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Impacts of the cloud structure's latitudinal variation on the general circulation of the Venus atmosphere as modeled by the LMD-GCM

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A new simulation of Venus atmospheric circulation obtained with the LMD Venus GCM is described and the impact of cloud's latitudinal structure on the general circulation is analyzed.

The model used here is based on that presented in Lebonnois et al. (2016). However, in the present simulation we consider the latitudinal variation of the cloud structure (Haus et al., 2014) both for the solar heating and to compute the infrared net-exchange rate matrix used in the radiative transfer module. The new cloud treatment affects mainly the balance in the angular momentum and the zonal wind distribution. Consequently, the agreement between the vertical profile of the modeled mean zonal wind and the profiles measured by different probes, is clearly improved from previous simulations in which zonal winds below the clouds were weak (roughly half the observed values). Moreover, the equatorial jet obtained at the base of the cloud deck is now more consistent with the observations. In Lebonnois et al. (2016) it was too strong compared to mid-latitudes, but in the present simulation the equatorial jet is less intense than the mid-latitude jets, in concordance with cloud-tracking measurements (Hueso et al., 2015).

Since the atmospheric waves play a crucial role in the angular momentum budget of the Venus's atmospheric circulation, we analyze the wave activity by means of the Fast Fourier Transform technique studying the frequency spectrum of temperature, zonal and meridional wind fields. Modifications in the activity of the different types of waves present in the Venusian atmosphere compared to Lebonnois et al. (2016) are discussed, in terms of horizontal and vertical transport of the angular momentum by diurnal and semi-diurnal tides, barotropic and baroclinic waves, and Rossby and Kelvin type waves.

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