Remnants of ice age linger in gravity

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Researchers have uncovered a large area of low but increasing gravity over North America – the lingering effect of the last ice age when sheets of ice sometimes three kilometres thick covered nearly all of Canada and the northeastern U.S.

The study, published in the May 11 issue of *Science*, is the first to show a map of ongoing changes in the gravity field over North America due to the ice age. It provides an unprecedented image of the geometry of the long-vanished Laurentide ice sheet: a massive ice complex that had two major domes, one east and the other west of the Hudson Bay area, and raised global sea-level about 60 metres when it disappeared.

"There are many uncertainties about the last ice age and its impact on the Earth," says U of T Professor of Physics Jerry Mitrovica, Director of the Earth System Evolution Program of the Canadian Institute for Advanced Research and one of the study's authors. "We are able to show that the ghost of the ice age still hangs over North America."

The study, performed in collaboration with Drs. Mark Tamisiea and James Davis of the Harvard-Smithsonian Center for Astrophysics, analyzed four years of data collected from the Gravity Recovery and Climate Experiment (GRACE) satellite mission – a pair of satellites that are measuring the Earth's gravitational field to determine how mass is being redistributed on the planet.

The researchers uncovered tiny changes in the gravity over Canada, reflecting the recovery of the Earth's crust that was pushed down by the

weight of the thick ice sheet. "These are parts of the crust that haven't completely rebounded from the giant depression caused by the ice," explains Dr. Tamisiea. "The ongoing uplift of the land continues to have an effect on gravity. Constraining the geometry of the ice is important to understanding ice age climate, and it is also important for making accurate corrections before we interpret modern climate records."

The ice age isn't the only thing responsible for the continental scale depression. According to Mitrovica, movement of material in the Earth's interior associated with plate tectonics is also pushing the area down. "When we think of plate tectonics we think of the plates moving horizontally, but mantle flow also shifts plates vertically," he says. "This movement is endemic in continents, like rafts being pushed downward by descending currents of water, and our study has also helped us to uncover this remarkable aspect of plate tectonics."

Source: University of Toronto