Canada's *in-situ* and Earth Observing contribution to the Global Terrestrial Network for Glaciers (GTN-P) - strategy, status, recent results and future directions.

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Earth Sciences Sector

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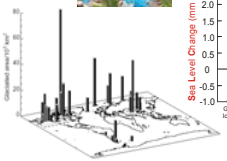
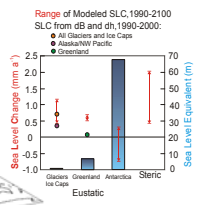
Introduction

Climate change perspectives based on glacier fluctuations are reliable and an important strategy for the WMO Global Climate Observing System's terrestrial observation goals through the "Global Terrestrial Network-Glaciers" or GTN-G.

Canada's land ice is uniquely situated geographically and in a glacier-climatologic sense. As far as the occurrence of glaciers and ice caps, the diversity of energy/moisture flux regimes spans that exhibited globally - from the cold, arid High Arctic to the humid maritime settings of the Coast Mountains.

Glaciers in Alaska and Canada are implicit in the sea-level rise issue, potentially contributing more to sea-level change than the Greenland Ice Sheet. They are also a critical source of freshwater for hydro-power generation, irrigation and other in-stream flow requirements such as the maintenance of riparian zones.





Activity Milestones

- Implementation and delivery to Canada and to the international community of an operational National Reference Glacier–Climate Observing Network
- Evolution of an Earth Observing strategy to foster improved regional perspectives
- Periodic thematic, regional and national syntheses documenting the recent change in land ice conditions, its attribution and impact
- National/regional databases (summary monitoring data, archival/legacy data-sets and educational/outreach products), with on-line web/public access
- Documents outlining the impact of climate change on Canada's glaciers and related systems

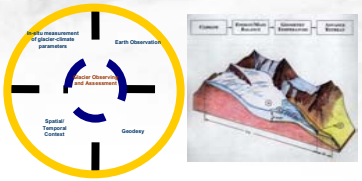
Framework

1. Systematic observation of glacier- climate parameters using *in-situ* and earth observation techniques

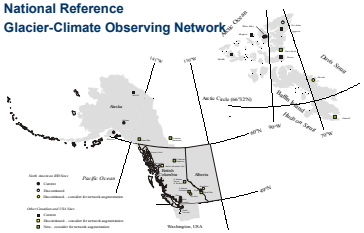
2. Site, regional and national assessments and syntheses of glacier fluctuations, their attribution and impacts

3. Develop improved and durable national/international observing and synthesis capacity to enhance confidence associated with assessments, attribution and impacts

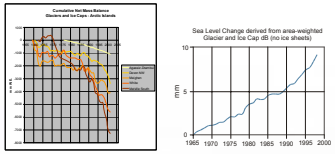
Method of Approach



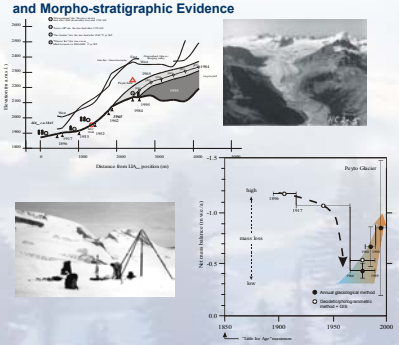
National Reference Glacier-Climate Observing Network



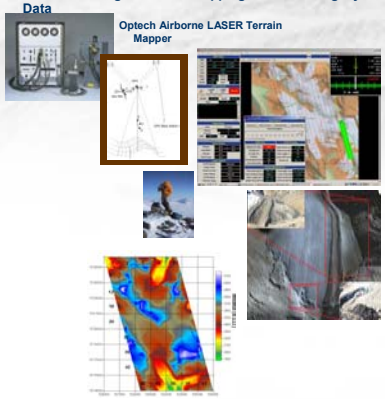
Sample Data - Cumulative Mass Balance Data from the Arctic Archipelago



Complimentary Perspectives Using Legacy Data and Morpho-stratigraphic Evidence



Modern Space-based Geodesy - Enabling Change Detection using Advanced Mapping Tools and Legacy Data



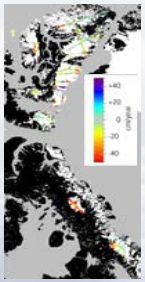
Regionalization/Up-scaling Using Earth Observation Tools

Despite the reliability of site measurements within the national and global observational basis, uncertainties in regards to size/situational biases and secular-scale hyposmetric influences need to be addressed in order to increase the signal-noise ratio for regional and world-wide assessments of the climate change signal.

Results to date are strongly influenced by a bias in geographic-weighting towards alpine glaciers and the high-latitude, maritime glaciers of Scandinavia within the basic framework. Large glacier systems, and the Arctic ice caps remain relatively under represented, as does the Southern Hemisphere.

Perspectives on sea level influences, for example, have been determined through extrapolation without the benefit of geo-spatial data describing mass balance-environmental controls.

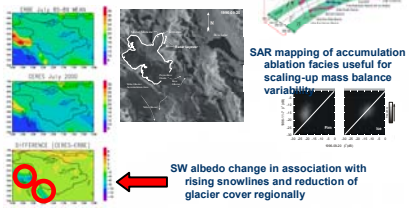
Repeat Airborne Altimetry of Glaciers and Ice Caps



Reducing Canada's vulnerability to climate change

Flow Regime Change Detection Using SAR Speckle Tracking Interferometry

Surface Albedo and SAR/Optical Glaciological Facies Mapping



Validation towards utilizing new EO tools: ESA CryoSat SAR Interferometric RaDAR Altimeter

I. To determine the efficacy of the CryoSat RaDAR altimeter for monitoring glacier and ice cap fluctuations and related parameters; and thereby its systematic use in the evolving Canadian and global glacier-climate monitoring strategy.

II. Study possible climate variability and trends by determining variations in the thickness and mass imbalance of land ice.

Uptake of Outputs and Progress towards Outcomes

- Parties to the Convention, UNFCCC
- IPCC WG 1, 2
- ACIA – Cryosphere Chapter
- GCOS-GTN-G through the World Glacier Monitoring Service
- ESA - GMES
- UNESCO-IHP, UNEP and GEMS
- IASC through the Arctic Glaciology Working Group and MAGICS.
- Action Plan 2000 – Systematic Climate Observing Program (Snow Network)
- CCCMA - development and validation of Canadian climate models
- Climate Change Impacts and Adaptation Directorate National reporting (CCS II)
- CrySys and CliC Canada
- National and Provincial SOE reporting
- Parks Canada SOP, Stats. Can. HAE and EC Water Threats reporting.
- Other CCP Projects and their component activities (e.g., CCAF, PERD)

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