

GEOPHYSICAL MASS REDISTRIBUTIONS FROM GRACE: THE CASE OF THE ANTARCTIC AND GREENLAND ICE SHEETS

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ABSTRACT.

The GRACE (Gravity Recovery and Climate Experiment) satellite mission launched in 2002 is able to observe global geophysical mass redistributions through their gravitational effect. At a long-term scale, they are dominated by ice-related processes, i.e., ice mass changes and glacial-isostatic adjustment of the solid earth. GRACE has, indeed, proven a valuable and unique tool for assessing, in particular, the large ice sheets' mass changes. However, respective results from different analyses differ considerably. A thorough understanding of the various error mechanisms involved in the GRACE data analysis and in the geophysical reductions is necessary to ensure reliable results with realistic uncertainty assessments as well as to advance the methods of analysis.

We present our results on Antarctic and Greenland ice mass changes obtained with an adapted methodology from the Release 04 monthly GRACE solutions by GeoForschungsZentrum Potsdam for the time interval from 08/2002 to 01/2008. We consider mass changes of the entire ice sheets but also of their individual large drainage basins. For Antarctica, for example, we detect ice mass loss which is clearly dominated by changes in the Amundsen Sea Sector and Northwest Marie Byrd Land (West Antarctica) while East Antarctica appears to be near balance. We also discuss global "fingerprints" of the detected ice mass changes in terms of sea level variations and crustal load deformations.

Emphasis is put on a thorough error assessment which exceeds previous work. The obtained insights may help to resolve some of the differences between the results of different studies and open the way to even more reliable and more detailed GRACE inferences on global mass redistributions.