PROGRESS REPORT on 2012 FIELD ACTIVITIES
Glacier Mass Balance Studies in the Canadian High Arctic
NRI Licence# 0200312R-M

Dr. David Burgess and Dr. James Zheng
Geological Survey of Canada

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 the mid 1980's. 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 2012

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 2012 give mass balance results up to September 2011. Results of the glacier mass balance surveys indicate that the 2010-2011 balances were the most negative on record for all four reference glaciers. Results of the glacier mass balance surveys indicate that melt rates from Mg, MV, and Dv ice caps were all highest on record for the entire 49-52 year observation period, and between 5 and 8 times greater than the long term average (see Table 1).

TABLE 1.

Ice Cap	Long Term (1960-2011) Net Mass Balance (mm s.w.e.)	2011 Net Mass Net Mass Balance (mm s.w.e.)
Devon (NW)	-123	-683
Meighen	-147	-1310
Melville	-249	-1339
Agassiz*	-47	-99

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

CryoSat-2 Calibration and Validation Across the Devon Ice Cap, Nunavut

Ground surveys involving *Kinematic GPS, Ground Penetrating Radar, Shallow Ice Core, and Snow pits* were conducted along several transects across the Devon ice cap during the April 26 – May 17 Cryosat-2 / IceBridge validation campaigns. Coincident airborne overflights were performed by the Danish Technical University (DTU) and the National Aeronautics and Space Administration (NASA). When analysed in-conjunction with airborne laser data collected in previous campaigns, these data provide a measure of recent thickness changes and mass loss from the Devon ice cap. Early results from this work indicates that data from the CryoSat-2 radar altimeter will contribute significantly to our mass balance program by mapping elevation change on a seasonal basis over the interior regions of the large ice caps in the QEI.

WORK PROPOSED FOR SPRING 2013

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. Additional work on the Devon ice cap will involve maintenance of 5 on-ice GPS that are used to track glacier motion throughout the year. There are no significant changes to the work planned for 2013 relative to the activities performed in 2012.

Logistics

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

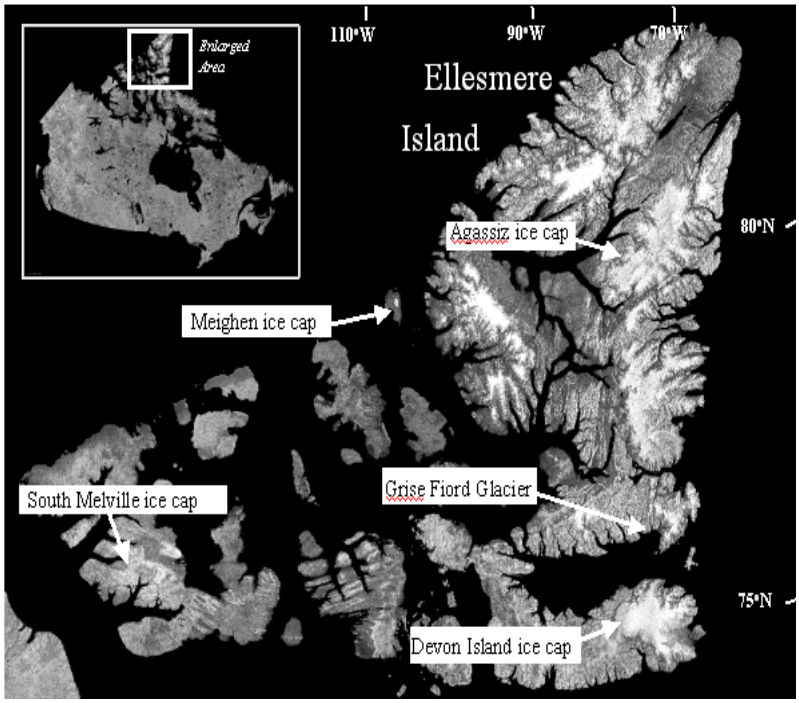

Figure 1. Location of the glacier mass balance sites across the Queen Elizabeth Islands.