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EMSL In Brief
Environmental Molecular Sciences Laboratory

Analyzing Atmospheric Chemistry in the Arctic

The Environmental Molecular Sciences Laboratory (EMSL) is playing an important role in understanding atmospheric processes in the Arctic. EMSL user Laura Alvarez-Aviles, from the University of Alaska Fairbanks, is using EMSL staff expertise and state-of-the-art instruments to determine the importance of aerosol surfaces in Arctic atmospheric chemistry.

Laura Alvarez-Aviles is one of the researchers from the University of Alaska Fairbanks who is using EMSL expertise and ion beam accelerator capabilities to study the response of halogen activation to Arctic sea ice. Photo courtesy of Bill Simpson, University of Alaska Fairbanks.

During springtime in the Arctic, unique and naturally occurring chemical processes convert inert sea salts into reactive radicals that deplete tropospheric ozone; oxidize mercury, which subsequently deposits to snow pack; and alter the fate of many organic pollutants. This process is known as halogen activation.

Halogen activation has been correlated with first-year sea ice, or ice formed within one season that is characterized by a high salinity. Arctic sea ice is currently undergoing major changes in response to a changing Arctic climate evidenced, in part, by drastic reductions in multi-year sea ice, or ice formed more than one year ago that is characterized by a low salinity. Alvarez-Aviles and her team are studying how halogen activation will respond to reductions in multi-year sea ice since less multi-year sea ice allows more space for first-year sea ice to form.

Determining which surfaces—aerosol, snow pack, or frost flowers from sea ice—release halogens, thus playing the key reactive role in halogen activation, is critical for understanding halogen activation. With this mechanistic understanding of halogen activation, scientists can make meaningful predictions about how its impacts to the Arctic will respond to changing Arctic sea ice conditions.

Alvarez-Aviles, together with researchers from the University of Alaska Fairbanks and Pacific Northwest National Laboratory, collected atmospheric samples from the Arctic and are using EMSL's ion beam accelerator to measure levels of the two halogens, bromine and chlorine, in the samples. EMSL staff working with Alvarez-Aviles on this research include Alex Laskin, Shuttha Shutthanandan, and Yury Dessiaterik.

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