Thermospheric Neutral Winds Obtained from COSMIC Radio Occultation Measurements

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Keywords *thermospheric dynamics, ionosphere, data assimilation*

Abstract

Knowledge of the thermospheric neutral wind and its meridional and zonal components is critical for an improved understanding of the low- and mid-latitude ionospheric F-region dynamics and morphology. To date, the reliable estimation of the wind and its components remains a challenge because of difficulties in both measurement and modeling. Previous methods that use ionospheric measurements to deduce winds provide their values only in the direction of the magnetic meridian. Using COSMIC radio occultation measuements, we will present the monthly climatology of the zonal and meridional components of thermospheric neutral wind at low and mid-latitudes obtained by a Kalman Filter technique. First, the climatology of the magnetic meridional wind is obtained by assimilating monthly maps of F-region ionosphere peak parameters (NmF2 and hmF2), obtained from COSMIC radio occultation data, into the Global Assimilation of Ionospheric Measurements Full Physics (GAIM-FP) model. The model provides the 3-D electron density throughout the ionosphere, together with the magnetic meridional wind. Next, the estimation of the global zonal and meridional wind components is performed using the Thermospheric Wind Assimilation Model (TWAM). TWAM combines magnetic meridional wind data obtained from GAIM-FP with a physics-based 3-D thermospheric neutral wind model using an implicit Kalman Filter technique. The ionospheric drag and ion diffusion velocities, needed for the wind calculation, are also taken from the GAIM-FP model. We present the monthly climatology of our wind estimation and compare individual horizontal wind components to their corresponding empirical model values and to measurements made by interferometers.