Investigation of the Impact of New Data Sources on IDA4D Analyzed Electron Densities

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New data assimilative methods combining ground and spaced-based ionospheric data are used to investigate the dynamics of the mid and low-latitude ionosphere. Data sources that are both linearly and non-linearly related to electron density can for the first time be ingested into the four-dimensional (4D) ionospheric imaging algorithm "Ionospheric Data Assimilation Four Dimensional" (IDA4D). This innovative step to use nonlinear data sources allows previously unused ionospheric data to be included in a data assimilation process that now takes in 9 types of measurements to produce highly accurate ionospheric maps on a global scale.

IDA is an ionospheric data assimilation algorithm that ingests a wide variety of data sources and produces space-time maps of electron density and estimated error. IDA has been in development for over 15 years, and is a mature, well validated algorithm that has been used for a number of scientific investigations.

Several new data sources have been added to IDA. The addition of the non-linear methodology has allowed the ingestion of non-linear data sources. These include time delay versus frequency obtained from ionosondes, and EUV data from the GUVI sensor on the TIMED satellite and the TIP sensor on COSMIC. In addition, the other data sources on COSMIC including occultations and Tri-band beacon data are routinely ingested by IDA3D. Finally, new linear data sources that are now ingested by IDA3D include data from the DORIS array and CITRUS receiver.

The effect of the new data sources upon the IDA3D analyzed electron density is investigated, and the importance of the various data sources discussed. The impact of ingestion of AMIE transport velocities upon the high latitude IDA plasma distribution