SEASONAL AND HEIGHT VARIATIONS OF GRAVITY WAVE ACTIVITIES IN THE MIDDLE ATMOSPHERE (15-70 KM) OVER SYOWA STATION (69S, 40E) IN THE ANTARCTIC USING RAYLEIGH/RAMAN LIDAR

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Gravity waves generated in the lower atmosphere, or near the surface, propagate upward and transfer significant momentum and energy into the middle atmosphere/lower thermosphere. Recently it is known gravity waves are extensively generated in the high latitudes in the southern hemisphere, but not many have been reported on the generation, propagation and dissipation of such waves.
In this study, we investigated gravity wave profiles in the high latitude southern hemisphere by potential energy (Ep) in the height range of 15-70 km from May 2011 to October 2013 by using Rayleigh/Raman lidar located at Syowa station (69S, 40E), in the Antarctic. We used 1908 h observation time in total for this analysis. Above 35km altitude, Ep was maximized during winter. The seasonal dependence of Ep over Syowa was similar to those observed at Davis (69S,79E) [Alexander et al., 2011]. Below 35 km altitude, Ep was enhanced in around May, and did not decrease in September. Almost all monthly mean profiles showed similar and constant growth rate (corresponding scale height of about 12-14 km) above 30 km altitude. Furthermore, almost all Ep profiles have a local minimum around 25 km altitude and a local maximum around 20 km altitude. Observational effect introduced the vertical variation due to Doppler shift. The profile of Ep in October 2012 was quite different from those in the other months. The profile had a local minimum around 40 km altitude. Comparisons with zonal wind in the NASA/MERRA reanalysis data suggests that a height region of weak zonal winds descended earlier in 2012 than in the other years. This also suggests gravity waves below stratosphere include waves with slow phase speed.

Key words: gravity wave, middle atmosphere, lidar