Thermospheric meridional winds and midnight temperature maximum

Takashi Maruyama[1]; Susumu Saito[1]; Kenro Nozaki[1]; hisao kato[1]; Mamoru Ishii[1]; Takuya Tsugawa[1]

[1] NICT

Multipoint ionosonde observation was conducted in Southeast Asia to study the ionosphere-thermosphere system. For this observation three ionosondes were installed along the magnetic meridian at 100deg.E (Southeast Asia Low-latitude Ionospheric Network: SEALION); two of them were at magnetic conjugate points at low latitudes and the third was near the magnetic equator. The F-layer virtual height, h'F, was scaled from nighttime ionograms obtained from September 2004 to August 2005. Height variations over the equatorial station were used to estimate the zonal electric field or vertical EXB drift velocity. In conjunction with the equatorial vertical EXB drift velocity, no-wind heights over the two low-latitude stations were calculated by solving ion continuity and momentum equations. Differences between the observed height and the modeled no-wind height were used to estimate the thermospheric winds in the magnetic meridional plane for transequatorial and convergent/divergent components (both with respect to the magnetic equator).

The nighttime wind variations broadly exhibited a seasonal pattern blowing from the summer hemisphere to the winter hemisphere and convergence on the equator. In addition to such a general tendency, higher order local time variations with a period of 6-8 hours were found. The amplitude of the higher order variations was significant in the northern winter months. Higher order variations of the meridional wind have been previously reported, and are attributed to the pressure bulge associated with the midnight temperature maximum (MTM). However, integrating the present and previously reported results, we did not find any evidence showing abatement of the equatorward wind associated with the pressure bulge caused by the MTM. On the other hand, a clear correlation was found between the convergent wind and the MTM, in which the peak of the convergent wind preceded the peak of the MTM observed by the AE-E satellite by a half hour or so. The adiabatic compression heating scenario of the thermospheric temperature and the absence of the wind abatement are consistent with the simulations by Fesen [JGR, 1996] and Corelico et al. [JASTP, 2002] using the NCAR thermosphere-ionosphere-electrodynamic general circulation model (TIEGCM). Those authors also suggest that higher order terms of wind variation are required to obtain a sufficiently large amplitude of the MTM as observed and wind abatement. We have observed higher order variations of the thermospheric wind. However, the origin of such variations and the separation of the cause and the effect remain an unresolved issue. Future works may clarify whether higher order variations of neutral winds are a requirement for the generation of the MTM or those are a consequence of the pressure bulge associated with the MTM, in other words, whether the higher order variations propagate from the lower atmosphere or nonlinearly generated in the thermosphere.