Study shows increased summer melting not increasing annual movement of Greenland ice sheet

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Isua Supracrustal Belt Isua, south-west Greenland. Credit: University of Washington.

(Phys.org) —A team with members from Scotland, the U.K. and Australia has found that despite record melting in the summer of 2012, the Greenland ice sheet is not slipping faster into the sea. The team reports on how they set up poles in the ice and measured their movement throughout the year in their paper published in *Proceedings of the National Academy of Sciences*.

For several years, climate scientists have been worried about the possibility of global warming causing the Greenland ice sheet to slide right off the continent into the sea, causing a massive sudden rise in

worldwide ocean levels. The worry came about as temperature increases caused more melting which led to water making its way beneath the ice sheet. That water would then lead to less friction and thus faster movement of the ice sheet.

But, according to the results of the researchers studying the problem, that doesn't appear to happening—instead, the increased water flow below the ice in the summer, appears to put the brakes on sliding on the water as it freezes in place the following winter, resulting in less movement on an annual basis.

The team made this discovery by pounding tall poles into the ice at various locations in the ice sheet and then measuring how far they moved (using GPS) over the course of a year. In analyzing the data they obtained, the team found that despite record melting in the summer of 2012, which resulted in a dramatic increase in movement (up to twice as fast as normal at times), the ice sheet actually moved 6 percent less than normal over the course of the entire year, as the flow slowed dramatically in the winter due likely to the water underneath freezing.

This is good news for the world community, of course, as concerns about a rapid rise in ocean levels rising due to global warming has caused panic in places that would be most impacted—seaside towns and cities and of course those who live on islands. It's important to note that the data suggests that people will have longer to plan for ocean levels rising, not that it won't happen.

More information: Greenland ice sheet motion insensitive to exceptional meltwater forcing, *PNAS*, Published online before print November 18, 2013, DOI: 10.1073/pnas.1315843110

Abstract
Changes to the dynamics of the Greenland ice sheet can be forced by

various mechanisms including surface-melt–induced ice acceleration and oceanic forcing of marine-terminating glaciers. We use observations of ice motion to examine the surface melt–induced dynamic response of a land-terminating outlet glacier in southwest Greenland to the exceptional melting observed in 2012. During summer, meltwater generated on the Greenland ice sheet surface accesses the ice sheet bed, lubricating basal motion and resulting in periods of faster ice flow. However, the net impact of varying meltwater volumes upon seasonal and annual ice flow, and thus sea level rise, remains unclear. We show that two extreme melt events (98.6% of the Greenland ice sheet surface experienced melting on July 12, the most significant melt event since 1889, and 79.2% on July 29) and summer ice sheet runoff ~3.9σ above the 1958–2011 mean resulted in enhanced summer ice motion relative to the average melt year of 2009. However, despite record summer melting, subsequent reduced winter ice motion resulted in 6% less net annual ice motion in 2012 than in 2009. Our findings suggest that surface melt–induced acceleration of land-terminating regions of the ice sheet will remain insignificant even under extreme melting scenarios.

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