



Using an SLR inversion to measure the mass balance of Greenland before and during GRACE

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The GRACE mission has done an admirable job of measuring large-scale mass changes over Greenland since its launch in 2002. However before that time, measurements of large-scale ice mass balance were few and far between, leading to a lack of baseline knowledge. High-quality Satellite Laser Ranging (SLR) data existed a decade earlier, but normally has too low a spatial resolution to be used for this purpose. I demonstrate that a least squares inversion technique can reconstitute the SLR data and use it to measure ice loss over Greenland. To do so, I first simulate the problem by degrading today's GRACE data to a level comparable with SLR, then demonstrating that the inversion can re-localize Greenland's contribution to the low-resolution signal, giving an accurate time series of mass change over all of Greenland which compares well with the full-resolution GRACE estimates. I then utilize that method on the actual SLR data, resulting in an independent 1994-2014 time series of mass change over Greenland. I find favorable agreement between the pure-SLR inverted results and the 2012 Ice-sheet Mass Balance Inter-comparison Exercise (IMBIE) results, which are largely based on the "input-output" modeling method before GRACE's launch.