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Has dynamic thinning switched off in south-east Greenland?

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Following a relatively stable period during the 1990's, dramatic changes have been reported for many tidewater outlets in the south-eastern part of the Greenland Ice Sheet (GrIS). Results from measurements using the GRACE (Gravity Recovery and Climate Experiment) mission clearly identified the south-eastern part of the GrIS as having the highest rates of mass loss (1, 2). Two of the major outlet glaciers in this area, Helheim and Kangerdlugssuaq, accelerated by about 100 percent and 40 percent, respectively, and their calving fronts retreated by several km (3). Retreat and acceleration occurred in two phases during summer 2003 and 2005 at Helheim, and in a single period between late 2004 and early 2005 at Kangerdlugssuaq. Further south widespread glacier acceleration between 1996 and 2005 affected most of the outlet glaciers (4). In all Greenland's mass loss was calculated to have doubled in the period (4). Increased discharge due to thinning in the marginal areas, coupled to rapid changes in ice dynamics and synchronous retreat of their calving front positions, led to speculations that the GrIS had crossed a "tipping point" induced by global warming. However, subsequent studies showed that during summer 2006 Helheim and Kangerlugssuaq had simultaneously slowed down and their thinning had stopped. Because variability in the ice sheet's mass loss results mostly from the SE Greenland sector, further understanding of the nature, distribution, and controls of dynamic change in this region is essential.
In order to examine the extent of the dynamic changes and to identify their cause we used satellite data to measure glacier surface elevation and calving front positions of 24 outlets of 14 major tidewater terminating glaciers, as well as speeds of 9 outlets in SE Greenland. We concentrate on the region where the GRACE data show highest rates of mass change and our data cover the period during and after the cessation of fast flow and thinning at Helheim and Kangerdlugssuaq (2004-2008).
We used digital elevation models (DEMs) extracted from ASTER stereo-satellite images to measure elevation changes near the glacier margins. Further, we used cross-correlation tracking from ASTER, Landsat 7, and ENVISAT-ASAR data, as well as repeated airborne lidar profiles to derive glacier flow speed estimates.
For the first time, we will characterise multi-decadal glacier changes for the whole south-eastern part of Greenland aiming to answer the questions: (i) Has mass loss slowed in the whole of the south-east of Greenland and dynamic thinning switched off? (ii), What are the controls of SE Greenland glacier dynamics?

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