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 and with ambient electric fields. We are seeking to understand how 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 depend on ambient electric fields and on stochastic effects such as the collision of neutral and charged clusters.

The simulation code we are using is partly written in Python and C++ and optimized for fast run times such that a variety of computer simulations can be run to obtain statistical relevant averages revealing the stochastic nature of ion assisted cloud formation.

We at TU Dortmund 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 christoph.koehn@tu-dortmund.de to obtain more information.