Examination of Aquatic Acidification Index (AAI) component variability and implications for characterizing atmospheric and biogeochemical nitrogen processes.

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In 2006, EPA began the development of a secondary air quality standard to protect U.S. aquatic ecosystems from deposition of ambient oxides of sulfur and nitrogen (SOx/NOy). These efforts culminated in a quantity called the Atmospheric Acidification Index (AAI), which was a regionally representative parameter that was intended to project a water quality level resulting from depositing concentrations of SOx/NOy. This work presents results of subsequent analyses that 1) explores the possibilities of more flexible and efficient formulations of the AAI, 2) evaluates the plausibility of the AAI approach against ANC measurement data, and 3) investigates variability of AAI component variables to aid in planning future data collection efforts.

Current AAI evaluation results generally show strong correlations (e.g., $R^2 > 0.9$) between newly developed water-body specific AAI values and ANC measurements at over 900 water bodies across the U.S. Spatial patterns of AAI values capture relative adversity with respect to our current understanding of impacted surface waters across the nation. Future year projections suggest that aquatic acidification gradually will shift from an eastern U.S. focus driven largely by sulfur deposition toward a more evenly distributed picture of aquatic acidification nationally, with significant improvement in eastern systems and increasing importance of nitrogen deposition throughout the country (especially reduced forms) relative to sulfur. Analysis of atmospheric and biogeochemical components of the AAI model indicate greater relative variability associated with heterogeneity of surface and sub-surface features, suggesting that enhances in the frequency and distribution of water quality monitoring be considered together with air monitoring design for future applications.

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