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A new mascon approach to assess global ice sheet and glacier mass balances from GRACE.

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Purpose of this paper is to assess the mass balances of the Greenland Ice Sheet (GrIS), Ice Sheets over Antarctica (AIS) and Land Glaciers and Ice Caps (LGIC) with a new method that yields monthly mass variations at 10242 mascons. Input for this algorithm are level 2 data from the GRACE system between 2002.7 and 2012.2. An ensemble of recently updated GIA models based upon new ice history models show for Greenland a mass change of -271 ± 21 Gt/yr which is compatible with mass balances computed from the ICE-5G based GIA models. Whereas the mass balances for the GrIS appear to be insensitive to GIA modeling uncertainties this is not anymore the case for the mass-balance of Antarctica. Ice history models for Antarctica were recently improved and updated historic ice height datasets and GPS time series have been used to generate new GIA models for Antarctica. We investigated the performance of two new GIA models dedicated for Antarctica and found an average mass balance of -91 ± 27 Gt/yr which is approximately 88 Gt/yr less negative than a mass balance derived with the ICE-5g based GIA models. The largest GIA model differences occur on East Antarctica; within the analyzed time window two episodic events occurred in 2009 and 2011 on Dronning Maud land which are related to extreme weather events. The mass balance of land glaciers and ice caps currently stands at -174 ± 8 Gt/yr for which there is no alternative other than to use an ICE-5G based GIA models. We assess the mass-driven part of sea level rise budget at 1.48 ± 0.04 mm/yr which is 0.25 mm/yr less than obtained with traditional GIA models.