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Oceanography of SE Greenland fjords: observations of interannual warming, circulation, mixing and the response of the calving front

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The region of greatest mass loss from the Greenland Ice Sheet is the south-east, where iceberg calving from marine-terminating outlet glaciers dominates mass loss. In this paper we report on a suite of oceanographic observations made in Sermilik and Kangerdlugssuaq Fjords on the SE coast. During July 2009, July 2010 and September 2010, we repeated a 60 km profile along Sermilik Fjord measuring water temperature and salinity. The results show warming of up to 4°C of the fjord waters. In July 2009, the fjord waters were strongly stratified, with an upper cold and relatively fresh layer of 150-180 m of water colder than 0°C, below which was warmer (up to 4°C), more saline Subtropical Water (STW) (>34 p.s.u.) originating from the Irminger Current. In July 2010, the upper layer was significantly warmer and saltier, with maximum differences of ∼3.2-4°C. Waters deeper than ∼460 m were also warmer by ∼1°C. In Kangerdlugssuaq Fjord we compare data from September 2010 with that from 2007 and 2004. The biggest changes are occurring in the surface layers with interannual temperature changes of 3°C in the upper 100m. We will present data spanning the depth range 200-900m from a 3 month mooring deployment in Sermilik Fjord that shows temperature variations of ∼1°C at sub-tidal frequencies. Finally we will present the first measurements of turbulence from these fjords obtained with a freefalling Microstructure profiler to identify the regions of enhanced mixing and the rates of vertical exchange of heat and salt. The clear interannual variability of waters in Sermilik Fjord between 2009-2010 seems to be a strong test of the hypothesis that the glacier calving front dynamics are controlled by the temperature of the fjord waters. Despite significant warming of the fjord waters in Sermilik the position and flow rates of Helheim Glacier from 2009 and 2010 do not yet show the glacier's calving front behaving significantly differently between the two years. We will update these time-series at the conference.