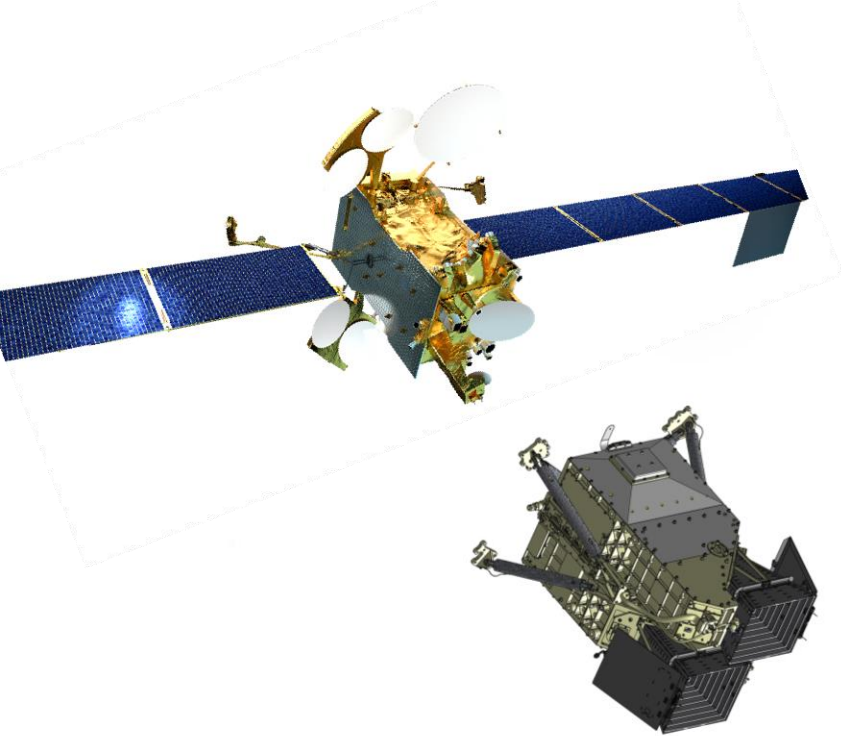


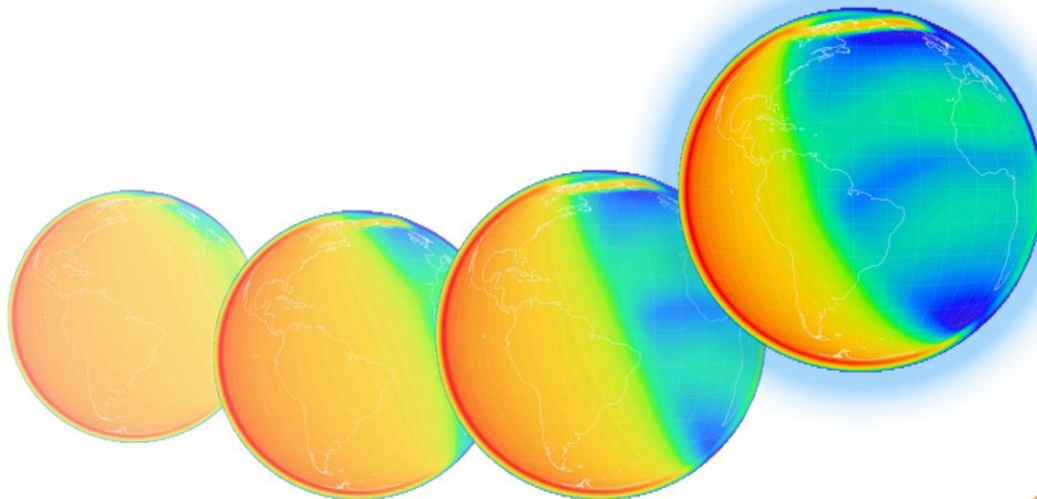


The GOLD Mission – Real-time Imaging of the Space Weather in Earth's Ionosphere and Thermosphere from Geostationary Orbit

R. Eastes (& the GOLD Team)

Laboratory for Atmospheric and Space Physics

University of Colorado



NASA Mission of Opportunity, Imaging T-I System from GEO

- **Host Mission**

- SES-14, in geostationary orbit over mouth of the Amazon River (47.5°W)

- **GOLD Instrument**

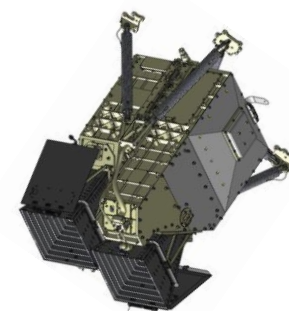
- Two identical, independent imaging spectrographs
- Each observes disk and limb at 132-162 nm

- **Data – geophysical quantities**

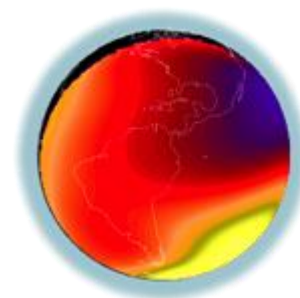
- Earth's disk images
 - Daytime: O/N₂ (density ratio) and temperature in lower thermosphere
 - Nighttime: peak density in ionosphere
- Earth's limb (at fixed longitudes)
 - Exospheric temperature and O₂ density profile



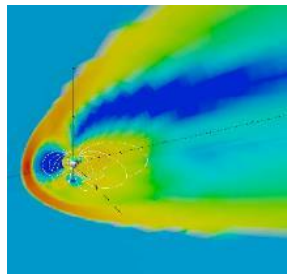
SES[▲]
Government Solutions



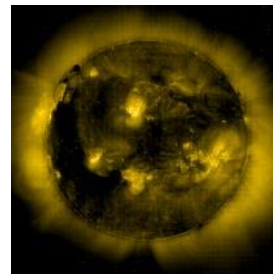
 **CLASP**
Laboratory for Atmospheric and Space Physics
University of Colorado Boulder



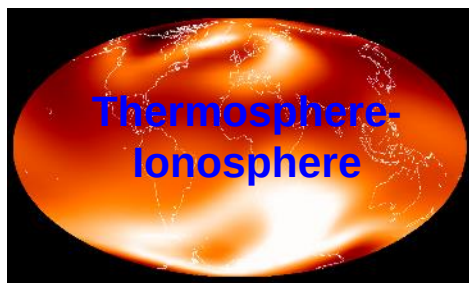
Forcing from Above



Science Question 1 (Q1).
How do geomagnetic storms alter the temperature and composition structure of the thermosphere?

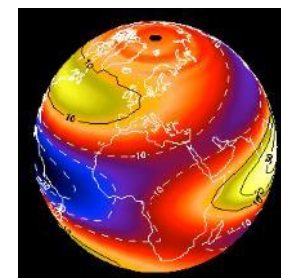


Q2. What is the global-scale response of the thermosphere to solar extreme-ultraviolet variability?

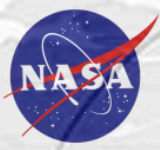


Q4. How does the nighttime equatorial ionosphere influence the formation and evolution of equatorial plasma density irregularities?

Q3. How significant are the effects of atmospheric waves and tides propagating from below on thermospheric temperature structure?



Forcing from Below



Science Data Downlink



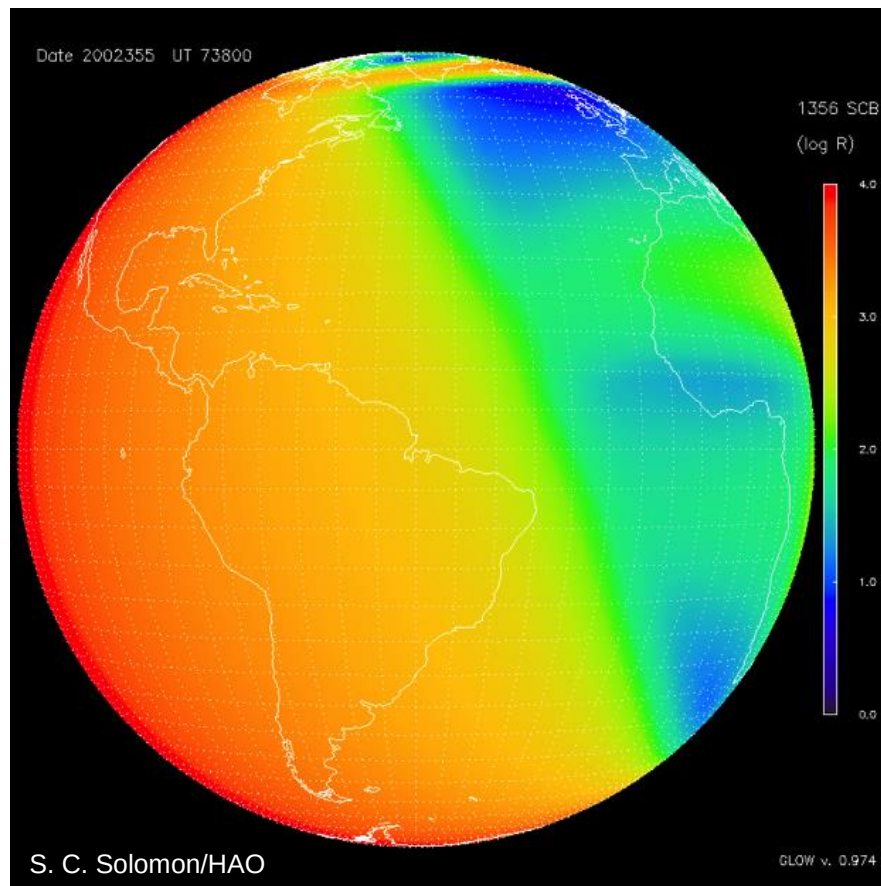
**GOLD Ground Station,
Woodbine, MD**



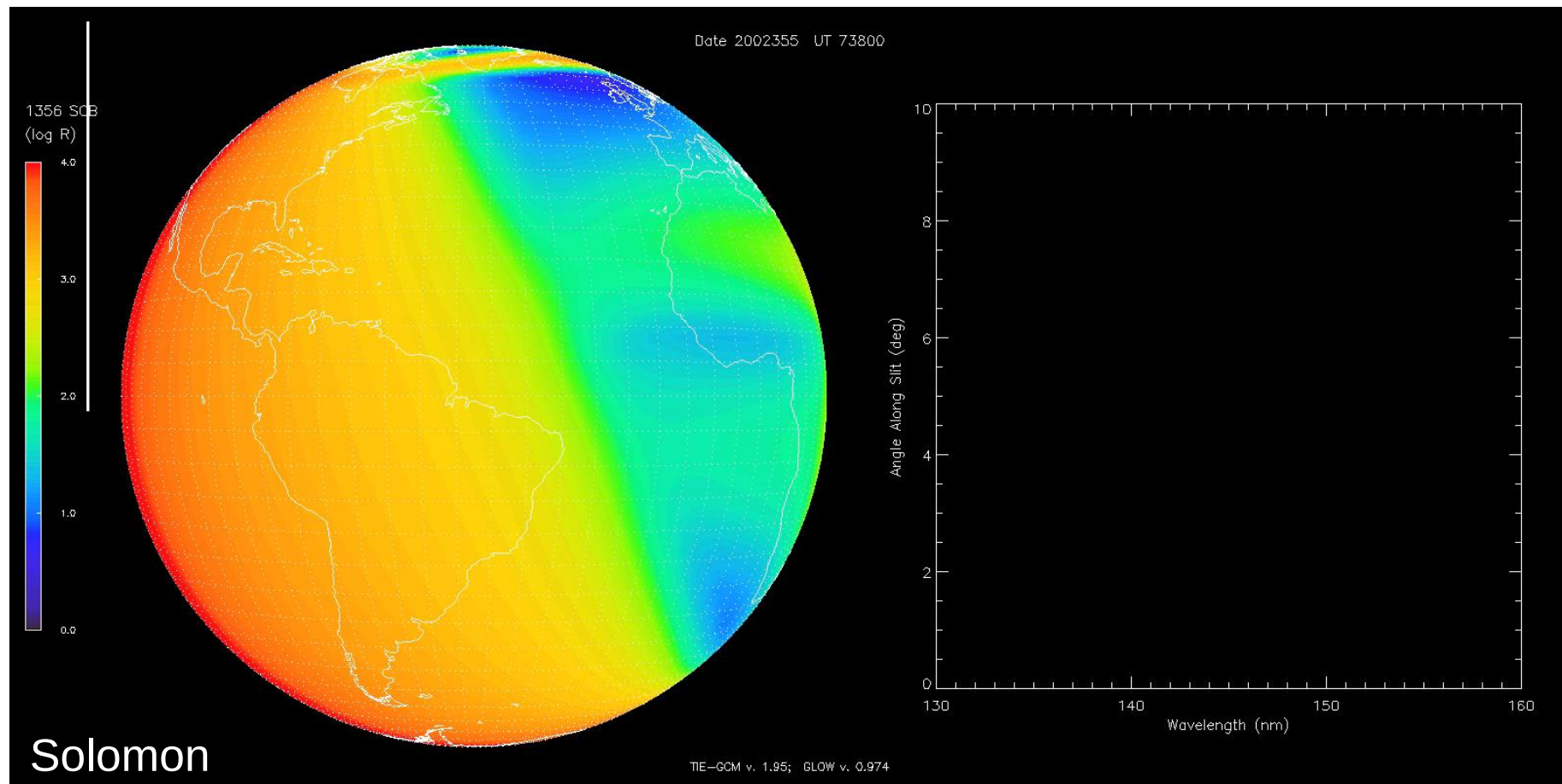
SES-14/GOLD Subsatellite Point



- Geostationary orbit, satellite stays over same location
- Data is not stored on the satellite
- Observing same locations for 18 hours each day
- Data transmitted to GOLD ground station in real-time (24/7)



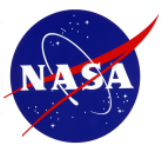
- Simulated GOLD image of oxygen (135.6 nm) emissions
- Simultaneously images N₂ emissions on dayside
- Emissions provide key data for thermosphere and ionosphere



Disk Image

Detector Image

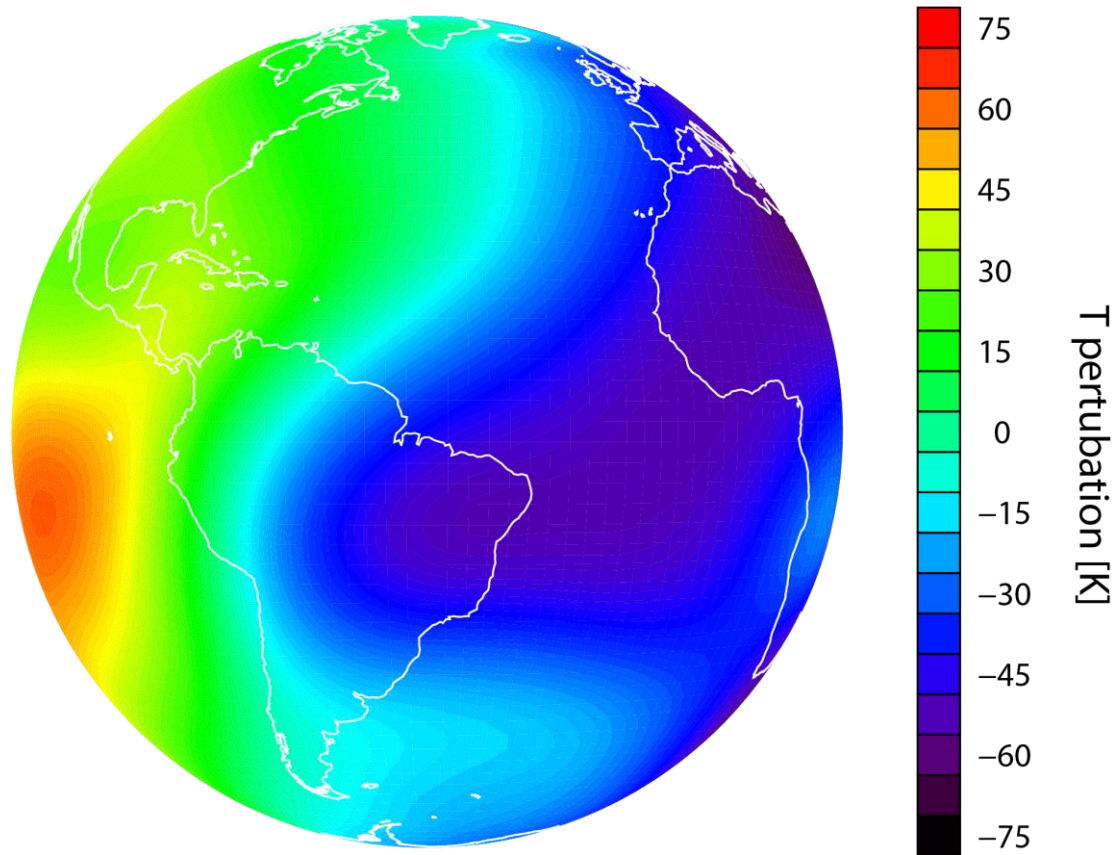
- Entrance slit of one (of two) channel is shown as white rectangle
- Step rate and position are commandable; can dwell on a location



Data Product	Notes/Constraints	Requirement	Realized*
Images of Temperature	60 min Cadence 250 x 250 km ² Resolution	Precision – 55 K	27 K
Images of O/N ₂ Density Ratio	30 min Cadence 250 x 250 km ² Resolution	Precision – 10 %	6.5 %
Exospheric Temperature	100 km Vertical Resolution on Limb	Precision – 40 K	22 K
O ₂ Column Density	at 160 km	Precision – 10 %	2 %
		Vertical Resolution – 10 km	5.5 km
Nmax F2	220 x 220 km ² Resolution	Precision – 10 %	5.7 %

*Realized values from retrievals using simulated data

Modeled Perturbations in Temperature (T) at 160 km due to Tides



- Typical temperatures are 625K near 160 km
- Modeled with version 2 of TIEGCM, which has finer spatial grid

(K. Greer, Colorado U., LASP)



Milestones for Phase E (Science Ops.)



- + 0 months – beginning of Phase E on October 10, at completion of commissioning
- + 4 months – release of Level 2 data to public following data initial validation of L2 data
 - GOLD web site <http://gold.cs.ucf.edu>

Availability of GOLD Data by Data Level

GOLD Data Level	Initial Validation Period*	After start of routine processing†
Level 1	90 days	< 30 days
Level 2**	120 days	< 60 days

* Relative to the completion of instrument commissioning

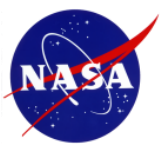
† Relative to the time of the corresponding observations

** L2 data is retrieved quantities, e.g., O/N₂ density ratio and temperatures

- **Launched on SES-14 - Jan 25, 2018**
 - Ariane 5 rocket from French Guiana
- **Detector doors opened - Jan 29, 2018**
- **Transfer to GEO in progress**
- **Simultaneous disk images of thermospheric composition and temperature**
- **Can separate changes in time from changes in location**
- **Real time data availability**
- **Two year mission operations to begin October 2018**



GOLD Launch (Jan 25th, 2018)



Thank You