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ON THE ASSIMILATION OF COLLOCATED AND CONCURRENT DATA FROM IONOSONDES AND GPS RECEIVERS

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Summary: Results pertaining to the response of the low latitude ionosphere to a major geomagnetic storm that occurred on 24 August 2005 are presented. These results shows variation of GPS derived total electron content (TEC) due to geomagnetic storm effect, local low latitude electrodynamics response to penetration of high latitude convection electric field and effect of storm induced traveling atmospheric disturbances (TAD's) on GPS-TEC in low latitude zone. The dual frequency GPS data have been analyzed to retrieve vertical total electron content at two Indian low latitude stations (IGS stations) Hyderabad (geographic latitude 17º 20' N, longitude 78º 30' E) and Banglore (geographic latitude 12º 58' N, longitude 77º 33' E).

1 ABSTRACT

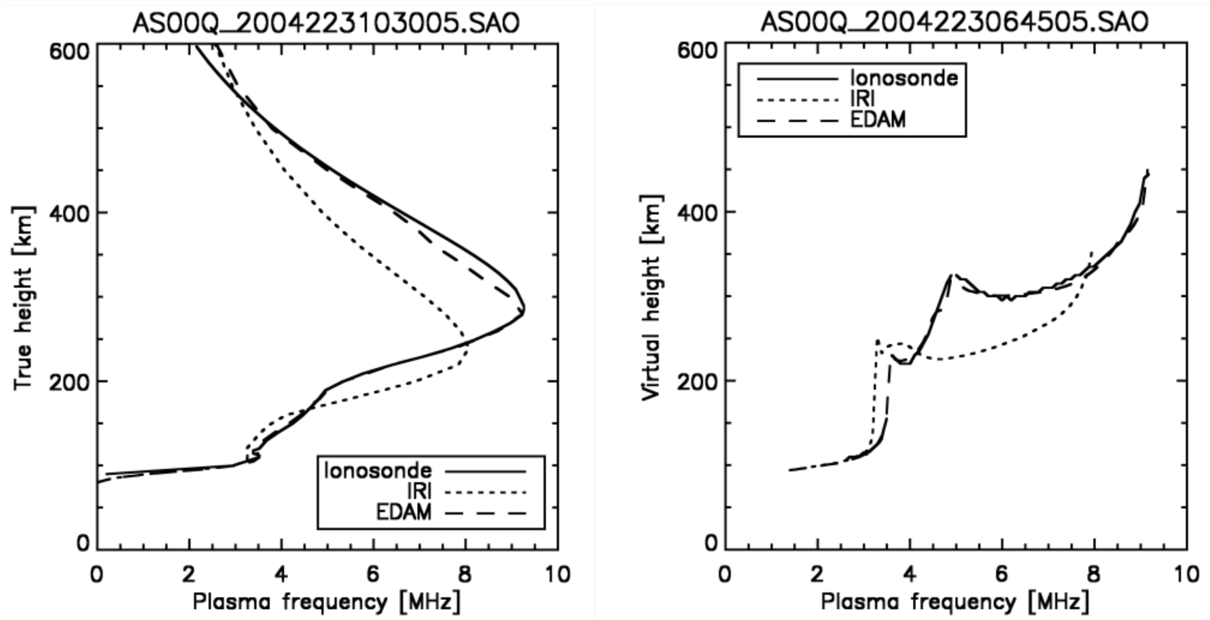
The Electron Density Assimilative Model (EDAM) has been developed as a means of assimilating disparate ionospheric measurements into a background model. EDAM exploits optimal data assimilation techniques that have been developed in the meteorological community over the past few decades. The philosophy has been to design a system that will operate on a single PC, that will continue to provide physical results with very sparse data and from which products can be derived for a range of RF systems. EDAM can assimilate a variety of different types of data:

- Ground-based slant TEC derived from GNSS data.
- Space-based TEC derived from GNSS data (both in a radio occultation geometry and using navigation antennas).
- Space-based TEC derived from dual frequency altimeters.
- Data from ionosondes and incoherent scatter radars.
- Electron density data from in-situ sensors.

Details of EDAM and of its testing can be found in *Angling and Khattatov* [2006] and *Angling et al*., [2009].

In the meteorological data assimilation community it is generally accepted that data should be assimilated in a form that requires the least amount of pre-processing. In keeping with this philosophy, new assimilation routines have been developed for EDAM that allow the assimilation of virtual height traces from ionograms. This avoids having to apply a true height inversion algorithm such as POLAN [*Titheridge*, 1998] or NHPC [*Reinisch et al.*, 2005]. Indeed, studies have shown systematic differences between these inversion techniques [*Sauli et al*., 2007]. The true height profile differences arise from differences in the underlying ionospheric models that are used to constrain the inversion in areas that are not sampled by the ionosondes (i.e. the E-F valley region). By assimilating the virtual height profile directly, the resultant true height profiles remain consistent with the EDAM model which may, of course, have been influenced by other data sources.

This paper will describe the virtual height assimilation technique used in EDAM. In particular, it will discuss the assimilation of collocated and concurrent ionosonde and GPS data. This can present difficulties, especially when the background model is biased low in TEC and high in foF2 or vice versa.



Example result of virtual height assimilation

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