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Year round subglacial water pressure and ice velocity data from the West-Greenland ice sheet margin

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Surface melt water plays in important role in controlling the motion of ice caps or ice sheets. However, the lack of subglacial pressure information currently hampers the interpretation of the physics of the hydraulic system beneath the ice and the melt and ice velocity at the surface. In July 2010 an experiment was started at Russell glacier, a land terminating glacier near Kangerlussuaq, West Greenland. The drilling location is proven to experience a particular strong coupling between melt water production and ice velocity. During the experiment two pressure, one tilt, and 23 temperature sensors were installed in two 600 m deep holes using a newly developed wireless sensor system (WiSe). Surface melt water production and surface velocity are monitored simultaneously at nearby locations. The measurements are ongoing and currently a continuous data set of subglacial pressure, ice velocity and surface melt has been collected for the period July 2010 to August 2011 from which results are presented. At the start of summer melt the ice velocity quickly increases with daytime maxima up to 500% of its wintertime background values and a clear daily variation in line with subglacial pressure. During a period of 20 days thereafter the mean ice velocity and subglacial pressure decrease substantially while maintaining a diurnal cycle. It is apparent that the subglacial drainage network quickly develops into an efficient channelized (low pressure) system. Throughout the second half of the melt season the mean ice velocity is slightly decreasing and the diurnal minima show values below wintertime. Only during periods with intense melting the ice velocity increases substantially. The evolution of subglacial pressure during this period appears quite different between 2010 and 2011 indicating that the sensor location was connected to a system influenced by either channels or cavities. At the end of the melt season daily variations in subglacial pressure and ice velocity cease at the same time as melt water production stops. Exceptional melt events thereafter, between September and December 2010, caused large pressure peaks and sudden increases in ice velocity well above wintertime values. Throughout the rest of the winter the subglacial pressure and ice velocity gradually increase without showing any systematic fluctuations.