Geophysical Research Abstracts
Vol. 14, EGU2012-2460-1, 2012
EGU General Assembly 2012

Recent contributions of all ice-covered regions, including mountain glaciers and ice caps, to sea level rise, as inferred from GRACE

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Glaciers and ice caps (GIC) are important contributors to present-day global mean sea-level rise (SLR). Most previous global mass balance estimates for GIC rely on extrapolation of sparse mass balance measurements representing only a small fraction of the GIC area- leaving their overall contribution to SLR unclear. Here we show that GIC, excluding the Greenland and Antarctic peripheral glaciers and ice caps (PGIC's), lost mass at a rate of 148 $\pm$ 30 Gt yr-1 from January 2003 to December 2010, contributing 0.41 $\pm$ 0.08 mm yr-1 to SLR. Our results are based on a global, simultaneous inversion of monthly GRACE-derived satellite gravity fields, for mass change over all ice-covered regions. Our GIC rate for 2003-2010 is about 30% smaller than earlier estimates most nearly matching this period that relied on extrapolation of mass balance measurements. The high mountains of Asia, in particular, show a mass loss of only 4 +- 20 Gt yr-1 for 2003-2010, compared to 47-55 Gt yr-1 in previously published estimates. We also estimate that the Greenland and Antarctic ice sheets, including their PGIC's, lost 384 $\pm$71 Gt yr-1, contributing 1.06 $\pm$ 0.19 mm yr-1 to SLR over the same time period. The total SLR contribution from all ice-covered regions was then 1.48 $\pm$ 0.26 mm yr-1, agreeing with independent estimates of SLR from new water to within the respective error bars.
In this talk, we will present results both for the GIC, and for the Greenland and Antarctic ice sheets. For the ice sheets, we will show GRACE results that illustrate how the ice loss patterns have been changing over the last decade.