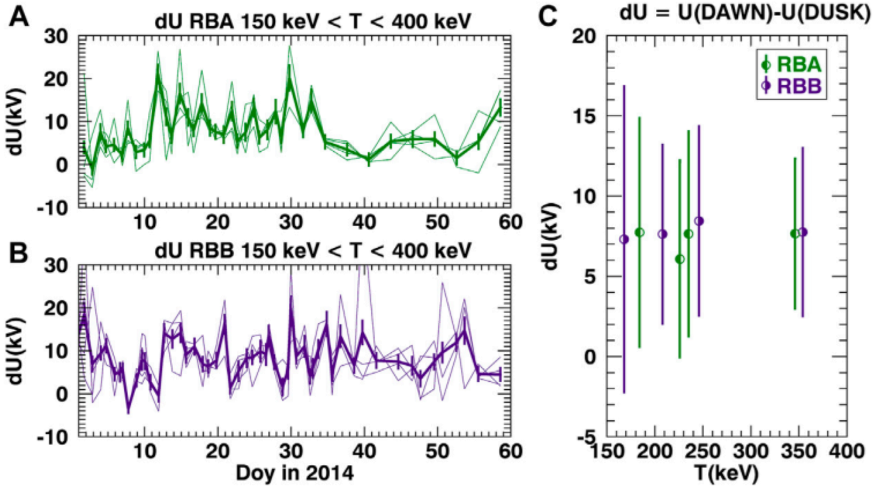
Solène Lejosne[1], Bela G. Fejer[2], Naomi Maruyama[3] and Ludger Scherliess[2]*

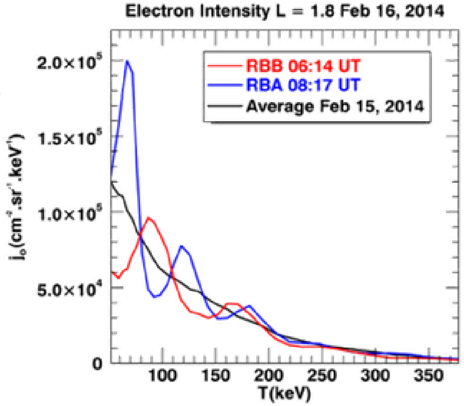
frontiers in Astronomy and Space Sciences
ORIGINAL RESEARCH
published: 01 September 2021
doi: 10.3389/fspas.2021.725800

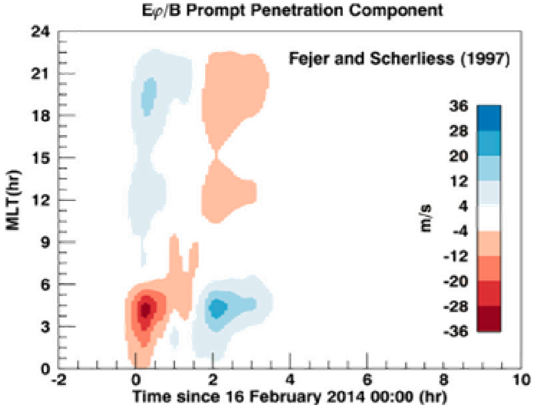
Thermospheric Neutral Winds as the Cause of Drift Shell Distortion in Earth's Inner Radiation Belt

Check for updates

Solène Lejosne[1], Mariangel Fedrizzi[2,3], Naomi Maruyama[2,3] and Richard S. Selesnick[4]*







IN COOPERATION WITH THE LOW LATITUDE IONOSPHERIC RESEARCH WORKING GROUP OF THE ASIA OCEANIA SOCIETY OF GEOSCIENCES (AOGS - REGIONAL ADVISORY COMMITTEE)

DLR

NCAR

The **Low Latitude Ionospheric Research Working Group (LLWG)** connects different research groups in Asia to exchange information and collaborate on certain observing campaigns. This group aims to expand collaboration to low-latitude regions around the world with this working group as the main component.

The objectives of the LLWG:

- Information exchange.
- Identification of emerging scientific and technical issues for joint study.
- Publication of reports or publications on behalf of AOGS for NGOs or government agencies.

Members:

1. Zamri Zainal Abidin (U. Malaya).
2. Binod Adhikari (St. Xavier's College).
3. Andres Calabia Aibar (UPM, NUIST).
4. Nadia Imtiaz (PINSTECH).
5. Siti Syukriah Khamdan (UTM Johor).
6. Jiuhou Lei (USTC)
7. Yajun Zhu (NSSC, CAS).

AOGS...In Asia for Asia and the World

Asia Oceania Geosciences Society

www.asiaoceania.org

https://aogsrac.org/working-group

PROJECTS, CONTRACTS, AND AWARDS

Andres Calabia, July 2022, *Characterization of Plasma Depletions and Effects on Geodetic Applications* (PI), 1,000€, PITHIA-NRF EU Horizon 2020 Research and Innovation Programme Grant Agreement Trans-National Access, at Ebro Observatory, Spain.

Andres Calabia, 2022-2025, Assistant professor at School of Land Surveying, Geodesy and Mapping Engineering, Technical University of Madrid, 28031 Madrid, Spain.

Andres Calabia, Nov. 2021, *Variability, impacts, and applications of cosmic ray and radiation belt particles*, 2,350€, Giner de los Ríos Grant, University of Alcalá, Madrid, Spain.

Liangliang Yuan, 2021-Now, Co-I, EGNOS Next SBAS-PPP, ESA.

Liangliang Yuan, 2021-Now, Co-I, *MEDUSE Data assimilation project*, DLR.

Munawar Shah, 2021-2022, Post Doc, KMITL, Prince of Chumphon Campus, Thailand.

Munawar Shah, 2022-Now, Co-PI, Space Education and GNSS lab, National Center for GIS and Space Application, Institute of Space Science, Pakistan

Munawar Shah, 2022-Now, Consultant, Agriculture field assessment in Northern Pakistan using GPS and GIS, partners Helvetas Swiss International.

Naomi Maruyama, 2022, *GDC AETHER instrument proposal selected for the NASA GDC mission*. It measures the electron density and temperature of the ionosphere(~400km) for the GDC mission. https://lasp.colorado.edu/home/2022/04/27/lasp-instrument-selected-for-the-next-nasa-living-with-a-star-mission/

Christine Amory-Mazaudier, Vikram Sarabhai Isro-Cospar Joint Medal, Indian Space Research Organisation (ISRO), Committee on Space Research (COSPAR), Ceremony Of Awards COSPAR 44th Athens July 18, 2022,

etc.

INVITATIONS

AOGS - Regional Advisory Committee Seminar Series

09/12/2022

AOGS-RAC Low Latitude Ionospheric Research Working Group Online Seminar Series No. 1

16:00 (GMT+8)

@Google Meet (Online)

(Registration here)

Dr. Chi-Yen Lin (Dept. of Space Science and Engineering, National Central University)

Title: The impact of radio occultation observation on space weather monitoring research

Moderator: Andres Calabia

https://aogsrac.org/

AOGS-RAC

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Frontiers in Astronomy and Space Sciences

Upcoming Frontiers Research Topic

Advances on upper-atmosphere characterization for geodetic space weather research and applications'

Guest Editors:
Andrés Calabia aibar, Nanjing University of Science and Technology,
Gang Lu, National Center for Atmospheric Research (UCAR)
Olawale S. Bolaji, University of Tasmania.

Hosted in Frontiers in Astronomy and Space Sciences : **Space Physics**

Lead by Specialty Chief Editors:
Joseph E Borovsky Space Science Institute, United States
Rudolf von Steiger University of Bern, Bern, Switzerland

Section homepage: Space Physics

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World Meteorological Organisation

WCRP

WWRP

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https://www.yess-community.org/

Early Career Researchers
NETWORK OF NETWORKS

APECS
Association of Polar Early Career Scientists

YHS

https://www.researchgate.net/project/IAG-FA-GSWR-JSG1-Coupling-processes-between-magnetosphere-thermosphere-and-ionosphere-MTI

Project

IAG-FA-GSWR-JSG1: Coupling processes between magnetosphere, thermosphere, and ionosphere (MTI)

Astrid Maute · Yury Yasyukevich · Gang Lu · Show all 17 collaborators

Goal: This Join Study Group (JSG) aims to improve the understanding of coupled processes in the MTI system, through interrelations, dependencies and coupling patterns of variability, and considerations of the solar contribution and lower atmosphere forcing.

Show details

Project log

Build your reputation by sharing a project update

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added an **update**

Jul 10

2nd International Symposium of IAG Commission 4 (C4) “Positioning and Applications”

Dear colleagues,

I would like to draw your attention to the 2nd International Symposium of IAG Commission

SUMMARY

Recent activities:

1. Enhancement of international cooperation, especially with developing countries, by sharing knowledge and research tools, helping in projects, co-supervising students, helping to improve manuscripts, etc.
2. Elaboration and submission of scientific manuscripts co-authored by JSG1 members and other colleagues.
3. Elaboration and submission of projects.

Present work:

1. Working effectively within the group members, creating a common platform to increase communication.
2. Increase international cooperation with other groups to break the existing isolation.
3. Regular online meetings.

Future plans:

1. Elaboration of proposal for *International Workshop on MTI Coupling (IWMTIC2021): Prospects, Challenges, and Opportunities*. Kathmandu, Nepal. 2023?
2. Advancement of MTI science in developing countries by organizing workshops, etc.

SPECIAL THANKS TO

IAG Commission 4 Symposium

FOR THIS OPPORTUNITY

Thank you !

THANKS TO ALL IAG FA-GSWR JSG1 MEMBERS FOR YOUR CONTRIBUTIONS