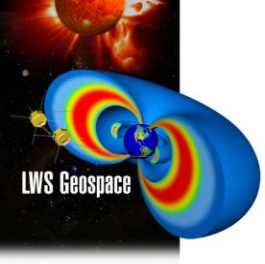


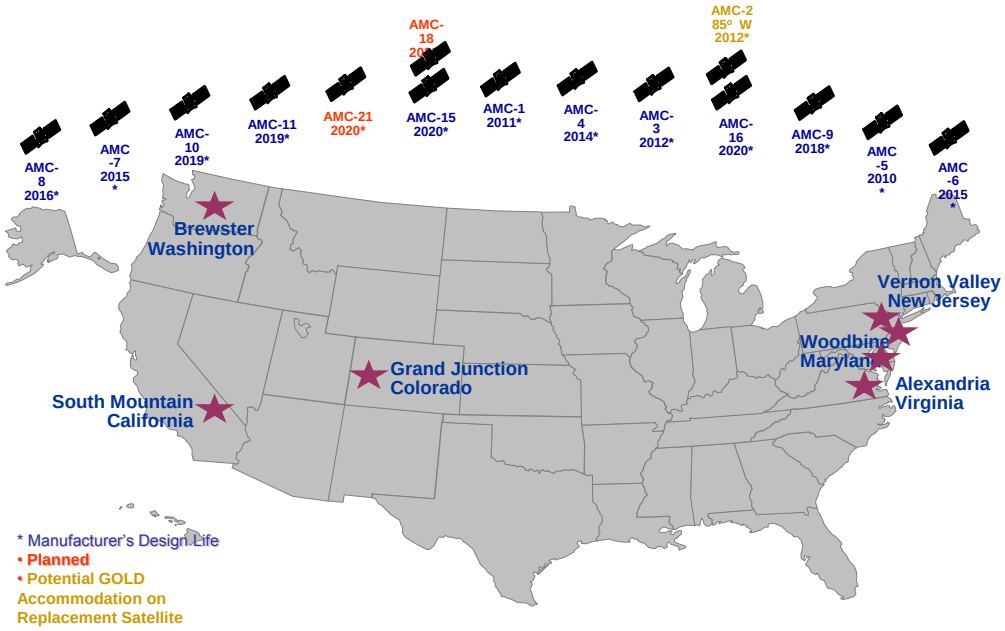
Global-scale Observations of the Limb and Disk (GOLD)

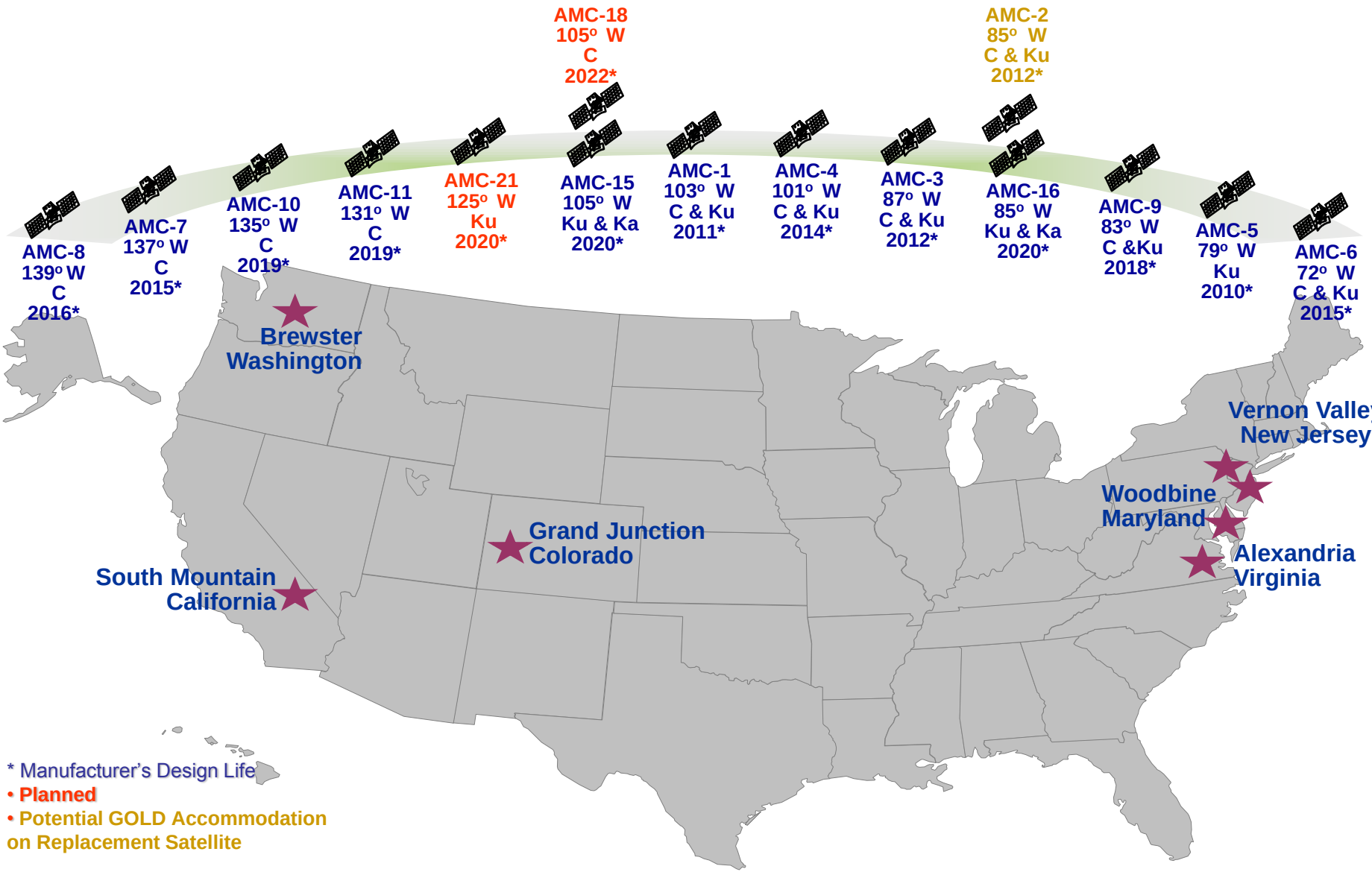
R. Eastes, W. McClintock, A. Aksnes, D. Anderson, L. Andersson, S. Budzien, A. Burns, M. Codrescu, R. Daniell, K. Dymond, F. Eparvier, J. Harvey, T. Immel, A. Krywonos, M. Lankton, J. Lumpe, G. Prölss, A. Richmond, D. Rusch, S. Solomon, D. Strickland and T. Woods

GOLD – Global-scale Observations of the Limb and Disk

GOLD Mission

- **Mission Of Opportunity proposed in response to 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**



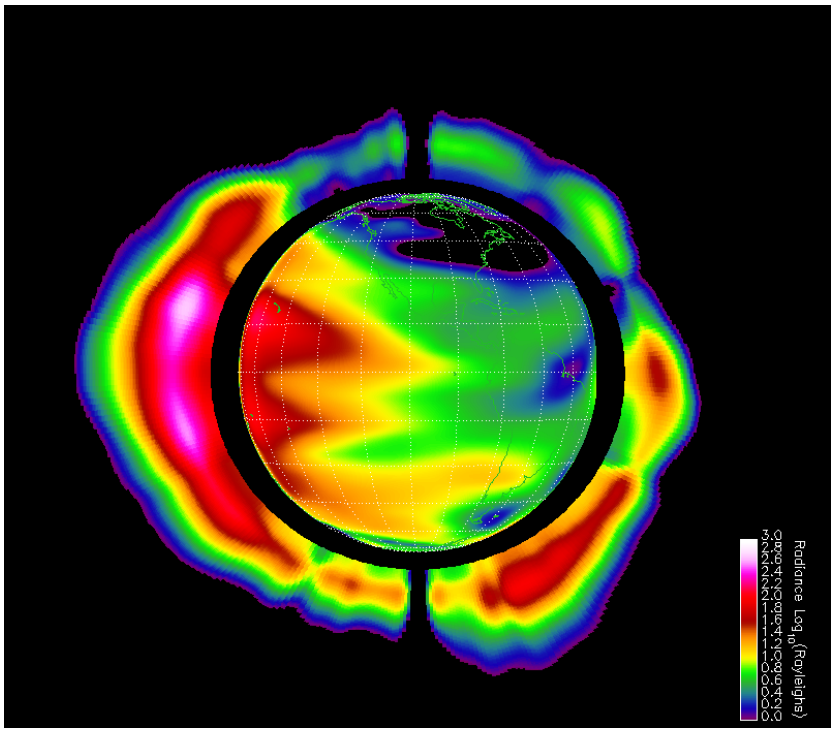

AMC-8
139º W
C
2016*
AMC-7
137º W
C
2015*
AMC-10
135º W
C
2019*
AMC-11
131º W
C
2019*
AMC-21
125º W
Ku
2020*
AMC-18
105º W
C
2022*
AMC-15
105º W
Ku & Ka
2020*
AMC-1
103º W
C & Ku
2011*
AMC-4
101º W
C & Ku
2014*
AMC-3
87º W
C & Ku
2012*
AMC-2
85º W
C & Ku
2012*
AMC-16
85º W
Ku & Ka
2020*
AMC-9
83º W
C &Ku
2018*
AMC-5
79º W
Ku
2010*
AMC-6
72º W
C & Ku
2015*
Brewster
Washington
Vernon Valley
New Jersey
Woodbine
Maryland
Alexandria
Virginia
Grand Junction
Colorado
South Mountain
California
* 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?

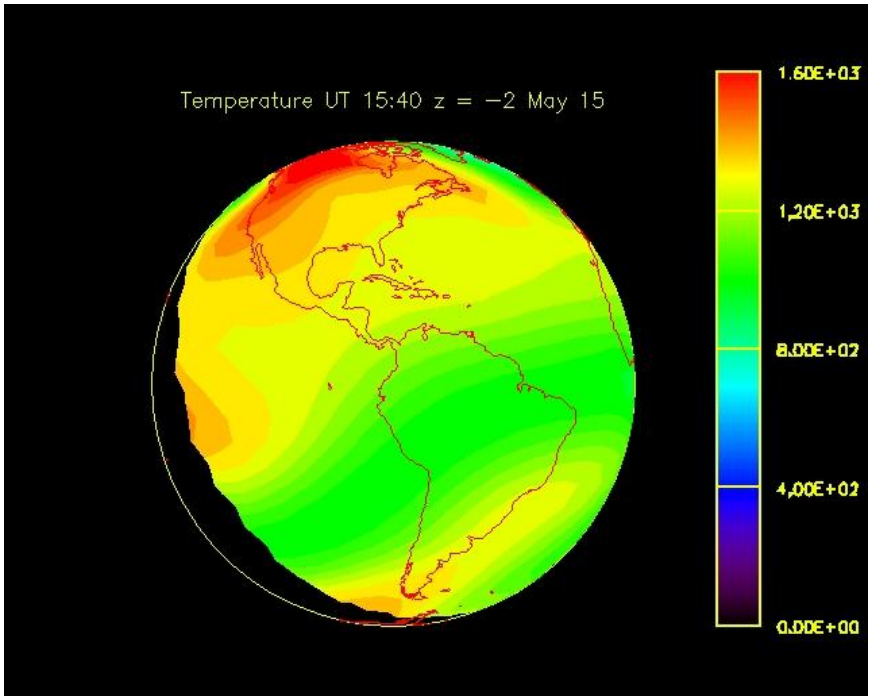
OI 135.6 nm (simulated)



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

GOLD – Global-scale Observations of the Limb and Disk

Neutral Temperatures/Densities on Disk



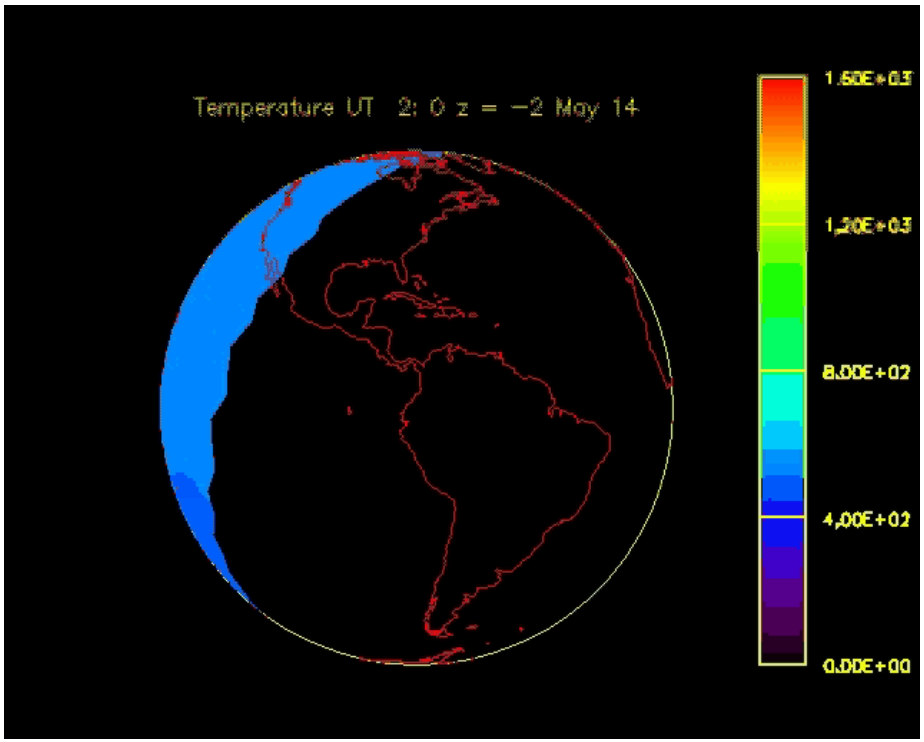
Calculations from CISM-CMIT model for ~170 km during May 1997 storm.

GOLD Observations

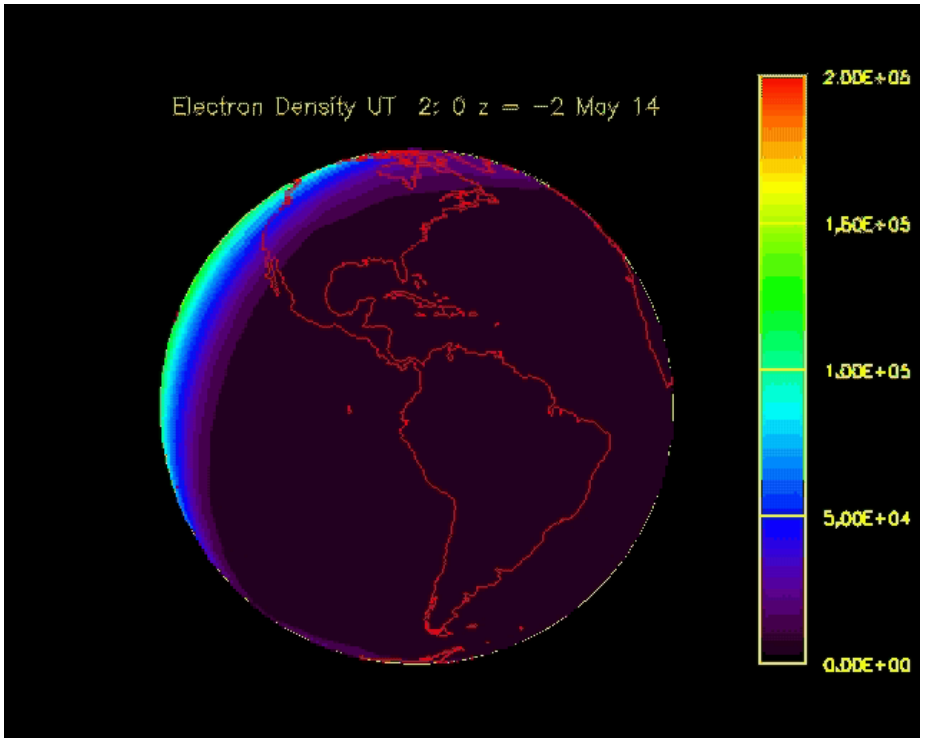
- **First observations of global-scale temperatures in thermosphere**
- **Observations of O/N_2 ratios during day**
- **O_2 density profiles**
- **Real time observations for Space Weather**
- **First global-scale observations of changes in thermosphere-ionosphere from a geographic region throughout day (one hour interruption at midnight)**

GOLD – Global-scale Observations of the Limb and Disk

Neutral Temperatures/Densities on Disk

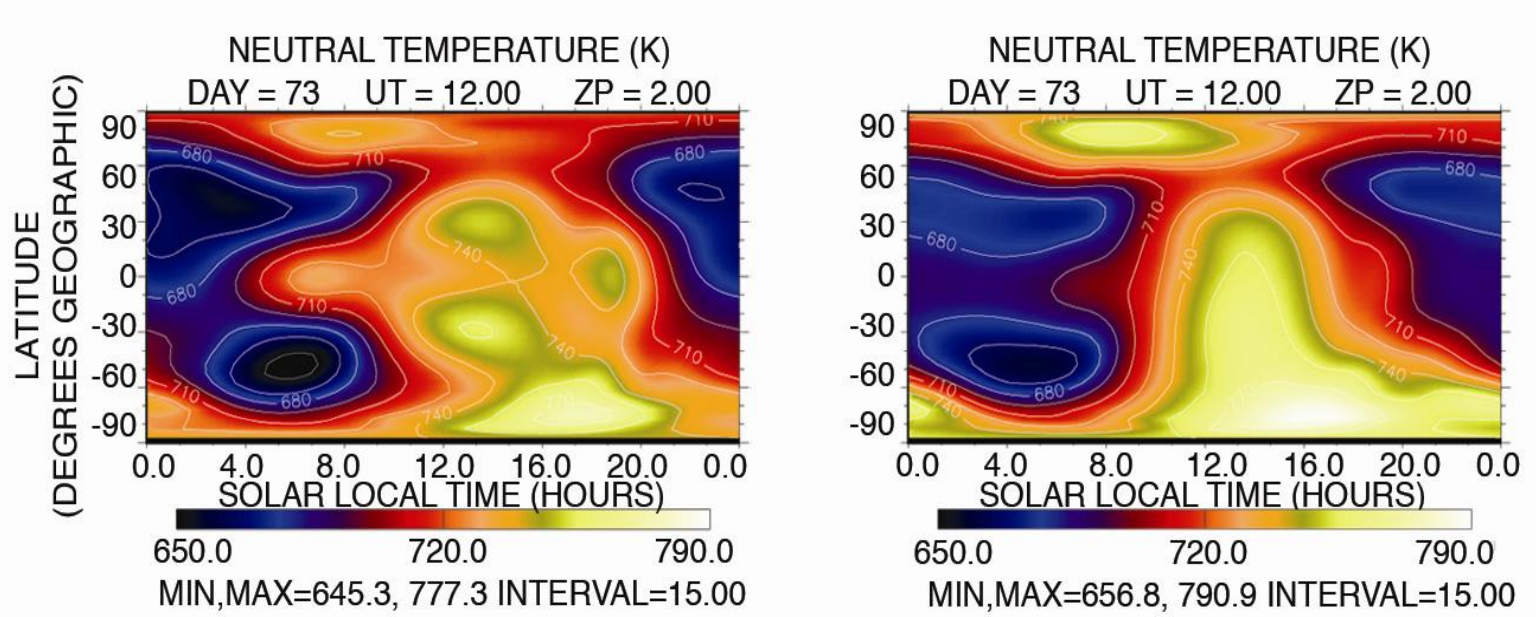


Electron Densities



Calculations from CISM-CMIT model for ~170 km (not F region peak) during May 14-16, 1997.

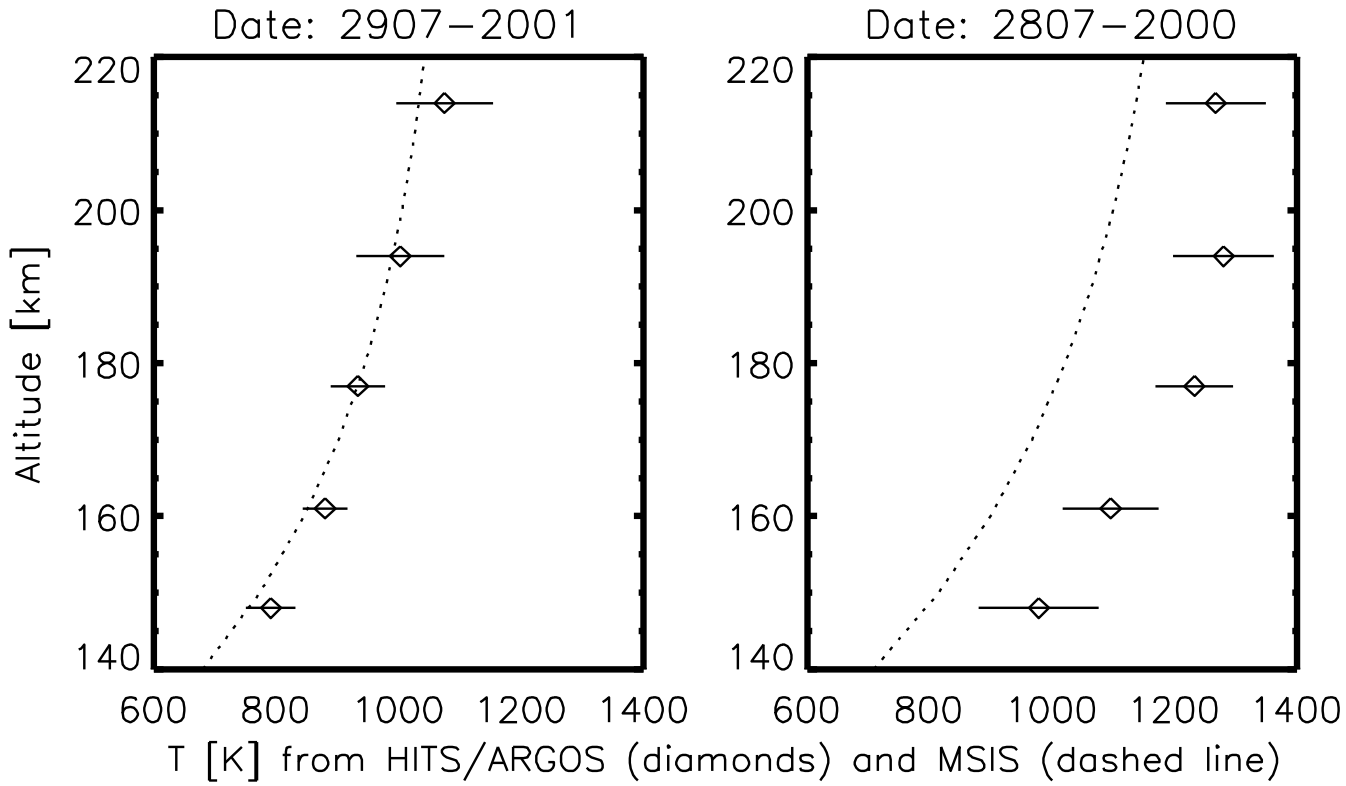
Global-scale Temperatures Reveal Tidal Amplitudes and Phases



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



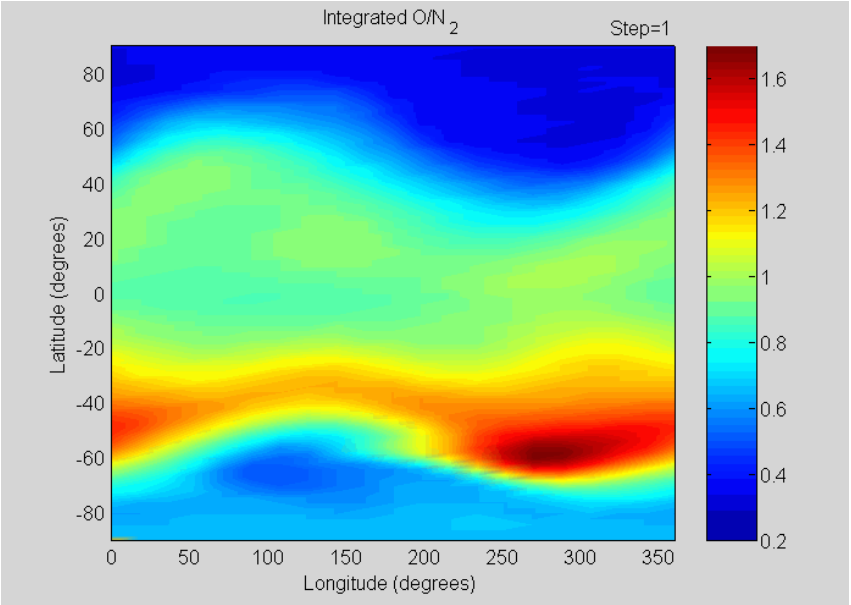
Comparison of MSIS temperature profile (calculated using F10.7) and temperatures measured using N_2 observations from the ARGOS satellite (29 July 2001 and 28 July 2000) in the lower thermosphere. (Aksnes et al., GRL, 2006)

GOLD – Global-scale Observations of the Limb and Disk

GOLD Measurements

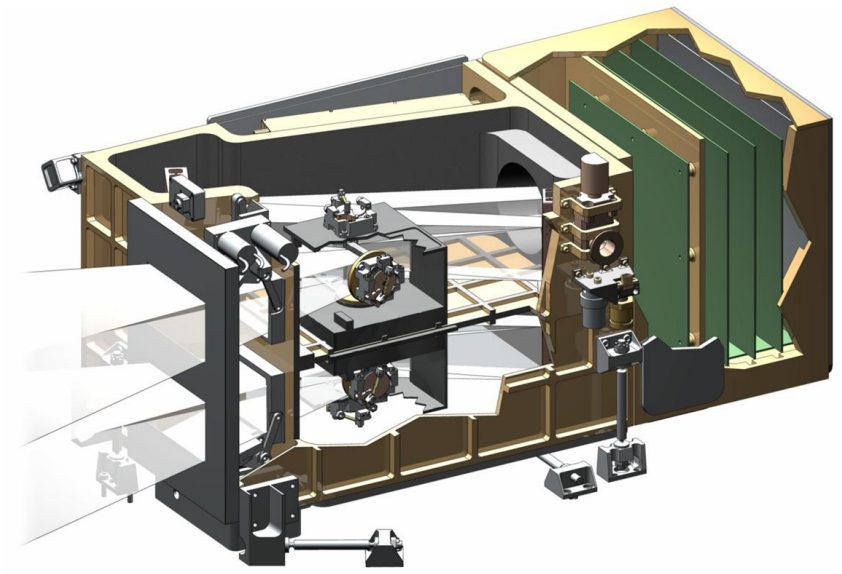
- **On the disk:**
  - **Global-scale neutral temperatures (near 150 km)**
  - **O/N_2 column density ratios**
  - **Electron density variations in latitude and longitude**
  - **Auroral locations & conductivities (storm time)**
- **On the limb:**
  - **O_2 density profiles from 150-240 km (day and night) by stellar occultation.**
  - **Daytime O emission profiles**
  - **Nighttime electron densities**

Ratio O/N_2



CTIPe calculations of O/N_2 column density ratio (above 160 km) during April 17, 2002 storm

GOLD – Global-scale Observations of the Limb and Disk



GOLD Instrument Concept

GOLD Instrument

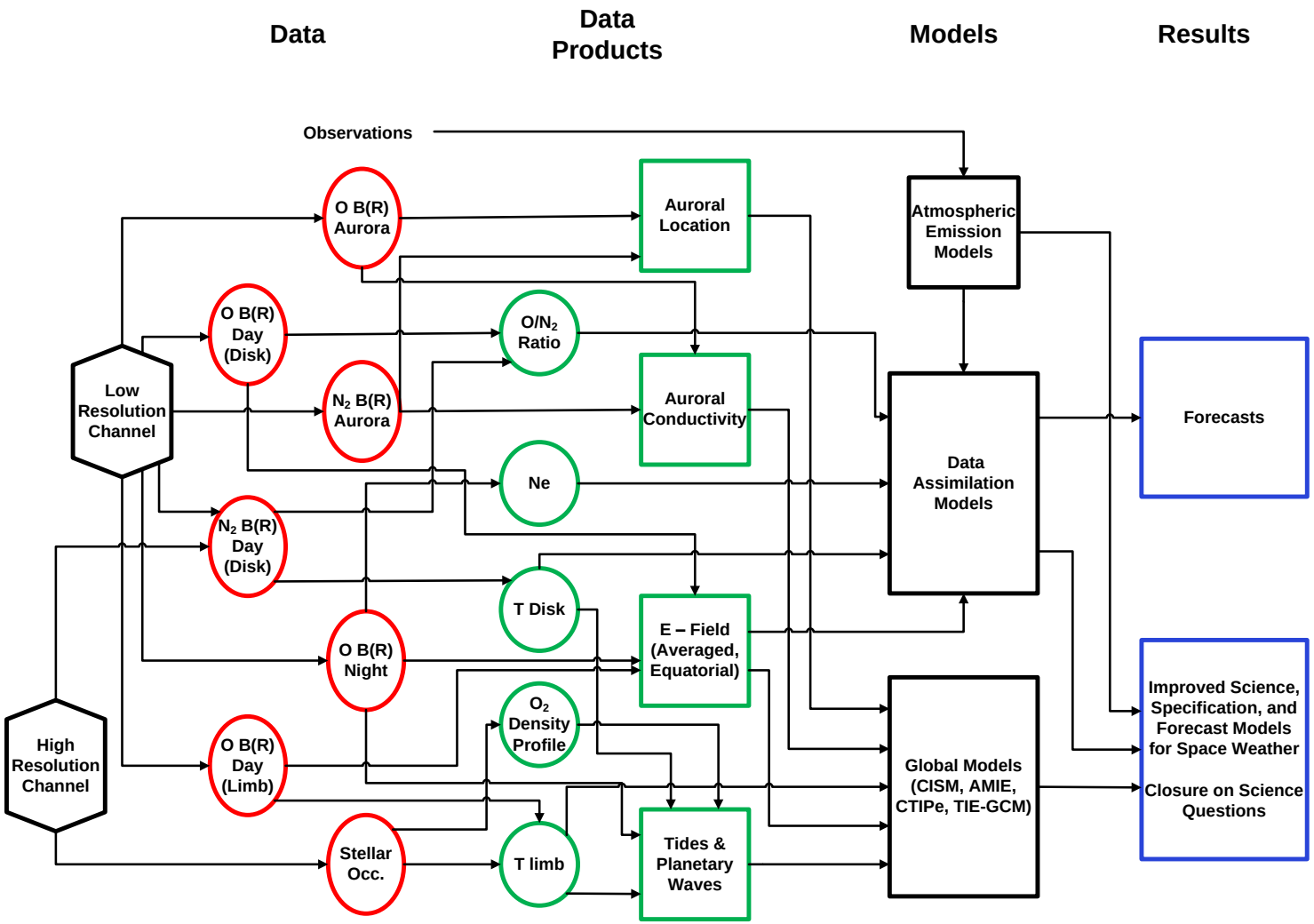
- **Low Spectral Resolution Channel**

  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**

GOLD – Global-scale Observations of the Limb and Disk



GOLD – Global-scale Observations of the Limb and Disk

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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