

Scatter of mass changes estimates at basin scale for Greenland and Antarctica - DTU Orbit (09/11/2017)

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During the last decade, the GRACE mission has provided valuable data for determining the mass changes of the Greenland and Antarctic ice sheets. Yet, discrepancies still exist in the published mass balance results, and comprehensive analyses on the sources of errors and discrepancies are lacking. Here, we present monthly mass changes together with trends derived from GRACE data at basin scale for both the Greenland and Antarctic ice sheets, and we assess the variability and errors for each of the possible sources of discrepancies, and we do this in an unprecedented systematic way, taking into account mass inference methods, data sets and background models. We find a very good agreement between the monthly mass change results derived from two independent methods, which represents a cross validation. For the monthly solutions, we find that most of the scatter is caused by the use of the two different data sets rather than the two different methods applied. Besides the well-known GIA trend uncertainty, we find that the geocenter motion and the recent de-aliasing corrections significantly impact the trends, with contributions of $+13.2 \text{ Gt yr}^{-1}$ and -20 Gt yr^{-1} , respectively, for Antarctica, which is more affected by these than Greenland. We show differences between the use of release RL04 and the new RL05 and confirm a lower noise content in the new release. The overall scatter of the solutions well exceeds the uncertainties propagated from the data errors and the leakage (as done in the past); hence we calculate new sound total errors for the monthly solutions and the trends.

We find that the scatter in the monthly solutions caused by applying different estimates of geocenter motion time series (degree-1 corrections) is significant – contributing with up to 40% of the total error.

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