Spatial Patterns and Temporal Trends in Mercury Wet Deposition in the Great Lakes Region

By Martin R. Risch[1], David A. Gay[2], and Kathleen K. Fowler[3], Gerard J. Keeler[4], Sean M. Backus[5], Pierrette Blanchard [6], James A. Barres[7], and J. Timothy Dvonch[8]

Data from three mercury wet-deposition-monitoring networks and two precipitation-monitoring networks in the USA and Canada, for 2002-2008, were combined to assess spatial patterns and temporal trends in 8 states and 2 provinces in the Great Lakes Region. Spatial patterns of annual mercury wet deposition were examined by generating high resolution maps based on precipitation-weighted annual mean mercury concentrations at 37 sites and annual precipitation depths at 1,541 sites. Temporal trends in weekly data were determined with the Seasonal Kendall Trends Test and the Seasonal Kendall Slope Estimator.

Year-to-year variations in spatial patterns of mercury wet deposition were observed throughout the region. Generally, mean annual mercury wet deposition was highest in the southern part of the study region and lowest in the north and followed patterns of mean annual precipitation depths. Localized areas with high annual mercury wet deposition (15 to 20 micrograms per square meter) were mapped in 6 of 7 years and typically corresponded with sites having high precipitation-weighted annual mean mercury concentrations.

Seven-year temporal trends in mercury wet deposition or mercury concentration were observed in data for weekly samples from 20 monitoring sites. For sites with significant trends, the median annual decrease or increase in weekly mercury concentration was less than a nanogram per liter. For a group of monitoring sites near southern Lake Michigan, trends of decreased mercury concentrations coincided with trends of increased precipitation depths. Significant 7-year trends in weekly mercury wet deposition were not coincident with trends in weekly mercury concentration.

During the 2002-2008 study period, mercury wet deposition was unchanged in the Great Lakes region or its sub-regions. Any small decreases in mercury concentration apparently were offset by increases in precipitation. Continued monitoring could detect whether these observations are consistent over a longer time period.

[1]U.S.Geological Survey, 5957 Lakeside Boulevard, Indianapolis, Indiana 46278, mrrisch@usgs.gov
(corresponding author, 317/290-3333 ext. 163)
[2]Illinois State Water Survey, University of Illinois, 2204 Griffith Drive, Champaign, Illinois 61820-7495, dgay@illinois.edu
[3]U.S.Geological Survey, 5957 Lakeside Boulevard, Indianapolis, Indiana 46278, kkfowler@usgs.gov
[4]University of Michigan, 6646 SPH Tower, 1415 Washington Heights, Ann Arbor, Michigan 48109-2029,
[5]Environment Canada, 867 Lakeshore Road, Burlington, ON M3H 5T4, sean.backus.ec.gc@gmail.com
[6]Environment Canada, 4905 Dufferin Street, Toronto, ON M3H 5T4, pierrette.blanchard@ec.gc.ca
[7]University of Michigan, M6210 SPH II, 1420 Washington Heights, Ann Arbor, Michigan 48109-2029, jbarres@umich.edu
[8]University of Michigan, 6642 SPH Tower, 1415 Washington Heights, Ann Arbor, Michigan 48109-2029, dvonch@umich.edu