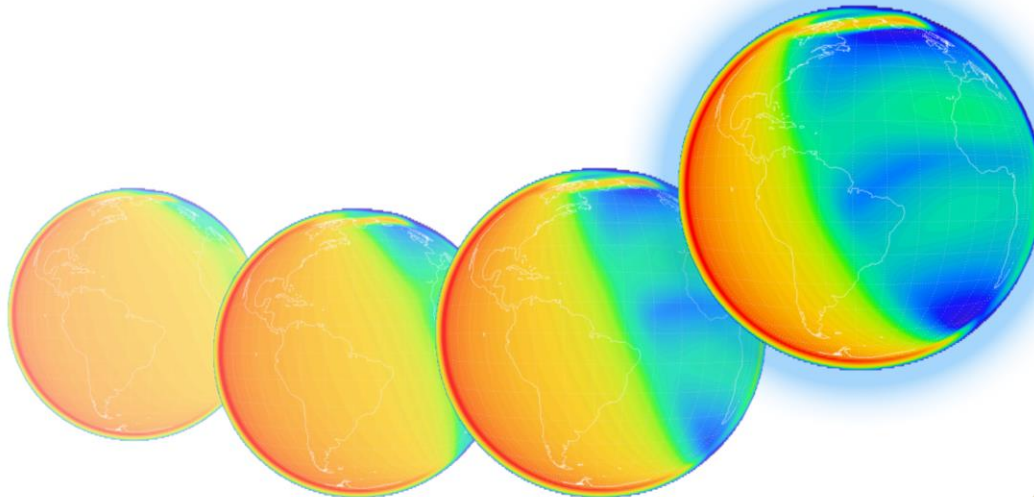


The GOLD Mission – Real-time Imaging of the Space Weather in Earth’s Ionosphere and Thermosphere from Geostationary Orbit

R. Eastes (& the GOLD Team)

Laboratory for Atmospheric and Space Physics

University of Colorado



Laboratory for Atmospheric and Space Physics
University of Colorado Boulder



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

• Host Mission

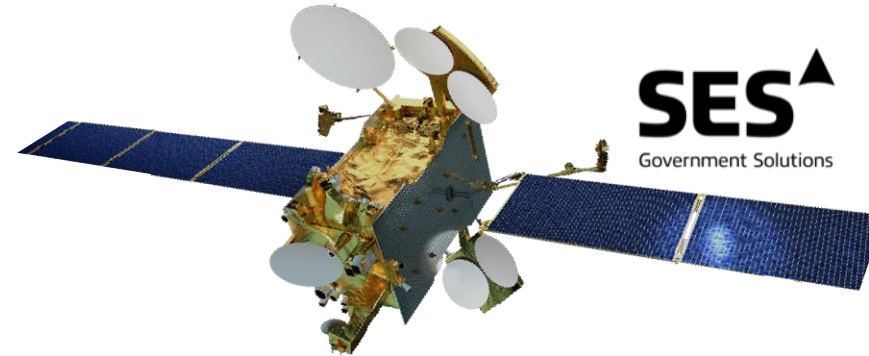
- SES-14, in geostationary orbit over mouth of the Amazon River (47.5°W)

• GOLD Instrument

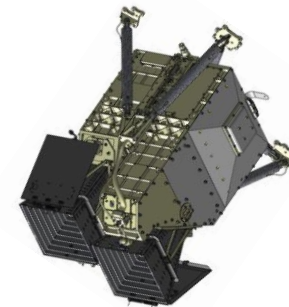
- Two identical, independent imaging spectrographs
- Each observes disk and limb at 132-162 nm

• Data – geophysical quantities

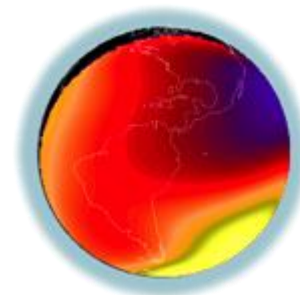
- Earth's disk images
 - Daytime: O/N₂ (density ratio) and temperature in lower thermosphere
 - Nighttime: peak density in ionosphere
- Earth's limb (at fixed longitudes)
 - Exospheric temperature and O₂ density profile



SES[▲]
Government Solutions

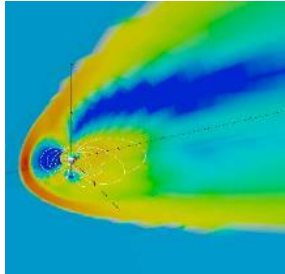


 **CLASP**
Laboratory for Atmospheric and Space Physics
University of Colorado Boulder

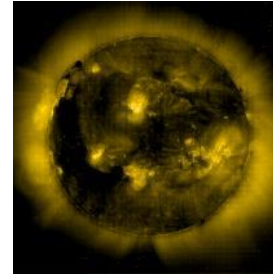


 **UCF**

Forcing from Above



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

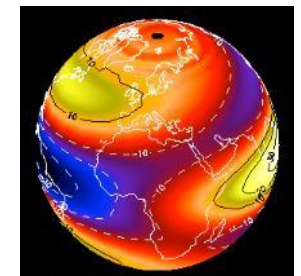


Q2. *What is the global-scale response of the thermosphere to solar extreme-ultraviolet variability?*

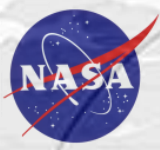


Q4. *How does the nighttime equatorial ionosphere influence the formation and evolution of equatorial plasma density irregularities?*

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



Forcing from Below

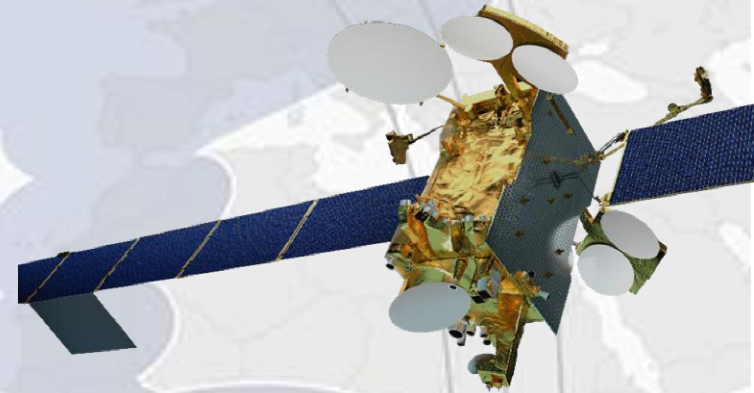


Science Data Downlink

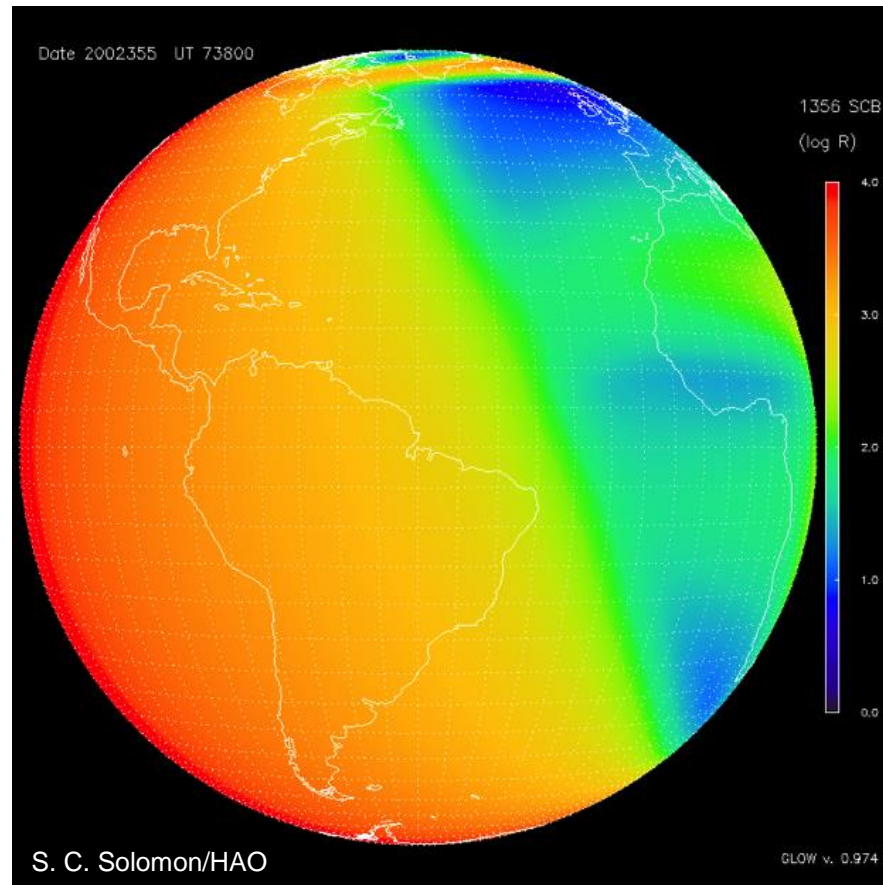


✦ **GOLD Ground Station,
Woodbine, MD**

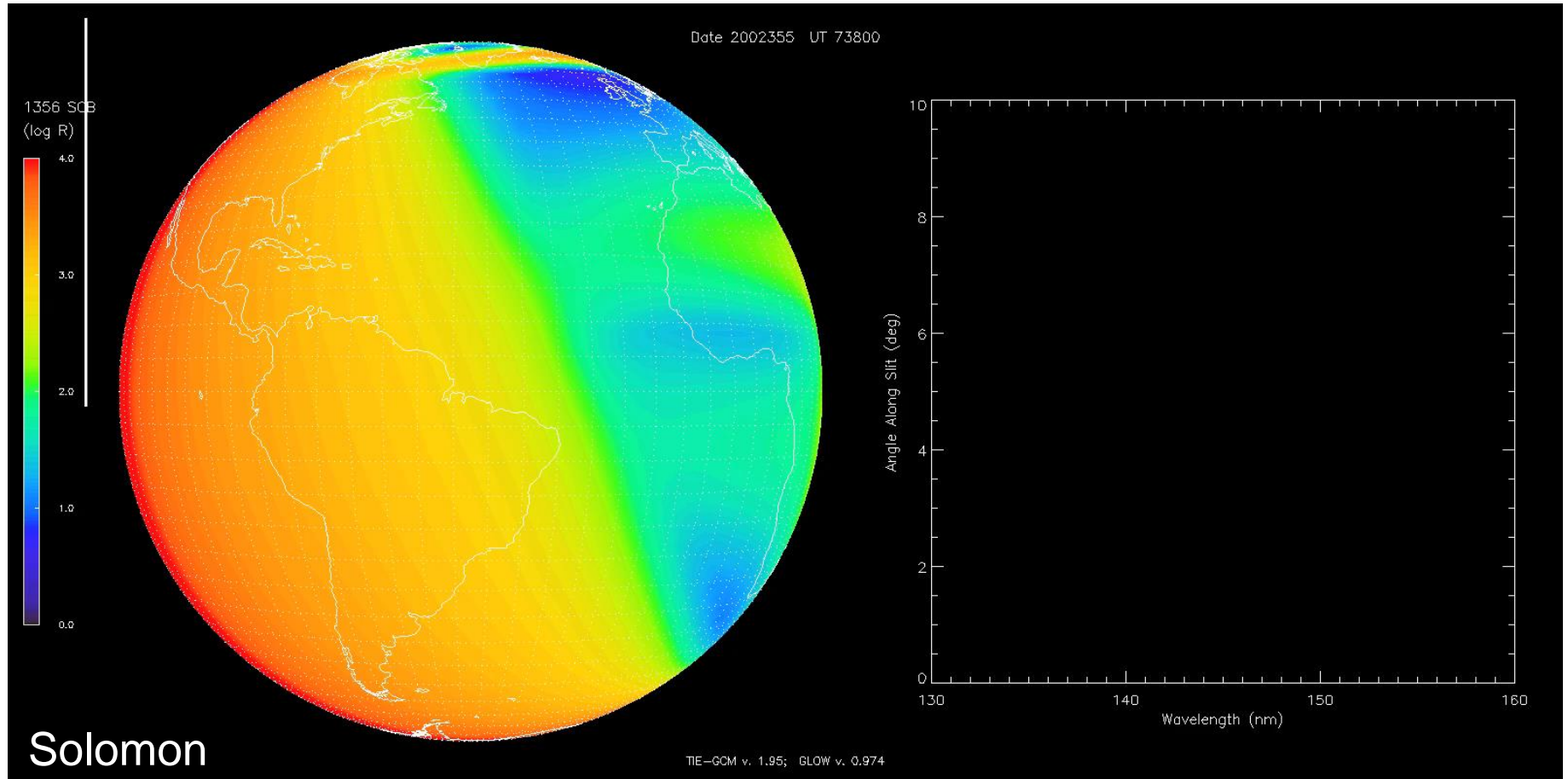
✦ **SES-14/GOLD Subsatellite Point**



- 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)



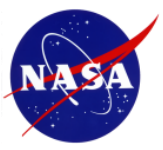
- Simulated GOLD image of oxygen (135.6 nm) emissions
- Simultaneously images N₂ emissions on dayside
- Emissions provide key data for thermosphere and ionosphere



Disk Image

Detector Image

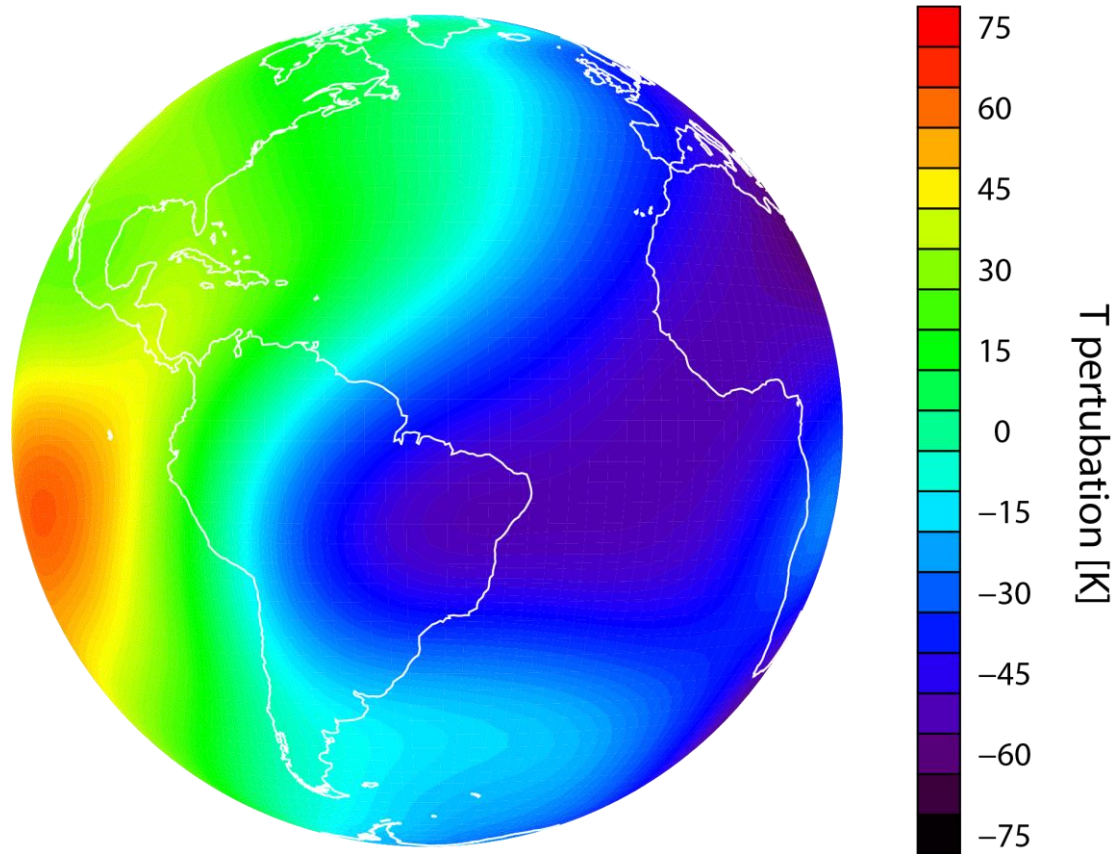
- Entrance slit of one (of two) channel is shown as white rectangle
- Step rate and position are commandable; can dwell on a location



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 %

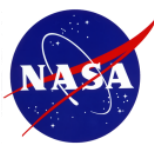
*Realized values from retrievals using simulated data

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)



+ 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

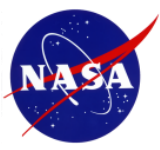
† Relative to the time of the corresponding observations

** 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