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Crane Glacier in the Larsen B Embayment: Faster, Slower, Higher, Lower after Ice Shelf Loss

C. Shuman (1), C. Hulbe (2), and T. Scambos (3)

(1) Goddard Earth Science and Technology Center, University of Maryland Baltimore Campus, (2) Department of Geology, Portland State Universiy, (3) National Snow and Ice Data Center, University of Colorado, Boulder (teds@nsidc.org)

Repeat ice velocity and elevation mappings of Crane Glacier and other outlet glaciers feeding the former Larsen B ice shelf and remnant Scar Inlet shelf show a complex, continuing response to the loss of the shelf and ice-ocean interaction. Although the initial response of Crane Glacier (April 2002 - January 2004) was acceleration (a 3-fold increase), subsequent ice velocity mappings using late 2004, 2005 and 2006 ASTER data show time-transient behavior that includes both slowdown and re-acceleration. While post-collapse speed-up is evident for the larger (wider) Larsen B glaciers, smaller (narrower) glaciers appear not to have changed. The difference is likely the result of differences in stress balance due to differences in valley geometry. Wider glaciers are more vulnerable to perturbation at their downstream ends because longitudinal stresses take up a larger portion of the overall stress balance than is the case for narrower glaciers. Depth of the valley floor likely also plays a role, as it is a key component in the stability of the calving front.

Repeat elevation profiles from the ICESat laser altimeter a few km inland from the current ice edge relative to ATM elevations acquired on NASA/CECS P3 flights showed $>$130 m lowering of the ice surface through October 2005 (mean of $\sim$45 m/year from late 2002 ATM flight to late 2005 ICESat track). Since then, drawdown rates slowed considerably at this location with a mean loss of $\sim$10 m/year between late 2005 and April 2007. However, substantial elevation losses ($>$15 m) occurred between June 06 and November 06 $\sim$50 km inland from the Crane Glacier's post-collapse ice edge indicating that the impact of the ice shelf's collapse has propagated over the majority of

the Crane's flow system.

Ice front retreat rates were initially very rapid during 2002-2005(?), but have since slowed as the glacier re-stabilized on bedrock highs. This variable response in speed and elevation, and the important role of sub-glacial topography, partly revealed by KU radar data acquired on the NASA/CECS P3 flights, is reminiscent of recent behavior of southeastern Greenland glaciers following ice tongue retreat. Recent structural changes in the lower remaining Crane Glacier ice trunk (now retreated 15 km from its former grounding line) suggest that a further round of retreat, acceleration, and elevation loss increases is imminent.