THE WOODS HOLE RESEARCH CENTER

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Scientists Expand Understanding of How River Carbon Impacts the Arctic Ocean

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Arctic rivers transport huge quantities of dissolved organic carbon (DOC) to the Arctic Ocean. The prevailing paradigm regarding DOC in arctic rivers it is that it is largely refractory, making it of little significance for the biogeochemistry of the Arctic Ocean. However, a recent study by R. M. Holmes of the Woods Hole Research Center and colleagues at collaborating institutions challenges that assumption by showing that DOC in Alaskan arctic rivers is remarkably labile during the spring flood period when the majority of annual DOC flux occurs. The research was published February 9 in Geophysical Research Letters.

According to Dr. Holmes, "Though only about 1% of global ocean volume, the Arctic Ocean receives almost 10% of global river discharge. As a consequence, organic carbon transported by arctic rivers has the potential to strongly impact the chemistry and biology of the Arctic Ocean".

The primary focus of the paper is the lability of dissolved organic carbon in Alaskan arctic rivers, or how available the DOC is for microbial decomposition. Because of logistical challenges, past studies have focused almost exclusively on the summer low-flow period, when numerous studies have shown arctic river DOC to be refractory. However, by timing their sampling to include the high-flow period just after the spring ice break, the authors found that much of the DOC discharged by Alaskan rivers to the Arctic Ocean is labile. Consequently, riverine inputs of DOC to the Arctic Ocean may have a much larger influence on coastal ocean biogeochemistry than previously realized, and reconsideration of the role of terrigenous DOC on carbon, microbial, and food-web dynamics on the arctic shelf is warranted.

Holmes says, "Though tantalizing evidence has been emerging in recent years, this study was the first to directly show that dissolved organic carbon in rivers during the spring flood period is highly labile."

Rivers sampled for this project were the Kuparuk, Sagavanirktok, and Colville rivers on the North Slope of Alaska. The next step will be to conduct similar experiments on larger arctic rivers, including the massive rivers entering the Arctic Ocean from Siberia.

Holmes adds, "If the pattern we've shown for Alaskan arctic rivers holds for the much larger Siberian rivers, and preliminary evidence suggests that it will, then we'll have to rethink the role of terrestrially-derived DOC as a potential energy source driving the coastal ocean foodweb in the Arctic."

Dr. Holmes is an earth system scientist with broad interests in the responses and feedbacks of ecosystems to environmental and global change. Most of his current research takes place in the Arctic (field sites are in Russia, Canada, and Alaska) and addresses how climate change is impacting the cycles of water and chemicals in the environment. Dr. Holmes is a member of the SEARCH Science Steering Committee (Study of Environmental Arctic Change) and is strongly committed to integrating education and outreach into his research projects, particularly by exposing K-12 and undergraduate students to the excitement of scientific research.

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cycle, forest function, landcover/land use, water cycles and chemicals in the environment, working in collaboration with partners ranging from local organizations to national governments and the United Nations.

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