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Model sensitivity studies on atmospheric iodine chemistry and coastal nucleation events

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We performed sensitivity studies regarding atmospheric iodine chemistry, and the possible role of iodine oxides in atmospheric new particle formation. We used the one-dimensional marine boundary layer model MISTRA, which includes chemistry in the gas and aerosol phase as well as aerosol microphysics. The chemical reaction set focuses on halogen (Cl-Br-I) chemistry. We included a two-step nucleation parameterization, where in the first step, the formation of cluster-sized nuclei via homogeneous condensation of gases is parameterized. Both ternary sulfuric acid - ammonia - water nucleation and homomolecular homogeneous OIO nucleation are considered. In a second step, the early growth of clusters up to about 10 nm by condensable vapors such as OIO, is parameterized.

According to these sensitivity studies, in the clean marine background atmosphere OIO can be responsible for both homogeneous nuclei formation and the subsequent growth of the clusters to detectable sizes. In contrast to this, in the continental case with its higher levels of pollutants and higher ternary nucleation rates, OIO nucleation is found to be less important. This is, however, partly due to significantly lower modeled OIO mixing ratios at high NOx conditions, which does not seem to be in agreements with recent field observations.

There are still considerable uncertainties regarding iodine chemistry in the atmosphere as well as the exact mechanism of new particle formation via iodine oxides. We discuss sensitivity studies adressing some of these uncertainties, especially concentrating on processes involving OIO.