



HAL
open science

Recent contributions of glaciers and ice caps to sea level rise, from GRACE

Thomas Jacob, J. Wahr, T. Pfeffer, S. Swenson

► **To cite this version:**

Thomas Jacob, J. Wahr, T. Pfeffer, S. Swenson. Recent contributions of glaciers and ice caps to sea level rise, from GRACE. Colloque G2 (Géodésie-Géophysique) 2011, Nov 2011, Marne-la-Vallée, France. hal-00633384

HAL Id: hal-00633384

<https://brgm.hal.science/hal-00633384>

Submitted on 18 Oct 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Recent contributions of glaciers and ice caps to sea level rise, from GRACE

Thomas Jacob^{1*}

John Wahr¹

Tad Pfeffer^{2,3}

Sean Swenson⁴

¹ Department of Physics and Cooperative Institute for Environmental Studies, University of Colorado at Boulder, Boulder, Colorado, 80309, USA

² Institute of Arctic and Alpine Research, University of Colorado at Boulder, Boulder, Colorado, 80309, USA

³ Department of Civil, Environmental, and Architectural Engineering, University of Colorado at Boulder, Boulder, Colorado, 80309, USA

⁴ National Center for Atmospheric Research, Boulder, Colorado, 80305, USA

* Now at Bureau de Recherches Géologiques et Minières, Orléans, France

Summary paragraph

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 interpolation of sparse mass balance measurements, representing a small fraction of the GIC area. Instead, we here perform a global, simultaneous inversion of mass change over all ice-covered regions larger than 100 km² using monthly GRACE-derived satellite gravity fields spanning January 2003 to December 2010. This is the first GRACE-based study where every such GIC region is considered and the results quantified. We conclude that GIC, excluding the Greenland and Antarctic peripheral glaciers and ice caps (PGIC), lost mass at a rate of 148 ± 30 giga tonnes per year (Gt/yr) during this period, contributing 0.41 ± 0.08 mm/yr to SLR. This rate is significantly smaller than previous estimates that rely on extrapolation of mass balance measurements. Our high mountain Asia (HMA) result, in particular, shows only a modest mass loss; far smaller than previously published estimates. For completeness, we also consider Greenland and Antarctica for this same time period, and find that those ice sheets, including their PGIC lost 384 ± 71 Gt/yr, contributing 1.06 ± 0.19 mm/yr to SLR. The total SLR contribution from all ice-covered regions was then 1.48 ± 0.26 mm/yr, agreeing with independent estimates of SLR from new water to within the respective error bars.