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Nunavunmi Parnaiyiit
Nunavut Planning Commission
Commission d'Aménagement du Nunavut

PUBLIC REGIST

Project Proposal Notices | Project Proposals

Public Registry - Project Proposals

NPC 149999: Arctic coastal and drifting ice processes and dynamics

Proposal Status: Conformity Determination Issued

Overview | Documents

Project Overview

Type of application: Amendment

Proponent name: Derek Mueller
Proponent company: Carleton University, Dept of Geography

Project Description:

Changes in Arctic climate have profound implications for the break-up of coastal ice. In the recent past, there have been large calving events of ice shelves and glaciers that have produced many vast ice islands and icebergs that drift through Nunavut waters. Our research is focused on understanding how various types of coastal ice interact with the atmosphere above, the ocean below as well as meltwater and glacier ice from the adjacent land. In particular, we are interested in how both thick ice (ice tongues, ice shelves) and thin ice (landfast sea ice and lake ice) are melting and breaking-up in a changing climate. In addition, we study how large ice masses (icebergs and ice islands) that break away from the coast, drift and deteriorate. To conduct our research, we place instruments in the water to measure temperature, salinity and water currents; we measure the temperature and melting rate of ice using dataloggers, ice-penetrating radar and ablation stakes; we also measure air temperature, wind and solar radiation to examine energy input to ice. We employ technologies such as satellite tracking beacons and remote sensing to examine ice drift, passive seismometers to record ice movements, as well as uninhabited aerial vehicles (UAVs), autonomous underwater vehicles (AUVs) and remotely operated vehicles (ROVs) to make precise maps of the ice and take water measurements under-ice. Some of our research takes place at the northern coast of Ellesmere Island where there are extensive ice shelves and ice tongues. Our study of drifting icebergs and ice islands occurs where they go, which is typically within the Queen Elizabeth Islands, Lancaster Sound and along the east coast of Ellesmere, Devon and Baffin islands. We hope to work out of and with eastern Baffin Island communities where icebergs drift by. We are also planning to study flat and ridged landfast sea ice near these communities. We access our far northern site from small camps that are established using Twin Otter and helicopter, we visit ice islands and icebergs by ship, boat and helicopter but also work from communities to access ice by snow machine or small boats. The data we collect will eventually be available in public repositories following dissemination of results to communities and in the peer-reviewed literature.

Project Schedule

Start Date: 2023-05-01
End Date: 2027-12-31

Project Map

List of project geometries:

Id	Geometry	Location Name
10067	polygon	Ice island, iceberg and landfast ice research area [offshore areas only]
10068	polygon	Ellesmere ice shelf, ice tongue, glacier, and fjord research area
10158	point	Qakuqtaqtujut (weather station & camp nearby)
10159	point	Naggutiqaqpaktuq (camera)
10160	point	Pullataujaq (weather station)
10161	point	Qikiqtatannak (weather station)
10162	point	GNSS Rovers North
10163	point	GNSS Rovers South
10164	point	GNSS Base Station North
10165	point	GNSS Base Station South
10166	point	Current meter East
10167	point	Current meter West

NPC Planning regions:

No Approved Plan
North Baffin

Project Land Use and Authorizations

Project Land Use:

Scientific Research

Licensing Agencies:

Nunavut Tunngavik Inc.
Nunavut Impact Review Board
Nunavut Research Institute
Government of Canada - Fisheries and Oceans Canada

Material Use

Equipment:

Type	Quantity	Type	Use
Ice auger	1-3	2 to 8 diameter	drilling holes in ice
Ice corer	1	5	taking short ice cores
ice-penetrating radar	3	50 cm x 50 cm	Measures ice thickness
Tracking beacons	2-5 per year	40 cm x 40 cm	Tracking the position of drifting ice
Ablation stakes	2-5 per year	3 m x 3 cm	Stakes positioned in the ice to measure melt
Uninhabited aerial vehicle (UAV)	1-2	50 cm diam	Mapping of ice features via stereo photography
Remotely operated vehicle (ROV)	1	60 cm x 80 cm	Mapping and measuring water properties under ice
Hole melter	1	1.5 x 1 x 1 m	Melting access holes through ice for instruments
Current meter/profiler	1-3	50 cm x 30 cm	Measure water currents
Temperature data loggers	10-20	1 x 10 cm	Measure temperature in water and ice
Conductivity-Temperature-Depth (CTD) datalogger/profiler	2-4	40 cm x 5 cm	Measure water properties
Helicopter	1	15 m x 5 m x 3 m	Transport
Twin Otter	1	20 x 20 x10 m	Transport
Snowmobile	0-2	1 x 2 m x 80 cm	Transport (at times)

Icebreaker/ship	1	100 m	Transport to field site
Generator	1-2	30 x 50 x 20 cm	Power generation
Kemmerer Bottle	1-2	50 cm x 10 cm	Water sampling
Small boats/launches	1	10 m	Accessing ice islands or icebergs and surveying
Seismometer	4-6	20 x 20 x 20 cm	Record ice movement
Sediment corer	1	2 m x 0.5 m x 0.5 m	To core sediment at the bottom of the fiord (ocean floor)
Sediment traps	5	40 x 10 cm	Collects falling sediment in the ocean (attached to a mooring line)
Automatic weather stations	6-8	2-3 m tall	Measure temperature, wind, solar radiation, ice melt/snow fall
SmartBUOY	2	3 m long	Measures sea ice temperature and thickness (installed by SmartICE)
SmartQamutik	1	2 m	Measures sea ice thickness (surveys by SmartICE) when towed behind a skidoo
Timelapse cameras	6-10	1 m x 2 m	Cameras on a tripod that take images on a regular interval in Milne Fiord and Admiralty Inlet. Some will be mounted on weather stations.
GNSS receivers	8-10	1 m x 50 cm x 50 cm	Global Navigational Satellite System receivers (base stations on land and rovers on ice). Accurate positioning and ice motion measurements (both Milne Fiord and Admiralty Inlet)
Tide gauges	4-6	3 x 3 cm	A small pressure recorder that lies in shallow water near the shore to monitor tides

Fuel Use:

Type	Container	Capacity	Use
Aviation fuel	6	200	Helicopter cache (Ellesmere Is)
Diesel	2	200	Ice melting/power generation
Propane	3	20	Cooking/heating
Gasoline	3	25	Generator/snowmobiles
Aviation fuel	18	200	Helicopter cache (Ellesmere Is)

Hazardous Material and Chemical Use:

Type	Container	Capacity	Use
hazardous	10	0.25	Powering UAVs, tracking beaons and some other instruments
Formalin (5%)	1	1	Mixed with hypersaline water. 100 mL used as a preservative at the bottom of sediment traps to prevent organic matter from decaying. (5 sediment traps)
Lithium batteries	15	1	Powering equipment, tracking beacons and instruments

Water Consumption:

Daily Amount (m^2)	Retrieval Method	Retrieval Location

0	Streams, ponds and lakes on land (Ellesmere Is), glaciers or floating ice, melting snow for camping on sea ice	Scooping, melting snow

Waste and Impacts

Environmental Impacts:

We have a very limited environmental footprint given that we are camping for a limited amount of time in small groups. We pack out all our garbage and we pack out human waste from our Ellesmere Island site.

Waste Management:

Waste Type	Quantity Generated	Treatement Method	Disposal Method
Combustible wastes	1 kg per day	incineration in nearest community	removal from site
Greywater	25 L per day	N/A	pour in sump away from lakes and streams; dispose of on ice so that it drains into the ocean
Non-Combustible wastes	1 kg per day	disposal in nearest community	removal from site
Sewage (human waste)	4 kg per day	incineration in nearest community	Removal from site

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