

WAVE DYNAMICS IN THE STRATOSPHERE REVEALED BY USING GPS RADIO OCCULTATION (RO) DATA

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GPS radio occultation (RO) measurement from a low-Earth orbit (LEO) satellite provides accurate temperature and humidity profiles below about 40 km and 10 km, respectively, with a very good height resolution (200m- 1km). Such profiles are superior to other conventional limb and nadir satellite measurements. The GPS RO data is very useful not only for improvement of both global and meso-scale NWP models through data assimilation but also for the studies of the wave dynamics in the stratosphere. After about 15 years from the first GPS/MET experiment in 1995, a number of follow-on GPS RO missions were carried out, such as CHAMP, SAC-C, GRACE and so on. Among those, COSMIC has been successfully providing a large amount (2,000-2,500/day) of high-quality profiles. Using the GPS RO data obtained with GPS/MET we studied a global morphology of atmospheric gravity wave activity, and found a good correlation between the wave energy (temperature variance) and tropical convection (Tsuda et al., 2000). With the CHAMP data during 2001-2006, climatological characteristics of the atmospheric wave energy in the tropics was studied (e.g., Ratnam et al., 2004; Tsuda et al., 2008). We also studied stratospheric dynamics in the polar region, and discussed wave generation due to geostrophic adjustment of the polar vortex and orographic effects (Hei et al., 2007). Results from the Antarctic stratospheric polar night jet showed that large wave energy is associated with strong mean wind speeds, rotating around the continent. The seasonal variation of the gravity wave activity during the spring-time vortex breakdown is related to the Eliassen-Palm flux divergence. We also employ the GPS RO data with COSMIC from September 2006 onwards to study the vivid behavior of atmospheric waves. The gravity wave generation in the tropics is coupled with deep convective activity. Interactions and filtering by the background QBO winds are clearly apparent (Alexander et al., 2008). Equatorially trapped Kelvin waves, Mixed Rossby gravity waves and equatorial Rossby waves with zonal wave numbers < 9 are obtained by band-pass filtering wave number-frequency spectra. Their temporal, spatial, hemispheric and vertical structure, propagation and wave-mean flow interaction is examined with respect to the background tropospheric and stratospheric winds (Alexander et al., 2008; Kawatani et al., 2008). In the northern hemisphere winter months, most of the gravity wave energy is related to the subtropical jet. The numerical model study confirms that the potential energy observed by COSMIC is due to waves propagating upward from the jet core, mainly with ground based phase speeds of less than 10m/s.