Dams impact carbon dynamics in U.S. rivers

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Dissolved organic carbon (DOC)—which leaches into freshwater systems from plants, soils, and sediments, and from other detritus present in the water itself—is the major food supplement for microorganisms and plays an important role in several environmental processes and in the global carbon cycle. In some aquatic systems such as estuaries the optically measurable colored component of dissolved organic matter (CDOM) is often proportional to the concentration of DOC.

CDOM forms when light-absorbing compounds are released into the water by decaying organic material and through photochemical degradation of certain organic compounds. Hence, CDOM reflects not just the environment and ecosystem, which is the source of the detritus, but also processes that deliver the organic matter into aquatic systems. Human activities, such as logging, agriculture, and waste water treatment, also affect CDOM levels in aquatic systems. It is relatively easy and inexpensive to measure the CDOM content in small volumes of water.

To examine the circumstances under which CDOM reflects DOC concentration, Spencer et al. measured CDOM and DOC concentrations in water collected from 30 rivers across the United States; the rivers represent a wide range of climate, watershed environments, ecosystems, and anthropogenic influence. Overall, the authors find that the CDOM level reflects the DOC concentration in the river water, except in four large rivers, namely, the Colorado, Columbia, Rio Grande, and St. Lawrence rivers.

These four rivers either drain from the Great Lakes or have significant restrictions within their watersheds such as dam building and other similar modifications. These activities result in long residence times of water, which may increase phytoplankton production, the relative contribution from human sources, or degradation of land-derived material by photochemical processes. As a result, there may have been a decoupling of CDOM from DOC, i.e., the amount of CDOM in these four rivers may have decreased without a concomitant decrease in DOC content. On the basis of their findings, the authors suggest that CDOM measurements in rivers are a useful way to investigate water quality and to monitor delivery of DOC into coastal regions as ecosystems respond to human activity and changes in climate in the near future.

More information: "Dissolved organic carbon and chromophoric dissolved organic matter properties of rivers in the USA" *Journal of Geophysical Research-Biogeosciences*, doi:10.1029/2011JG001928, 2012.

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