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Improving the constraint on present-day ice mass changes with tide gauge data

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In this study it is examined whether the present-day ice mass balance variation derived from satellite observations over the ice sheet can be validated using tide gauge data. In order to do so, the present-day ice mass changes must be derived from the tide gauge measurements. This is achieved by fitting the distinct geographical dependent pattern produced by the response of the elastic Earth to ice mass changes, the so-called fingerprints, to the sea level change observed by the tide gauges.

In the past it has been demonstrated that by use of a limited number of tide gauges, a value for uniform melt of the ice-sheet in Greenland and Antarctica can be obtained [1]. Here the number of applicable tide gauges is increased by applying corrections for solid earth deformation. Next to the global effect of post glacial rebound, estimates for contributions of local geophysical processes are used. Furthermore, GRACE observations are used to constrain the spatial fingerprint over the oceans and to estimate the separate contribution of the ocean mass and volume changes to the tide gauges.

Several melting scenarios are then tested against this enlarged date set. This way it is examined whether it provides sufficient constraint to distinguish between areas of land based ice melt and growth as observed by satellites.

[1] Mitrovica J.X., et al, Recent mass balance of polar ice sheets inferred from patterns of global sea-level change, Nature 409, 1026-1029 (2001)