

## Ecole Doctorale des Sciences Fondamentales

### Title of the thesis: Physico-chemical and microbiological characterization of clouds

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### Summary :

Clouds are a complex multiphase medium where droplets are in equilibrium with the gas phase and the ubiquitous aerosol particles. Gas-phase molecules and the soluble fraction of aerosols can dissolve or be incorporated into droplets, where they can undergo chemical, microbiological or light-induced transformations.

Therefore, the aqueous phase of clouds has a complex chemical composition, including a multitude of organic and inorganic compounds, but also metals and oxidizing species. In situ measurements have mainly focused on the physical and chemical properties of the cloud environment. However, a significant fraction (80%) of the molecules is still not characterized, due to the complexity of the medium. In addition, clouds contain a large number of microorganisms (bacteria, yeasts and fungi) capable of transforming dissolved molecules and producing other compounds.

The characterization of the cloud environment is a major scientific question in the understanding of atmospheric chemistry. Indeed, they modify the gas-phase chemistry and the chemical compounds that dissolve into the cloud droplets. Clouds are notably responsible of the modification of the physicochemical properties of aerosol particles, thus causing indirect effect on climate.

The candidate will regularly collect cloud water samples at the puy de Dôme site but also in other sites. She/he will be in charge of the physico-chemical analysis of the samples as well as the characterization of dissolved organic matter in cloud water by high-resolution mass spectrometry. This last task, in particular, requires instrumental and methodological development as well as statistical analysis of the results. In the lab, irradiations and incubations of natural samples are being considered to understand the effect of photochemical and microbiological transformations on the chemical composition of clouds.