Ion assisted cloud formation

The nucleation of molecular clusters is estimated to contribute about half of all cloud condensation nuclei. A central molecule in nucleation is sulfuric acid H_2SO_4. Because of their interaction with sulfuric acid dipoles and their relative higher stability, clusters with a central hydrogen sulfate ion HSO_4^- hereby play an important role in the process of nucleation.

The purpose of this project is to understand the microscopic properties of sulphuric acid-water (H_2SO_4-H_2O) clusters and hydrogen sulfate ion-water (HSO_4^--H_2O) clusters and their interaction with each other. We are seeking to understand the spatial, energy and size distribution of such clusters and especially the formation rate of large clusters, i.e. per volume and time, as a precursor for the formation of cloud condensation nuclei.

A current version of our Monte Carlo particle code is written in Python and one part of the project will be to transfer the code to a high-end programming language like Fortran or C++ in order to speed up simulations. Once, this is done, simulations will be performed in order to understand the influence of hydrogen sulfate ions on the formation of large clusters.

We at DTU Space, located in Lyngby, study phenomena related to various stages of cloud formation. Recently, we have started to develop a particle Monte Carlo code tracing individual H_2SO_4-H_2O clusters and monitor their spatial and size distribution leading to the early stages of cloud formation.

If we have caught your attention, please contact koehn@space.dtu.dk or enghoff@space.dtu.dk to obtain more information.