The study for designing the future Venus atmosphere observing mission of radio occultation measurement among small satellites using data assimilation

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In the Venus atmosphere, there is a unique phenomenon called “cold collar”, where the temperature at 60-80˚ latitude is lower than that of polar region at the altitude of about 65 km. So far, we developed the Venusian atmospheric GCM (AFES-Venus)[1] based on AFES (Atmospheric GCM For the Earth Simulator) and AFES-Venus succeeded in reproducing the cold collar for the first time. However, the temperature difference between the pole and the surroundings is smaller than that of the observations. Recently, introducing the Local Ensemble Transform Kalman Filter (LETKF), we have developed the Venus AFES LETKF Data Assimilation System (VALEDAS)[2]. In this study, we prepare idealized observations assuming radio occultation measurement among small satellites and assimilate them by VALEDAS. The idealized observations are provided from French Venus atmospheric GCM (IPSL VGCM)[3], in which the cold collar is realistically reproduced, and their conditions such as time interval, places and numbers are changed. We investigate the effectiveness of radio occultation measurement among small satellites by the reproducibility of the cold collar. As a result, the cold collar is reproduced if the observations are 2-3 vertical profiles 4-6 hourly, and it is expected that radio occultation measurement among small satellites will be promising to reproduce the polar atmospheric structures by 3 small satellites[4]. However, the cold collar is destroyed in the case which has a lot of observation points and high frequency, because there is a temperature bias between AFES-Venus and IPSL VGCM. In this study, correction of temperature bias between models is conducted. Bellow figures are temperature distribution at 30-90˚N at the altitude about 66 km in the cases which are 72 vertical profiles at temperature observations at 60-85˚N with every Earth hour; (a) is before the bias correction, and (b) is after. It is suggested that the bias correction enables us to correct temperature bias between models. In the poster presentation, in addition to these results, we will show the results considering real orbits.

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