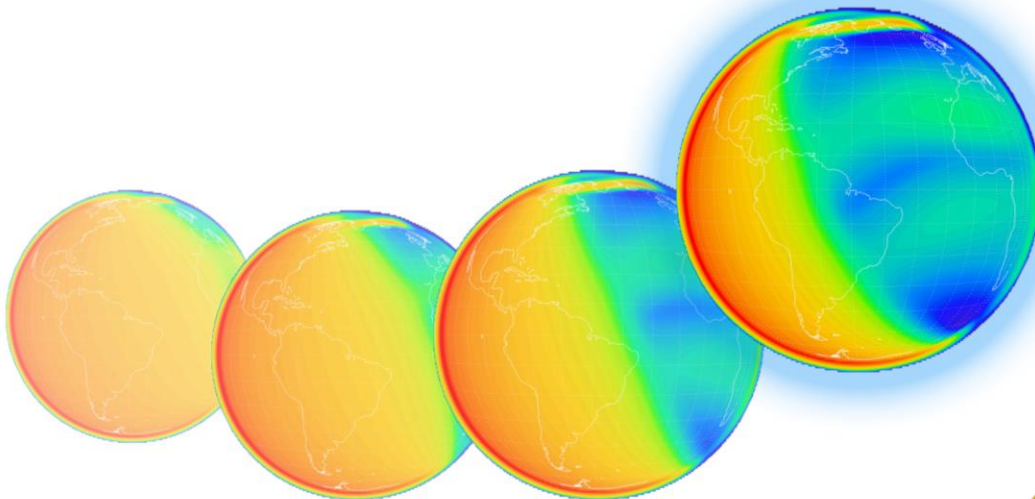


# The GOLD Mission – Real-time Imaging of the Space Weather in Earth's Ionosphere and Thermosphere from Geostationary Orbit

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*Laboratory for Atmospheric and Space Physics*

*University of Colorado*



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

- **Host Mission**

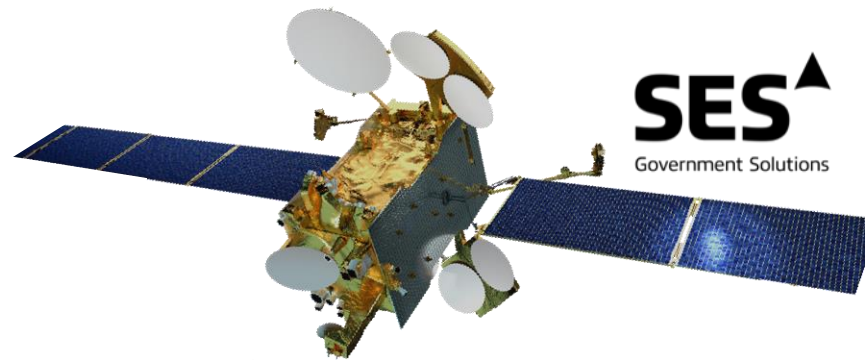
- SES-14, in geostationary orbit over mouth of the Amazon River (47.5°W)

- **GOLD Instrument**

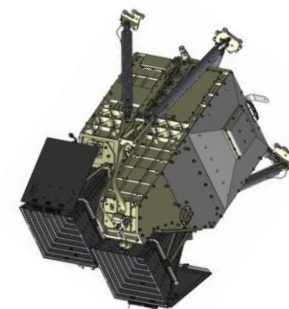
- Two identical, independent imaging spectrographs
- Each observes disk and limb at 132-162 nm

- **Data – geophysical quantities**

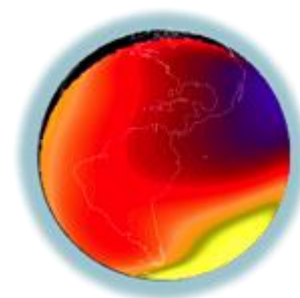
- Earth's disk images
  - Daytime: O/N<sub>2</sub> (density ratio) and temperature in lower thermosphere
  - Nighttime: peak density in ionosphere
- Earth's limb (at fixed longitudes)
  - Exospheric temperature and O<sub>2</sub> density profile



**SES**<sup>▲</sup>  
Government Solutions

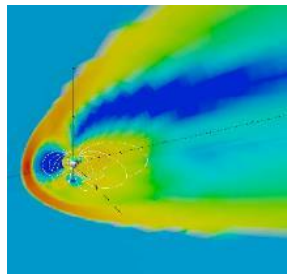


 **CLASP**  
Laboratory for Atmospheric and Space Physics  
University of Colorado Boulder

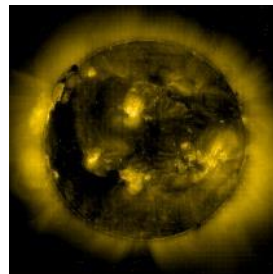


 **UCF**

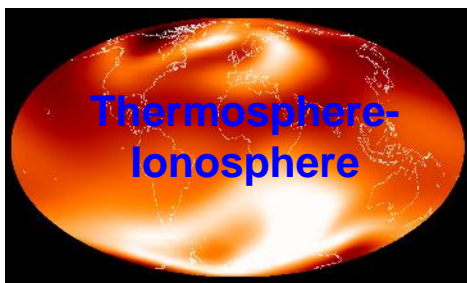
## Forcing from Above



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

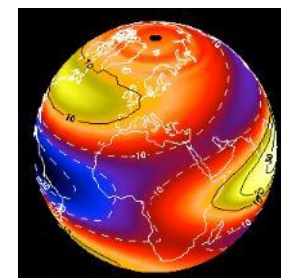


**Q2. What is the global-scale response of the thermosphere to solar extreme-ultraviolet variability?**



**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



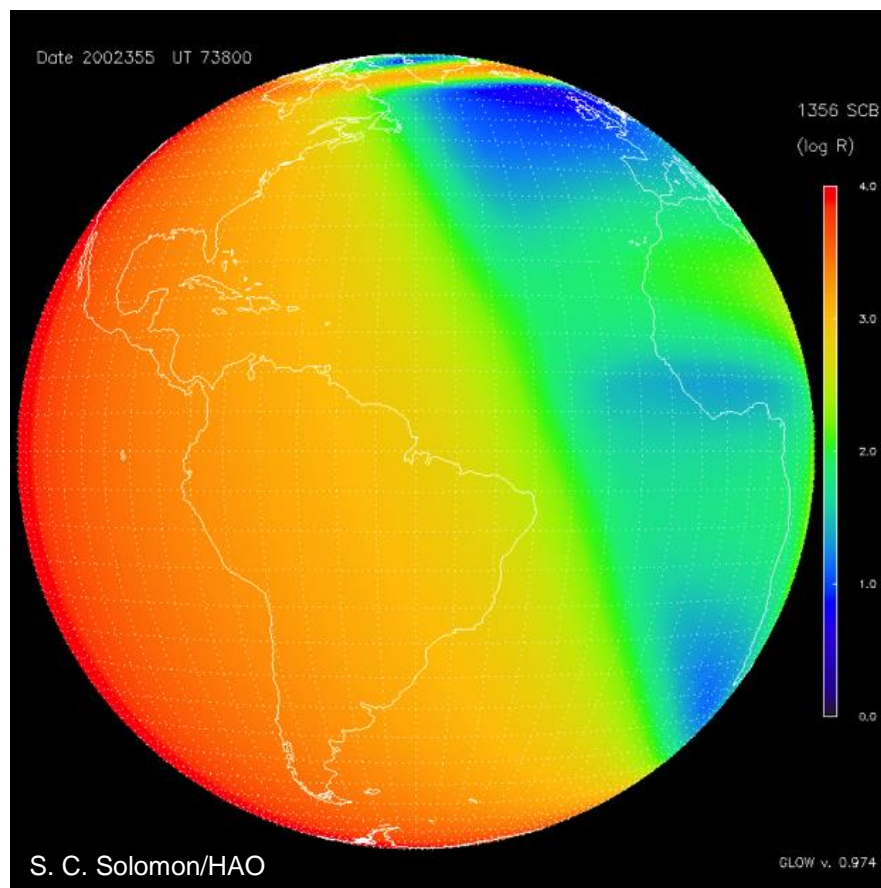
**GOLD Ground Station,  
Woodbine, MD**



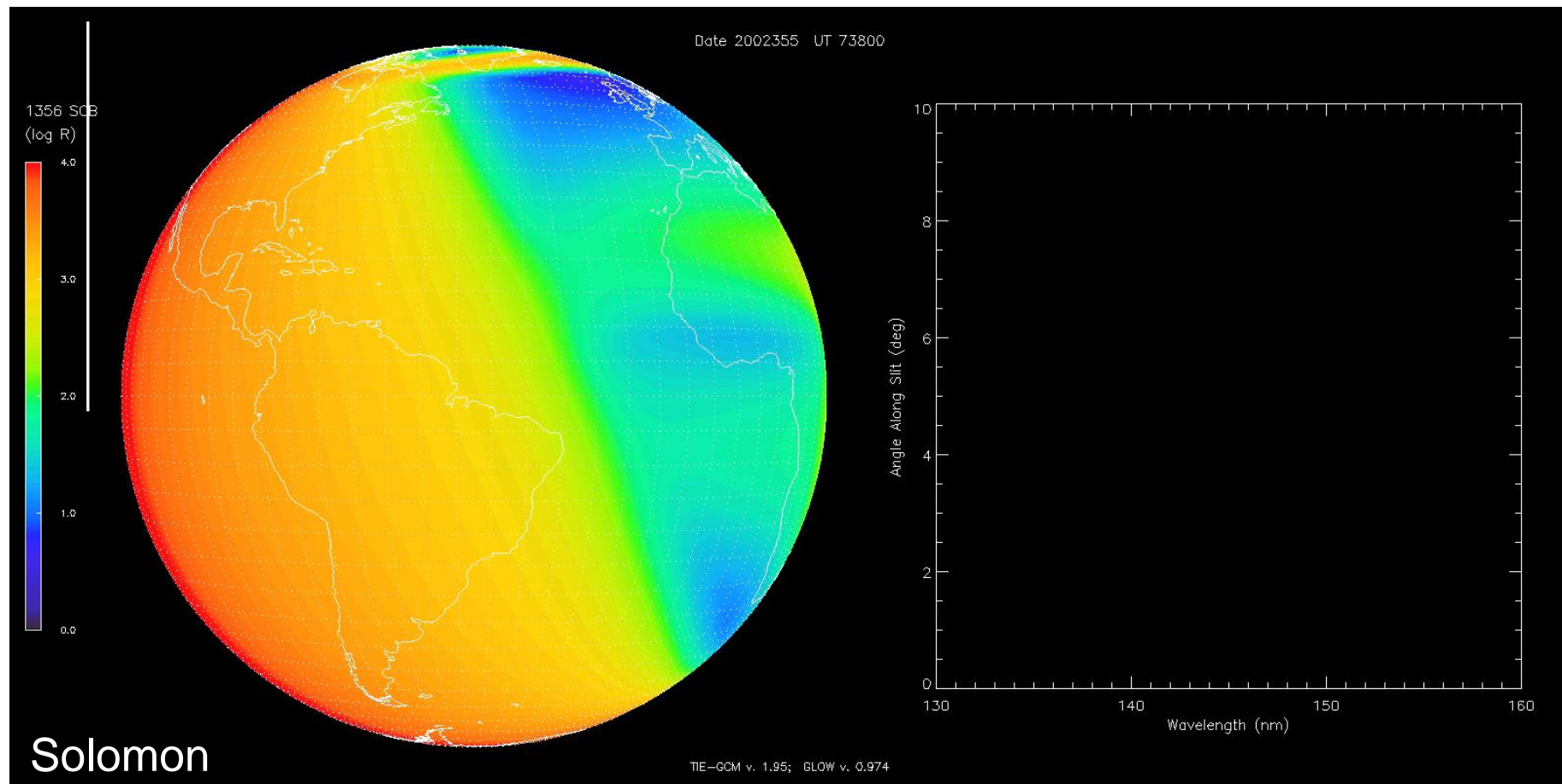
**SES-14/GOLD Subsatellite Point**

- 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)





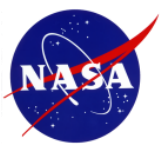
- Simulated GOLD image of oxygen (135.6 nm) emissions
- Simultaneously images N<sub>2</sub> emissions on dayside
- Emissions provide key data for thermosphere and ionosphere



**Disk Image**

**Detector Image**

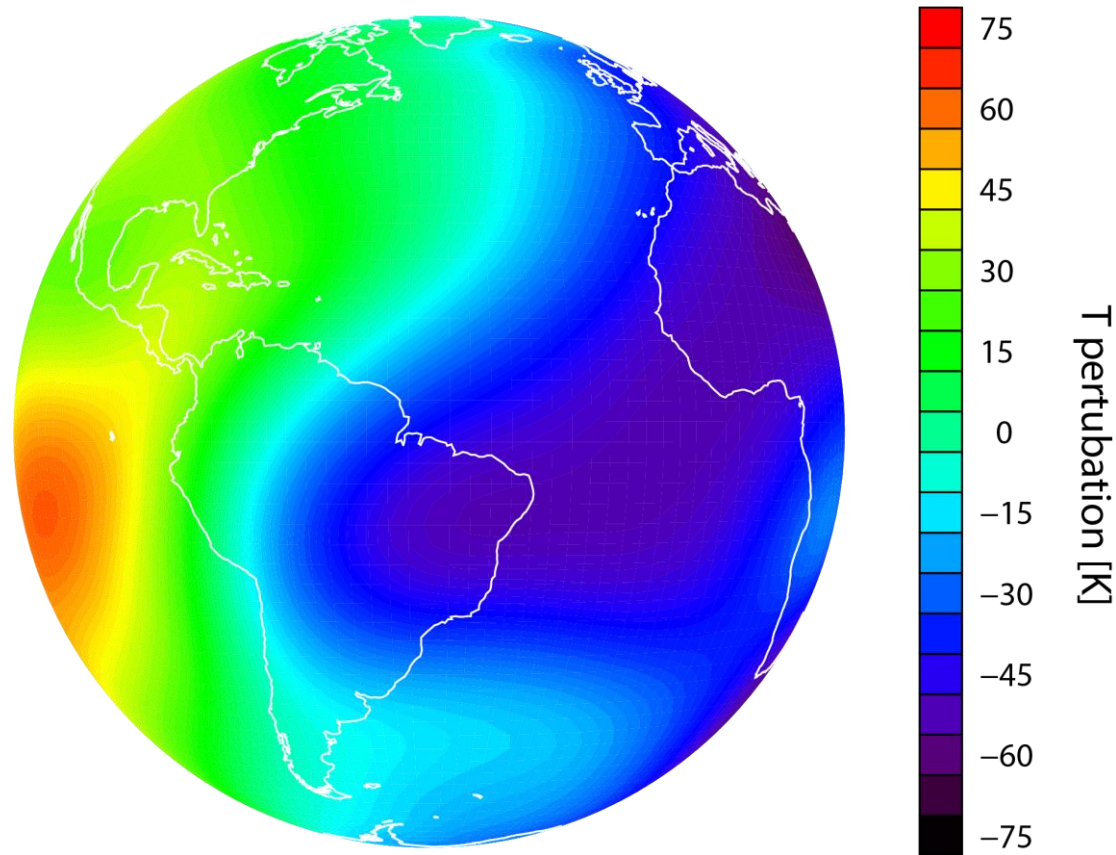
- Entrance slit of one (of two) channel is shown as white rectangle
- Step rate and position are commandable; can dwell on a location



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

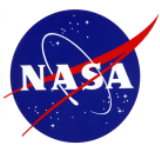
\*\* L2 data is retrieved quantities, e.g., O/N<sub>2</sub> density ratio and temperatures

- **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**



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**GOLD Launch (Jan 25<sup>th</sup>, 2018)**



# Thank You