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Extension of the IPSL Titan climate model to full three-dimensional GCM

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The 2-dimensional Climate Model developed for the atmosphere of Titan at the Institute Pierre-Simon Laplace has been very successful to interpret many of the features observed in this complex atmosphere. But in order to take into account the couplings between dynamical, microphysical and photochemical processes, the model was reduced more than ten years ago to an axisymmetric latitude-altitude formulation to save computational time. For that purpose, a specific parameterization was introduced to take into account the non-axisymmetric barotropic waves that were obtained and studied with a 3-dimensional, but uncoupled, previous version of the model.

Now that computational power has greatly improved, we are coming back to a full 3-dimensional GCM. This improved version ranges from the surface to roughly 500 km altitude, with an horizontal resolution of 64 longitudes by 48 latitudes. It takes into account the couplings with the microphysics and photochemistry developed for the 2-D model, with 3-D haze and composition. Though, the microphysical evolution of the haze and the photochemistry are still computed only in the altitude-latitude plan, with diurnally, zonally averaged tendencies.

Starting with an initial state obtained from the 2-dimensional simulations, the GCM has been run for several Titan years without dramatic changes in the circulation, though analysis and tests are still going on. We will present preliminary analysis of the 3-D circulation obtained, with emphasis on the differences with the 2-D simulations.