Long Term Variability of Super-Rotation Reproduced by Akatsuki Horizontal Wind Assimilation

*Yukiko Fujisawa[1], Norihiko Sugimoto[1], Nobumasa Komori[1], Shin-ya Murakami[2], Hiroki Ando[3], Masahiro Takagi[3], Takeshi Imamura[4], Takeshi Horinouchi[5], George HASHIMOTO[6], Masaki Ishiwatari[5], Takeshi Enomoto[7], Takemasa Miyoshi[8], Hiroki Kashimura[6], Yoshi-Yuki Hayashi[6]

1. Keio University, 2. Japan Aerospace Exploration Agency, 3. Kyoto Sangyo University, 4. The University of Tokyo, 5. Hokkaido University, 6. Kobe University, 7. Kyoto University, 8. RIKEN Center for Computational Science

In Fujisawa et al. (2022) [1], we previously produced an objective analysis of the Venusian atmosphere by assimilating horizontal winds derived from cloud tracking of the UVI camera onboard the Venus orbiter Akatsuki. To produce objective analysis, we used the Venus atmospheric data assimilation system ALEDAS-V (Sugimoto et al., 2017) [2], which is based on the Venus general circulation model AFES-Venus (Sugimoto et al., 2014) [3]. This dataset appropriately corrects both the phase bias of thermal tides and the super-rotation speed in AFES-Venus to be closer to those observed in the real Venusian atmosphere. The dataset was produced by assimilating observations from September to December 2018, a period that includes an intensive observation period of Akatsuki.

Akatsuki has accumulated observational data over a long period from 2015 to 2024, and it has been revealed that the super-rotation speed exhibits both faster and slower periods (Horinouchi et al., 2024) [4]. In this study, we selected five epochs during the Akatsuki observation period that exhibit characteristic super-rotation speeds and performed data assimilation for each epoch. The figure shows the super-rotation speed for each epoch, defined as the zonal-mean zonal wind at an altitude of 69 km. Compared with the free-run experiment without data assimilation (frf), the super-rotation speeds in each epoch with assimilated observations are significantly reduced, and we confirm that speeds close to the observations, including their meridional asymmetry, are successfully reproduced. In this presentation, we will show the relationship between the reproduced super-rotation speeds and the structure of the atmospheric circulation.

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[3] Sugimoto, N., et al. (2014) J. Geophys. Res. Planets 119, 1950–1968.
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