Understanding the climate and storms on Uranus & Neptune

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Despite the little insolation received by the ice giant planets, the stormy activity of their atmospheres is intense. What is the phenomenon responsible for this activity ?

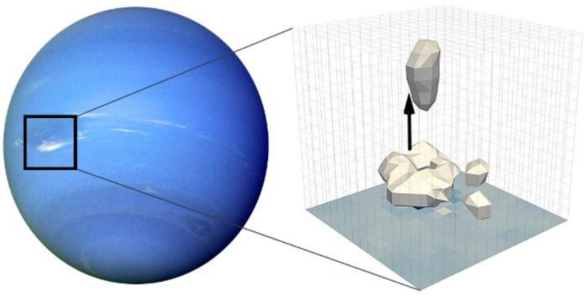
Interestingly, unlike the Earth, the species able to condense in the atmospheres of Uranus and Neptune, methane in particular, are heavier than the ambient air, essentially hydrogen. This property makes convection difficult to start.

Convection in these atmospheres should therefore be a regime of strong intermittence where convective energy can be stored for a long time before being released in short episodes.

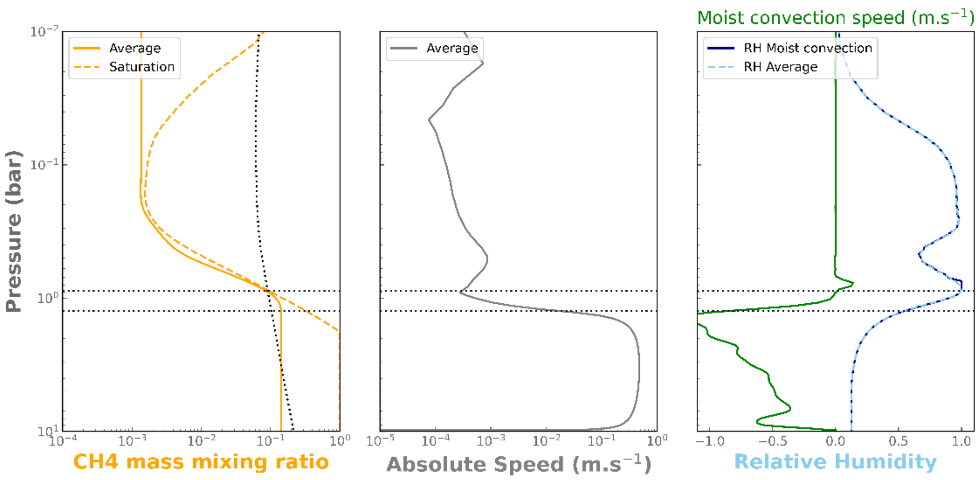
Our hypothesis is that this regime is at the origin of intense storms.

To study this hypothesis, we use a "cloud-resolving" model. This model is built from a dynamical core (The Weather Research and Forecasting model) solving the equations of motion, that has been initially developed for terrestrial applications and already adapted for simulations on Mars and Venus, coupled to independent physical parameterizations such as radiative transfer. The high resolution of the model grid can allow us to highlight moist atmospheric convection, by resolving cloud formation and dissipation.

We will present our implementation of methane cycle in this model and results from simulations, which reveal the impact of methane cycle in tropospheric convection on Neptune, having a special look on methane abundance that can vary at different latitudes.



Artist view of a simulation run on Neptune



Key parameters calculated by a simulation run on Neptune