R007-06
Zoom meeting A ：11/1 AM2 (10:45-12:30)
11:15-11:30

Spacecraft radio scintillation observations of the solar wind acceleration region in different solar activity periods

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Radio occultation observation is one of the limited means to approach the solar wind acceleration region, whose physical properties are difficult to obtain by optical methods because of the thin, dark plasma. The coronal heating by magnetohydrodynamic waves and the wave-induced magnetic pressure are thought to play major roles in the acceleration. Radio occultation observations of the corona have revealed frequent occurrence of quasi-periodic fluctuations of the received frequency, which are thought to be caused by density fluctuations associated with acoustic waves (e.g., Efimov et al. 2012). The acceleration profile and the radial distribution of quasi-periodic density fluctuations were revealed by radio occultation observations in 2011 using radio waves transmitted from Akatsuki spacecraft and received at the ground station (Imamura et al. 2014; Miyamoto et al. 2014). The density fluctuations were attributed to acoustic waves and were considered to have been generated from the nonlinearity of Alfven waves that originate from the photosphere. They also quantitatively analyzed the radial dependence of the wave energy flux. However, since the observations in 2011 using Akatsuki covered the quiet sun region only, the characteristics in coronal hole regions is unclear. Moreover, the dependence on the 11-year solar activity cycle is also left to be studied.

In this research, we analyze data taken in Akatsuki's radio occultation observations carried out during the superior conjunction periods from 30 May 2016 to 15 June 2016 and from 29 December 2017 to 20 January 2018 as well as the observations in 2011. Solar offset distances of about 2 to 10 solar radii were probed intermittently 11 times in the former period and 10 times in the latter period. The frequency and the intensity time series of radio waves received at the ground station are analyzed. Radial velocities of the solar wind are estimated from intensity spectra, and wavelet analysis is applied to the frequency time series to detect quasi-periodic density fluctuations that are thought to be manifestations of acoustic waves.

From the data taken in 2016, we derived the radial dependences of the flow velocity, the spectral slope of the density fluctuation, the inner scale and the acoustic wave's amplitude. We found a striking difference in the solar wind velocity between the regions near coronal holes and other regions by comparing the derived velocities with those measured at far distances by IPS (Interplanetary Scintillation) observations. The inner scale, which is the scale of the dissipation of turbulence, was also found to be different between the coronal hole region and other regions. The difference in the plasma processes between fast and slow winds is being investigated.

We also study the dependence of the plasma processes on the solar activity by analyzing all the data taken from 2011 to 2018 and comparing the results.