Simulating long term climate variation with a planetary evolution model

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Résumé

To accurately simulate the climate and the fate of volatiles for thousands to millions of years we
must couple physical processes with very different timescale, ranging from clouds microphysics
and atmospheric dynamics (represented in the GCM) to the evolution of lakes, glacier accumulation, and subsurface ice evolution.
Given the diversity and the complexity of the Martian paleoclimates, we choose to use use an ambitious "asynchronous coupling" between the slow ice and water reservoirs models and the
GCM.
In practice our innovative Mars evolution model will use a horizontal grid identical to that of the
GCM, and include the same representation of the micro-climate on slopes. In our case, we will run
the Mars Evolution Model with a timestep of 50 to _˜500 years, depending upon the dynamics of
the modeled system (smaller timesteps must first be used so that the different volatile reservoirs
reach a quasi-equilibrium, then the timestep will depends on the evolution of the forcing, which is
slow in the case of obliquity, for instance) . At each timestep, the inputs from the atmosphere (e.g.
mean precipitation, sublimation and evaporation, temperatures, dust deposition) will be obtained
through a multi-annual run of the Global Climate model using the outcome of the Mars Evolution Model as initial state.
First results about evolution of water ice and CO2 ice glacier will be presented.

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