Data assimilation of the Venus atmosphere assuming radio occultation measurement by small satellites

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At the altitude of approximately 60-70 km in the Venus atmosphere, there is an interesting phenomenon called "cold collar" where the temperature of the polar region is higher than that of the surroundings (latitude of about 60-80 degrees). The Japanese Venus Atmospheric GCM For the Earth Simulator (AFES-Venus) succeeded for the first time in the reproduction of cold collar[1]. However, the temperature difference between the pole and the surroundings is small compared with that observed. Recently, using the Local Ensemble Transform Kalman Filter (LETKF), we have succeeded in developing the Venus AFES LETKF Data Assimilation System (VALEDAS)[2]. In this study, we investigated the reproducibility of cold collar by the data assimilation of French Venus Atmospheric GCM(LMD/VGCM) in which cold collar is realistically reproduced[3]. We prepared idealized observation data assuming radio occultation measurement by small satellites. We will report the reproducibility of cold collar by changing the conditions such as observation point, observation number, and time interval. Figure shows three vertical profiles of temperature observations at 85 degrees North every Earth hour (obtained by temperature field from 30-90 degrees North at the altitude of about 66 km). Therefore, such kind of future mission would be promising.

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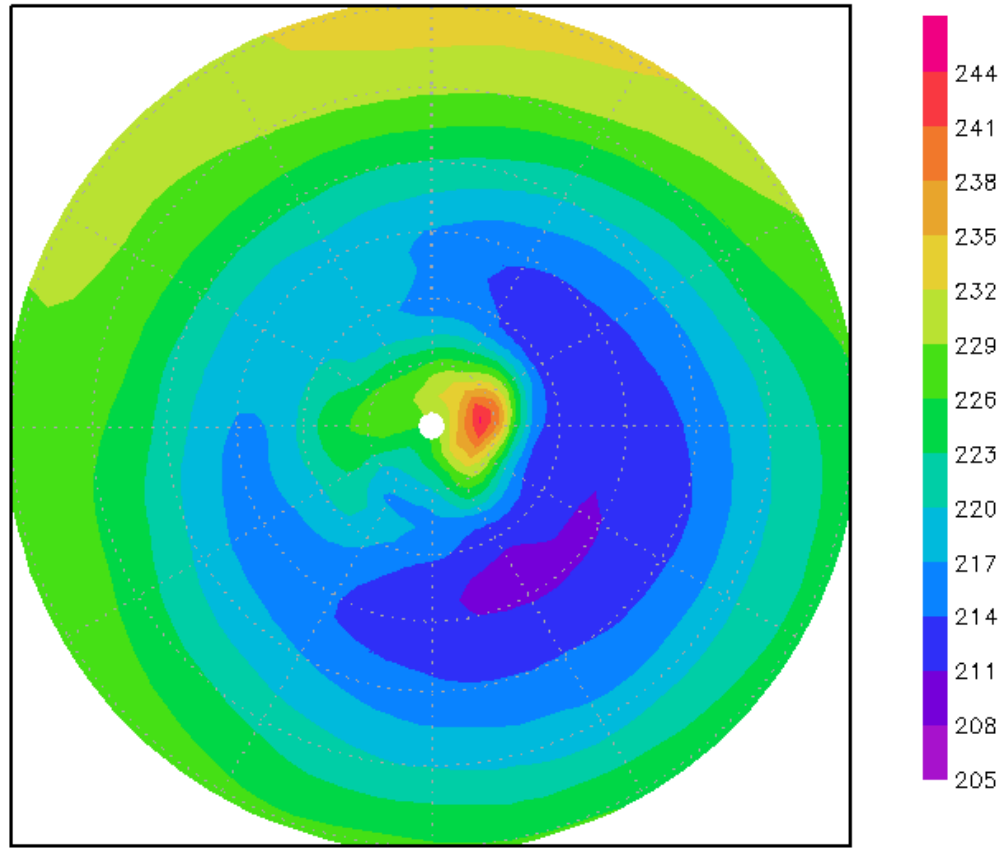[2] Development of an ensemble Kalman filter data assimilation system for the Venusian atmosphere, Norihiko Sugimoto, Akira Yamazaki, Toru Kouyama, Hiroki Kashimura, Takeshi Enomoto, and Masahiro Takagi, *Scientific Reports*, Vol. 7, (2017), 9321, 9pp
[3] Latitudinal variation of clouds' structure responsible for Venus' cold collar, Itziar Garate-Lopez, Sébastien Lebonnois, *Icarus*, Vol. 314, (2018), p1-11.

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