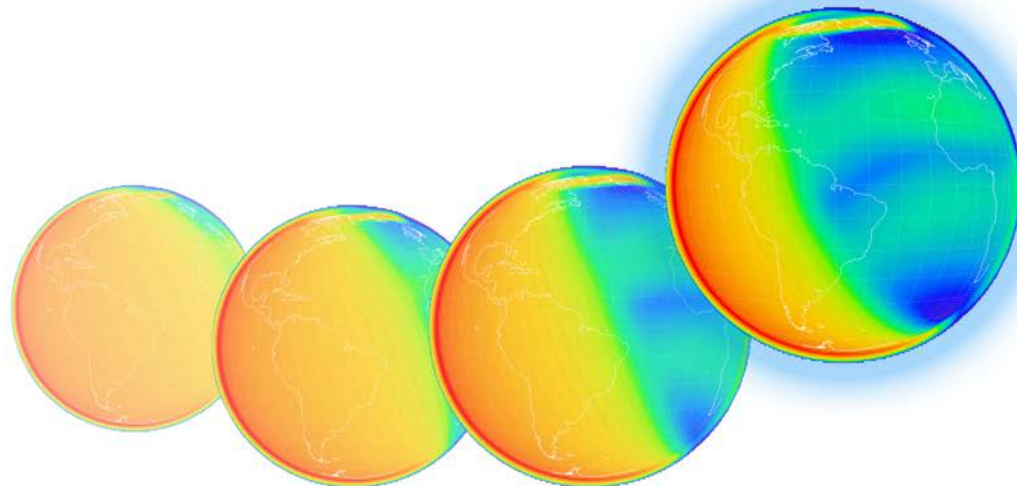


Global-scale Observations of the Limb and Disk (GOLD) – First Light Observations

Richard Eastes, Alan Burns,
William McClintock, and the
GOLD Science Team

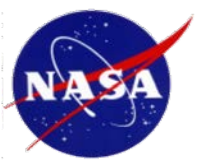


6/15/19



Laboratory for Atmospheric and Space Physics
University of Colorado Boulder





GOLD Mission Overview



• Host Mission

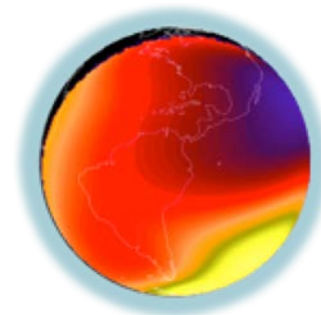
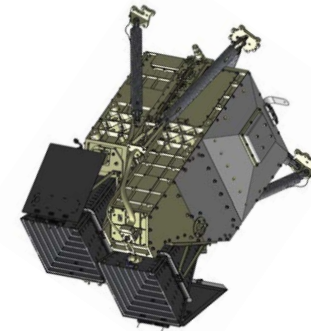
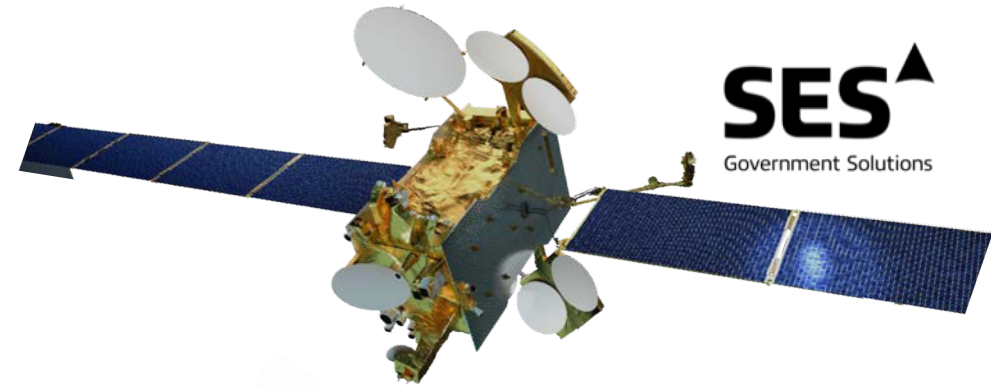
- SES-14, in geostationary orbit at 47.5° west (over mouth of the Amazon River)

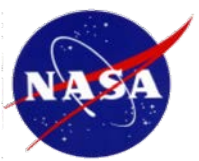
• GOLD Instrument

- Two identical, independent imaging spectrographs covering 132-162 nm

• Measurements

- Earth's disk
 - Tdisk & O/N₂ - Daytime: from spatial-spectral image cubes of O-135.6 nm and N₂-LBH emission
 - Nmax - Nighttime: from images of O-135.6 nm emission
- Earth's limb
 - Texo - Altitude profiles of N₂-LBH emission
 - O₂ density profile - Stellar occultations



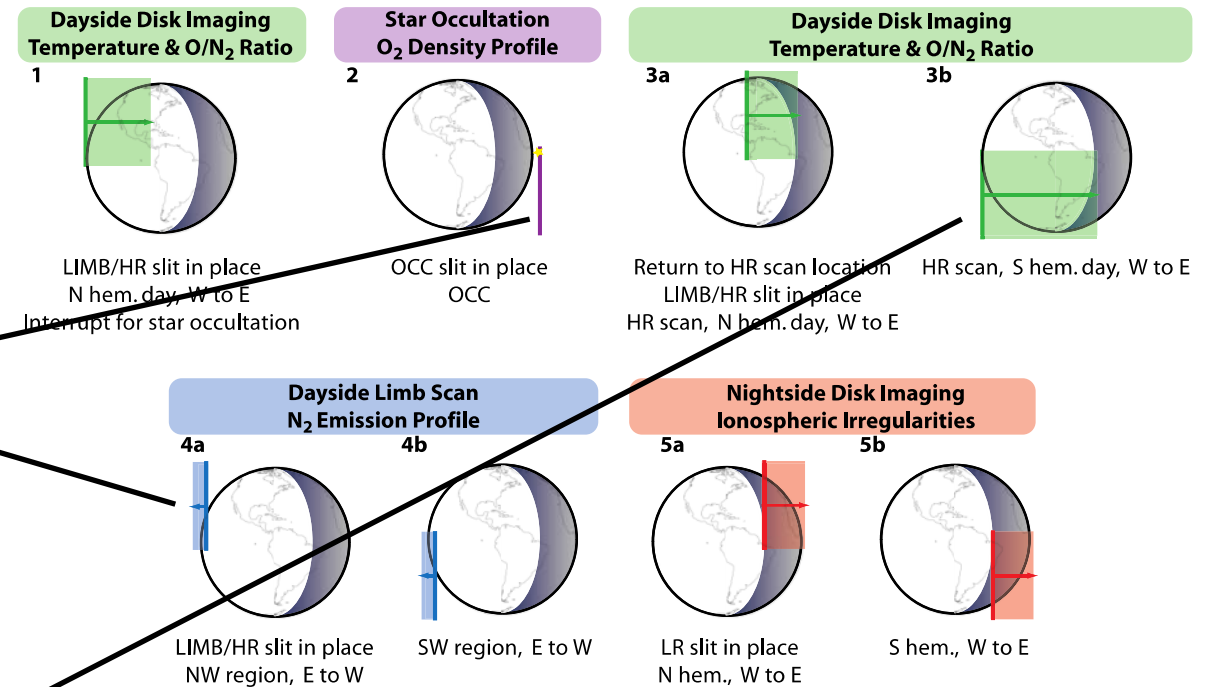


GOLD Uses Whiskbroom Imaging to Build Spatial-Spectral Image Cubes

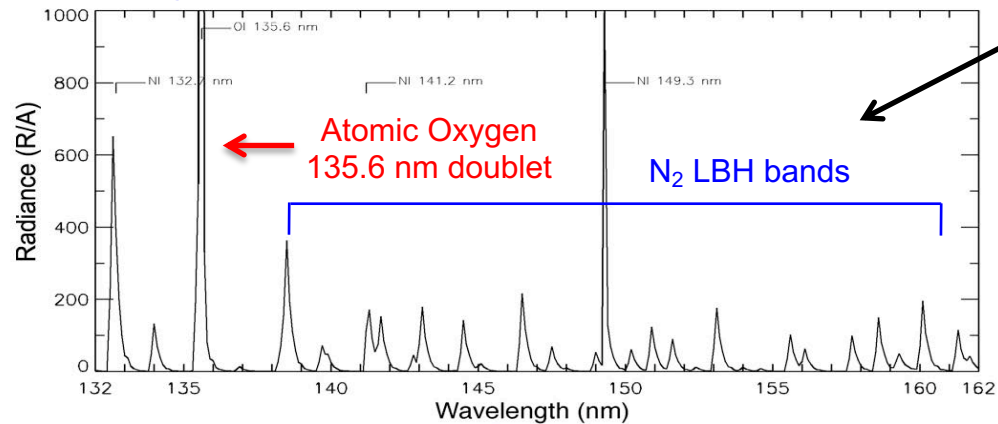


Technique

- Telescope equipped with a scan mirror images the T-I system onto the slit of an imaging spectrograph.
- The limiting resolution is ~ 50 km.
- Measurements include stellar occultations and altitude profiles on the limb



Daytime Far-Ultraviolet Spectrum



The spectrograph records spectra as a function of slit height at each point on the disk.

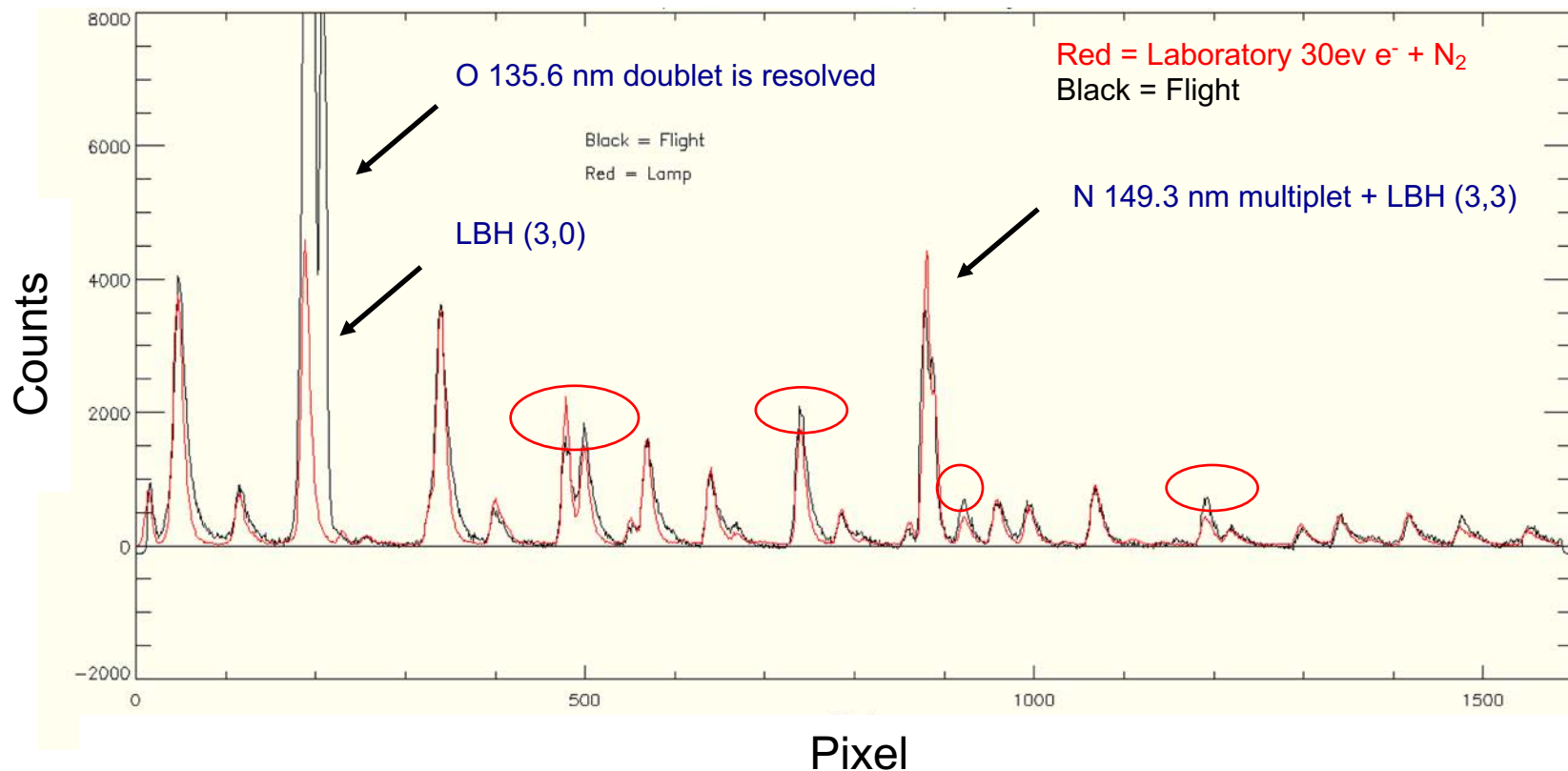


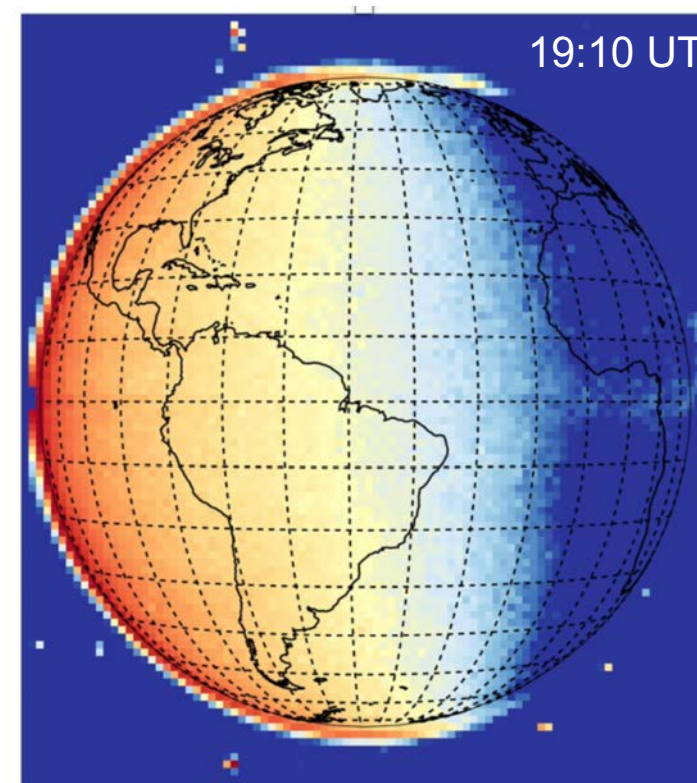
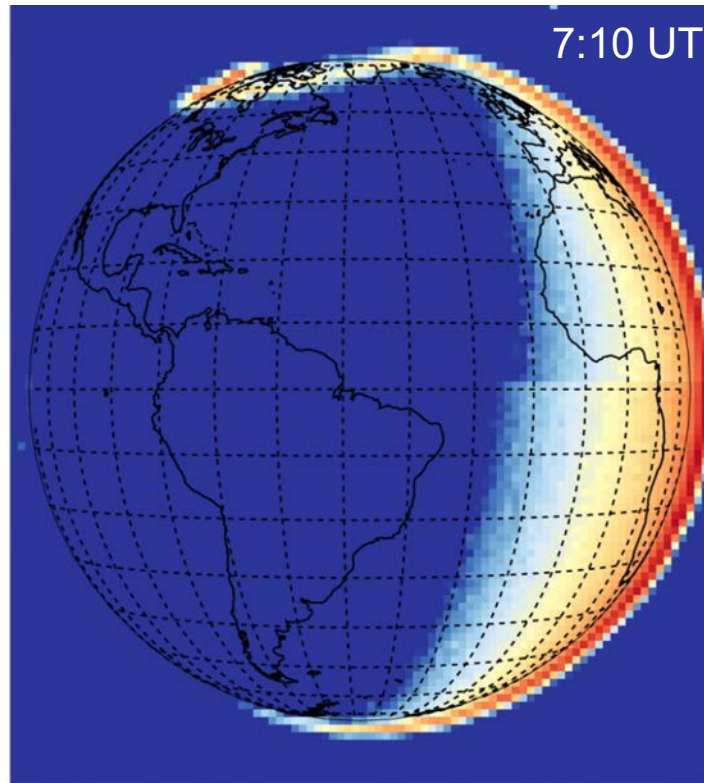
Flight - Laboratory Comparison



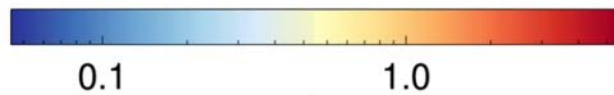
Direct comparison with electron lamp spectra acquired during ground calibration shows that the relative band strengths are in **good but not perfect** agreement with Franck- Condon factors derived in the laboratory

Comparison of Laboratory Electron-Impact Spectrum and Flight Data





30-minute disk images



Brightness (kR)



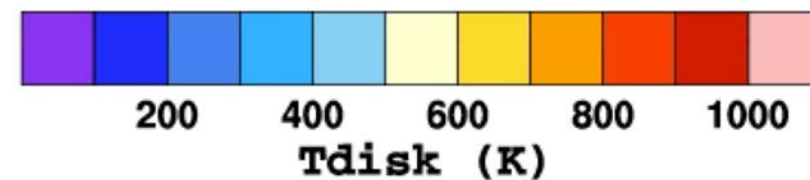
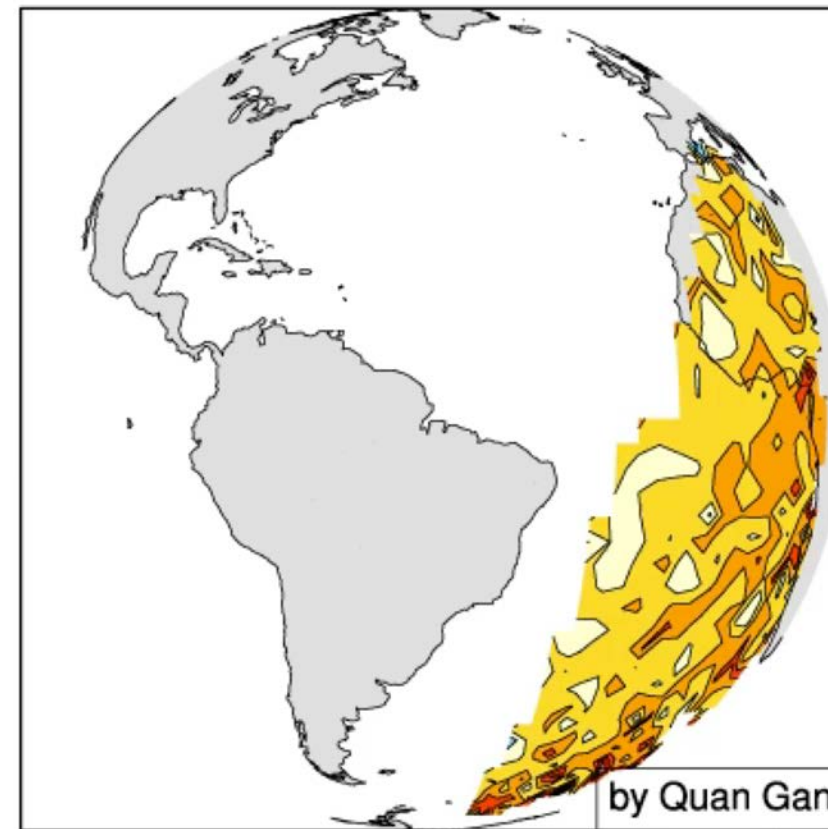
Morning

- Aurora is visible above North America

Afternoon

- Numerous stars in the galactic plane appear around the disk
- Equatorial arcs are visible in the nominal disk scan

Day = 308 0800UT



Days 308-309 (Nov. 4-5, 2018)

Geomagnetic storm (Kp 6-) on day 309

Storm increases thermospheric temperature

Oct. – March 2018 data are available

Current data is at higher temporal and spatial resolution than planned

Days 308-310 (Nov. 4-6, 2018)

Geomagnetic storm (Kp 6-) on day 309

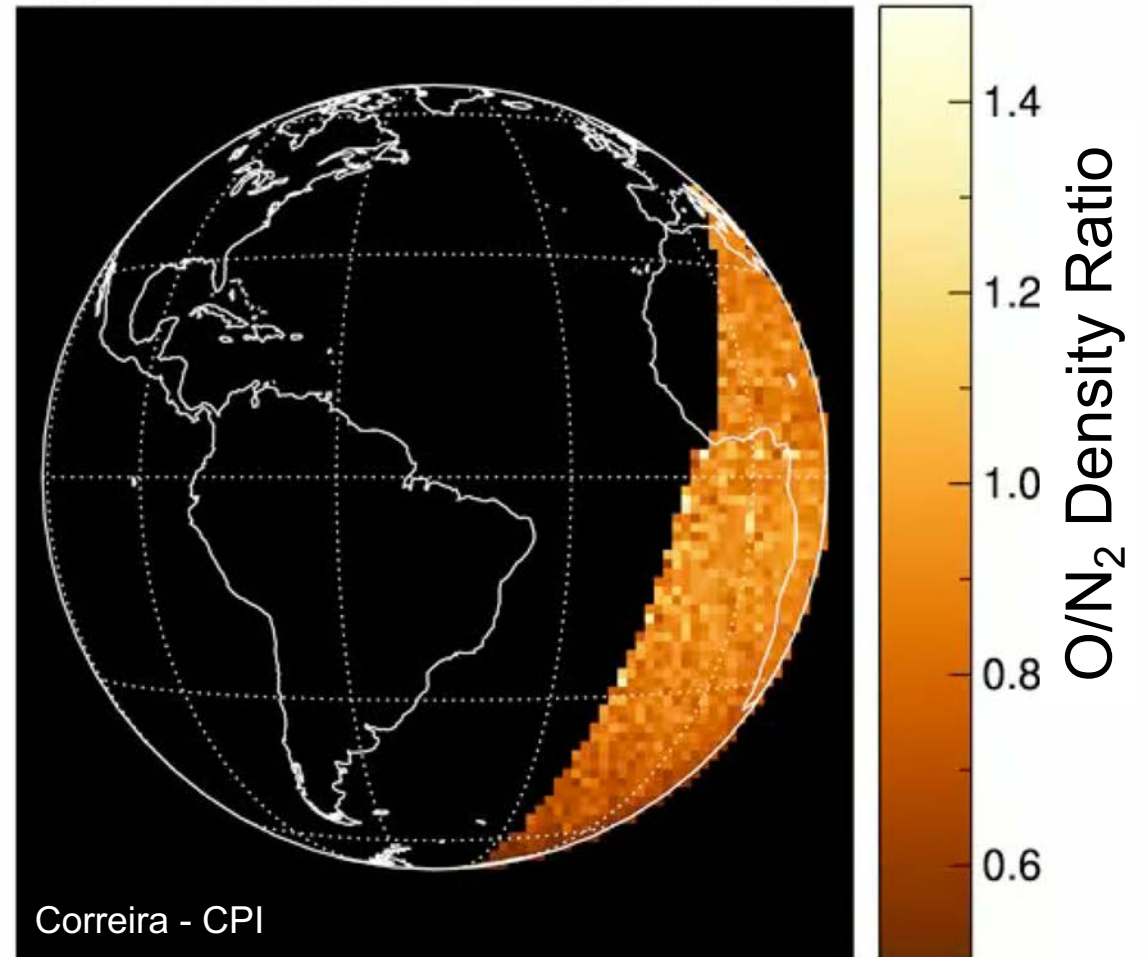
On that day oxygen density (relative to N₂) decreases significantly at high latitudes, equatorward of the aurora

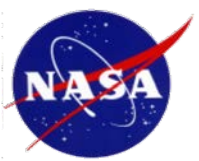
Oct. – Dec. 2018 data are available

Updating data products soon with O/N₂ through Feb. 2019; adding correction for detector changes

(note: O/N₂ values valid only outside the regions with energetic particle precipitation)

DOY 308 / 2018-11-04T07:16:10Z



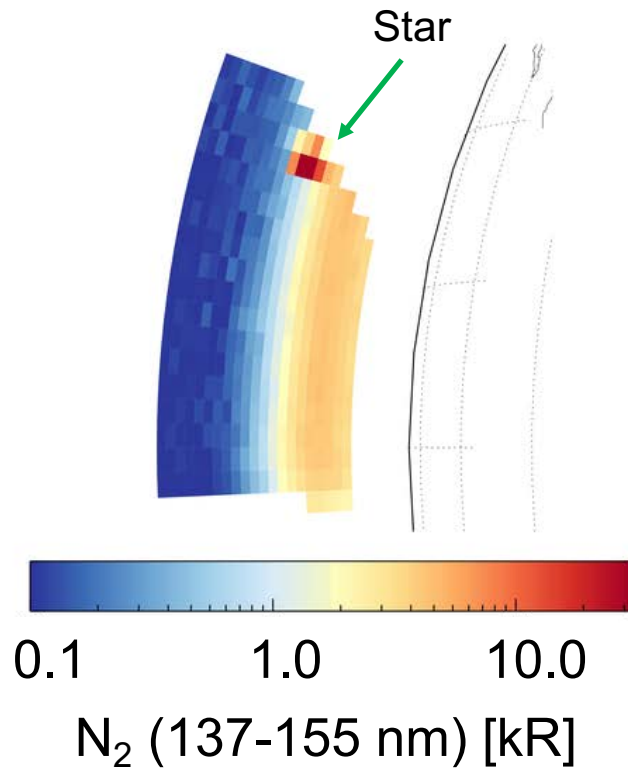


Limb Scans for Exospheric Temperature

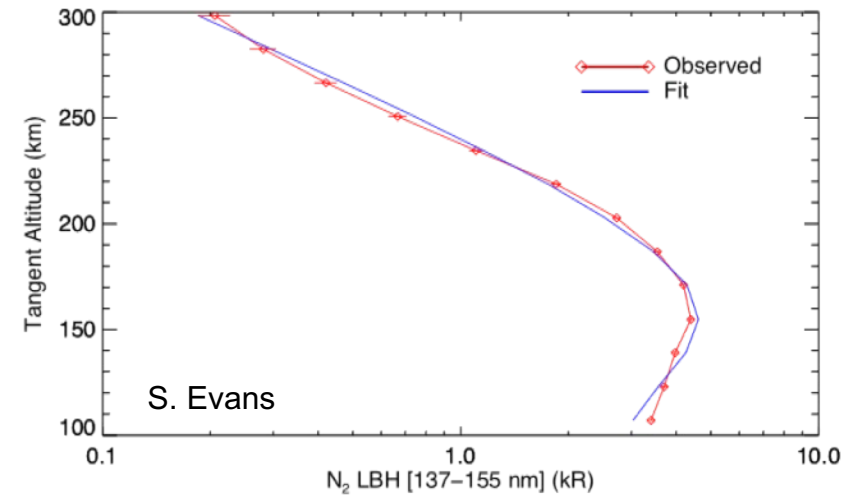


Exospheric temperature (T_{exo}) derived from limb scans near the equator

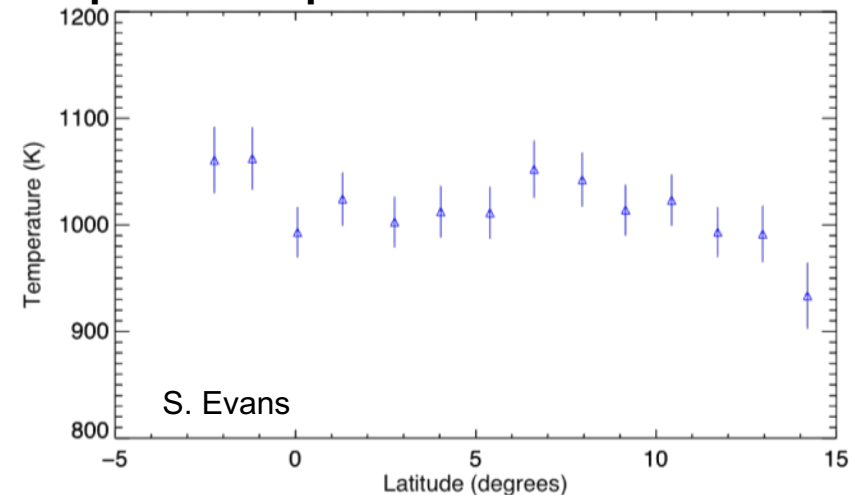
Day 254 20:07 UT limb scan

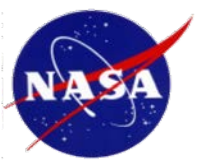


Fit to N_2 emission the profile at 2.75 N latitude



Exospheric temperature is derived from each profile



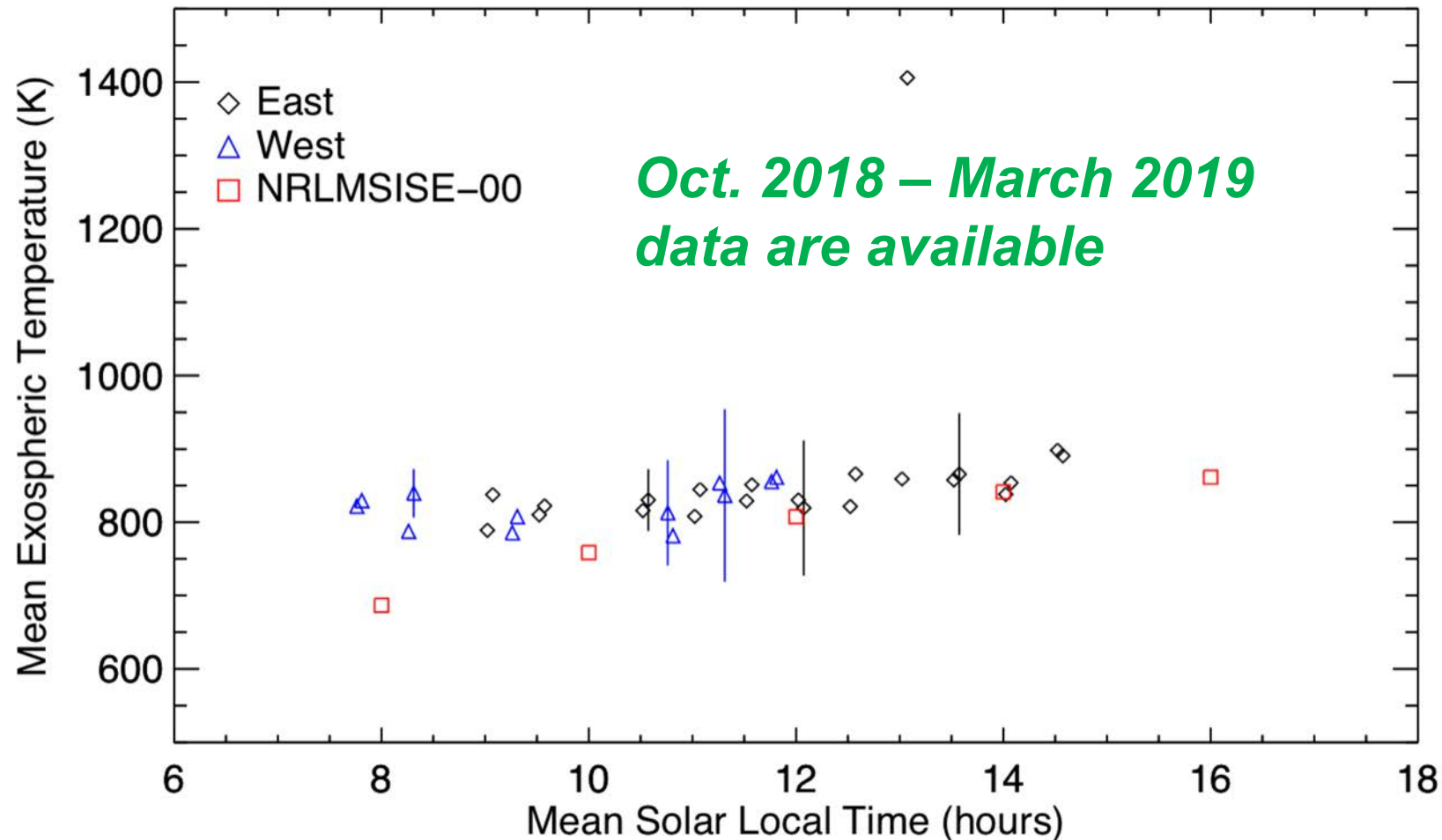


Limb Scans for Exospheric Temperature



Exospheric temperature (Texo) derived from limb scans near the equator

GOLD vs. MSIS



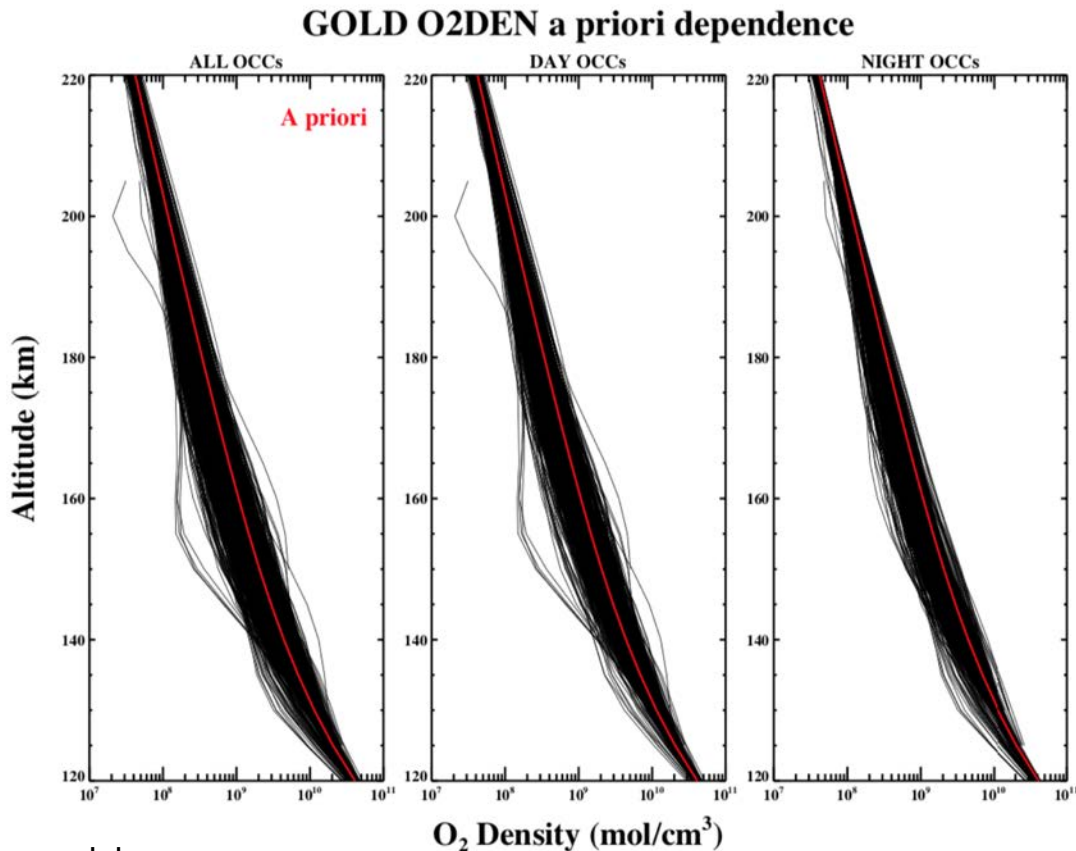


O₂ Density Profile

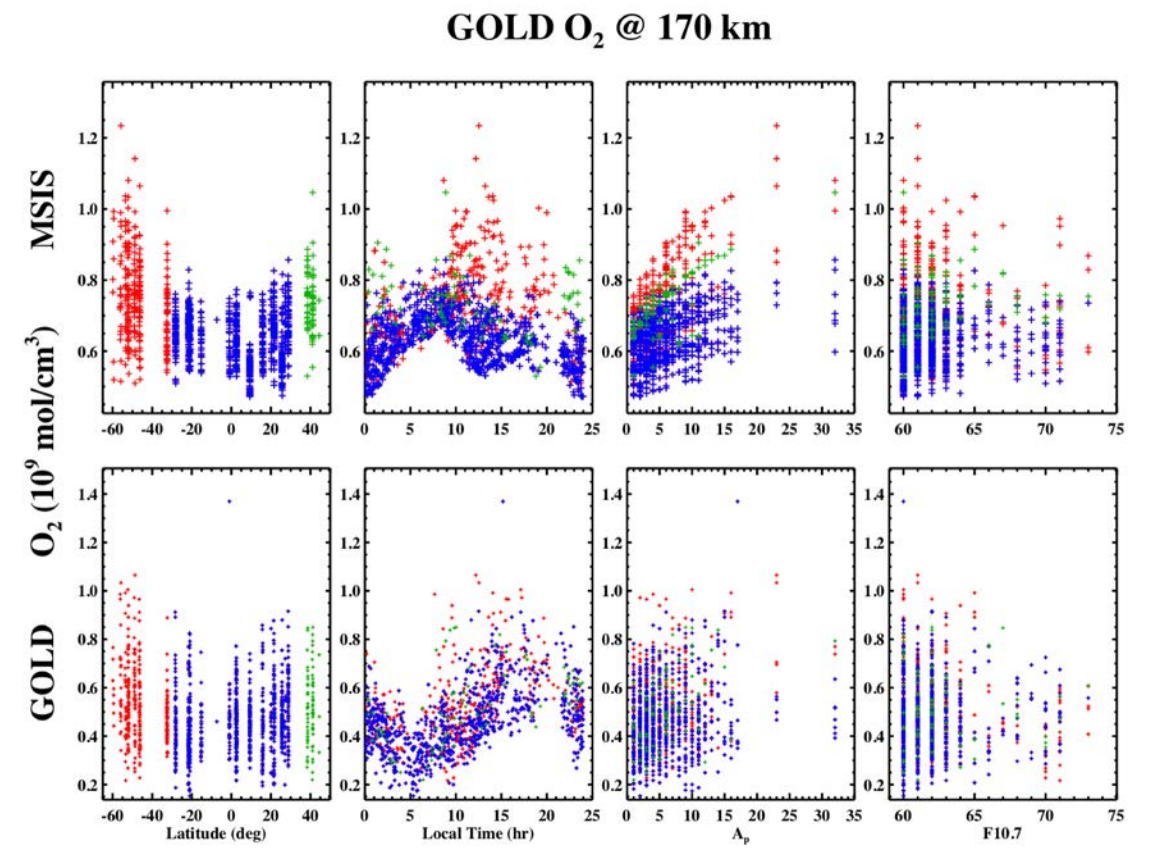


O₂ Density Profiles (black) vs. a priori (red)

O₂ Morphology compared to MSIS



J. Lumpe



October 2018 – March 2019 data are available

Observing O 135.6 nm emissions
from Appleton anomaly

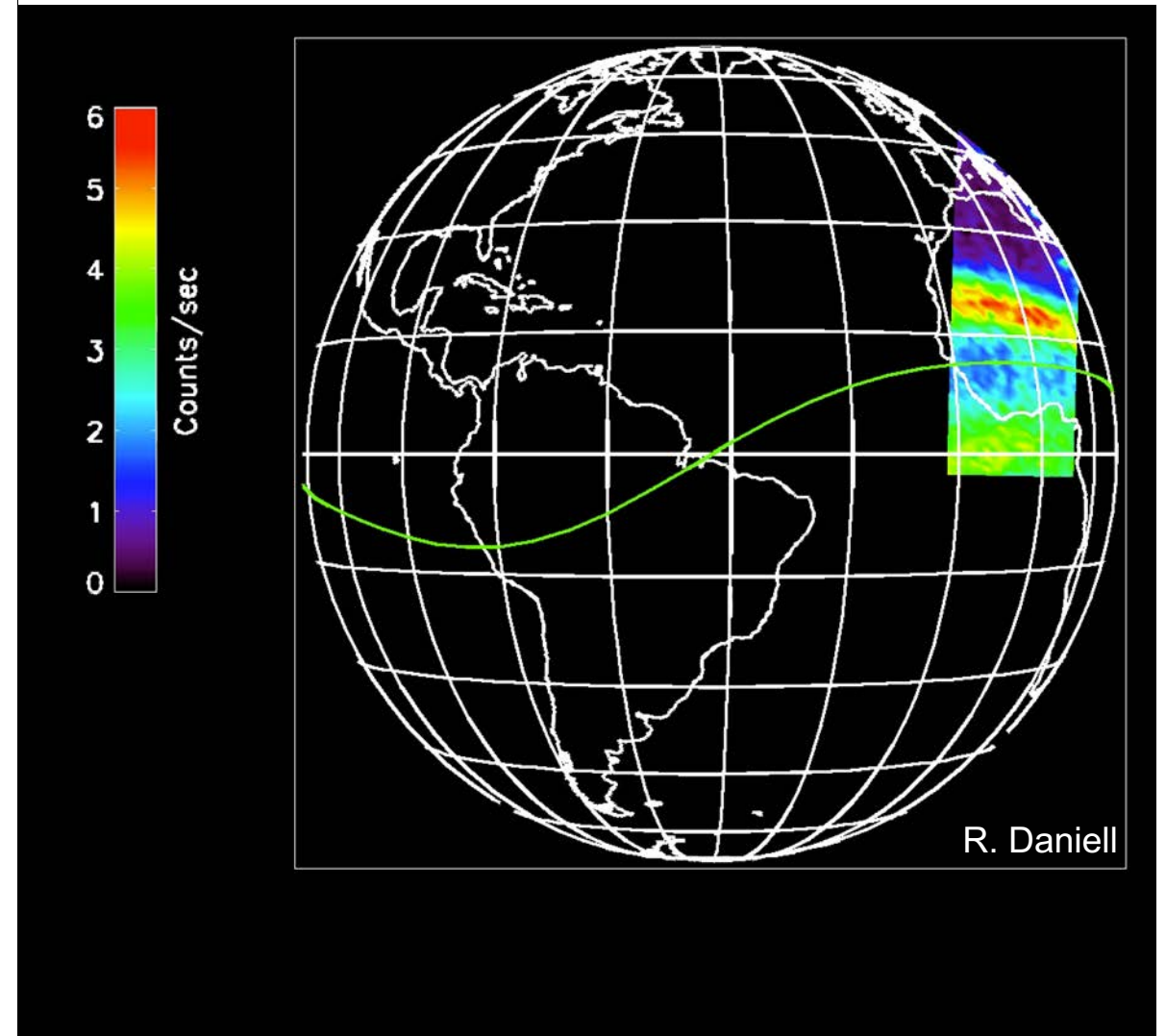
*Single channel 17-20 LT; 30 min
imaging cadence*

Both channels 20-21 LT; 15 min
imaging cadence

Green line on magnetic equator

October 2018 – March 2019 data
are available

October 17, 2018 (day 290)





Status



- **GOLD began science operations on October 17, 2018**
- ***Routine observations include:***
 - *Dayside disk scans, limb scans & stellar occultations (03:00 – 20:00 LT)*
 - *Nightside disk scans (17:00 – 21:00 LT, to 21:30 LT in 2019)*
- **Level 1 data released March 2019 (<http://gold.cs.ucf.edu>, also at SPDF)**
 - Channel A - October 6, 2018 – March 14, 2019
- **Level 2 data released June 3, 2019 (at same locations as L1)**
 - Tdisk, Texo, O₂ density profiles – October 6, 2018 – March 14, 2019
 - O/N₂ – October 6, 2018 – December 31, 2018; *through February 2019 after reprocessing*



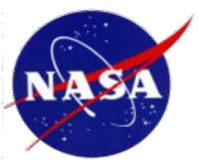


Summary



- Instrument performance is nominal and consistent with planned performance
- *Level 1 & Level 2 data are online for download*
- Current data showing good agreement with other other observations and modeling
- *Planning for focused observations for solar eclipse next month & for a yet to be drafted hurricane in the Atlantic*
- Already, unanticipated and surprising **‘weather’** in the I-T system





Thank You