# Improved empirical model of thermospheric mass density by the CHAMP satellite

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Recently many scientists are investigating the interaction between the thermospheric wind and the electron density in the ionosphere. Immel et al. [2006] pointed out that the atmospheric tidal wind and the electron density in the ionosphere have a common dependence on geographical longitude, that is, they have a common wave number (k), which is four.

The CHAMP satellite measures the electron density, zonal wind, thermospheric mass density, and so on at about 410km altitude. The observation of the CHAMP confirmed that the thermospheric mass density on dayside and in the vicinity of the magnetic equator is anomalously small [Liu et al., 2005]. That mass density structure is called EMA(equatorial mass anomaly). Liu et al [2005] reported that the thermospheric MSIS(Mass Spectrometer Incoherent Scatter) model can not reproduce the EMA structure.

By applying the least-squares approximate polynomial method to the CHAMP observation data, we constructed an empirical model to reproduce the thermospheric total mass density at about 410km altitude; the geographical longitude, local time (LT) on the CHAMP orbit, and day of the year (1-365) are independent variables of our model. For example, the model can reproduce a mass density distribution in [longitude, latitude] at the spring equinox and on fixed local time sector, for example local time as a variable in the polynomial is fixed 13LT.

In the present paper, we improve the empirical model so that it can express the geographical longitudinal dependence up to k=6. (The old model could express up to only k=2.) It is found that the improved model has a k=4 dominant structure on a part of the year similar to that of Immel et al. [2006].