

## **New applications of horizontal phase velocity spectrum derived from airglow imager 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 quite 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 horizontal structures of gravity waves for more than two decades. Although the huge amount of the image data has been obtained at various observation sites all over the world, a time consuming manual procedure has been used for extracting horizontal propagation characteristics from airglow data. This causes difficulty in obtaining a global map of gravity wave characteristics in the mesopause region. Another important fact on the mesospheric gravity wave studies is that observations over the Antarctic region were quite rare despite a significant amount of gravity waves generated in this region.

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 critical level filtering by background winds 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]. However, such a gravity waves cannot be reproduced in numerical simulation. 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 was clearly different from small-scale gravity waves. This result suggests that horizontal phase velocity spectrum is useful for comparison between airglow imaging observation and numerical simulation.