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An overview of mercury speciation measurements and analysis at high latitudes

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Mercury cycling at high latitudes has been an important area of research for many years due to the potential impacts to fragile polar ecosystems. The Minamata Convention mentions the Arctic, in particular, as a critical area where the mercury biogeochemical cycle must be better understood to avoid harmful impacts to wildlife and humans. Although the Antarctic has no permanent human population there is a need to also understand mercury cycling in these areas to determine how wildlife in the region may be subjected to mercury contamination. In this presentation, a phenomenon will be described that was until recently thought to only occur at high latitudes-atmospheric mercury depletion events (AMDEs). AMDEs are processes by which atmospheric gaseous elemental mercury (GEM) is converted to oxidized forms (Hg(II)) and deposited to the snow and ice surfaces. These events are thought to be facilitated by high halogen concentrations coupled with low temperatures and sunlight. AMDEs provide a unique opportunity under ambient conditions to evaluate the behavior of current atmospheric mercury analyzers, including collection efficiency of the mercury speciation system when GEM concentrations fall below 0.1 ng m⁻³ while gaseous oxidized mercury (GOM) and particulate bound mercury (PBM) reach several hundred pg m⁻³. Strong depletion events may also allow us to perform atmospheric mass balance calculations to further constrain uncertainties surrounding the species collected by the current Tekran Speciation Unit. Discussion will include a summary of the many mercury speciation measurements made to date in high latitudes including the site with the longest continuous record of mercury speciation-Alert Canada. GEM measurements at this site have been collected since 1995 with speciation measurements since 2002. Alert is also where spring time AMDEs were first discovered and the site where the initial atmospheric mercury speciation measurements using pyrolysis were made. A variety of other mercury speciation measurements made by the group and by colleagues in Barrow, Alaska; Ny-Alesund; Summit, Greenland; McMurdo Station, Antarctica; the South Pole; and from an icebreaker in the middle of the Beaufort Sea along with some of the additional difficulties associated with sampling in these harsh environments. The presentation will end with a brief discussion on the future potential for mercury speciation measurements at high latitudes.

Biography

Chris Moore is an Assistant Research Professor in the Division of Atmospheric Sciences at the Desert Research Institute in Reno, Nevada, USA. He has been conducting research in the cycling of mercury between air, snow, ice, water, and soils for over a decade. He has been working on mercury at high latitudes since the summer of 2008 when he participated in a field study at the top of the Greenland Ice Sheet. In February 2014, he and his colleagues published an article in Nature detailing an important link between Arctic Ocean sea ice dynamics and the atmospheric cycling of mercury and ozone in the region.

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