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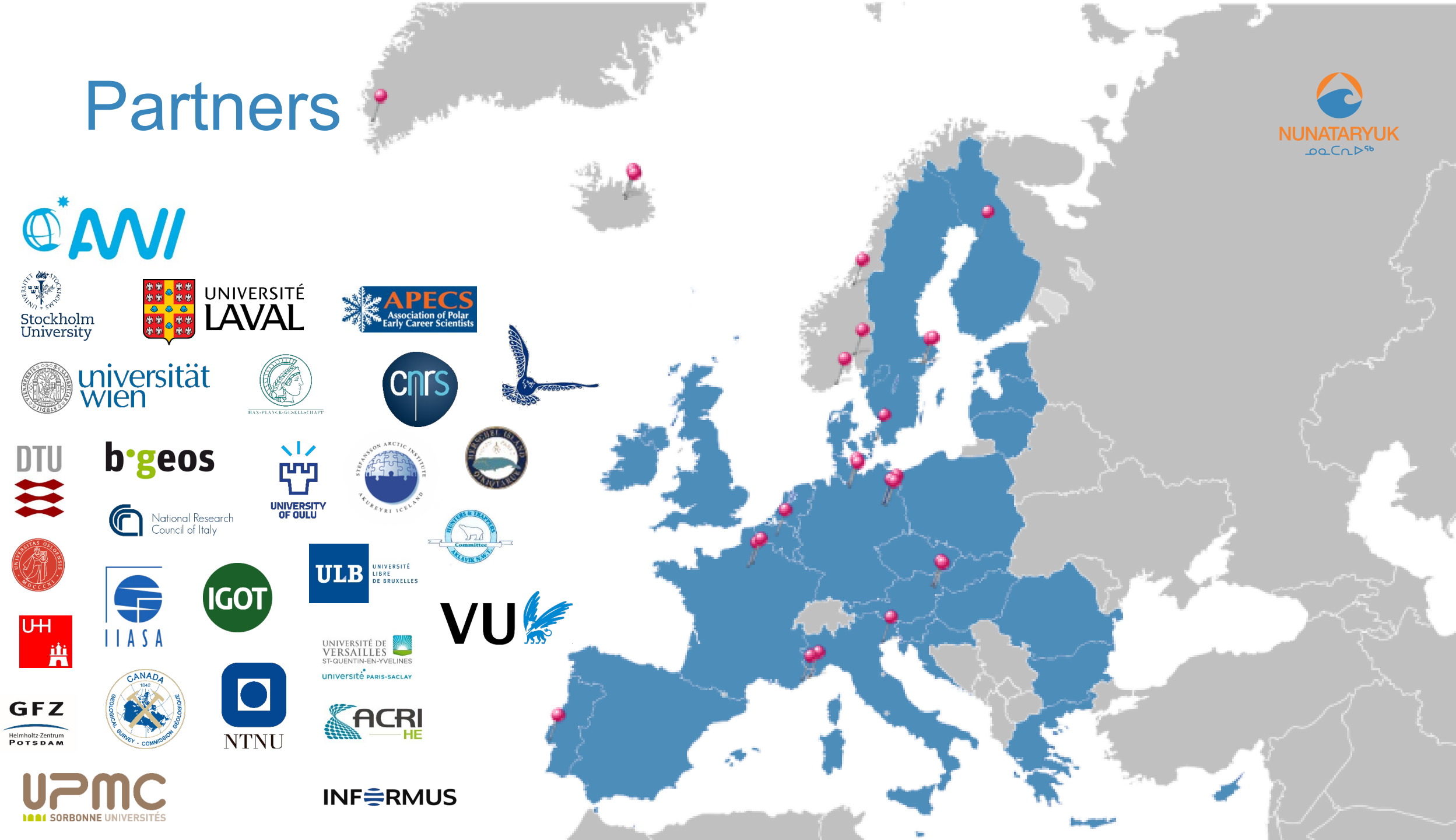
Permafrost thaw and the changing Arctic coast, science for socioeconomic adaptation

This project is funded by the European Union


6 years
26 partners
13 countries
Community consultations
Co-design
Permafrost
Adaptation
Impacts
11.5 Mio €
Infrastructure
Health
Global climate

Partners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AWI
Stockholm University
UNIVERSITÉ LAVAL
APECS Association of Polar Early Career Scientists
universität wien
MAX-PLANCK-GESELLSCHAFT
cnrs
DTU
b·geos
UNIVERSITY OF OULU
STEFANSSON ARCTIC INSTITUTE AKUREYRI ICELAND
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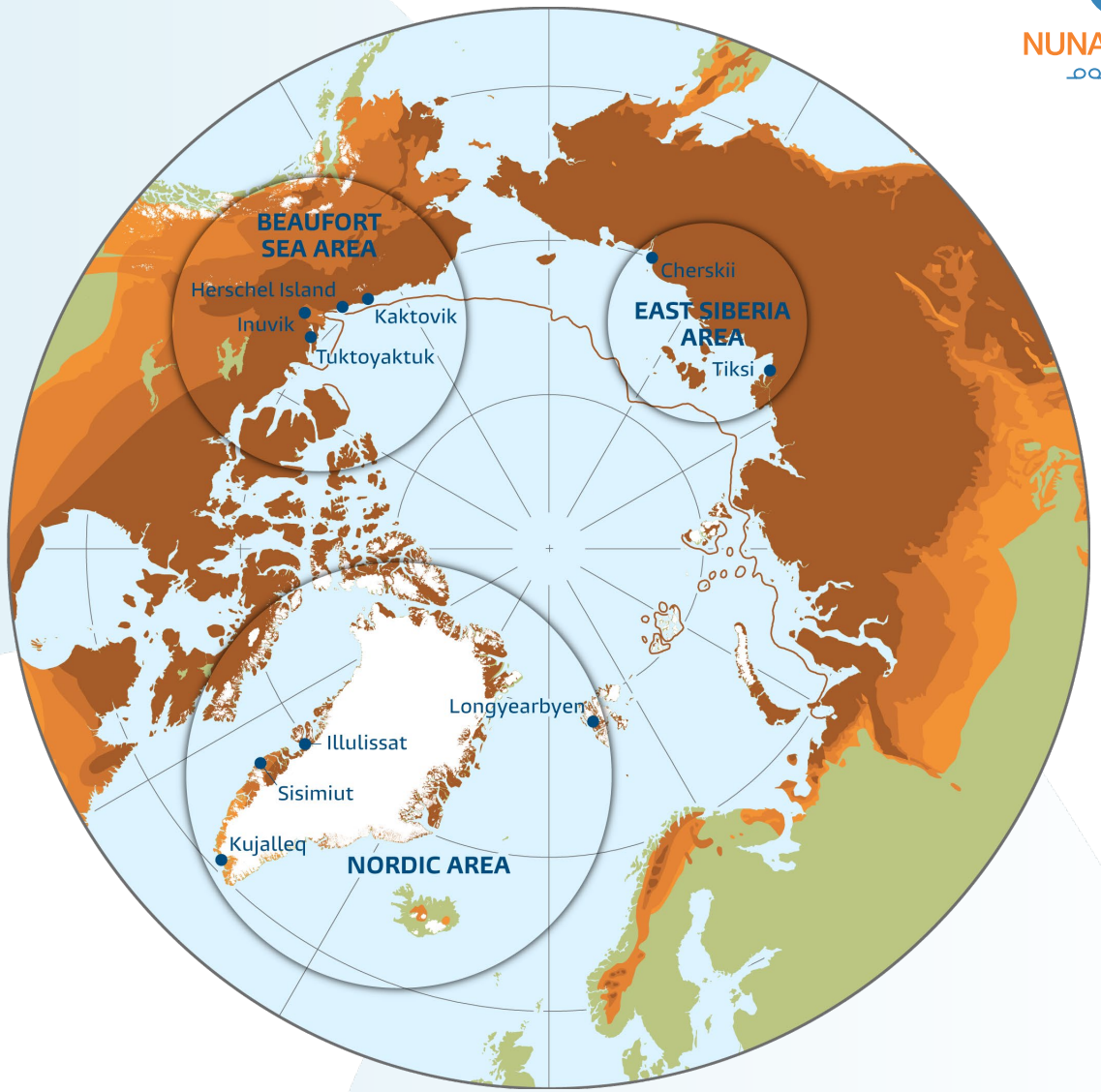
université PARIS-SACLAY
GFZ Heimholtz-Zentrum POTSDAM
CANADA GEOLOGICAL SURVEY - COMMISSION GÉOLOGIQUE
NTNU
ACRI HE
UPMC SORBONNE UNIVERSITÉS
INFORMUS

Focal areas

- Nordic area
- Beaufort Sea area
- East Siberian area,

until early 2022



Permafrost coastal system

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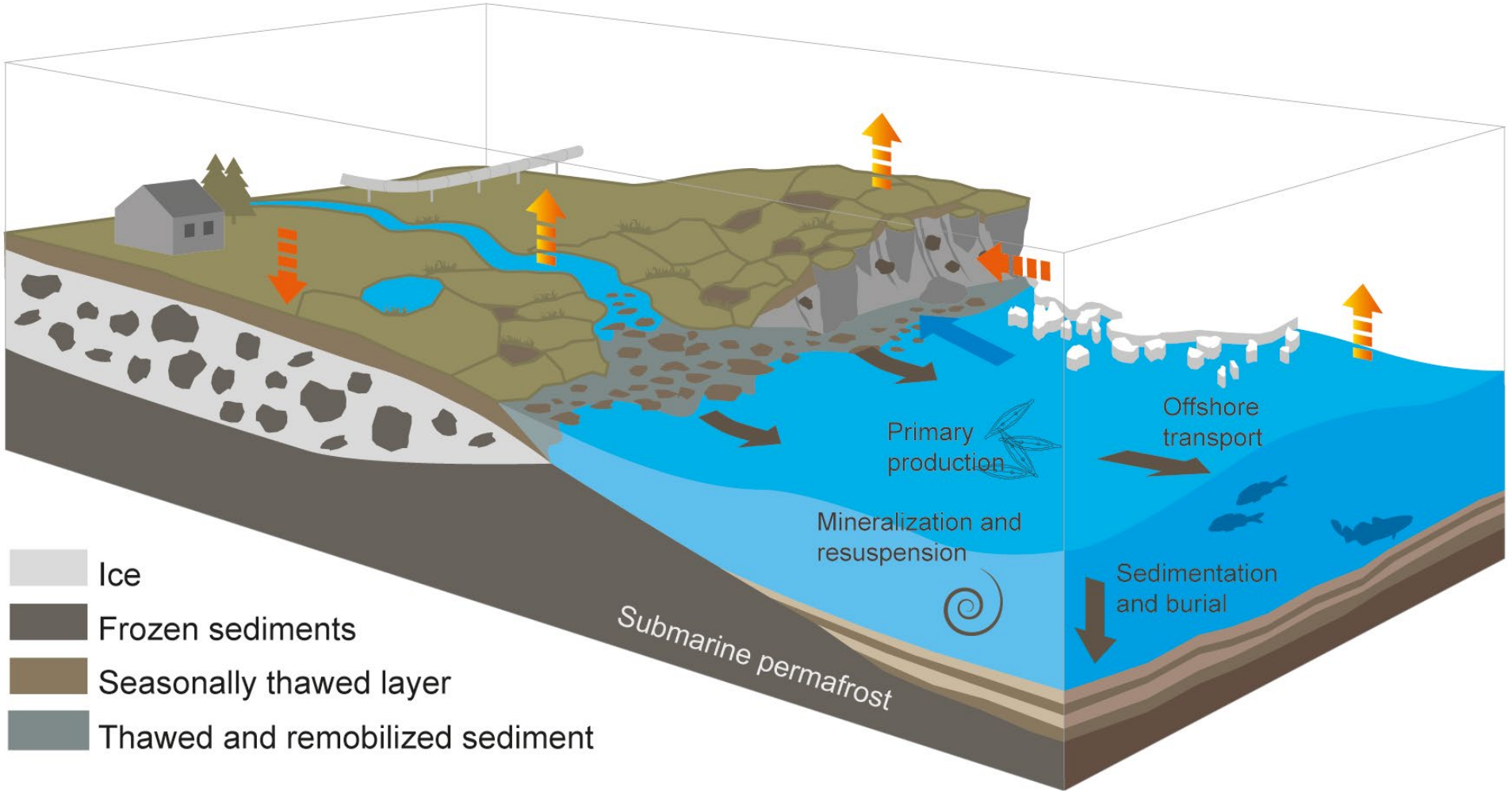
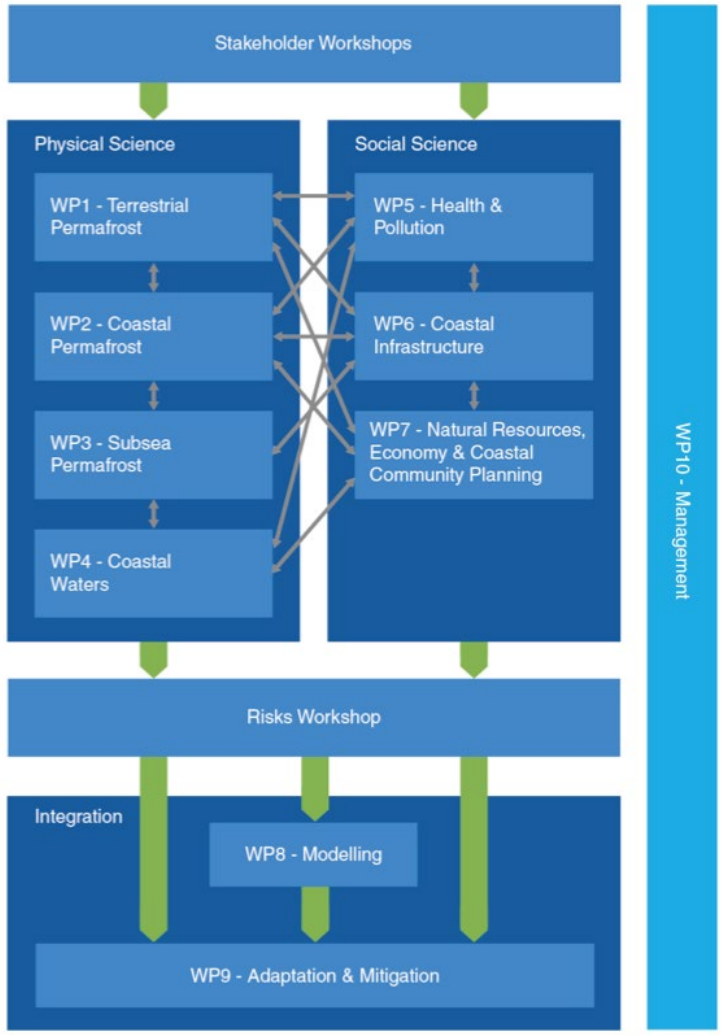


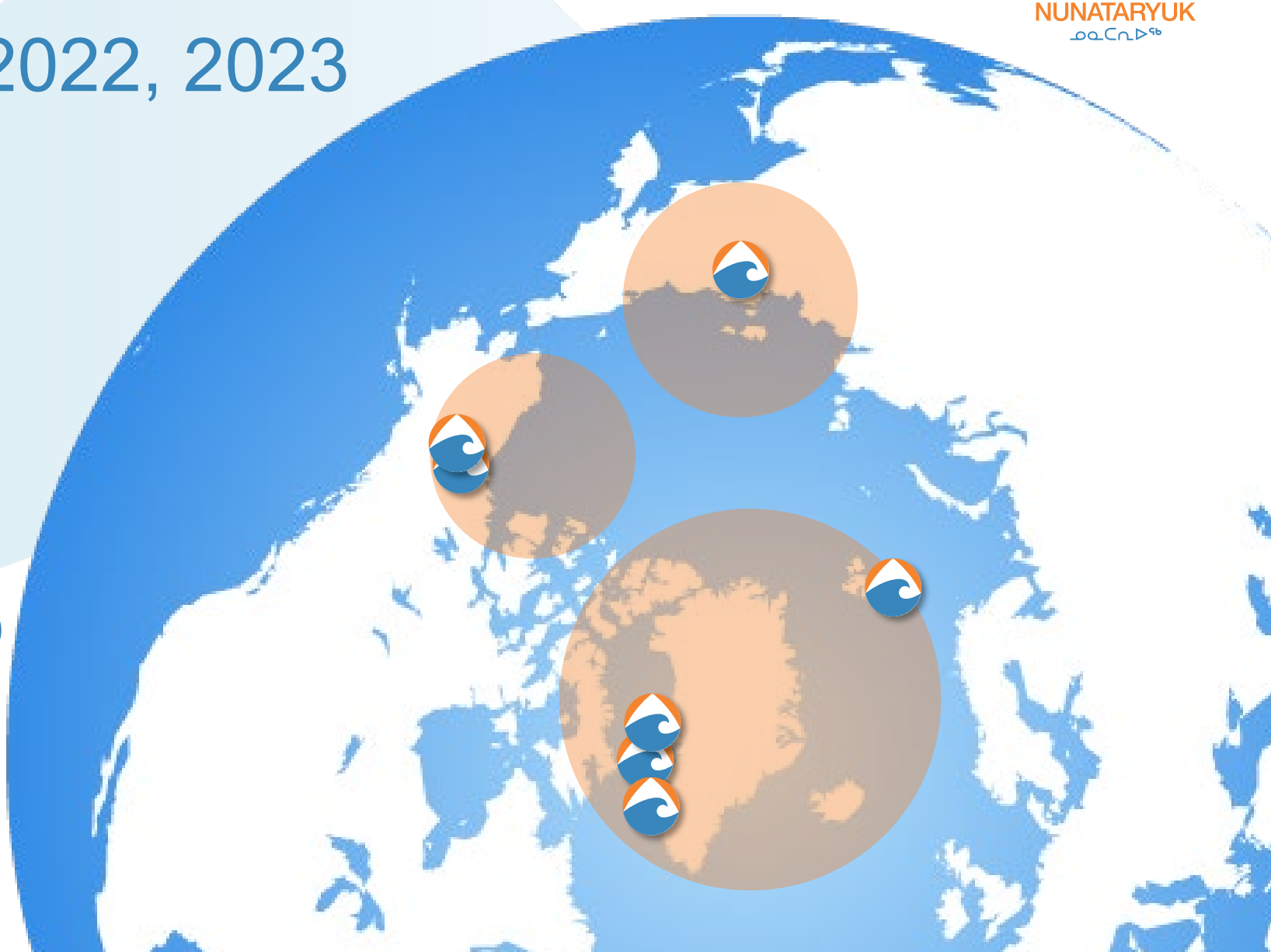
Project framework

1. Stakeholder consultation & co-design
2. Nunataryuk physical & social science activities
3. Risk framework
4. Integration activities and community workshops



Consultations
2018-2019, 2021, 2022, 2023

- Aklavik,CA
- Inuvik, CA
- Ilulissat, GL
- Sisimiut, GL
- Nuuk, GL
- Longyearbyen, NO
- Tiksi, RU (until 2022)



Major field campaigns 2019, fall 2021, 2022

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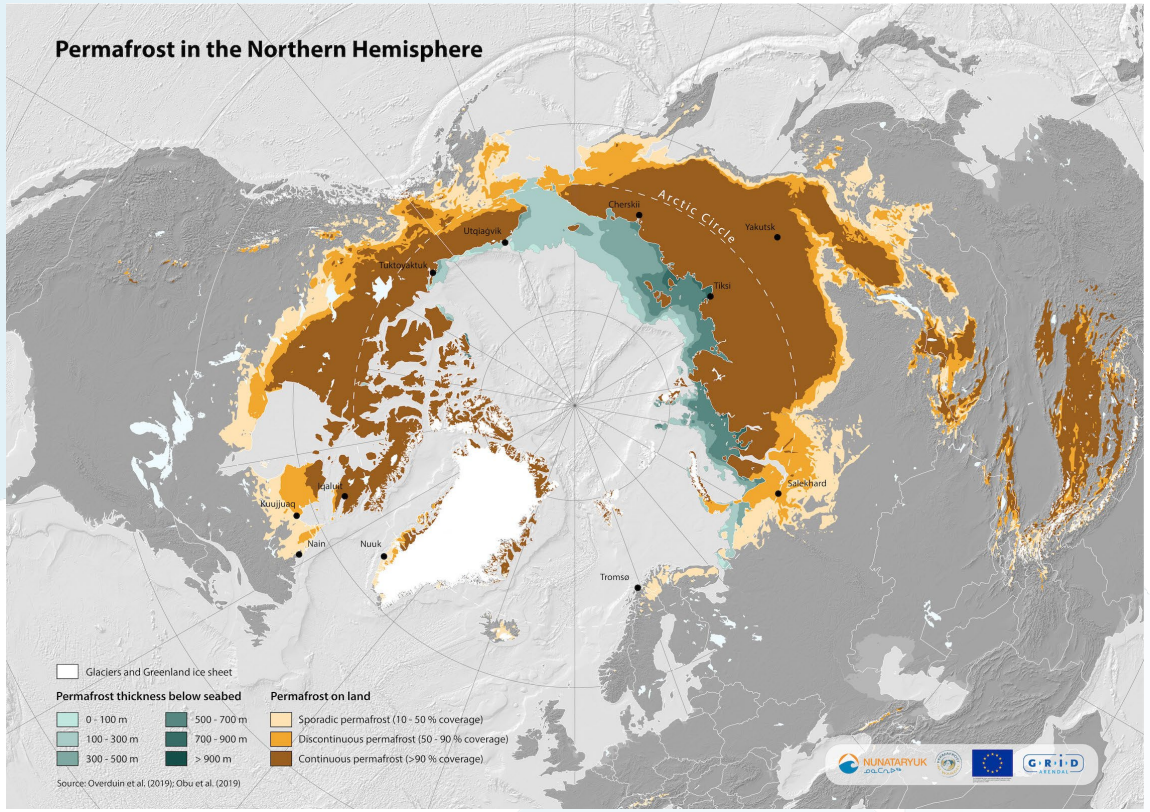
- Yukon coast, Herschel Island, Mackenzie Delta, CA
- Ilulissat, Sisimiut GL
- Svalbard, NO
- Yakutia, RU (2019)
- Chersky, RU (2019)
- Tiksi, RU (2019)

Major results so far include:

- **A unique new submarine permafrost extent map**
- shows that submarine permafrost is more widely distributed than previously thought, and is almost all getting thinner.



https://doi.org/10.1029/2018JC014675

https://www.flickr.com/photos/gridarendal/49612927788/

Major results so far include:

- **New estimates on greenhouse gas release, in response to coastline collapse**, indicate that eroding permafrost coasts and nearshore waters are a potentially notable source of CO2 emissions.

https://doi.org/10.1029/2019GL084303

©George Tanski

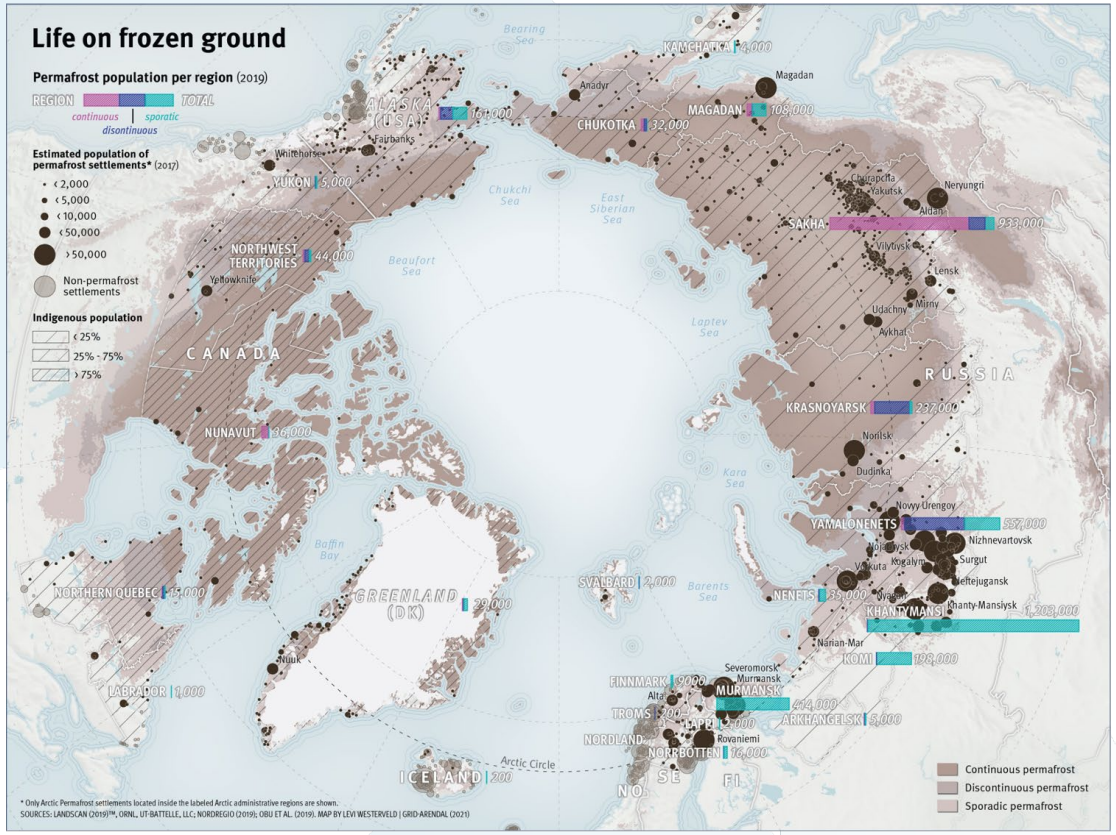
Major results so far include:

- **Atlas of population, societies and economy in the Arctic**
- a collection of standardised indicators, illustrated as maps, that demonstrate the state of the Arctic regions.
- The focus is on demography, society, economy, production, accessibility and infrastructure as well as physical conditions and resources.

doi.org/10.30689/WP2019:3.1403-2511

Major results so far include:

- **4.9 million people live in 1162 permafrost settlements across eight Arctic countries**.
- It is estimated that the number of people living in permafrost settlements in the Arctic will decline dramatically to 1.7 million by 2050
- It is further estimated that **42 percent of current permafrost settlements will be permafrost-free by mid-century**.



©Grid Arendal (2021)

https://doi.org/10.1007/s11111-020-00370-6

Major results so far include:

- The **perception of permafrost thaw in the Sakha Republic (Russia):** Narratives, culture and risk in the face of climate change
- A better understanding of the new risk patterns associated to permafrost thaw
- Narratives of personal experiences in order to identify the main concerns, how these are defined and which coping strategies are considered by local inhabitants.

https://doi.org/10.1016/j.polar.2020.100589

©N. Doloisio

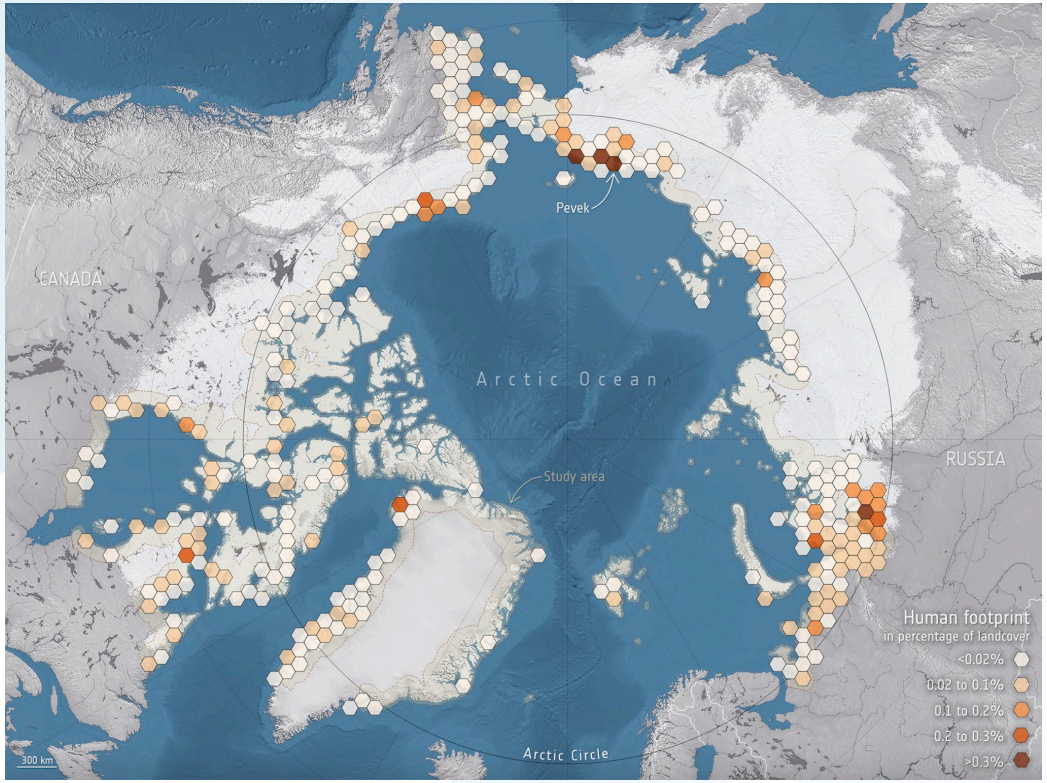
Major results so far include:

- The **impact of permafrost degradation on the life in Northwest Greenland**
- The study concludes that scientific knowledge needed to inform decision-making is useful for identifying overall changes, but existing data sources are scarce, and more detailed permafrost maps are needed for long-term town planning.
- Many individuals and institutions engage in autonomous adaptation on an ad hoc basis, rather than pursuing an overall strategy to increase the adaptive capacity in advance of future permafrost degradation in Northwest Greenland.

https://doi.org/10.1080/1088937X.2021.1995067

Major results so far include:

- The first pan-arctic **satellite-based record of expanding infrastructure and anthropogenic impacts along all permafrost affected coasts**
- 55% of the identified human impacted area will be shifting to above 0°C ground temperature at two meter depth by 2050 if current permafrost warming trends continue at the pace of the last two decades



©European Space Agency

https://doi.org/10.1088/1748-9326/ac3176

Major results so far include:

- **A new epidemiological model for anthrax transmission** that is specifically **tailored to the Arctic environmental conditions**
- Results show how the temporal variability of grazing and **active layer thawing may influence the dynamics of anthrax disease and, specifically, favor sustained pathogen transmission.**
- Particularly warm years, favoring deep active layers, are shown to be associated with an increase risk of anthrax outbreaks, and may also foster infections in the following years.

https://doi.org/10.1038/s41598-020-72440-6

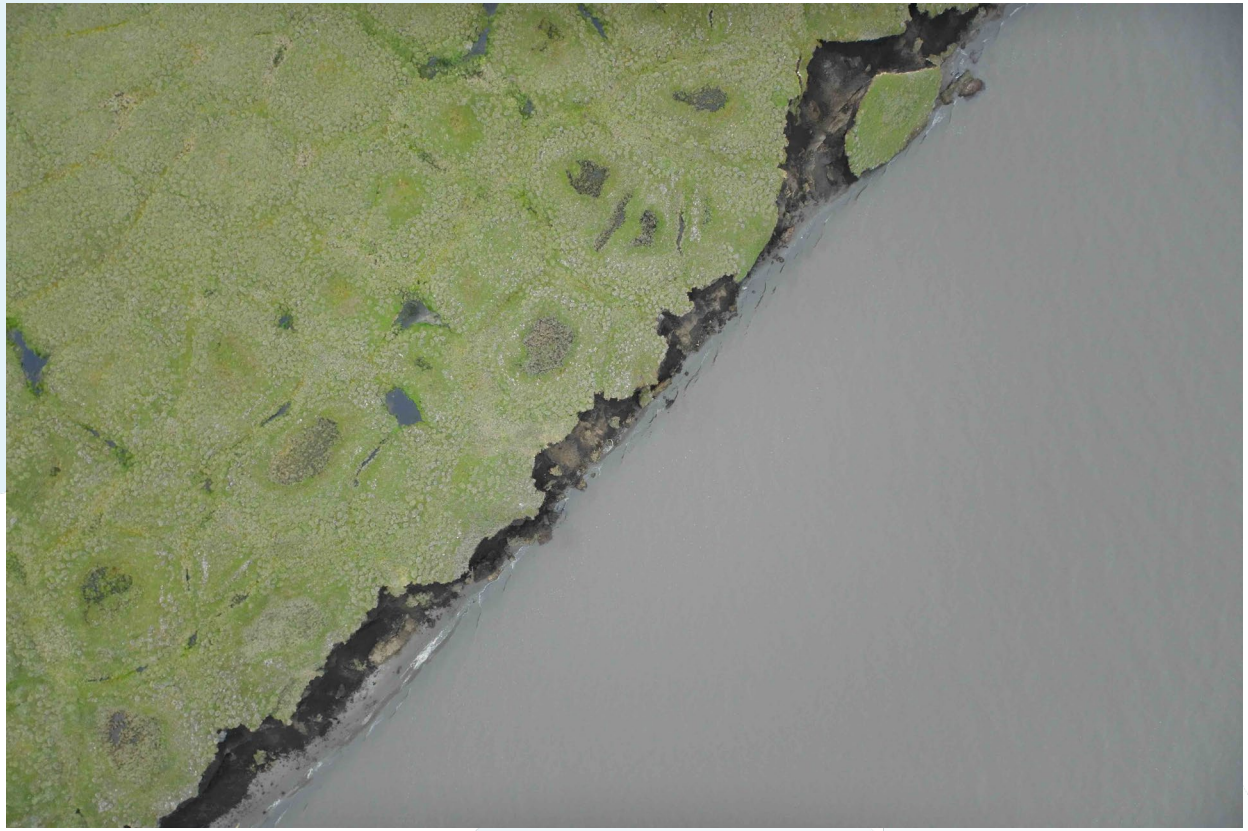
Major results so far include:

- A new assessment on the influence of anthropogenic warming on Arctic coastal dynamics:
- Arctic coasts are some of the most rapidly changing coasts on Earth. Most change occurs during the sea-ice-free period, which can be up to 3 months.
- **The erosion of permafrost coasts has increased since the early 2000s when compared with the late twentieth century (1960s–1990s), coinciding with an intensification of environmental drivers linked to anthropogenic warming**.
- **Mean annual erosion rates** along stretches of unlithified permafrost coasts in Alaska, Canada and Siberia **have more than doubled since the early 2000s compared with the latter half of the twentieth century.**

https://doi.org/10.1038/s43017-021-00232-1

Major results so far include:

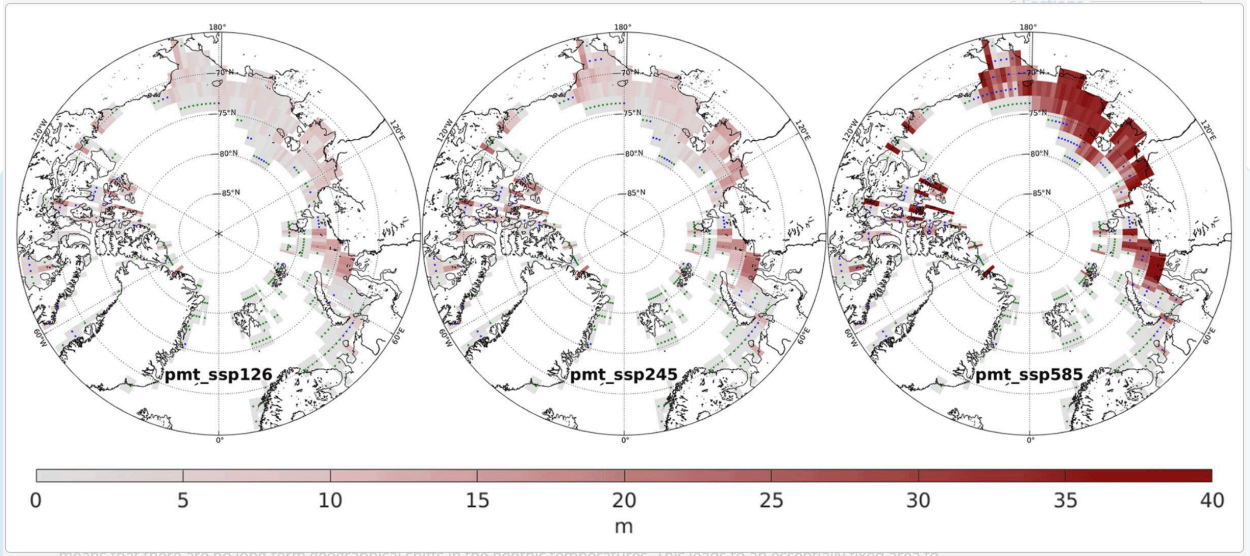
- A novel approach to represent **Arctic coastal erosion at the scales of modern Earth System Models:**
- A semi-empirical Arctic coastal erosion model combining observations from the Arctic Coastal Dynamics (ACD) database, climate reanalyses, and ESM and ocean surface wave simulations.
- The **results predict that the sensitivity of erosion to warming roughly doubles by the end of the century.**



https://doi.org/10.1038/s41558-022-01281-0

©G.Vieira

Major results so far include:



- New study on the **fate of subsea permafrost in the next 1000 years** by implementing subsea permafrost into JSBACH, the land component of the Max Planck Institute Earth System Model (MPI-ESM).
- The authors investigated three extended scenarios from CMIP6. The **results for the 21st century show only small differences among the scenarios, but in the upper-end emission scenario SSP5–8.5 (shared socio-economic pathway), especially in the 22nd century, subsea permafrost ice melting is more than 15 times faster than in the pre-industrial period.**

All results will be compiled into an Arctic Permafrost Atlas

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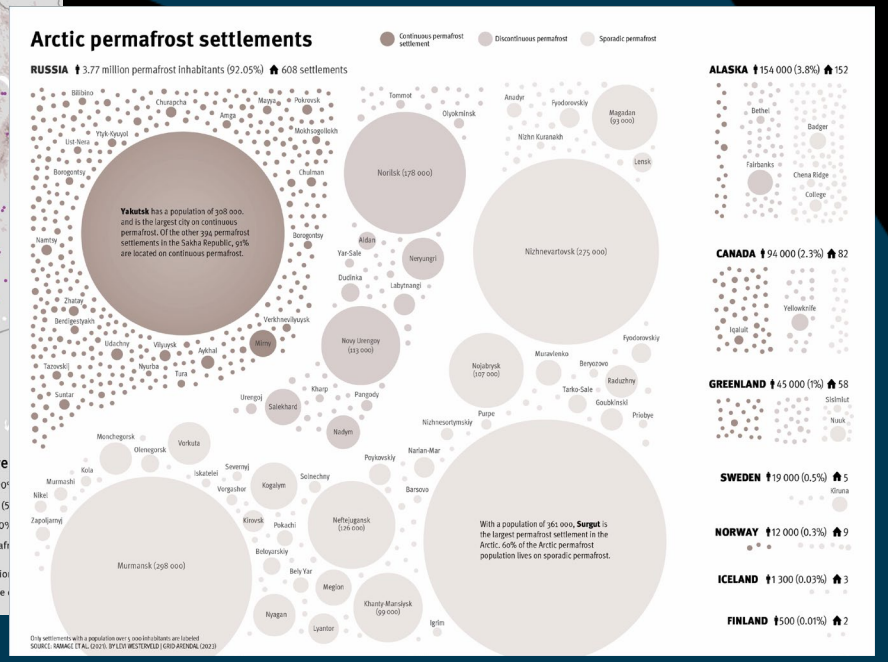

Arctic Permafrost Atlas

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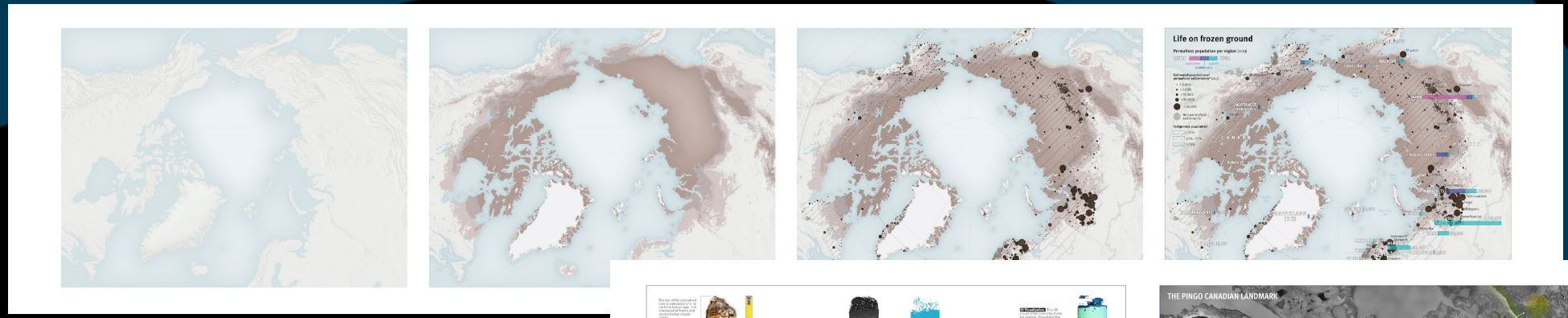
Covering over 150 pages, it will include a set of unique new maps on different aspects of permafrost and the impacts of permafrost thaw.



Arctic Permafrost Atlas

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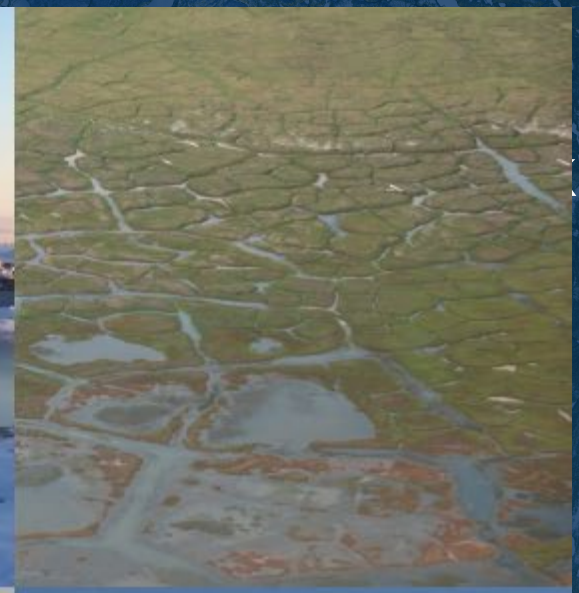
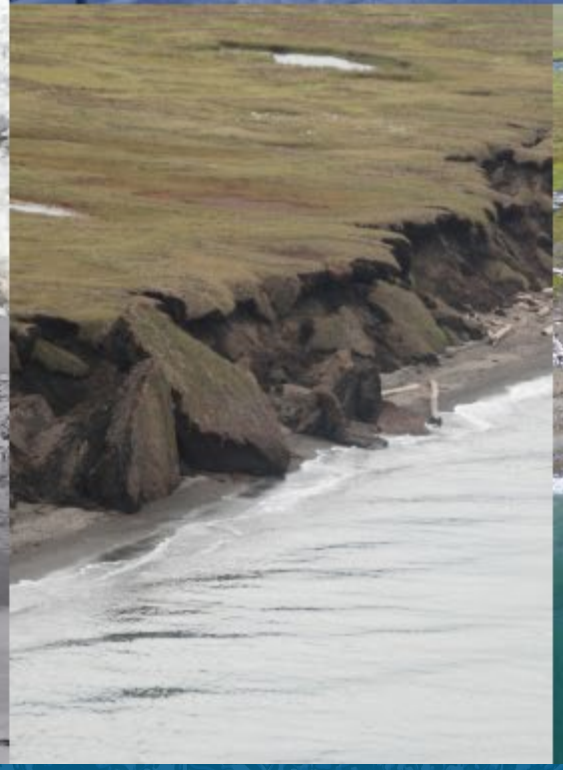
In addition to the latest scientific information, the publication will give voice to the indigenous peoples in the arctic in the form of portraits that will allow understanding of the changing arctic permafrost also from the context of local communities and peoples.

- These portraits are illustrated by a Yakutian artist, giving them even more depth and providing a different representation of the data.







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