



CAWSES: Climate and Weather of the Sun–Earth System

Sunanda Basu
Chair, Science Steering Committee,
CAWSES

*Second ILWS General Meeting
Banff, Canada
May 25–26, 2004*

SCOSTEP

SCOSTEP's mission: to implement research programs in solar-terrestrial physics that benefit from international participation and that involve at least two ICSU bodies.

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CAWSES

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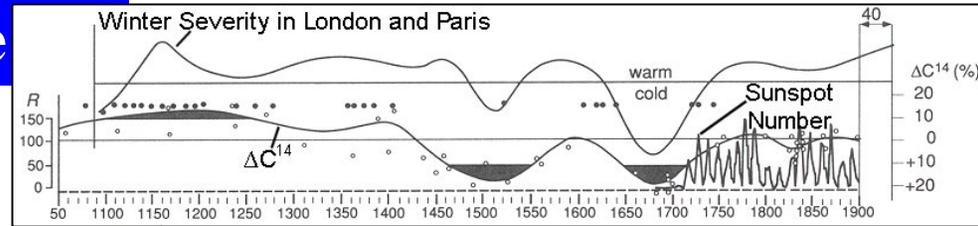


CAWSES Meetings – Initial Phase

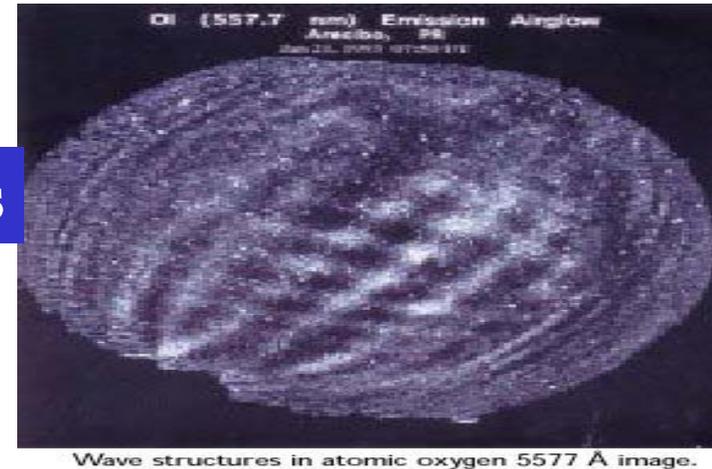
- First CAWSES SSG Meeting held at Maastricht, The Netherlands in August 2002
- Four themes approved by SCOSTEP Bureau at Rio de Janeiro, Brazil, September 2002
- Theme leaders presented their plans at a Town Hall Meeting in April 2003 during the EGS/AGU Joint Assembly in Nice, France
- CAWSES Program presented at first ILWS Meeting in Nice, France, April 2003
- Special CAWSES Meeting held in July 2003 in conjunction with the IUGG Meeting at Sapporo, Japan
- Election of new SCOSTEP Bureau was held in Sapporo and CAWSES Report was presented to them

Four Themes under CAWSES

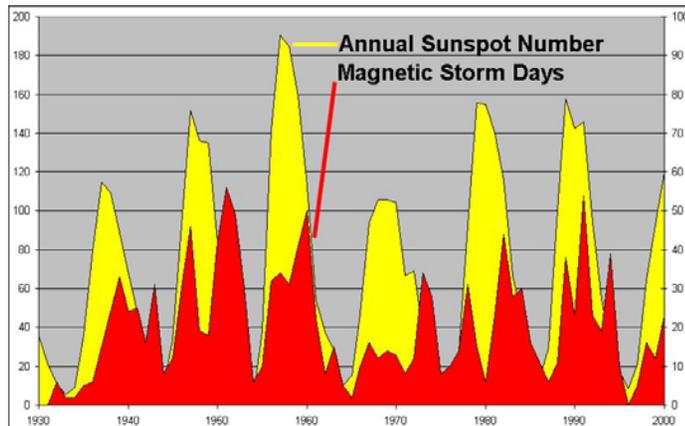
Solar Influence on Climate



Space Weather: Science and Applications



Atmospheric Coupling Processes



Climatology of the Sun-Earth System

Theme 1: Solar Influence on Climate

Co-Chairs: Michael Lockwood (UK) and Lesley Gray (UK)

WG 1.1: Assessment of Evidence for Solar Influence on Climate

Juerg Beer (Switzerland), William Russow (USA), Ilya Usoskin (Russia), Judith Lean (USA), Gerard Thuillier (France), Gerry North (USA), Peter Stott (UK), Warren White (USA), Lon Hood (USA), Karin Labitzke (Germany), Augusto Mangini (Germany)

WG 1.2: Investigation of Mechanisms for Solar Influence on Climate

Ulrich Cubasch (Germany), Gerry Meehl (USA), Kuni Kodera (Japan), Garcia (USA), David Rind (USA), Mark Baldwin (USA), Charles Jackman (USA), Jon Kristjansson (Norway) and Giles Harrison (UK)

Theme 2: Space Weather Science & Applications

Co-Chairs: Janet Kozyra (USA) and Kazunari Shibata (Japan)

Santimay Basu (USA), Walter Gonzalez (Brazil), Nat Gopalswamy (USA), A. T. Koba (Ivory Coast), Anatoly Petrukovich (Russia), Rainer Schwenn (Germany), Wei Feng Si (China) and R. Sridharan (India)

Theme 3: Atmospheric Coupling Processes

Co-Chairs: Franz-Josef Luebken (Germany) and Joan Alexander (USA)

WG 3.1: Dynamical Coupling and its Role in the Energy and Momentum Budget of the Middle Atmosphere

Martin Mlynczak (USA), William Ward (Canada), David Fritts (USA), Nikolai Gavrilov (Russia), S. Gurubaran (India), Maura Hagan (USA), J. Y. Liu (Taiwan), Alan Manson (Canada), Dora Pancheva (UK), Kauro Sato (Japan), Kazuo Shiokawa (Japan), Hisao Takahashi (Brazil), Robert Vincent (Australia) and Yi Fan (China)

WG 3.2: Coupling via Photochemical Effects on Particles and Minor Constituents in the Upper Atmosphere

Charles Jackman (USA), Ulf Hoppe (Norway), Manuel Lopez-Puertas (Spain), Daniel Marsh (USA), James Russell (USA), David Siskind (USA)

WG 3.3: Coupling by Electrodynamics including Ionospheric Magnetospheric Processes

Steve Cummer (USA), Peter L. Dyson (Australia), Inez S. Batista (Brazil), Archana Bhattacharya (India), Jorge Chau (Peru), Martin Fullekrug (Germany), Gang Lu (USA), Roland Tsunoda (USA), and M. Yamamoto (Japan)

WG 3.4: Long-Term Trends in Coupling Processes (*inter-connected with 4.4*)

Theme 4: Space Climatology

Co-Chairs: Claus Froehlich (Switzerland) and Jan Sojka (USA)

WG 4.1: Solar Irradiance Variability

Judit Pap (USA) and Gerard Thuillier (France)

WG 4.2: Heliosphere Near Earth

Leif Svalgaard (USA)

WG 4.3: Radiation Belt Climatology

Takahiro Obara (Japan)

WG 4.4: Long-Term trends in Ionospheric and Upper-Atmospheric Variability (*inter-connected with 3.4*)

Capacity Building & Education

Co-Chairs: Marv Geller, S. T. Wu and Joe Allen

- CAWSES will hold meetings and provide specialized training courses for scientists from developing nations and help with computational and data resources
- Establish partnerships between developing & industrialized nations
- ICSU Grant Application made for such activities



1st CAWSES Campaign

> 40 participating international space & ground-based programs & growing. In collaboration with:

- **ISR World Days, MI-coupling campaign, 29 March - 3 April 2004**

- Focus:

- Coupling between the high- and low-latitude ionospheres
- Coordinated observations by incoherent scatter radars worldwide

- Sonderstrom, EISCAT, Svalbard, Millstone Hill, Arecibo, Jicamarca, Irkutsk (Russia), and Kharkov (Ukraine)

- Led by Chao-Song Huang (MIT/Haystack)

- **CPEA (Coupling Processes in the Equatorial Atmosphere) Campaign, March - April 2004**

- Focus:

- Coupling troposphere up through thermosphere
- strong convective region over Indonesia

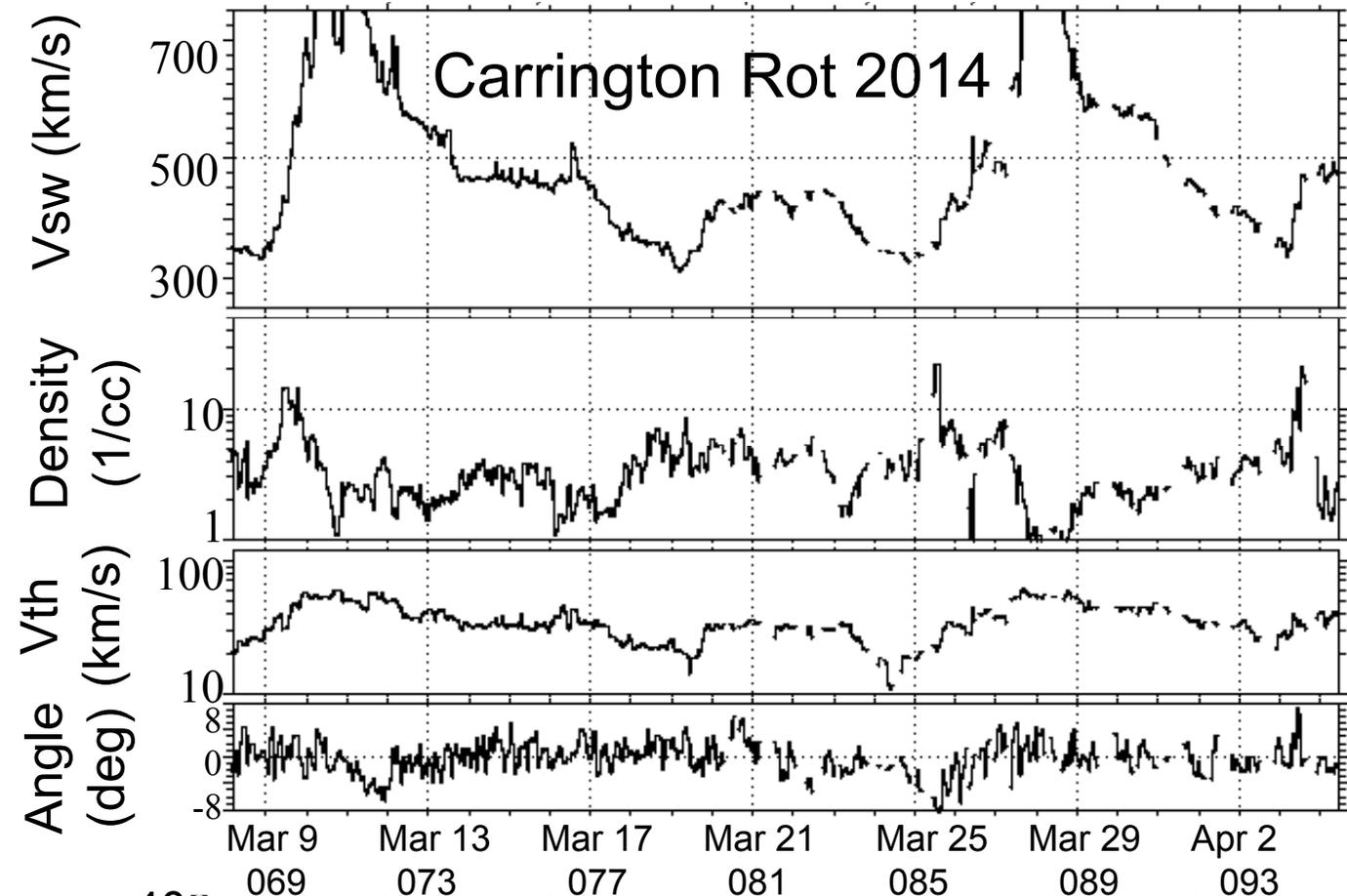
- Led by Prof. Shoichiro Fukao, Dr. Mamoru Yamamoto (Kyoto Univ)

Purpose to investigate:

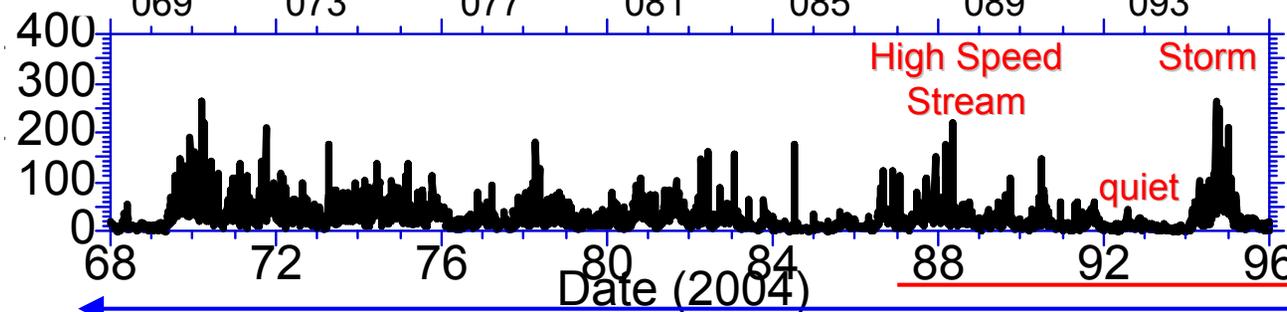
- **Space Weather Sun-to-Earth (27 March - 6 April 2004)**
 - Collect a sun-to-Earth data set which dips down into the lower atmosphere
 - Provide first testbed for a CAWSES/GEM/IAGA effort to combine international magnetometer chains & produce global maps of ULF wave index and magnetospheric density.
- **Equinox State of the Middle Atmosphere & Coupling between Atmospheric Regions (March - April 2004)**
 - By collecting worldwide information on the equinox middle atmosphere.
 - By serving as test bed (where possible) for global integrated maps of middle atmosphere parameters - (i.e., gravity waves, temperature, winds, etc). Looking for gaps to fill.
- **Post-Event Analysis Led Jointly by CAWSES Space Weather & Atmospheric Coupling Panels**

What Happened during the Campaign?

University of Maryland SOHO/celias/mtof/PM



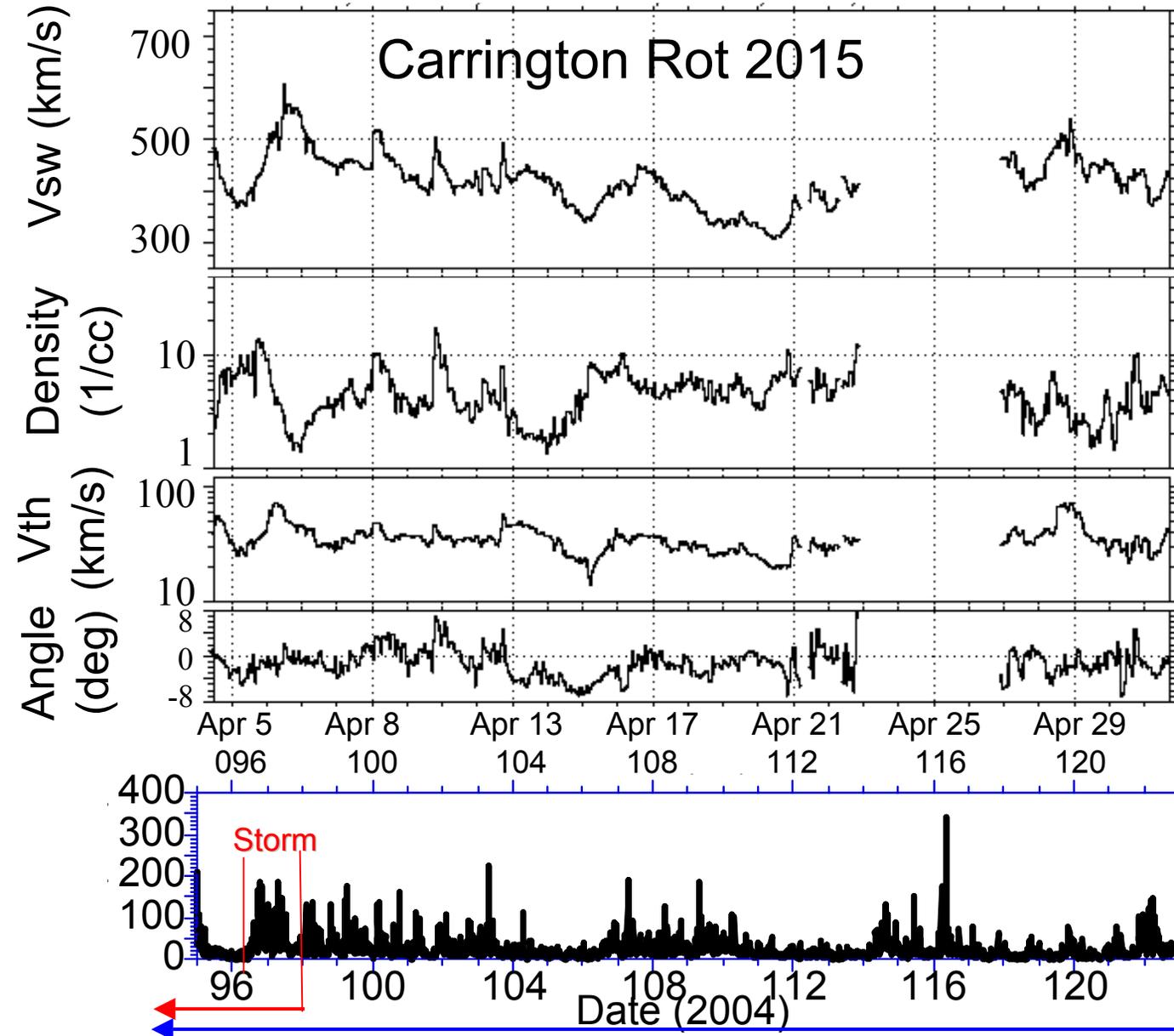
- Strong high speed stream beginning March 25, peaking March 27.
- Electron radiation belt enhanced beginning late March 28
- Supports campaign focus area on ULF waves & electron acceleration



Space Weather
Atmospheric Coupling

What Happened during the Campaign?

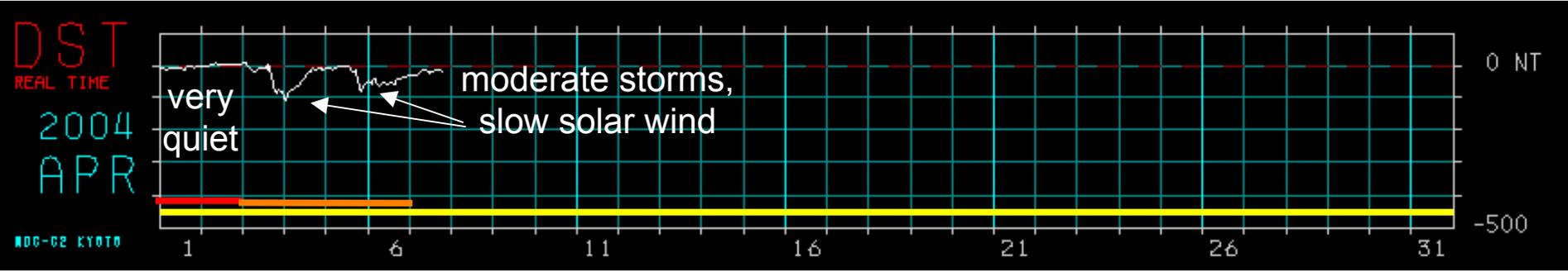
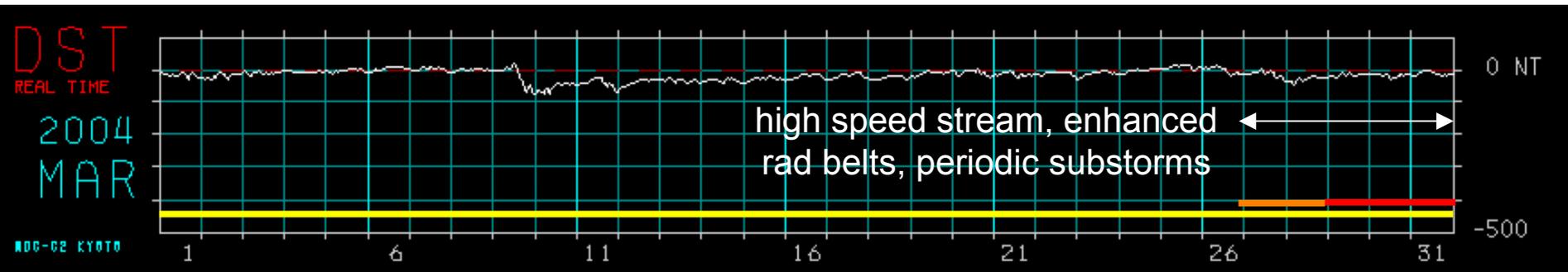
University of Maryland SOHO/celias/mtof/PM



- Strong stream structure has disappeared in April 2004 (CR 2015).
- Weak smaller-scale solar wind streams still generating considerable auroral activity due to fluctuating IMF Bz.
- Storm on 5-6 April at leading edge of a high speed stream

Space Weather
Atmospheric Coupling

Magnetic Activity during the Campaign?

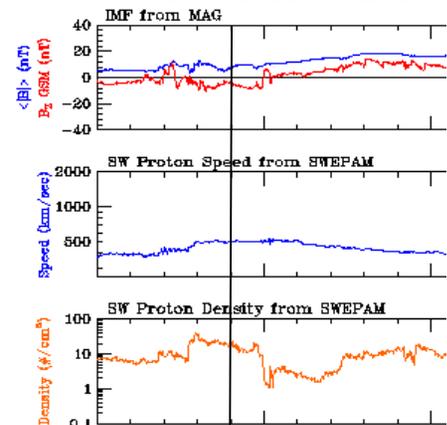


- ISR World Days
- Expanded CAWSES Space Weather Campaign
- CAWSES Equinox Atmosphere Campaign, collaboration with CPEA

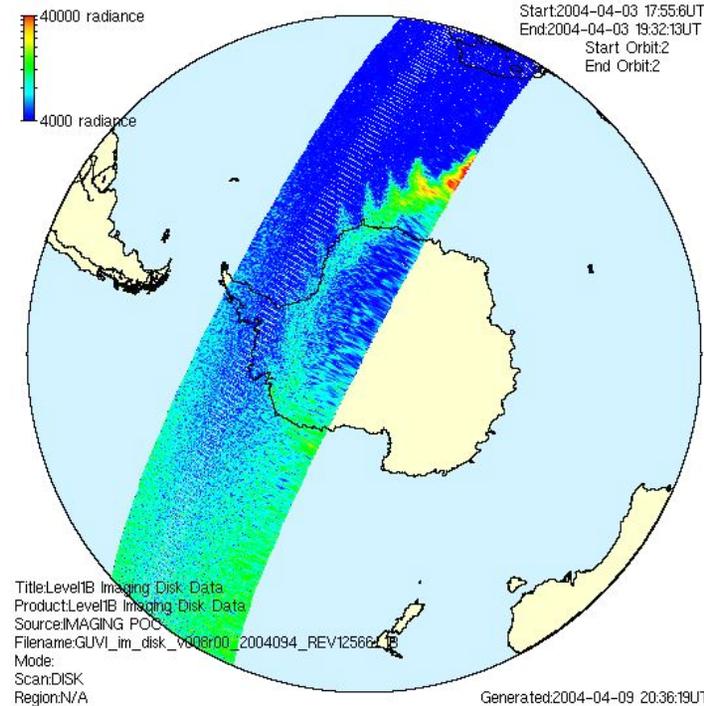
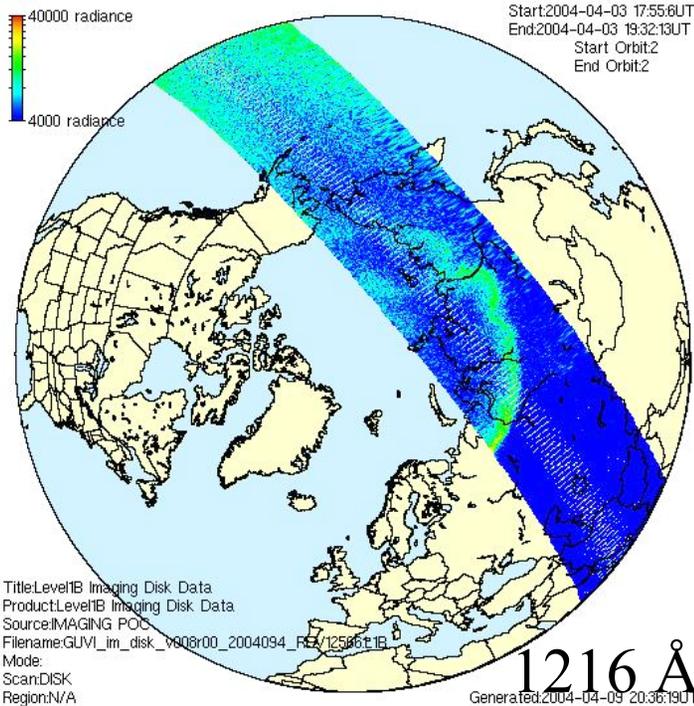
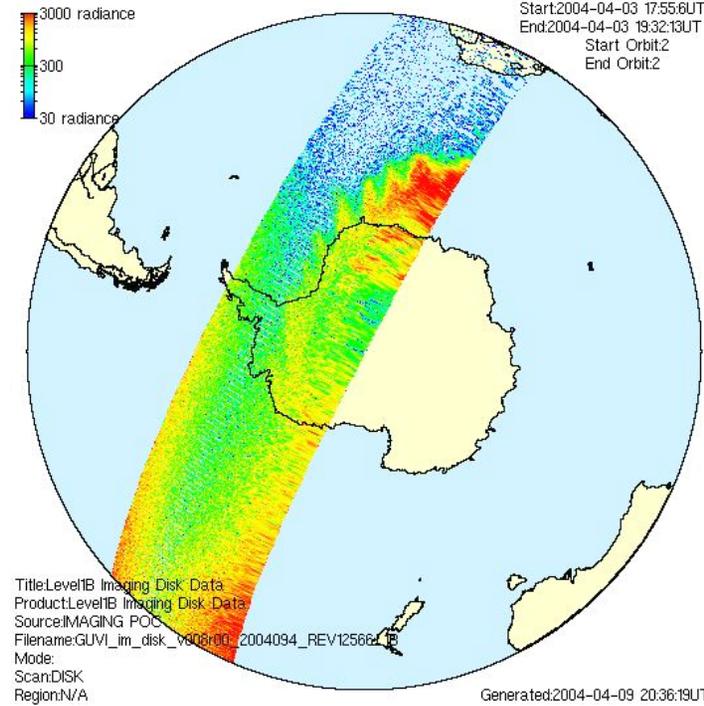
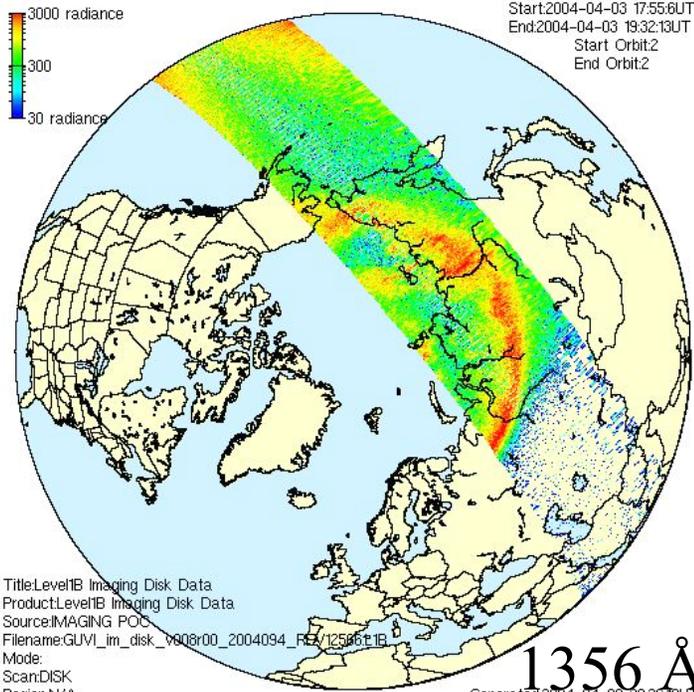
Early Science Highlights

- ❖ Superdense cool plasma sheet on 4/3 [Michelle Thompson, LANL GEO]
- ❖ Observations of unusual wave-like structures in the auroral emissions on 4/3 and 4/5 [Larry Paxton, TIMED]
- ❖ Enhanced levels of odd Nitrogen and Ozone in April 2004 - cause unknown [James Russell, UARS HALOE].
- ❖ High speed stream observed
 - Delayed enhancement in the radiation belts.
 - Potential for new scientific discovery: Global maps of ULF wave parameters, satellite observations of radiation belts, ULF & VLF wave activity
- ❖ 4/3 storm produced by 3/31 CME
 - Why was transit so slow?
 - How is geoeffectiveness different for slow CME?
- ❖ Very magnetically quiet days (4/1-2).
 - Important to specify initial quiet state of the system
 - Starting point for assimilative or first principles modeling of the following storm activity.

ACE Browse Data - Latest 4



April 3 April 4



[Courtesy
Larry Paxton,
TIMED/GUVI]

CAWSES Moves Forward

- CAWSES Office established at Boston University, Jan 16, 2004
 - D. Pallamraju (Raju) appointed Scientific Coordinator
- First Newsletter published in March, 2004
- Many Working Group members have been chosen
- First CAWSES Campaign organized in March –April, 2004 in conjunction with CPEA Campaign
- Proposal submitted by L. Gray (as PI) for Workshop on Solar Influences on Climate at ISSI in Bern, Switzerland
- Special all–day CAWSES Meeting at Observatoire de Paris, July 17, 2004
- CAWSES presentation at ILWS Session, COSPAR Meeting, Paris, July 19, 2004
- Solar Irradiance Variability Session at COSPAR, 2004
- Atmospheric Coupling Group Meeting on July 22, 2004 at COSPAR

CAWSES – National and Regional Programs

- CAWSES–India has been approved by ISRO
 - Workshop held in April, 2004
- CAWSES has been approved as a priority program by DFG in Germany
- CAWSES–Japan will have its inaugural Workshop near Nagoya, Japan on June 16, 2004
- CAWSES–AOPR (Asia Oceania and Pacific Rim) Center will be discussed in Taipei on June 18, 2004