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The Global Importance of Bromine on the Atmospheric Chemistry of Mercury.

Is Br the missing mercury oxidant in the free troposphere?

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Mercury is recognized as a highly toxic pollutant and exists in the atmosphere predominantly in the gaseous elemental form: Hg(0). Because of its prolonged atmospheric lifetime of 0.5-1.5 years, mercury is of global concern. Oxidation reactions are essential in transforming elemental mercury to oxidized (divalent) mercury, and it is the latter form that deposits most rapidly from the atmosphere to ecosystems. Although hydroxyl radicals and ozone are believed to be the main global oxidants of Hg(0), it is still not clear which reactions dominate. Here we present an overview of the current knowledge on bromine species as important oxidants of Hg(0) on a global scale. For example, resent observations indicate a dynamic oxidation of gaseous mercury in the Arctic and Antarctic troposphere at polar sunrise, probably by reactive halogens such as BrO. In addition, atomic bromine radicals released from sea salts could be important players in the enhanced wet deposition measured by the mercury deposition network (MDN) in the Gulf of Mexico region of the U.S., in sharp contrast with the number and magnitude of known sources of divalent mercury in that region. Data analyses from airborne measurements, results from the GOME (Global Ozone Monitoring Experiment) and recent atmospheric model applications will be presented. We conclude that bromine radicals are important oxidants of mercury on a global scale and bromine-mediated formation of mercury-containing aerosol may represent an important sector of the global mercury cycle in the upper troposphere transporting mid-latitude mer-

cury emission towards the poles. Hence, more research is needed to elucidate the role of bromine on the oxidation state of mercury in the free troposphere and thereby facilitate the inclusion of mercury-bromine chemistry in models.