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Diurnal ice deformation variability driven by subglacial water pressure: Observations from boreholes at the margins of the Greenland Ice Sheet

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We present measurements of ice deformation and water pressure in an array of boreholes to the bedrock in the marginal parts of the Greenland Ice Sheet. These boreholes were drilled in summer 2011 in two arrays separated by 7 km, and are located downstream of Swiss Camp. At each drill site, sensor systems recording pressure, temperature, tilt and magnetic field were installed throughout the ice thickness of 620 and 700 m, respectively. Observed diurnal variations of borehole tilt coincide with variations of subglacial water pressure, and with flow acceleration at the surface. The data set is interpreted with help of a transient ice flow model, from which synthetic tilt curves are generated. The results indicate that the observed tilt variations can be qualitatively reproduced if a varying viscosity of a spatially constricted subglacial layer is prescribed. Hence it is likely that our measurements show the reaction of the ice body to a spatially diverse pattern of varying basal motion, controlled by subglacial water pressure.