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Transport of angular momentum and tracers by waves in a Venus General Circulation Model

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The present paper tries to caracterise planetary waves in a numerical simulation of the Venus atmospheric dynamics, performed with a General Circulation Model developed recently by our team.

We can first separate low frequency waves such as thermal tides (diurnal and semi-diurnal tides) and high frequency waves. These two families of waves are well-caracterised by their propagation: thermal tides propagate eastward (following the sun) and vertically from the middle of the clouds (in the maximum solar heating layer) while high frequency waves propagate westward (in the same direction than the solid planetary rotation).

Thermal tides are centered on equatorial regions whereas high frequency waves are modeled in high latitudes (at around 60 degrees) above the clouds (around 65 km) and in equatorial regions below the clouds (around 20 km). These different locations of high frequency waves suggest the presence of both equatorial Kelvin-like wave and mid-latitude Rossby-like wave.

Two main groups of high frequency waves are predominant: waves with periods smaller than 8 Earth days and waves with periods between 10 and 30 Earth days. A 4-Earth day period wave has been found in the GCM in equatorial region below the clouds, which seems to contribute significantly to horizontal angular momentum transport.

We show in particular that these high frequency waves transport angular momentum horizontally towards equator at 50 km, in good agreement with what can been re-

trieved with Eliassen Palm flux diagnostics. Passive tracers are also used to diagnose transports by waves and mean meridional circulation. This equatorward transport is a key component of the angular momentum budget, needed to explain the superrotating regime.