

# **New applications of horizontal phase velocity spectrum derived from airglow imaging observation at Syowa**

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Gravity waves, generated in the lower atmosphere, can propagate to the mesosphere and the lower thermosphere, and transport great amount of energy and momentum, and release them at various altitude regions. Among many parameters to characterize gravity waves, horizontal phase velocity is very important to discuss vertical propagation and where the momentum is released. Near the mesopause region, OH and other airglow imaging has been used for investigating the horizontal structures of gravity waves for more than two decades.

Matsuda et al., 2014 developed new statistical analysis method for deriving horizontal phase velocity spectrum of gravity waves derived from airglow imaging data. It is suitable to not only deal with a large amount of data, but also reveal a temporal variation of phase velocity spectrum. In this study, we obtained 9 horizontal phase velocity spectra every an hour at 1501-0000 on May 11 2013 at Syowa (69S, 40E) with a horizontal wavelength of 5-100km and a period of 8-60min. We compared these spectra with background wind using re-analysis data (MERRA) and MF radar data, and found that effect of wind filtering by critical level could not by itself explain the temporal variation. Previous airglow imaging observations have mainly reported small-scale (<100 km) and short-period (<60 min) gravity waves [e.g. Matsuda et al., 2014] while larger-scale gravity waves are investigated by model study and satellite measurements. In this study, we applied phase velocity spectrum to gravity waves with larger horizontal wavelength and longer periods. We derived horizontal phase velocity spectra of gravity waves observed at Syowa with horizontal wavelengths of 100-200 km and periods of 60-120 min. As a result, directionality of the larger-scale (100-200 km, 60-120 min) gravity waves clearly showed different directionality from small-scale gravity waves. This result suggests that horizontal phase velocity spectrum is useful for comparison between airglow imaging observation and model result.

Key words: gravity waves, airglow imaging, spectral analysis