Simulation of Thermal Infrared Emission from Venusian Atmosphere

Kazuya Sakata[1]; Makoto Taguchi[1]

[1] Rikkyo Univ.

The Longwave Infrared (LIR) camera onboard the first Japanese Venus mission, PLANET-C, or the Venus Climate Orbiter, operates in the middle infrared region with a single bandpass filter of 8-12 micrometer, measuring thermal radiation emitted from the cloud tops of the Venusian atmosphere. A horizontal wind vector field at the cloud-top height will be retrieved by means of a cloud tracking method. In addition, absolute temperature will be determined with an accuracy of 3 K. Since solar irradiation scattered by the atmosphere is much weaker than the atmospheric thermal radiation, LIR can continuously monitor a hemispheric wind field independent of the local time of the apocenter throughout the mission life. Wind and temperature fields obtained by LIR will provide key parameters to solve climatological issues related to the Venusian atmosphere.

In order to simulate observation by LIR and to develop retrieval technique synthetic images of thermal infrared emission from the Venusian atmosphere were calculated using a model atmosphere that is composed of observational data obtained by the past Venus missions. A full disk infrared image of Venus is obtained by integrating the radiative transfer equation for each pixel of LIR. In the model the altitude region from the ground to the lower thermosphere is divided by 100 layers with a same thickness of 1 km. Optical thickness of the cloud layer as well as molecular absorption by isotopes of carbon dioxide and minor constituents such as SO_2 and H_2O within the pass-band of LIR is taken into account.

Results show thermal radiation observed by LIR will mainly reflect temperatures around the cloud top layer as expected. Artificially generated temperature inhomogeneity and its temporal variation will be added to evaluate capability in retrieval of temperature and wind vector fields from the simulated images.