Geophysical Research Abstracts
Vol. 21, EGU2019-7716, 2019
EGU General Assembly 2019

In situ measurement of tundra snowpack chemistry during a boundary layer 'bromine explosion' event at Eureka, Canada

Xin Yang (1), Kristof Bognar (2), Pierre Fogal (2), Kimberly Strong (2), kaley Walker (2), Sara Morris (3), and Audra McClure-Begley3 (3)

(1) British Antarctic Survey, Chemistry and Past Climate, Cambridge, United Kingdom (xinyang55@bas.ac.uk), (2) Department of Physics, University of Toronto, Toronto, Canada, (3) NOAA Earth System Research Laboratory, Boulder, CO, USA

Polar coastal sites and the sea-ice boundary layer often exhibit enhanced BrO concentrations during springtime; these so-called 'bromine explosion' events (BEEs) can last from days to more than a week. Elevated BrO plumes can extend from the surface to a height of a few km and be transported long distances across the Arctic. It has been found that bromine-mediated catalytic chemical reactions are responsible for significant ozone depletion, and most BEEs are associated with ozone depletion events (ODEs). Blowing snow and associated sea salt aerosol (SSA) could act as bromine sources. However, this mechanism does not rule out the possibility of the snowpack acting as a direct bromine source. Thus, it is not completely clear which reservoir dominates the bromine supply, therefore the direct source of bromine during the BEEs remains a topic of debate.
Both BEEs and ODEs have been observed at Eureka, Nunavut, Canada (80[U+F0B0]N, 86[U+F0B0]W), although it is located in a pristine site, less influenced by salts from young sea ice. It is therefore an ideal site to test whether local tundra snowpack, as proposed by other studies, plays a dominant role in boundary layer bromine, especially for BEE. During late February-March 2018, we joined the intensive phase of the springtime Canadian Arctic ACE/OSIRIS Validation Campaign, during which enhanced ground-based measurements of BrO by MAX-DOAS, ozone by an in situ surface ozone sensor and ozonesondes were obtained. In total, we collected more than 1,500 snow samples at six sites near the Eureka Weather Station, covering land types of sea ice, offshore inland, and the top of a ridge at a height about 600 m above the sea level. Basic snow physical and chemical characters such as density and salinity were measured on site. More than 1,200 snow samples were shipped back to Cambridge for Ion Chronology (IC) analysis. We will report some of the preliminary result from the IC analysis, with a focus on Br- concentration and the time evolution of bromide in snow during an observed bromine explosion event. We aim, for the first time, to seek direct evidence to answer the key question of whether or not local snowpack is key in determining boundary layer bromine, especially during a BEE.