Simulation of ice nucleation in a parcel model

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The effect of different aerosol (mineral dust, bacteria and soot) acting as immersion ice nuclei is investigated using ACPIM (Aerosol–Cloud Precipitation Interaction Model) (Connolly *et al* (2009)).

ACPIM is a powerful tool which can be used in two different ways. This box model can be, either, driven by experimental data (experiments carried out at the AIDA cloud chamber facility) or used as an air parcel in order to examine different ice nucleation parameterizations under specific conditions.

This adiabatic air parcel model was employed for the simulation of a convective cloud. In a first step, immersion freezing is described based on Diehl and Wurzler's parameterization (Diehl and Wurzler (2010)). The effect of each aerosol is studied individually and the results were compared to the ones in Diehl and Wurzler (2010).

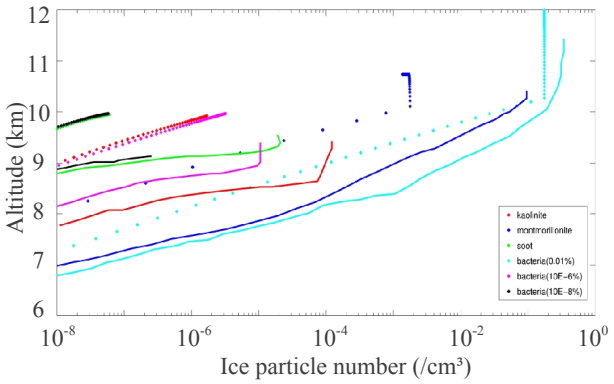

Figure 1. Comparison between ACPIM (dots) and data from Diehl and Wurzler (2010).

The study with mineral dust aerosol is then extended using Niemand *et al.* 's parameterization (Niemand *et al* (2012)), which was derived form laboratory studies in AIDA and is an extension of surface site density approach suggested by Connolly *et al* (2009).

Then, the effect of two aerosols acting simultaneously is investigated; introducing Hummel *et al.* 's parameterization for biological aerosols (Hummel *et al* (2013)) :

$$f_{in} = f_{max}\left(1 - \exp\left(-A_p * n_s(T)\right)\right)$$

With an empirically fitted ice nucleation active site density n_s based on AIDA measurements of Pseudomonas syringae bacteria (Oehm *et al* (2013)).

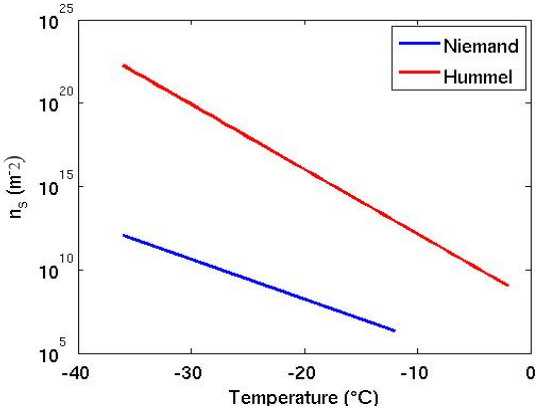

Figure 2. Immersion freezing parameterizations from (Niemand *et al* (2012) and Hummel *et al* (2013))

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Oehm, C. *et al.* (2013) In preparation