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A cloud modal representation for the IPSL Venus GCM: validation and first results

Sabrina Guilbon (1), Anni Määttänen (1), Franck Montmessin (1), Jérémie Burgalat (2), Sébastien Lebonnois (3), Aurélien Stolzenbach (4), Pascal Rannou (2), Arnaud Beth (5), Anton Laakso (6), Harri Kokkola (6), Kevin McGouldrick (7), Maxence Lefèvre (3), and Franck Lefèvre (4)

(1) LATMOS/IPSL, UVSQ Université Paris-Saclay, UPMC Univ. Paris 06, CNRS, Guyancourt, France (sabrina.guilbon@latmos.ipsl.fr), (2) GSMA UMR CNRS 7331, Université de Reims Champagne-Ardenne, Reims, France, (3) Laboratoire de Météorologie Dynamique (LMD), France, (4) LATMOS/IPSL, UPMC Univ. Paris 06 Sorbonne Universités, UVSQ, CNRS, Paris, France, (5) Department of Physics, Imperial College London, Prince Consort Road, London SW7 2AZ, UK, (6) Finnish Meteorological Institute, Kuopio, Finland, (7) University of Colorado-Boulder, Laboratory for Atmospheric and Space Physics, USA

Venus is a terrestrial planet enshrouded by 20 km-thick clouds, which are composed of sulphuric acid-water solution droplets. To understand the Venus atmosphere, LMD and LATMOS laboratories have developed a 3D IPSL Venus Global Climate Model (Lebonnois et al. 2010). In this GCM, the cloud description is simplified. As clouds play a crucial role in radiative transfer, dynamics and generally the climate of Venus, it is necessary to improve the VGCM with a microphysical representation. To this end, we develop a Modal Aerosol Dynamics of Venusian Liquid Aerosol cloud model (MAD-VenLA). This model uses an implicit moment scheme to describe the particle size distribution and the microphysical processes in 0D. The particle size distribution is described by its first moments: total particle number (zeroth moment) and total particle volume (third moment) of the size distribution (Seigneur et al. 1986, Burgalat et al. 2014). Moreover, with this representation, the form of the size distribution is assumed to be a log-normal function. To represent a source of aerosol particles and the sedimentation of our cloud droplets, we have developed a 1D extension to our model. We are currently coupling MAD-VenLA with the 1D version of the IPSL Venus GCM.

First, we will describe MAD-VenLA. Then, for validation, we will compare it with the sectional model SALSA in 0D (Kokkola et al. 2008), and with the CARMA Venus model (McGouldrick et al. 2007) and the Pioneer Venus LCPS observations (Knollenberg and Hunten, 1980) in 1D.

In case of successful validation in 1D, we will be able to conduct 3D simulations with full microphysics in the future.