SENSITIVITY OF STREAM METHYL HG CONCENTRATIONS TO ENVIRONMENTAL CHANGE IN THE ADIRONDACK MOUNTAINS OF NEW YORK, USA

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The Adirondacks of New York have high levels of mercury (Hg) bioaccumulation as demonstrated by a region-wide fish consumption advisory for children and women who may become pregnant. The source of this Hg is atmospheric deposition that originates from regional, continental, and global emissions. Soils in the region have large Hg stores equivalent to several decades of atmospheric deposition suggesting that the processes controlling Hg transport from soils to surface waters may greatly affect Hg concentrations and loads in surface waters. Furthermore, Hg can be converted to its neuro-toxic methyl form (MeHg), particularly in riparian and wetland soils where biogeochemical conditions favor net methylation. We measured MeHg concentrations during 33 months at Fishing Brook, a 65 km^2 catchment in the upper Hudson River basin in the Adirondacks. Seasonal variation in stream MeHg concentrations was more than tenfold, consistent with temperature-driven variation in net methylation rates in soils and sediment. These data also indicate greater than twofold annual variation in stream MeHg concentrations among the three monitored growing seasons. The driest growing season had the lowest MeHg concentrations, and these values were greater during the two wetter growing seasons. We hypothesize that contact of the riparian water table with abundant organic matter and MeHg stored in the shallowest soil horizons is a dominant control on MeHg transport to the stream. An empirical model was developed that accounted for 81 percent of the variation in stream MeHg concentrations. Water temperature and the length of time the simulated riparian water table remained in the shallow soil were key predictive variables, highlighting the sensitivity of MeHg to climatic variation. Future changes in other factors such as Hg emissions and deposition and acid deposition will likely also influence stream MeHg concentrations and loads. For example, lime application to an Adirondack stream to increase pH and enhance ecosystem recovery from acidification has increased MeHg concentrations, which may be associated with parallel increases in dissolved organic carbon concentrations. Future changes in the Hg cycle of this region will likely be complex, reflecting changes in climatic drivers and emissions of Hg and other air pollutants.

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