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Seasonality of mercury in the Atlantic marine boundary layer

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Around one third of the mercury emissions today are from primary anthropogenic sources, with the remaining two-thirds from secondary reemissions of earlier deposition and natural sources (AMAP/UNEP 2008). Mercury exchange at the air-sea interface is important for the global distribution of atmospheric mercury as parts of deposited mercury will reenter the atmosphere through evasion. The exchange at the air-sea interface also affects the amount of inorganic mercury in the ocean and thereby the conversion to the neuro-toxic methylmercury.
Here we combine new cruise measurements in the atmospheric marine boundary layer (MBL) of the Atlantic Ocean (Northern Hemisphere) from the fall of 2006 and the spring of 2007 with existing data from cruises in the Atlantic Ocean since 1978. We observe from these data a seasonal cycle in Hg(0) concentrations in the Atlantic marine boundary later (MBL) that exhibits minimum concentrations during summer and high concentrations during fall to spring. These observations suggest a local, seasonally dependent Hg(0) source in the MBL that causes variability in concentrations above the open ocean. To further investigate controls on Hg(0) concentrations in the MBL, we developed an improved representation of oceanic air-sea exchange processes within the GEOS-Chem global 3-D biogeochemical mercury model. Specifically, we used new data on mercury redox reactions in the surface ocean as a function of biological and photochemical processes, and implemented new algorithms for mercury dynamics associated with suspended particles. Our coupled atmospheric-oceanic modeling results support the premise that oceanic evasion is a main driver controlling Hg(0) concentrations in the MBL.
We also use the model to investigate what drivers the evasion across the air-sea interface on shorter timescales. This is done by tracking evasion rates and other model components on an hourly basis for chosen locations in the Atlantic Ocean.