

NSF's Evolving Support for Space Weather Research and Operations

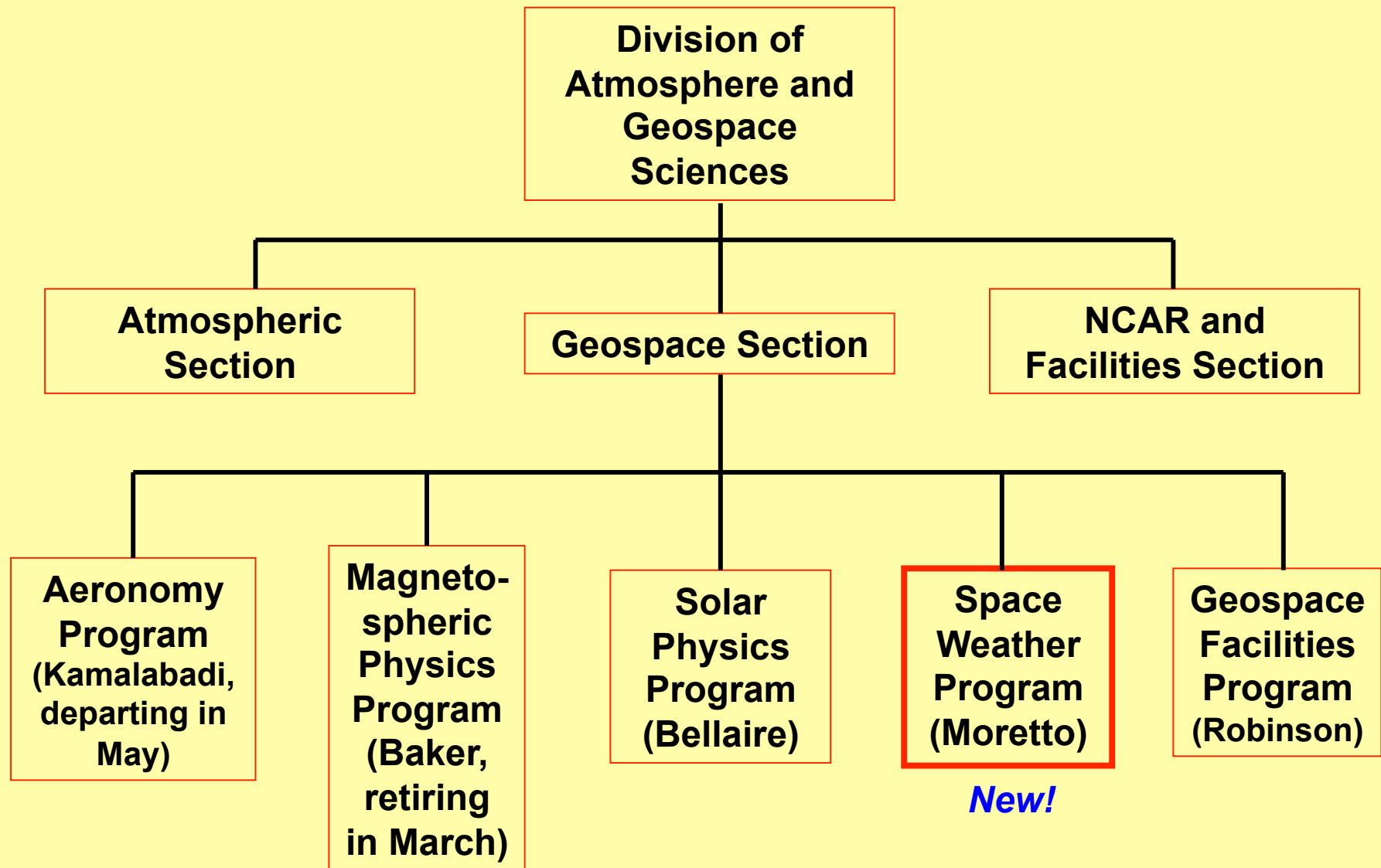


Bob Robinson

Recent Changes

- Space weather proposal solicitation discontinued
- Space weather basic research in CEDAR, GEM, and SHINE strengthened
- Multifaceted approach to space weather modeling in the post-CISM era
- Creation of a new Space Weather disciplinary program

NSF's Geospace Section



Purview of NSF's New Space Weather Program

- **Space weather modeling activities through NASA partnership, FESD*, and future NSF solicitations**
- **AMPERE program and follow-ons**
- **Cubesat program**
- **CCMC**
- **Space Weather awards for educational and outreach activities**

* Frontiers in Earth System Dynamics

NSF supports space weather research and operations; support for operations is done in the context of broader impacts:

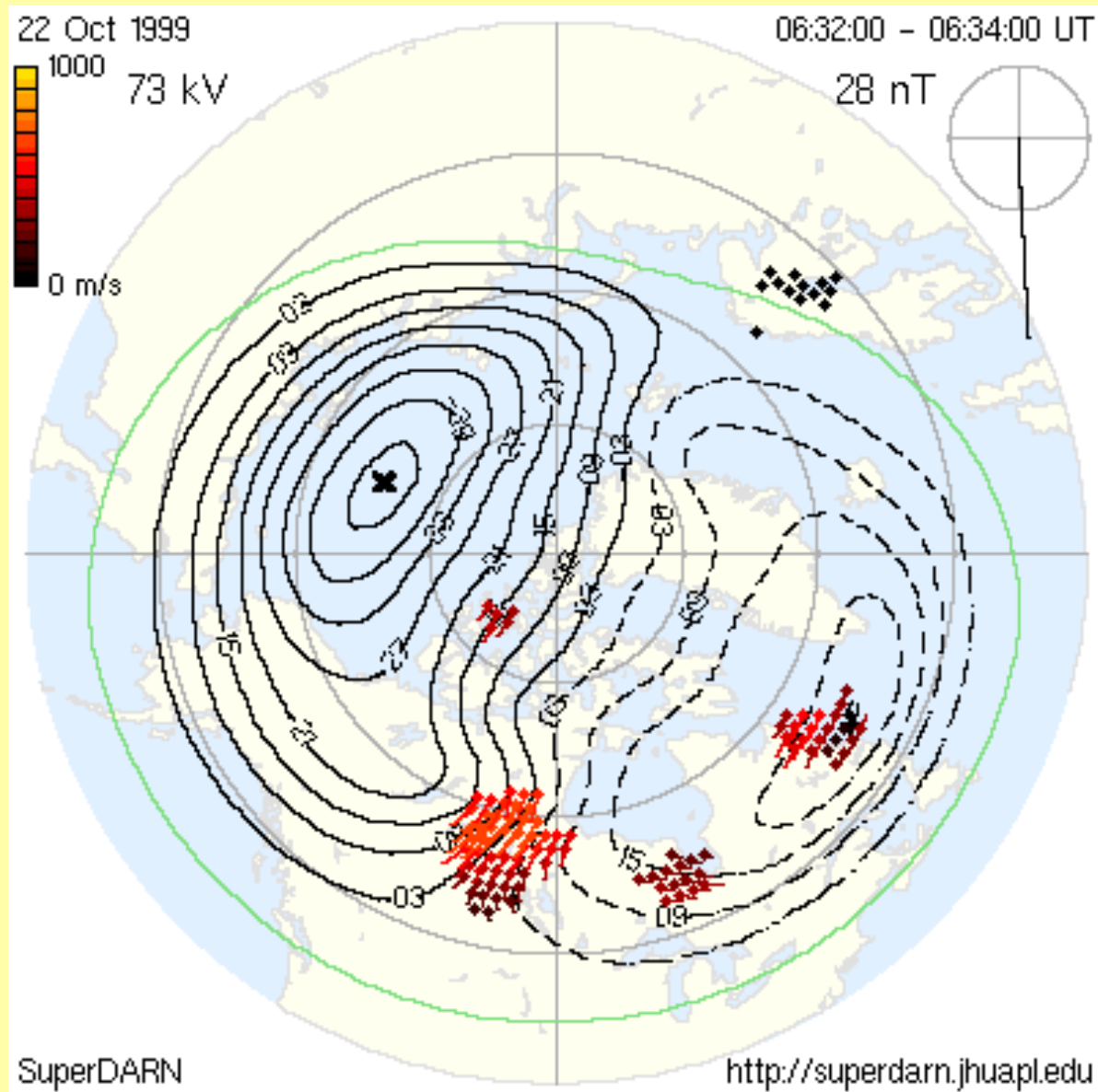
- **Make data available in a timely manner by means of databases, digital libraries, or other venues such as CD-ROMs.**
- **Demonstrate the linkage between discovery and societal benefit by providing specific examples and explanations regarding the potential application of research and education results.**
- **Partner with academic scientists, staff at federal agencies and with the private sector on both technological and scientific projects to integrate research into broader programs and activities of national interest.**

Examples of Real-Time Observations Supported by NSF

- **SuperDARN**
- **AMPERE**
- **AMISR**
- **COSMIC**
- **GPS Networks**



SuperDARN Real-Time Convection Map





Data acquisition up and running!



Side-by-side comparison of data acquired in 10 minutes. Old: 200 s/sample
Standard AMPERE: complete coverage with $\sim 1^\circ$ lat. res. 20 s/sample
High rate AMPERE: $\sim 0.1^\circ$ lat. res. 2 s/sample

Old Data

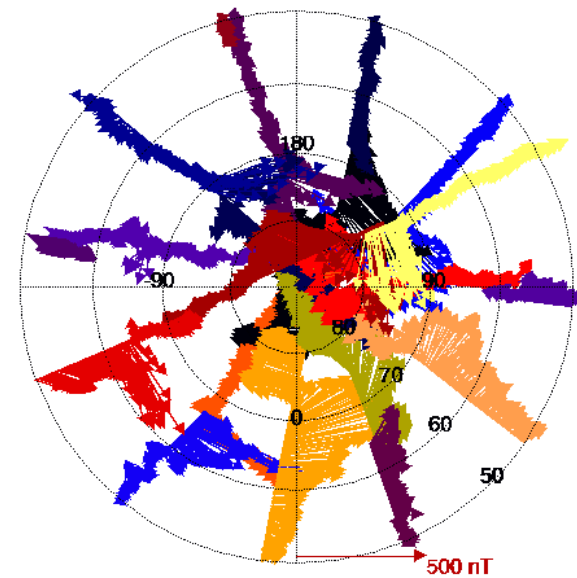
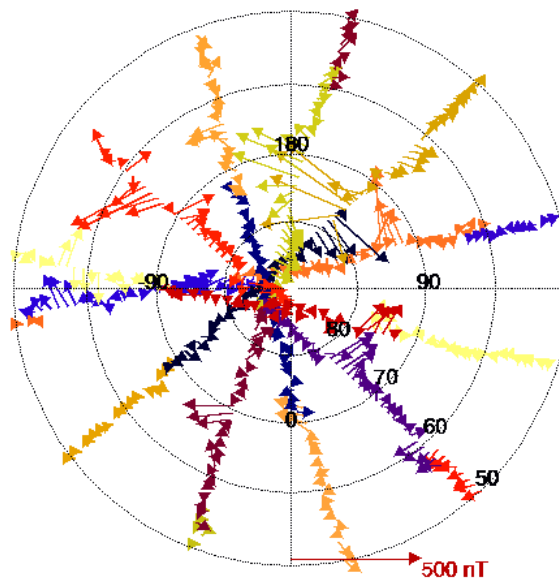
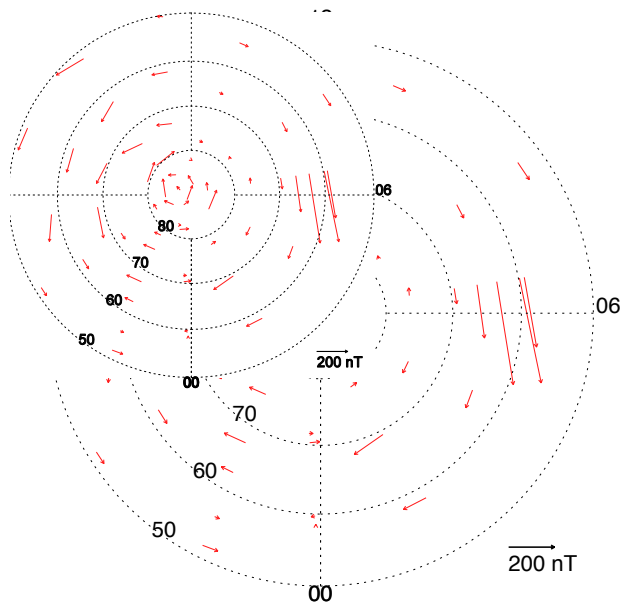
AMPERE: Standard

AMPERE: High

10/01/2002 11:55-12:05

11/25/2009 08:45-08:55

11/24/2009 18:27-18:37

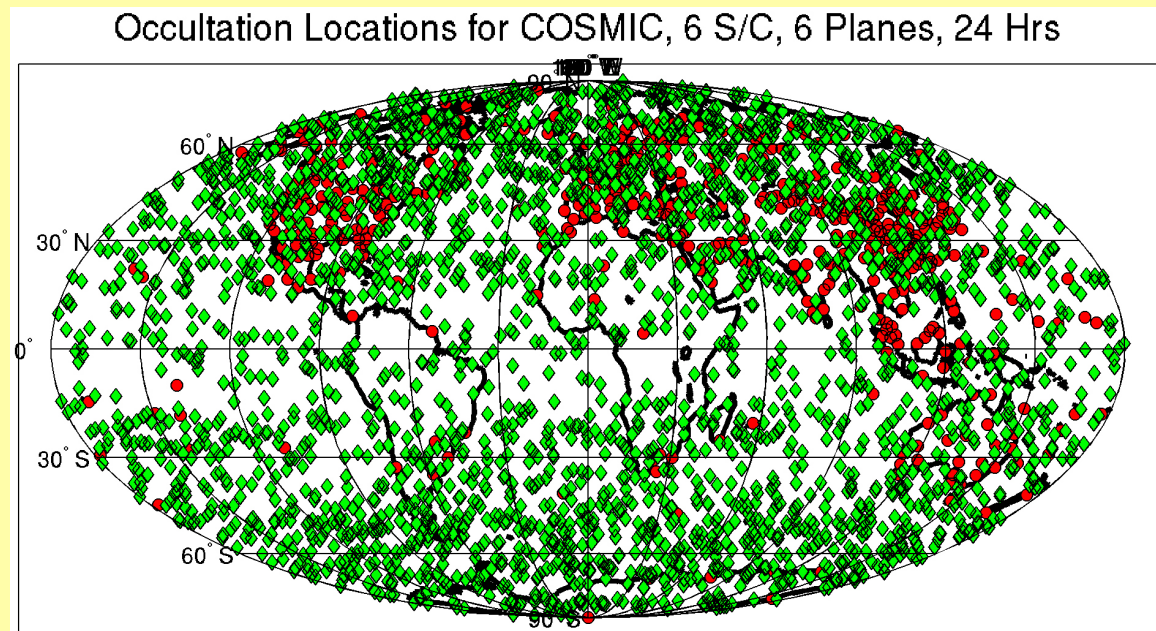
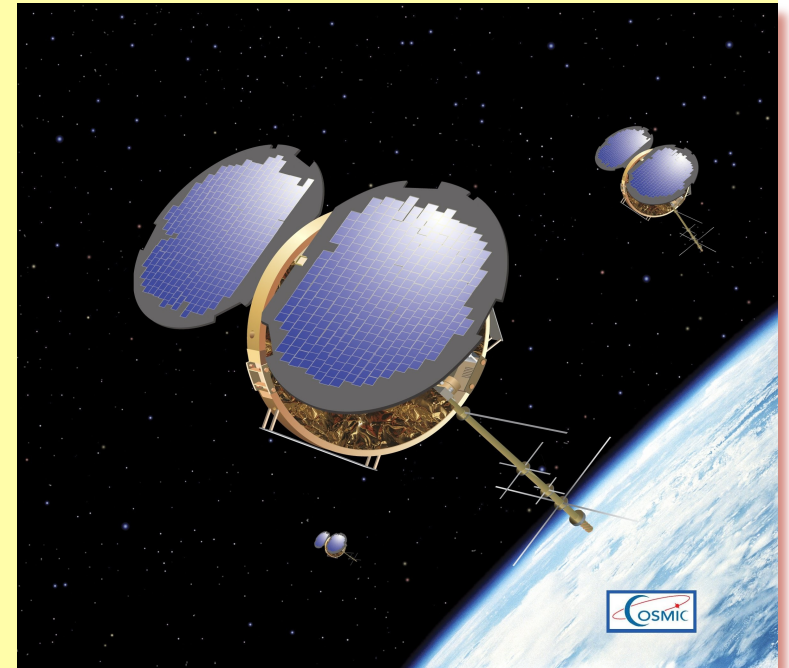


TLM data from all satellites

Different colors denote different satellites

COSMIC

- Taiwan-US Collaboration
- Six satellites record weather, climate, and space weather data
- NSF lead agency for science activities



Benefits of real-time data to research community

- Researchers are users of space weather information too
- Predictions are used to plan experiments and campaigns
- Real-time data can be used to initiate observations
- Real-time data can be used to reconfigure sensors or change operating modes

The Valley of Death is changing

- **The internet has made enormous amounts of research results easily accessible**
- **Models and data need not be strictly “operational” to be of use to operations**
- **Education and training is key to effective use of research model results and observations**
- **The CCMC has demonstrated the tremendous operational usefulness of research level data and models**

Conclusion:

The CCMC has demonstrated that:

- **The research community can contribute and benefit from enabling transition of research results to operations**
- **The easy and reliable access to information has created a valuable resource of quasi-operational data and model results**
- **Education and training is vital to getting the most out of available information**
- **The Valley of Death is becoming a Valley of Opportunity**