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Uncertainties in the mass balances of Greenland and Antarctica reconstructed from monthly GRACE level 2 temporal gravity solutions

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With the availability of monthly GRACE level 2 temporal gravity solutions since 2002 we are able to reconstruct the mass balances of the main ice sheets on earth. The reconstruction procedure of the mass balance graphs is however not trivial and depends on at least four assumptions which are discussed in this paper. The first assumption is that our reconstruction procedure is based on an elastic loading theory, which is applied to the potential coefficients observed by GRACE, whereby we remark that gravity flattening of the Earth (due to coefficient C20) requires us to import knowledge from satellite laser ranging. The second assumption is that there is a glacial isostatic adjustment model that describes the visco-elastic rebound of the Earth due to paleo ice sheet loading. A third assumption is that the degree 1 terms of the temporal gravity solutions follow from present day exchanges of mass on Earth which affect the definition of the geocenter. The third assumption imports knowledge from the geocenter for which different possibilities exist. The fourth assumption is that we can undo the consequence of observing the mass changes on Earth with a band limited system such as GRACE which offers a spatial resolution no better than 300 km. The consequence of all above mentioned steps directly affects the outcome of the reconstructed rates of mass change for Greenland and Antarctica. We will show a comprehensive overview of these steps in an attempt to explain the possible limitations and capabilities of the current GRACE system.