

PROGRESS REPORT on 2009 FIELD ACTIVITIES

Glacier Mass Balance and Pollution Studies in the Canadian High Arctic NRI Licence# 0102209N-M

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INTRODUCTION

The objectives of this study were to continue the time series of glacier mass balance and pollution measurements on the Devon, Melville, Meighen, and Agassiz ice caps (Figure 1). An additional component of the work was to install GPS units on 4 glaciers that drain the Devon ice cap in order to detect seasonal variability in the rate of flow along these glaciers. The objectives for 2010 are essentially the same as 2009, and involve the same site locations as those visited under licence# 0102209N-M.

GLACIER MASS BALANCE

All mass balance measurements on Melville, Meighen, Agassiz, and Devon ice caps and the Grise Fiord glacier were successfully acquired. Data collected in 2009 (summarized in Table 1) give mass balance results up to September 2008. Meteorological data from the automatic weather stations (AWS) on all ice caps were downloaded and reset for data acquisition over the 2009/10 balance year. Upgrades to the AWS on the Sverdrup Glacier, Devon ice cap included the installation of a remote camera and satellite up-link capabilities. These equipment provide near real time retrieval of image and meteorological data from this site, allowing for a close analysis of the relationship between ice melt and air temperature throughout the summer season. Results to date indicate that the summer of 2009 was slightly warmer than average over the 16 year temperature record and eighth highest in terms of the amount of ice loss due to surface ablation over the 40 year mass balance record at this location.

TABLE 1.

	Long Term Net Mass Balance (Kg m ⁻²)	2008 Net Mass Balance (Kg m ⁻²)
Devon Ice Cap - NW	-97	-388
Meighen Ice Cap	-119	-705
Melville Ice Cap	-208	-905
Agassiz Ice Cap	-42	-86

MONITORING POLLUTION LEVELS

A ~17 meter ice core was obtained from the summit of the Agassiz ice cap and returned to the National Glaciology Laboratory in Ottawa for analysis of lead, mercury, and sulphates. These data will add a ~60 year record of atmospheric contaminant deposition to the network of sites where pollution levels are currently being monitored on high Arctic glaciers.

VARIABILITY IN FLOW RATES OF MAJOR OUTLET GLACIERS ON THE DEVON ICE CAP

As part of a project funded by the Canadian Space Agency under the Earth Observation and Development Program (EOADP), 4 differential GPS units were deployed on the Sverdrup, North Croker Bay, South Croker Bay (LL), and Southeast Glaciers on the Devon ice cap. The GPS units were programmed to collect high resolution coordinates daily, allowing us to track detailed variations of ice flow throughout the year. Upon retrieval in 2010, these data will provide validation to measurements of glacier velocity derived from space-borne sensors such as Radarsat-2, TerraSar-X, and ALOS, and will improve our estimates of mass loss from this ice cap due to iceberg calving.

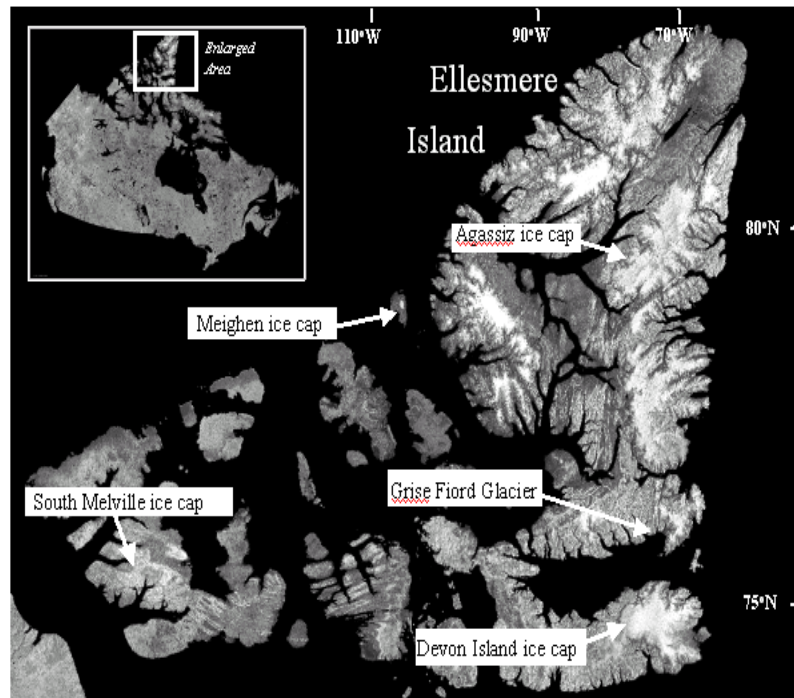


Figure 1. Location of the 2009 glacier mass balance and pollution monitoring sites across the Queen Elizabeth Islands.