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Sea spray aerosols as a pathway for mercury export at the ocean–atmosphere interface

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Mercury (Hg) is a global pollutant whose marine biogeochemical cycling at the sea–air interface remains poorly constrained. While most studies focus on gaseous Hg exchange, a largely overlooked pathway is the transport of dissolved and particulate-bound Hg from the ocean into the atmosphere via sea spray aerosols (SSA). The sea surface microlayer (SML), a thin (0.1–1 mm) boundary layer enriched in organic matter and with complex redox chemistry, can act as a reservoir for Hg[1]. Organic matter within the SML is thought to enhance Hg incorporation into SSA, potentially leading to elevated enrichment factors. We investigated this pathway by conducting *in vitro* sea spray chamber experiments[2] using both artificial seawater and natural samples from the Baltic and Arctic Seas. Experiments spanning gradients in Hg concentration, organic matter content, and salinity enabled assessment of Hg transfer from seawater to SSA. Preliminary results show that Hg is consistently exported to sea spray aerosols, exhibiting enrichment relative to bulk seawater even under low Hg and low salinity conditions representative of the Baltic Sea. These findings address a critical knowledge gap in marine Hg cycling. SSA emissions are not yet included in global Hg budgets, yet may represent a significant source of atmospheric Hg. Incorporating Hg-SSA fluxes into models could improve predictions of Hg mobility within the marine environment and its exchange with the atmosphere.

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[2]Zinke J, Nilsson E, Markuszewski P, Zieger P, Mårtensson EM, Rutgersson A, Nilsson ED, Salter ME (2024) Sea spray emissions from the Baltic Sea: comparison of aerosol eddy covariance fluxes and chamber-simulated sea spray emissions. Atmospheric Chemistry and Physics 24, 1895–1918. https://doi.org/10.5194/acp-24-1895-2024