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The dynamic response of Arctic glaciers to global warming: A Canadian contribution to International Polar Year project Glaciodyn (IPY30)

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Introduction: The goal of the 2009 field season was to complete the fieldwork component of this IPY project. Fieldwork was conducted from early May to early June, and a helicopter visit was made in late August to recover equipment and data. The main objective of the project is to investigate what causes changes in the flow of a large outlet glacier (Belcher Glacier) that ends in the ocean, and how these changes affect how the glacier reacts to climate warming. The field program is linked to a program of mathematical modeling of the glacier.

Summary of Activities: In May, Duncan and Gascon made high-resolution GPS measurements of the glacier surface elevation. They towed the GPS system down the centerline of the glacier, along cross-glacier transects, and up the centerlines of smaller tributary glaciers that flow into the Belcher Glacier. They re-measured 2 transects of ablation stakes installed in 2008 to determine how much ice had melted from the surface of the glacier in summer 2008, and serviced 2 automatic weather stations on the glacier.

Danielson and Milne resurveyed the positions of 48 stakes that were drilled into the ice in 2008 to determine the annual ice surface velocity in different parts of the glacier. They serviced the continuously operating GPS stations that have been tracking the flow of the glacier since spring 2008. Several of these stations were damaged over the winter, but enough data were recovered to calculate ice surface velocities at different times of the year. Seven stations were left recording through the 2009 summer. They serviced an automatic weather station and all air temperature loggers, and reinstalled 3 time-lapse cameras used to monitor the filling and drainage of glacier surface lakes. To gather detailed observations of iceberg calving events, they installed 3 more time-lapse cameras on cliffs above the glacier terminus, and 3 sets of geophones and an audio-recording system on the ice near the most active iceberg calving area of the glacier. These recorded noise and ice-quakes associated with calving throughout summer 2009.

In August, Danielson and Milne returned to the glacier by helicopter. They recovered data from the GPS stations and air temperature loggers, and reprogrammed them to record data over the 2009/2010 winter. All of the time-lapse cameras, the audio recorder, and geophone systems were recovered and removed from the glacier.

We have started to remove many of the materials used for this project, including instruments, camp supplies, and fuel caches and will continue this effort in 2010. We plan to maintain a small set of monitoring instruments (GPS and weather stations) for 2-5 years as part of our project on the dynamics and change of the Devon Island ice cap.