## 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

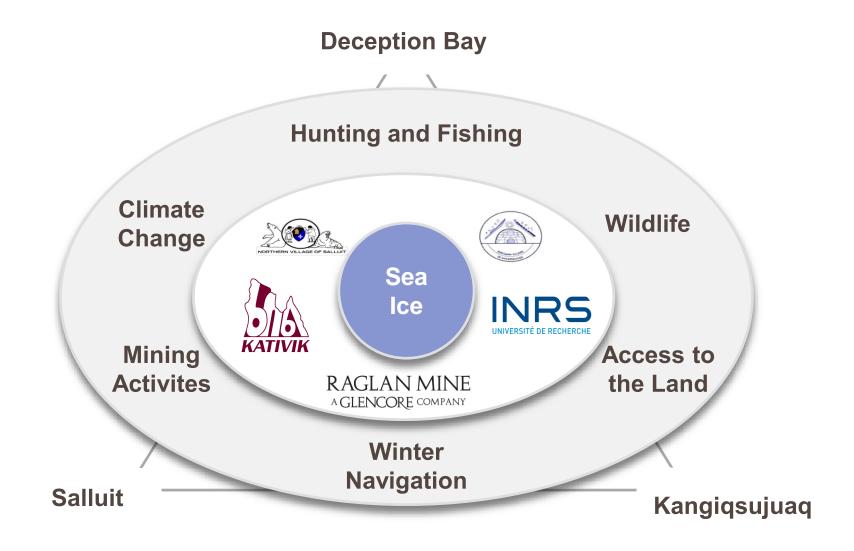




acorder acources, environment, Lands and Parks Department
Service des ressources renouvelables, de l'environnement, du territoire et des parcs

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## **Context: Concerns About Changing Sea Ice**



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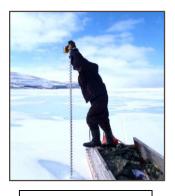
Test and compare different ice monitoring techniques



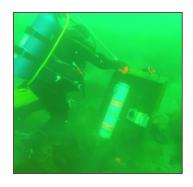
Cameras



Satellite Images



Drilling and Coring



**Underwater Sonar** 

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

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

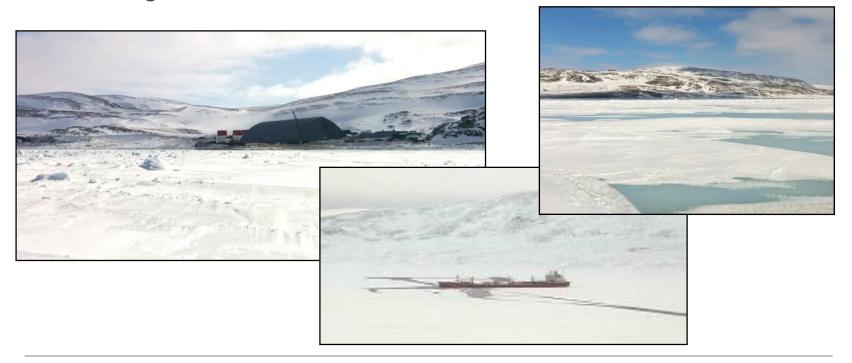


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- Similar fjords
- Control sites: to compare observations from Deception Bay
- Community involvement

# Cת⊳< לל"ל<>J° (<>J° (<> Umber 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

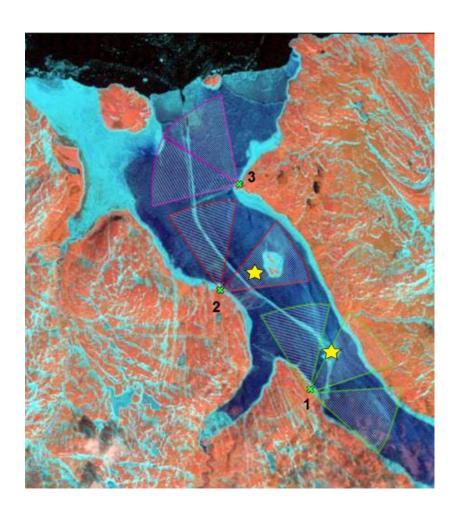


## ∧⊳ካdロc ነር ጋ∆ር ∇<<∿ቦናσ Equipment in Deception Bay

Cameras (5)

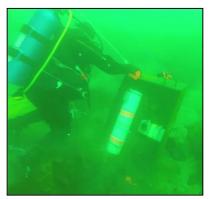




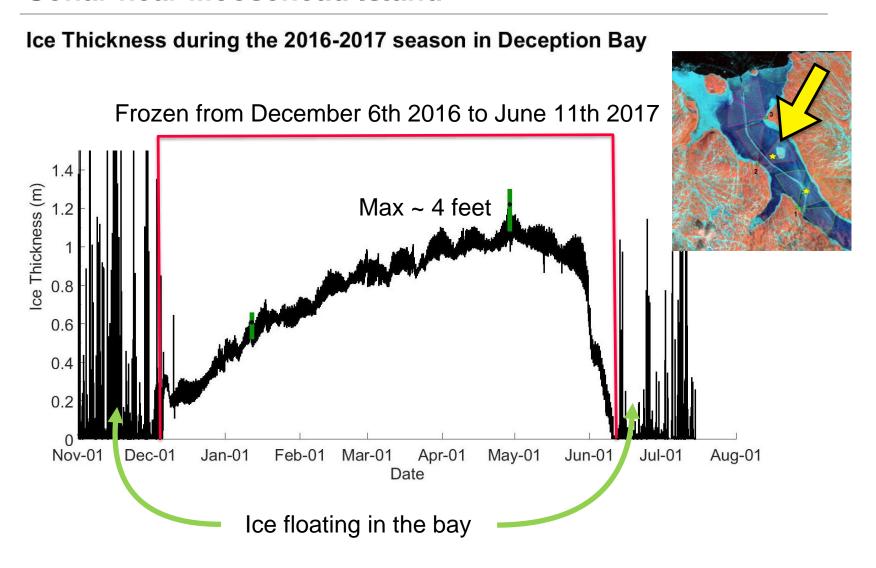


Sonars (2)



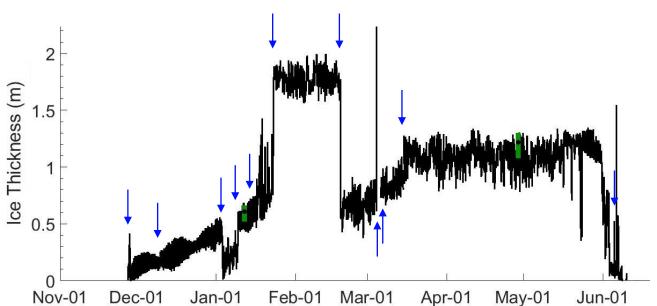


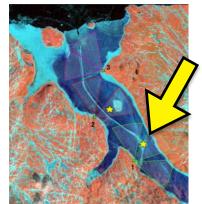
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# ኄ⊳⊁⊳ሶ ▷Γ⊲ኁ⊅⊲ ጜኄJՐ⊲ኄል∿し╆⁻⊃ Sonar underneath the ship turning point

#### 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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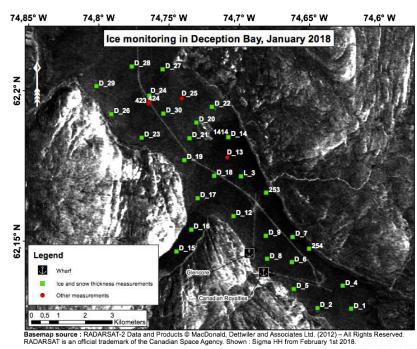
#### **Salluit**

# 75,75° W 75,75° W 75,65° W 75,65° W 75,55° W | Ice Monitoring in Salluit, January 2018 | S\_23 | S\_21 | S\_24 | S\_18 | S\_20 | S\_16 | S\_17 | S\_19 | S\_15 | S\_17 | S\_19 | S\_15 | S\_17 | S\_19 | S\_15 | S\_18 | S\_20 | S\_2

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

#### INRS

#### **Deception Bay**



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.

# לאר ∆< ∧ Jלים ל 3018-Γ בי 2018 בי 2018 בי 2018 בי 100 מבל משל 100 בי 2018 בי

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





#### 3. How thick is the snow? The ice?



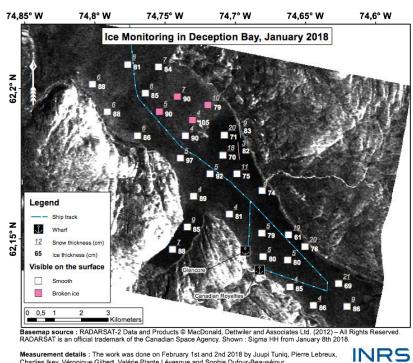






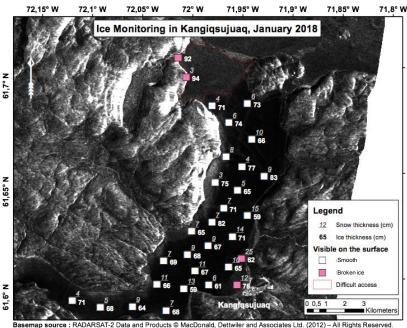
## **/**4Γ<sup>6</sup> Δ<//> 2018-Γ Ice monitoring in January and February 2018

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



Charlies Ikey, Véronique Gilbert, Valérie Plante Lévesque and Sophie Dufour-Beauséjour.





RADARSAT is an official trademark of the Canadian Space Agency. Shown: Sigma HH from January 5th 2018.

Measurement details: The work was done on January 27th and 28th 2018 by Jamie Jaaka Valérie Plante Lévesque and Sophie Dufour-Beauséjour



#### **Around Moosehead Island**

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

# לאר מאר מאר מאר מאר מאר 2018-Γ בי 2018 בי לאר מאר מאר מאר מאר בי 2018-Γ בי 2018 בי מאר מאר מאר מאר מאר מאר מאר בי מאר

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

Avorago chow thicknoss

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.

Avorago ico thicknoss

# C°°PCL° d°AC dr.4° 'd'Jdnc>/Ltbd° Satellite images taken every month

Optical images (Landsat-8)



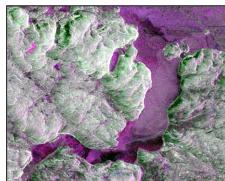




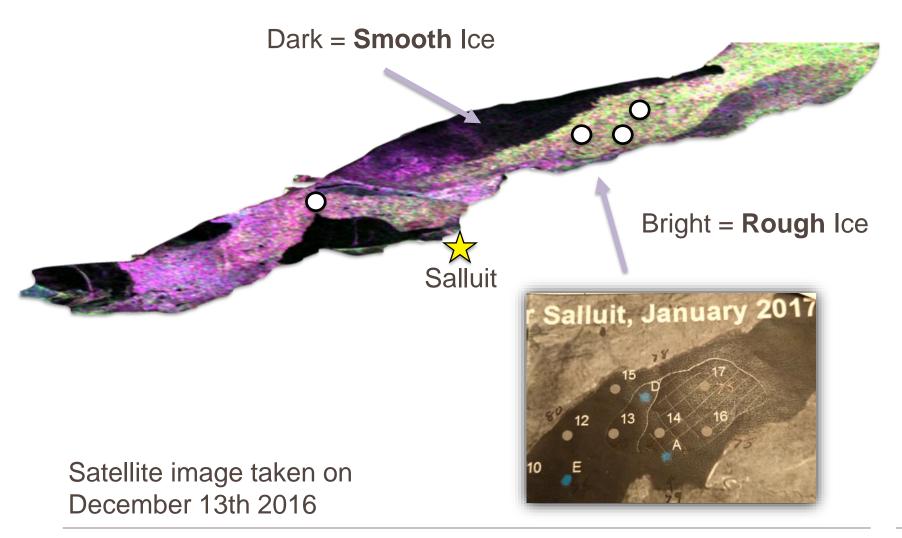
Radar image (RADARSAT-2)



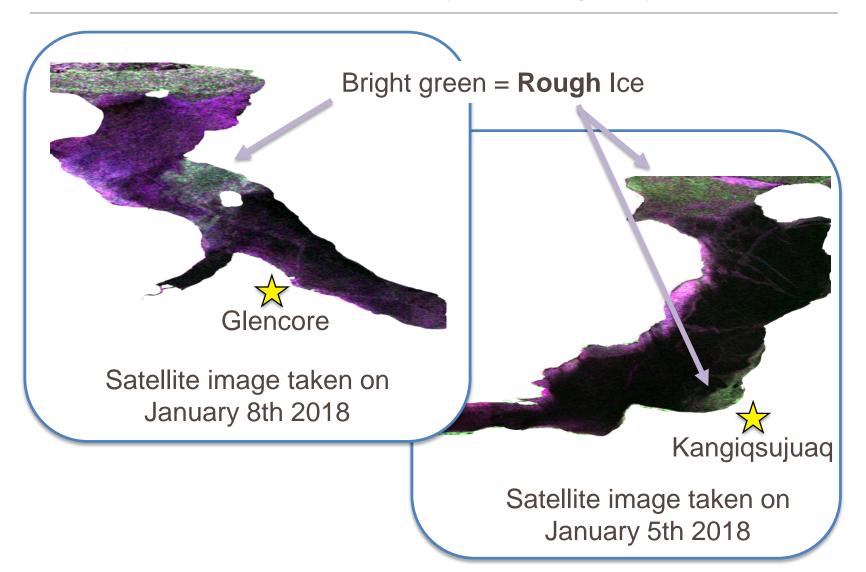




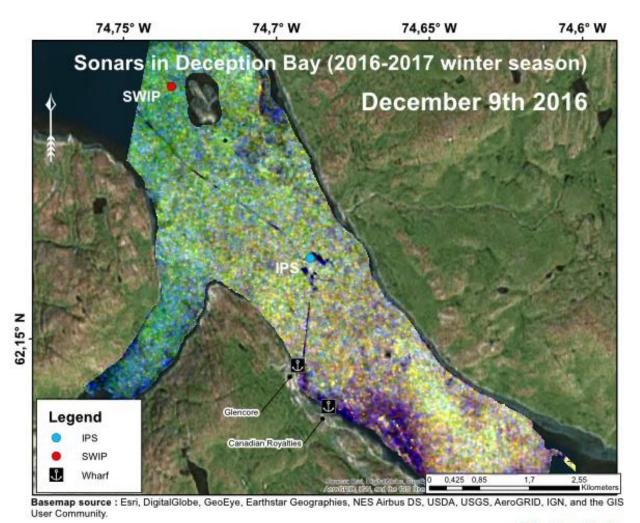
# る。ちょう とっぱん しゅっつ こと さら Rough ice in Salluit last year



#### /dΔ° Lσና⊳∿∿Ր⊃° 'dΛ/Lל-ڬ∿σ° հ-كΔ° ∇<<∿Ր•σ ৬∿Րነ/ተላባΓ-ك С\*ペσ ⊲'ĠJΓ / Broken ice in Deception Bay and Kangiqsujuaq 2018

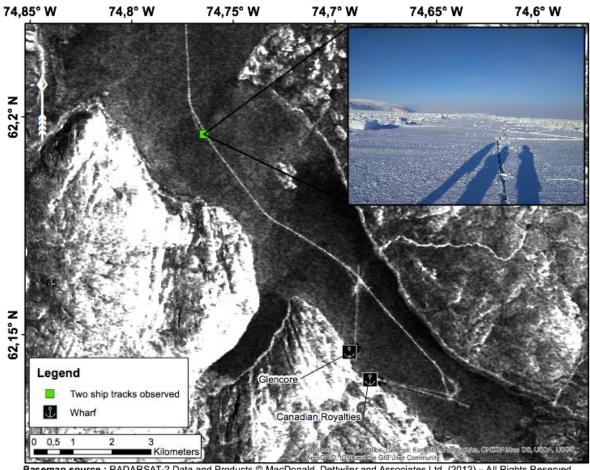


## /ժΔትፕ/Lጚ° ⊳Γ⊲ናን⊲° ⊲ናዓ∩∿Ր° ኣ-ച∆° ∇<<∿しσ∿ ⊲ናĠσ (2017) Broken ice on the ship's path in Deception Bay last year



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

# C°ペσ ◁°ĠJГ Կ゚¬Δ° ∇°<°C°σ (2018) ▷Γ◁°7◁° ◁°Ġ∩ሪσ°°C° Ship tracks observed this year in Deception Bay



Basemap source: RADARSAT-2 Data and Products © MacDonald, Dettwiller 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.



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- 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



#### ∆ርካያልታ ለፈረ⊲ኄ∩ኄዖ∩ׂ° Activities with the school

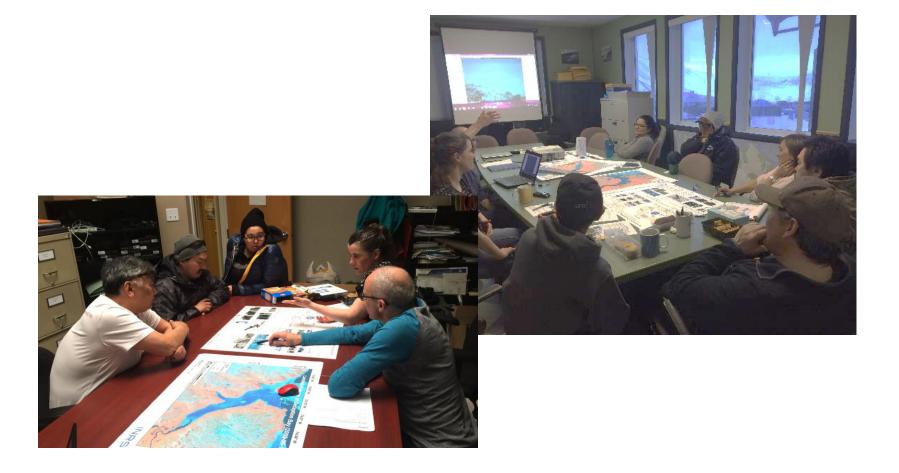
- In the context of the AVATIVUT program (KSB), students from the schools participate in the field work and lab analysis.
- Last April, the team went to talk to the high school students about the research project and explain what we are doing



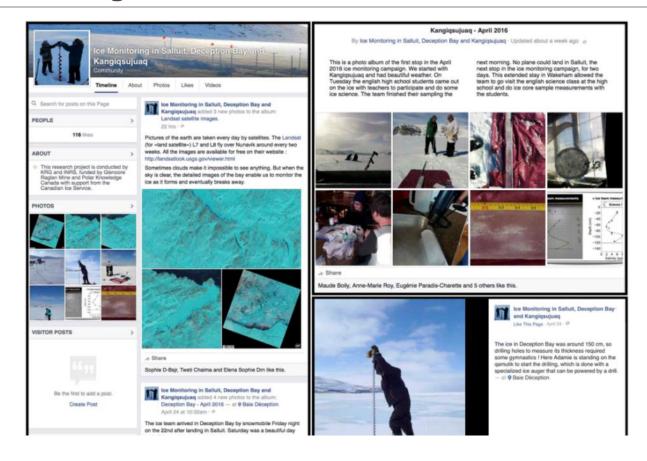


#### 

In April 2017, discussions about the results and future work



# Facebook-d° Cd°4>∩°7&%c°°dJ°! Facebook Page!





#### Ice Monitoring in Salluit, Deception Bay and Kangiqsujuaq

https://www.facebook.com/IceMonitoringNunavik/

## <゚つJ∩゚ C゚>゚し <゚ĠJJ゚ (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)

# בלירות בי Lcc∩⊳ъcc/Lלc! Thanks to all the guides, Nakurmimarialuk!

#### **Salluit and Deception Bay**

- Juupi Tuniq
- Johnny Ashevak
- Jimmy Kakayuk
- Kululak Tayara
- Adamie Raly Kadjulik
- Joannasie Kakayuk
- Markusi Jaaka
- Jani Kenuajuak

- Michael Cameron
- Putulik Cameron
- Chris Alaku
- Denis Napartuk
- Casey Mark
- Eyetsiaq Papigatuk
- Luuku Isaac
- Pierre Lebreux
- Charlie Ikey

#### Kangiqsujuaq

- Noah Annahatak
- Elijah Ningiuruvik
- Peter Arngak
- Elijah Qisiiq
- Maasiu Arngak
- Charlie Alaku
- Jamie Jaaka
- Dany Alaku
- Joe Pilurtuut
- Adamie Jr. Sakiagak

