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Sources, Sinks and Biogeochemical Cycling of Mercury in the Ocean - *C.C. Patterson Award Lecture*

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Anthropogenic activities and climate change have strongly impacted the biogeochemical cycling of mercury (Hg) in the biosphere and increased exposure of human and wildlife to elevated monomethylmercury (MMHg) levels in higher trophic level organisms, a growing health concern. In the ocean, Hg exists as dissolved ionic complexes of inorganic Hg and MMHg, as well as dissolved gaseous species (elemental Hg (Hg^0) and dimethylmercury (DMHg)). Dissolved Hg forms are highly particle reactive and substantially bioaccumulated into the marine food chain, with the highest trophic magnification occurring between water and microbes. In the bioshpere, abiotic reactions and biological transformations, including redox transformations and methylation/demethylation, result in the interconversion of all Hg species in the ocean, atmosphere and in terrestrial ecosystems, affecting their spatial and temporal distribution, and controlling the removal of Hg from the ocean water column, primarily through gas exchange of Hg^0 and sediment burial of ionic Hg. Overall, atmospheric deposition is the main external Hg input, but regional variations in sources and sinks impact its importance in specific locations, as well as the relative concentration of methylated Hg in the ocean. This talk will focus on discussing the factors influencing the air-sea exchange of Hg species, and the importance of this is the global Hg cycle. and the role of redox chemistry, gas exchange and other processes, as well as discuss the importance of terrestrial inputs to the coastal ocean. Additionally, recent advances in understanding Hg methylation and MMHg demethylation within the upper waters of the coastal and open ocean will be discussed. The talk will focus on polar regions and coastal locations given the impact of climate change on these ecosystems. Overall, the presentation will highlight the complexities and dynamics of the transformations between species and the dynamic nature of the ocean biogeochemical cycling of Hg.