

ILWS Ionosphere Thermosphere Task Group

MEMBERS

Dr. Roderick A. Heelis
University of Texas at Dallas

Prof. Gurbax Singh Lakhina
Indian Institute Geomagnetism

Dr. Mark Lester
University of Leicester

Dr. Koh-Ichiro Oyama
Institute for Space & Astronautical Science

Dr. Andrew W. Yau
University of Calgary

Huey-Ching Yeh
National Central University, Taiwan

Dr. Harri E. Laakso
ESA/ESTEC/SCI-SO

Stanislav I. Klimov
Space Research Institute (IKI)

Dr. Timothy J. Fuller-Rowell
Space Environment Center

Pierre-Louis Blelly
CESR-CNRS

Dr. Mangalathayil A. Abdu
Instituto Nacional Pesquisas Espaciais

Prof. Sergai Alexander Pulinets
Universidad Nacional Autonoma de Mexico

Dr. Torsten Neubert
Danish Space Research Institute

ILWS Ionosphere Thermosphere Task Group

Overall Task

**Build a better model to specify and predict
the behavior of the I-T system**

Needs

- Specification of External Drivers from Above and Below
- Specification of the Spatial and Temporal scales that are most important for models
- Determination of the Triggering Conditions for instabilities in the system

ILWS Ionosphere Thermosphere Task Group

Convenient to divide the region into three domains

- **High latitudes**
 - **Magnetic field almost vertical**
 - **Influence of magnetosphere and solar wind is direct**
- **Middle latitudes**
 - **Magnetic field inclined**
 - . **field-aligned motions driven by horizontal motions**
 - **Magnetosphere and Solar wind effects are large but indirect**
 - **Propagation of high latitude influences is important**
- **Low latitudes**
 - **Magnetic field almost horizontal**
 - **Internal dynamo e-fields dominate but magnetospheric influences are important**
 - **Critically unstable to gravitational overturning**

ILWS Ionosphere Thermosphere Task Group

MAJOR FINDINGS

- **High Latitudes**

- System response must be described over small spatial and temporal scales.
- Quasi-steady stable state requires specification of magnetospheric inputs at spatial and temporal scales equal to the model capability (10 km/10min)
- Combination of auroral imaging, in-situ measurements, ground-based measurements, models and assimilation procedures will be in place

RAVENS ; DMSP/NPOESS ; SWARM ; ePOP

SuperDarn ; AMISR ; Magnetometer Chains ; GPS

MHD models ; AIME

- **Low Latitudes**

- Local and high latitude influences are longitude dependent.
- Relative importance dependent on magnetic activity
- Instability dependent on ExB drift history and local perturbation history.
- Ground based and space-based diagnostics in place to provide next generation specification and prediction

C/NOFS ; EQUARS

Jicamarca ; GPS ; Spaced Receivers ; Ionosondes ; All Sky Imagers

Coupled I-T Models Hi-Res GRT Instability Models

ILWS Ionosphere Thermosphere Task Group

MAJOR FINDINGS

- **Middle Latitudes**

- **System response occurs over middle to large spatial and temporal scales.**
- **Strongly influenced by the magnetic field and thus by longitude.**
- **Do not presently know what appropriate small spatial scales are**
- **Expect that appropriate spatial scales depend upon propagating disturbances dependent on magnetic activity.**
- **System is sometimes unstable and instability conditions are poorly understood**
- **Good distribution of GPS and ionosondes for specification**
- **Very few measurements of winds and drifts to describe connecting physics and appropriate spatial scales.**

Need a Dedicated Middle Latitude Space Observations Mission I-T Probes

**Millstone Hill ; Arecibo ; Mu ; Ionosondes ; GPS ; Spaced Receivers ; All Sky Imagers
Coupled I-T Models ; Disturbance Dynamo Models**

ILWS Ionosphere Thermosphere Task Group

SUMMARY

- **International Assets provide wide spectrum of observations in the high latitude ionosphere-thermosphere.**
- **International Collaborations and ground based observations provide next step in definition of low latitude ionosphere.**
- **I-T probes would provide a focus for international collaborations that will fill the present gap in defining the behavior of the middle latitude ionosphere and thermosphere.**
- **All advances in I-T specification assume that characterization of the interplanetary environment and the solar euv spectrum will be available when required.**

• **Best Opportunity afforded by overlap between**

SDO, SWARM, IT-PROBES, RAVENS, DMSP, and ACE-L1