The Dynamic Response of Arctic Glaciers to Global Warming: A Canadian Contribution to International Polar Year Project Glaciodyn (IPY30)

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Project Location:

This study will focus on the Belcher Glacier, which is located in the North East sector of the Devon Island ice cap, Nunavut (75.6^{o} *N,* 81.5^{o} *W*).

Time Frame:

May 1 – August 1, 2007 and 2008

Project Description:

The purpose of this project is to provide a better understanding of the mechanisms that control the flow rates of the Belcher Glacier. Identification of these factors should allow us to model how this glacier will respond to future climate warming and determine the impact that these changes will have on the mass balance of the ice cap as a whole.

Methodology:

The Belcher Glacier was chosen as the focus of study for this project because it is the most important pathway along which ice is transported from the interior of the Devon ice cap and deposited directly into the ocean. Variations in flow rates will be monitored by global positioning system (GPS) measurements performed at ~4 km intervals along the entire length of the glacier. These systems will be deployed in the summer of 2006 (NRI licence # 0201606N-M) and will continue to monitor glacier movement continuously until 2011. The presence of water at the glacier bed will be detected and the basal topography mapped using an Ice Penetrating Radar (IPR) system that will be towed by snowmobile along transects running parallel and perpendicular to glacier flow. Point studies using seismic reflection techniques will also be made at a small number of sites chosen on the basis of results of the radar surveys. Long-term snow accumulation rates will be measured at ~15 borehole locations throughout the Belcher Glacier catchment area. Spatial variability of accumulation will be tracked with the IPR system between the locations where long-term accumulation measurements were performed. Snow melt throughout the spring and summer seasons will be monitored with a series of temperature loggers and an automatic weather station that are to be deployed between the glacier terminus and the glacier head. The evolution of surface streams and ponds will be monitored by taking pictures of the glacier surface daily throughout the melt season with digital cameras mounted at 2 or 3 locations along the sidewall cliffs overlooking the

glacier valley. Tides in the area in front of the glacier will be monitored with a pressure transducer.

Travel along the glacier will be via snowmobile and komatiq sled and by helicopter. There will be as many as 3 mobile camps operating on the glacier at any one time as well as a base camp where equipment and fuel will be stored.

Data:

The data resulting from these field campaigns will be used to determine linkages between the local weather and tidal conditions and variable flow rates along the glacier. These data will also be input into a computer model to simulate how the flow rates of the glacier may change under climate warming situations.

Reporting:

In addition to publication in scientific journals and presented at conferences, results from this work will be presented through the usual NRI reporting process and at local communities such as Grise Fiord and Resolute Bay. Results will also be communicated through the local media (eg. *Above 'n' Beyond, Nunatsiaq News, CBC North, and Kivalliq News*) as well as the *Edmonton Journal*. In addition, progress and results will be posted on a web page maintained by the glaciology group at the University of Alberta.