Global-scale Observations of the Limb and Disk (GOLD)

GOLD – Global-scale Observations of the Limb and Disk

GOLD Mission

- Mission Of Opportunity proposed in response to RBSP AO
- Chosen for competitive Phase A study
- Approach
  - Fly in geostationary orbit on commercial satellite (right)
  - Continuous coverage over Americas
  - Launch in 2012 on second in series of satellites
* Manufacturer's Design Life
- Planned
- Potential GOLD Accommodation on Replacement Satellite
GOLD – Global-scale Observations of the Limb and Disk

GOLD Science

- What is the global-scale response of the thermosphere and ionosphere to geomagnetic forcing?
- What is the global-scale response of the thermosphere and ionosphere to changing EUV radiation?
- What are the solar & geospace causes of small-scale ionospheric density irregularities?
- What are the global-scale tidal amplitude and phase variations?

Disk & limb at local midnight from GEO during 2003 Halloween storm.

OI 135.6 nm (simulated)
GOLD – Global-scale Observations of the Limb and Disk

Neutral Temperatures/Densities on Disk

GOLD Observations

- First observations of global-scale temperatures in thermosphere
- Observations of O/N$_2$ ratios during day
- O$_2$ density profiles
- Real time observations for Space Weather
- First global-scale observations of changes in thermosphere-ionosphere from a geographic region throughout day (one hour interruption at midnight)

Calculations from CISM-CMIT model for ~170 km during May 1997 storm.
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Neutral Temperatures/Densities on Disk

Electron Densities

Calculations from CISM-CMIT model for ~170 km (not F region peak) during May 14-16, 1997.
Global-scale Temperatures Reveal Tidal Amplitudes and Phases

Simulated temperatures on a constant-pressure surface (~150 km mean altitude) with (on left) and without upward-propagating migrating semidiurnal tides at the lower boundary (97 km). The difference between the two figures represents the migrating semidiurnal tidal effects. Peak differences are 30K.

- Need temperatures in lower thermosphere
Remote Sensing of Temperatures in Lower Thermosphere

Comparison of MSIS temperature profile (calculated using F10.7) and temperatures measured using N₂ observations from the ARGOS satellite (29 July 2001 and 28 July 2000) in the lower thermosphere. (Aksnes et al., GRL, 2006)
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GOLD Measurements

- On the disk:
  - Global-scale neutral temperatures (near 150 km)
  - O/N\textsubscript{2} column density ratios
  - Electron density variations in latitude and longitude
  - Auroral locations & conductivities (storm time)
- On the limb:
  - O\textsubscript{2} density profiles from 150-240 km (day and night) by stellar occultation.
  - Daytime O emission profiles
  - Nighttime electron densities

CTIPe calculations of O/N\textsubscript{2} column density ratio (above 160 km) during April 17, 2002 storm
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GOLD Instrument

- **Low Spectral Resolution Channel**
  - Disk Imaging & Limb Altitude Profiles
    - 130-170 nm spectral range
    - 1 nm spectral resolution
    - 30 min. cadence (15 min. likely)
    - 100 (50) km disk, 30 km limb res.

- **High Spectral Resolution Channel**
  - Disk Imaging
    - 140-165 nm spectral range
    - 0.1 nm spectral resolution
    - 30 min. cadence
  - Stellar Occultation
    - 140-165 nm spectral range
    - 1 nm x 8 km resolution
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**GOLD Science**

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**Summary**

- “What we see depends on how we look – instruments and analysis define our perspective.” - John Foster
- Observations of large scale variations of temperatures throughout day will provide us a new perspective on the ionosphere and thermosphere
- IT Storm Probes observations would complement & significantly increase benefits of imaging data