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A glacier's pace

How much do glaciers contribute to rising sea levels?

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Satellites are being used to measure how much ice glaciers are calving off into the ocean. (Photo: ClimbOne)

Satellite measurements of Canadian glaciers are starting to provide a precise picture of the impact of climate change.

Ice caps and glaciers cover 150,000 square kilometres of the Canadian Arctic Islands, the largest such area outside of the Greenland and Antarctic ice sheets. Over the past 10 years, Natural Resources Canada (NRCan) scientists have been measuring the velocity of this area of land ice with the help of the Canadian Space Agency-funded Radarsat-1 and Radarsat-2 satellites. These satellites can detect changes as small as 30 millimetres.

Armed with a glacier's velocity, researchers can then use its width and depth to calculate the volume of ice calving off into the ocean over a given period of time.

That is crucial information for coastal communities trying to adapt to changing sea levels, says NRCan Ottawa-based research scientist Thomas James. "If you don't have a good sense of the calving, you're missing a component of the glacier's contribution to sea level change."

James has combined estimates of sea-level contributions of ice sheets and glaciers with other measurements to create more precise estimates of sea level change in Canada’s North. For example, he estimates a sea level rise anywhere between 0 and 70 centimetres by 2100 off the coast of Iqaluit on Baffin Island.

Using satellite data also gives scientists a better handle on mass balance. “The concept is pretty simple,” says glaciologist Mike Demuth at NRCan. “What adds to the glacier, what takes away from the glacier, and what do you have at the end of the year?”

While NRCan researchers have been visiting parts of the massive Devon Island ice cap for decades to measure surface mass balance, it’s an expensive proposition. In situ measurements show that since 1961, the northwest section has lost an average of five metres of thickness.

But with the help of Radarsat-2, scientists can now monitor the entire Devon ice cap. That has to be a relief to any researcher with the dangerous task of measuring how much ice is calving off into the ocean.

As for the thickness of Canada’s glaciers, NRCan scientists will soon be working with data from the European Space Agency’s CryoSat-2 satellite, launched in 2010. CryoSat-2 can take 20,000 measurements of a glacier’s elevation every second, from which scientists can extrapolate changes in thickness.

“What we are interested in measuring can vary rapidly in time and space,” says Demuth. “These methods help us understand whether changes are unique and of concern.”

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