Glacier-Ocean Interactions on Short Timescales: can observations of tidal and calving impacts on near-terminus ice flow inform us about controls on terminus stability?

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Many tidewater glaciers have experienced rapid change over the last decade. Increases in velocity, enhanced thinning, and retreat of the calving fronts have increased Greenland's contribution to sea level. Improving our understanding of the mechanisms related to terminus stability for these glaciers would seem important, but observations of short-term variability are difficult. Here we present observations made with a pair of ground based portable radar interferometers (GPRI) during a two-week deployment along Jakobshavn Isbrae during which we were able to observe the glacier flow response to the tide and multiple calving events. The range (~16 km) and fast acquisition time (3 minutes) of the GPRI allowed collection of thousands of interferograms showing ice flow in the lower 10+ kilometers of the glacier, as well as patterns of displacement in the pro-glacial ice mélange which covers the fjord. Our data show that of the ~12 different calving events observed only one produced a significant (~33%) increase in velocity that persisted for several days. The ice mélange response to calving varied spatially with the location of those events along the calving face. In addition, we were able to map the spatial extent and amplitude of the ice flow response to the tidal cycle for the lower glacier. These measurements are one way to probe controls on ice flow in the lower reach of a large tidewater glacier.