# Comparison of GOLD nighttime measurements with total electron content: preliminary results

Xuguang Cai[1], Alan G. Burns[1], Wenbin Wang[1], Anthea Coster[2], Liying Qian[1], Jing Liu[1], Stanley C. Solomon[1], Richard W. Eastes[3], Robert E. Daniell[4], William E. McClintock[3]

1 High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado, USA
2 Haystack Observatory, Massachusetts Institute of Technology, Cambridge, MA, USA
3 Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO, USA
4 Ionospheric Physics, 38 Sandy Ridge Road, Stoughton, MA, USA

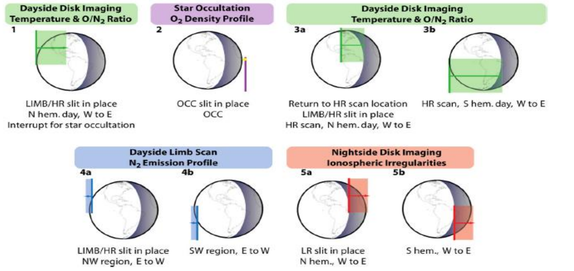
## Abstract

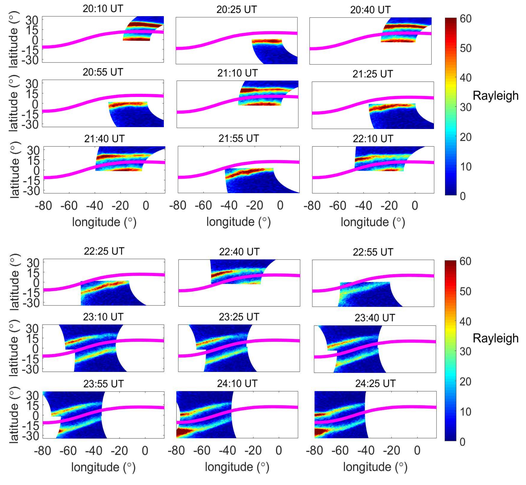
The National Aeronautics and Space Administration (NASA) Global-scale Observations of the Limb and Disk (GOLD) has been imaging the thermosphere and ionosphere since October 2018. It provides continuous measurement over a large area from its geostationary orbit. The unambiguous 2-dimensional (2D) maps of OI 135.6 nm radiance retrieved from GOLD after sunset are compared with the total electron content (TEC) maps measured by GPS receivers in the America sector. The OI 135.6 nm radiance observed by GOLD is an indicator of the peak electron density of the ionosphere F2 region, while the TEC is the total electron density in the column. Our comparisons show that the two datasets match each other very well in the EIA morphology and its seasonal variability. Equatorial plasma bubbles (EPBs) are evident in GOLD night-time OI 135.6 radiance. The corresponding depletion is shown in TEC maps, but without GOLD data as a reference, it is difficult to discern if the depletions are EPBs. In addition, both GOLD 135.6 radiance and TEC maps observed third peaks of electron density southward of the southern EIA crest. Furthermore, both show that the ionosphere after sunset is quite dynamic and has strong day-to-day variability. In all, the GOLD and TEC have valuable synergy to allow us to gain a better understanding of the equatorial ionosphere.

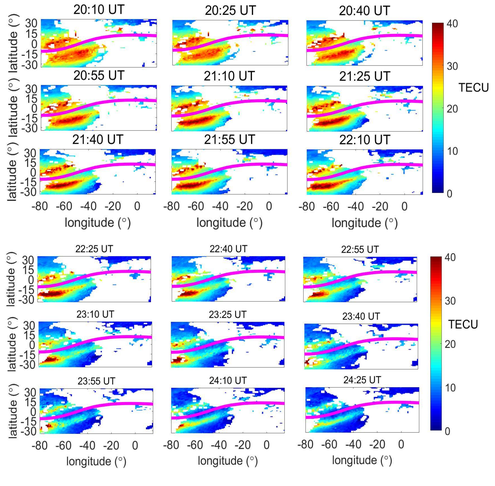
## 2 Brief introduction of GOLD

GOLD is a high-resolution (1°*1°), far ultra-violet imaging spectrograph with two identical channels (132-162 nm). It mainly scans 135.6 and LBH in the daytime, and 135.6 at night [Eastes e al., 2017]

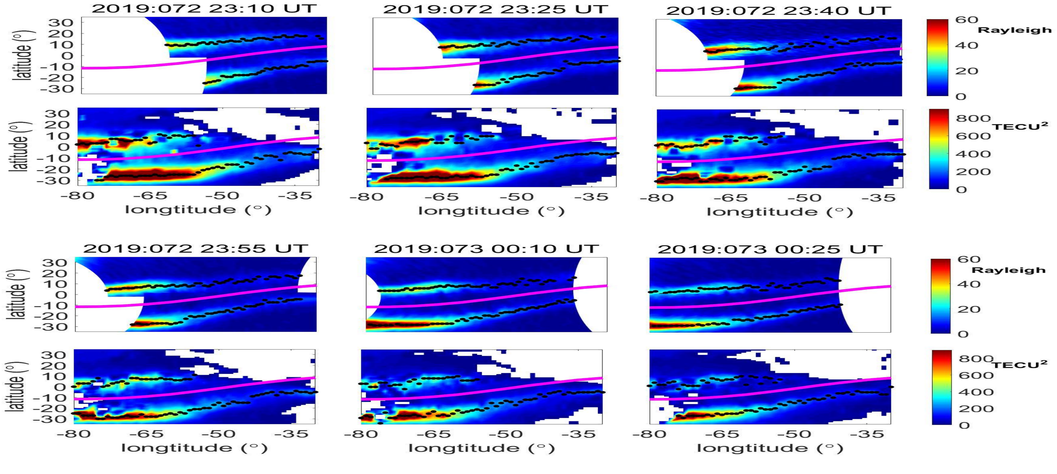
GOLD performs global-scale imaging of the Disk with 30-min cadence in daytime and nighttime, 15-min cadence in part of nighttime. (daytime fixed range 120W to 20E, 70S to 70N; nighttim range moving from east to west 80W to 20E, 70S to 70N)

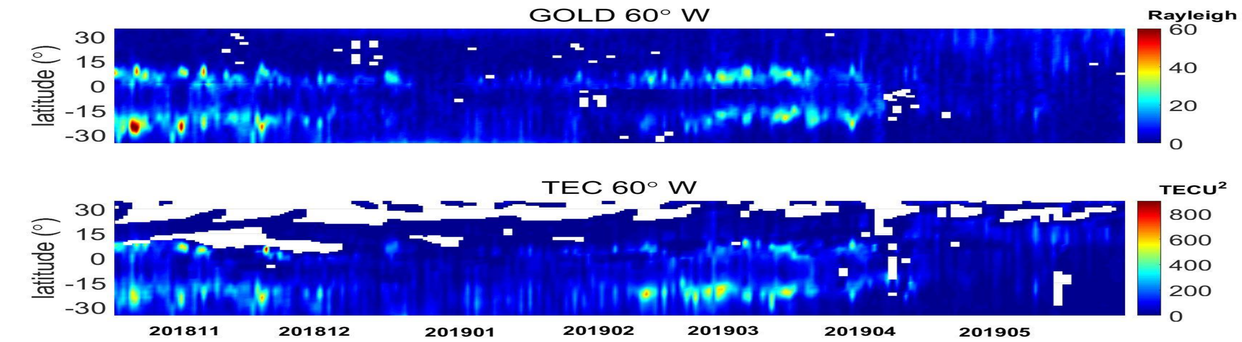


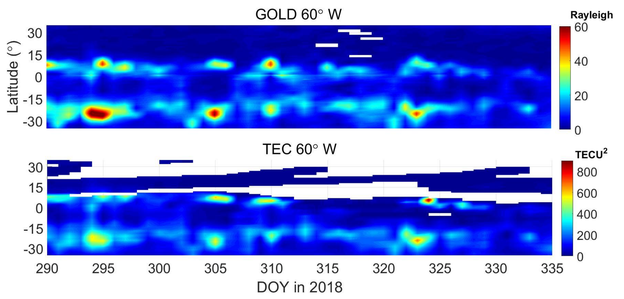



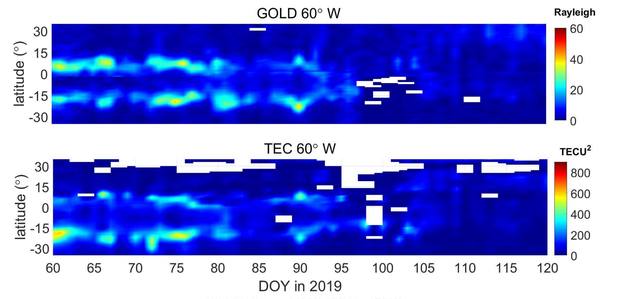



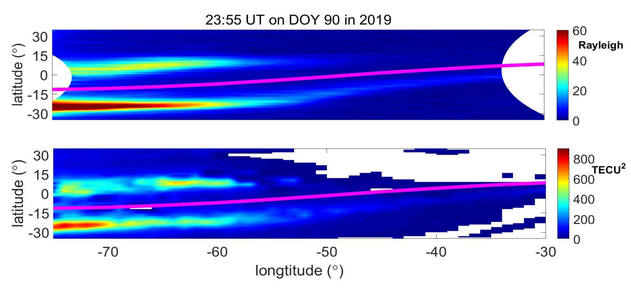

## 3 Comparison of morphology between GOLD and TEC

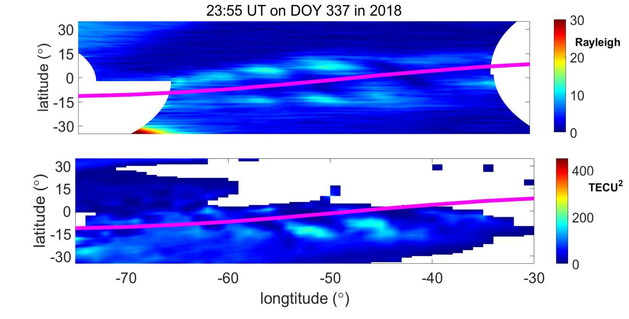


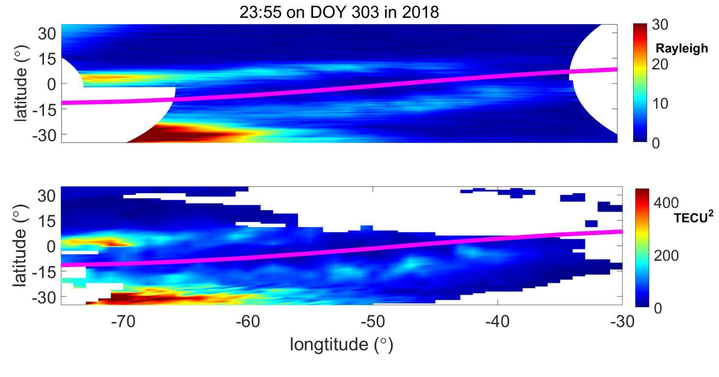




## New findings




Third peak south of southern crest of EIA, mainly observed in Oct

## 4 Conclusion

1 TEC and GOLD maps match well in morphology in the equatorial ionosphere

2 Combinations of TEC and GOLD maps are a promising tool to study the equatorial nighttime ionosphere

3 GOLD has great advantages over TEC in studying equatorial plasma bubbles (EPBs)

4 A third peak of EIA in southern hemisphere suggests an uncovered complexity of EIA

**Reference**

Eastes, R. W., McClintock, W. E., Burns, A. G., Anderson, D. N., Andersson, L., Codrescu, M., et al. (2017). The Global-scale Observations of the Limb and Disk (GOLD) mission. *Space Science Reviews*, *212*(1-2), 383–408. https://doi.org/10.1007/s11214-017-0392-2