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Title:

The Thermosphere-Ionosphere System: Contributions by the Global-scale Observations of The Limb and Disk (GOLD) Mission

Abstract:

Global-scale, synoptic imaging of daytime, thermospheric composition and temperatures and of nighttime equatorial ionization anomaly densities is dramatically enhancing the understanding of thermosphere-ionosphere (T-I) responses to forcing from below and above. NASA's GOLD mission, imaging the Earth from geostationary orbit at 47.5° W longitude, provides simultaneous imaging of the composition and temperature near 160 km for locations on the dayside (06:10 to 23:10 UT; 03:00-20:00 LT at the satellite), as well as the nighttime equatorial ionization anomaly (EIA) over the Atlantic and South America every evening. Observations during geomagnetic storms and solar eclipses have provided unanticipated results, as have observations of the nighttime EIA and O₂ density profiles. Examples include greater than expected thermospheric responses to minor geomagnetic activity and to solar eclipses during daytime observations; and multiple examples of the nighttime EIA being influenced by atmospheric waves. GOLD images also show a dramatic response to the January 15, 2022 volcanic eruption in Tonga and tantalizing thermospheric changes during the solar eclipse over Antarctica in December 2021, events that are observed by other satellite missions (e.g., ICON and COSMIC-2) and by ground-based instruments. These observations provide tests of our current understanding of both the Thermosphere-Ionosphere system and how it interacts with other regions of the geospace system. The quantitative changes observed in many of these cases are significantly greater than is predicted in model calculations. GOLD and other recent additions to our observing capabilities provide an unprecedented opportunity to advance both our understanding of the T-I system and capabilities to forecast space weather conditions.