



# ***Solar-Terrestrial and Aeronomy Research Initiatives During the International Polar Year***

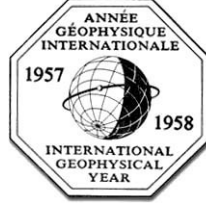


**Allan Weatherwax, Siena College, New York**

- K. Kauristie, Finnish Meteorological Institute, Finland
- N. Ostgaard, University of Bergen, Norway
- R. Stamper, Rutherford Appleton Laboratory, UK
- E. Donovan, U. of Calgary, Canada
- S. Palo, U. of Colorado, USA
- The IHY and ICESTAR Team Members...



# Commemorate the 50<sup>th</sup> anniversary of the International Geophysical Year 1957-1958



- Allowed scientists from different countries to participate in global observations
- Gathered unprecedented volume of geophysical data from around the World
- Launched first Earth artificial satellites and established the World Data Center



## **International Polar Year (IPY)**

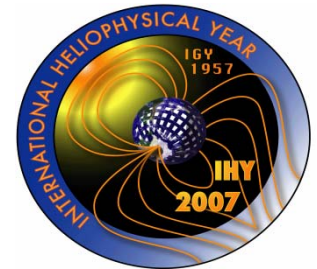
Studies of, and from, the polar regions.

**2007-2009**

## **International Heliophysical Year (IHY)**

Physics of the heliosphere.

**2007-2009**



## **Interhemispheric Conjugacy Effects in Solar Terrestrial and Aeronomy Research**

Coordinated polar research in the fields of solar-terrestrial physics and aeronomy.

**2004-2009**



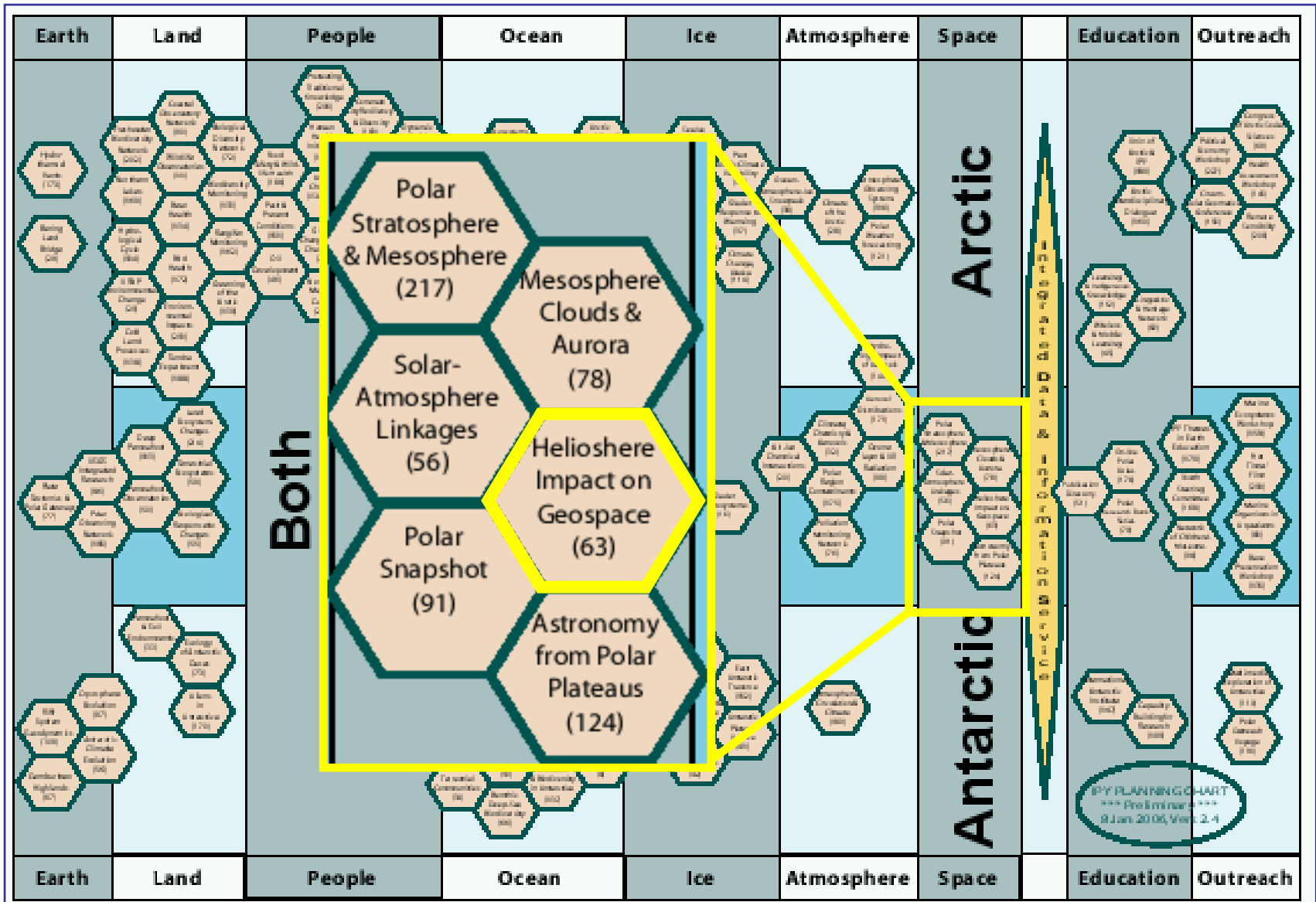
# International Polar Year(s) (2007-2009)

<http://www.ipy.org/>

- **Science Program “Expressions of Interest”**
  - Over 1000, grouped into ~50 clusters, covering all areas of polar science
- **Heliosphere Impact on Geospace**
  - One of the core projects of the fourth International Polar Year program which will take place during March 2007 - March 2009.
- **Project (IPY ID# 63)**
  - Run by a federation of 29 international research groups from which the **ICESTAR** and **IHY** communities will carry management responsibility and will serve as the contact point towards the IPY Project Office

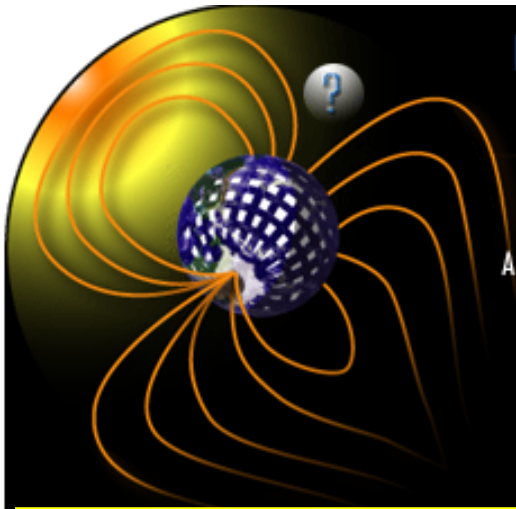


# The International Polar Year Planning Chart



# International Heliophysical Year (IHY)

*Science, Observatory Development, Outreach, History*



INTERNATIONAL HELIOPHYSICAL YEAR

2 · 0 · 0 · 7

Advancing our Understanding of the Fundamental Heliophysical Processes that Govern the Sun, Earth and Heliosphere

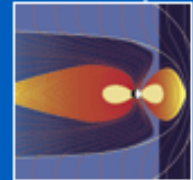
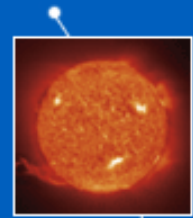
Continuing the tradition of international research and advancing the legacy on the 50th anniversary of the International Geophysical Year

Demonstrating the Beauty, Relevance and Significance of Space and Earth Science to the World

Visit: [ihy2007.org](http://ihy2007.org)

International  
Geophysical Year

Continuing a Tradition  
of International Collaboration  
on the 50th Anniversary  
of IGY 1957

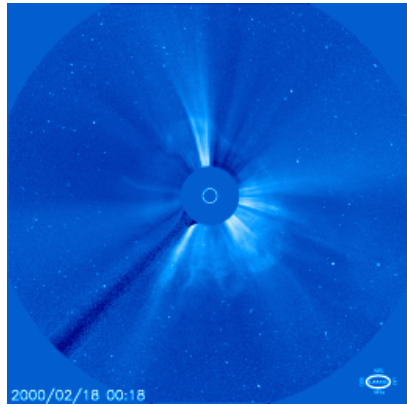


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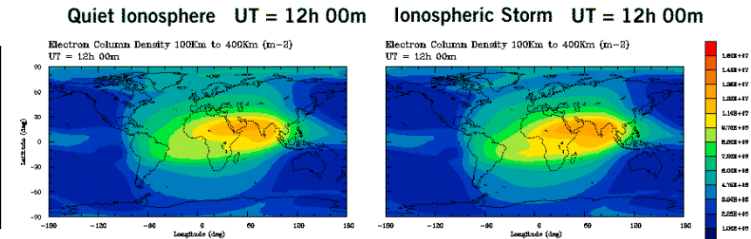
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# IHY: Overarching Science Themes



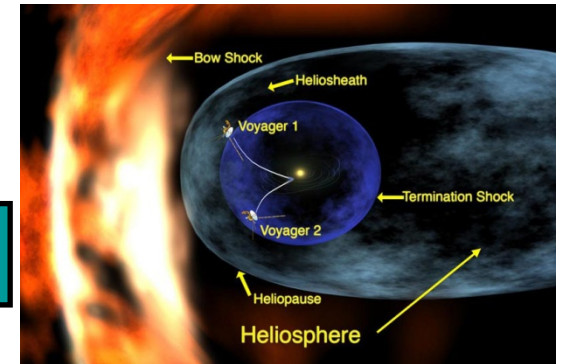
**Evolution and Generation of Magnetic Structures and Transients**

**Energy Transfer and Coupling Processes**

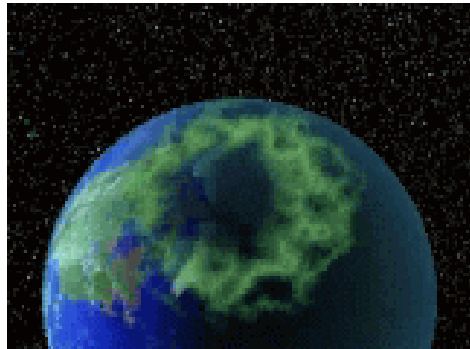
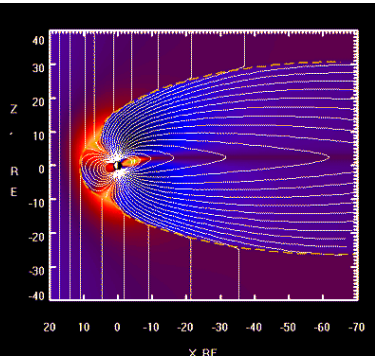


**Flows and Circulations**

**Boundaries and Interfaces**



**Synoptic Studies of the 3-D Coupled Solar-Planetary-Heliospheric System**





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

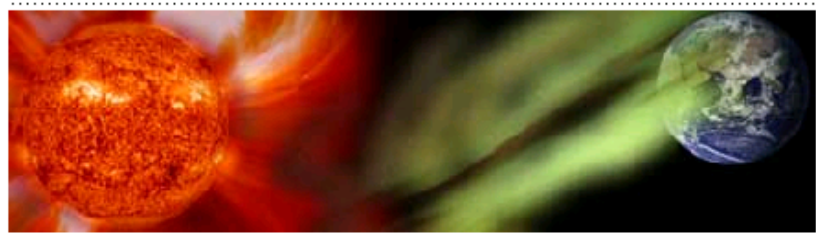
 

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## Interhemispheric Conjugacy Effects in Solar Terrestrial and Aeronomy Research



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.

### SCAR Meeting in St Petersburg

- July 8-11, 2008
- <http://www.scar-iasc-ipy2008.org/>
- **The ICESTAR business meeting will be held on 06 July 2008 in the afternoon starting at 14:00. The meeting will be in the "Conference Meeting Rooms, R8, Blue Hall."**

### Featured Presentation

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

by Milinevsky et al.

## 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](#)

Logout

# ICESTAR: Some Overarching Science Themes

- How the states of Earth's magnetosphere differ qualitatively and quantitatively under extreme, moderate, and quiet solar wind conditions?
- **What is common and what is different in solar-terrestrial phenomena observed over both the Arctic and Antarctic?**
- To what extent are the ionized and neutral high-latitude upper atmospheric regions affected by inputs from the lower atmosphere?



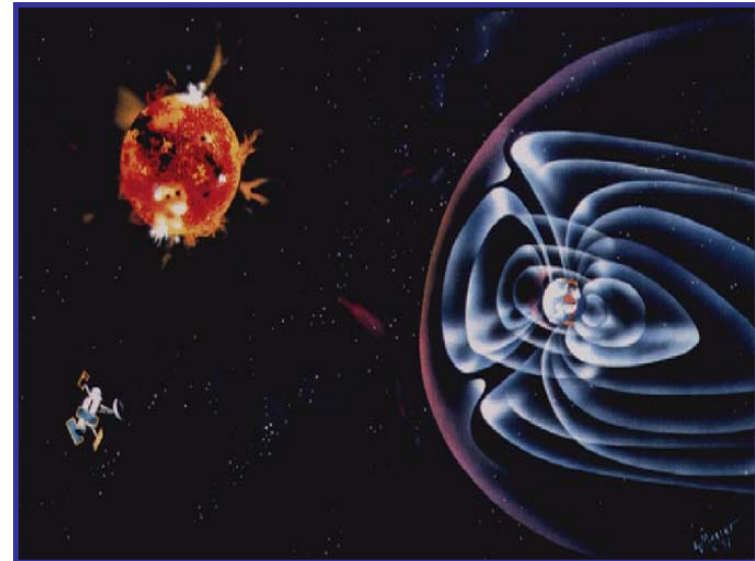
It is important and timely to study the polar regions in their interhemispheric context from observations in Space and over the Arctic and Antarctic

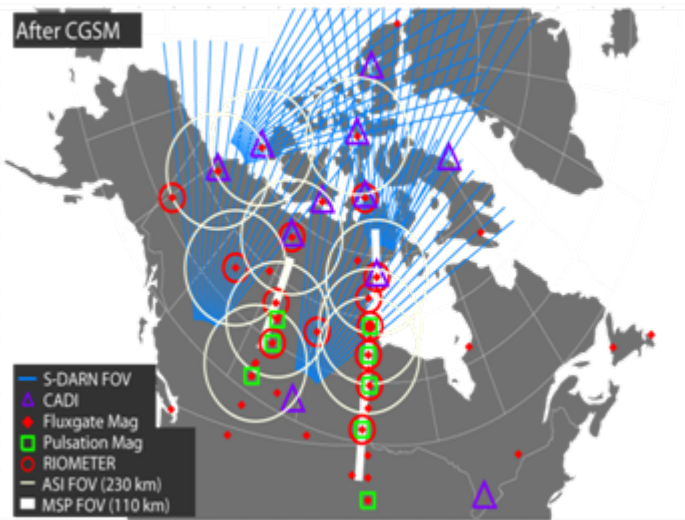
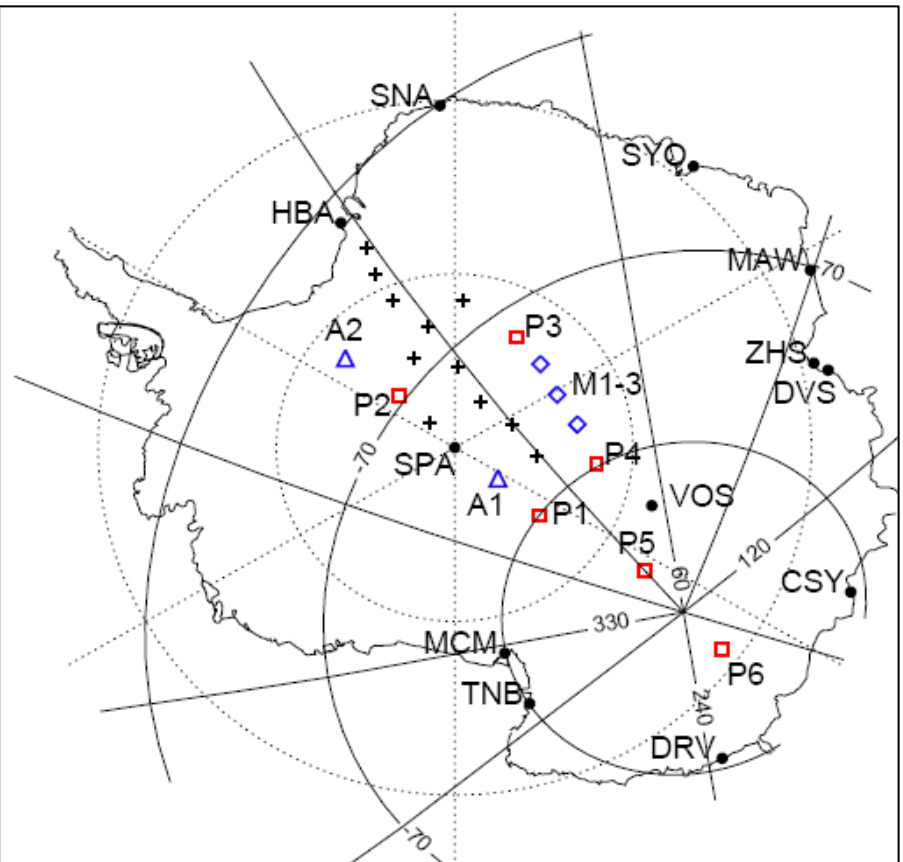
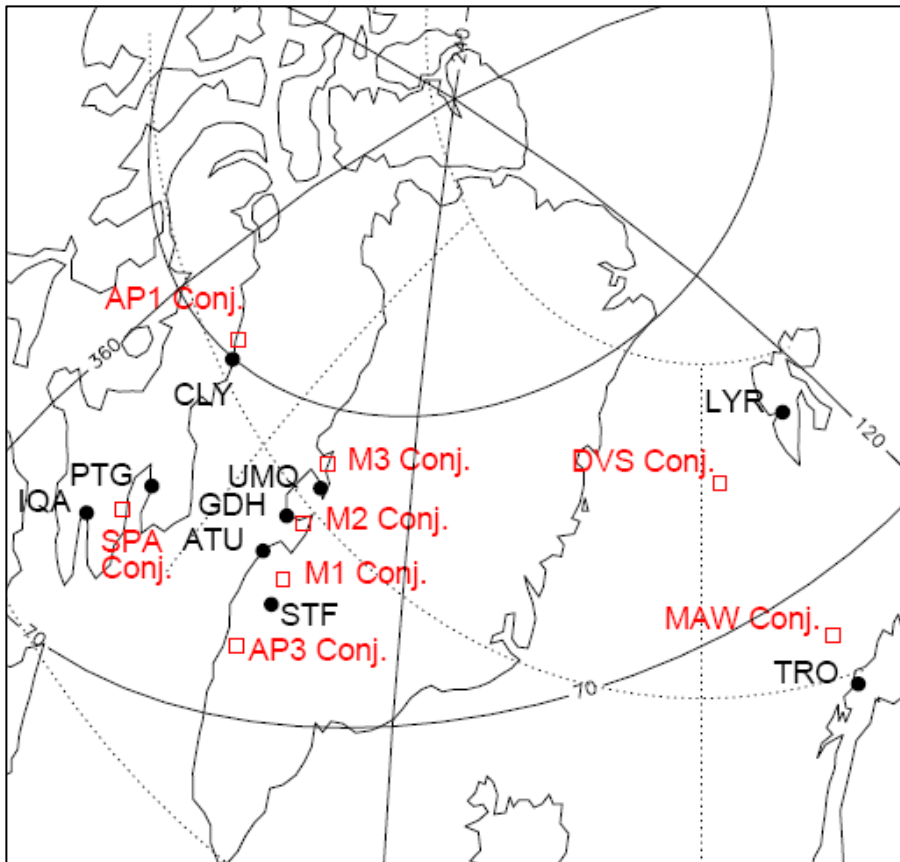




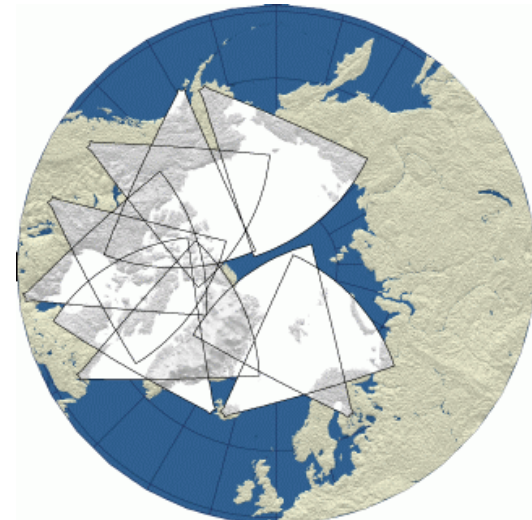
# IPY – ICESTAR - IHY

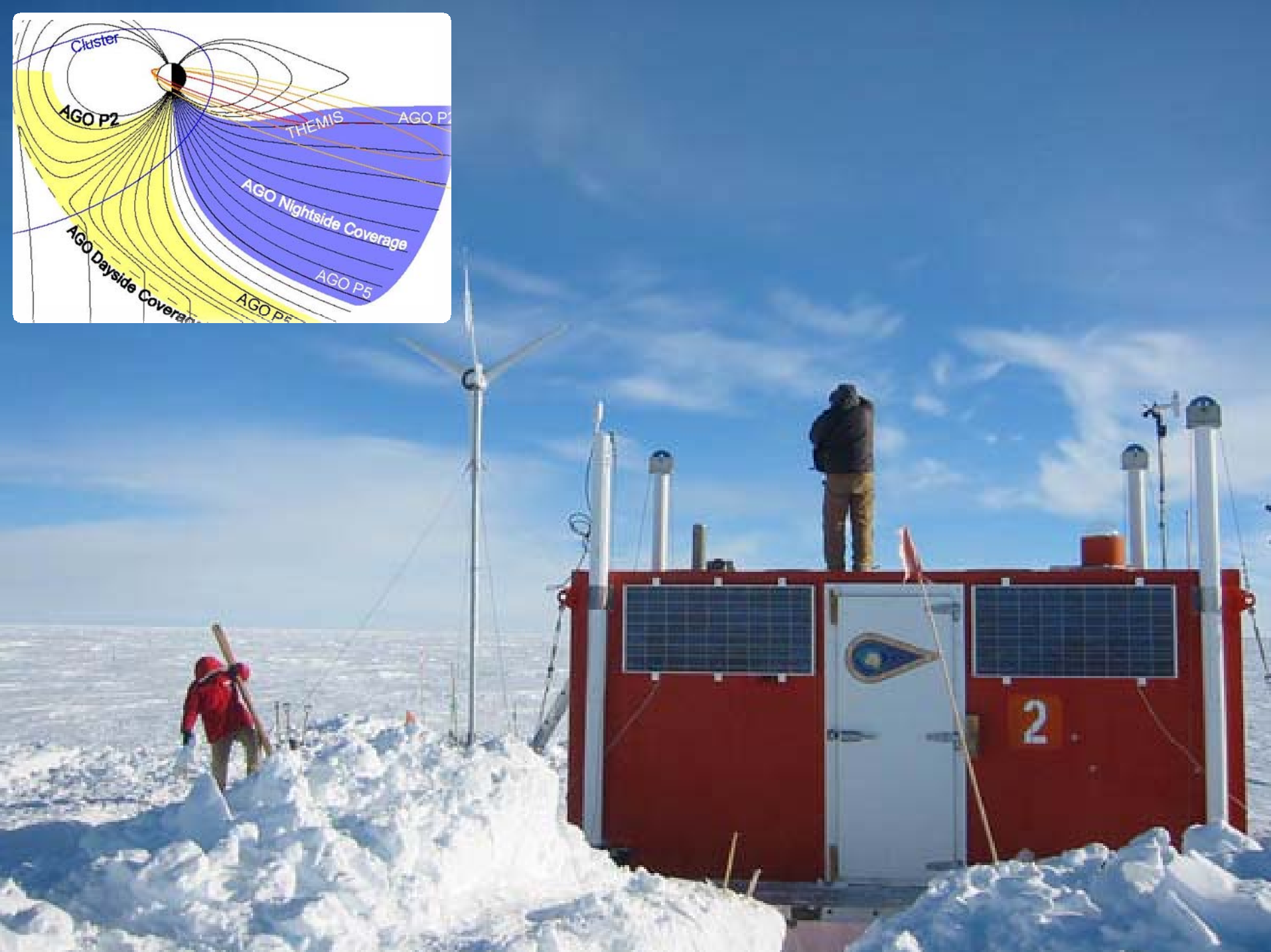
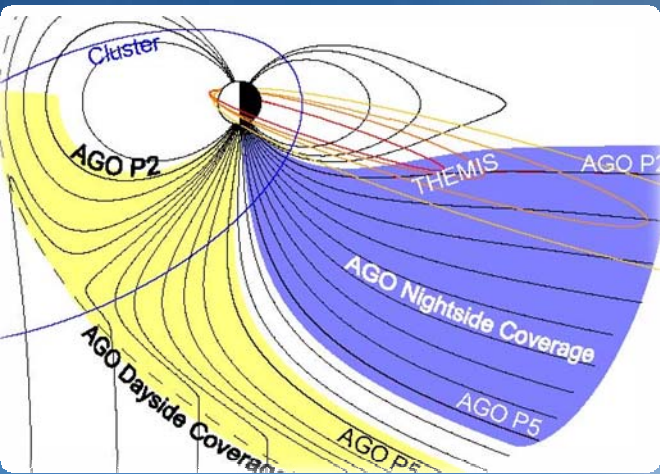
- **Coupling processes between the different atmospheric layers and their connection with solar activity**
  - Effects of solar energetic particles in mid-atmospheric chemistry
  - Global geo-electric circuit
  - Planetary and waves in the coupled mesosphere-thermosphere-ionosphere system
- **Energy and mass exchange between the ionosphere and magnetosphere**
  - Solar-Terrestrial plasma physics, space weather
  - Ionospheric tomography and scintillation
  - Remote sensing of radiation belt dynamics
- **Inter-hemispheric similarities and asymmetries in geospace phenomena**
  - Substorm development etc.
- **In addition**
  - Development of Virtual Observatories
  - New instrumentation and technology





**Global arrays of instruments provide one of the best resources for investigating the Atmosphere-Ionosphere-Magnetosphere System and validating models.**

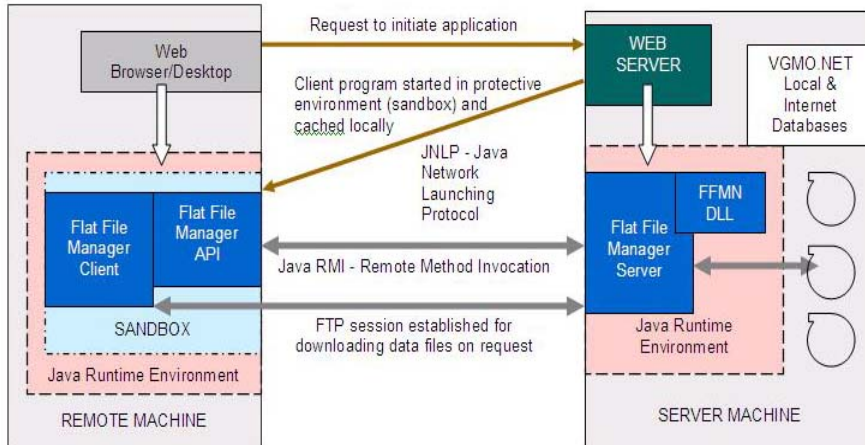




# Virtual Observatories and Data Management

## *Supporting Virtual Observatories*

### Virtual Global Magnetic Observatory



### Global Auroral Imaging Access



- The Global Magnetometer Initiative - SuperMAG
- A Virtual Global Magnetic Observatory: VGMO.NET, *Earth, Planets and Space*, 2006.

<http://gaia-vxo.org>

# Substorm Onset Location in the Conjugate Hemispheres

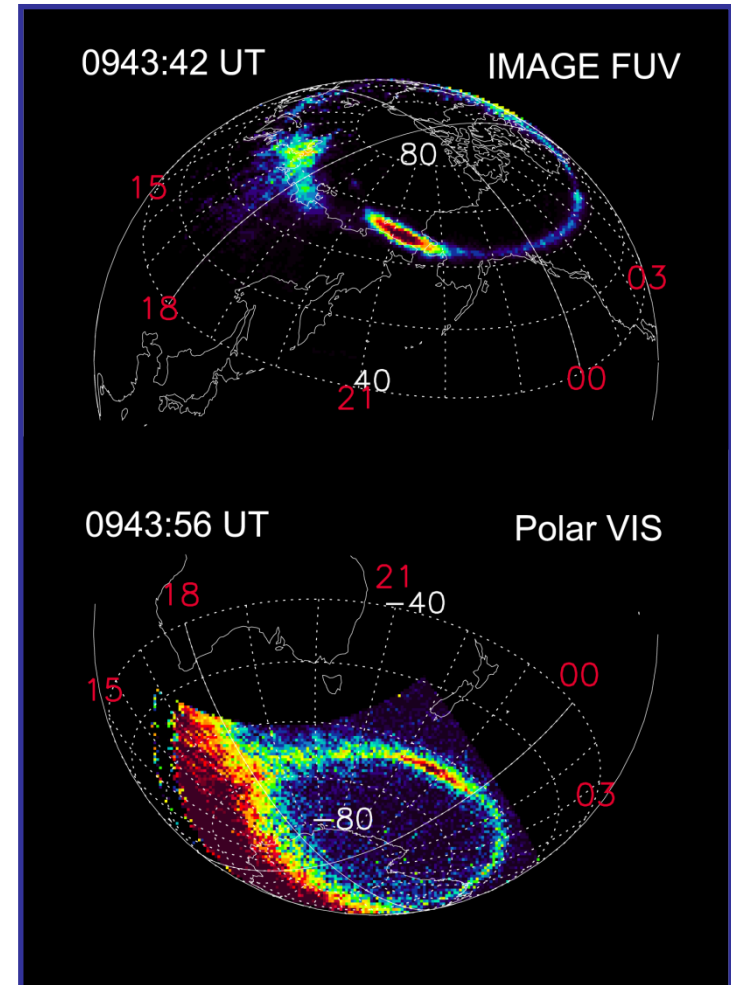
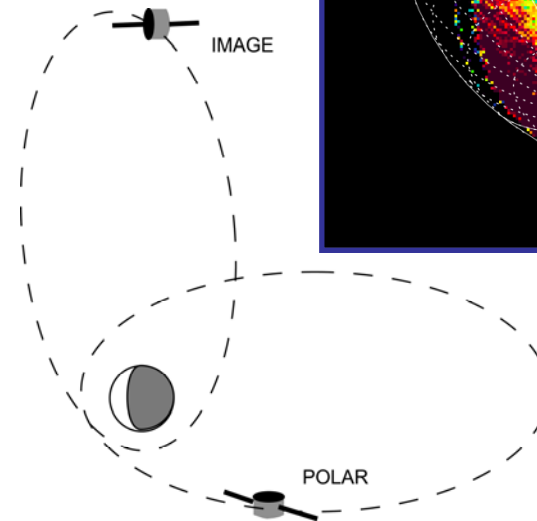
- Substorm onset is the first brightening of the aurora.
- Conjugate means points connected by magnetic field lines.
- What controls the asymmetry of substorm onset locations?
  - The orientation of the solar magnetic field – IMF?
- Asymmetry is 5-10 times larger than model predictions

See recent papers by:

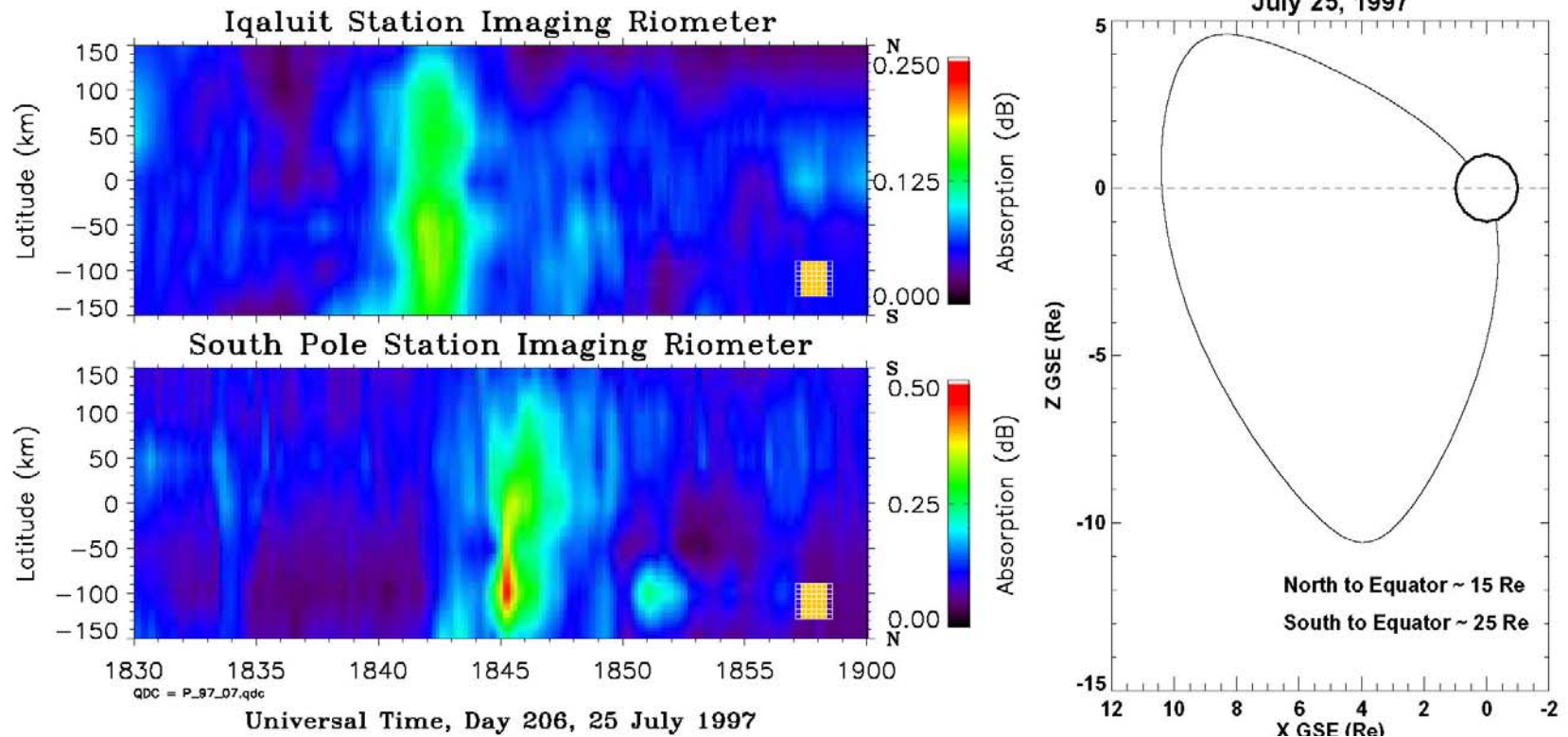
Østgaard et al., JGR, 2004

Østgaard et al., GRL, 2005

Østgaard et al., JASTP, 2006



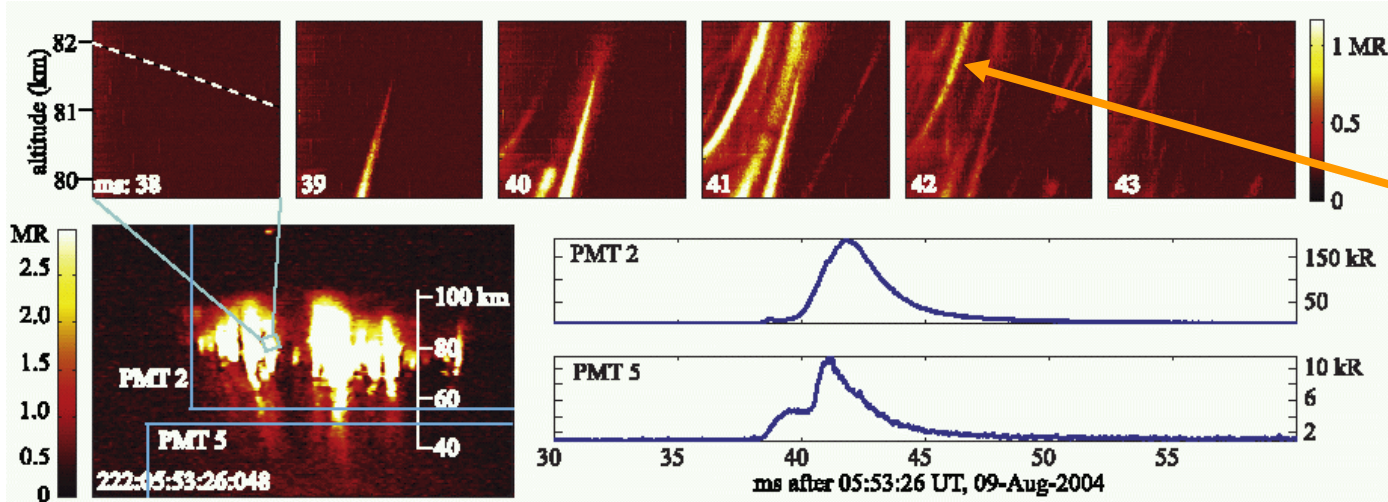
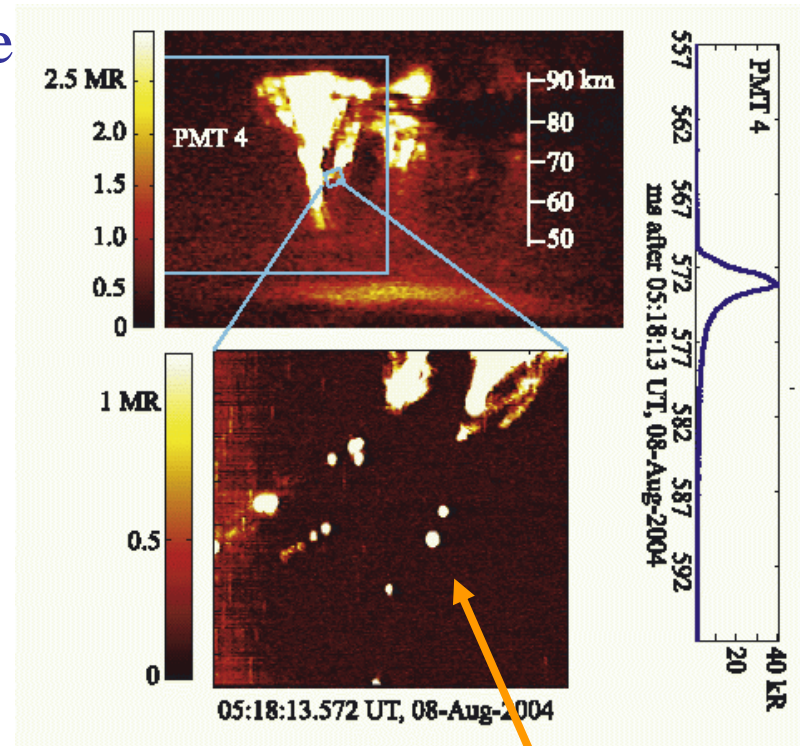
# Conjugate Observations of Traveling Convection Vortices



- TCV on closed field lines, source at  $\sim 8R_e$
- Riometers see the hard tail of electrons in the upward current, 1-3 min delay in South, they speculate if this is due to the different length of field lines from the source to the ionosphere.
- Murr et al., JGR, 2002

# Small Scale Structures in Sprites

- Marshall and Inan, Radio Science 41, RS6S43, 2006.
- Transient luminous events at 40-90 km, ~665 nm
- Streamers:  $L \sim$  tens of km,  $T \sim$  a few ms
- Above thunderstorms, typically associated with positive cloud-ground lightnings
- New imager system with both high time and space resolution



Beads

Streamers



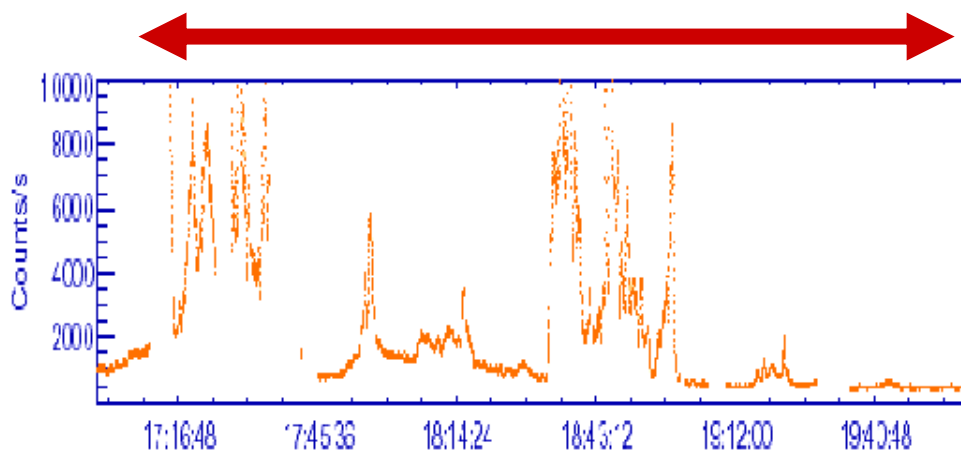
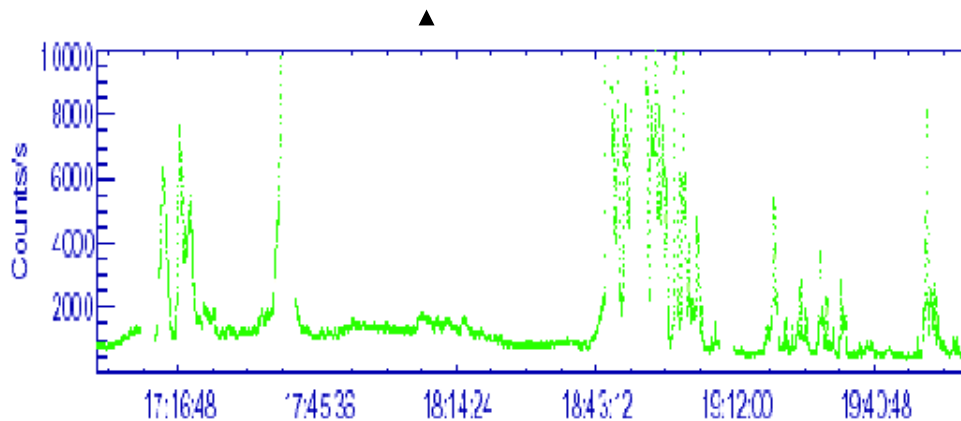
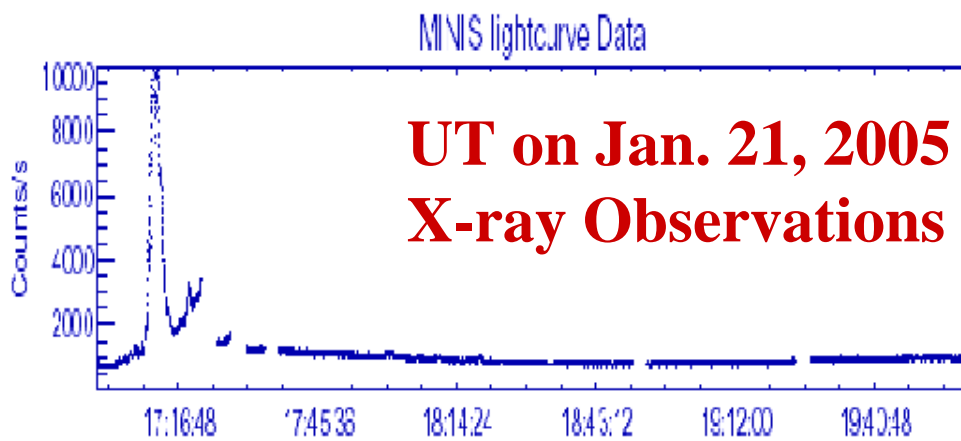
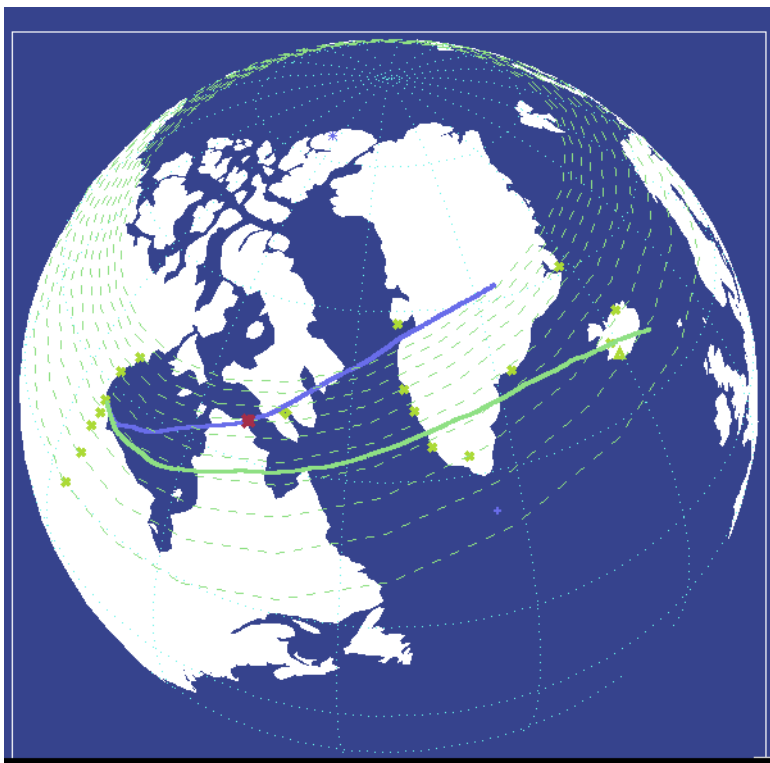


# Northern Balloon Observations

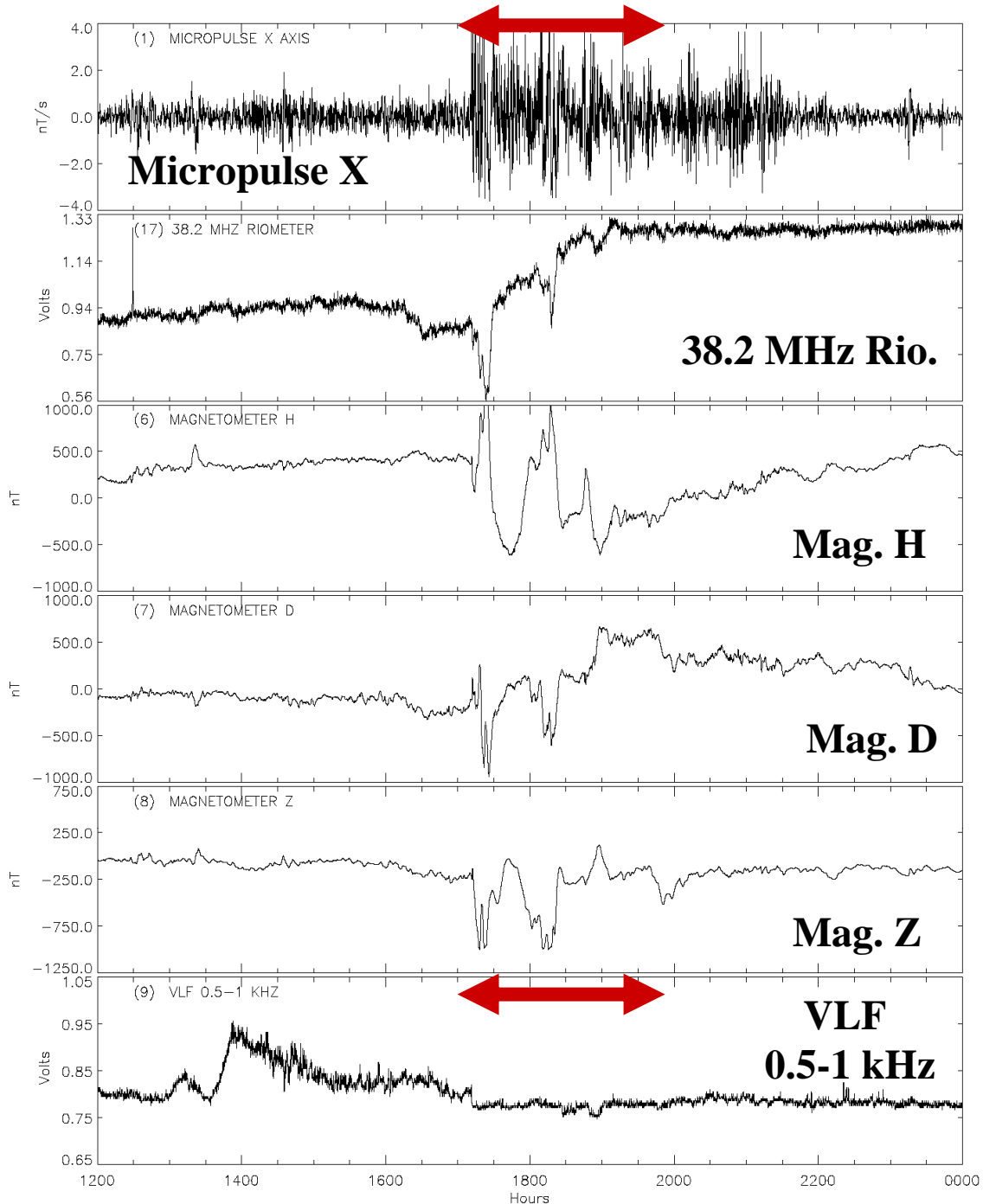
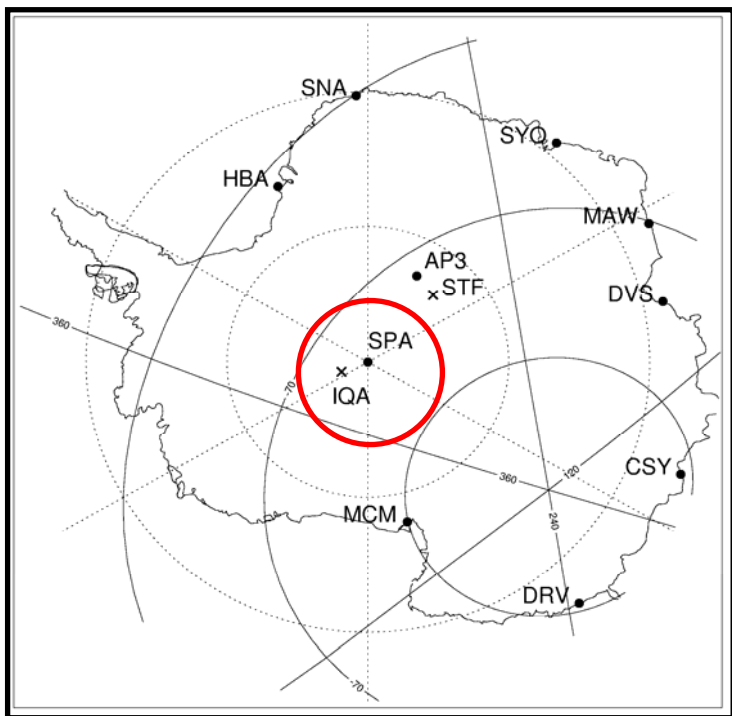
During the extremely active solar period from January 16-22, 2005, when several large X-class solar flares occurred, the MINIS (MINIature Spectrometer) balloon campaign had multiple payloads aloft.

R. M. Millan et al.

Dartmouth College



**Nominally conjugate magnetic, particle and wave activity at South Pole Station during the balloon campaign.**

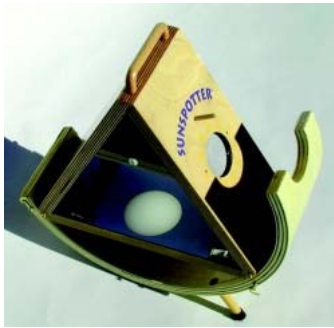


South Pole Station, day 021, 21 January, 2005

# Potential Outreach Activities

## Space Research Suitcase – University of Bergen

### Sunspotter



### Magnetometer



• *Mag-03IE*

### VLF-receiver



### Camera with a fish-eye lens



### Geiger counter or a cosmic ray detector



### Laptop



# Outreach

## VLF Monitors



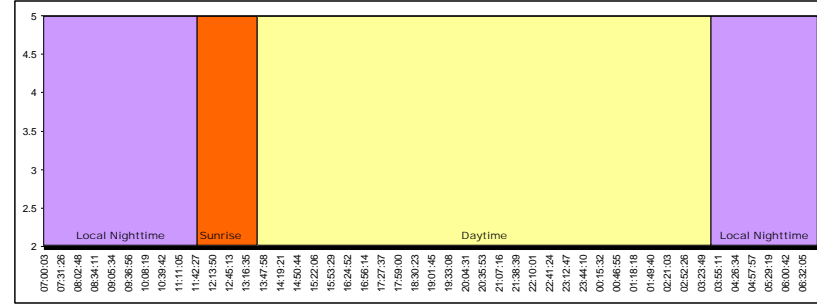
- Low Cost (~\$150)
- Single band
- 1 sample/5 seconds
- Preassembled & tuned
- Students build antenna
- Available free to underserved schools

## Contact

**Dr. Deborah Scherrer**

Stanford Solar Center

<http://solar-center.stanford.edu/SID>



A man with short dark hair, wearing a red long-sleeved shirt, is smiling and looking towards the camera. He is positioned in the lower right foreground. Behind him is a large, complex metal structure of a radio telescope dish, composed of many thin metal rods forming a grid. The dish is partially filled with snow or ice. The background is a clear, bright sky.

**Thank You**

**Please Visit**

*<http://scar-icestar.org>*

*<http://www.ipy.org>*