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Basal melt rate at the Larsen-C Ice Shelf

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During the past decade, the Larsen Ice Shelf has progressively thinned and two large sections have collapsed, catastrophically, leading to increased ice discharge into the oceans and a global sea level rise of about 0.07 mm yr-1. If similar events are to occur at the remaining Larsen-C section, the fate of a tenfold greater ice reservoir hangs in the balance. Although the origin of the underlying instability has yet to be determined, only three processes can realistically be to blame; enhanced basal or surface melting, or accelerated flow.

To quantify rates of basal ice melting, we deployed a phase sensitive radar at the Larsen-C Ice Shelf in 2008. The radar is a high-precision instrument that directly measures changes in ice thickness at the base of the ice shelf, in contrast to indirect methods which infer basal melting from surface observation while assuming steady state equilibrium. During the spring 2008, we established three sites at the Larsen-C where time-series of satellite altimeter data are also available. In the spring 2009, the 3 sites have been re-visited twice with the objective of measuring yearly and summer rates of basal melting. We combine the phase sensitive radar observations with measurement of surface mass balance, gps-determined strain rates, surface velocity field from InSAR and elevation changes from altimetry to quantify the role of basal melting in the overall mass balance of the Larsen-C Ice Shelf.