Radio occultation electron density retrieval aided by ground-based GNSS observations and a global ionospheric data assimilation model

Xinan Yue, William S. Schreiner, Ying-Hwa Kuo

COSMIC Program Office, University Corporation for Atmospheric Research, Boulder, CO

xinanyue@ucar.edu

Radio Occultation (RO) has been proved a powerful technique on profiling ionospheric electron density profile (EDP). The currently used Abel inversion in RO EDP retrieval has degraded performance in regions with large horizontal gradients because of an assumption of spherical symmetry as indicated by many studies. Since the number of RO observations will likely increase rapidly in the near future, it is worthwhile continuing retrieval method improvements.

In this study, both the global ionospheric map (GIM) aided Abel inversion and global data assimilation retrieval methods are systematically evaluated. It is found that the GIM aided Abel inversion can significantly improve upon the standard Abel inversion in either the F or the E region if an accurate GIM is available. It can correct large scale deviations, i.e. the plasma cave underneath the equatorial ionization anomaly (EIA) crests, in the Abel inversion. However, the current IGS GIM does not appear accurate enough to improve retrieval results, because of the spherical symmetry assumption and sparse GNSS stations used in its creation. Global data assimilation retrieval can also significantly improve upon the Abel inversion and offers an optimal EDP retrieval approach if sufficient RO and ground GNSS observations are available.