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Simulating the fate of cryospheric mercury

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The fate of mercury deposited onto snow- and ice-covered surfaces is of critical importance for atmospheric mercury models. At high-latitudes, springtime Atmospheric Mercury Depletion Events (AMDEs) are accompanied by important deposition of oxidized mercury to the cryosphere. A significant portion of the deposited mercury may revolatilise from the cryosphere rapidly. However, a combination of physical and chemical environmental factors may trap a substantial portion of the deposited mercury within the cryosphere for an extended period of time. During snowmelt, the cryospheric mercury may enter the snowpack's meltwater. The subsequent emission of mercury from the snowpack's meltwater can be an important source of atmospheric mercury. Indeed, it is possible that the high-latitude summertime increase in the concentration of surface-level atmospheric gaseous elemental mercury is caused by significant emission of mercury from cryospheric meltwater. To simulate these various processes, a new atmosphere/cryosphere parameterisation has been developed for atmospheric mercury models. This parameterisation predicts the concentrations of elemental and oxidised mercury in the snowpack surface layer, the underlying snowpack, and the snowpack meltwater. Emission of elemental mercury from the snowpack and its meltwater to the atmosphere is represented.

In this presentation, we will describe the developed snowpack/meltwater mercury model. This parameterisation has been incorporated into Environment Canada's atmospheric mercury model, the Global/Regional Atmospheric Heavy Metals model (GRAHM). We will discuss the performance of the updated GRAHM. We find that the addition of the snowpack/meltwater model significantly improves the seasonality of GRAHM's simulated surface-level atmospheric gaseous elemental mercury concentrations.

Please list some keywords

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