Study of vertical / seasonal variation of gravity wave in the height range of 15-70km over Syowa Station in Antarctica using Rayleigh/Raman lidar

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The gravity waves are generated in the lower atmosphere, propagate upward and transfer momentum and energy to the middle atmosphere. It has been found that the gravity waves induce large scale meridional circulation and drive the middle atmosphere away from radiative equilibrium [Lindzen, 1981; Holton, 1982; Matsuno, 1982]. However, we have not completely known the quantification of gravity wave roles in the middle atmospheric circulation. A Rayleigh/Raman(RR) lidar was installed in January 2011 at Syowa Station, Antarctica (69°S,40°E). The lidar has measured temperature profiles between 5 and 80 km for more than 350 nights (before the end of October in 2014).
In this study, we investigated monthly mean gravity wave potential energy (*Ep*) in the height range of 15-70 km from May 2011 to October 2013. Above 35km altitude, *Ep* was maximized during winter. The seasonal dependence of *Ep* over Syowa was similar to *Ep* observed at Davis(69°S,79°E) [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 have constant slope above 30 km altitude. *Ep* increases exponentially with height (increasing rate is approximately exp(z/H); H~7 km is scale height). Furthermore, almost all *Ep* profiles have a local minimum around 25 km altitude and a local maximum around 20 km altitude. In October 2012, *Ep* is significantly different from the other *Ep* profiles. As a result of comparison between the *Ep* profiles and zonal wind in the NASA MERRA reanalysis data, the reason was probably that weak zonal wind layer in 2012 descends earlier than the other years.

Keywords: gravity wave, middle atmosphere, lidar

