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# Meltwater Retention Processes in the Firn Layer of the Greenland Percolation zone

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Since the beginning of the satellite era, the Greenland Ice Sheet has shown a strong response to climate change. Mass loss from the Greenland Ice Sheet is increasing in recent decades due to significant increases in surface melt and runoff. As the surface melt percolates into the underlying cold firn it can refreeze, acting as a buffer to the seasonal runoff. There are challenges to quantifying both infiltration and refreezing of meltwater in this complex heterogeneous cold firn and to understand the spatial variability of these processes. We present continuous in situ measurement of volumetric water content in the near-surface snow and firn using TDR (Time Domain Reflectometry) methods at Dye 2, in the percolation area of the Greenland Ice Sheet. TDR probes and thermistors were installed to a depth of 4 m to quantify the percolation and refreezing of meltwater through summer 2016. A weather station was also installed at this location to model the surface melt. We also drilled shallow firn cores to monitor the ice layer development from spring 2016 to summer 2017. Our results from two sites 650 m apart indicate that meltwater percolated to a depth of about 2 m during summer 2016, and was able to penetrate several well-developed ice layers after they reached the melting point. 100% of the surface melt in summer 2016 refroze within the upper 2 m, and the firn at depths below this remained below the melting point through the summer. The thermal and hydrological evolution at the two study sites was very similar through the summer.