# Measuring the velocity deviation between the movement of planetary-scale and mesoscale cloud features using UVI/AKATSUKI images

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Venus has a global cloud layer whose thickness exceeds 30 km, and the atmosphere rotates with the speed over 100 m/s from east to west. The scattering of solar radiance and absorption in clouds cause the strong dark and bright contrast in UV range. Since the orbit insertion in December 2015, the Japanese Venus orbiter AKATSUKI continues to monitor cloud features having various spatial scale size in 283 nm SO2 and 365 nm unknown absorption bands. Depending on the AKATSUKI's highly elliptical orbit with 10.8-day period, the spatial resolution ranges from ~50 km to ~5 km in the equatorial region, and UVI can capture ~100 km mesoscale cloud features over the entire visible dayside area. In contrast, the planetary-scale feature, which is often represented as Y-feature, is simultaneously observed when the orbiter is at the moderate distance from Venus and when the Sun-Venus-orbiter phase angle is smaller than 45 degree.

At the previous exploration of Venus Express, cloud top wind velocity was measured with the cloud tracking technique using the mesoscale cloud motion. This approach is widely used, and the long-term trend of wind velocity is being revealed. However, at the same time, observations of the propagation velocity and its variation of the planetary-scale feature are not well conducted because of the limitation of the observable area in the dayside. In this study, we use the ground-based telescope named Pirka and revealed the periodicity change of planetary-scale waves with a time scale of a couple of months. It is considered that the motion of the planetary-scale clouds is related to the atmospheric planetary-scale waves, and the contribution of the waves to the wind acceleration would be a key parameter to solve the generation mechanism of the mysterious super-rotation.

The purpose of this study is to clarify the motion of mesoscale and planetary-scale cloud features simultaneously using AKATSUKI UVI images. Each cloud feature can be represented as the wind and phase velocity of the planetary-scale waves, respectively. For the initial study, we used the time-consecutive and well spatially resolved UVI images taken in the orbit #32. During this orbit (from Nov. 13 to 20, 2016), 7 consecutive images were obtained in a dayside with ~2 hr time-interval between the images and with the spatial resolution ranged from 35 km to 10 km. To investigate the typical spatial scale dividing the mesoscale and planetary-scale motion, the Gaussian-filters with sigma = 1-, 3-, 5- and 8-deg. were used to smooth geometrically mapped images, which were produced by projecting the original UVI images with 0.25 deg. resolution using the Akima interpolation. Then the mapped images were divided into 15 x 5 deg. (lon x lat) sub-images covering N50–S50. The amount of longitudinal shift between each pair of two time-consecutive bands was estimated by searching the 2D cross-correlation maximum. The final wind and phase velocity (or rotation period) for mesoscale features were determined with a small error about +/- 0.2-day period. In the case of planetary-scale features, they still were not well determined because of the unnatural correlation peak, and it was necessary to exclude the low contrast sub-images manually especially when the larger sigma at the Gaussian-filter and sub-images of higher latitudes were used. However, the visual inspection of the figures, which arrange sub-latitudinal images smoothed by the 3-deg. filter in the vertical direction (as shown in Figure 1), clearly showed the velocity deviation between the mesoscale and planetary-scale motion.

At the presentation, the methodology of our new analyses using UVI images and the results of the time variation of the velocity deviation with the time scale of a couple of months will be shown. The phase velocity of the planetary-scale features can also be compared with the results derived from our ground-based simultaneous observations using the Pirka telescope.

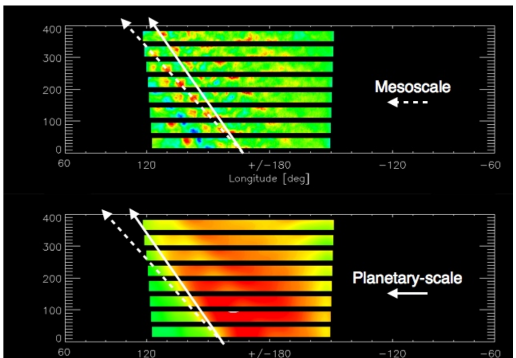


Figure 1