

**PROGRESS REPORT on 2013 FIELD ACTIVITIES**  
**Glacier Mass Balance Studies in the Canadian High Arctic**  
**NRI Licence# 0200313R-M**

*Dr. David Burgess<sup>1</sup>, Tyler deJong<sup>2</sup>, and Ian Scriver<sup>3</sup>*

*1 - Geological Survey of Canada*

*2 - University of Ottawa*

*3 - University of Alberta*

**INTRODUCTION**

Collectively, glaciers and ice caps from the Canadian Arctic represent the largest mass of ice outside of the Greenland and Antarctic Ice Sheets. Recently, these features have been reported to be one of the largest contributors to global sea level rise (Gardner et al, 2011), which will have additional impacts on marine ecosystems and ocean circulation patterns. Measurements of glacier mass balance to date reveal accelerated rates of ice loss in response to recent climate warming, particularly since 2005. The objectives of this study are to continue these long term measurements of glacier mass balance from 4 sites across the Canadian high Arctic in order to monitor the rapid environmental changes that are occurring across this region.

**RESULTS FROM SPRING 2013**

**Glacier Mass Balance Measurements**

All mass balance measurements on Melville(Mv), Meighen(Mg), Agassiz(Ag), and Devon(Dv) ice caps, and the Grise Fiord(Gf) glacier (Figure 1) were successfully acquired. Data collected in 2013 give mass balance results up to September 2012. Results of the glacier mass balance surveys indicate that mass balance for 2012 was most negative on record for the Melville ice cap, and 4<sup>th</sup> and 2<sup>nd</sup> most negative for the Devon and Meighen ice caps respectively. Overall, the 2012 mass balance values for all ice caps were between 2 and 5 times more negative than the long term average (see Table 1). These values are consistent with relatively high 850mb temperatures which indicate that 2012 was the 4<sup>th</sup> warmest year on record (1960-2013) across the Canadian high Arctic.

TABLE 1.

Ice Cap	Long Term (1960-2012)	2012 Net Mass
	Net Mass Balance (mm w.e.)	Net Mass Balance (mm w.e.)
Devon (NW)	-131	-503
Meighen	-147	-1118
Melville	-275	-1556
Agassiz*	-480	-720

\*Measurements from the Agassiz ice cap represent a climatic signal only and are not yet expressed as a basin-wide value of mass change.

### **CryoSat-2 Calibration and Validation - Devon ice cap**

Ground surveys involving *Kinematic GPS data collection* were conducted on May 16 along a 20 km transect directly west of the Devon ice cap for validation of the Cryosat-2 radar altimeter over this region. Preliminary results from this work indicates that data from the CryoSat-2 radar altimeter will contribute significantly to the Geological Survey of Canada mass balance program by mapping elevation change on a seasonal basis over the interior regions of the large ice caps in the QEI.

### **Glacier Dynamics - Devon ice cap**

Data from 5 in-situ GPS stations that were installed on the North Croker Bay glacier and near along the North-West transect and Sverdrup glacier were successfully downloaded. The GPS unit on the Sverdrup glacier was reset and left in place while the remaining 4 units were removed and transported back to Resolute Bay. Data from these units provide validation to ice velocity measurements from satellites, as well as providing glacier velocity measurements throughout the summer months when satellite measurements are not available.

### **WORK PROPOSED FOR SPRING 2014**

#### **Scientific Measurements**

We propose to continue the glacier mass balance measurements over the Devon, Agassiz, Meighen, and Melville ice caps, and the Grise Fiord Glacier. This work involves maintenance and data retrieval from the Automatic Weather Stations (AWS), and pole measurement and replacement (or extension) as required. There are no significant changes to the work planned for 2014 relative to the activities performed in 2013.

**Logistics**

Transportation to field sites will be provided by the Polar Continental Shelf Program. All work on site will be performed out of a permanent hut that exist on the Melville ice cap, tents on the Agassiz and Devon ice caps, and Meighen Ice Cap, and the Co-op Hotel while in Grise Fiord. Transportation at each site will be by snowmobile.

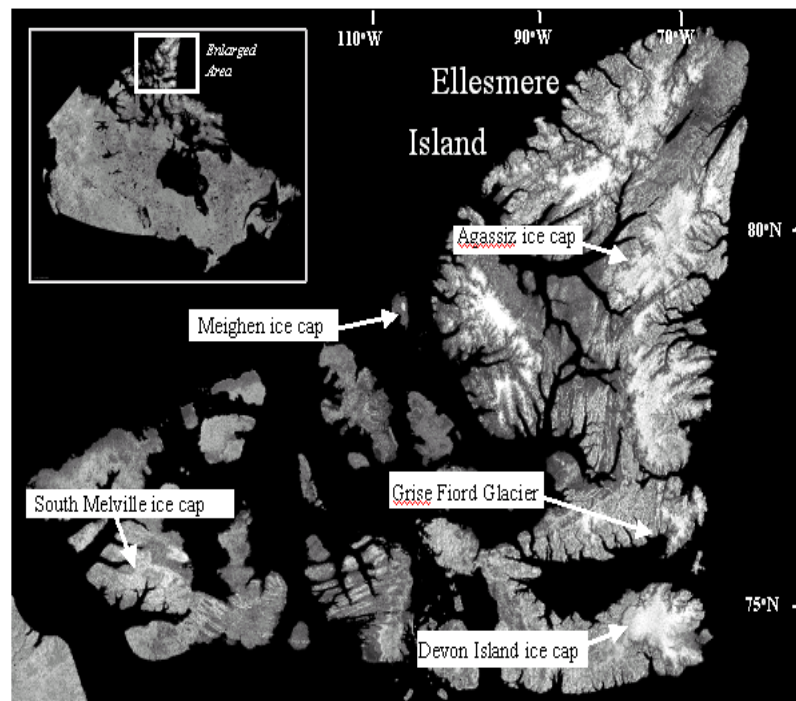


Figure 1. Location of the glacier mass balance sites across the Queen Elizabeth Islands.