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Tributary Glacier Elevation and Mass Loss in the Larsen A and B Ice Shelf Embayments, 2001-2010

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Analysis of multi-sensor elevation data sets acquired over the tributary glaciers of the Larsen A and B ice shelves spanning the period from before the Larsen B shelf disintegration into late 2010 has quantified remarkable decreases in glacier volume. Elevation changes have been minimal for adjacent large glaciers still constrained by a remnant ice shelf. Our study continues to use a combination of MODIS imagery, ASTER and SPOT5 image-derived DEMs, airborne laser altimetry, as well as ICESat laser altimetry to determine timing, extent, and magnitude of ice elevation change on the Drygalski, Hektoria-Green-Evans, Jorum, and Crane Glaciers. Crane Glacier exhibited a rapid ice front retreat of over $\sim$10 km between 2002 and late 2004; although the ice front position stabilized by early 2006, elevation loss continued, and locally exceeded 90 m/year. 2001-2010 losses on the lower trunk are about 180 m as measured by a combination of DEM, ICESat, and ATM data. Elevation losses now extend over the full length of the Crane, well up into all its main tributaries. Jorum Glacier lost 30 to 40 m elevation in its lower 7 km in the period late 2002 to 2006, but losses were not as significant upstream. The Hektoria-Green-Evans glacier system had >100 m elevation loss between 2001-2006 and continues to thin at about 30 m/yr with the Evans becoming distinctly shorter and splitting into two branches. Continued elevation losses by Drygalski Glacier at >3 m/yr for the interval, spanning 6 to 14 years after the 1995 disintegration of the Larsen A Ice Shelf, suggest that response of the Larsen B tributaries will continue for many years. Grounded ice volume losses exceed 13 km3 for Crane Glacier and 30 km3 for Hektoria-Green-Evans over 2001 – 2006 and will be updated with fully calibrated 2010 data. Total mass loss exceeds 62 km3 overall for the study area during this period. These changes account for nearly 30% of the total mass loss estimated by GRACE satellite gravity analysis for the Antarctic Peninsula over similar time periods.