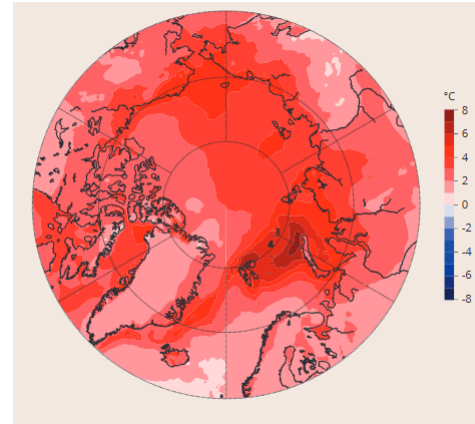


# An overview on Arctic Observing (Systems)

Michael Karcher and the Arctic PASSION team



© ESA



© AMAP



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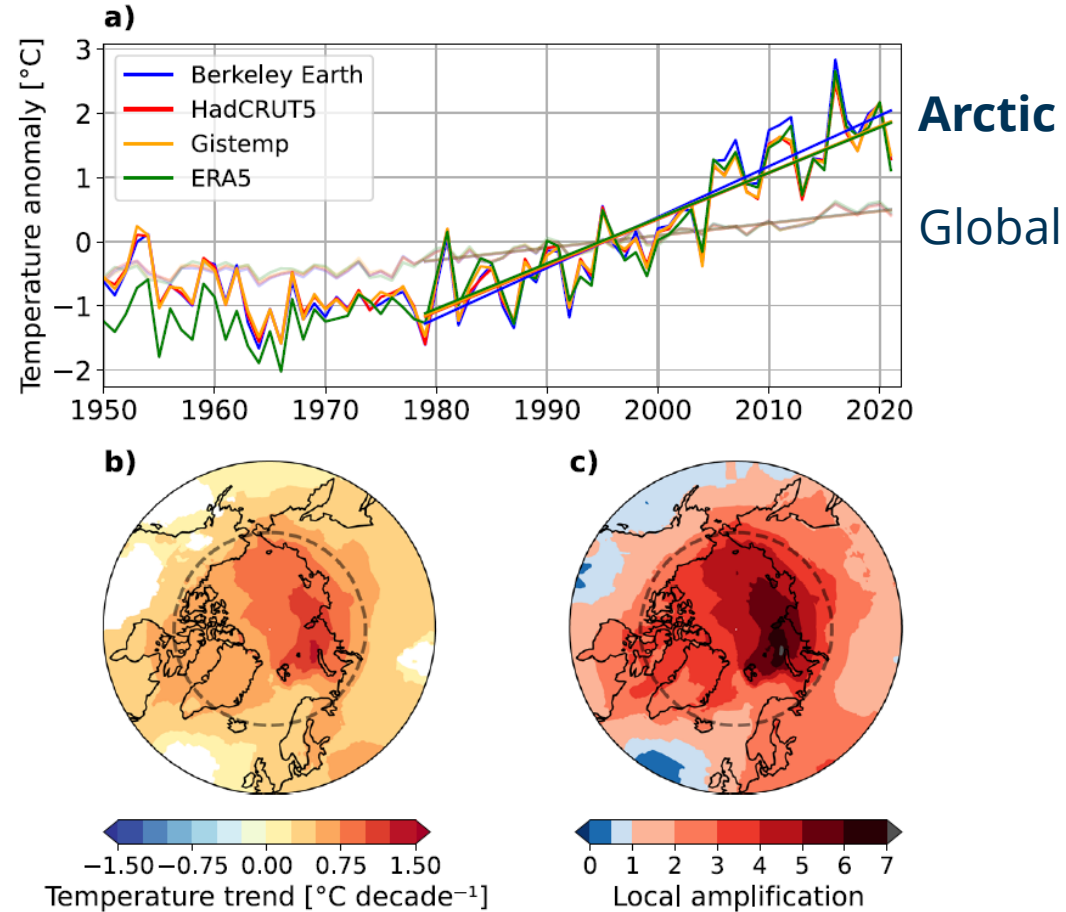
© J. Bamber



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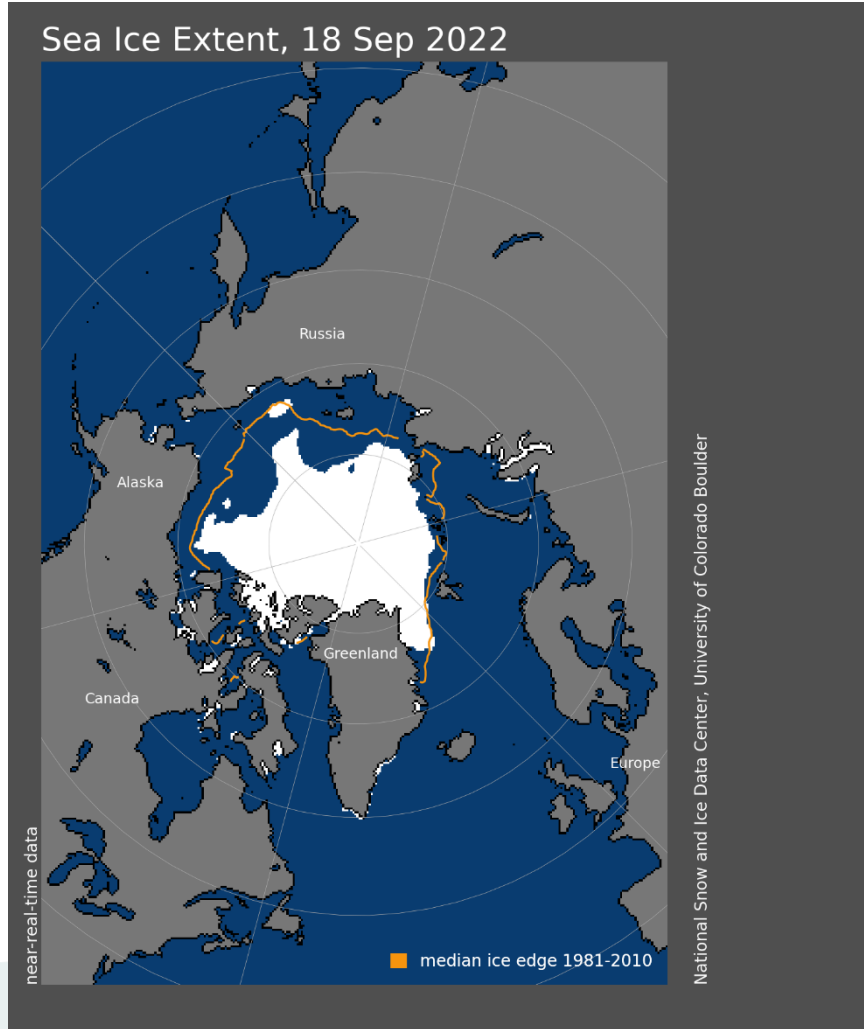
# Warming of the Arctic Atmosphere: Arctic Amplification

Anomaly of the annual mean surface air temperature

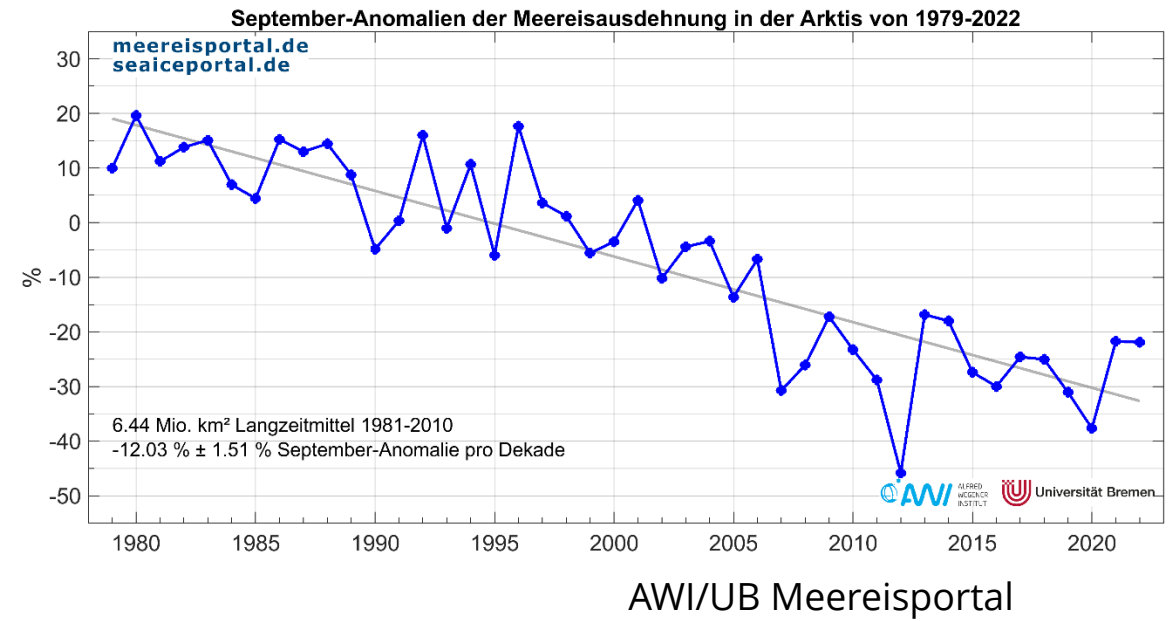


(Rantanen et al., 2022)

# Arctic Sea Ice

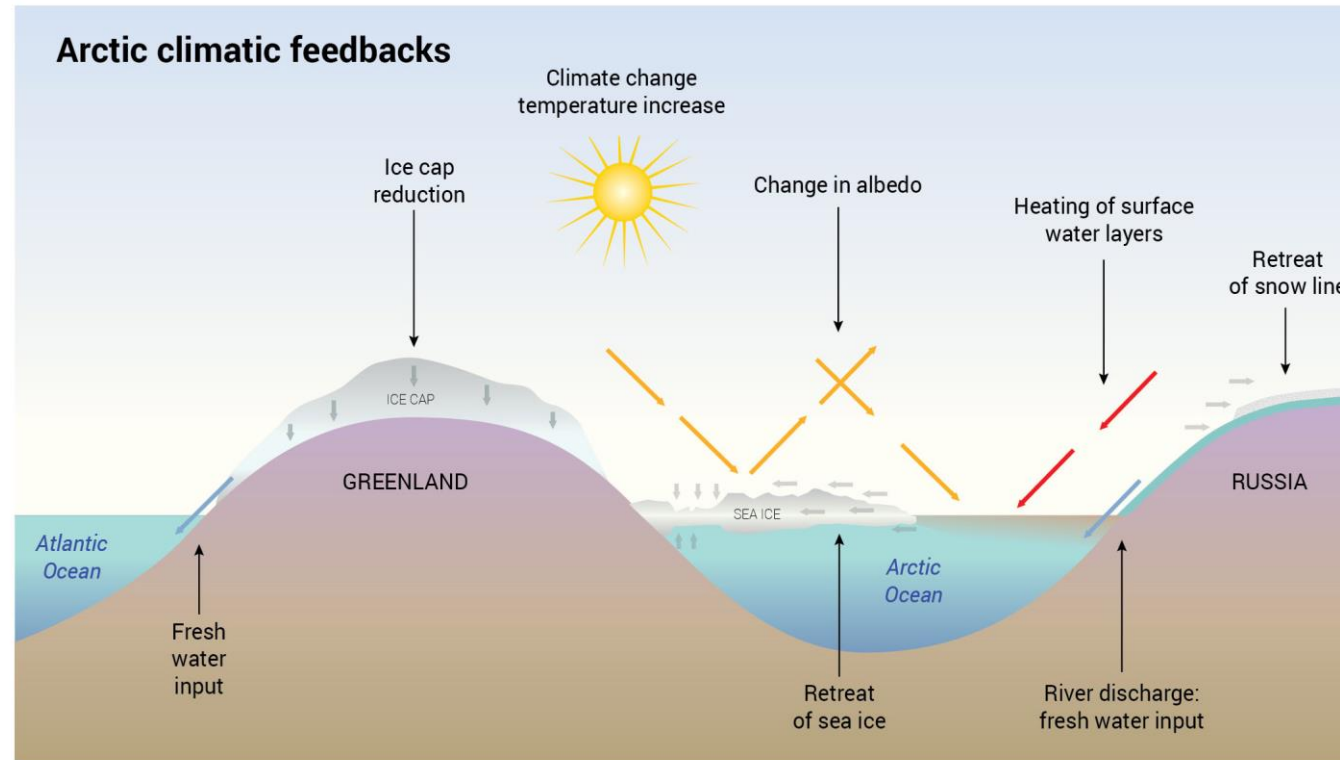


NSIDC



# Arctic Climate Feedbacks

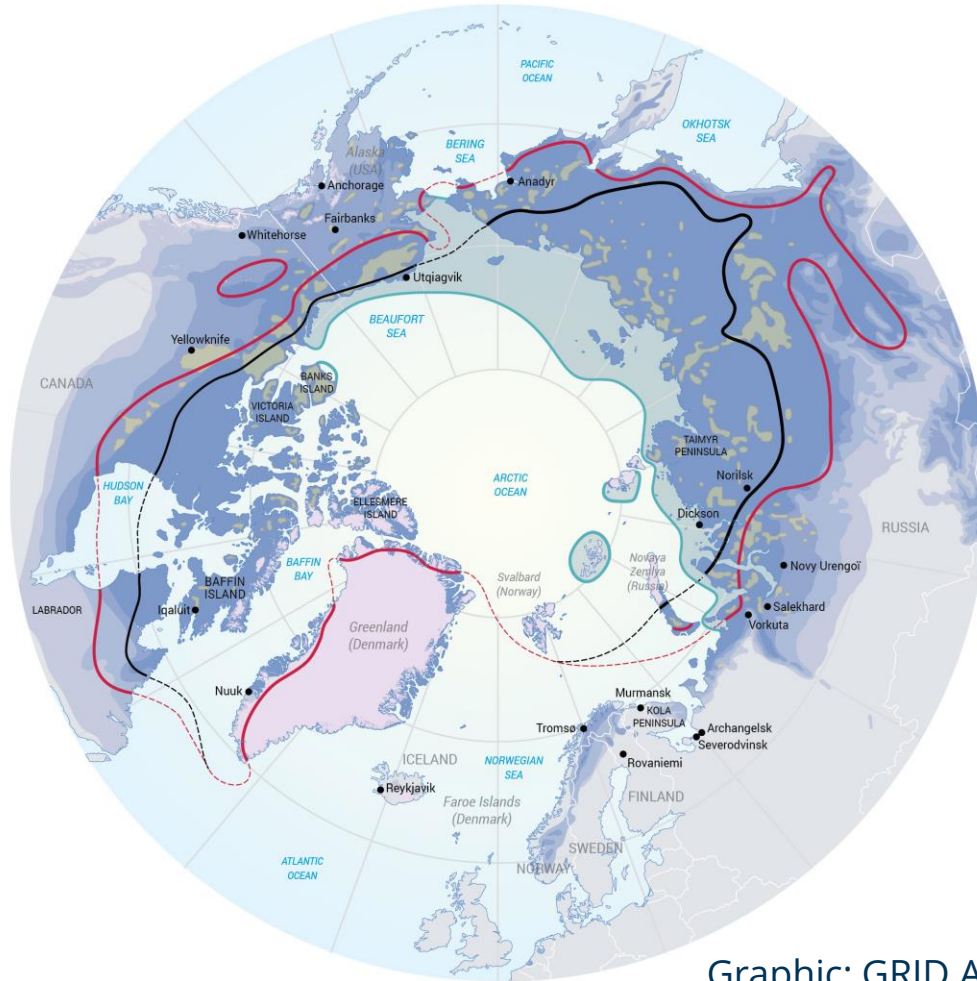
## The role of the Arctic in the global climate system



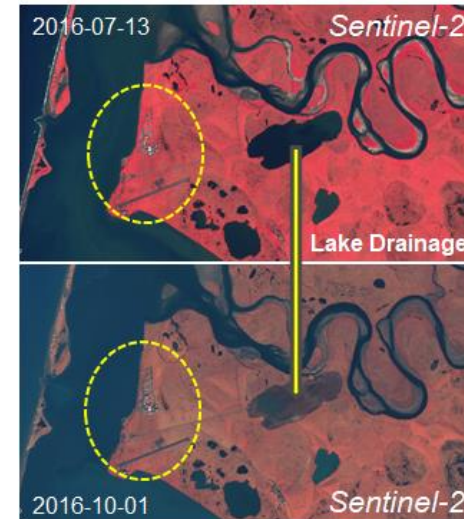
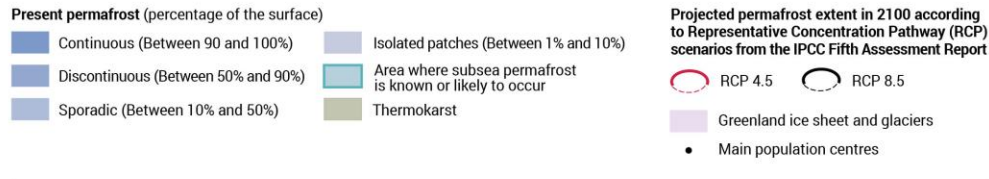
Graphic: GRID Arendal



# Thawing Permafrost



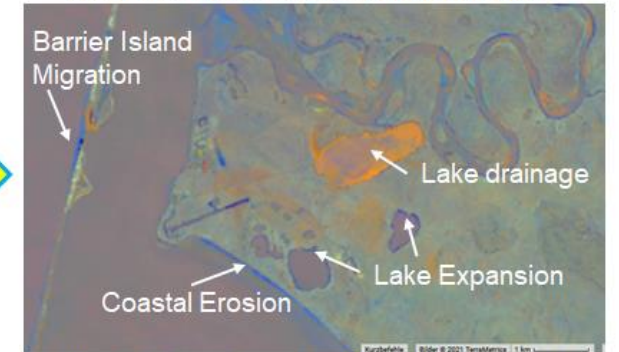
Graphic: GRID Arendal



Village of Point Lay, Northern Alaska

## Impacts on Northern Communities

Google Earth Engine App with Remotely Sensed Trends in 30m resolution from 2001-2020

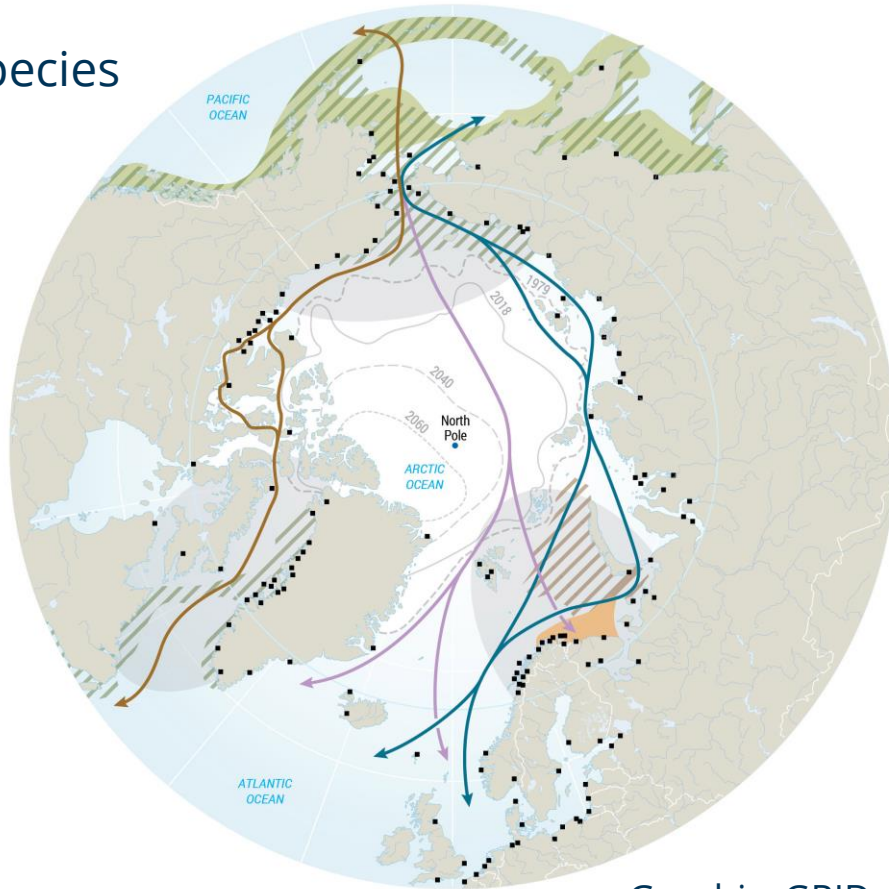


ESA GlobPermafrost + ESA CCI+ Permafrost

G. Grosse & A.Irrgang, AWI

# Human Impact in the Arctic

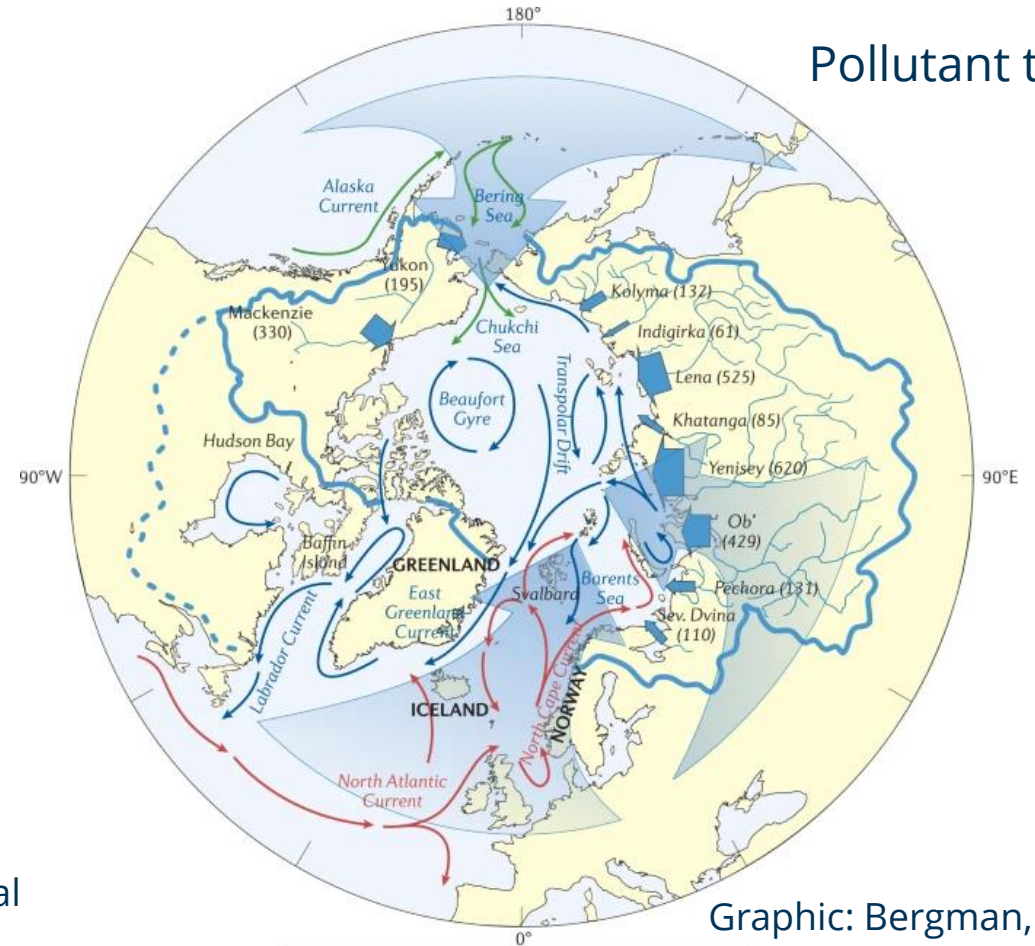
## Invasive species



Graphic: GRID Arendal

<b>Infrastructure</b>	<b>Sea ice extent in summer</b>	Human activities favouring the introduction of invasive species (marine tourism, mining, oil and gas extraction, major fisheries, ballast water)
<b>Open now</b>	— 2018	<b>Crabs in the Barents Sea</b>
— Northern Sea Route	- - - 1979	
— Northwest Passage		<b>1. Native range</b>
<b>Due to open in a few decades</b>	<b>Forecast for summer</b>	■ Red king crab    ▨ Snow crab
— Transpolar Sea Route	— 2040	<b>2. Invaded area</b>
■ Main harbours	- - - 2060	■ Red king crab    ▨ Snow crab

## Pollutant transport

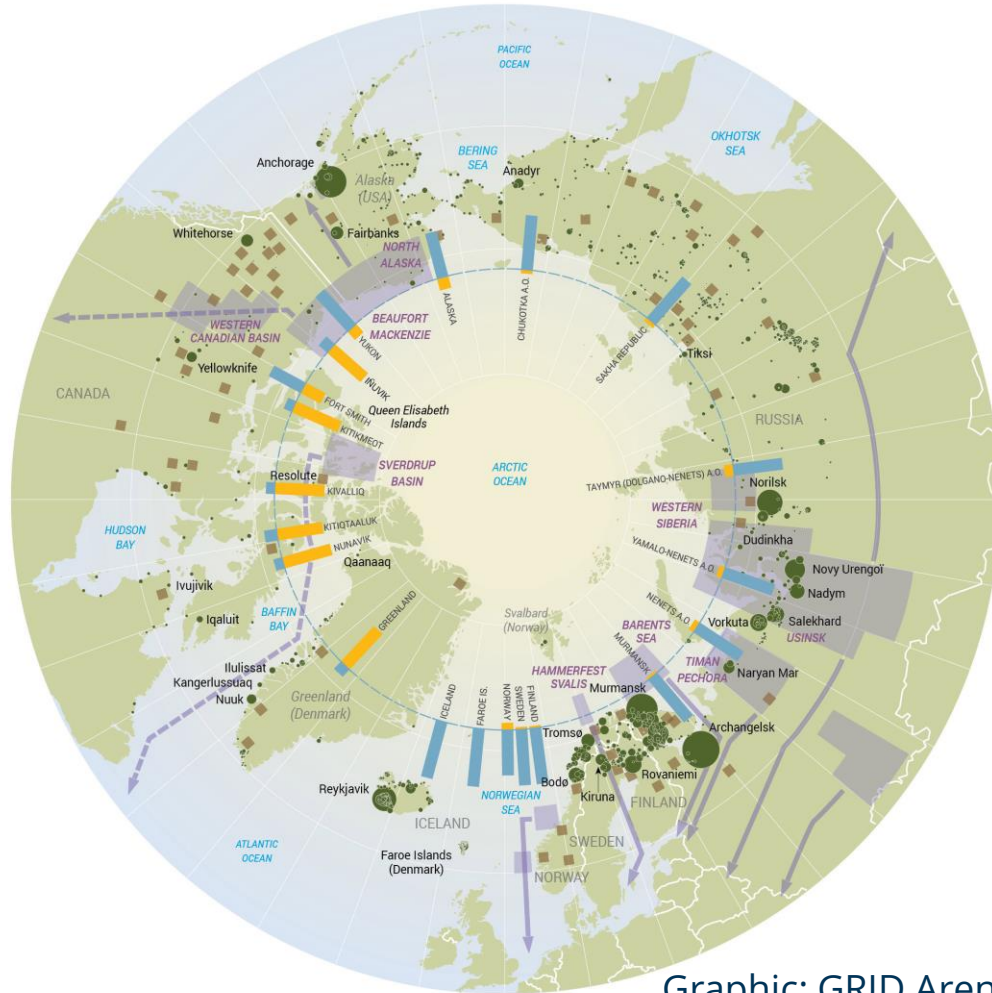


Graphic: Bergman, et al. 2022

→ Pacific currents	↻ Airflow
→ Atlantic currents	→ River outflow in km³ year⁻¹
→ Other currents	

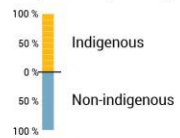


# The Arctic is inhabited



Graphic: GRID Arendal

Population distribution: composition by main regions



Population centres



Oil and gas fields (purple square), Large mines (brown square), Main transport routes for raw materials (solid purple arrow), Potential routes for raw materials (dashed purple arrow)

A.O. : Autonomous okrug



© Brechbühl



© AFA



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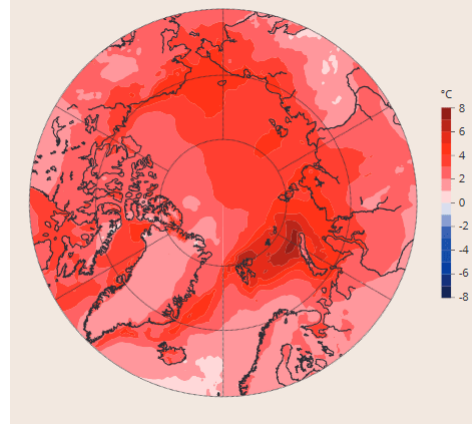


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# Arctic Observing - a multitude of goals and interests, methods and actors



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© J. Bamber



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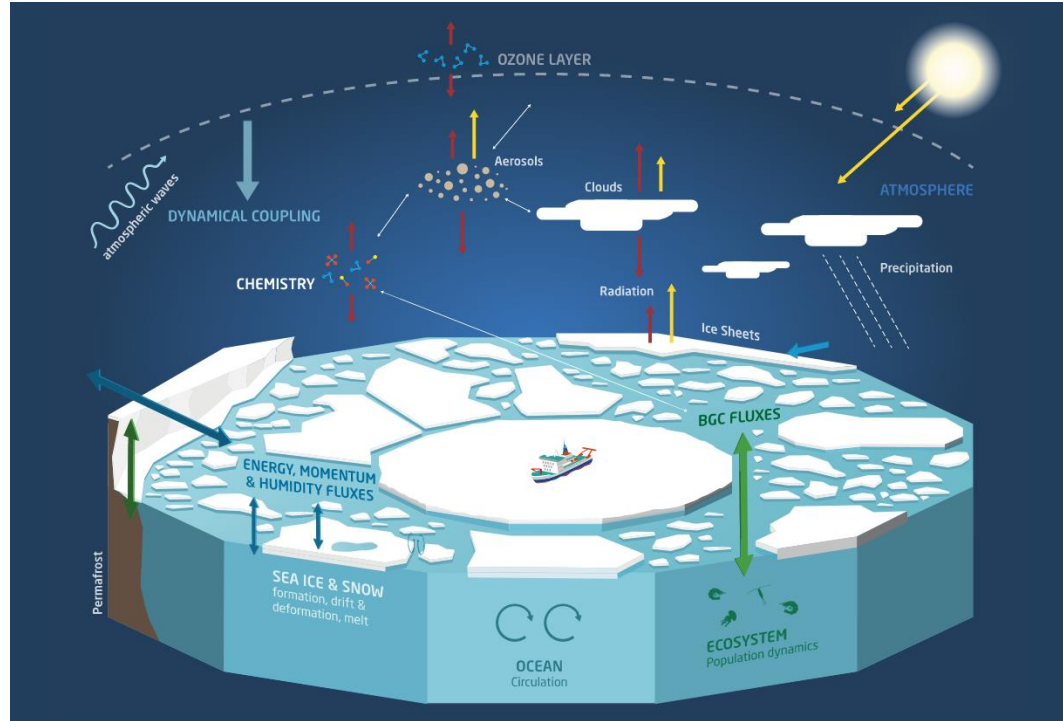
# Coordinated international Experiments/Campaigns



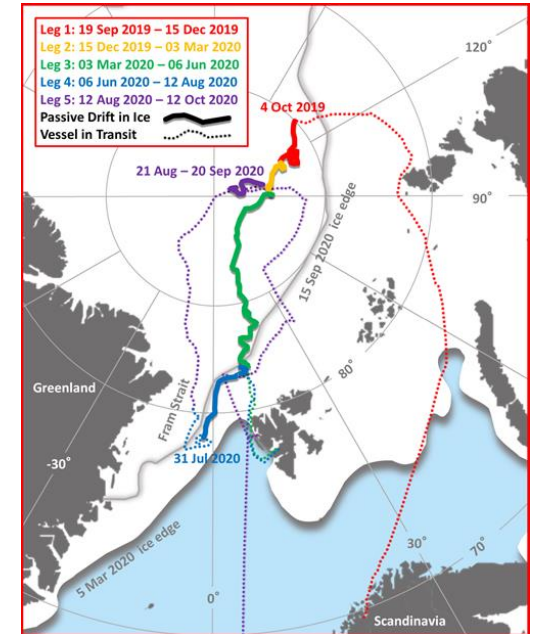
(E. Horvath)



(M. Gutsche)



## MOSAic: Multidisciplinary Drifting Observatory for the Study of Arctic Climate



(M. Shupe)

### INTERACT – International Network for Terrestrial Research and Monitoring in the Arctic



<https://eu-interact.org/>

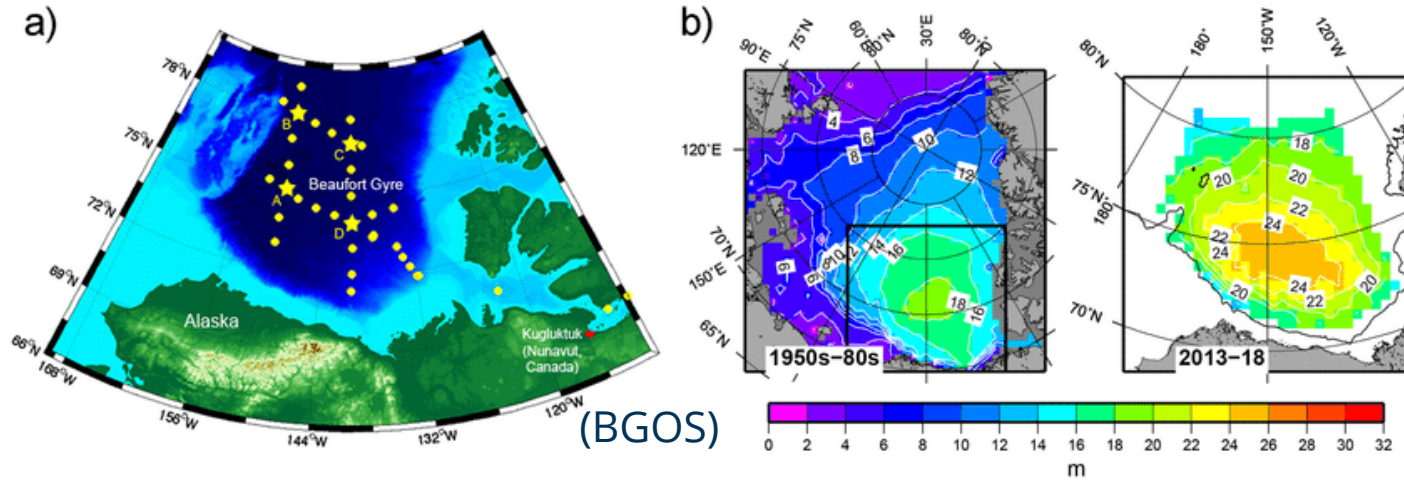
- Infrastructure project encompassing an arctic network of 68 terrestrial field bases
- Covers northern Europe, US, Canada, Greenland, Iceland, the Faroe Islands and Scotland as well as stations in northern alpine areas.
- INTERACT specifically seeks to build capacity for research and monitoring all over the Arctic
- Offers access to numerous research stations through the Transnational Access Program.
- INTERACT participates in Arctic PASSION

The logo for INTERACT, featuring a stylized line drawing of a mountain range and a signal waveform above the text "INTERACT".

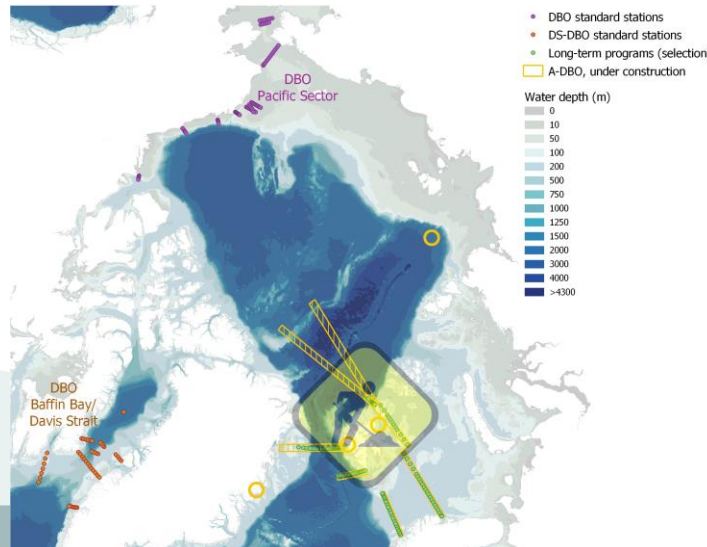
INTERACT

# Arctic Marine Observing Networks

## The Beaufort Gyre Observing System (WHOI)



The system of Distributed Distributed Observatories (DBOs) in the Pacific Arctic, Davis Strait/Baffin Bay and the Atlantic Arctic



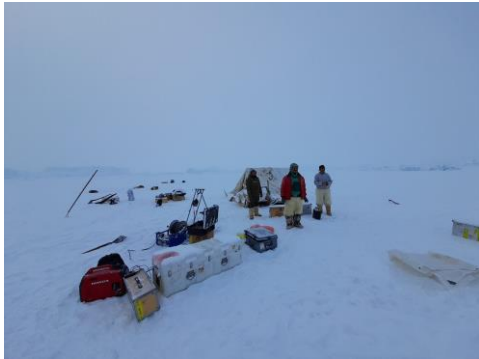
(Nikolopoulos, NPI)



# Including Indigenous and Local Knowledge

## Community Based Observations

Fieldwork in West Greenland on marine noise pollution



Team from Qaanaaq surveying the ocean under the ice.

Photos: Steffen M. Olsen



### Commentary Science Must Embrace Traditional and Indigenous Knowledge to Solve Our Biodiversity Crisis

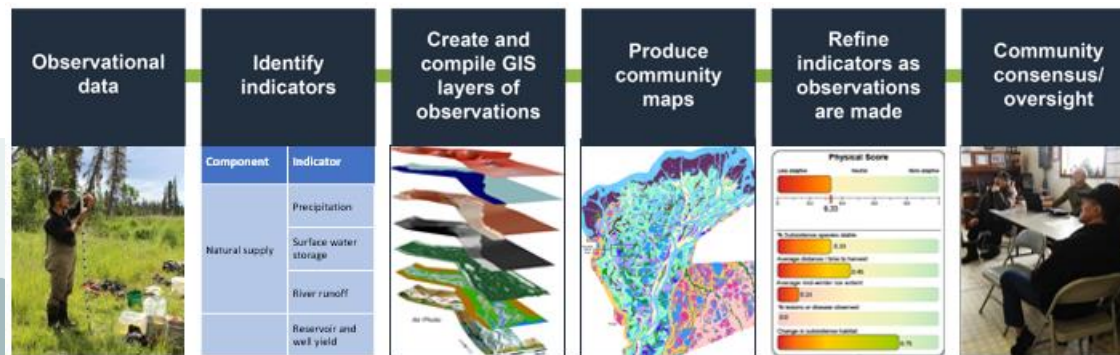
Edwin Ogar,<sup>1</sup> Gretta Pecl,<sup>2,3,4</sup> and Tero Mustonen<sup>4,5</sup>  
<sup>1</sup>Ekuri community, 6 Abasi Ita Street, off 138 MCC Road, Calabar, Cross River State, Nigeria  
<sup>2</sup>Centre for Marine Socioecology, University of Tasmania, Private Bag 129, Hobart, Tasmania 7001, Australia  
<sup>3</sup>Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Tasmania 7001, Australia  
<sup>4</sup>University of Eastern Finland, Yliopistokatu 2, PO Box 111, Joensuu 80101, Finland  
<sup>5</sup>Snowchange Cooperative, Finland, Havukkavaarantie 29, Lehto 81235, Finland  
 \*Correspondence: gretta.pecl@utas.edu.au  
<https://doi.org/10.1016/j.oneear.2020.07.006>



Preserving the Knowledge of the Elders

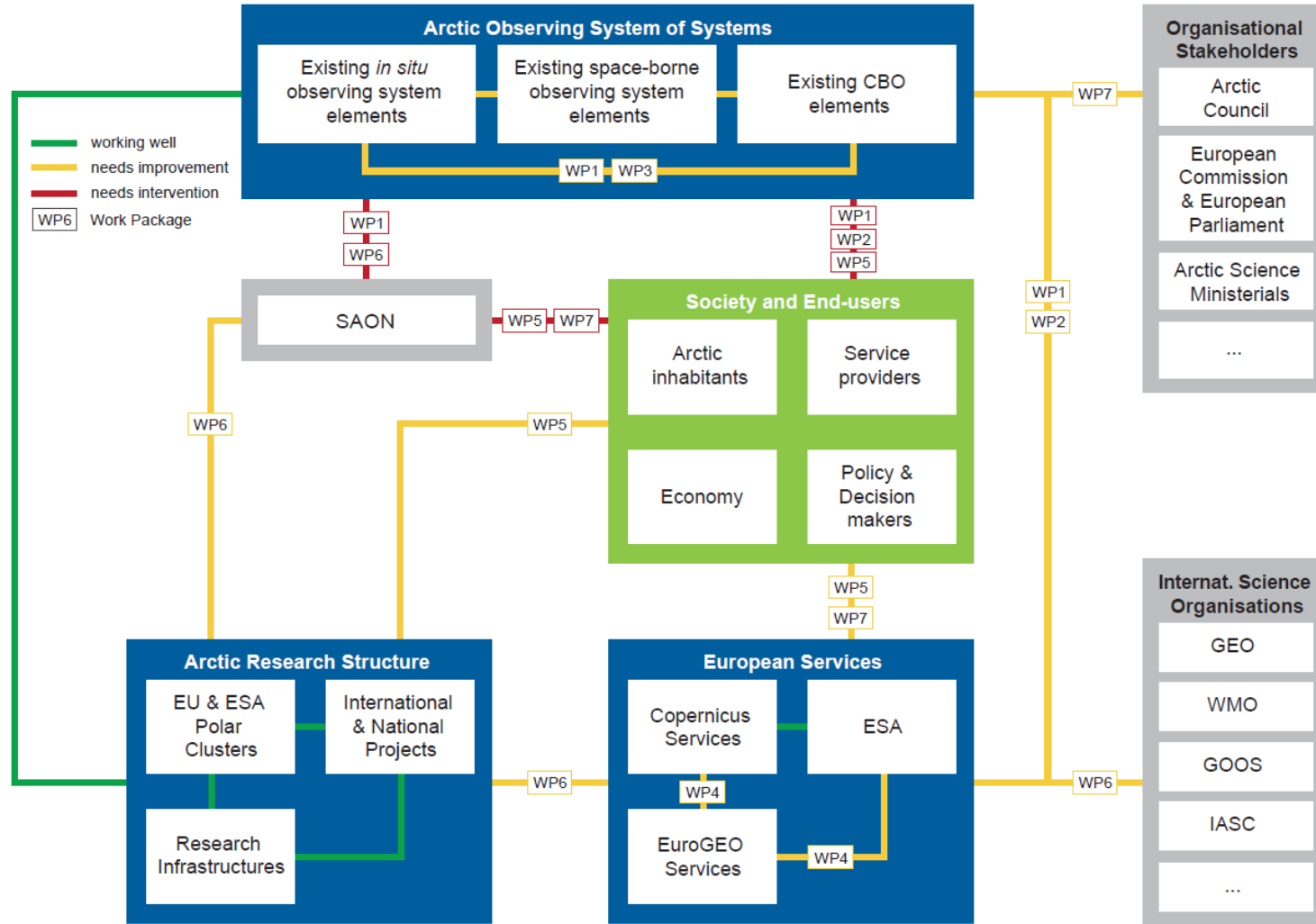
(Gwich'in Tribal Council, 2021)

Process of co-development of a community-centered, regional early warning and response system based on interoperable data from community-based observing networks and systems



(Alessi et al. 2015)

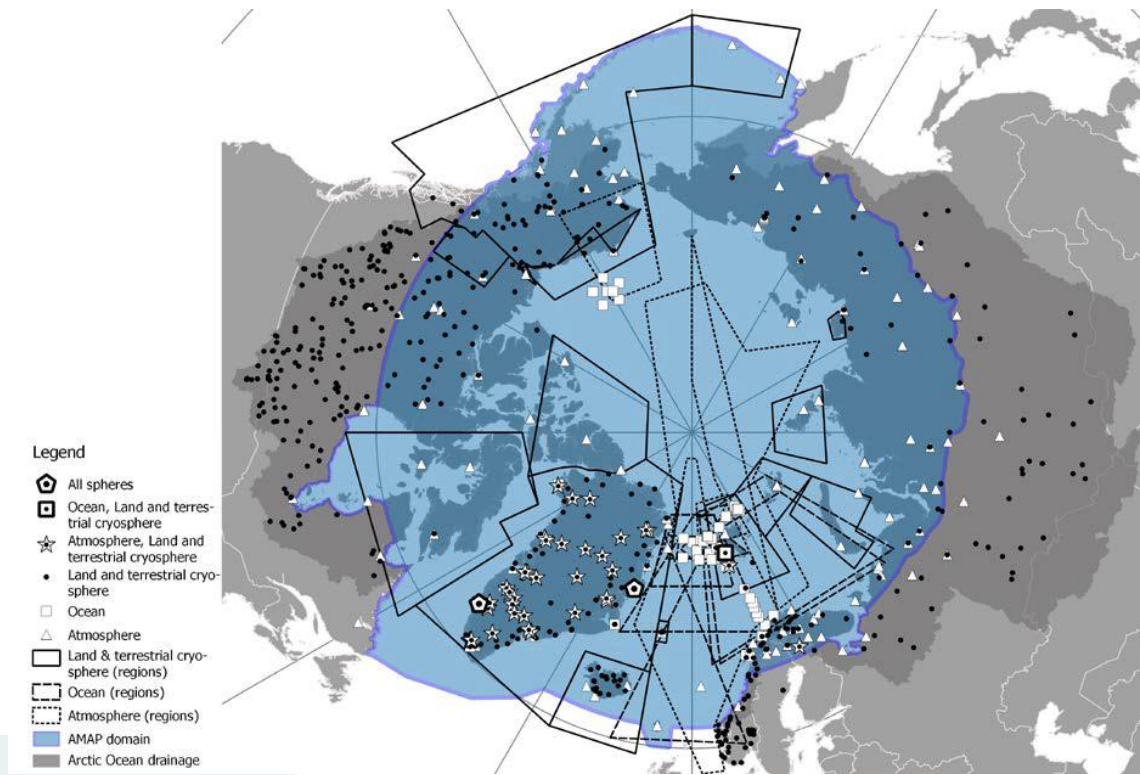
# The organisational ecosystem for Arctic Environmental Observing Systems





# INTAROS

Integrated Arctic Observation System (2017-2021, EU-H2020)



(Tjernström et al., 2019, INTAROS)

**In-situ observing systems and their domain assessed by INTAROS**



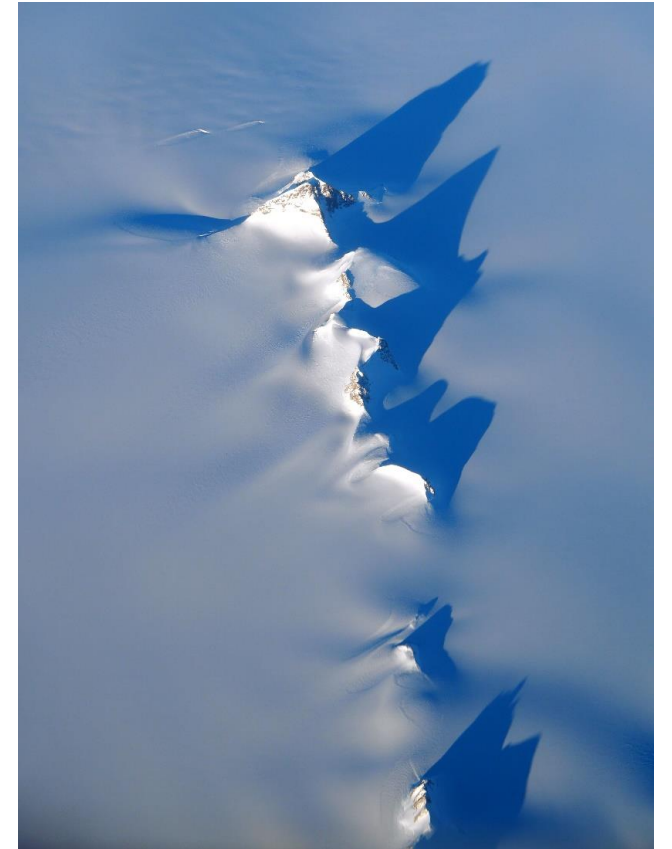


# ARCTIC PASSION

Pan-Arctic Observing  
System of Systems:  
Implementing Observations  
for Societal Needs

- European Commission H2020 Program
- 4 years, 18 countries
- 35 partner organizations and 6 Indigenous Communities
- July 2021 – June 2025
- Website: [www.arcticpassion.eu](http://www.arcticpassion.eu)
- Coordination: Alfred Wegener Institute for Polar and Marine

Research 



© M. Karcher



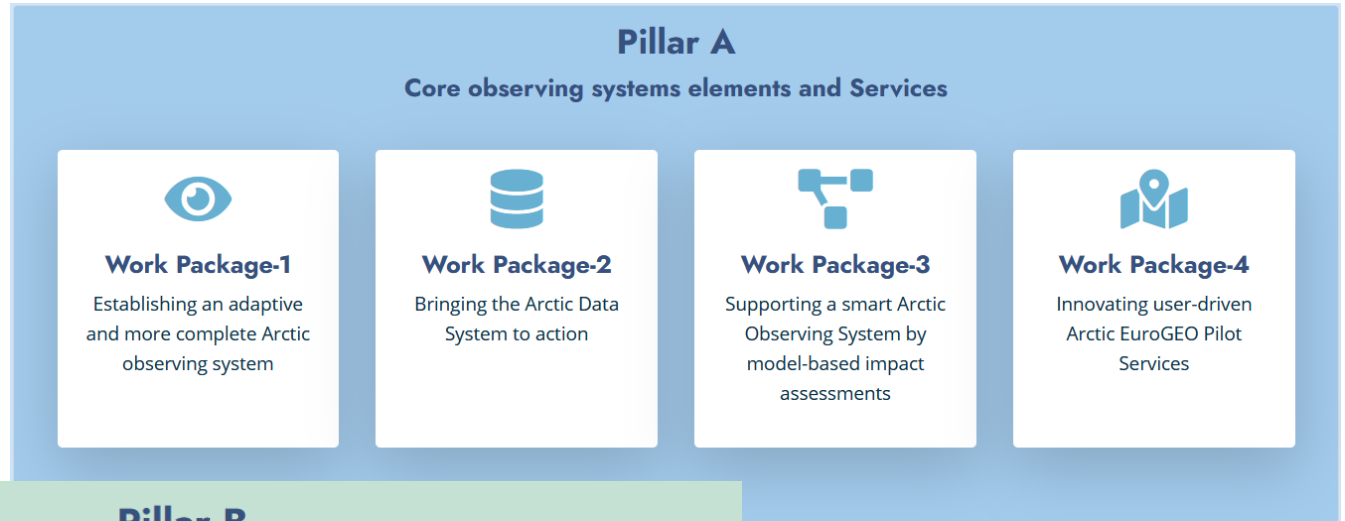
# Geographical regions of activity of Arctic PASSION



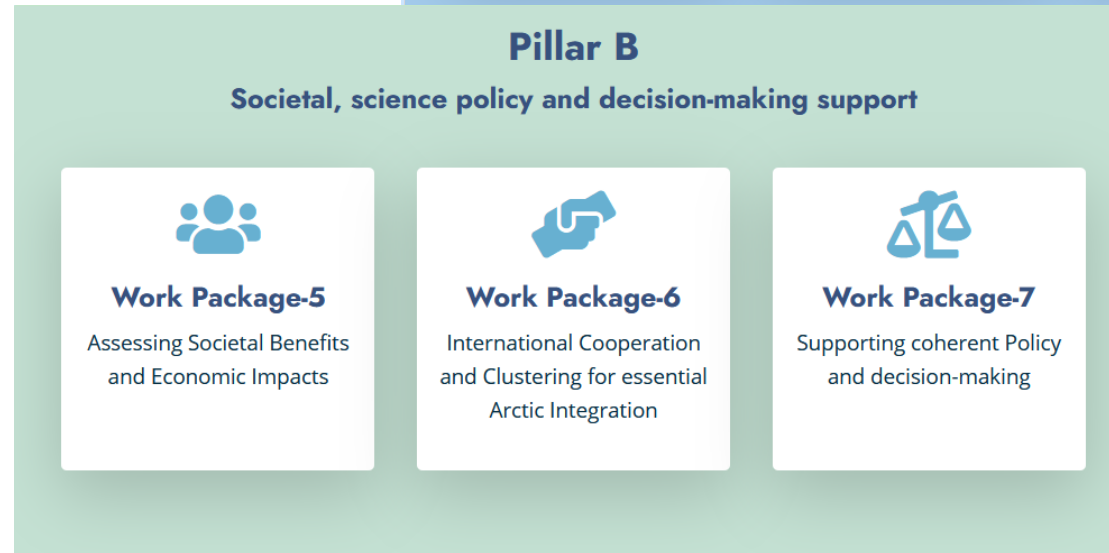
- PS1 "IK and LK Event Database"**  
 C1 – C7 communities  
 C1 Unalakleet, Alaska  
 C2 Tahtán and Gwitchin Communities, BC-Yukon, NWT, Canada  
 C3 Attu, Greenland  
 C4 Näättämö basin, FI/NO  
 C5 Ponoï, Russia  
 C6 Khanty-Mansia (Ob), Russia  
 C7 Lower Kolyma, Russia
- WP1/WP3** Glaciers and Greenland ice sheet
- PS2/WP3 "Permafrost"**  
 Permafrost on land  
 Sporadic permafrost (10 – 50 % coverage)  
 Discontinuous permafrost (50 – 90 % coverage)  
 Continuous permafrost (> 90 % coverage)  
 Source: Overduin et al. (2019); Obu et al. (2019)
- PS4 "INFRA"**  
**PS5/WP1 "Aerosol sat-val network"**  
**PS7 "Acoustic monitoring"**  
**PS8 "Lake Ice"**  
**WP1** Drifting buoys  
**WP1** EONs including moorings
- PS6/WP3 "Shipping safety"**  
 Example of Trans-Arctic Vessel traffic  
 Example of local Arctic Vessel traffic
- WP1/PS5 INTERACT** stations with specific Arctic PASSION activities

# The Work Package structure of Arctic PASSION

Strengthening  
core observing  
system elements

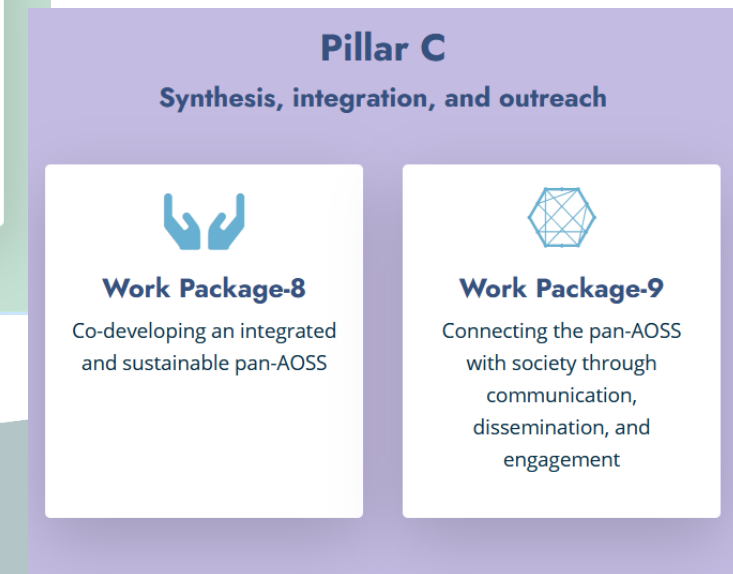


Decision-making  
support



[www.arcticpassion.eu](http://www.arcticpassion.eu)

Synthesis and  
outreach





# Overall Project Objectives

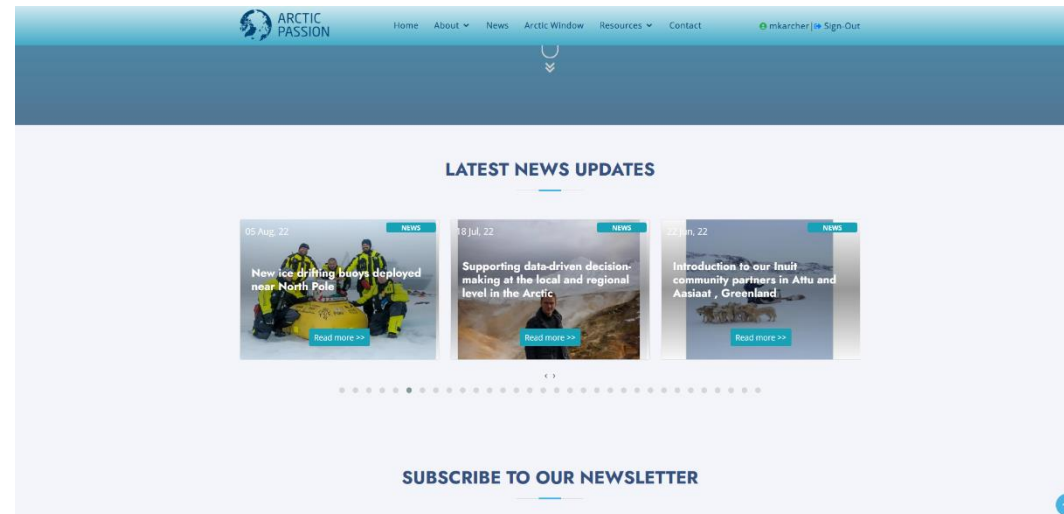
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- Co-create a **coherent, integrated and sustainable pan-Arctic Observing System of Systems**
- Meaningful collaboration with **Arctic communities, Indigenous Peoples and organisations;**
- Expand monitoring capabilities, also through **broad inclusion of Indigenous Knowledge and Local Knowledge;**
- Improve **data interoperability** and simplify access to 'application-ready' environmental data for the benefit of all users;
- **Improve monitoring to support predictions, risk assessment, inform and guide mitigation and adaptation and sustainable development**
- Develop **EuroGEO Pilot Services and support SAON to upgrade Arctic GEOSS into a 'GEO initiative'**
- Initiate **SAV Expert Panels** and develop SAVs in support of SAON's ROADS program



# ARCTIC PASSION

Pan-Arctic Observing  
System of Systems:  
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Website:

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