Ice Monitoring in Deception Bay, Kangiqsujuaq and Salluit

CONFERENCE ON THE VULNERABILITIES OF QUÉBEC'S ARCTIC TERRITORY IN THE CONTEXT OF CLIMATE CHANGE

April 2018



ነ ሪ<\J/ው Context : Concerns About Changing Sea Ice



⊲לייµר⊂ אל< ∆<ארץסים ` אבאנס< Strategy of the Ice Monitoring Project

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Test and compare different ice monitoring techniques



Observe the ice, measure its thickness, document the differences from year to year (2015-2018)

א∟ אב ∆ עב עג עג ער מר ער מר ער מר ער Why Deception Bay?

- Year long transit hub for ore from nickel mines currently in operation
- Hunting and fishing area for Inuit communities
- A sensitive ecosystem



ל∟` ۵° מי⊥` ۵° לע` Why Salluit and Kangiqsujuaq?

- Similar fjords
- Control sites: to compare observations from Deception Bay
- Community involvement

Cへ> ۲d∿Lσ ۵ Δ<AJ/⊂ ۲ C Δ⊃i<>J C When observing sea ice, we pay attention to :

- Seasonal evolution
- Dynamic events
- Events related to ice travel and subsistence activities
- Historical changes
- Providing information to the communities



∧⊳^ьd∩́^c ∖-ک∠^c ⊽<<∿∩-œ Equipment in Deception Bay

Cameras (5)







Sonars (2)





ኄ⊳ሥነኊ⊳∪ ኈኄራ Sonar near Moosehead Island

Ice Thickness during the 2016-2017 season in Deception Bay



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Ice Thickness during the 2016-2017 season in Deception Bay





Blue arrows identify ships coming in or going out of the bay:

2016-2017	In	Out	In	Out	In	Out	In	Out
MV Arctic (Raglan)	Nov.27	Dec.9	Jan.9	Jan.23	Mar.6	Mar.15	Jun.5	Jun.15
MV Nunavik (CR)	Nov.17	Nov.27	Jan.3	Jan.15	Fev.18	Mar.4	Jun.15	Jun.26

Identifying Freeze-Up (and Break-Up) with Cameras



The freeze-up north-east of Moosehead Island took 10 days longer in 2015-2016 (26 days) compared to 2016-2017 (16 days).

The bay was frozen two weeks earlier in 2015-2016 compared to 2016-2017, and the ice lasted until 9 days later.

The ice cover lasted three weeks and half longer in 2015-2016 (31 weeks), compared to 2016-2017 (27 weeks and 2 days).

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Salluit

Deception Bay



RADARSAT is an official trademark of the Canadian Space Agency. Shown : Sigma HH from January 25th 2018.

Measurement details : The work was done on January 30th 2018 by Juupi Tuniq, Pierre Lebreux, Véronique Gilbert, Valérie Plante Lévesque and Sophie Dufour-Beauséjour.



RADARSAT is an official trademark of the Canadian Space Agency. Shown : Sigma HH from February 1st 2018.

Measurement details : The work was done on February 1st and 2nd 2018 by Juupi Tuniq, Pierre Lebreux Charlies Ikey, Véronique Gilbert, Valérie Plante Lévesque and Sophie Dufour-Beauséjour.



לאך איש 2018-ך באראים איש 2018-ך מאין איש Ice monitoring in January and February 2018

1. Is the snow flat or uneven ? 2. Is the ice smooth or broken ?





3. How thick is the snow? The ice?







לאר איש 2018-ך באראים איש 2018-ך מעל איש 2018-ך נכי 1ce monitoring in January and February 2018

Broken ice (in pink) in Deception Bay and Kangiqsujuaq :



Around Moosehead Island

In front of the village and close to the sea/strait

לאך איש 2018-ך בי⊇ער איים אראיים אין עריים עודי Ice monitoring in January and February 2018

	Average snow thickness	Average ice thickness		
Salluit	2''	2'8''		
January 30th 2018	(6 cm)	(81 cm)		
Deception Bay	3''	2'9''		
February 1st-2nd 2018	(8 cm)	(83 cm)		
Kangiqsujuaq	3''	2'4''		
January 27th-28th 2018	(8 cm)	(71 cm)		

The average snow thickness was roughly the same in all the bays, but the distribution is different.

In Salluit the snow was even. In Deception Bay and Kangiqsujuaq, some areas had more or less snow than others.

C[°][°]PCL[°] ⊲[°]≻⊂⊲_∩4[°] 'J[⊥]J⊲∩C≻/L⊀^bd[°] Satellite images taken every month

Optical images (Landsat-8)



Radar image (RADARSAT-2)

ح ۲۰ Lخ د کے ح Rough ice in Salluit last year



לל∆ʿ Lʊʕ⊳∿∿Ր⊃ʿ ʿᠯ٨ʔLᠯ نَ`ى ܡʿ ↘ ܟʿ ¤ʿ ܟʿ ܟʿ ܟˁ ܟ Խ∿Րˁዖל⊲Г ב ⊂്≪♂ ⊲ʿᡬJГ / Broken ice in Deception Bay and Kangiqsujuaq 2018



לאליץLל^c ⊳ך⊲ּיָאס^c ⊲ּיּא∩∿ר^c א∟אַ∆^c ⊽<<∿נּשי ⊲ּיׂלס (2017) Broken ice on the ship's path in Deception Bay last year



Basemap source : Esri, DigitalGlobe, GeoEye, Earthstar Geographies, NES Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

TerraSAR-X constellation (K1,K0,K5), image from DLR, acquired on December 10th 2016 MV Arctic departed on December 9th 2016



C^{*}≪σ ⊲ⁱĠJΓ ኣ-ט∆^c ∇[<]<[∿]Ր[•]σ (2018) ▷Γ⊲ⁱ?⊲^c ⊲ⁱd∩/σ[∿]Ր^c Ship tracks observed this year in Deception Bay



Basemap source : RADARSAT-2 Data and Products © MacDonald, Dettwiler and Associates Ltd. (2012) – All Rights Reserved. RADARSAT is an official trademark of the Canadian Space Agency. Shown : Sigma HH from February 1st 2018.

Measurement details : The work was done on February 2nd 2018 by Juupi Tuniq, Pierre Lebreux, Charlies Ikey, Véronique Gilbert, Valérie Plante Lévesque and Sophie Dufour-Beauséjour.



בֹ⁻ אבי⊂ אבינר⊳י אביך אביר Community involvement - Local knowledge

- Local guides make the fieldwork possible with their expertise on the land
- Their insight as ice users guides the scientists in the analysis and planning
- Advice from local collaborators improves the project



∆ຕհˤልσ⁵ ∧⊾ϟ⊲℉∩℉ʔᡤ⊂ Activities with the school

- In the context of the AVATIVUT program (KSB), students from the schools participate in the field work and lab analysis.
- Last April, the team went to talk to the high school students about the research project and explain what we are doing



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• In April 2017, discussions about the results and future work



Facebook-d^c Cd^c\>Ո^c/ձնշնն։ Facebook Page !





<ʿຈJ∩ʿ ⊂ໍ>ົL ⊲ʿϚ່JJʿ (2018) Plan for this year (2018)

- Field measurements with KRG and INRS (May)
- Data analysis by INRS
- Present the results to the communities (May)
- Retrieve underwater sonar in Deception Bay (October)

Extention of the project until 2020

- Weather station installation in Deception Bay (summer)
- Install live-feed ice-monitoring cameras for Kangiqsujuaq and Salluit land users (summer or fall)
- Yearly ice monitoring (April-May 2019 and 2020)

مە^c⊂∩⊳₅CrLל^c ! Thanks to all the guides, Nakurmimarialuk !

Salluit and Deception Bay

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