

Mass Loss and Surface Displacement Estimates in Greenland from GRACE

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Abstract:

The Gravity Recovery and Climate Experiment (GRACE) has provided monthly solutions of the global gravity field since 2002. These monthly solutions can be used to estimate the mass balance of the Greenland Ice Sheet (GrIS). In this project, the post-processing required in order to isolate the signal originating from the ice sheet and the common filtering methods used to remove the correlated noise patterns dominating the signal is described.

Using the inversion method by Wahr et al. (1998) 129 monthly solutions, from the latest Release-05 data product, spanning from April 2002 until January 2014 are converted to mass balance estimates, relative to the average of the time period, in a grid of points spanning the Greenland area. The secular and seasonal components of temporal variation are determined in each grid point, for both filtered and unfiltered time series, and their spatio-temporal character is discussed. Estimating mass change using three different filtering techniques reveals similar time series.

The filtering methods effectively remove the spatially correlated error patterns, but also influences the temporal variation of the mass change estimates, by reducing the amplitude of seasonal variation and rate of mass loss. The inter-annual variation of the seasonal parameters is compared with climatological data at a single coordinate point, using meteorological observations from the same location. This comparison shows that the seasonal variation correlates best with winter temperatures.

The spatio-temporal patterns of mass change found in this study is similar to GRACE estimates found by Kjær et al. (2012) and Ice, Cloud, and Land Elevation Satellite (ICESat) estimates found by Sasgen et al. (2012), taking into account the different resolution of ICESat and GRACE observations.