

Mid-latitude horizontal wind structure from 0-100 km based on Beijing MST radar, radiosonde, meteor radar, TIMED/TIDI observations and ERA-Interim reanalysis and HWM07

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A 50 MHz Beijing MST radar has been operating at Xianghe station (39°45'14.40"N, 116°59'24.00"E) since July 2011, measuring winds, turbulence et al. in the height range of 3-25 km and 65-100 km and even above. In the present paper monthly mean winds from 0 to 100 km are derived and presented using 3 years of data (2012-2014) from MST radar along with corresponding nearby radiosonde, meteor radar, TIMED Doppler interferometer (TIDI) observations, ERA-Interim reanalysis and horizontal wind model HWM07.

The monthly mean zonal winds show westerly winds below 20 km with a maximum at about 15 km. There are east winds in the height range of 20-80 km during May to August. West winds are dominated in 80-100 km for all months. The monthly mean meridional winds show northerly winds below 20 km. From May to September, in the height range of 60-80 km are mainly south winds, while northerly winds predominate in 80-100 km.

The monthly mean winds obtained by the variety of techniques were also compared. The measurements of MST radar showed excellent consistency with both radiosonde observations and ERA-Interim reanalysis below 25 km. The HWM07 model results showed the same trend but larger wind speeds compared with the above mentioned methods in some months below 25 km. In the height range of 25-40 km, the HWM07 model results generally agreed with radiosonde observations and ERA-Interim reanalysis from April to November.

However, in the height range of 60-100 km, the HWM07 model results showed larger discrepancy with MST radar, meteor radar and TIDI observations mainly in amplitudes. During May to August the monthly mean zonal winds measured by meteor radar were larger than that by MST radar and TIDI observations, and the results obtained by these three techniques agreed well in other months at the height range from 80 to 100 km. The monthly mean zonal winds obtained by MST radar and TIDI showed good consistency. As for the monthly mean meridional winds, in the height range of 80-100 km the MST radar observations generally agreed with meteor radar results but showed discrepancy with TIDI results.

By combining with the variety of techniques, the distribution of mid-latitude horizontal winds from 0 to 100 km were obtained and this will play a significant role in fully understanding of the dynamic characteristics, processes and their interactions within and among layers. Our preliminary study showed that both the consistency and discrepancy of various techniques measuring the middle atmosphere winds need to do further investigation.