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Assessing the accuracy of Greenland ice sheet ice ablation measurements by pressure transducer

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In the glaciological community there is a need for reliable mass balance measurements of glaciers and ice sheets, ranging from daily to yearly time scales. Here we present a method to measure ice ablation using a pressure transducer. The pressure transducer is drilled into the ice, en-closed in a hose filled with a liquid that is non-freezable at common Greenlandic temperatures. The pressure signal registered by the transducer is that of the vertical column of liquid over the sensor, which can be translated in depth knowing the density of the liquid. As the free-standing AWS moves down with the ablating surface and the hose melts out of the ice, an increasingly large part of the hose will lay flat on the ice surface, and the hydrostatic pressure from the vertical column of liquid in the hose will get smaller. This reduction in pressure provides us with the ablation rate. By measuring at (sub-) daily timescales this assembly is well-suited to monitor ice ablation in remote regions, with clear advantages over other well-established methods of measuring ice ablation in the field. The pressure transducer system has the potential to monitor ice ablation for several years without re-drilling and the system is suitable for high ablation areas. A routine to transform raw measurements into ablation values will also be presented, including a physically based method to remove air pressure variability from the signal. The pressure transducer time-series is compared to that recorded by a sonic ranger for the climatically hostile setting on the Greenland ice sheet.