



FPI observations of nighttime mesospheric and thermospheric winds in China and their comparisons with HWM07

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We analyzed the nighttime horizontal neutral winds in the middle atmosphere (~ 87 and ~ 98 km) and thermosphere (~ 250 km) derived from a Fabry–Perot interferometer (FPI), which was installed at Xinglong station (40.2° N, 117.4° E) in central China. The wind data covered the period from April 2010 to July 2012. We studied the annual, semiannual and terannual variations of the midnight winds at ~ 87 km, ~ 98 km and ~ 250 km for the first time and compared them with Horizontal Wind Model 2007 (HWM07). Our results show the following: (1) at ~ 87 km, both the observed and model zonal winds have similar phases in the annual and semiannual variations. However, the HWM07 amplitudes are much larger. (2) At ~ 98 km, the model shows strong eastward wind in the summer solstice, resulting in a large annual variation, while the observed strongest component is semiannual. The observation and model midnight meridional winds agree well. Both are equatorward throughout the year and have small amplitudes in the annual and semiannual variations. (3) There are large discrepancies between the observed and HWM07 winds at ~ 250 km. This discrepancy is largely due to the strong semiannual zonal wind in the model and the phase difference in the annual variation of the meridional wind. The FPI annual variation coincides with the results from Arecibo, which has similar geomagnetic latitude as Xinglong station. In General, the consistency of FPI winds with model winds is better at ~ 87 and ~ 98 km than that at ~ 250 km. We also studied the seasonally and monthly averaged nighttime winds. The most salient features include the following: (1) the seasonally averaged zonal winds at ~ 87 and ~ 98 km typically have small variations throughout the night. (2) The model zonal and meridional nighttime wind variations are typically much larger than those of observations at ~ 87 km and ~ 98 km. (3) At ~ 250 km, model zonal wind compares well with the observation in the winter. For spring and autumn, the model wind is more eastward before $\sim 03:00$ LT but more westward after. The observed nighttime zonal and meridional winds on average are close to zero in the summer and autumn, which indicates a lack of strong stable tides. The consistency of FPI zonal wind with model wind at ~ 250 km is better than the meridional wind.