The Real-World Impact of AI in the Polar Regions

2024 European Polar Science Week

3–6 September 2024 | The Black Diamond | Copenhagen, Denmark

From global AI satellite products to local Inuit led travel safety maps

Michel Tsamados (UCL)

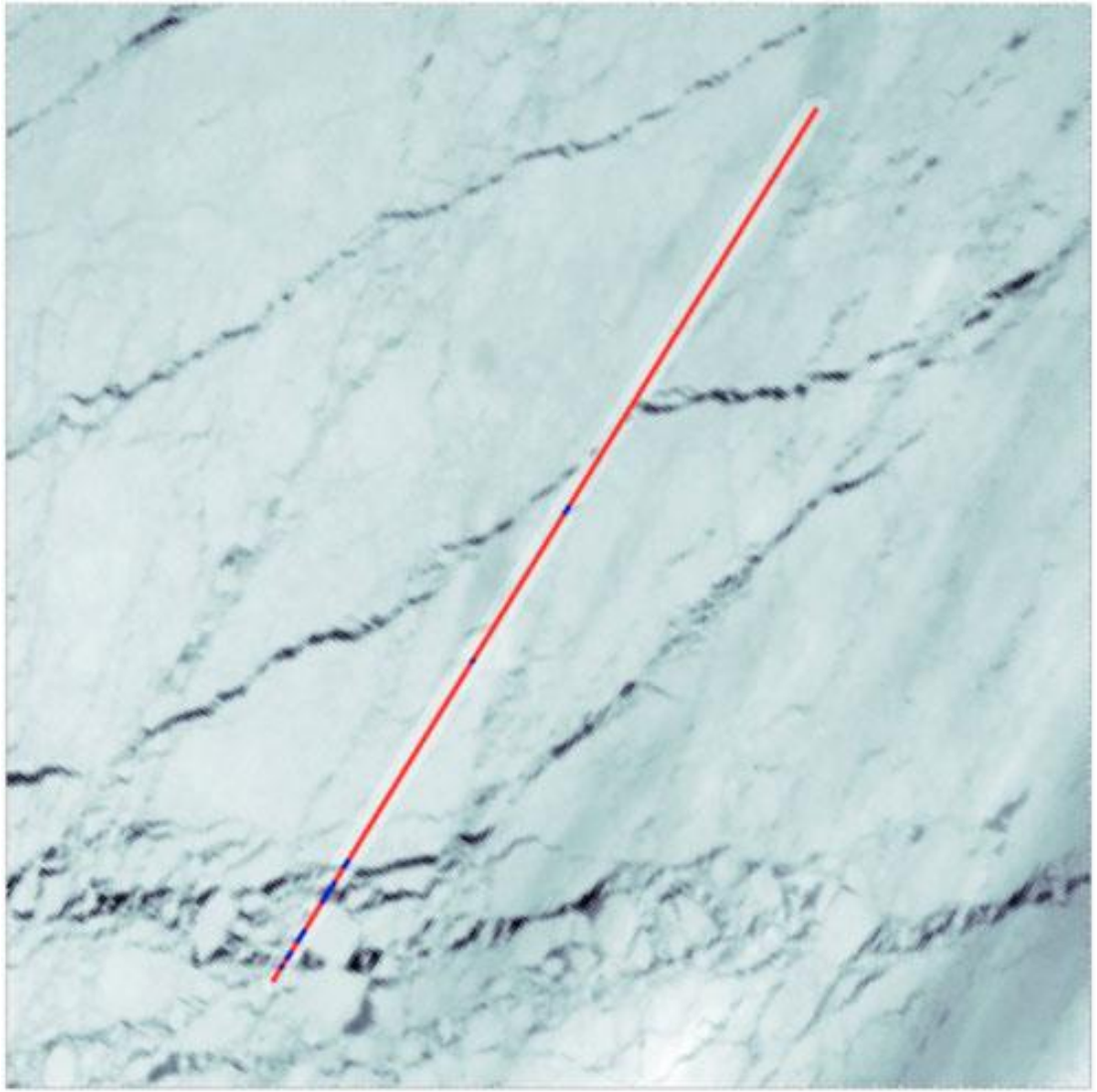
Ex1: Lead detection with OLCI

: ViT

: S3 (OLCI)

: 2016 – present

: 300 m



Chen et al (2024)

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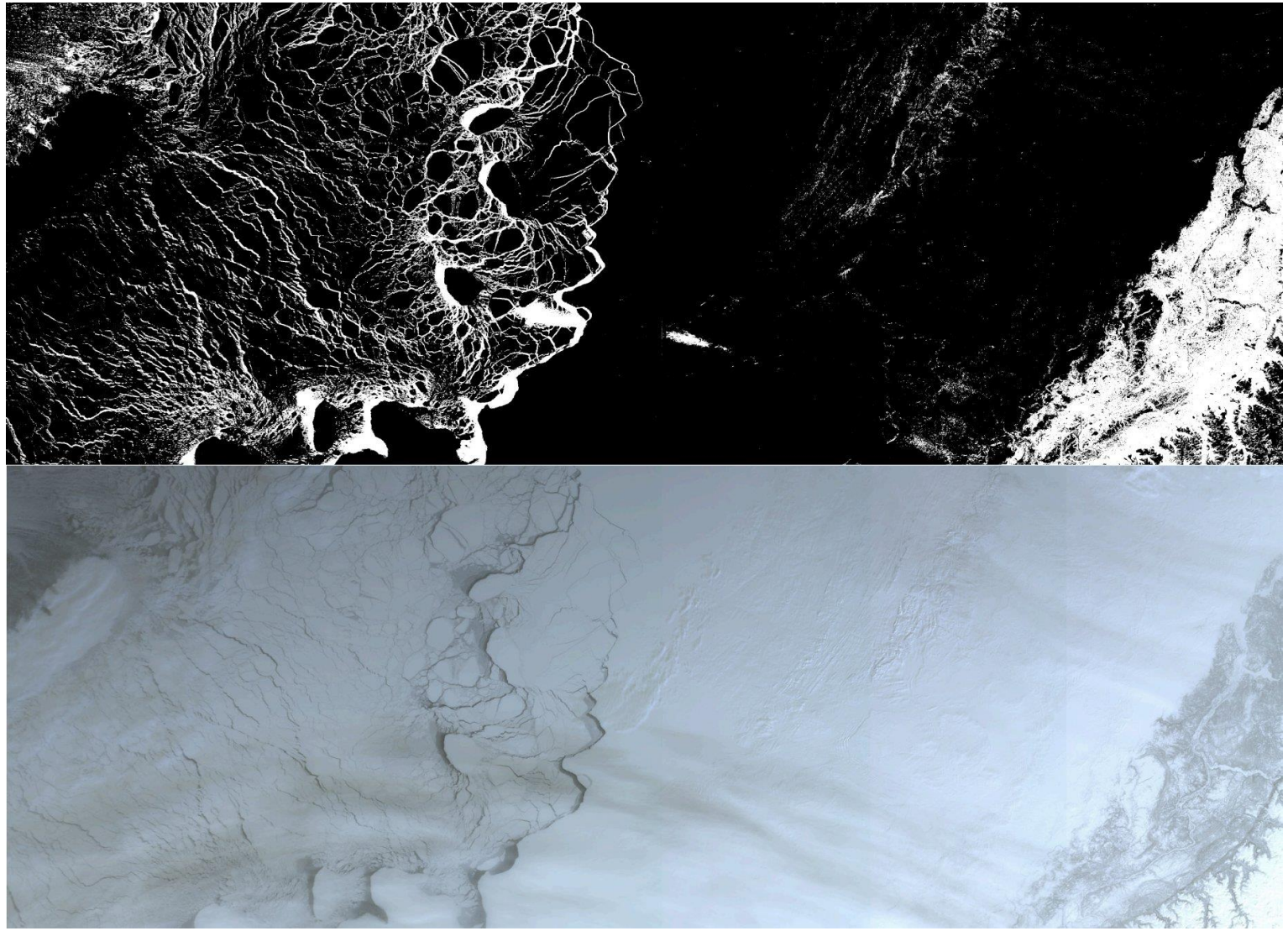


Chen et al (2024)

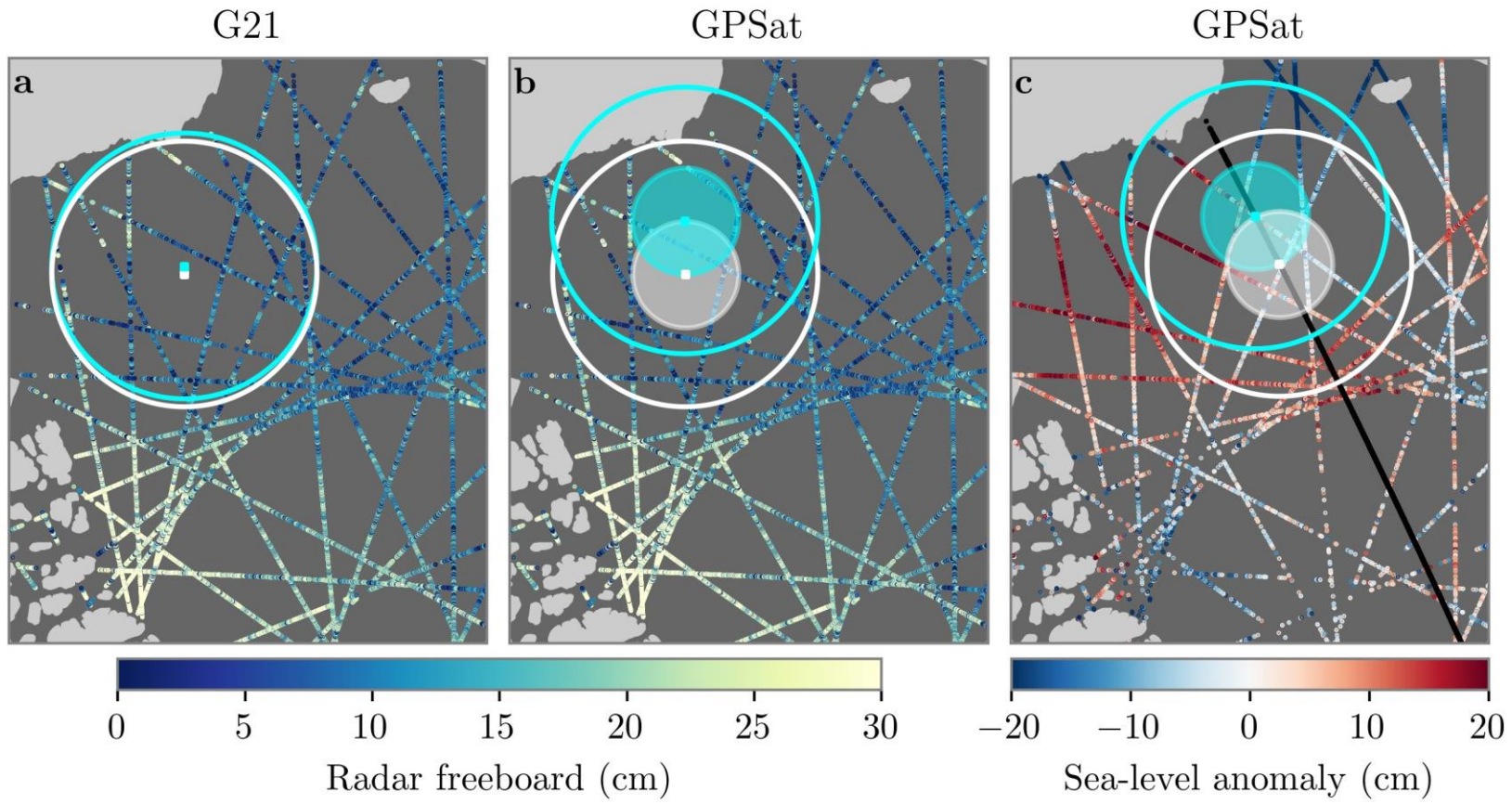
Ex2: OI using GPSat

: GP

: Altimetry (CS2)

: 2010 – present

: 10 km / 300m



Gregory et al (2024)

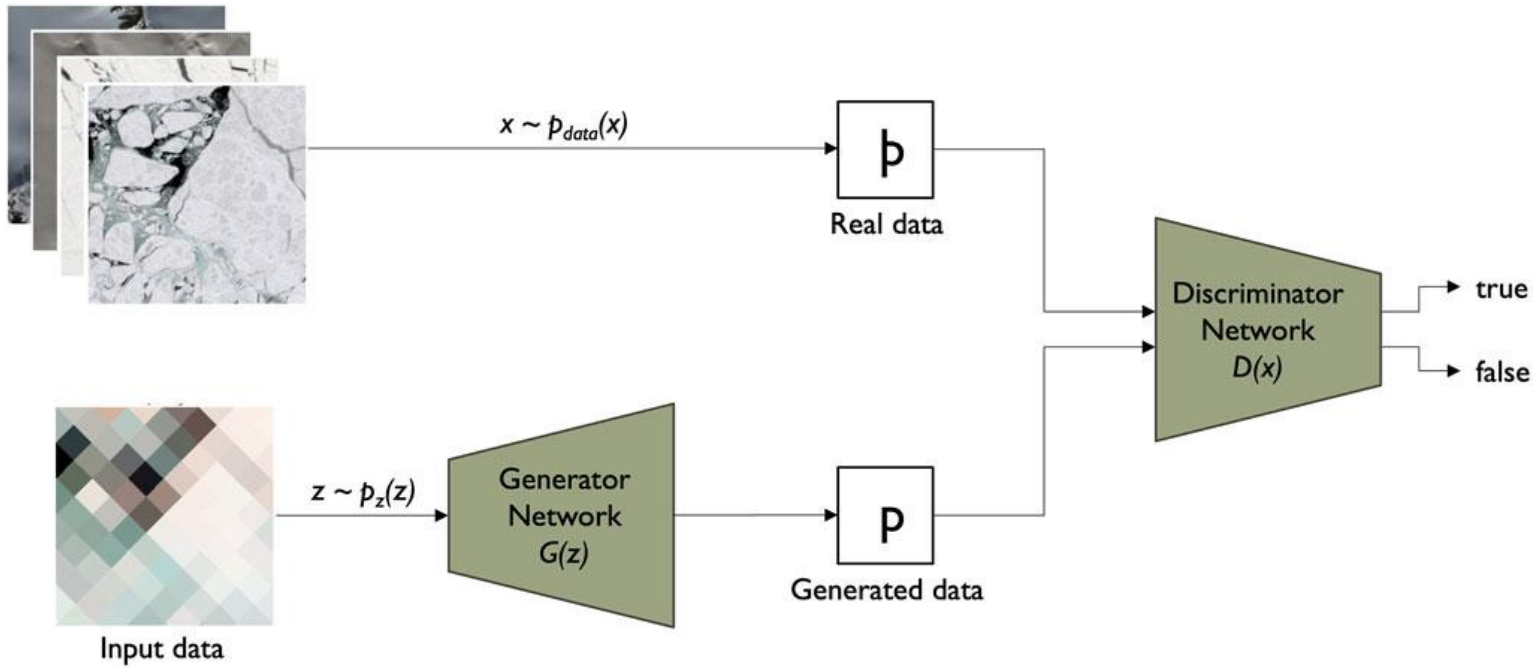
Ex3: Super-Res using ARISGAN

: GAN

: Optical S3 + S2

: 2016 – present

: 300 m -> 10m



Au et al (2024)
ARISGAN: Extreme super-resolution of arctic surface imagery using generative adversarial networks

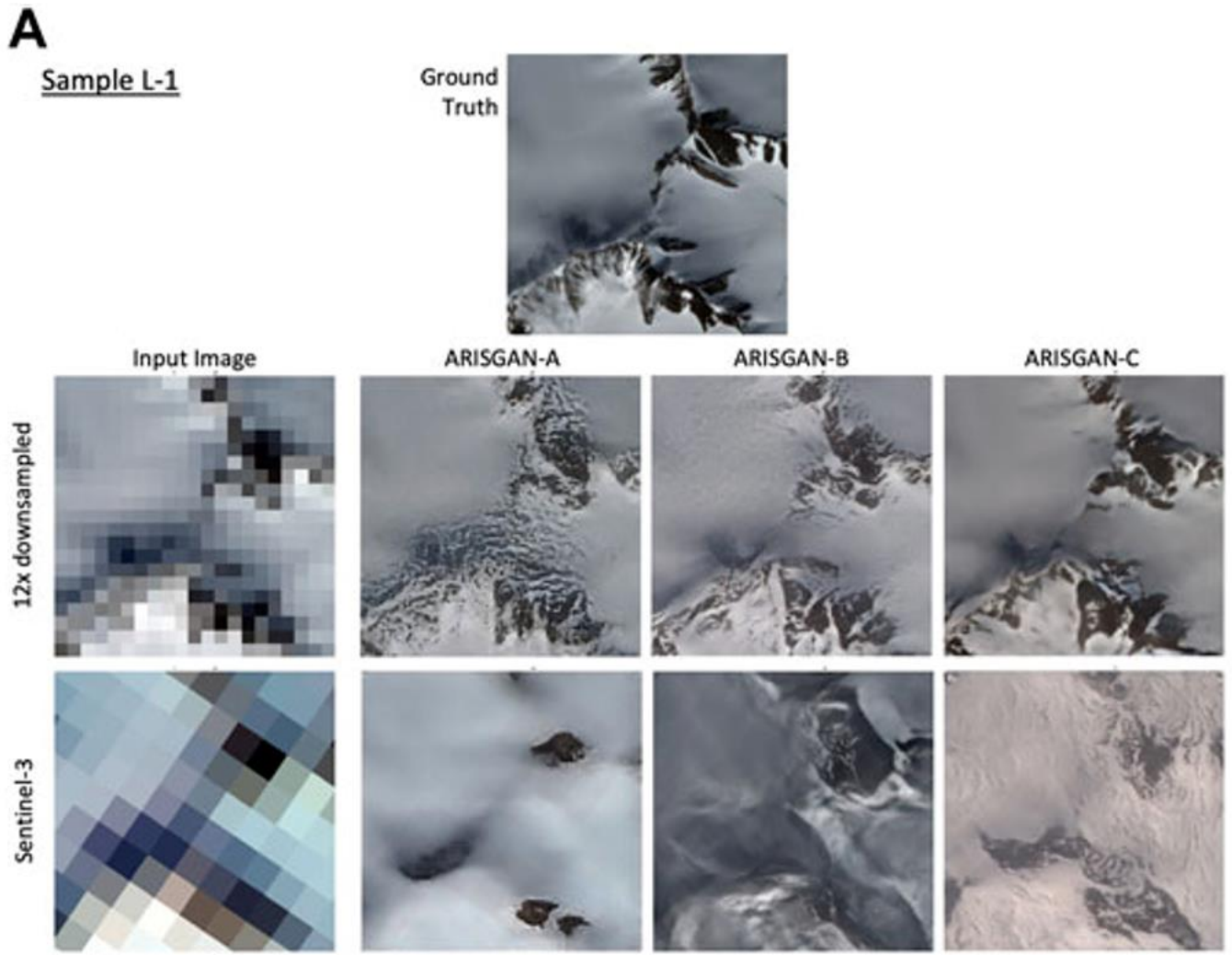
Ex3: Super-Res using GANs

: GAN

: Optical S3 + S2

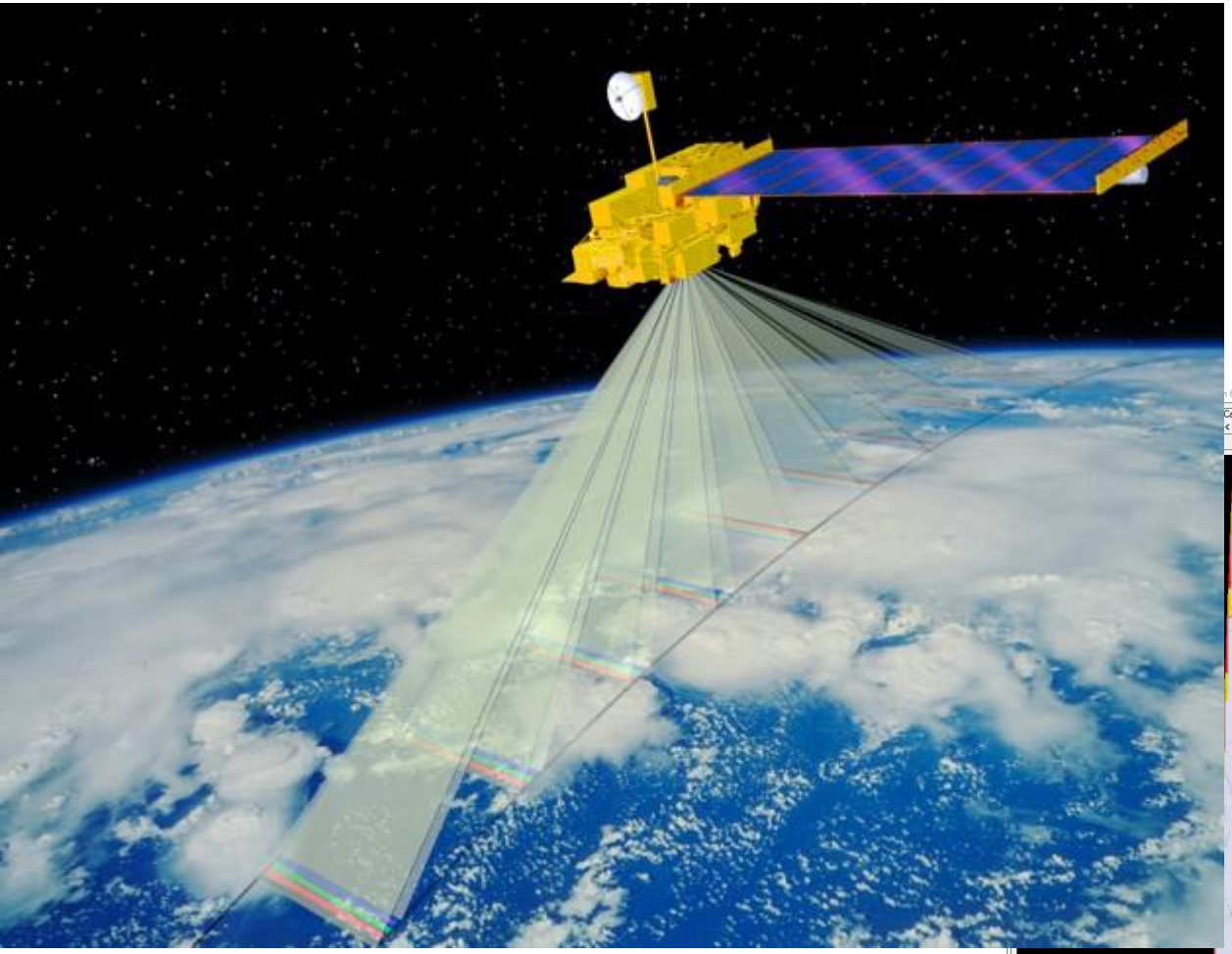
: 2016 – present

: 300 m -> 10m

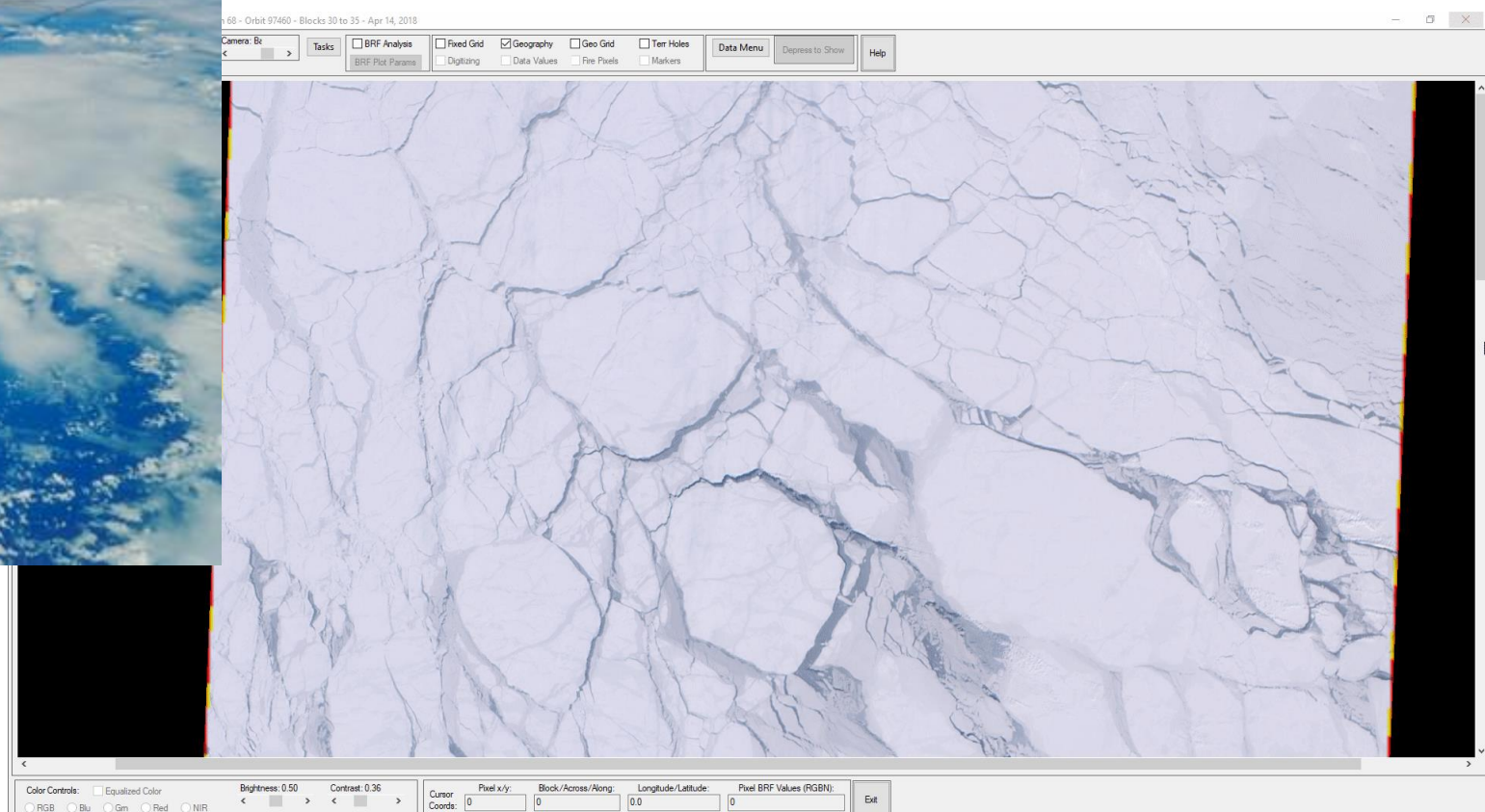


Au et al (2024)

Ex4: MISR Roughness product



Optical imagery
MISR



Credit: Thomas Johnson

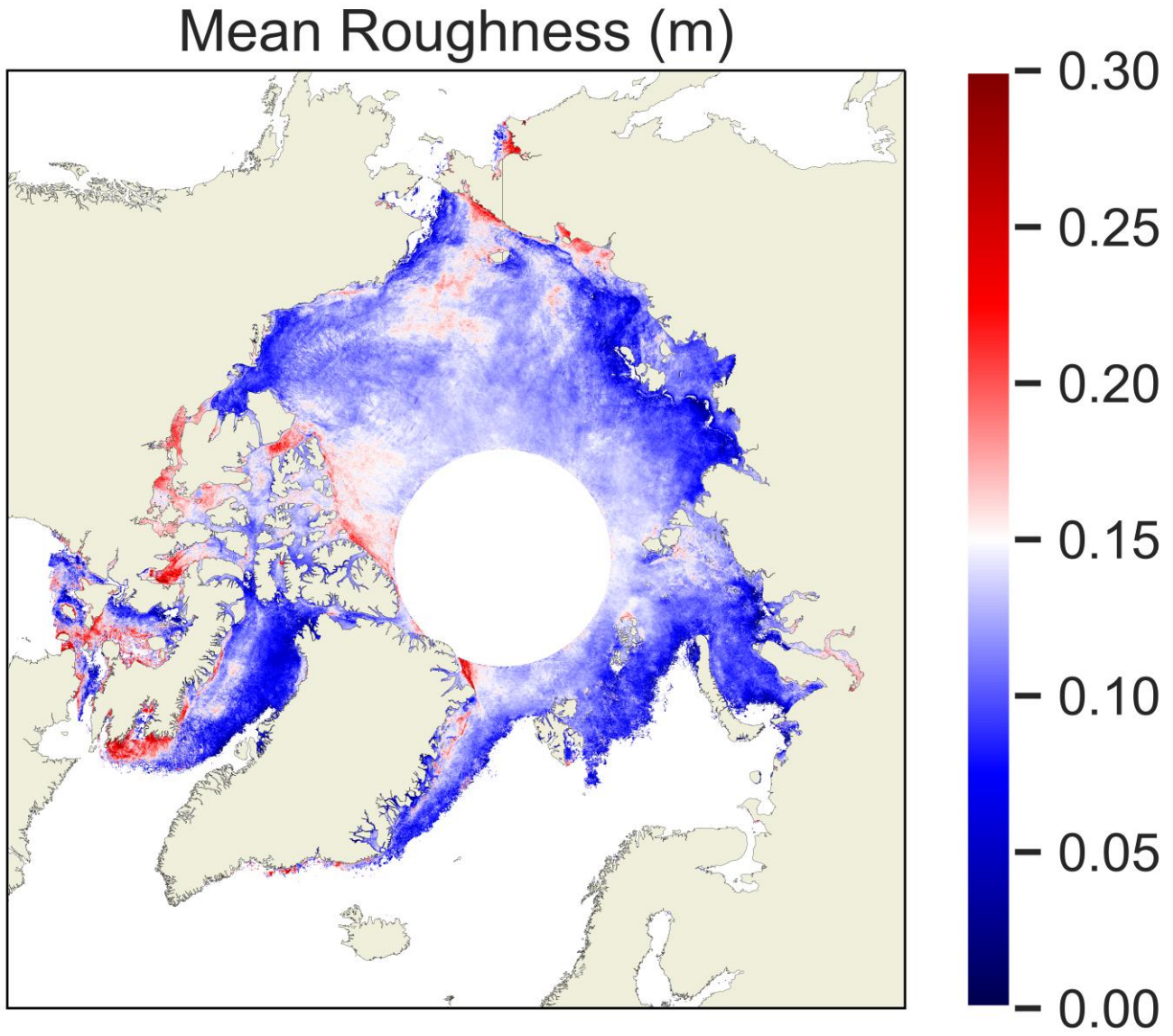
Ex4: MISR Roughness product

: SVR

: MISR

: 2000 – present

: 1.1 km



Johnson et al (2022)

Travel over **rough ice** is damaging to snowmobiles, costly in time and fuel, and more dangerous than smooth ice

INRS Institut national de la recherche scientifique

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MAKETECH

CINUK

CANADA – INUIT NUNANGAT – UNITED KINGDOM ARCTIC RESEARCH PROGRAMME

Universität Bremen

UCL from space to core earthsciences

Empowering our communities to map rough ice and slush for safer sea-ice travel in Inuit Nunangat

Sikuttiaq – means "good ice"

ICE remote sensing lab

ice | climate | ecosystem

geography | university of victoria

Bird's Eye Inc. FRQ

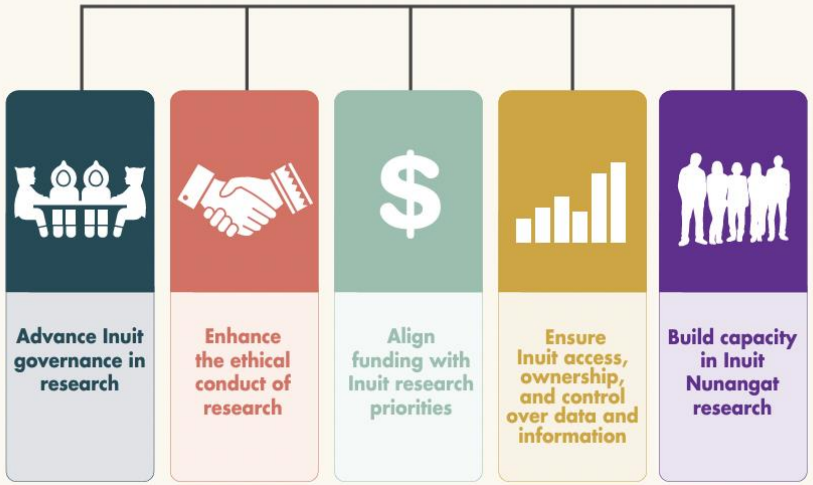
National Research Council Canada

Conseil national de recherches Canada

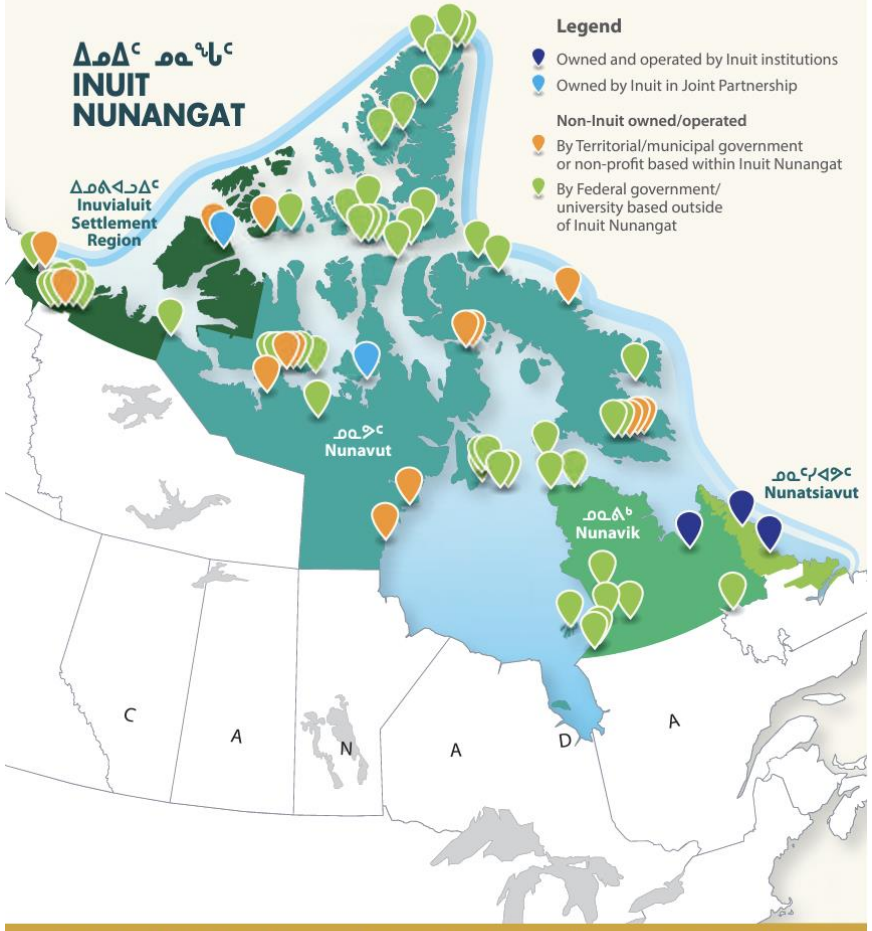
National Inuit Research Strategy

RESPECTFUL AND BENEFICIAL RESEARCH FOR ALL INUIT

5 Priority Areas of National Inuit Strategy on Research



DISTRIBUTION OF RESEARCH STATIONS IN INUIT NUNANGAT



See Appendix A for full list of research stations, which was adapted from publicly available information on the Canadian Network of Northern Research Operators (CNNRO) website and Isaaffik website.

Ex5: SAR Roughness product

: DT

: SAR

: 2019 – present

: 200m

Macdonald et al (2024)

Ex5: SAR Roughness product

: DT

: SAR

: 2019 – present

: 200m

Macdonald et al (2024)

Credit: Thomas Newman (UCL)

Land – Sky – Space

Data sources

Research and Training activities

New map data layers to support ice travel safety

Externally controlled

User controlled

User controlled

From Space
Optical, Radar

From Land
Inuit obs., Cameras, EM, etc

From Sky
Lidar, Cameras, EM

Slush on ice

Surface roughness

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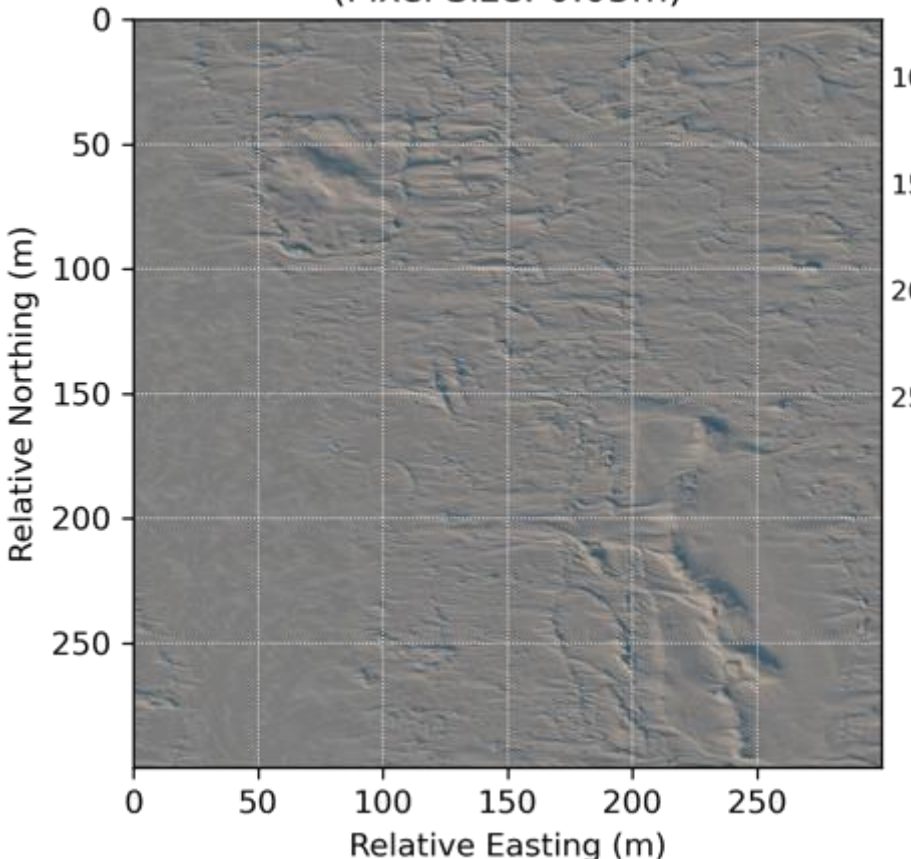
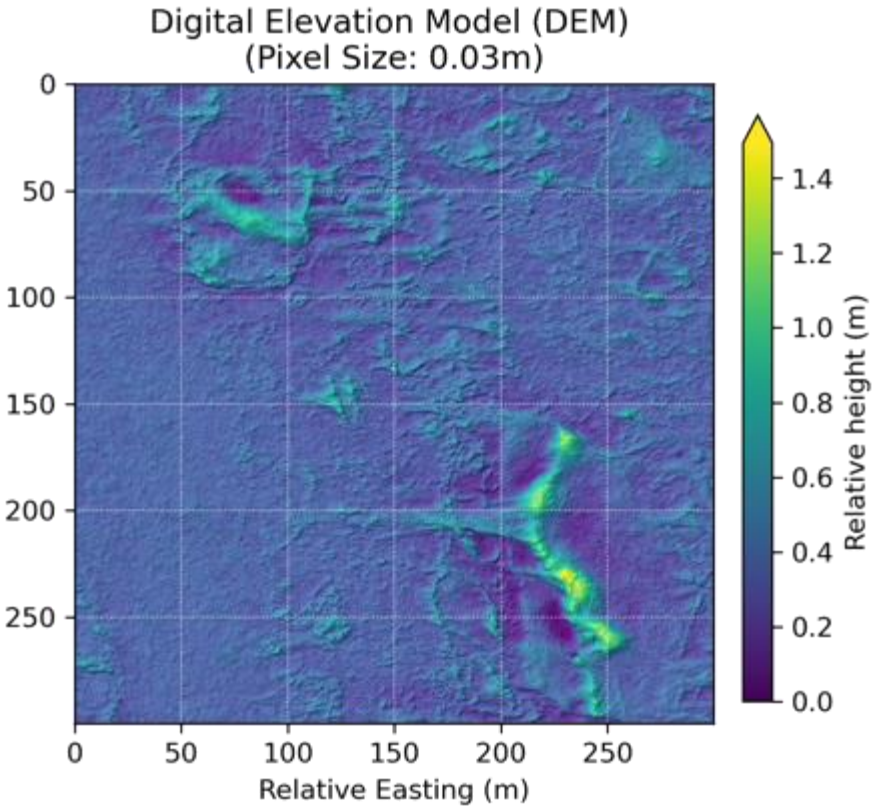
Drone photogrammetry

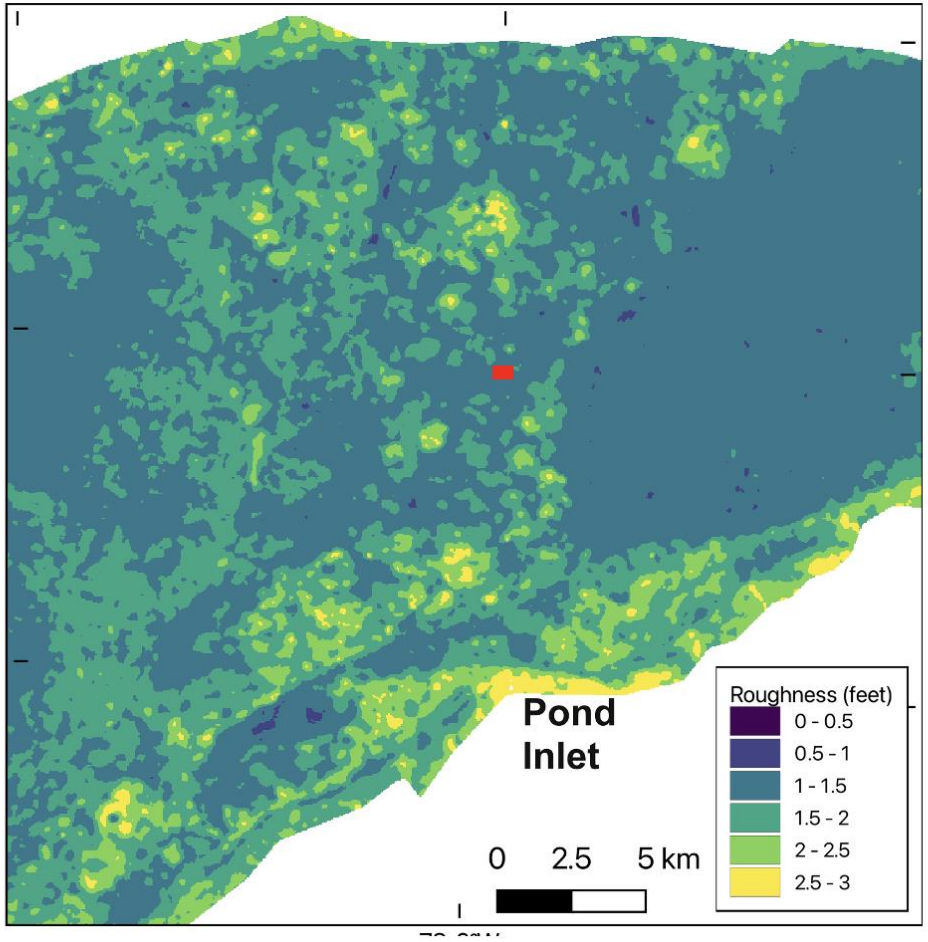


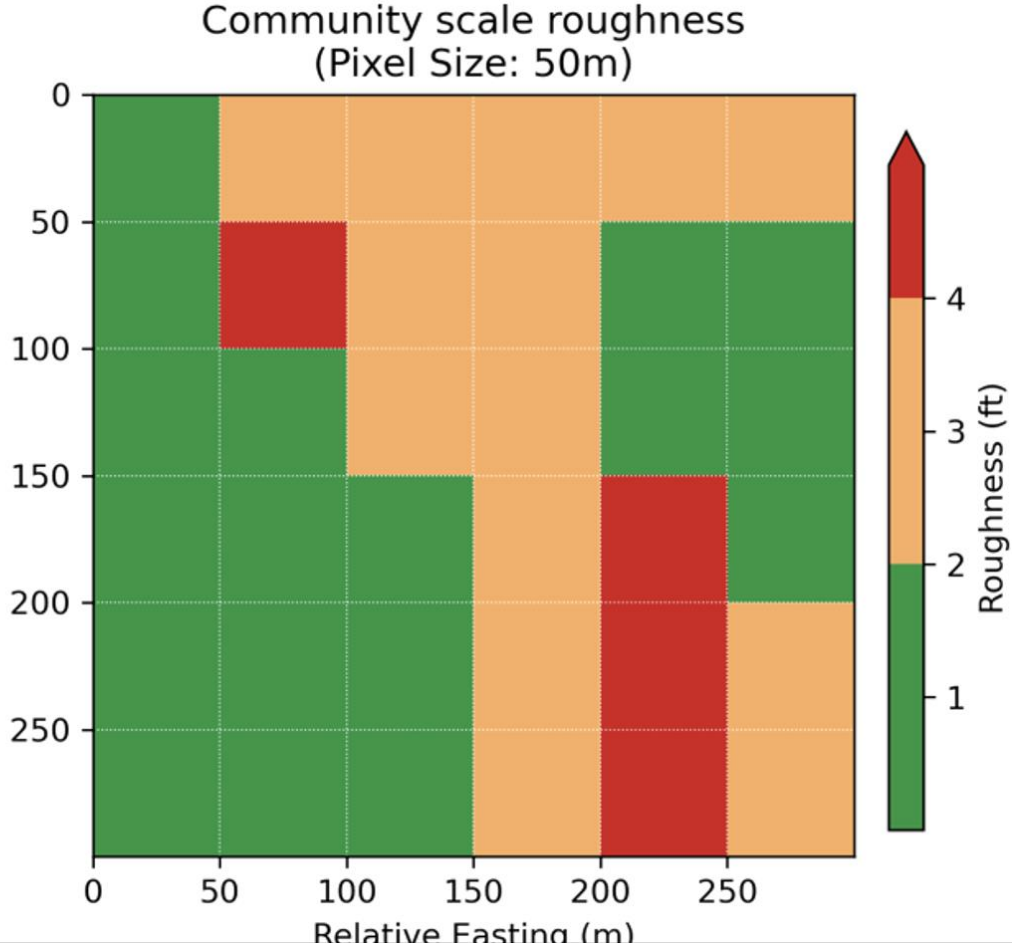


Credit: Thomas Newman (UCL)

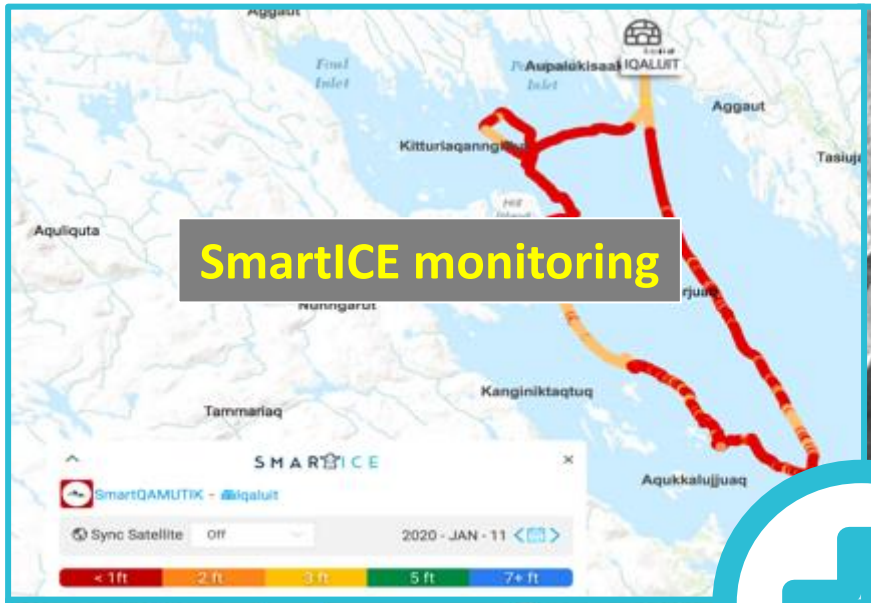
Towards travel safety maps

Credit: Thomas Newman (UCL)

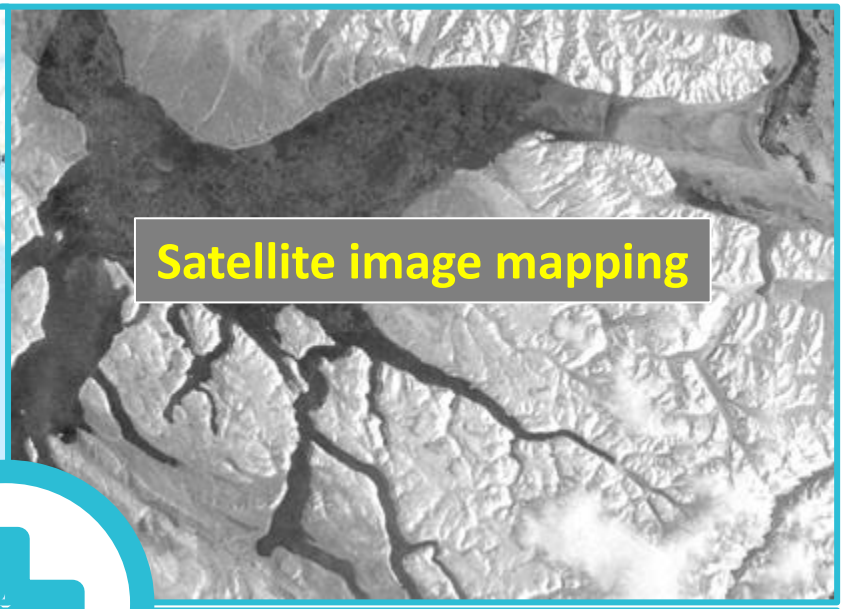




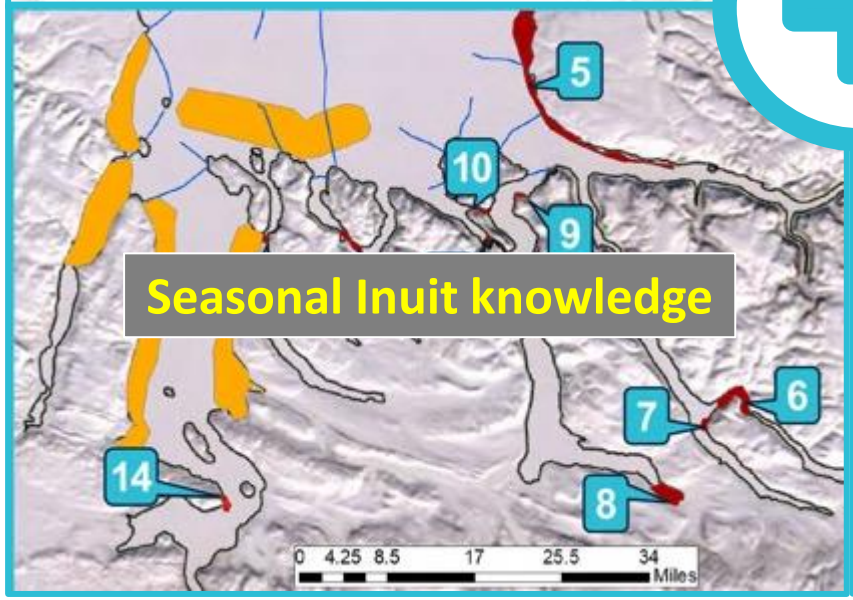
Operational ice travel safety maps



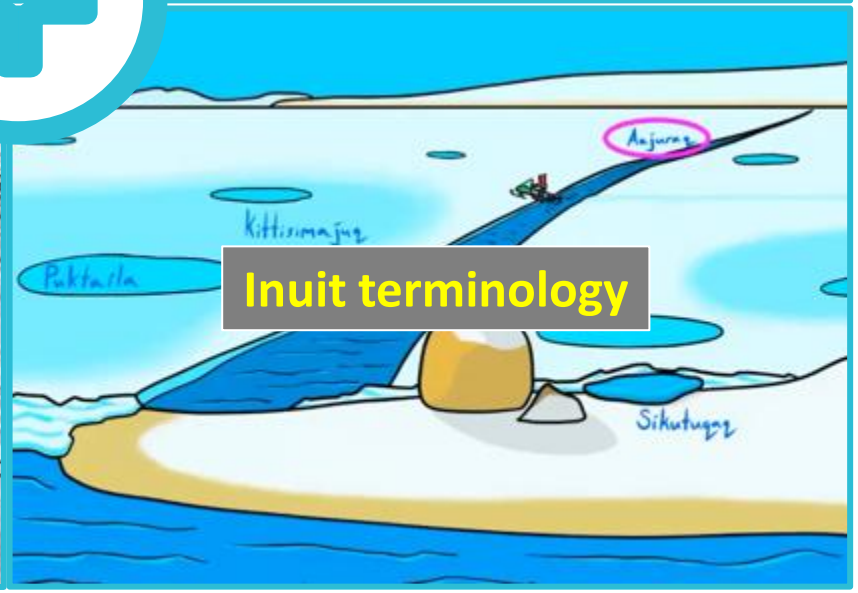
SmartICE monitoring



Satellite image mapping



Seasonal Inuit knowledge



Inuit terminology

What is success for Sikuttiaq?

1. Transcend traditional scientific outputs, generate operational products practical for communities
2. Community products informed by *Inuit Qaujimajatuqangit*
3. Involves Inuit in all aspects of its operation and decision-making
4. Training reflects Inuit ways of knowing and learning; culturally contextualized learning environment
5. Map products readily available in communities; formats meet ice user needs
6. Map products sustainable and scalable to all Inuit Nunangat communities

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