

International Master 2 Atmospheric Environment: Research Training 2017-2018

Laboratory: LOA

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CaPPA Work Package: WP-5 Cloud-aerosol interactions

An Ising-like model for cloud organization at mesoscale under natural marine conditions

A striking feature of clouds at large scales is their apparent organization under certain conditions.

The natural question that arises is whether this organization is governed by some underlying laws and thus whether it can be understood within a formal frame: are clouds totally random systems? Are clouds auto-organized systems, and at which correlation scale? In the context of the climate change, trying to answer such questions is important to further predict how clouds can be structured at the mesoscale, how they can evolve according to surroundings and what is their radiative impact.

Statistical physics has provided powerful tools and models to analyze collective behaviors in the field on condensed matter (e.g. magnetism). Because clouds are physical systems in interaction with their environment, they should be fruitfully tackled by such methods. This is a very original and novel approach in atmospheric physics.

Especially, in this Master 2 internship, the student will have to develop a 2-dimensional Ising model similar to that used to explain magnetic behaviors of some medium. Focus will be put on cloud structures under marine natural conditions (Indian Ocean). Using the typical thermodynamical variables, the student will have to investigate, with the Ising model built, how we can pass from clear air conditions to (organized, or not) marine cloudy atmospheres.

Skills : Python language, Understanding of statistical and theoretical physics

Key words: Cloud organization, Ising model, marine conditions, statistical physics