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Surface reactions on sea salt aerosol: Importance for halogen and sulfur chemistry in the marine boundary layer

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Sea salt aerosol is important for the physics and chemistry of the atmosphere, for example as cloud condensation nucleus, as "reaction chamber" for the oxidation of sulfur, and for the release of reactive halogens. Chlorine and bromine are often drastically depleted in sea salt aerosol which is generally thought to be caused by acid displacement in the case of chlorine and by autocatalytic reactions in the case of bromine. Recently, a variety of laboratory, molecular dynamics, and kinetic modeling studies have indicated that reactions on the surface of sea salt aerosol can lead to the release of chlorine directly from the aerosol surface. Furthermore, it was speculated that a "byproduct" of this surface reaction, namely OH^-, could lead to a delay of the acidification of sea salt aerosol and therefore to an increase of the oxidation rate of S(IV) in sea salt aerosol resulting in the formation of less new aerosol particles in the marine boundary layer (MBL) with potential impacts for the indirect aerosol effects on climate.

Using the microphysical and chemical model of the MBL MISTRA in the box model mode I investigated the importance of the suggested surface reactions on the chemistry of the marine boundary layer and focused on the effects on reactive halogens and sulfur. The main conclusion is that the importance of these surface reactions has been overstated in previous studies but that very interesting, but so far ignored, feedbacks occur. This will be explained in detail in this presentation.