

Annual Report 2015: Dynamics and Change of the Devon Ice Cap, Nunavut

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Martin Sharp, Department of Earth and Atmospheric Sciences, University of Alberta

Our goal is to document and explain the dynamics and recent changes of ice caps in the Canadian Arctic, and evaluate their impact on global sea level. Fieldwork on Devon Ice Cap in 2015 involved myself, 3 Graduate Students and a Postdoctoral Fellow:

(i) Calving Dynamics of Belcher Glacier: We retrieved data from continuously recording GPS stations that measure the flow and deformation of the terminus region of Belcher Glacier, and collected time-lapse cameras that successfully recorded iceberg calving activity at the terminus of the glacier from May 2014-2015. We also surveyed the surface elevation of the glacier along a 24 km profile to extend her multi-year study of how recent climate warming is changing the glacier's thickness.

(ii) Monitoring Glacier Change. We retrieved data from 3 automatic weather stations and 1 continuously recording GPS that is monitoring the rate of bedrock uplift rate around the ice cap. We installed 3 new GPS stations on bedrock adjacent to glaciers with different flow rates to see whether uplift rates are linked to glacier dynamics. Bedrock uplift records the response of the bedrock to changes in glacier mass.

(iii) We collected samples of the basal ice (ice with properties that reflect interactions between the glacier and its bed) from 4 glaciers with different basal temperature regimes (melting vs frozen to the bed). She will investigate how the temperature of the ice at the glacier bed affects the physical properties, chemistry and microbiology of the ice.

(iv) We used a UAV to take high-resolution photographs of the terminus area of Fox and Sverdrup Glaciers. We are making a map and digital elevation model of the region. This is a pilot study to see if UAVs can be used to monitor long-term changes in glacier thickness and mass.

(v) We collected ground-based radar measurements and shallow ice cores along a number of airborne radar profiles flown over the ice cap in 2014. The goal is to determine whether it is possible to use changes in the nature of the airborne radar return from the glacier surface to map patterns in the near-surface properties of the firn layer on the ice cap. The results tell us about the extent and intensity of summer melt at high elevations on the ice caps. As this was very successful, we are applying the method to other ice caps using existing airborne radar data.

(v) We collected two 20-m deep ice cores for Environment Canada to measure depth-concentration profiles of plastic microparticles, organophosphate based flame-retardants (OPFRs), and perfluorinated chemicals (PFCs) in glacier ice. The cores extend back to ca 1965.