Outwelling of methylmercury from coastal and estuarine tidal wetlands

B. A. Bergamaschi*[1], J. A. Fleck[1], B. D. Downing[1], B. D. P. Krabbenhoft[2] and G. R. Aiken[3]

[1]*USGS California Water Science Center
Correspondence: bbergama@usgs.gov
[2]USGS Wisconscin Water Science Center
[3]USGS National Research Program Boulder CO

Coastal and estuarine tidal wetlands represent quintessential environments for the production and export of methylmercury: high leaf-area densities facilitate the uptake of gaseous elemental mercury from the atmosphere; plant biomass provides an abundant source of labile organic matter to support microbial oxygen depletion and sulfate reduction; and tidal hydrologic exchange regularly flushes sediments, supplying sulfate and limiting build-up of sulfide, which can inhibit methylation. While high concentrations of methylmercury in the sediments and waters of coastal and estuarine wetlands are relatively commonly reported, studies quantifying the tidally-driven dispersive mixing of wetland material into surrounding waters (outwelling) of methylmercury from these systems are relatively rare.

We have assessed mercury and methylmercury dynamics in several tidal wetlands using classical hydrodynamic techniques: hydroacoustic assessment of discharge and development of continuous time-series records of mercury concentration. The mercury concentration time-series are developed from various combinations of *in situ* optical measurements as concentration proxies for both particulate and dissolved material.

We found that while the dominant physical driver of export is dispersive mixing, the magnitude of this flux results from complex and unpredictable interactions between tides, geomorphic features, particle sorption/desorption, and episodic events such as wind storms and precipitation. Areal methylmercury yields determined using these physically-explicit methods are 10 to 20 times greater than reported yields from terrestrial wetland systems, suggesting that export from tidal wetlands should be included in mass-balance estimates for methyl-mercury loading to estuary and coastal waters. We will compare the results from studies covering a range of wetland types and geomorphic properties, and discuss how these interact to affect methylmercury export.