

Diurnal wind variations in the upper troposphere and lower stratosphere observed with the MU radar and global reanalysis data

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Diurnal variations result from several phenomena with different spatial scales, such as local land-sea circulations and atmospheric tides. Winds in the troposphere and stratosphere are influenced by these phenomena, and it is intriguing what phenomena causes diurnal variations in each height range. We investigated diurnal wind variations, using data from the MU radar at Shirasaki (136 °E, 35 °N), and the global reanalysis data. The diurnal and semidiurnal components are extracted and analyzed.

In this presentation, we focus on the results in the region from the upper troposphere (UT) to the lower stratosphere (LS). For both components, the influence of local circulations is small in the UT/LS region. The diurnal component in the LS region shows a clear seasonal variation, with its amplitude maximizing in summer. The phase is almost reversed between summer and winter. Using the reanalysis data, it is found that the diurnal component in this region is caused by atmospheric tides and that the seasonal variation is interpreted by that of the diurnal tide. In the UT region, the diurnal component shows a seasonal variation similar to the one in the LS region except in spring. In spring, the amplitude reaches about 1.0 m s^{-1} around 10 km, which is much greater than that in other seasons and altitude regions and is not consistent with previous observational and theoretical studies on tides. The tropopause-level diurnal disturbances are probably associated with medium-scale tropopausal waves (Sato et al., 1993), whose periodicity is reported as 23-29 hours and which are active in this season in the midlatitude northern Pacific. As was suggested by Kodama et al. (2008), medium-scale tropopausal waves may have local time dependency due to the forcing over Tibet. On the other hand, the semidiurnal component is found to be associated with the migrating semidiurnal tide.