Ongoing Changes in Glacier Elevation and Mass, Larsen A and B Embayments, Antarctic Peninsula

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Abstract

We investigate the elevation and mass balance response of northern Antarctic Peninsula tributary glaciers over the period 2001 to the present following the loss of the Larsen A and B ice shelves (in 1995 and 2002 respectively). Our study uses MODIS imagery to track ice extent, and ASTER and SPOT5 satellite stereo-image DEMs plus ATM, LVIS, and ICESat laser altimetry to track elevation changes, spanning the period 2001-2010. The measured Larsen B tributary glaciers (Hektoria, Green, Evans, Punchbowl, Jorum and Crane) have lost up to (165 m in elevation during 2001-2010. Elevation changes were small for the more southerly Flask and Leppard glaciers, which are still constrained by a remnant of the Larsen B Ice Shelf in Scar Inlet. In the Larsen A embayment, continued thinning of >3 m a^{-1} on Drygalski Glacier, 14 years after the Larsen A Ice Shelf disintegrated, suggests that mass losses for the exposed Larsen B tributaries will occur well into the future. Grounded ice volume losses now exceed 13 km^3 for the Crane Glacier and 30 km^3 for the Hektoria-Green-Evans glaciers. The combined mean loss rate for 2001-2006 is at least 11.2 Gt a^{-1} and continues into the Operation Ice Bridge (OIB) time frame. Our values differ significantly from other published mass-budget-based estimates for these embayments, but are a reasonable fraction of GRACE-derived rates for the overall northern Peninsula mass-loss region (~40 Gt a^{-1}).