



ICESTAR - Interhemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research



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Interhemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research

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<http://scar-icestar.org>





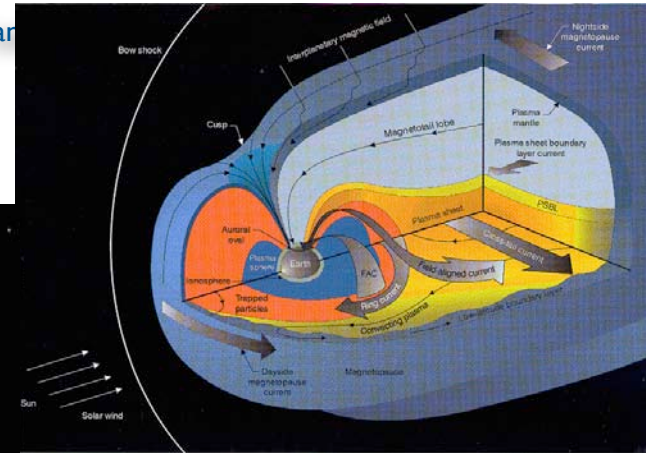
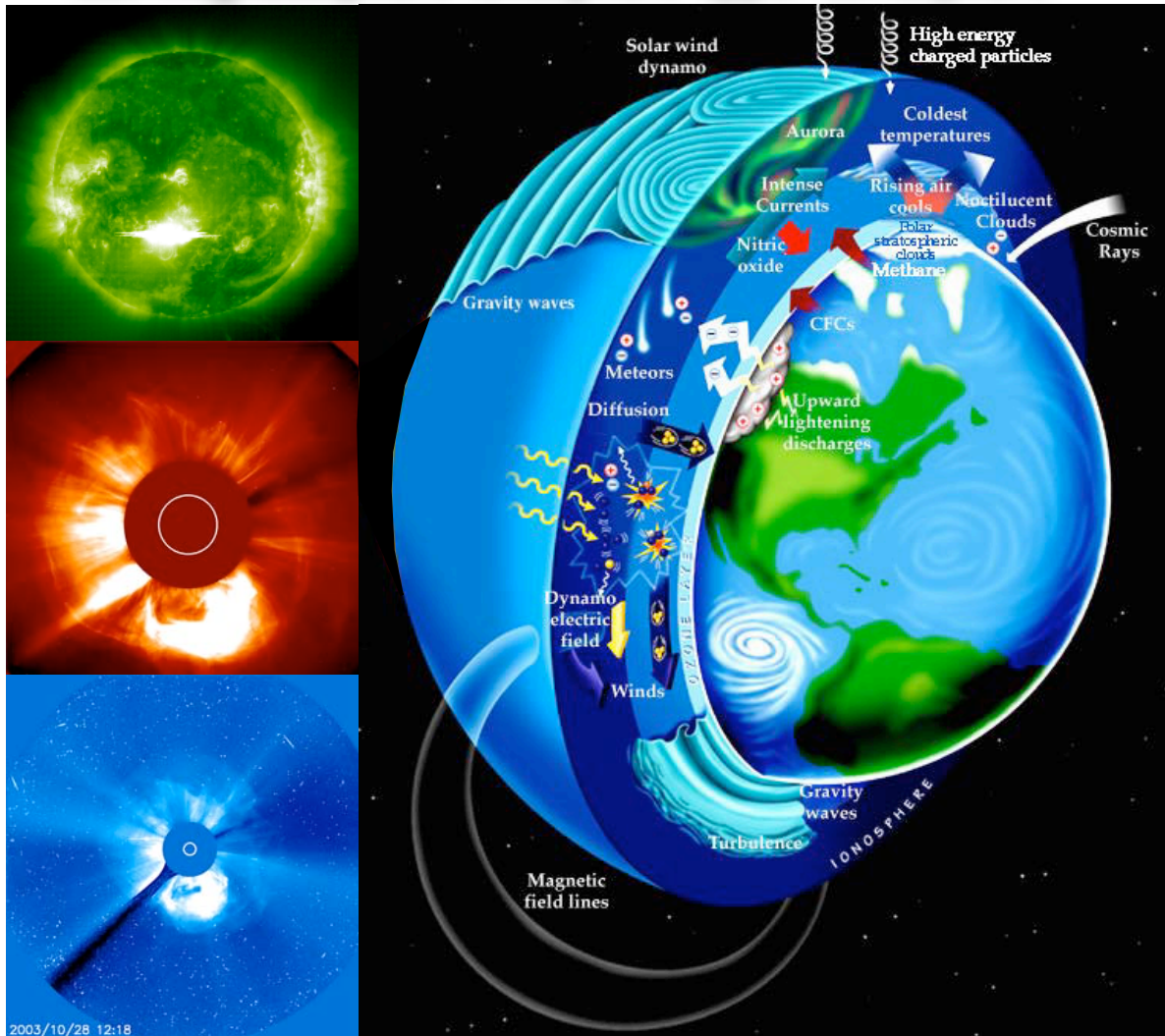
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Near-Earth space (geospace) is an integral part of the Earth system, providing the material link between the Sun and Earth, primarily through the polar regions.

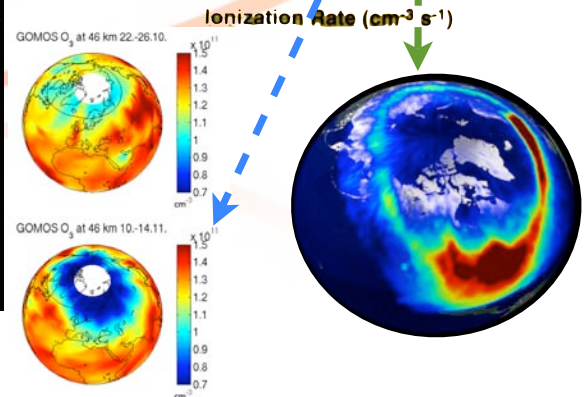
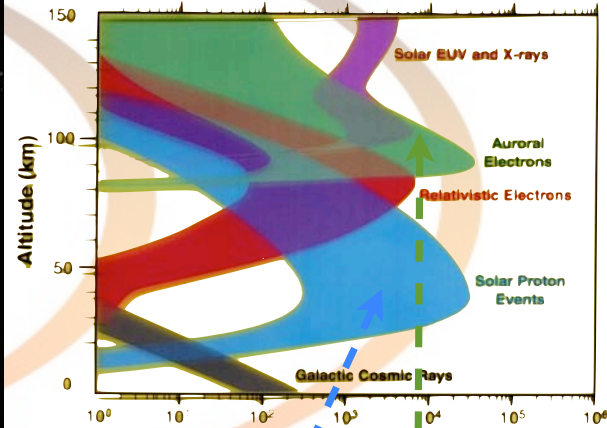
Goal is to create an integrated, quantitative description of the upper atmosphere over Antarctica, and its coupling to the geospace environment.

- Identify and quantify various mechanisms controlling **interhemispheric regional differences and commonalities** in the electrodynamics and plasmadynamics of the Earth's **magnetosphere-ionosphere coupling system**, and in **aeronomy of the upper atmosphere** over the Arctic and Antarctic.
- Develop a “virtual” data portal that will link together a large number of globally distributed geophysical databases, including both data serving applications and visualisation tools; this will enable a systems view of the polar upper atmosphere and geospace.

View to the coupled system - Sun-magnetosphere-ionosphere-upper atmosphere



Principal Sources of Ionization in Earth's Atmosphere



2003/10/28 12:18



ICESTAR Action Groups

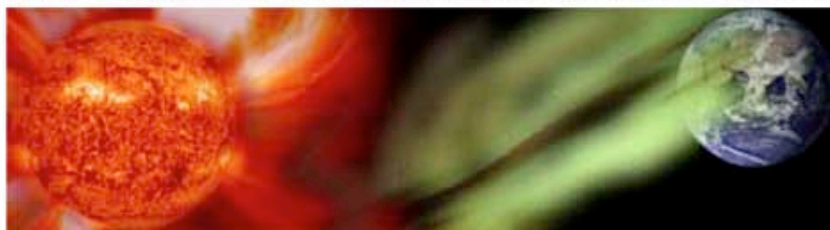
Thematic Action Groups (TAGs) coordinate scientific activities and objectives:

- **A:** Quantification of the **coupling between the polar ionosphere and neutral atmosphere** from the “bottom-to-top” and the global electric circuit.
- **B:** Quantification of the **inner magnetospheric dynamics** using remote sensing techniques.
- **C:** Quantification of the **state of the upper atmosphere, ionosphere, and magnetosphere over the Antarctic continent** and how it differs from the Northern hemisphere during a wide range of geophysical conditions.
 - C.1: Quantify the **atmospheric consequences of the global electric circuit** and further understand the electric circuit in the middle atmosphere as guided by the electric fields generated at the solar wind–magnetosphere interface.
 - C.2: Quantify the **thermal and dynamical structure of the middle and upper atmosphere** over the Antarctic continent and how it differs from the Northern hemisphere during a wide range of geophysical conditions.
- **D: Creation and management of the data portal** to enable the ICESTAR programme and SCAR’s SSG/PS.



- About ICESTAR
- Annual Reports
- Heliosphere Impact on Geospace Workshop
- ICESTAR Intro
- ICESTAR Presentations
- ICESTAR Proposal
- ICESTAR Publications
- ICESTAR Travel Forms
- ICESTAR Data Portal Workshop
- International Heli. Year
- International Polar Year
- Polar Gateways 2008
- Riometer Workshop III
- SCAR-ICESTAR 2008
- SCAR

Interhemispheric Conjugacy Effects in Solar Terrestrial and Aeronomy Research



Near-Earth space (geospace) is an integral part of the Earth system, providing the material link between the Sun and Earth, primarily through the polar regions. A goal of the ICESTAR Programme is to create an integrated, quantitative description of the upper atmosphere over Antarctica, and its coupling to the geospace environment.

Featured Presentations

[ICESTAR program in Japan during IPY2007-2008](#)

by A. Kadokura et al.

[Planetary Waves, Ozone Distribution And Tropopause Height Asymmetries In Connection To Antarctic Peninsula Warming](#)

by Milinevsky et al.

2007 American Geophysical Union Fall Meeting.

ICESTAR is co-sponsoring and/or providing support for the following international meetings in 2008

Polar Gateways Arctic Circle Sunrise 2008

News and Events



- **Prof. Eric Donovan** joins the ICESTAR team as a Thematic Action Group (TAG) leader. Eric is an Associate Professor in the Department of Physics and Astronomy at the U. of Calgary.
- [Polar Gateways Conference](#): Barrow, Alaska, January 23-29, 2008
- [International Polar Year](#): March 2007-2009.
- [Greenland Space Science Symposium](#): May 4-9 2007
- ICESTAR co-chair Dr. Kirsti Kauristi leads [Heliosphere Impact on Geospace](#) effort with Dr. Richard Stamper.
- [SCAR Newsletters](#)

Heliosphere Impact on Geospace



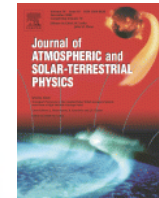
One of the core projects of the fourth



Past-Present-Future

iceSTAR

- Over 100 peer reviewed publications in 2007 - 2008. JASTP special issue in 2008.
- Leading role in IPY core project *Heliosphere Impact on Geospace*.
- ICESTAR will end (and become an SSG/PS expert group) in 2010.





IPY project: Heliosphere impact on geospace

- IPY core project (#63) conducted by ICESTAR, IHY (International Heliophysical Year) and 29 other consortia with scientists from 22 countries.
- Research on solar-generated events which affect the composition and dynamics of the atmosphere in the terrestrial polar areas. Studying coupling:
 - Between the different atmospheric layers
 - Between the magnetosphere and ionosphere
 - Between the different hemispheres
- Versatile bi-polar space research instrumentation to support the IPY campaign.
- <http://www.space.fmi.fi/ipyid63>

Examples of PR and outreach activities

IPY Cluster 63 has arranged several international scientific meetings with significant PR and outreach components in their programs. Some examples:

Greenland Space Science Symposium (May 2007):

The symposium celebrated the rich history of Greenland as a forum for near-Earth space observations. Researchers from 14 countries participated the meeting whose scientific contents will be presented in a JASTP special issue. Local people and political decision makers were invited to the sessions presenting historical reviews and the state-of-art of today's geospace instrumentation. The Nortel LearnIT company has created education material about the symposium.

Polar Gateways Arctic Circle Sunrise (Barrow, Alaska, Jan 2008):

The meeting discussed the motivations and legacies of the first three International Polar Years and the main challenges for the on-going Polar Year. The presentations by NASA scientists discussed also the advantages of polar icy regions for testing instrumentation of different planetary missions and of outer solar system exploration. In addition to the sessions in Barrow the meeting included several video conferences with other institutes around the Arctic Circle.

Winter school on auroral substorms in Iceland (Nov 2007):

This winter school was organized for university students as collaboration of the University of Bergen and Finnish Meteorological Institute. In addition to daytime lectures and laboratory exercises the students got the opportunity to spot auroras with their own eyes during night time.





GAIA - Global Auroral Imaging Access

http://gaia-vxo.org

Interface Mode

Overview

Detailed view



GAIA V2.0



Global Auroral Imaging Access

[Link to this page](#)

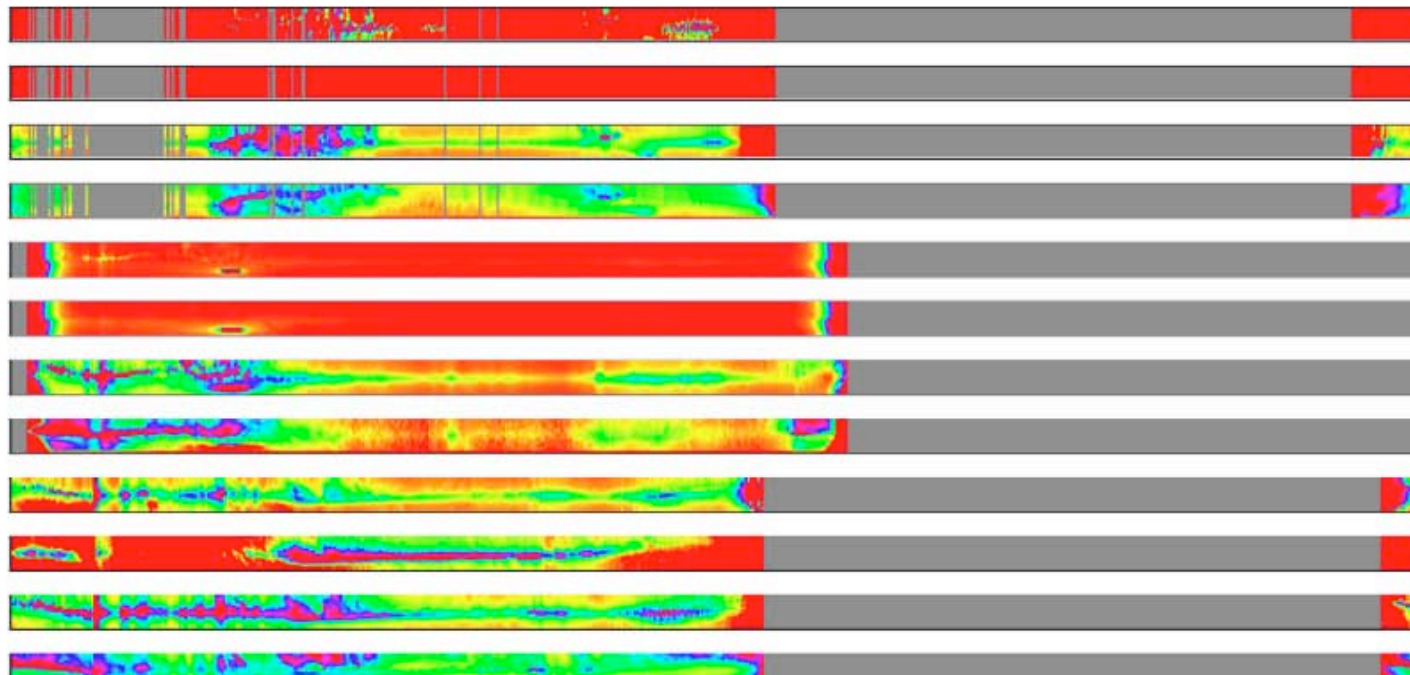
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GAIA is a virtual observatory providing quick access to summary data from satellite and ground-based instruments that remote sense auroral particle precipitation.

Open toolbox

Project: CANOPUS-MSP

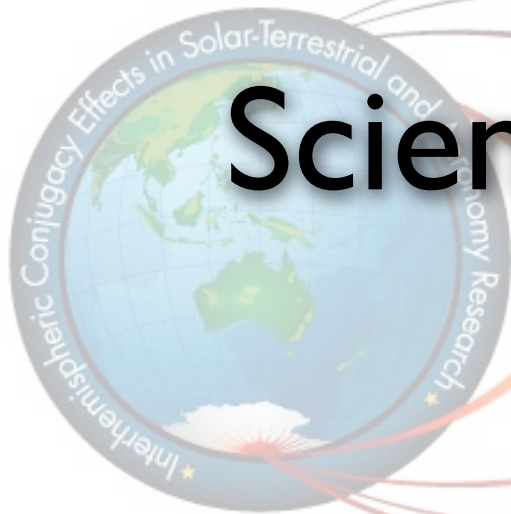
Overview Mode



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470.9 nm (MSP)
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- CANOPUS-MSP RANK
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Science Highlights



Science Highlights

Nordic Ionospheric Sounding rocket Seeding Experiment NISSE

- Daytime rocket water release experiment by space physics students from University of Bergen, University of Oulu, University of Helsinki, and Finnish Meteorological Institute
- <http://www.space.fmi.fi/NISSE/NISSEhomepage.html>
- Scientific objectives
 - Detection of the effects of the released water on the ionosphere by an incoherent scatter radar (tri-static EISCAT UHF)
 - Influence of the water release on the incoherent scatter spectrum
- Educational objectives
 - To obtain experience in planning, building and executing a scientific experiment in space physics.
 - To obtain experience about international scientific collaboration.



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Science Highlights

Nordic Ionospheric Sounding rocket Seeding Experiment NISSE

- REXUS BEXUS Program – Rocket and Balloon Experiments for University Students, coordinated by ESA Education Office
 - SNSB (Swedish National Space Board)
 - DLR (Deutsches Zentrum für Luft- und Raumfahrt/German Aerospace Center)
- The NISSE/REXUS-6 rocket campaign in Esrange, Kiruna, Sweden
- **2-14 March, 2009**
 - The REXUS-6 rocket: Improved Orion with an apogee altitude of 95 km
 - Several magnetometers aboard the rocket in the AGADE (Applied Geomagnetism for Altitude Determination Experiment) experiment by a group of German students



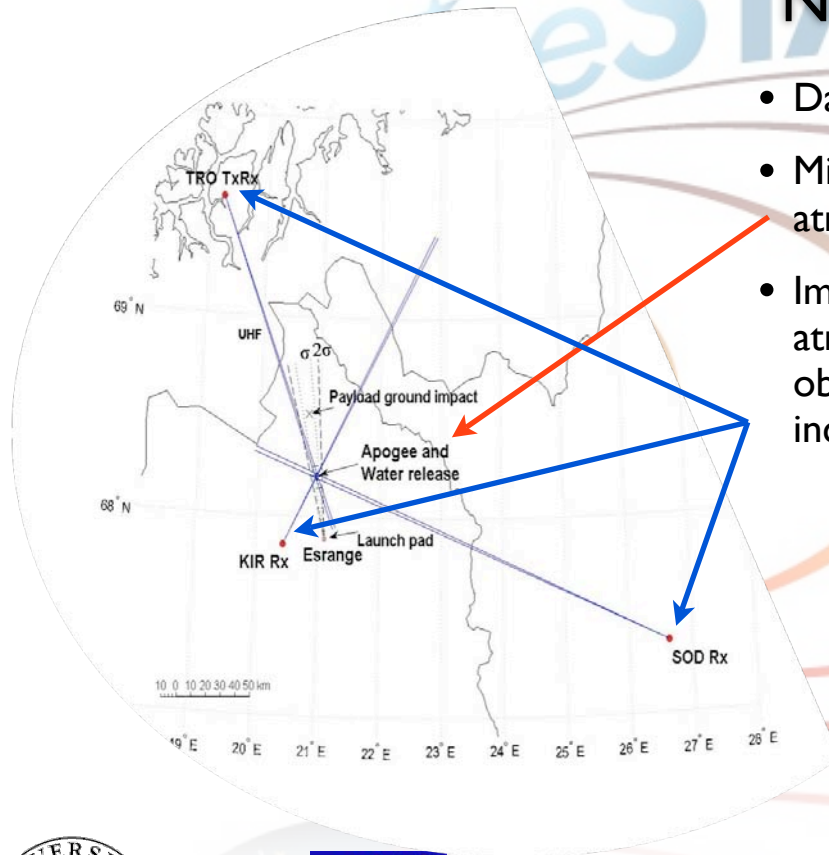
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Science Highlights

Nordic Ionospheric Sounding rocket Seeding Experiment NISSE



- Daytime rocket water release experiment.
- Midday release of 10-20 kg water into the upper atmosphere at the rocket apogee altitude of 95 km.
- Impact of the released water on the upper atmosphere/ionosphere will be studied by observations using the tri-static EISCAT UHF incoherent scatter radar system.



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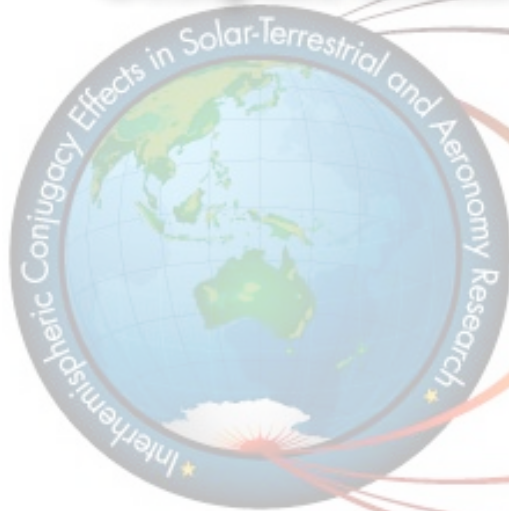




Science Highlights

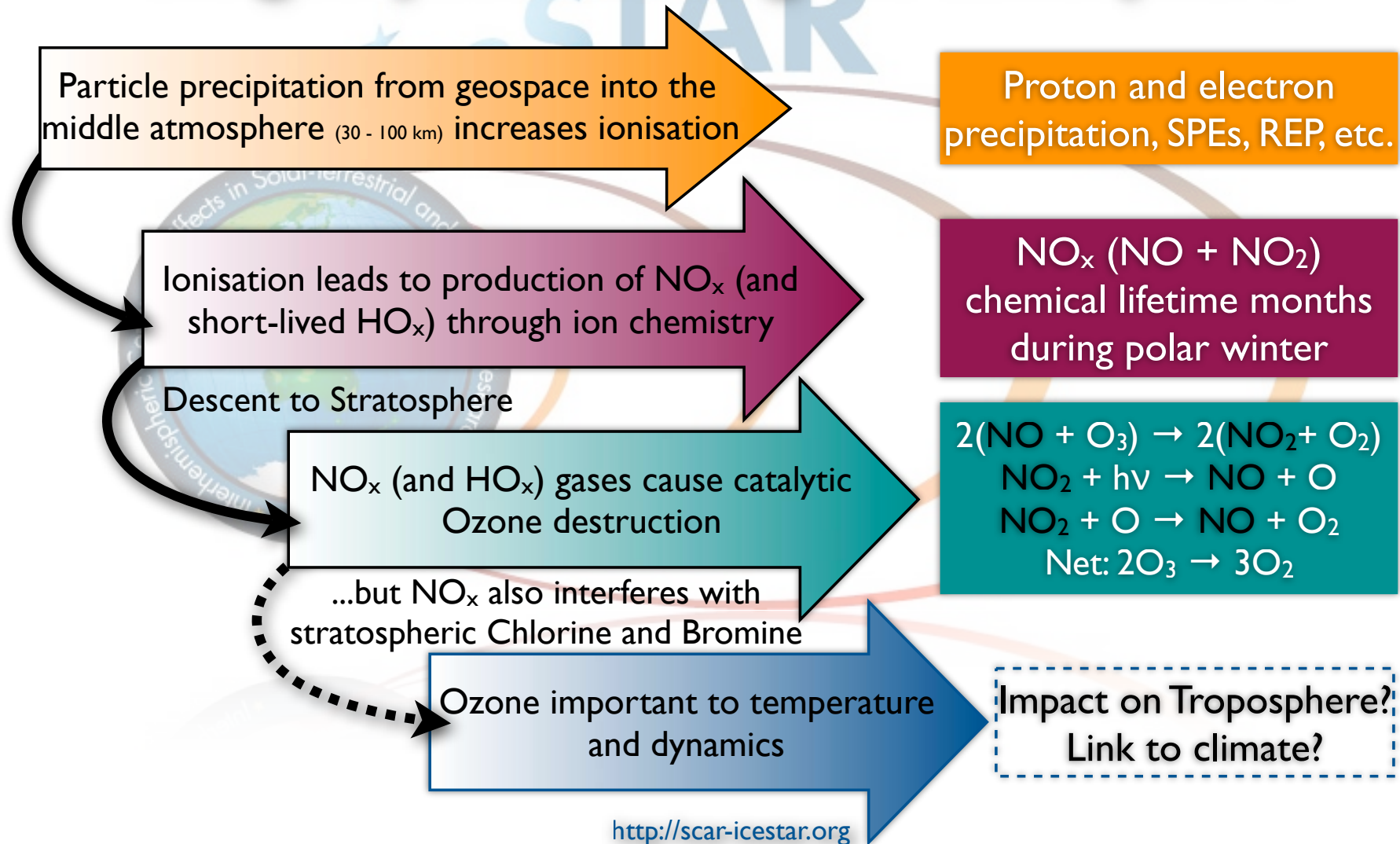
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Geospace affecting the chemical composition of polar atmosphere





Energetic particle precipitation from the geospace affecting the atmosphere

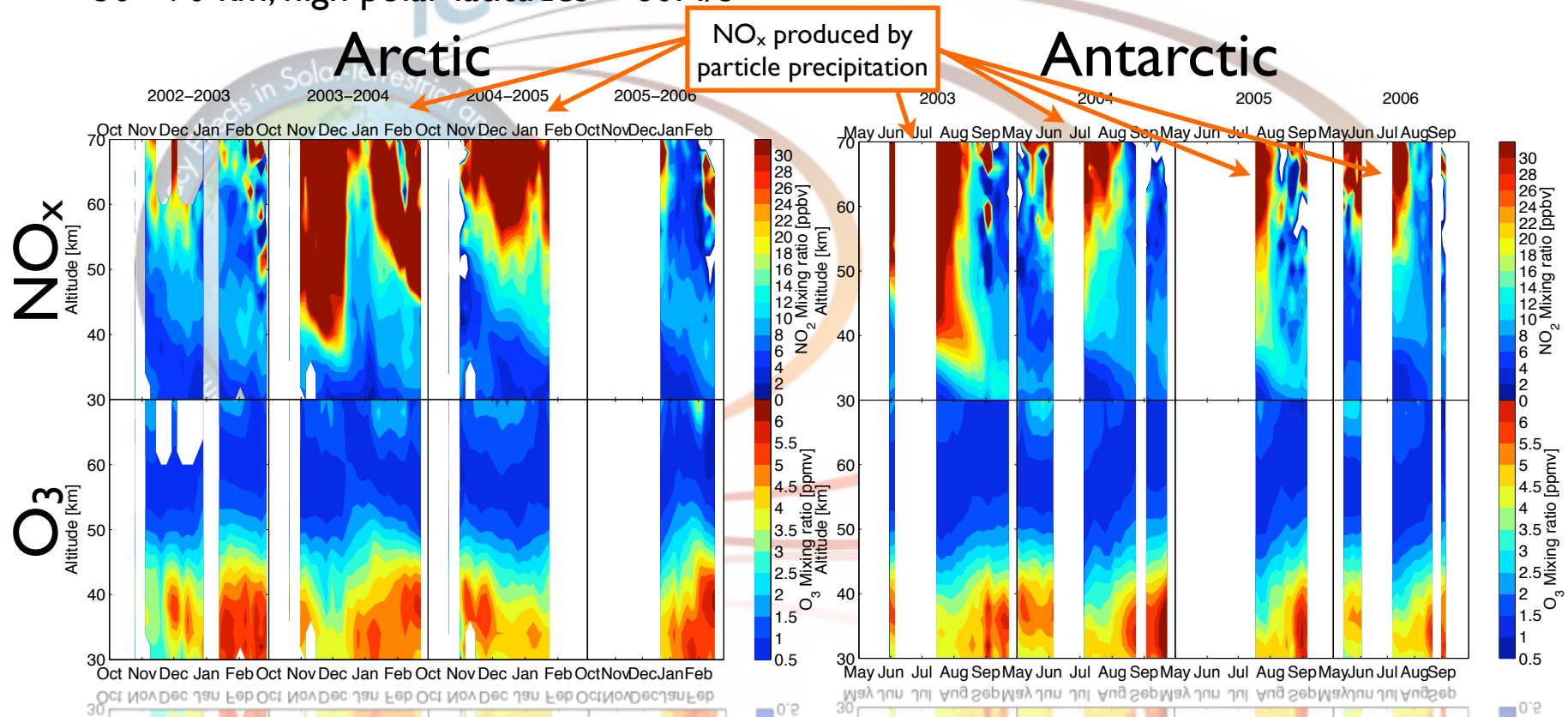




Science Highlights

Geospace affecting the chemical composition of polar atmosphere

- GOMOS polar night NO_x and O_3 observations from Envisat satellite.
- 30 - 70 km, high polar latitudes > 60N/S



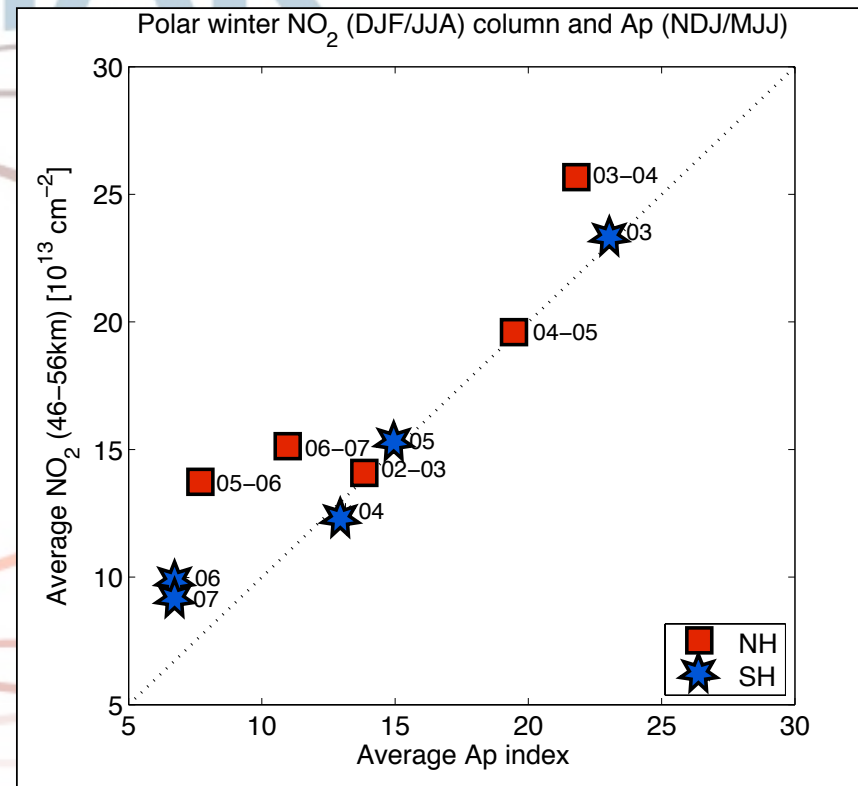
Seppälä, et al. (2007), Arctic and Antarctic polar winter NO_x and energetic particle precipitation in 2002-2006. Geophys. Res. Lett., Vol. 34, No. 12, L12810, doi: 10.1029/2007GL029733.



Science Highlights

Geospace affecting the chemical composition of polar atmosphere

- GOMOS polar night NO_x observations from Envisat satellite.
- Geomagnetic activity level measure, A_p -index, used as Energetic Particle Precipitation proxy.
- Average wintertime A_p -index related to upper stratospheric NO_x (NH: DJF, SH: JJA).
- Nearly linear relationship found in both Antarctic and Arctic.



Seppälä, et al. (2007), Arctic and Antarctic polar winter NO_x and energetic particle precipitation in 2002-2006. Geophys. Res. Lett., Vol. 34, No. 12, L12810, doi: 10.1029/2007GL029733.

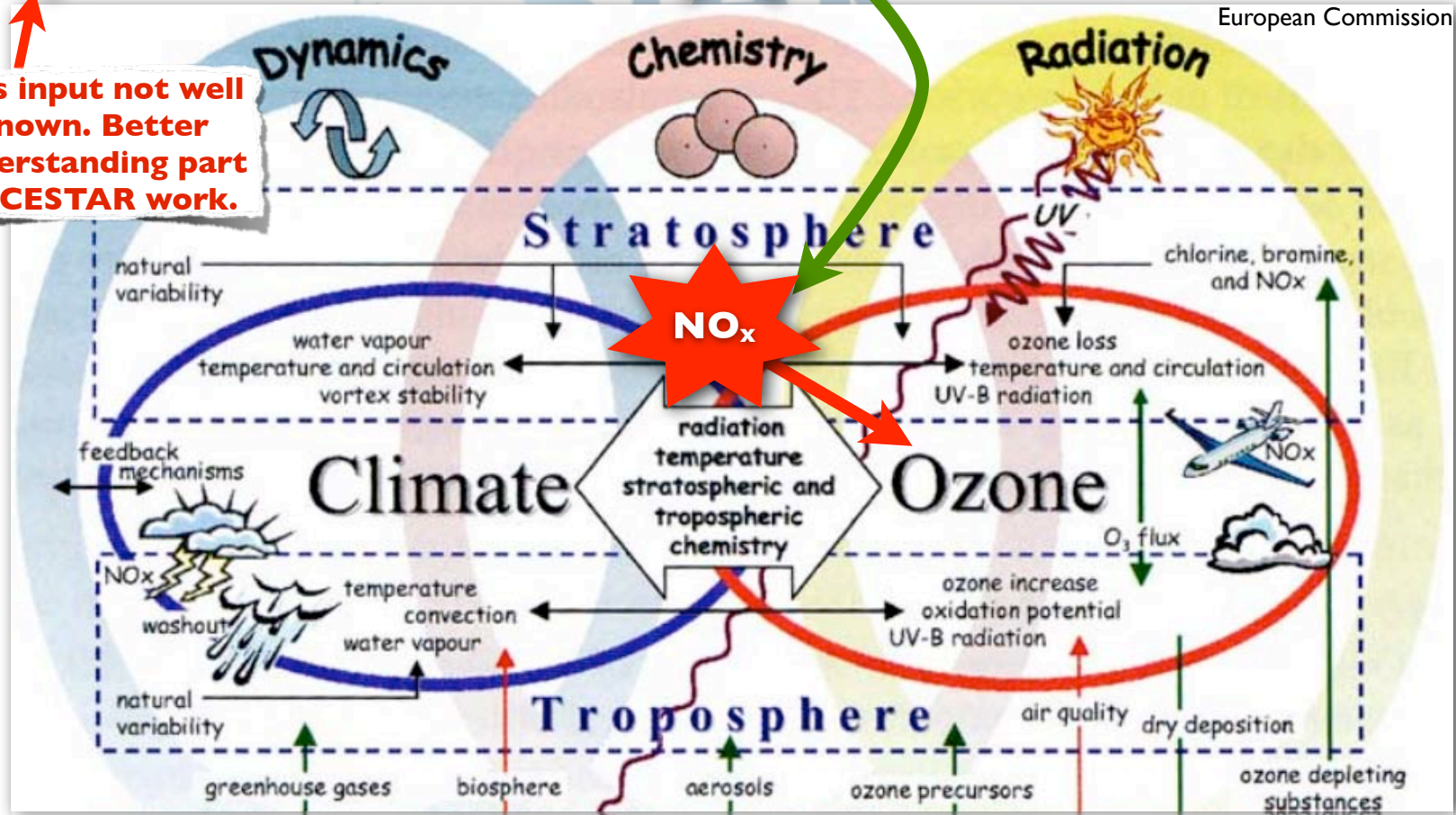


Energetic Particle Precipitation

Mesosphere - Lower Thermosphere (Upper-Atmosphere)

NO_x

This input not well known. Better understanding part of ICESTAR work.



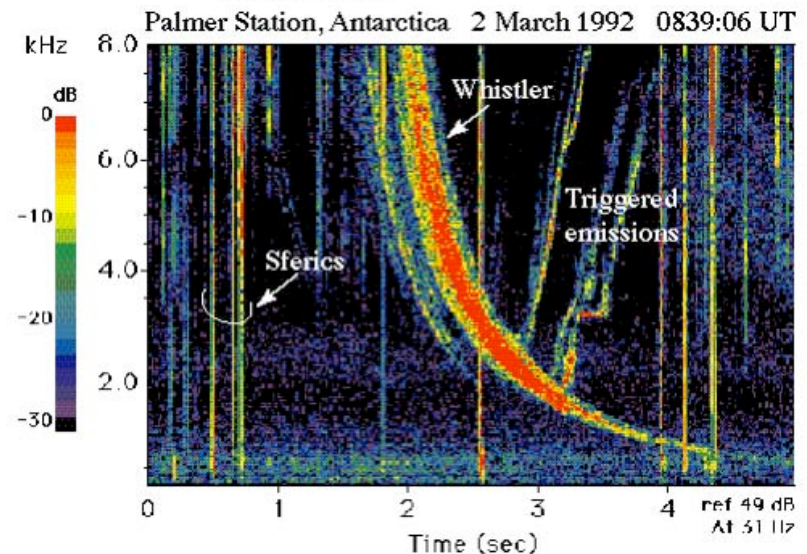
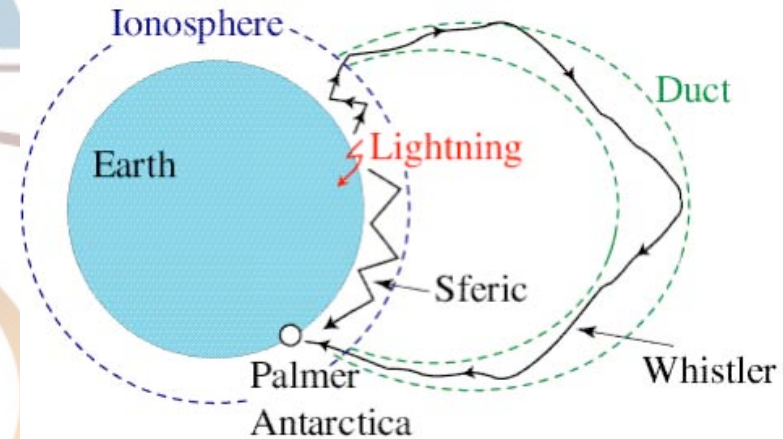
European Commission



Science Highlights

Electron precipitation from lightning-generated whistlers

- Very Low Frequency (VLF) radio waves launched by lightning propagate in the Earth-ionosphere wave guide.
- Wave energy also couples upward to the radiation belts, propagating along filamentary “ducts” of enhanced ionisation.
- ⇒ The waves can travel through two different paths.
- Signal arriving at the conjugate region on the other hemisphere sounds like a whistler.

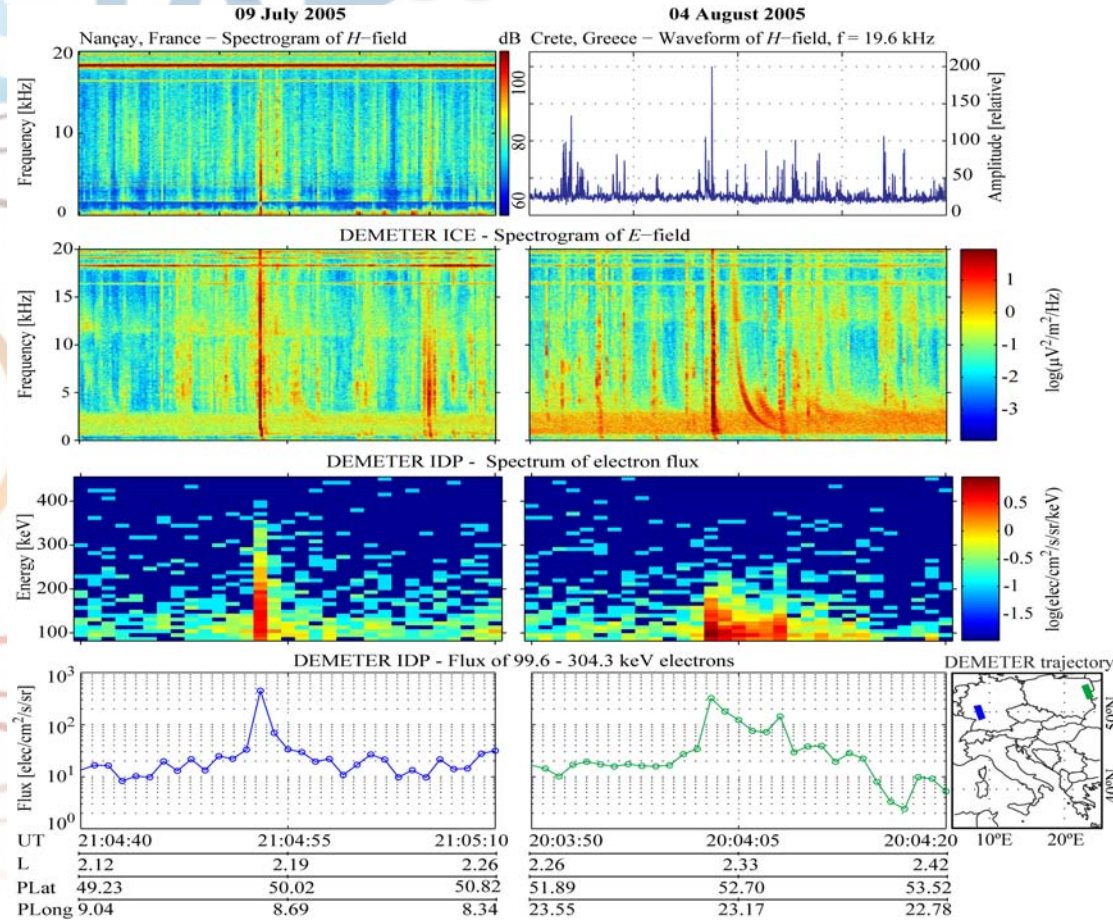
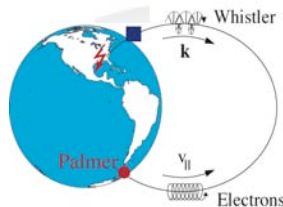




Science Highlights

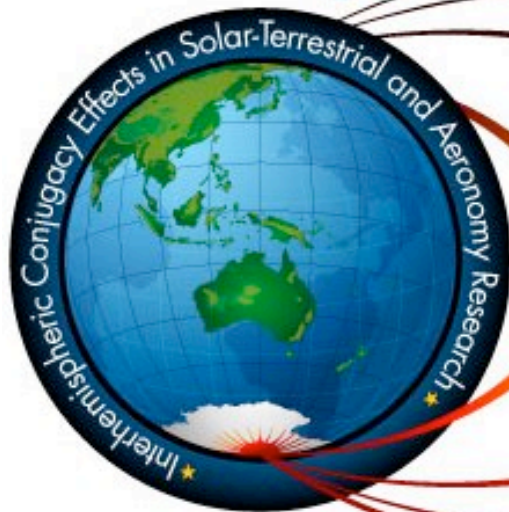
Electron precipitation from lightning-generated whistlers

- Lightning during strong thunderstorms is known to launch electromagnetic waves which propagate both in the wave guide between the earth surface and ionosphere and along geomagnetic field lines.
- The waves propagating along the field-aligned ducts can **interact with radiation belt electrons** and under certain conditions **cause their precipitation into the atmosphere.**
- Inan et al. (2007) provide the **first clear observational supporting this scenario** using combined observations from VLF-antennas, a lightning detection system, and the DEMETER satellite.
- *Inan et al. (2007): DEMETER satellite observations of lightning-induced electron precipitation. Geophys. Res. Lett., doi: 10.1029/2006GL029238*





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Thank You!

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