



Reduction of GIA errors in GRACE and altimetry-based solutions for interannual ice mass balance for the Earth's ice sheets

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Recent reports on the interannual ice mass loss/gain for East and West Antarctica, and for 4 geographical quadrants of Greenland, have given somewhat discrepant results, varying generally by as much as, or even in excess of, 100 Gt/yr (~ 0.28 mm/yr equivalent sea level rise equivalent, or ESLR). Here we examine the level of discrepancy attributable to errors in the glacial isostatic adjustment (GIA) components, tides, oceans, atmosphere, hydrology and filtering technique. GIA may be especially poorly modeled and we focus attention to the full breadth of the uncertainty for these models and isolate their impact on both altimetry and gravity change interpretation. Toward this purpose, Global Positioning System (GPS) satellite geodesy has emerged during the last decade as a powerful method for connecting past ice sheet and glacier evolution to present-day uplift patterns and magnitudes and we show how these data may be integrated to form tighter constraints on present-day secular ice sheet change. The imbalance ESLR error caused by GIA error for Antarctica may be reduced by factors of 2 or more in certain regions of Antarctica with proper application the uplift data.