High-resolution topographic and velocity measurements from TanDEM-X data for Helheim and Kangerdlugssuaq glaciers in south-east Greenland

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Approaches to developing an understanding of how calving glaciers respond to warming oceans and atmosphere involve a combination of observational and modelling studies. The high-resolution models needed to determine the responses of specific glaciers to regional forcing require initialisation and validation with equally high-resolution observations. Here we use sequences of TanDEM-X acquisitions over ‘supersites’ Helheim and Kangerdlugssuaq glaciers in south-east Greenland to generate high spatial resolution interferometric digital elevation models (DEMs) and to feature-track surface displacement between image acquisitions. The day/night, and cloud-penetrating capabilities of the X-band SAR system are particularly advantageous in polar regions. We will present time series of DEMs for both Kangerdlugssuaq and Helheim glaciers at the unprecedented spatial resolution of 2 m. The DEMs span the period June 2011 to December 2012, at 11-day intervals, with a few breaks. Time-lapse animations of Helheim DEMs reveal the development of troughs in surface elevation close to the front. The troughs propagate down flow and develop into the rifts from which calving takes place. On both glaciers, regions of high variance in elevation can be identified caused by the transit of crevasses. In addition, on Helheim, a 1 km wide band of high variance adjacent to the calving front may be interpreted as the response to tidal forcing of a partially floating tongue. In addition to the DEMs we will present featured-tracked high-quality surface velocity fields at a posting of 40 m coincident with the DEMs. On both glaciers these velocity fields indicate a winter deceleration of less than 10% at points a few km behind the calving front.