Observational evaluation of temperature/wind perturbations associated with small-scale AGWs : Parameterisation and validation of wave structures

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The Tromsoe Na lidar operated by the Institute for Space-Earth Environmental Research, Nagoya University has monitored wind and temperature structures associated with auroral activity in the high latitude upper atmosphere since 2010. Although the observations are limited during the winter night, the lidar detected atmospheric wave signatures with period of a few hours and temperature change related to the wave propagation with high precision (less than 1K). Furthermore, this lidar started five-direction observation from 2012: horizontal distance between the beam positions are 58 km or 22 km at a height of 100 km and the observational setup can detect smaller-scale perturbations.

In this study, we tried to identify small-scale (less than 100 km) and short-period (less than 1 h) gravity waves by using the Tromsoe Na lidar. Gravity waves contribute significantly to the wind field and thermal balance in the mesosphere and lower thermosphere (MLT) region because they vertically transport horizontal momentum from the lower atmosphere. It is also pointed that, in particular, smaller-scale and shorter-period waves tend to transport larger momentum. Small-scale gravity waves in the MLT region are mainly studied with airglow imaging measurements. The airglow measurements, however, cannot observe temperature and wind perturbations directly, which are necessary for the estimation of wave’s momentum flux. Based on temperature and wind perturbations with the five-direction lidar, we evaluate dynamical effect of small-scale gravity waves propagating in the upper atmosphere quantitatively.

In this presentation, we will report some initial results derived from simultaneous measurements of the lidar and airglow imaging in 2013-2016.

Keywords: atmospheric gravity waves, lidar observation

