Relationship between cloud scale and motion on Venus

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Super rotation is the most mysterious phenomenon in research of Venusian atmosphere. In order to reveal the mechanism of the atmospheric super rotation, we must know detail motion of the atmosphere.

The wind velocity can be deduced by cloud tracking. Past ultraviolet and infrared imaging observations indicated that the wind velocity is about 100m/s at the altitude of 65km and about 80m/s at the altitude of 45km, respectively. Though such wind velocity analysis has been carried out, the relationship between the scale of cloud structure and the apparent velocity of cloud motion has not been examined.Ground based near infrared observation by Crisp et al(1990) reported that the rotation period of large scale cloud (greater than 2000 km) is 5.5 days and that of small scale cloud (400 to 1000 km) is 7.4 days. This fact suggest that the motions of different scale cloud structures could provide the atmospheric information of difference altitude. That is why we actually investigate the relationship between the different scale motions in detail.

We used the images taken at 418 and 986 nm by Solid State Imaging camera (SSI) onboard Galileo spacecraft. First, we applied Fourier transform to the images and found that the scale of advection (200 - 1000 km) is the typical scale size of cloud. Second, we deduced the wind velocities by using the two hour separated images, which are consistent with previous studies. Third, we extracted a certain scale cloud structures by digital filter and estimated the velocity of the structures. For violet images, we found that the structure smaller than 500km drifted at about 110m/s and that larger than 500km at about 90m/s. As for the near infrared images, the velocity of the structure smaller than 500km was about 70m/s and that of the structure larger than 500km was about 85m/s. We discuss about the cause of the difference, using two different angle: altitude profile of zonal wind and taking into account the propagation of planetary-scale wave.