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Tidally induced displacement of the hinge zone of 79°N Glacier, Greenland

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At the transition between inland ice and floating tongues, tidal uplift is forcing the grounding line to move on short time scales and cause bending. Tidal forcing also affects the horizontal motion of the glacier far upstream the grounding line, as an effect of non-linear sliding. Here we aim at studying the tidally induced bending at the hinge zone of 79°N Glacier in Greenland, which drains the North East Greenland ice stream and forms a floating tongue. For this purpose, in a field campaign numerous GPS stations were used to observe displacement in horizontal and vertical direction. We compare the vertical displacement to bending derived using satellite-borne Synthetic Aperture Radar (SAR) interferometry. GPS stations are distributed along flow lines reaching up to 50km upstream the grounding zone covering nearly one tidal cycle in summer 2016. Numerous double differential interferograms were derived from ERS-2, TerraSAR-X and Sentinel-1 data, challenging loss of coherence due to high glacier velocities and significant surface melting during summer. Based on these datasets, we assess the bending of the glacier in the hinge zone and the phase shift arising from the viscoelastic response of the ice to tidal forcing.