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Influence of the presence of organics on the freezing of ice particles investigated by micro-Raman scattering

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An important mechanism of UT (Upper Troposphere) cirrus cloud formation is the heterogeneous ice freezing process. Anthropogenic pollutants such as NO_x, VOC_x, and HO_x precursors from the planetary boundary layer (PBL) can be transported into the Upper Troposphere (UT) [1], where they can participate to the local photochemistry and modify the ozone concentration.

During the convection, soluble pollutants including nitric acid, alcohols, carbonyl compounds and carboxylic acids are likely to be scavenged by supercooled droplets contained in polluted convective air masses [2]. Furthermore, the amount of dissolved organics could be greatly enhanced by the presence of HNO3 [2]. At lower temperature, theses compounds could participate to the heterogeneous freezing of the supercooled droplets where they can be retained or expulsed from the newly formed ice particles.

In this study, we perform laboratory work to examine and characterize the influence of the presence of ethanol (EtOH) on the freezing of ice particles. Supercooled droplets produced by nebulization (or in emulsion) are characterized by micro-Raman spectroscopy. The vibrational spectra of water O-H and EtOH C-H are analysed to determine the influence of temperature and relative composition on the freezing process and the distribution of EtOH between the solid and the gas phase. Depending on the EtOH content, different crystalline phases are identified and analyzed in relation to spectra of ice, amorphous and hydrate phases obtained by co-deposition of ethanol and water [3].

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