How natural is the dissolved inorganic composition of Mississippi River water?

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The dissolved inorganic composition of rivers provides insights into natural interactions between the hydrologic cycle and the "critical zone" in watersheds, and anthropogenic modifications thereof. For instance, major ion compositions allow us to infer how effectively weathering processes counteract increasing atmospheric CO_2 concentrations. Prerequisite to such assessments is the ability to detect and correct for anthropogenic modifications of river chemistry.

An observatory campaign of the Mississippi River in New Orleans from July 2015 to October 2016 with an in-situ sensor system (LOBO-SUNA) and 161 discrete water samples reveals systematic changes in the dissolved ion and water stable isotope compositions, nutrient loading, and physical parameters of the Mississippi River. We compare this high-resolution data set to long-term data generated by the USGS at St. Francisville upstream of Baton Rouge, data from the USGS Baton Rouge gaging station and in-situ sensor system, as well as other historic geochemical data.

Results reveal systematic shifts in major ion composition in response to hydrologic conditions. In addition to such annual and interannual changes, long-term trends in concentrations of certain major ions are consistent with anthropogenic activities in the drainage basin that are reminiscent of well-known, long-term changes in nutrient fluxes. Our current working hypotheses explaining observed increases in Mg and Na concentrations, for example, are contaminations from road salt, from additives used in drinking and waste water treatment, as well as from groundwater pumping, particularly in the western part of the Mississippi River basin. Uncorrected, these changes impede our abilitiy to use the current chemical composition of Mississippi River water as a quantitative indicator of natural weathering processes in the watershed.