
 [EE] Evening Poster | P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS04]Results from Akatsuki and advances in Venus science

convener:Takehiko Satoh(Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency), Takeshi Horinouchi(Faculty of Environmental Earth Science, Hokkaido University), Masaru Yamamoto(九州大学応用力学研究所, 共同), Kevin McGouldrick(University of Colorado Boulder)

Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

More than two earth years in Venus orbit, Akatsuki has acquired a volume of high-quality data, unveiled many new phenomena and is allowing researchers to investigate the underlying mechanisms. As the data accumulate, numerical models and theories are being advanced as well. We are no doubt living in the new golden era of Venus studies. This session invites papers of the new scientific results with Akatsuki data and the latest results of theoretical and numerical works. We expect participants of this session share the latest research results through presentations and discussion.

[PPS04-P02]Development of radiative transfer scheme interactive to the cloud time-variation on Venus General Circulation Model

*Akiba Takehiko¹, Takeshi Kuroda^{1,2}, Kohei Ikeda³, Masaaki Takahashi³, Yasumasa Kasaba¹, Naoki Terada¹ (1.Tohoku University, 2.National Institute of Information and Communications Technology, 3.National Institute for Environmental Studies)

Keywords:Venus, GCM, Cloud

We have developed a Venus General Circulation Model (VGCM) that takes into account radiative processes, cloud processes (condensation/evaporation, advection and gravitational sedimentation) and chemical processes related to sulfuric acid clouds/vapor based on CCSR/NIES/FRCGC MIROC [Ikeda, 2011], which enables us to interpret observational results from Akatsuki. Our model has suggested that SO₂ is lifted upward into the upper cloud layer in the equatorial atmosphere and changes into sulfuric acid clouds followed by a poleward transport along a meridional circulation [Kuroda et al., to be submitted].

In this study, we have improved the radiative processes of the sulfuric acid clouds in the VGCM. Our previous model calculated the optical depth of the sulfuric acid clouds assuming a fixed mixing ratio profile based on VEX measurements in Haus and Arnold [2010]. Now, we calculate it from a mixing ratio obtained in the VGCM. This is the first VGCM that allows us to self-consistently model the radiative effect of the clouds and the cloud distribution. The simulation started from the equilibrium states of wind, pressure, and temperature fields with horizontally uniform cloud distributions taken from the observed vertical profiles in Haus and Arnold [2010]. After 300 terrestrial days, the atmospheric state converged to a steady cycle. We report the zonal wind field, absorption altitude of solar flux, and cloud patterns reproduced from this simulation.

The maximum zonal wind obtained is 110 m/s at middle latitudes and 70-75 km altitudes, which agrees with the observation from Pioneer Venus [Walterschied et al., 1986], successfully reproducing the superrotation. About 65 % of the incident solar flux is absorbed in the upper cloud layer, and then about 25 % in the lower cloud layer and atmosphere below the cloud layer. Consequently, 160 W/m² of the incident solar flux diminishes to 20 W/m² on the surface. This feature is in a good agreement with the observational result [Tomasko et al., 1980]. The apparent cloud top altitudes calculated with an optical thickness at 1.85-2.20 μm are ~67 km altitude at the equator, ~65 km at mid-latitudes, and ~61 km at the pole (zonal averaged values). Calculating the optical thickness of SO₂ above the cloud top from

the SO₂ mixing ratio, the “Y-feature” observed by UVI is reproduced around 65 km altitude. We will also discuss the zonal wind flux balances, vertical stability profile, and cloud mass flux balance quantitatively.