

## **TIP observations of the low latitude ionosphere**

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The Tiny Ionospheric Photometer (TIP) on FORMOSAT-3/COSMIC is used to characterize the nighttime ionosphere. TIP is a compact, nadir directed, narrow-band, ultraviolet photometer operating at the 135.6 nm wavelength. This emission is produced by recombination of oxygen ions and electrons, which is the natural decay process for the ionosphere. At night, the strength of the emission is proportional to the square of the peak electron density. TIP measures the horizontal structure of the ionosphere with 15-30 km resolution and high sensitivity, providing remarkable detail even during solar minimum conditions.

TIP observes horizontal gradients due to the equatorial ionospheric anomaly and low latitude irregularity structures responsible for scintillation. Ground-based observations are used to validate TIP observations. Daily variability of ionospheric conditions as observed by TIP is used to investigate irregularity development and scintillation.

Multiple TIP sensors are used to map the global pattern of the post-sunset equatorial anomaly for individual days. While the 4-cell pattern persists from day to day, variability in the magnitude of individual cells are observed and appear to occur on hemispheric scales, suggesting a large scale day-to-day variability in the global neutral wind pattern.

Early in the mission multiple spacecraft were in the same orbit, providing a higher density of radio occultation data near the local time of that orbit – a condition analogous to proposed COSMIC-2 constellations. These high density radio occultation data are ingested into a global assimilative model and validated using TIP data. Comparison with TIP data reveals the horizontal performance of these models and demonstrates the improvement obtained from ingesting the high density radio occultation data.