Gravity wave packets detected in radio occultation temperature profiles of the Venus atmosphere

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Temperature profiles has been obtained from 2016 by the radio occultation experiment in the Venus orbiter mission Akatsuki. The radio occultation experiment is a method that measures the change of the atmospheric refractive index as a change of the frequency of the signal received on the ground. At the opportunity when the radio wave transmitted from Akatsuki toward the Earth pass through the planetary atmosphere, the wave is refracted and then reaches the receiving station. We can retrieve the vertical profiles of the pressure and the temperature from each refractive index profiles. In the temperature profile obtained in this way, variations due to various atmospheric disturbances are observed. We focus on gravity waves which are thought to play an import role in driving the general atmosphere circulation.

Gravity waves are small-scale waves with the restoring force being the buoyancy in the atmosphere. Gravity waves play a role in carrying the momentum in the vertical direction. So, it results in acceleration or deceleration of the mean wind by passing momentum on the background atmosphere while dissipating. This process should affect the global structure of the high-speed zonal wind. However, since gravity waves have properties that the spatial scale is small and the wave period is relatively short, it is difficult to capture the spatial structure by observation. The latitudinal profile of the amplitude of short vertical-scale temperature disturbances, which are thought to be associated with gravity waves, has been investigated; however, the dominant wavelength and the typical vertical extent have not been studied.

In this study, we applied wavelet analysis to the temperature profiles and extracted spatially localized temperature disturbances. Though there have been studies that apply Fourier transform to the temperature data, Fourier transform assumes infinitely lasting waves and it is not suitable for extracting spatially localized wave packets. Wavelet analysis is an effective way of obtaining the periods and the amplitudes of waves in such finite intervals. In this presentation, we report the result of wavelet analysis applied to the temperature data obtained with high vertical resolution by radio holographic method. From the obtained results, we also report the relationship between the length and the packet length of gravity wave in the atmosphere.

Keywords: Akatsuki, Gravity wave in the atmosphere, The radio occultation experiment

