Ecole Doctorale des Sciences Fondamentales

**Title of the thesis: A study of the vertical partitioning of liquid and ice phase in mixed cloud and how this impacts precipitation.**

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**Summary :**

Ice phase onset is triggering precipitation within clouds. Once ice crystals appear in cold clouds, their growth will be favored first through vapor deposition (Wegener-BergeronFindeisen mechanism), then possibly by impaction and riming of supercooled droplets. As a consequence, few of the hydrometeors will be more massive and start precipitating. The study of the life cycle for clouds and precipitation is therefore closely related to the understanding of how liquid and ice phase interact within clouds. This study will be performed for several kinds of clouds, including contrasted vertical phase partitioning between supercooled liquid and ice phase (deep convective clouds with large amount of supercooled water up to the top versus dynamically less vigorous clouds like stratiform clouds with shallower liquid layers or presence of snow).

The LaMP laboratory holds several datasets of comprehensive cloud particle measurements from microphysical probes that are included in the French national airborne cloud measurement facility. These recent datasets were acquired during several experimental campaigns and for different meteorological situations and cloud types. In parallel, LaMP has developed a cloud microphysics model DESCAM that describes the evolution of hydrometeors as a function of particle size and phase and associated to cloud processes. The model will be used in a vertical dynamical frame, this simplification allows focusing on how each process leads to the observed vertical structure of clouds and impacts precipitation formation. The student will be in charge to go through the datasets to identify and select some interesting case studies to be tested with the model in order to explain how cloud processes simulate the observations. The candidate shall have a degree in atmospheric sciences and some programming skills.