

Development and application of a new statistical analysis for deriving horizontal phase velocity distribution of gravity waves from airglow imaging at Syowa Station (69S, 39E), Antarctica

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Atmospheric gravity waves (AGWs), which are generated in the lower atmosphere, transport significant amount of energy and momentum into the mesosphere and lower thermosphere and cause the mean wind accelerations in the mesosphere. This momentum deposit drives the general circulation and affects the temperature structure. Airglow imaging is a useful technique for investigating the horizontal structures of AGWs in mesosphere and Lower thermosphere. Recently, there are many reports about statistical characteristics of AGWs observed by airglow imaging. However, it is difficult to compare these results obtained at various locations because each research group uses own method for extracting of AGW events. A statistical analysis method, which can be applied evenly without a bias induced by each analyzer, is desirable to deal with significant amount of imaging data obtained for a long time at various observation sites.

We have developed a new spectral analysis to obtain power spectra of airglow intensity variation caused by short-period small-scale AGWs, in horizontal phase velocity domain from a series of airglow images. We applied this spectral analysis to the data obtained at Syowa Station (69S, 39E), Antarctica in 2011 and obtained 30 horizontal phase velocity spectra. These data were also analyzed by detecting and identifying gravity wave events with naked eyes. 80 events were picked up from the airglow images by such an event analysis and horizontal phase velocity of each event was determined. 30 events of them included in the data-windows of the spectral analysis were compared with the horizontal phase velocity spectra. We compared the horizontal phase velocity spectra derived by the spectral analysis and the distribution of horizontal phase velocity determined by the event analysis. Averaged horizontal phase velocity spectrum of all data-windows in 2011 was also compared with the distribution of horizontal phase velocity in 2011. These results showed that the power spectrum of horizontal phase velocity corresponded well to the horizontal phase velocity of the events derived from the event analysis. The new spectral analysis introduced in this presentation could be applied to analysis for a longer time data set or comparison with data from other airglow imagers located in high, mid or low latitude and will contribute to the statistical analysis of the AGWs at mesosphere and lower thermosphere..