



Mass balance of Greenland from combined GRACE and satellite altimetry inversion

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With 12 years of GRACE satellite data now available, the ice mass loss trend of Greenland are clearly demonstrating ice mass loss in marginal zones of the ice sheets, and increasing mass loss trends in some regions such as the north west marginal zones. Although the GRACE release-5 products have provided a significant increase in resolution, the detailed space-based detection of where the ice sheet is losing mass needs to come from other sources, notably satellite altimetry from EnviSat, IceSat and CryoSat, which point out the detailed location of areas of change, and – when combined with firn compaction and density models – also can be used to infer mass changes. In the paper we outline results of a novel direct inversion method, where all satellite data can be utilized in a general inverse estimation scheme, and the leakage from neighbouring ice caps minimized. We demonstrate overall mass change results from Greenland and Eastern Canadian Ice Caps 2003-14, highlighting the increasing melt in the marginal zones both in NW and NE Greenland, and highlighting the dynamic nature of the Greenland ice sheet mass loss through the 2012 record melt event, and the 2013 mass gain anomaly.

The used data for the Greenland Ice Sheet are provided partly through the ESA Ice Sheets CCI project 2012-17, which will make available long term Essential Climate Variables such as Surface Elevation Changes, Ice Velocity, Mass Balance and Calving Front Locations.