



**CAWSES: Climate and Weather
of the Sun-Earth System**
**Activities in Theme 3:
Atmospheric Coupling Processes**

**Joan Alexander and Franz-Josef Luebken
Co-Chairs for Theme 3**

and

**Sunanda Basu
Chair, Science Steering Committee**



CAWSES Scientific Steering Group

- Chair: Sunanda Basu, BU, USA
- Jean-Louis Bougeret, CNRS, France
- Joanna Haigh, Imperial College, UK
- Yohsuke Kamide, STEL, Japan
- Arthur Richmond, NCAR, USA
- C.-H. Liu, NCU, Taiwan
- Lev Zelenyi, IKI, Russia
- D. Pallamraju, Scientific Coordinator
- L. Walsh, Program Admin.



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
- CAWSES – Asia–Oceania–Pacific Rim Center in Taipei facilitating such activities





CAWSES Activities



- CAWSES Office established at Boston University, Jan 16, 2004, Webpage URL <http://www.bu.edu/cawses>
 - D. Pallamraju (Raju) appointed Scientific Coordinator
- Newsletters published in March and Sept 2004, March 2005
- 4 Themes and Working Group members chosen
- First CAWSES Campaign organized in March -April, 2004 in conjunction with CPEA Campaign – data analysis continues
- Special all-day CAWSES Meeting held at Observatoire de Paris, July 17, 2004
- Solar Irradiance Variability Session at COSPAR, 2004
- Atmospheric Coupling Group Meeting on July 22, 2004 at COSPAR
- CAWSES SW Workshop in Beijing, September 11-12, 2004
- US NSF decided to fund CAWSES Office at BU for 2005-07 on the basis of peer-reviewed proposal



ES – National and Regional Programs

- CAWSES-India approved by ISRO Indian Space Research Org
 - Workshop held in April, 2004
 - 13 research projects funded and selected in 2005
- CAWSES-Japan inaugural Workshop near Nagoya, Japan, June 16-18, 2004
- AOPR Center established at National Central University, Chung-Li, Taiwan on July 1, 2004 with Lou Lee as Director
- CAWSES-US Workshop held on June 29, 2004 at CEDAR Meeting in Santa Fe to discuss campaign results
- CAWSES approved as a priority program by the DFG (Deutsche Forschungsgemeinschaft = German Science Foundation)



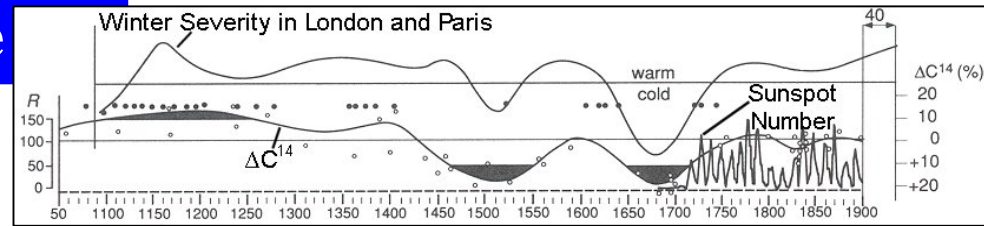
CAWSES – DFG Priority Program

From F.-J. Leubken

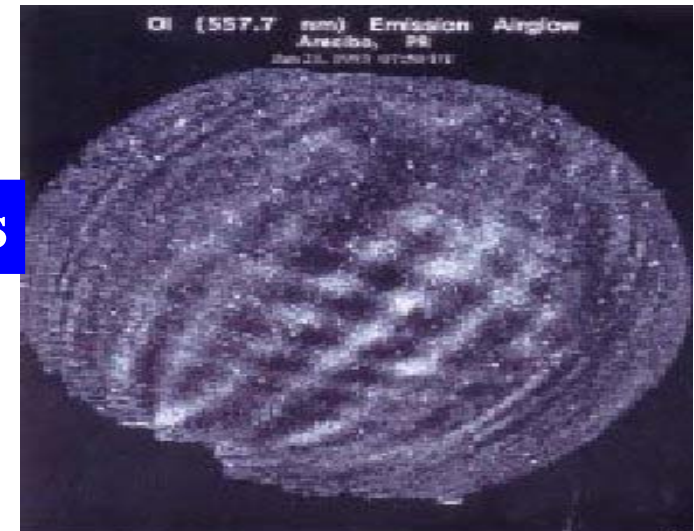
- DFG German Science Foundation
 - CAWSES Priority Program approved 2005
 - Proposed funding cycles through 2010
 - First year: 3M Euro funding 24 proposals at 18 institutions
- Priority program scope (spans CAWSES Themes 1, 3 and 4):
 - Solar forcing and variability and effects on the atmosphere
 - Coupling mechanisms: tracer transport and waves
 - Solar induced and anthropogenic trends
- International collaborations strongly encouraged
- Funding supports 9 Postdocs, 30 PhD students, travel, etc.
- First-round projects funded for 2 years

Four Themes under CAWSES

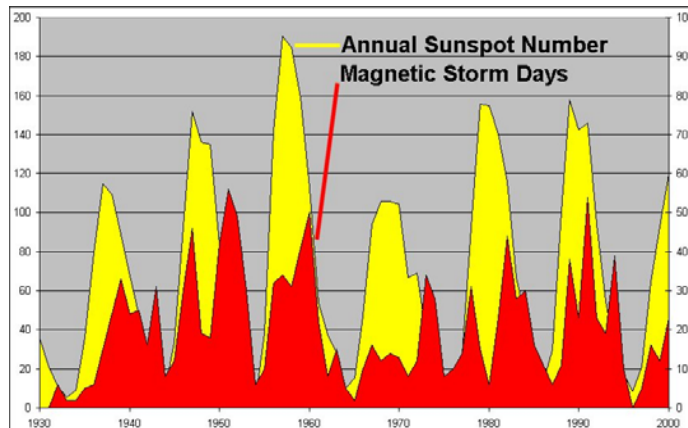
Solar Influence on Climate



Space Weather: Science and Applications

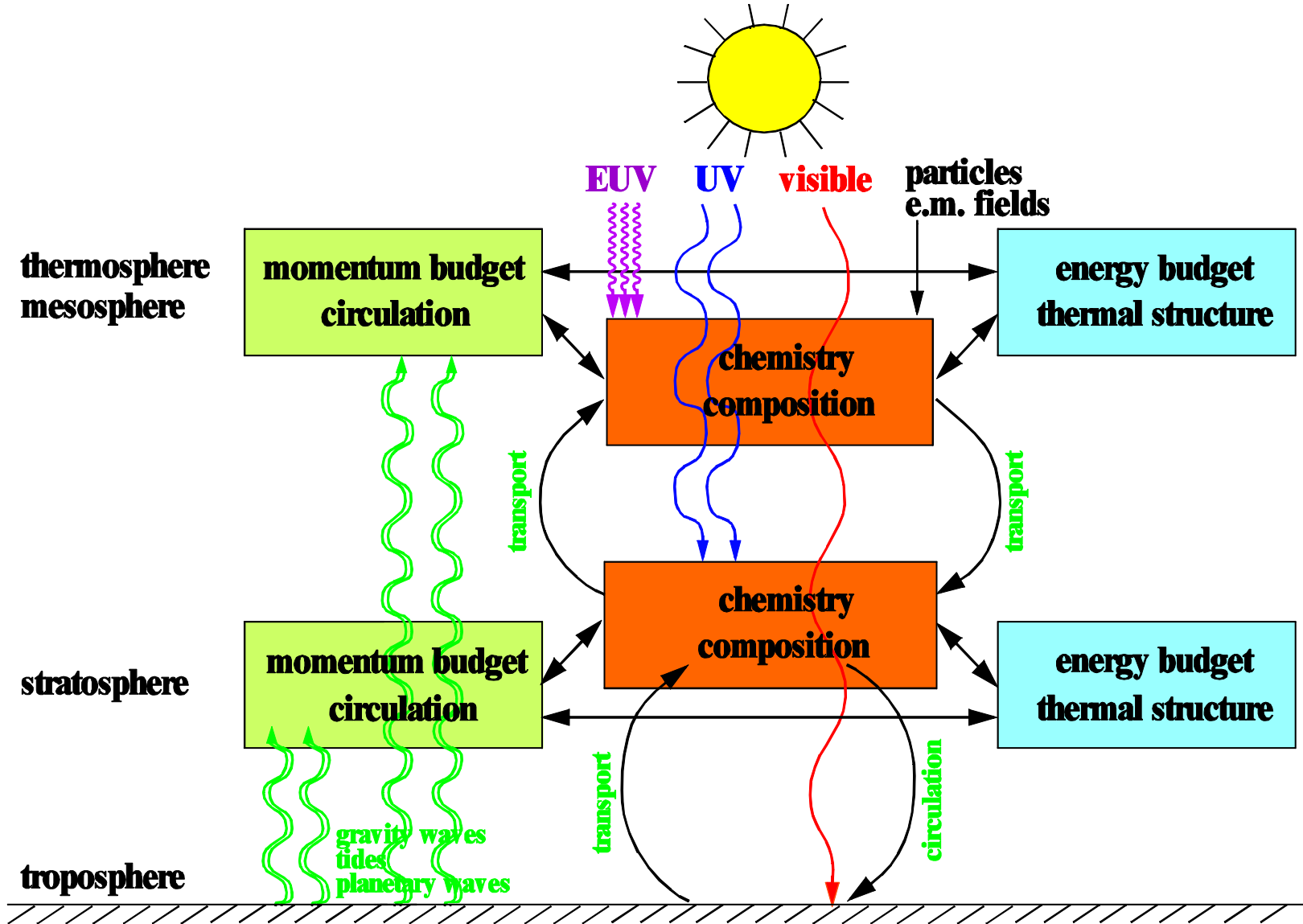


Atmospheric Coupling Processes



Climatology of the Sun-Earth System

Theme 3: Atmospheric Coupling Processes



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), 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

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

WG 3.3: Coupling by Electrodynamics including Ionospheric Magnetospheric Processes

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



Themes 2 and 3 Joint Activity: 1st CAWSES Campaign

Purpose to investigate:

- **Space Weather Sun-to-Earth (27 March - 6 April 2004)**
 - Collect a sun-to-Earth data set which includes the lower atmosphere
 - Provide first testbed for CAWSES worldwide maps - new international research tools.
- **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).

Other Theme 2 and 3 Joint Activities

- **Session at Spring AGU:**
 - Exploring the global response of the Sun-H-M-I-A system (Janet Kozyra et al.)
- **Session at IAGA, Toulouse**
 - Low latitude A-I-M coupling, dynamics and energetics (M. A. Abdu)
- **30 day campaign in September 2005**
 - All 8 worldwide ISR radars will operate on best effort basis
 - Investigate global ionospheric variability
 - Special focus on modeling of this variability
 - Extend observations sun-to-Earth to look at solar drivers and geospace responses
- **CPEA Campaign**
 - Nov - Dec, 05
- **2005 Campaign on Ice Layers in the Summer Mesosphere**
- **Joint ICESTAR/CAWSES coordinated effort on analysis of the Jan 2005 solar flare effects**
 - CEDAR Workshop on July 1, 05 at Santa Fe

Theme 3 Projects:

6 Project ideas emerged from the CAWSES

Theme 3 Meeting in Paris, July 2004

Title:

Status:

- | | |
|--|--------------------------|
| 1. Polar vortex project – A. Manson | Winter 2004/05 completed |
| 2. Layers Campaign – F.-J. Luebken | Ongoing in summer 2005 |
| 3. Coupling Processes in the Equatorial Atmosphere (CPEA) | Mar-Apr 2004, ongoing |
| 4. Tides & influence troposphere-thermosphere – W.Ward | |
| 5. Gravity waves & turbulence – D.Fritts | |
| 6. Ozone: how well do we understand it? – M. Mlynchzak | |

Theme 3 Projects:

Priority Areas Research of the Grant-in-Aid for Scientific Research
funded by Ministry of Education, Culture, Sports, Science and
Technology (MEXT)

Coupling Processes in the Equatorial Atmosphere (CPEA)

- Six-year project in the period of 2001-2006 headed by **Prof. S. Fukao** (RISH*, Kyoto Univ.).
- CPEA studies dynamical coupling processes in the equatorial atmosphere from the troposphere to the ionosphere.
- CPEA conducts various observations in Indonesian equatorial region centered around the EAR.

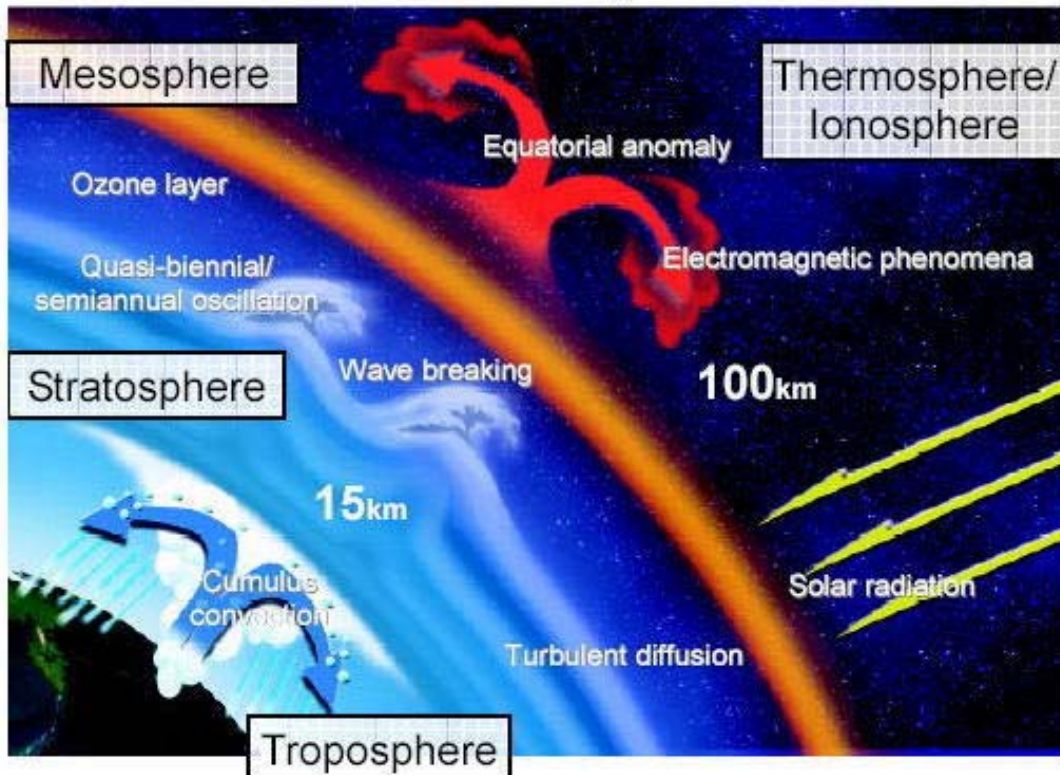
*RISH: Research Institute for Sustainable Humanosphere



Theme 3 Projects:

Coupling Processes in the Equatorial Atmosphere (CPEA)

Observations with...



Radars:

EAR, boundary layer radar, X-band meteorological radar, meteor radar, and FM-CW ionosonde (by NICT) at the EAR site, X-band Doppler radar near Bukittinggi, two MF radars at Pontianak and Pameungpeuk.

Lidars:

Rayleigh/Mie lidar at the EAR site.

Balloon experiment:

GPS radiosondes launched from four locations in Indonesia, and from three more locations in Malaysia & Singapore.

Other instruments:

RASS, airglow imager and airglow temperature photometer at the EAR site, GPS receivers at the EAR site and Padang.

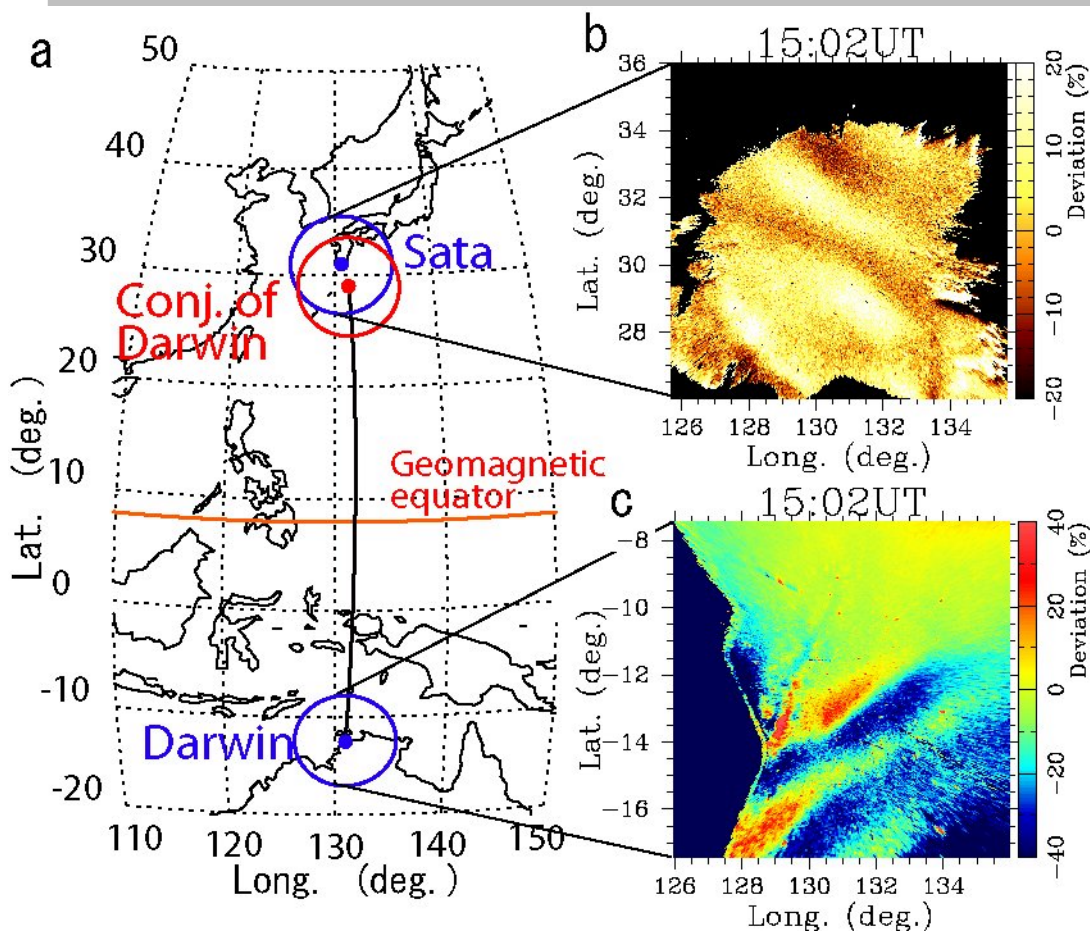
Meteorological instruments:

Radiometer, rain gauge, disdrometer, etc., at EAR site.

Theme 3 Projects:

Coupling Processes in the Equatorial Atmosphere (CPEA)

Report by M. Yamamoto



(a) Map of observation sites and coverage of airglow imagers. Darwin and Sata are geomagnetic conjugate sites.

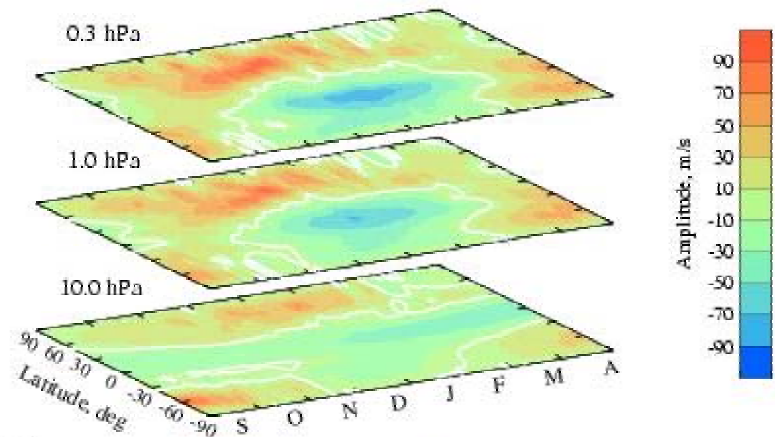
(b and c) 630-nm airglow showing medium-scale traveling ionospheric disturbances. The mirrored patterns illustrate electro-magnetic coupling processes between the ionospheres in

Theme 3 Projects:

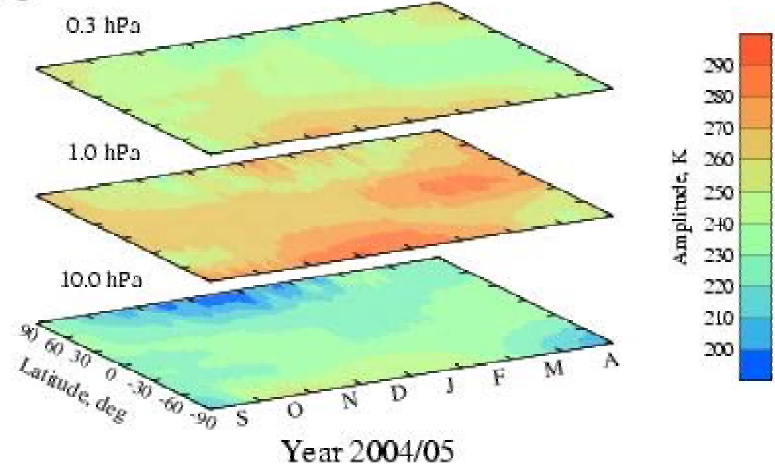
Atmospheric wave influences upon the winter polar vortices (0-100 km) using both observations and models – A. Manson

- Winter 2005 January-April
- Data from 13 MF radars
 - Yamagawa 31N to Svalbard 78N
 - Mean wind and wavelet analyses
 - Weak planetary wave activity above 60 km
- Stratospheric warmings in Feb +
- Other team member participation via optical airglow & temperatures, satellite winds & temperatures, and global models.

MetO EW

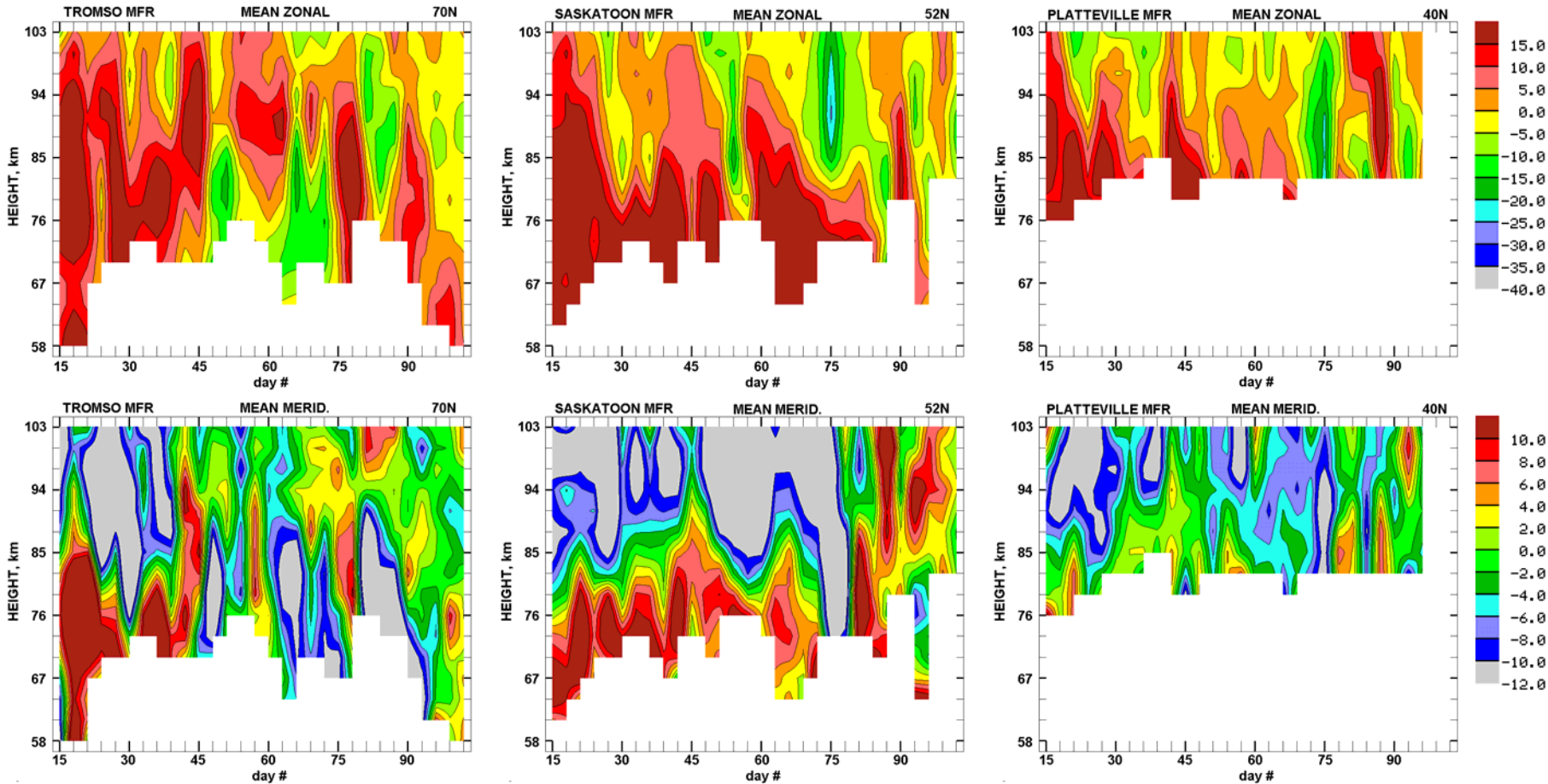


MetO T



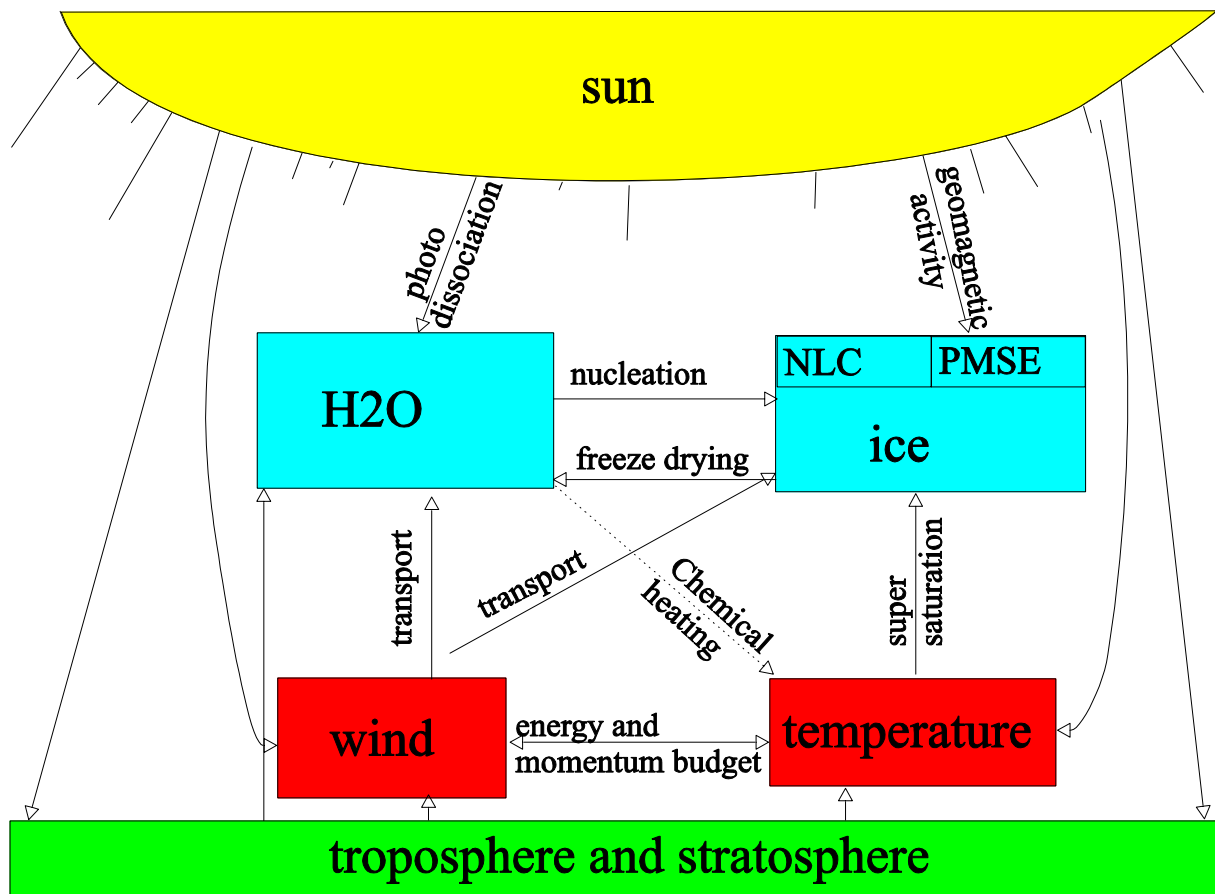
Theme 3 Projects:

Atmospheric wave influences upon the winter polar vortices (0-100 km) using both observations and models – A. Manson



Theme 3 Projects:

2005 Campaign on ice layers in the summer mesosphere
– F.-J. Luebken, U.-P. Hoppe, S. Bailey



- Aim is to study the morphology of ice layers and the physical/ photochemical/ dynamical conditions of their formation

The role of upper atmospheric layers in Sun/Earth coupling

Theme 3 Projects:

**2005 Campaign on ice layers in the summer mesosphere
– F.-J. Luebken, U.-P. Hoppe, S. Bailey**

- Measurements related to ice particles in the mesopause region:
 - Temperatures, water vapor, noctilucent clouds, polar mesospheric clouds, and polar mesospheric summer echoes
 - Lidar, radar, satellite-based, and rocket-borne techniques
 - July: first combined ENVISAT + ground-based measurements



Future Meetings 2006

- **SCOSTEP – 11 Solar-Terrestrial Physics Symposium**
Rio de Janeiro, March 6-10, 2006: Marv Geller, organizer
(Includes CAWSES and Atmospheric Coupling Processes)
- **Special CAWSES session at EGU Meeting, Vienna, Austria,**
April, 2006: F-J Luebken, organizer
- **Workshop on Ice Layers in the Mesosphere, Spring 2006, F-J**
Luebken, organizer



Upcoming in 2005

- **Theme 3 Planning Meeting Toulouse**
this Wednesday July 20, 2005
- **General CAWSES Planning Meeting at Toulouse**
this Saturday July 23, 2005

Want to know more?

- **Association Lecture on CAWSES at IAGA, July 27, 2005**
given by Sunanda Basu
- **Fourth issue of CAWSES News September 2005**
<http://www.bu.edu/cawses>