Research reveals surprising seasonal changes in Hudson Bay currents

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Research by University of Alberta oceanographers is shedding new light

on the complexities of currents in Hudson Bay—and how the hydroelectric power industry may be affecting them.

"Our most significant finding was that there is a seasonal flow reversal in eastern Hudson Bay," said Natasha Ridenour, a Ph.D. student in the Department of Earth and Atmospheric Sciences and lead author of two studies on the topic.

"This gives us a better understanding of the impact the hydroelectric industry has on Hudson Bay—and a better understanding of where river water carries nutrients, pollutants and contaminants in the bay, which can get into the food chain."

Currents in Hudson Bay were previously thought to flow only counterclockwise, based on studies from the 1980s. But the researchers found that in May and June, the flow pattern in eastern Hudson Bay reverses and flows clockwise, while currents in the western part of the bay continue flowing counterclockwise.

Ridenour explained that the flow reversal is generated by winds and melting snow in the spring, but is also sensitive to where the river discharge enters the bay—which can be changed by hydroelectric operations.

"The results from these two papers tell us that river discharge is important, and that hydroelectric regulation likely has an impact on the bay," said Ridenour, who conducted the research under the supervision of oceanographer Paul Myers.

"This is especially important to understand if we are to increase hydroelectricity production as a form of renewable energy."

From the river to the sea

The drainage basin for the Hudson Bay region covers about 40 percent of Canada, with waters as far as the Rocky Mountains draining into the bay. This makes the area ideal for hydroelectric development, explained Myers, but means it's critical to understand the impact on the Hudson Bay system.

"With the expansion of the hydroelectric industry in Manitoba, Ontario and Quebec, the downstream impacts of altering river discharge are unknown," said Myers.

"This research is critical to fully understanding the impact of the hydroelectric industry on ocean currents in Hudson Bay, which is useful not only to the hydroelectric industry, but to the shipping industry and Indigenous communities along the coastline as well."

The studies, "Sensitivity of Freshwater Dynamics to Ocean Model Resolution and River Discharge Forcing in the Hudson Bay Complex" and "Revisiting the Circulation of Hudson Bay: Evidence for a Seasonal Pattern," were published in the *Journal of Marine Systems* and *Geophysical Research Letters* respectively.

More information: Natasha A. Ridenour et al. Revisiting the Circulation of Hudson Bay: Evidence for a Seasonal Pattern, *Geophysical Research Letters* (2019). DOI: 10.1029/2019GL082344

Natasha A. Ridenour et al. Sensitivity of freshwater dynamics to ocean model resolution and river discharge forcing in the Hudson Bay Complex, *Journal of Marine Systems* (2019). DOI: 10.1016/j.jmarsys.2019.04.002

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