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Atmospheric general circulation and waves simulated by a Venus AORI GCM with topographical and radiative forcings

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General circulation and waves are investigated using a T63 Venus general circulation model (GCM) with solar and thermal radiative transfer in the presence of high-resolution surface topography. This model has been developed by Ikeda (2011) at the Atmosphere and Ocean Research Institute (AORI), the University of Tokyo, and was used in Yamamoto et al. (2019, 2021). In the wind and static stability structures similar to the observed ones, the waves are investigated. Around the cloud-heating maximum (~65 km), the simulated thermal tides accelerate an equatorial superrotational flow with a speed of ~90 m/swith rates of 0.2–0.5 m/s/(Earth day) via both horizontal and vertical momentum fluxes at low latitudes. Over the high mountains at low latitudes, the vertical wind variance at the cloud top is produced by topographically-fixed, short-period eddies, indicating penetrative plumes and gravity waves. In the solar-fixed coordinate system, the variances (i.e., the activity of waves other than thermal tides) of flow are relatively higher on the night-side than on the dayside at the cloud top. The local-time variation of the vertical eddy momentum flux is produced by both thermal tides and solar-related, small-scale gravity waves. Around the cloud bottom, the 9-day super-rotation of the zonal mean flow has a weak equatorial maximum and the 7.5-day Kelvin-like wave has an equatorial jet-like wind of 60-70 m/s. Because we discussed the thermal tide and topographically stationary wave in Yamamoto et al. (2021), we focus on the short-period eddies in the presentation.