

## Comparison of the lower thermospheric neutral winds derived with the EISCAT radar and predicted by NCAR TIME-GCM

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A comparison study of the lower thermospheric neutral wind has been conducted using the EISCAT radar observations and TIME-GCM predictions. The daily mean wind as well as diurnal and semidiurnal tidal winds are compared for the three seasons summer, equinox and winter between 95 and 119 km. Fairly good agreement is found in the altitude profile of the mean zonal wind between the EISCAT observation and the TIME-GCM prediction for summer, while the meridional mean wind is not. Generally good agreement is found for the amplitude of the diurnal tide, while disagreements between the model and observational results are found for the corresponding phases. The semidiurnal amplitude predicted by the TIME-GCM is much smaller than that observed by EISCAT.

A comparison study of the lower thermospheric neutral wind has been conducted using the European Incoherent Scatter (EISCAT) radar observations and Thermosphere-Ionosphere-Mesosphere-Electrodynamics General Circulation Model (TIME-GCM) predictions. The aim of this study is to clarify how realistically the wind field can be predicted by the TIME-GCM for the lower thermosphere at high latitudes, where little number of comparison of winds has been conducted between TIME-GCM predictions and observations.

The TIME-GCM [Roble and Ridley, GRL, 21, 417-420, 1994] covers a wide height region of the earth's atmosphere from the stratosphere to the thermosphere, and thus it is one of the best modeling tools for examining the lower thermospheric wind dynamics. It has been widely realized that gravity wave breaking plays an important role in determining the general circulation in the mesosphere/lower thermosphere [e.g., Fritts, Pure Appl. Geophys., 130, 343-371, 1989]. In the TIME-GCM model, parameterization of the gravity wave forcing is based on the linear saturation theory [Lindzen, JGR, 86, 9707-9714, 1981]. Parameters of the gravity wave forcing scheme [Boville, JGR, 100, 9017-9039, 1995] are adjusted so that the tide and zonal mean zonal wind give the best fit to the UARS data [McLandress et al., JGR, 101, 4093-4114, 1996].

The TIME-GCM is a self-consistent time-dependent three-dimensional model of the earth's atmosphere from 30 to 500 km. The TIME-GCM has been run through a year in model time under geomagnetically quiet conditions (polar cap potential drop 45 kV and hemispheric power 16 GW) and moderate solar activity (F10.7 index = 150). This geomagnetic activity level roughly corresponds to a Kp index < 3, and the amplitude of the electric field is less than 5 mV/m for a latitude of 67.5 deg N and longitude 20 deg E. Diurnal and semidiurnal tides at the lower boundary are specified from the global scale wave model [see e.g., Hagan et al., JGR, 104, 6813-6828, 1999], while no planetary waves are specified at the lower boundary. In addition, the TIME-GCM self-consistently calculates tidal generation above 30 km due to solar heating.

Fifty-six days of EISCAT wind data obtained over 10 years occurring from 1987 to 1996 were used for comparison. The daily mean wind as well as diurnal and semidiurnal tidal winds obtained by the EISCAT radar and predicted by the TIME-GCM are compared for three seasons summer, equinox and winter between 95 and 119 km. Fairly good agreement is found in the altitude profile of the mean zonal wind between the EISCAT observation and the TIME-GCM prediction for summer, indicating the parameterization of gravity waves employed in the TIME-GCM is adequate for this feature. The meridional mean wind amplitude predicted by the TIME-GCM is considerably smaller than that observed by EISCAT and the predicted wind is slightly northward for all the seasons above 100 km. Generally good agreement is found for the amplitude of the diurnal tide, especially the summer prediction, while disagreements between the model and observational results are found for the corresponding phases. The semidiurnal amplitude predicted by the TIME-GCM is much smaller than that observed by EISCAT, and relatively large differences of the semidiurnal phase between the observations and predictions are found for all seasons.

These comparison results suggest that further advancements in the gravity wave parameterization as well as the addition of planetary wave effects are needed to predict more realistic lower thermospheric winds at high latitude. In addition to the year run, we made additional perpetual runs for solstice and equinox conditions and we obtained results in better agreement with the observed mean wind and tides when we reduced the GW activity (by half) and increased the semi-diurnal ((2,4) mode) tidal amplitudes.