T-MOSAiC

Terrestrial **M**ultidisciplinary distributed **O**bservatories for the **S**tudy of **A**rctic **C**onnections

ALASKA GEOBOTANY CENTER
University of Alaska Fairbanks
INSTITUTE OF ARCTIC BIOLOGY

Rapid Arctic Transitions due to Infrastructure and Climate (RATIC).

https://www.geobotany.uaf.edu/ratic/

T-MOSAiC: Progress, updates and opportunities for the RATIC Action Group

Warwick F. Vincent[1] and João Canário[2]

[1]Centre for Northern Studies (CEN), Laval University, Canada
[2]Centro du Quimica Estrutural (CQE), University of Lisbon, Portugal

RATIC meets T-MOSAiC: Sharing Best Practices in Research on Infrastructures in the Arctic; 21 March 2021, ASSW2021

T-MOSAiC

Terrestrial **M**ultidisciplinary distributed **O**bservatories for the **S**tudy of **A**rctic **C**onnections

T-MOSAiC Action Groups: https://www.t-mosaic.com/action-groups.html

(Press logo to link to each TMAG page)

Arctic Trace Gas AG
Chairs: Torben Christensen (DNK) and Sally McIntyre (USA)

Arctic Transects AG
Chairs: Sergey Kirpotin (RUS), Warwick Vincent (CAN) and Guido Grosse (GER)

Remote Sensing AG
Chairs: Gonçalo Vieira (PRT), Annette Bartsch (AUT) and Isla Myers-Smith (GBR)

Data Systems and Modelling AG
Chair: Peter Pulsifer (CAN)

Land-Water Processes AG
Chairs: Jasmine Saros (USA) and Jorien Vonk (NLD)

Arctic Infrastructure AG
Chairs: Donald A. Walker (USA) and Peter Schweitzer (AUT)

Arctic Microbiomes AG
Chairs: Anne Jungblut (GBR), Birgit Sattler (AUT) and Jérôme Comte (CAN)

Coastal Processes AG
Chairs: Hugues Lantuit (GER), Benjamin Jones (USA) and Dustin Whalen (CAN)

Permafrost Thaw AG
Chairs: Julia Boike (GER), Sarah Chadburn (GBR) and Simon Zwieback (USA)

Paleoclimatology/Paleoecology AG
Chairs: John Smol (CAN) and Bianca Perren (GBR)

Northern Community Issues AG
Chairs: Maribeth Murray (CAN) and João Canário (PRT)

Crosscutting AG
Chair: Andrey Petrov (USA)

RATIC

Northern Roads and Railways: Social and Environmental Effects of Transport Infrastructure

(convened by Olga Povoroznyuk, Warwick F. Vincent and Fabrice Calmels)

Northern Roads and Railways: Social and Environmental Effects of Transport Infrastructure

(convened by Olga Povoroznyuk, Warwick F. Vincent and Fabrice Calmels)

Thursday, March 25

ID:19 - Northern Roads and Railways: Social and Environmental Effects of Transport Infrastructure (I)

8:00 – 10:00 AM (GMT)

Conveners: Olga Povoroznyuk (University of Vienna), Warwick F. Vincent (Centre for Northern Studies & Laval University) and Fabrice Calmels (Yukon University Whitehorse)

Northern Roads and Railways: Social and Environmental Effects of Transport Infrastructure

(convened by Olga Povoroznyuk, Warwick F. Vincent and Fabrice Calmels)

Arctic Change Session 1:

https://vimeo.com/488141252

1- *(Rail)roads and Arctic Communities: A Social Science Overview*
Presenter: Peter Schweitzer

2- The Social Impacts of Road and Railroad Projects: Cases from the Russian North
Presenter: Olga Povoroznyuk

3-*Arctic Crossings: Hierarchies of transportation infrastructure in the Arctic and their social and environmental implications*
Presenter: Vera Kuklina

4- *Reindeer, Railways, and the Embodied Limits of Cultural Politics in Sámiland*
Presenter: Natalia Magnani

5- *The Yamal Obskaya-Bovanenkovo railway and Nenets reindeer herders: three decades of shared territory*
Presenter: Timo Kumpula

Arctic Change Session 2:

https://vimeo.com/488143072

1-*Progress in detection and monitoring of transportation infrastructure in the Arctic based on satellite data*
Presenter: Annett Bartsch

2-*Environmental and Economic Consequences of Operation of the Western Section of theBaikal-Amur Railway in Conditions of Climate Warming and Multidirectional Permafrost Dynamics*
Presenter: Dmitrii Sergeev

3-*Geohazards caused by massive ice below the Dempster Highway, YT: an overview and some possible adaptation approaches*
Presenter: Fabrice Calmels

4-*Environmental consequences of Arctic roads across lake and river landscapes*
Presenter: Warwick F. Vincent

Northern Roads and Railways: Social and Environmental Effects of Transport Infrastructure

(convened by Olga Povoroznyuk, Warwick F. Vincent and Fabrice Calmels)

Environmental consequences of Arctic roads across lake and river landscapes

Warwick F. Vincent & Christopher D. Arp

Center for Northern Studies (CEN)
Département de Biologie
Laval University
Quebec City, Québec, Canada

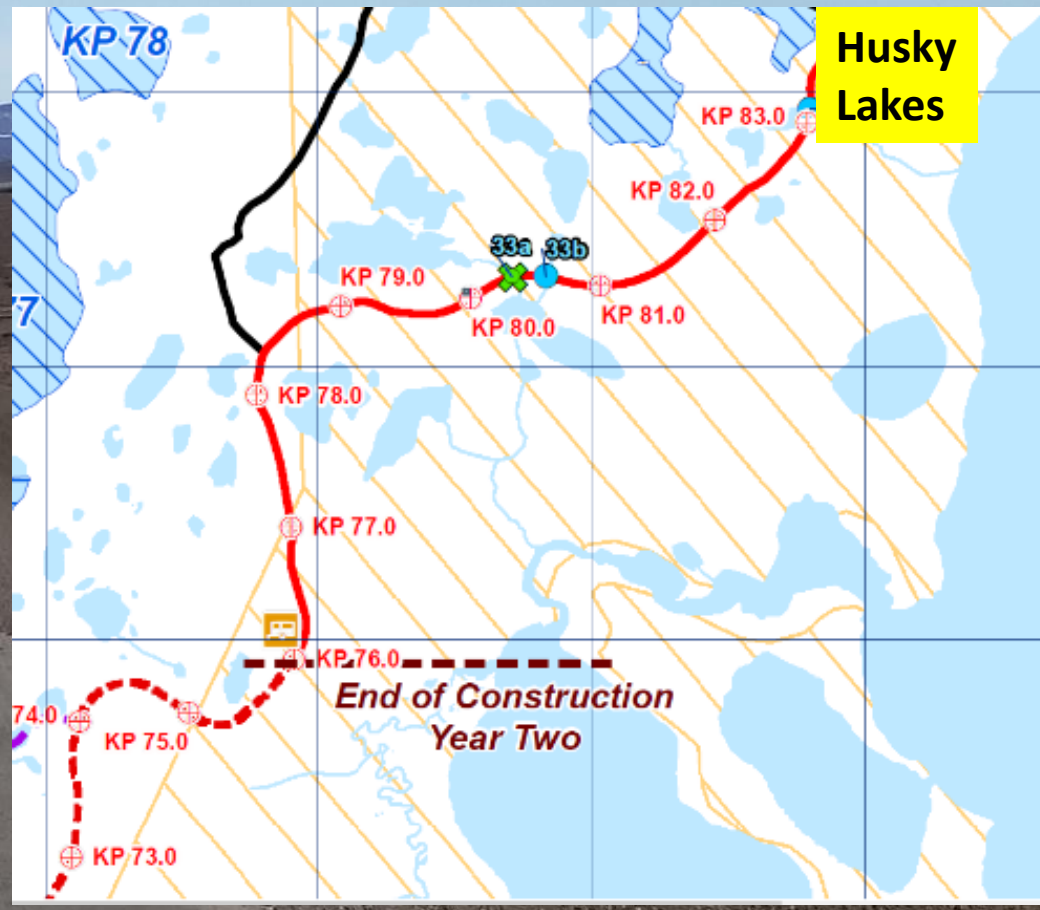
Water and Environmental Research Center
Institute of Northern Engineering
University of Alaska Fairbanks
Fairbanks, Alaska, USA

IASC RATIC/T-MOSAiC Symposium on Arctic Roads and Railways

Arctic Change 2020

http://www.horizonnorth.ca/inuviktuktoyaktukhighway

Inuvik-Tuktoyaktuk Highway, NWT, Canada



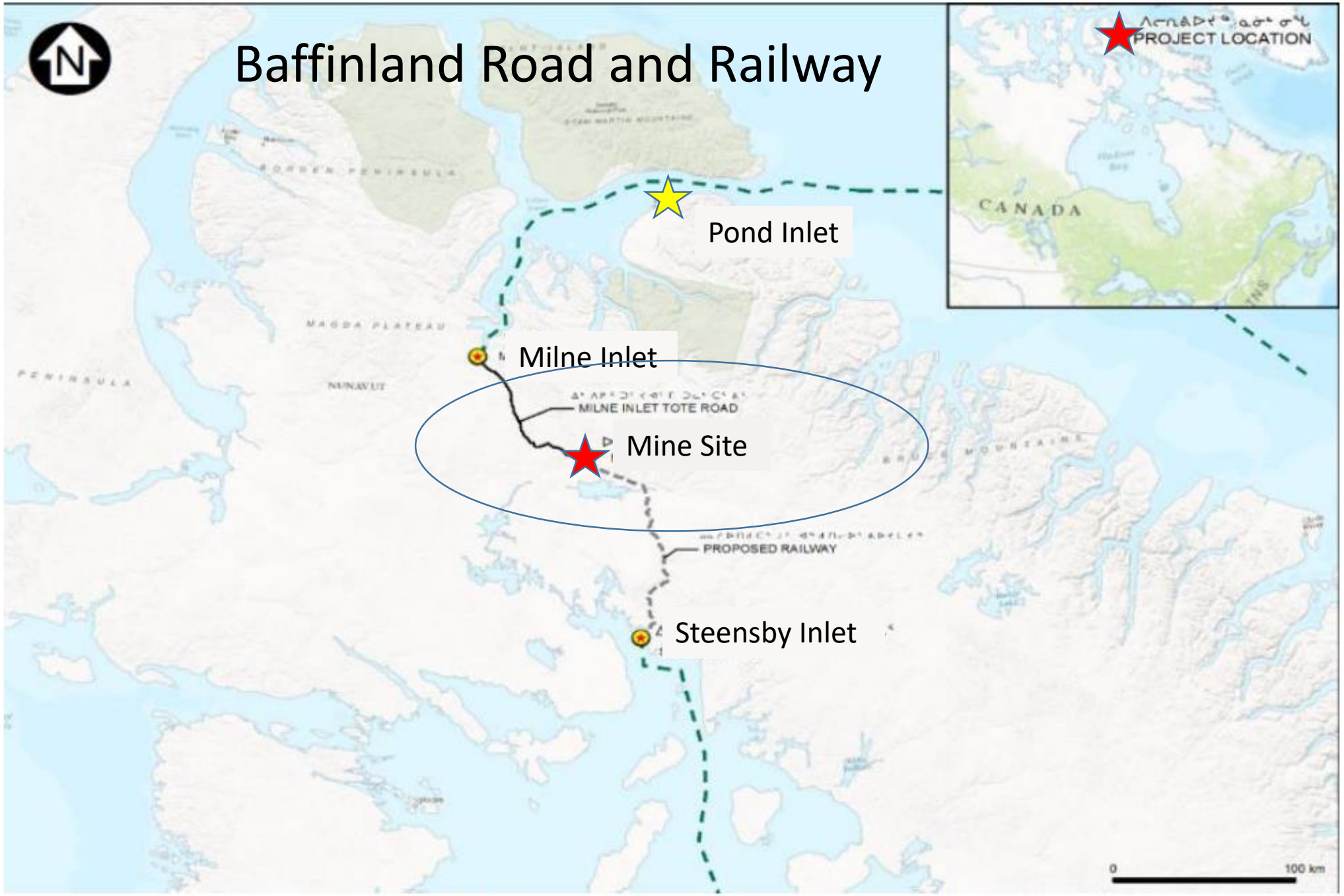
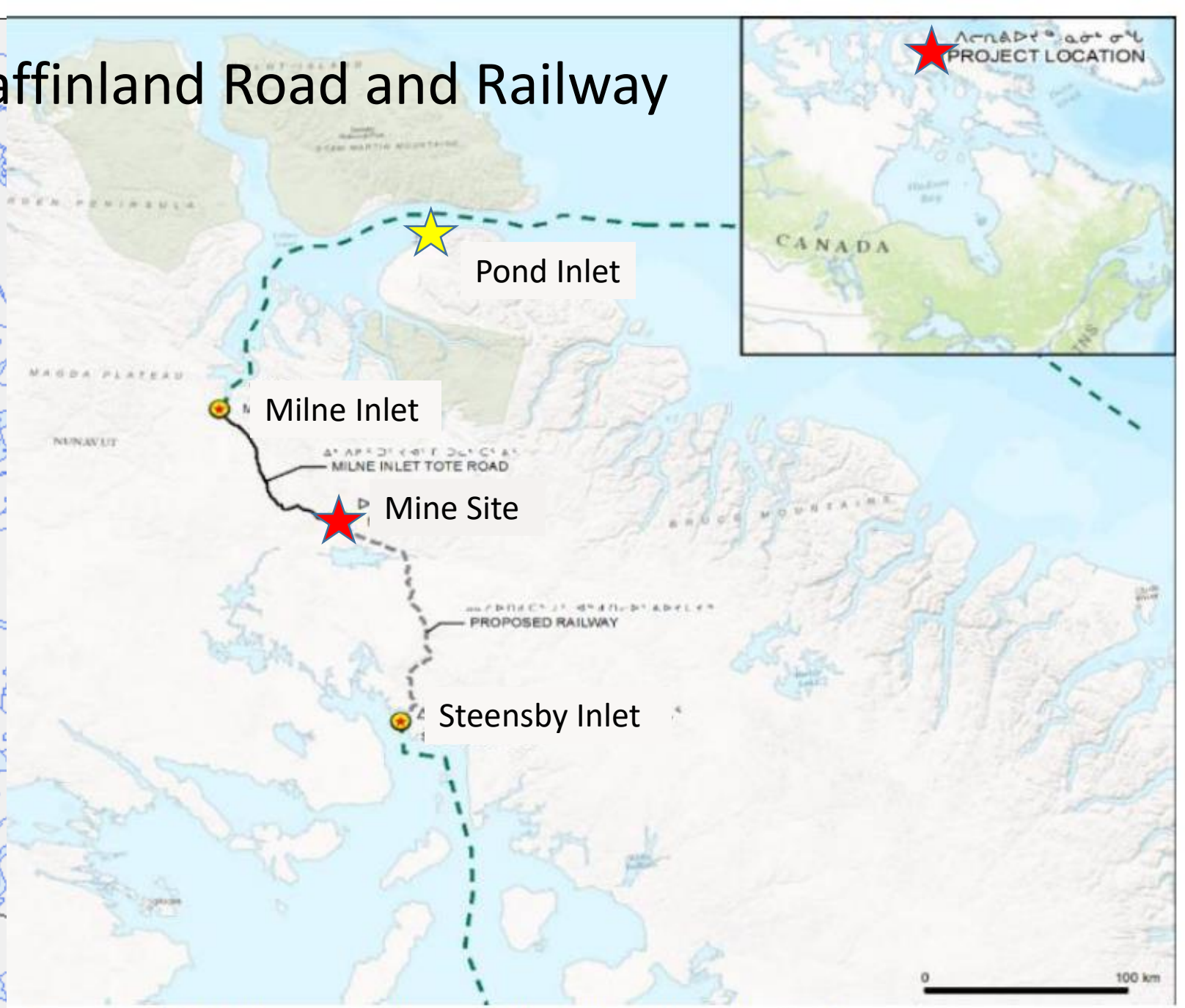


Figure 2: Early Revenue Phase of the Mary River Project

Baffinland Road and Railway



https://www.nirb.ca/application?strP=r

Figure 2: Early Revenue Phase of the Mary River Project

Baffinland Image:
http://nunatsiaq.com/stories/article/65674baffinland_railway_may_be_dead_pond_inlet_group_declares/

Figure 2: Early Revenue Phase of the Mary River Project

MONDAY, MAR 15, 2021

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BUSINESS FEB 2, 2021 – 12:42 PM EST

Baffinland says it won't budge on proposed railway route

Pond Inlet hamlet and hunters and trappers association remain concerned about impact on caribou

Megan Lord-Hoyle, Baffinland's vice-president of sustainable development, says the company is committed to its proposed railroad route. Critics of the company's plans to expand its Mary River mine say more work needs to be done. (Screenshot from NIRB/Zoom)

Figure 2: Early Revenue Phase of the Mary River Project

https://nunatsiaq.com/stories/article/baffinland-says-it-wont-budge-on-proposed-railway-route/

Baffinland Image:
http://nunatsiaq.com/stories/article/65674baffinland_railway_may_be_dead_pond_inlet_group_declares/

ALJAZEERA

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Inuit voices grow louder in fight over Nunavut mine expansion

Inuit communities in northern Canada say they fear mine expansion will harm wildlife and cultural practices.

An ice-covered fjord on Baffin Island, the fifth largest island in the world, in the territory of Nunavut in northern Canada [File: Michael Studinger/NASA/Handout via EPA]

By Jillian Kestler-D'Amours

27 Feb 2021

https://www.aljazeera.com/news/2021/2/27/inuit-voices-grow-louder-in-fight-over-nunavut-mine-expansion-canada

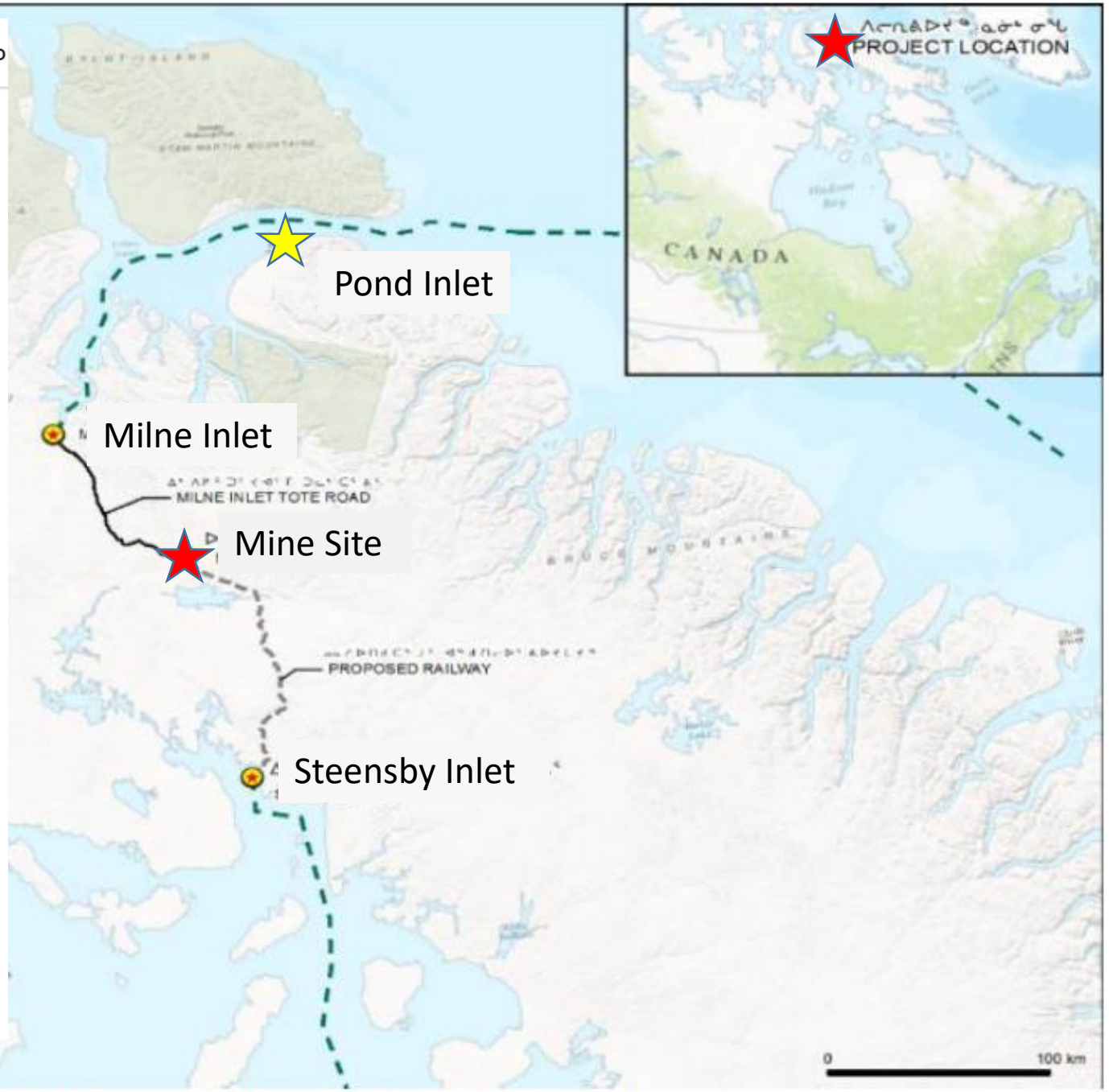


Figure 2: Early Revenue Phase of the Mary River Project

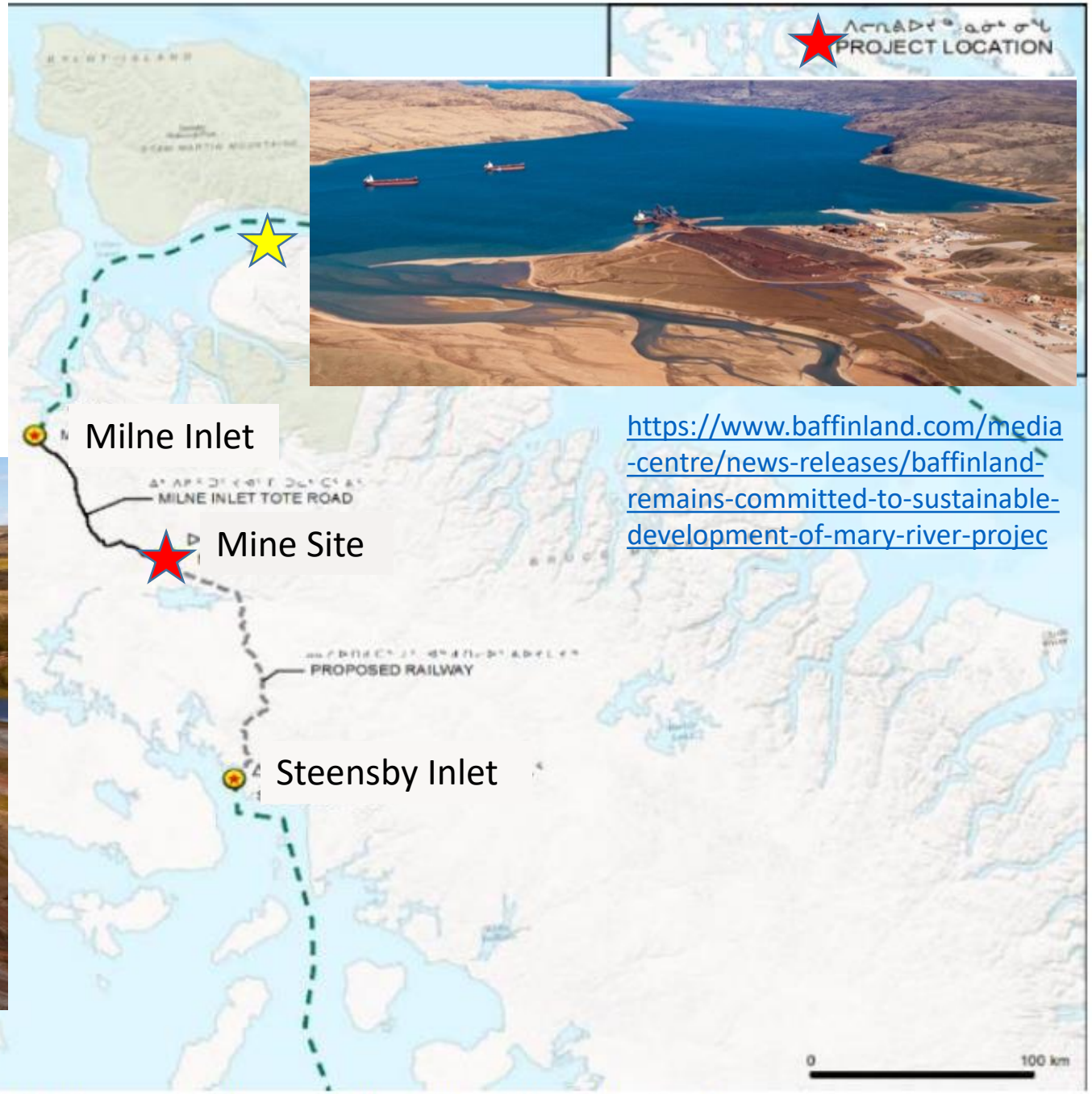
nunavut news
Circulated in all 25 Nunavut communities.

NUNAVUT NEWS

Qikiqtani Inuit Association withholds support for Baffinland's proposed Mary River Mine expansion

by Derek Neary
March 5, 2021

https://www.nunavutnews.com/nunavut-news/qikiqtani-inuit-association-withholds-support-for-baffinlands-proposed-mary-river-mine-expansion/

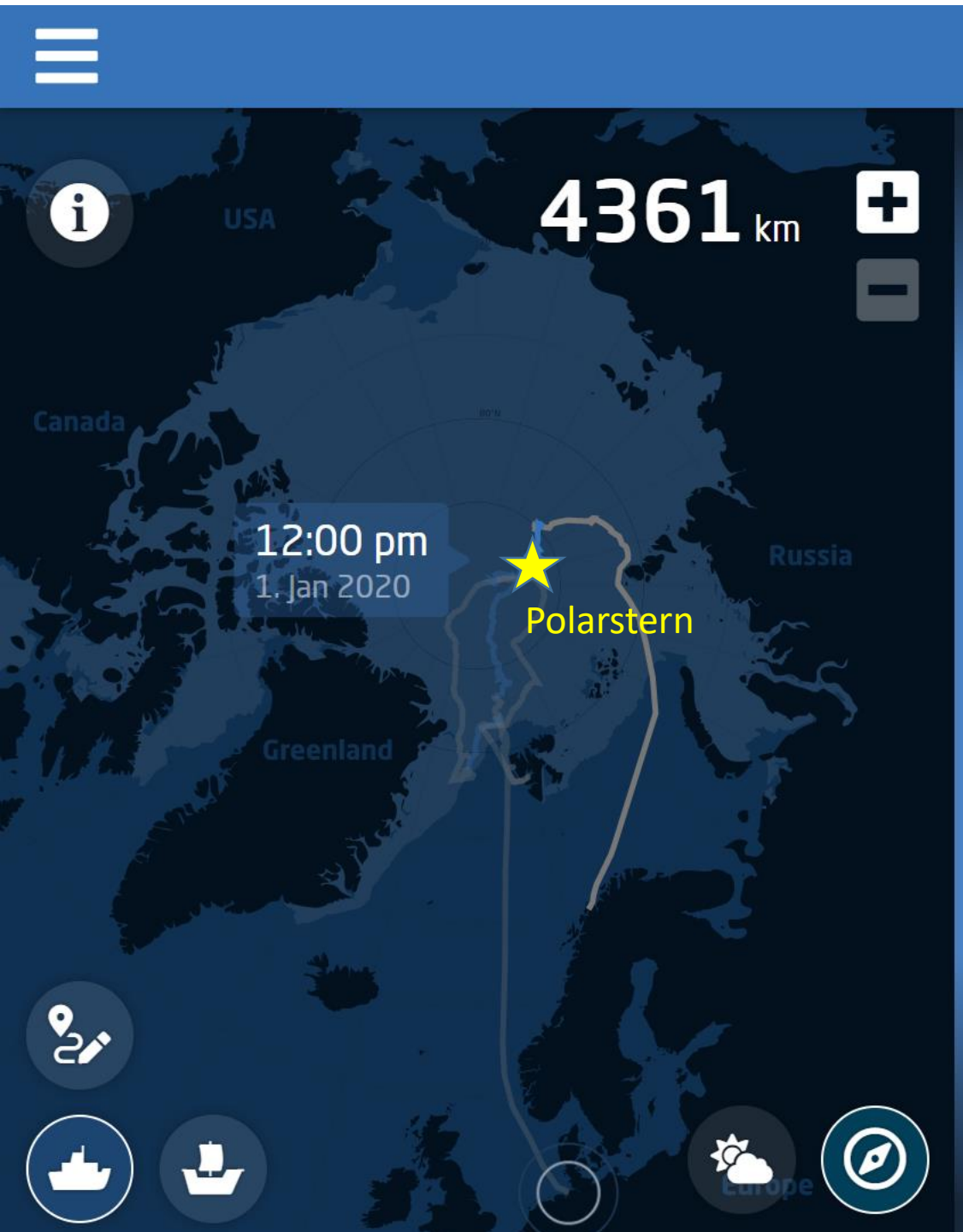


https://www.baffinland.com/media-centre/news-releases/baffinland-remains-committed-to-sustainable-development-of-mary-river-projec

Figure 2: Early Revenue Phase of the Mary River Project

MOSAiC

https://follow.mosaic-expedition.org



3. January
2020

THURSDAY
2. January
2020

WEDNESDAY
1. January
2020

TUESDAY
31. December
2019

MONDAY
30. December

558 SHARE DAY 104 N86°44 E117°43

31. December 2019

Eric Brossie

The Polarstern crew conducts safety drills on a weekly basis. The drills begin with the horrifying ship's alarm, and fire brigades march through the ship. But fortunately, the scientists are informed in advance, and we do not need to be afraid.

MOSAiC - Keeping track

Website: https://mosaic.colorado.edu/

University of Colorado **Boulder**

A Year in the Ice

MOSAiC: Multidisciplinary Drifting Observatory for the Study of Arctic Climate

Home | About | News | People | Education | Blogs | Partners | MOSAiC Monday

MOSAiC PIs

Markus Rex
Matthew Shupe
Martin Schneebeli
Christian Haas
Annette Rinke
Wiesław Masłowski
Katja Metfies

T-MOSAiC Newsletter

Front page of T-MOSAiC website:
https://www.t-mosaic.com/

Help / FAQ
Home
Sign In
Search
Browse by Day
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Union and Named Lectures
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Poster Summary Sessions
AGU Events
COVID-19 Itinerary

C036-02 - Warm air intrusions and surface melt over sea ice from MOSAiC during spring 2020

Friday, 11 December 2020
07:04 - 07:08

Abstract

Onset of surface melt over sea ice at the MOSAiC Central Observatory (CO) occurred at 83.3°N on 25 May 2020. This date is defined thermodynamically following Persson (2012), but represents the point at which the transition in the surface energy budget from wintertime net cooling to summertime net warming begins to melt the snow rather than just warm it. It is the seasonal genesis of persistent top-side melt of the sea ice and in the central Arctic onset dates have trended earlier by ~7 d/da since 1979 (Bliss and Anderson 2018). Onset at MOSAiC was associated with a southerly air intrusion of cyclonic origin and melt initiation was dominated locally by longwave radiative processes. Melt was sustained nearly un-interrupted for ~128 hours. These characteristics are similar to the onset at both SHEBA in the Beaufort at 76.4°N on 28 May 1998 (Persson 2012) and N-ICE2015 at ~80°N near Svalbard on 1 June 2015 (Walden et al. 2017, Cohen et al. 2017). At MOSAiC, both shortwave and longwave processes worked in concert to sustain melt. In 2020, the breakdown of the polar vortex beginning in mid-April allowed for such air masses to reach the CO from the North Atlantic with synoptic regularity thereafter. Indeed, the air temperature was rarely above -20°C before and rarely below -20°C after. The bulk temperature of the ice responded similarly. Four unique pre-onset events having the potential to melt the surface occurred after 13 April. While episodic melt was observed conclusively on 19 April, evidence of heterogenous melt was observed earlier on the 16th, highlighting the importance of spatial variability in snow optical and/or physical properties. These events were followed by near-neutrality in the surface radiation budget through April before it turned persistently positive in early May. Pre-onset events reduced the (clear-sky) surface albedo by ~2% and were followed by colder near-surface air and, when melt occurred, refreezing of the upper snow layer. Conversely, melt onset was associated with an abrupt reduction of diffuse-regime surface albedo of >5% and subsequent episodes of cold air became less frequent. In this study, we examine the surface energy budget in more detail to elucidate the role of springtime warm air intrusions on melt and the reasons that events prior to onset produced melt that was brief and episodic rather than persistent.

Authors

Christopher Cox
NOAA PSL

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Ola P G Persson

Warm air intrusions in spring produced brief episodes of melting

Help / FAQ
Home
Sign In
Search
Browse by Day
Browse by Sections
Union and Named Lectures
eLightning
Poster Sessions
Co-sponsoring Organizations
Town Halls
Scientific Workshops
Keynote and Plenary
Innovative Sessions
Pod Reservation System
Poster Summary Sessions
AGU Events
COVID-19 Itinerary

C044-0003 - Cloud Influences on the Surface Energy Budget at MOSAiC

Monday, 14 December 2020
07:00 - 23:59

Abstract

Clouds have a substantial impact on the Arctic sea-ice surface energy budget. In particular, cloud phase is a strong determinant of the overall effect of clouds on surface radiation and the response of other surface energy budget terms to radiative forcing. These processes are one key focus of the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC), wherein the icebreaker Polarstern drifted passively with the central Arctic sea ice for a full year from October 2019 to October 2020. During MOSAiC, a sophisticated suite of measurements was used to identify and quantify cloud properties over this full annual cycle, including cloud phase, the amount of condensed liquid water, and the overall cloud radiative effect on the surface. The bi-modal state of the Arctic atmospheric system was clearly present during MOSAiC, wherein the occurence of liquid clouds leads to an increase of 40-50 W/m2 in the surface longwave radiative balance relative to periods without liquid clouds. The rising sun and evolving surface albedo as summer progresses complicate these radiative states, but liquid clouds remain important drivers of variability. Cloud-driven changes in surface radiation modulate surface temperatures, the surface turbulent heat exchange, the conduction of heat through the sea ice, and phase transitions within the coupled atmosphere-ice-ocean system. The primary focus here is on the winter evolution towards summer, capitalizing on measurements that are exceedingly rare at this time of year in the central Arctic. Results suggest that in winter liquid clouds warm the surface by 10 degrees Celsius or more, and decrease the conduction of heat upward through the ice by 10-20 W/m2 depending on snow depth, with these effects diminishing towards summer. The net effects of clouds on each component of this system are examined and, to the extent possible, quantified, to support development of a conceptual model of cloud impacts on Central Arctic sea-ice.

Authors

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The results suggest that winter liquid clouds warm the surface by 10°C

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Home
Sign In
Search
Browse by Day
Browse by Sections
Union and Named Lectures
eLightning
Poster Sessions
Co-sponsoring Organizations
Town Halls
Scientific Workshops
Keynote and Plenary
Innovative Sessions
Pod Reservation System
Poster Summary Sessions
AGU Events
COVID-19 Itinerary

C044-0002 - Structure of Arctic Cyclones During MOSAiC and Their Surface Impacts

Monday, 14 December 2020
07:00 - 23:59

Abstract

Recent studies of primarily summertime Arctic cyclones (ACs) have revealed a unique structure, where long-lived tropopause polar vortices (TPVs) phase with surface baroclinic zones and rapidly become quasi-barotropic and nearly axisymmetric in nature. Cold lower and warm upper thermal anomalies result in a lowered tropopause, and ACs impact sea ice through both thermodynamic and kinematic processes. Though most studies utilize reanalysis data, the recently completed, year-long MOSAiC field program allow observational examination of the structure and surface impacts of High Arctic ACs during the entire annual cycle (Oct 2019-Oct 2020).

Over 20 cyclones impacted the MOSAiC observational domain. Atmospheric structure was sampled with high-frequency rawinsondes, a cloud radar, a wind profiler radar, and on-ice radiation, turbulence, and basic meteorological measurements. Observations of surface impacts include surface energy budget measurements, precipitation gauges, ice radar, SAR imagery, and an array of GPS buoys. Synoptic-scale spatial structure is provided by validated reanalysis data and satellite imagery. This preliminary work examines several cases. One mid-November case showed many classical structural features, but also features not previously associated with Arctic cyclones. These include a suggestion of topographical vortex-stretching influences from Greenland, and a low-level jet structure to the quasi-axisymmetric near-surface winds. Changes in direction of the strong surface winds produced ice fracturing, which later led to significant shearing with the passage of a subsequent weaker cyclone. Thermodynamic impacts on the sea ice resulted from dramatic changes in turbulent heat fluxes and longwave radiation, resulting in a brief reversal of the typical heat loss from the sea ice to the atmosphere. During the winter and following spring, numerous additional cyclones, including ones with much lower central pressure than the November cyclone, passed near the MOSAiC site. Many showed the LLJ structure, some produced thermodynamic impacts on the sea ice, and others kinematic impacts. This presentation will examine the structure of a number of these cyclones and their surface impacts. If time permits, cyclone structure from a coupled model will also be compared to the observations.

Authors

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Matthew Shupe

https://tc.copernicus.org/preprints/tc-2020-375/
https://doi.org/10.5194/tc-2020-375
Preprint. Discussion started: 16 February 2021

The Cryosphere Discussions
Open Access
EGU

Arctic sea ice anomalies during the MOSAiC winter 2019/20

Klaus Dethloff[1], Wieslaw Maslowski[2], Stefan Hendricks[3], Younjoo Lee[2], Helge F. Goessling[3], Thomas Krumpen[3], Christian Haas[3], Dörthe Handorf[1], Robert Ricker[3], Vladimir Bessonov[4], John J. Cassano[5], Jaclyn Clement Kinney[2], Robert Osinski[6], Markus Rex[1], Annette Rinke[1], Julia Sokolova[4], Anja Sommerfeld[1]

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[2] Department of Oceanography, Graduate School of Engineering and Applied Sciences, Naval Postgraduate School, Monterey, CA 93943, US[3] Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Am Handelshafen 12, 27570 Bremerhaven, Germany
[4] Arctic and Antarctic Research Institute, Center Ice and Hydrometeorological Information, Bering Street 38, St. Petersburg, Russia
[5] Cooperative Institute for Research in Environmental Sciences, National Snow and Ice Data Center and Department of Atmospheric and Oceanic Sciences, University of Colorado, Boulder, US
[6] Institute of Oceanology, Polish Academy of Sciences, Sopot 81712, Poland

T-MOSAiC

Terrestrial **M**ultidisciplinary distributed **O**bservatories for the **S**tudy of **A**rctic **C**onnections

Northern Community Issues AG
Chair: Maribeth Murray - Canada

MODAAT

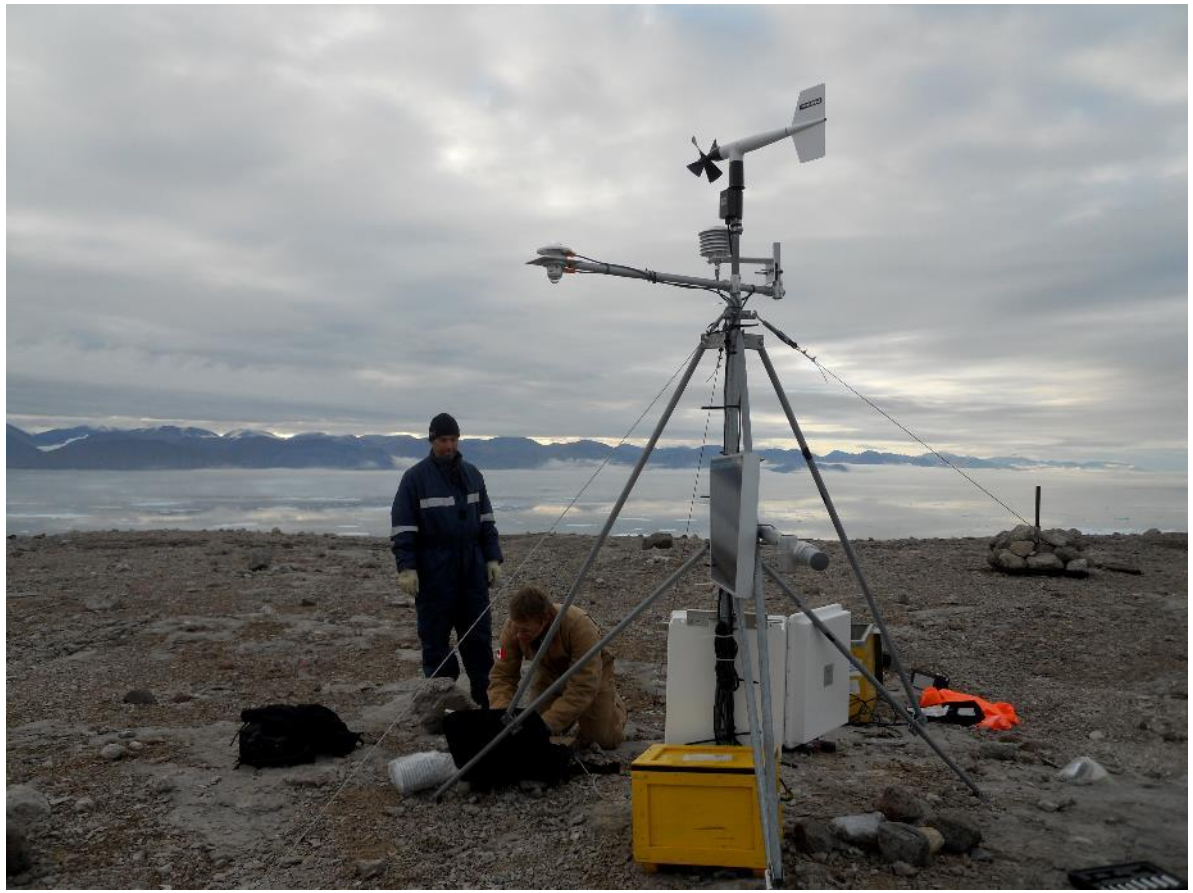
MERGED OBSERVATORY DATA for ARCTIC AIR TEMPERATURES

Étienne Godin and collaborators
in CCADI & T-MOSAiC/MOSAiC

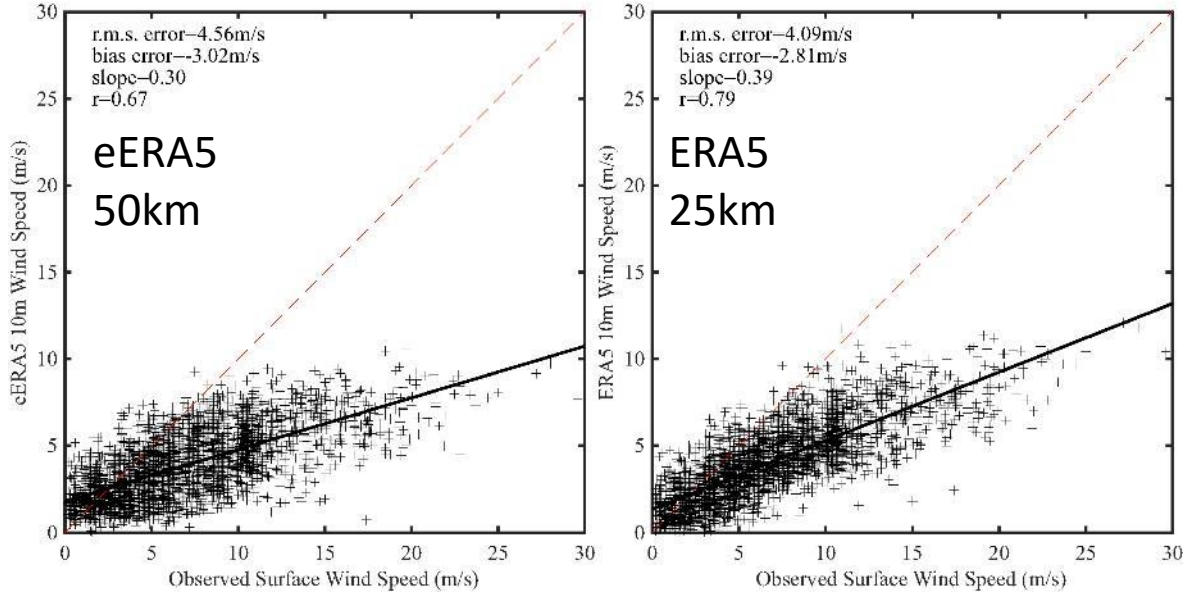
CCADI: Maribeth Murray and Peter Pulsifer

INNOVATION.CA
CANADA FOUNDATION FOR INNOVATION | FONDATION CANADIENNE POUR L'INNOVATION

The problem with reanalysis data – wind (Kent Moore)



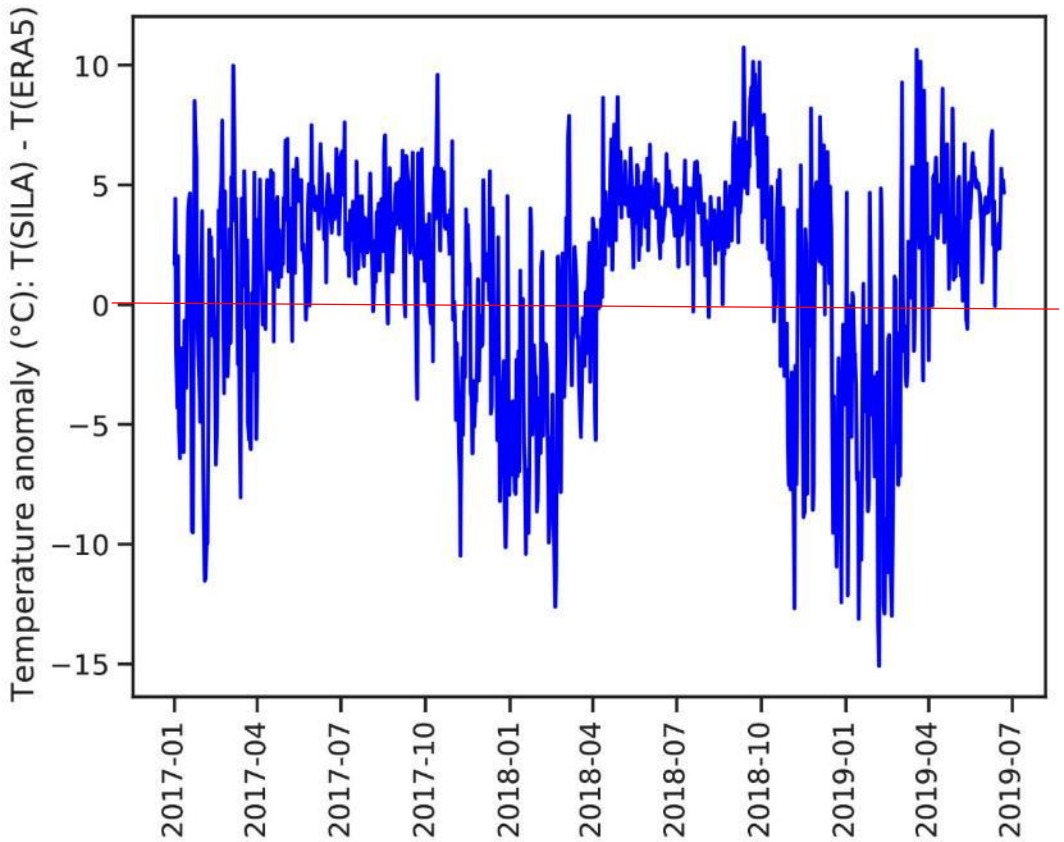
Canadian/Danish/American group installed AWS on Hans Island in 2012



ECMWF's Integrated Forecast System

Problems with reanalysis data – temperature (Étienne Godin)

Phoo: CE,
Bylot island, Canada



AWS data versus ERA5

Godin et al. 2020. Arctic Change

MODAAT: Merged Observatory Data for Arctic Air Temperatures
Mobilize AWS data (2017-2020)

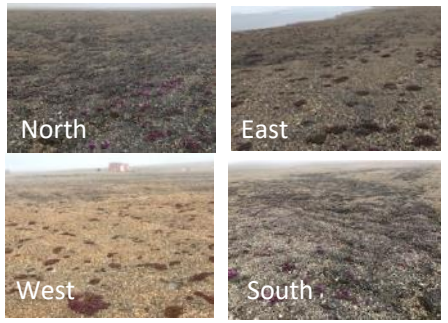
Nordicana D

Available data | List of publications

Station name : **Ward Hunt Island Observatory, Canada**

Location: 83.0914°N, 74.1328°W; altitude 8m

Summary: Ward Hunt Island is located near the northern coastline of Ellesmere Island, Nunavut, in the Canadian High Arctic. The Automatic Weather Station (AWS) is 50 m from a coastal lagoon on the northern side of the island, in a polar desert landscape. This record contains air temperature data within the period 1 January 2019 to 31 December 2020, and landscape images looking outwards from the station in summer. **Links to the full AWS database**, station operator and contact details are given in the metadata record.



Updated
air temperature plot
1/1/2017 to 31/12/2020

20xx: mean, min, max

Metadata download Landscape images download Air temperature data download

Nordicana D doi versioning

Authors: YYY (Authors could be persons, projects, programs or station names)

Cite this dataset as:

YYY (2021) Air temperature data and landscape images at Ward Hunt Island, Canada, 2019-2020, version 1.0. Nordicana DXX, https://doi.org/10.5885/XXXX ← This registered digital object identifier (DOI) allows the data to be discovered and cited

MODAAT: Merged Observatory Data for Arctic Air Temperatures
Mobilize AWS data (2017-2020)

Thursday, March 25

ID:68 - Progress Towards Realizing Data Sharing for the Arctic Region and Beyond
(I) 11:30 AM - 1:30 PM (GMT) and (II) 3:30 – 5:30 PM (GMT)
Conveners: Peter L. Pulsifer (Carleton University), Kirsten Elger (GFZ German Research Centre for Geosciences) and Mareike Wieczorek (Alfred Wegener Institute)

12:35 - Merged Observatory Data for Arctic Air Temperature **(MODAAT):** Under the hood of an interoperable system to mobilize automated weather station data, Etienne Godin

15:35 - A new and simple protocol for data collection on permafrost thaw during the period of T-MOSAiC (Terrestrial Multidisciplinary distributed Observatories for the Study of Arctic Connections), Julia Boike

T-MOSAiC

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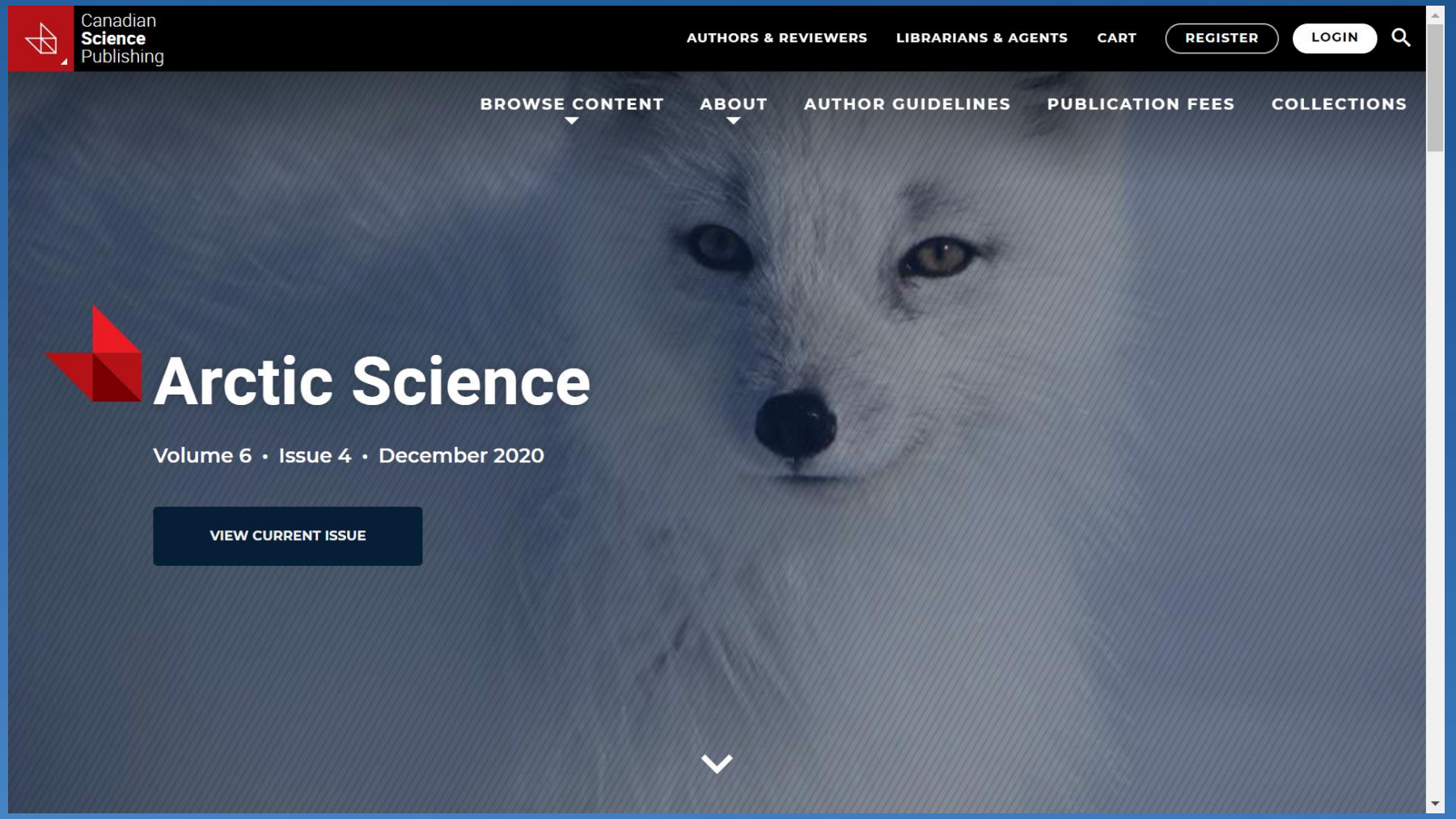
T-MOSAiC Special Issue of Arctic Science

Terrestrial Geosystems, Ecosystems and Human Systems in the Fast-Changing Arctic

Open for submissions until 31 March 2022



T-MOSAiC

Terrestrial **M**ultidisciplinary distributed **O**bservatories for the **S**tudy of **A**rcti**c** **C**onnections

Four central objectives

1) Connect observations
2) Develop new approaches
3) Identify gaps and priorities
4) **Apply system-level concepts**

Innunguaq at Kuujjuarapik-Whapmagoostui, Quebec, Canada. Photocredit: João Canario, Chair T-MOSAiC

T-MOSAiC

Terrestrial **M**ultidisciplinary distributed **O**bservatories for the **S**tudy of **A**rcti**c** **C**onnections

System-level concepts

- **Connectivity**
  - including to Arctic seas
- **Thresholds**
  - abrupt changes & regime shifts
- **Emergent properties**
- **Extreme events**
- **Gradients**
- **Feedbacks**
- **Legacy effects**

T-MOSAiC

Terrestrial **M**ultidisciplinary distributed **O**bservatories for the **S**tudy of **A**rcti**c** **C**onnections

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