The contribution of the Greenland ice sheet to sea-level rise will continue to increase

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New research has shown surface ice melt will be the dominant process controlling ice-loss from Greenland. As outlet glaciers retreat inland the other process, iceberg production, remains important but will not grow as rapidly.

The Greenland ice sheet is often considered an important potential contributor to future global sea-level rise over the next century or longer. In total, it contains an amount of ice that would lead to a rise of global sea level by more than seven metres, if completely melted.

Changes in its total mass are governed by two main processes - fluctuations in melting and snowfall on its surface, and changes to the number of icebergs released from a large number of outlet glaciers into the ocean.

The ice loss from the ice sheet has been increasing over the last decade, with half of it attributed to changes in surface conditions with the remainder due to increased iceberg calving – the process by which ice detaches from the glacier to become an iceberg.

Researchers from the Vrije Universiteit Brussel, funded by ice2sea, a European Union project, tackled the question of how both processes will evolve and interact in the future. This was done with a computer model, which projects the future ice sheet evolution with high accuracy using the latest available techniques and input data.

They devised a method to generalize projections made in earlier research which concerned just four of Greenland's outlet glaciers. By doing so they could apply the earlier findings to all calving glaciers around the Greenland ice sheet. Their results indicate a total sea-level contribution from the Greenland ice sheet for an average warming scenario after 100 and 200 years of 7 and 21 cm, respectively.

The balance between the two processes by which ice is lost is, however, changing considerably in the future so that iceberg calving may only account for between 6 % and 18 % of the sea-level contribution after 200 years. This is important, because variations in outlet glacier dynamics have often been suspected to have the potential for very large sea-level contributions.

Lead author Dr Heiko Goelzer, of the Vrije Universiteit Brussel, says,

"Our research has shown that the balance between the two most important mass loss processes will change considerably in the future so that changes in iceberg calving only account for a small percentage of the sea-level contribution after 200 years with the large remainder due to changes in surface conditions."

The limited importance of outlet glacier dynamics in the future is the result of their retreat back onto land and of strongly increasing surface melting under global warming, which removes ice before it can reach the marine margin.

Ice2sea coordinator Professor David Vaughan, of the British Antarctic Survey says,

"This scenario is no reason to be complacent. The reason the significance of calving glaciers reduces compared to surface melting is, so much ice will be lost in coming decades that many glaciers currently

sitting in fjords will retreat inland to where they are no longer affected by warming seas around Greenland."

More information: The paper Sensitivity of Greenland ice sheet projections to model formulations by Dr Heiko Goelzer et al is published on Wednesday (10.07.2013) online by the *Journal of Glaciology*.

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