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1D modeling of snow photochemistry at Summit Greenland

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Reactive halogens in Arctic regions and their impact on ozone levels have been a subject of intensive research since the mid 1980s, in particular in regions close to first-year sea ice. Motivated by indirect evidence that reactive halogens are also present on the Greenland ice shield, two field campaigns have been conducted at Summit, Greenland in 2007 and 2008. The purpose of these studies was to measure air and snow properties with a particular focus on halogen and HO_x chemistry in snow covered remote regions. Initial results show evidence for halogen chemistry with BrO concentrations measured up to 3 ppt with the UCLA long path DOAS instrument. In order to understand the chemical and physical processes occurring during these field experiments we have developed a new 1D model for snow physics and chemistry. This model has been coupled to the boundary layer model MISTRA, which includes detailed multiphase chemistry in the atmosphere, with the goal of understanding how chemical species evolve with time in the interstitial air and to study the interplay between the chemistry in and above the snow. The importance of gas exchange will be highlighted as well at the necessity for studies to quantify the ion content of the liquid layer on snow grains. The methodology for modeling the multiphase in-snow chemistry will be presented along with results from this new model, including vertical profiles of halogens in the snow pack and in the atmosphere along with their evolution in time.