Abstract Preview - Step 3/4

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Topic: A6.2 Ice sheet – ocean – atmosphere interactions

Title: Decadal Variability of Petermann Gletscher, NW Greenland From Observations of Ice, Ocean, and Atmosphere

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Text: Petermann Gletscher drains 6% of the Greenland Ice Sheet via an 80 km floating ice shelf that since 2010 has been reduced to 50 km. We describe observed regional ice, ocean, and atmospheric conditions for the last decade that include two extreme events when Petermann discharged 380 km^2 or 42 Gt of ice in 2010-12. Annual discharge at the glacier's grounding line is 12 Gt/y.

Surface elevation from Lidar on two track lines flown in both 2007 and 2010 reveal that hydrostatic ice thickness decreased by 14 m along both lines. This reduction includes surface ablation and basal melt to give ice thickness of 150 m along the central melt-channel and 240 m along the ambient ice shelf when averaged from the grounding line to the terminus.

Coastal air temperatures of northern Greenland and Canada indicate a warming trend of 0.1+/-0.05 C/y for the 1987-2012 period, which is more than four times the global rate. Moored ocean temperature observations at 300-m depth outside the fjord indicate warming rates of 0.06+/-0.02 C/y. In 2012 we observed deep water renewal within Petermann Fjord as warm waters spilled over the 400-m deep sill and plunged down more than 300-m. Deep fjord waters also freshened, consistent with accelerated basal melt water flux that is most pronounced near the grounding line.

Prior steady state mass budgets showed that 90% of the 12 Gt/y ice flux into the fjord is lost by basal melting of the ice shelf. Observations of changing air and ocean temperatures, ice shelf thickness, and the recent calving events may indicate a transition to a new state. Support for this hypothesis requires systematic observations and models of physical processes that control ice-shelf thickness, ice-shelf coupling to grounded ice, and of system response from tidal to millennial scales.

Preferred Presentation Type: Oral presentation

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Print Back