LABORATORY MODELS OF ICE CLOUD NUCLEATION

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For the Earth's weather and climate system, clouds are of major importance. On the one hand they cool by reflecting parts of the solar radiation and on the other hand they heat by absorbing solar radiation and by trapping the outgoing infrared radiation. However, the latest report of the international panel of climate change (IPCC) presents clouds and aerosols as the largest non-anthropogenic uncertainties of earth's radiation balance [1]. Therefore, a lot of research is directed to this issue [2]. Recent lab studies show that droplets isolated in an oil-matrix allow studying the homogeneous ice crystallization [3]. From certain concentrations on, carboxylic acids prevent the ice growth. Inspired by those results further investigations on this system were done by using different analytical techniques. For these measurements, the matrices were cooled down to the temperature of the upper troposphere (i.e. 213K); where cirrus ice clouds regularly form. Here, citric acid was used as a proxy for the organic fraction of cirrus clouds. Measurements were done with environmental scanning electron microscopy (ESEM) to gain morphologic information, with X-ray diffraction (XRD) to gain structural information and by Raman spectroscopy to gain spectroscopic information. The collected data can be used to make predictions for cirrus cloud formation and ice crystallization in general and to start to understand the changes of earth's radiation balance in more detail.

[1] Intergovernmental Panel on Climate Change, 4th Assessment Report "Climate Change 2007: The Physical Science Basis, Summary for Policymakers", Geneva, 2007; www.ipcc.ch

[2] M. Baker and T. Peter "Small-scale cloud processes and climate" Nature, 451, 299-300, 2008

[3] B.J. Murray "Inhibition of ice crystallization in highly viscous aqueous organic acid droplets." Atmos. Chem. Phys., 8, 5423-5433, 2008