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Gravity waves in the upper stratosphere - lower mesosphere observed by Rayleigh lidar at Syowa(2)

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The deposition of energy and momentum in the upper stratosphere and lower mesosphere (USLM) by gravity waves propagating upward from lower atmospheric sources strongly decelerates the polar night jet. The transfer of momentum into the background atmosphere induces large scale meridional circulation from the summer pole towards the winter pole. The existence of a stratopause over the winter pole is itself indicative of strong gravity wave dynamical forcing. A Rayleigh lidar was installed at Syowa, Antarctica (69S, 39E) in January, 2011. It has been operational since February and has measured temperature profiles between approximately 25 and 70 km for 115 nights in 2011. In this study, gravity wave activity in the USLM is investigated using the temperature data. The temporal and height variabilities of potential energy per unit mass of gravity waves with vertical wavelengths between 4 km and 20 km are analyzed. Gravity waves dissipate above 40-45 km during winter, while there is no dissipation in March-April and August in the USLM. As a result, the seasonal cycle of gravity wave activity shows single peak observed during winter in the upper stratosphere and double peaks observed in March-April and August in the lower mesosphere.

Keywords: middle atmosphere, atmospheric gravity wave, Antarctica, Reyleigh lidar, temperature