ROSMIC: Role Of the Sun and the Middle atmosphere/thermosphere/ionosphere In Climate

ROSMIC, a new project in the SCOSTEP VarSITI program

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Aurora and airglow: iss029e007502 NASA

Role **O**f the **S**un and the **M**iddle atmosphere/thermosphere/ionosphere **I**n **C**limate (**ROSMIC**)

Goals & Objectives: To understand the impact of the Sun on the terrestrial middle atmosphere/ lower thermosphere/ionosphere (MALTI) and Earth‘s climate and its importance relative to anthropogenic forcing over various time scales from minutes to centuries.

Anticipated Outcome: The development of a better understanding of the impact of solar activity on the entire atmosphere, relative to anthropogenic forcing and natural long term variability.

ROSMIC Co-chairs:

•Prof. Dr. Franz-Josef Lübken, Leibniz Institute of Atmospheric Physics, Germany

•Dr. Annika Seppälä, Finnish Meteorological Institute, Finland.

•Prof. William E. Ward, University of New Brunswick, Canada

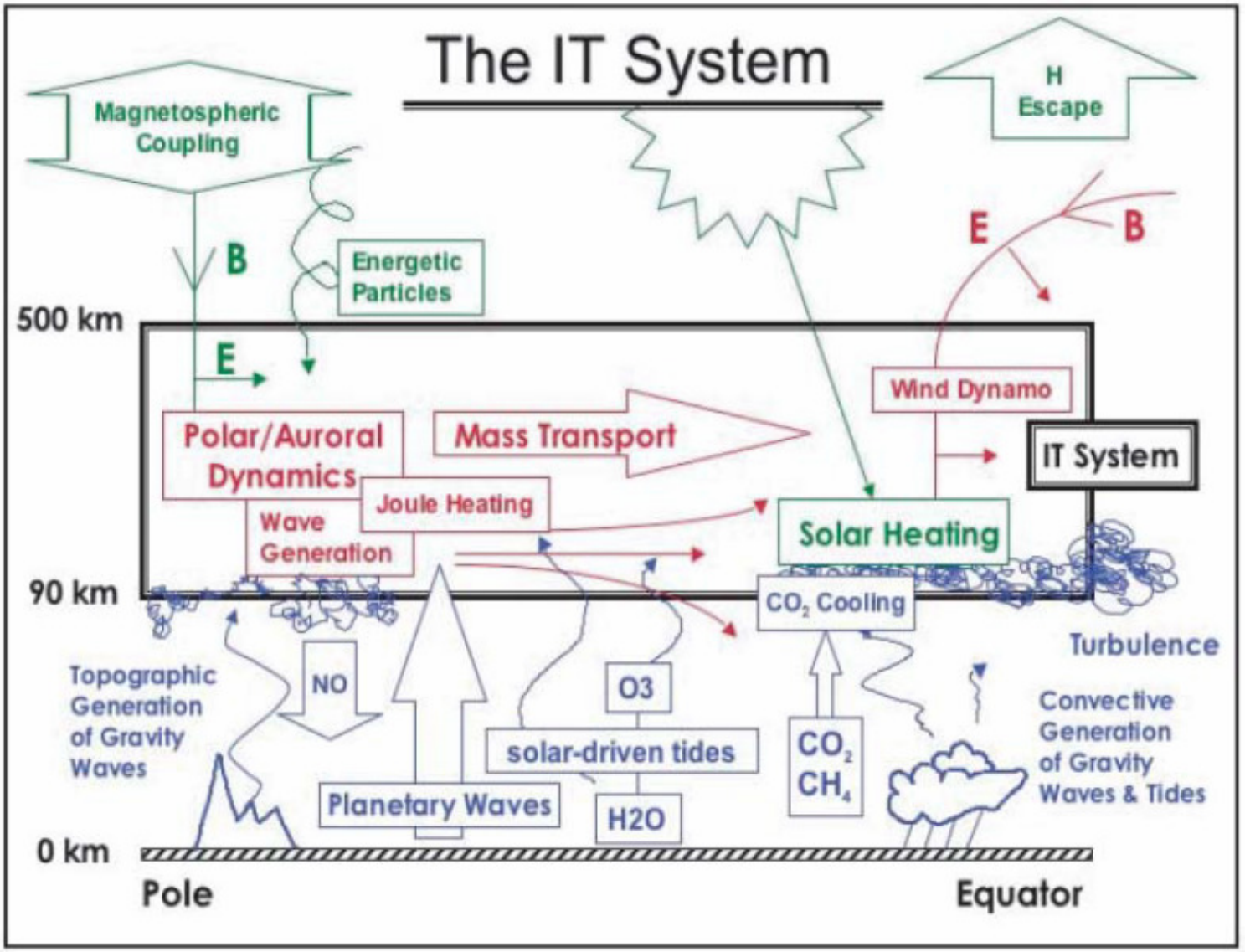
Context and Motivation

- The investigation of Earth-Sun interactions can now start to be undertaken from a systems perspective.
- Further advances in this field require the detailed **3D physical connections** between atmospheric regions/ionosphere/ magnetosphere/solar wind to be addressed.
- The terrestrial atmosphere/ionosphere is the most extensively and intensively observed and analysed physical system in the natural world.
- It is a complex non-linear system which responds non-locally to external forcing and changes in its internal characteristics.

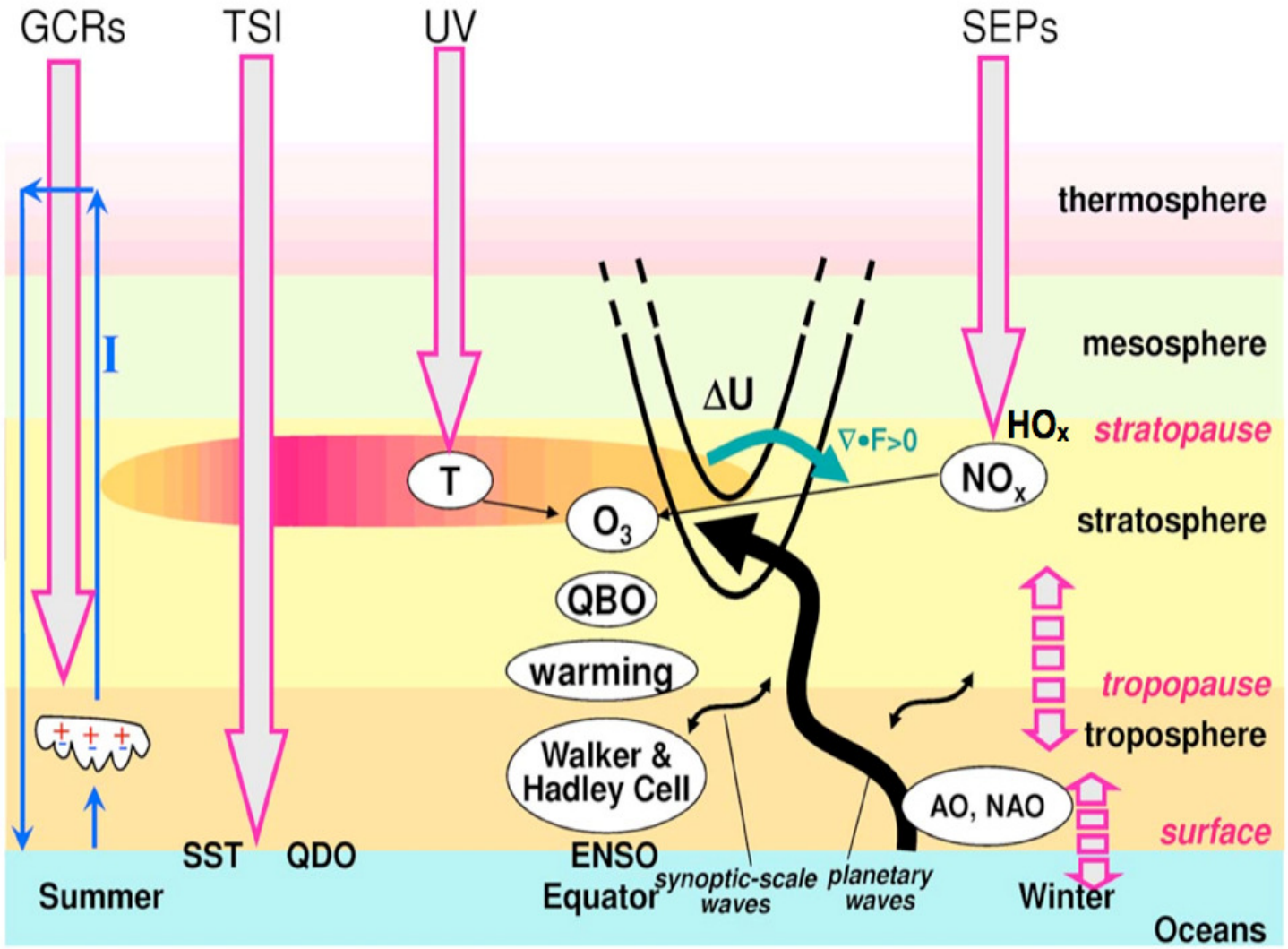
Key Issues

- The variability in the ionosphere and middle/ upper atmosphere is a combination of **upward** propagating disturbances from lower in the atmosphere and variability associated with the **downward** effects of short term solar influences.
- **What the relative roles of these various influences and their interactions?**

- The pathways whereby solar effects may influence the lower atmosphere are still poorly known. Changes to the composition of the atmosphere such as those currently taking place through anthropogenic activity may result in the atmospheric response to solar influences.
- **How stable is the structure of the atmosphere?**



Schematic of the processes relevant to the Ionosphere-Thermosphere system showing the upward and downward coupling processes which influence this region of the atmosphere (after Forbes, JMSJ, 2007).



Mechanisms of Solar Influence (after Gray et al, 2010)

Scientific Questions I

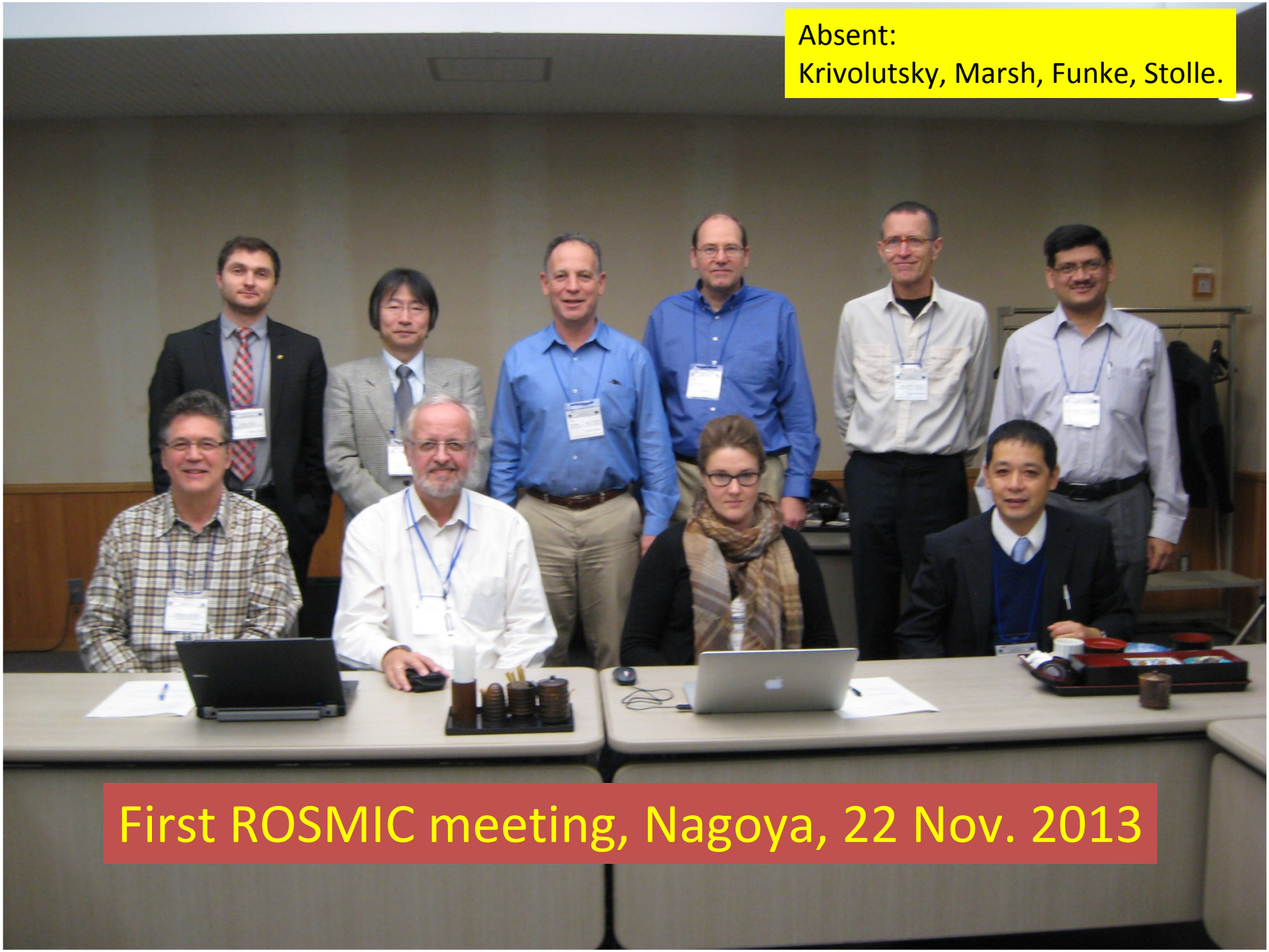
- What is impact of solar forcing of the entire atmosphere? What is the relative importance of solar irradiance versus energetic particles?
- How is the solar signal transfered from the thermosphere to the troposphere?
- How does coupling within the terrestrial atmosphere through (e.g. gravity waves and turbulence) function?
- What is the impact of anthropogenic activities on the MALTI ?

Science Questions 2

- Which parameters in the MALTI show long term variations and why?
- What are the characteristics of reconstructions and predictions of TSI and SSI?
- What are the implications of trends in the ionosphere/thermosphere for technical systems such as satellites?

ROSMIC is organized into four working groups to address these questions. These groups and their leaders are:

- **Solar Influence on Climate**: Berndt Funke (Instituto de Astrofisica de Andalucia, Spain), Alexei Krivolutsky (Central Aero-logical Observatory, Russia), Tom Woods (LASP, USA).
- **Coupling by Dynamics**: Takuji Nakamura (National Institute of Polar Research,Japan), Claudia Stolle (GFZ German Research Centre for Geosciences, Germany), Erdal Yigit (George Mason University, USA).
- **Trends in the MLT**: Jan Lastovicka (Institute of Atmospheric Physics, AS CR, Czech Republic), Dan Marsh (NCAR, USA)
- **Trends and Solar Influence in the Thermosphere**: Duggirala Pallamraju (Physical Research Laboratory, India), Stan Solomon (NCAR, USA)


Absent:
Krivolutsky, Marsh, Funke, Stolle.
First ROSMIC meeting, Nagoya, 22 Nov. 2013

How Is ROSMIC Activity Supported?

- Workshops: *ANGWIN – October/14;*
- Conference sessions on specific topics at international conferences: *COSPAR 2.2- August/14; HEPPA/SOLARIS – July/14; EGU/15; IUGG/15;*
- International campaigns,
- Modelling comparisons;
- Establishing data archives, etc.
- The identification of science topics by an international organization can help justify funding applications. *ROMIC, Germany/14*

Participation

- Activities of the various groups is being organized.
- To express interest contact the group leaders the ROSMIC Co-PI's or the VarSITI project leaders.
- Small amounts of money are available to help seed activities associated with VarSITI. Information is on the VarSITI website under the tab, Organization.
- http://www.yorku.ca/scostep/
- http://www.varsiti.org/