Arctic Symposium: Status & Prospects for Japan-US collaboration in the Arctic – Jan 2025

Grand challenges in Arctic research

Perspectives from UAF's International Arctic Research Center

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UNIVERSITY OF ALASKA FAIRBANKS

International Arctic Research Center

IARC – Japan & U.S. Arctic science collaboration

- IARC was founded at UAF through an agreement between Japan and the United States
"to demonstrate our ability to solve, jointly, problems that are beyond what any one nation can address"
- ~120 Scientists, analysts, students, professional staff that span the physical, biological, and social sciences; ~150 research projects (externally funded)

Outline

1. **Introduction: The Arctic & disruptive change**
2. Permafrost degradation
3. Sea ice loss
4. Ecosystem restructuring
5. Conclusions

Rapid change and “tipping elements”

- Arctic is warming 3X faster than rest of globe
- Warming impacts key functions of the earth system
- Arctic controls majority of globally relevant tipping elements

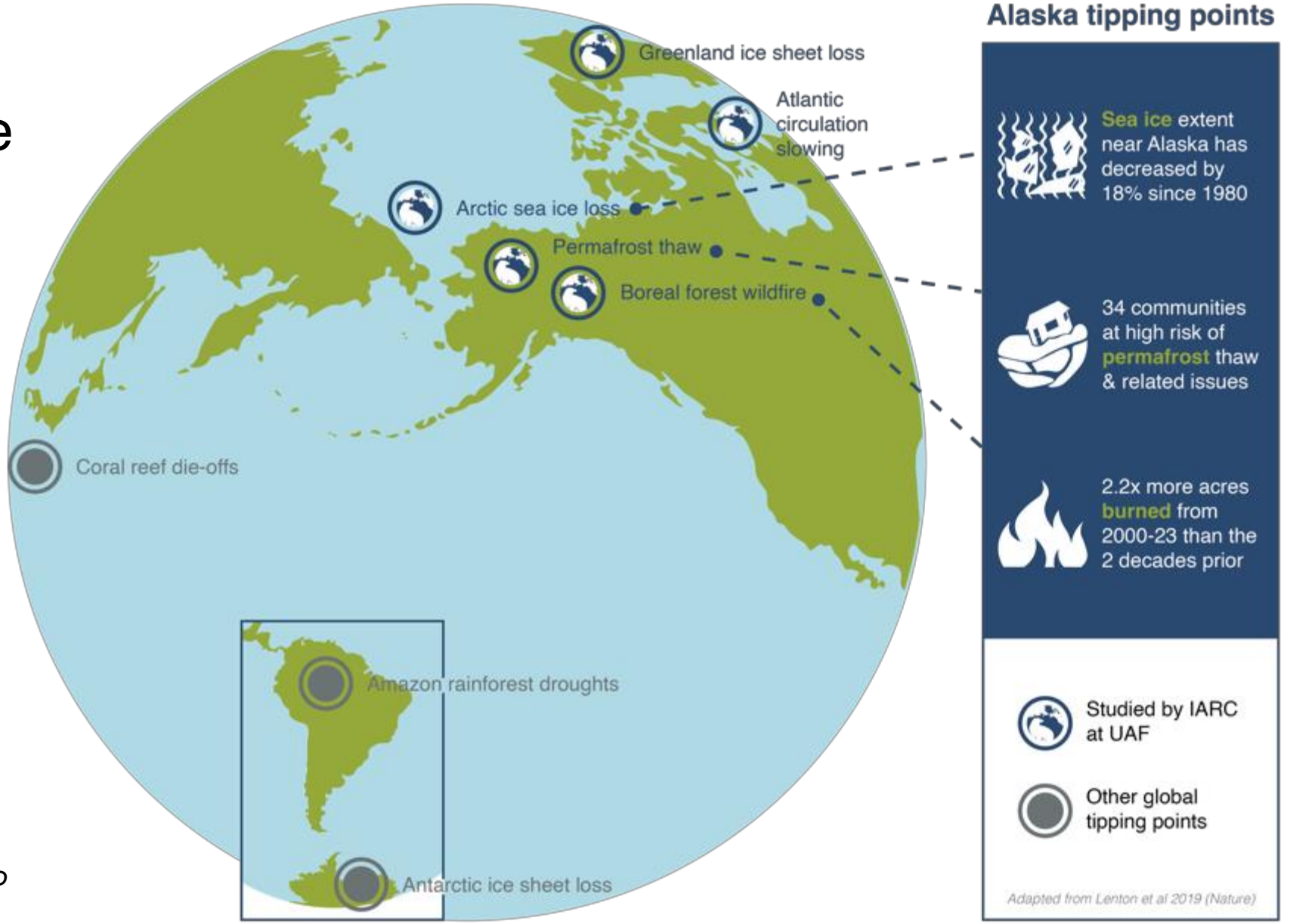

Fig. by McFarland, based on Lenton et al. (2019) & ACCAP

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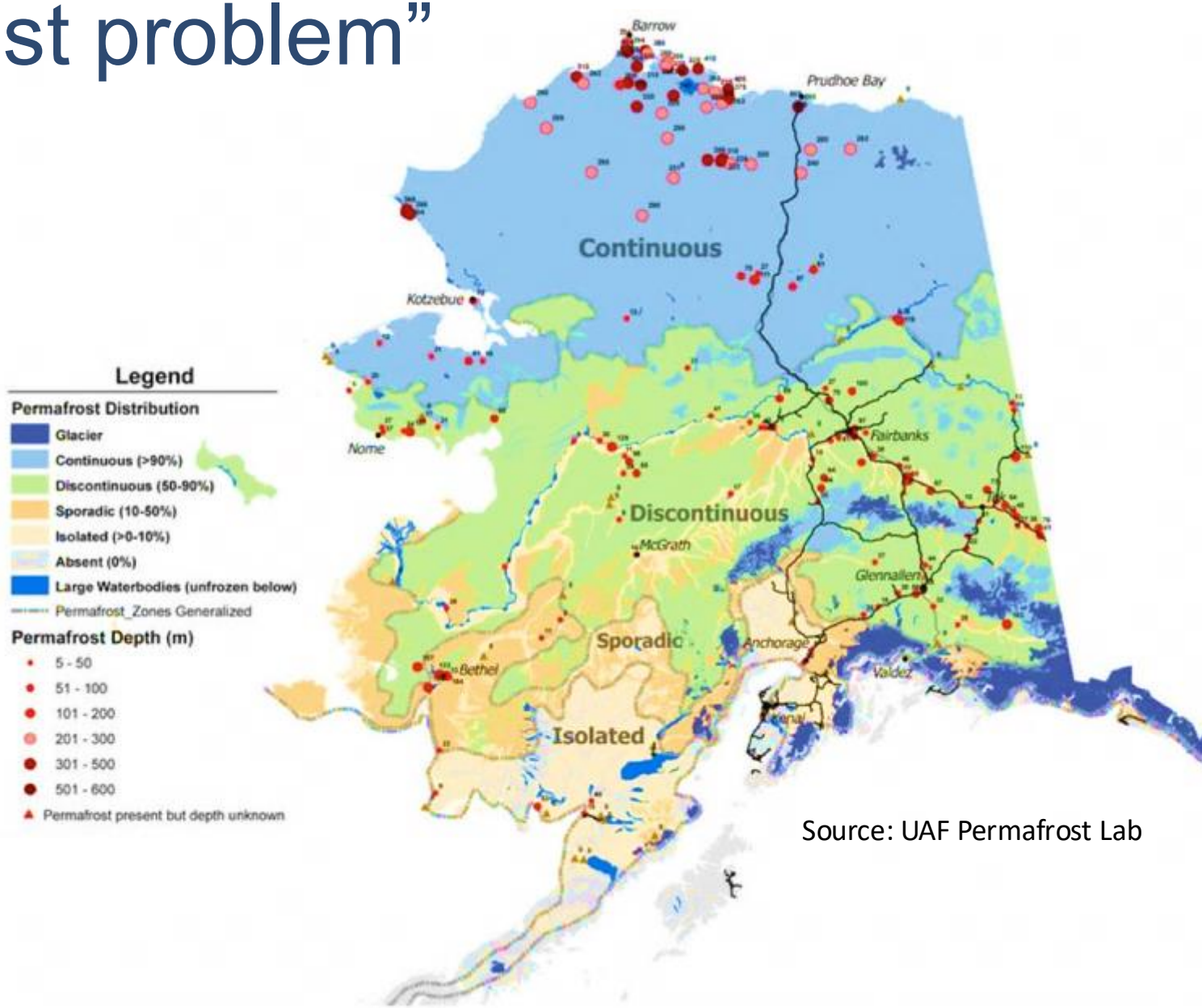
Scale of the “permafrost problem” - Alaska as example

- Infrastructure damage - Road and building integrity
- 78% of highways underlain with >50% permafrost
- 52% of communities underlain with >50% permafrost
- Ecosystem change: Increased erosion, sudden lake draining



Source: UAF Permafrost Lab

UNIVERSITY OF ALASKA FAIRBANKS | ALASKA CLIMATE ADAPTATION SCIENCE CENTER

Home What are climate projections? What data and places are shown here?

Northern Climate Reports

FOR CHANGING ARCTIC ECOSYSTEMS

northernclimatereports.org

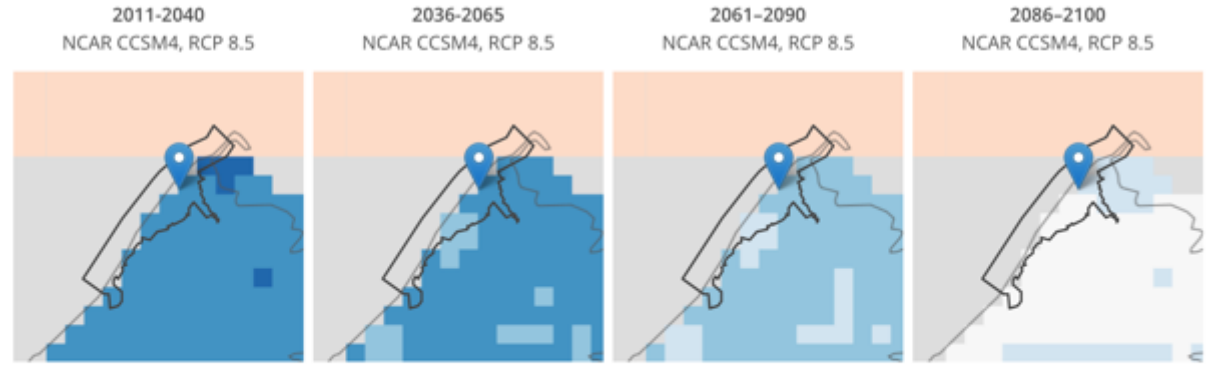
Projected Conditions for Utqiaġvik (Barrow)

In **Utqiaġvik (Barrow)**,
average annual temperatures
may increase by about **18°F** by the end of the century.

Winter temperatures are increasing the most (**+31°F**).

Models have higher uncertainty with regard to precipitation,
but **summer** is likely to have more precipitation (**+67%**).

By the late century, permafrost within about 10ft of the ground
surface may **disappear**.



This table is a legend for the maps above.

Category	Mean Annual Ground Temperature
Continuous Permafrost	<21°F
Cold Discontinuous	≥21°F, <25°F
Discontinuous	≥25°F, <28°F
Cold Sporadic	≥28°F, <30°F
Sporadic	≥30°F, <32°F
Permafrost Possible	≥32°F, <34°F
Permafrost Unlikely	≥34°F, <36°F
No Permafrost	≥36°F

Projected permafrost active layer thickness and ground freeze depth through the end of the century are shown below. The active layer is the layer of soil above permafrost that thaws seasonally. Ground freeze is the maximum depth to which winter freeze occurs in non-permafrost areas.

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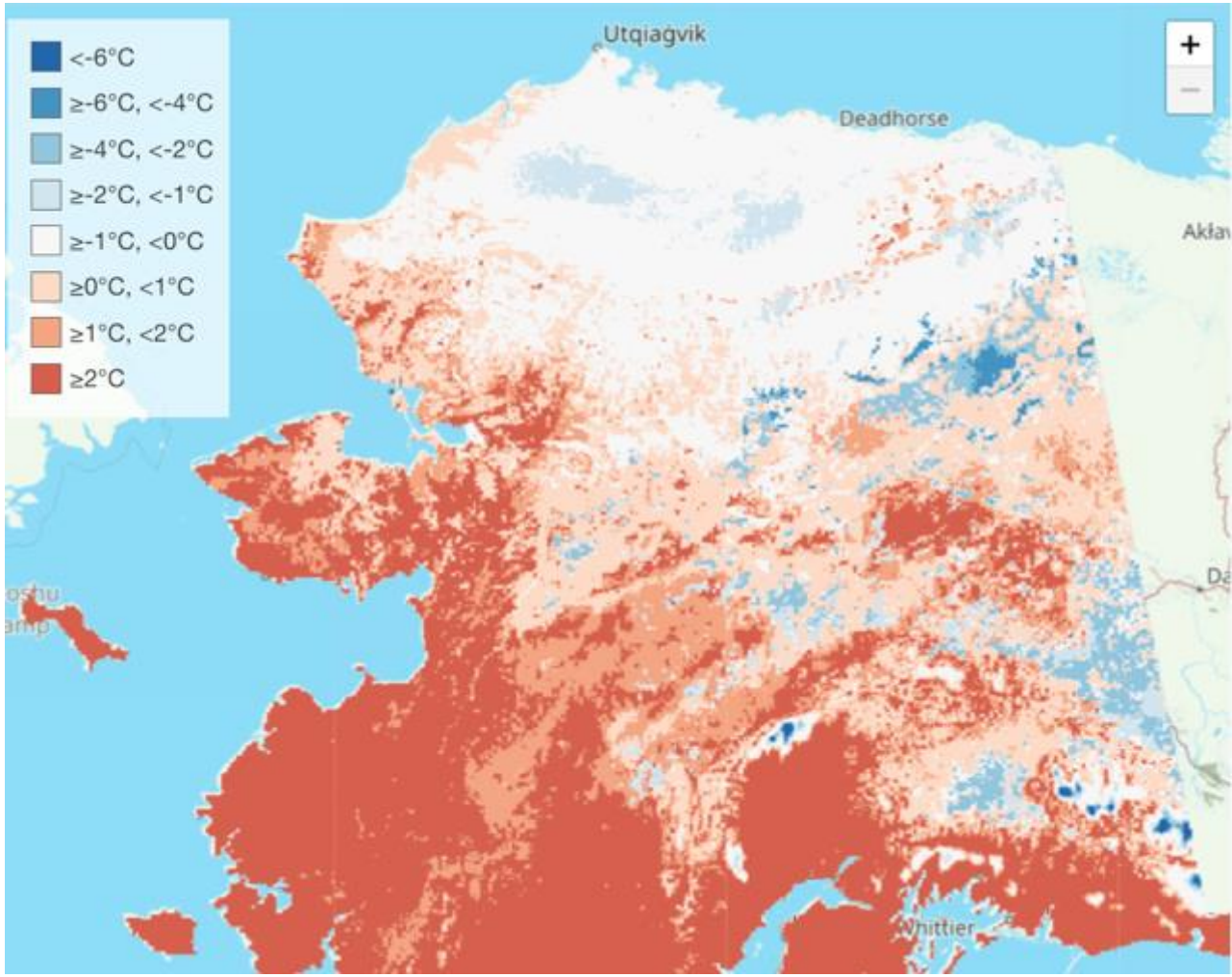
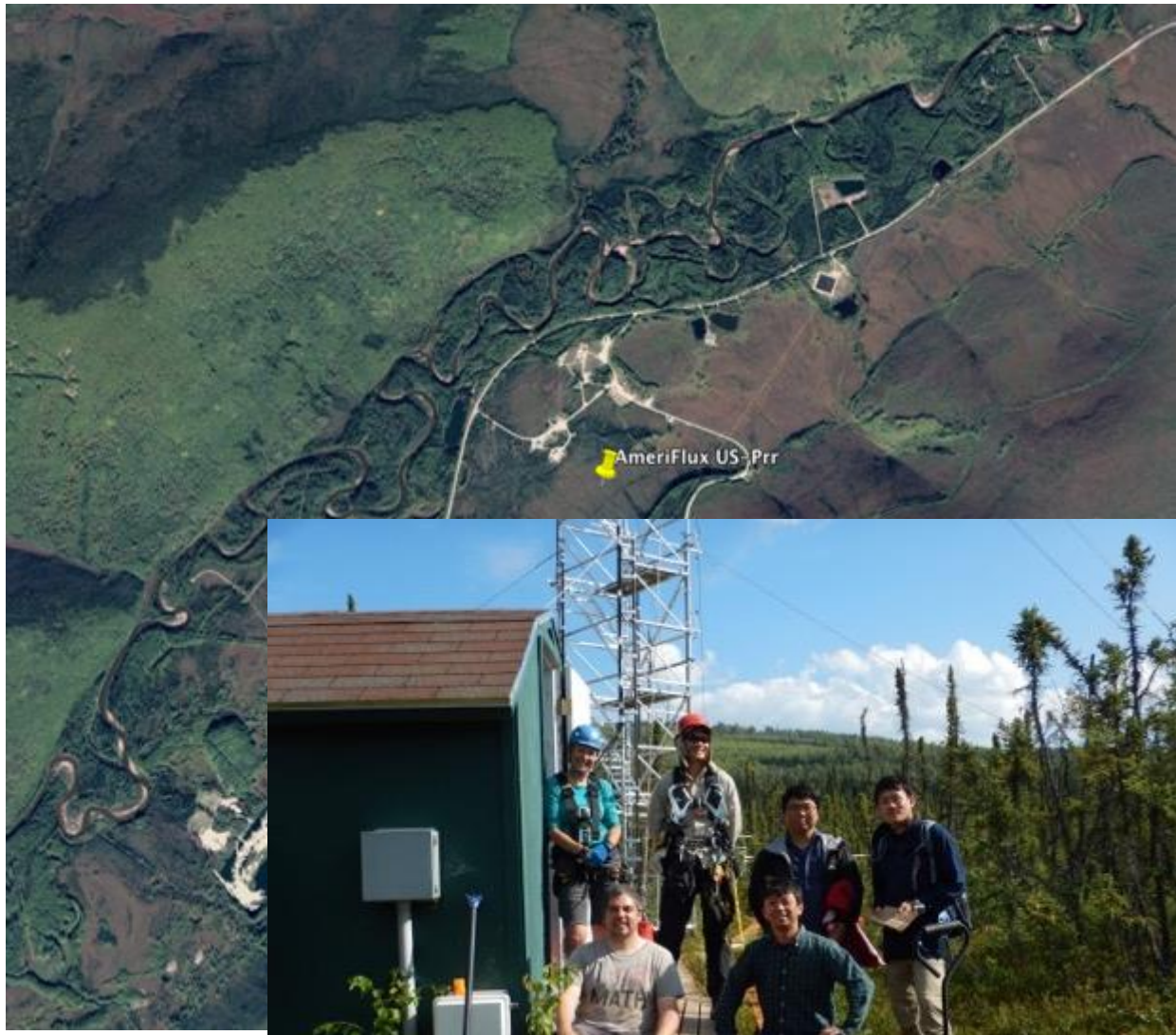
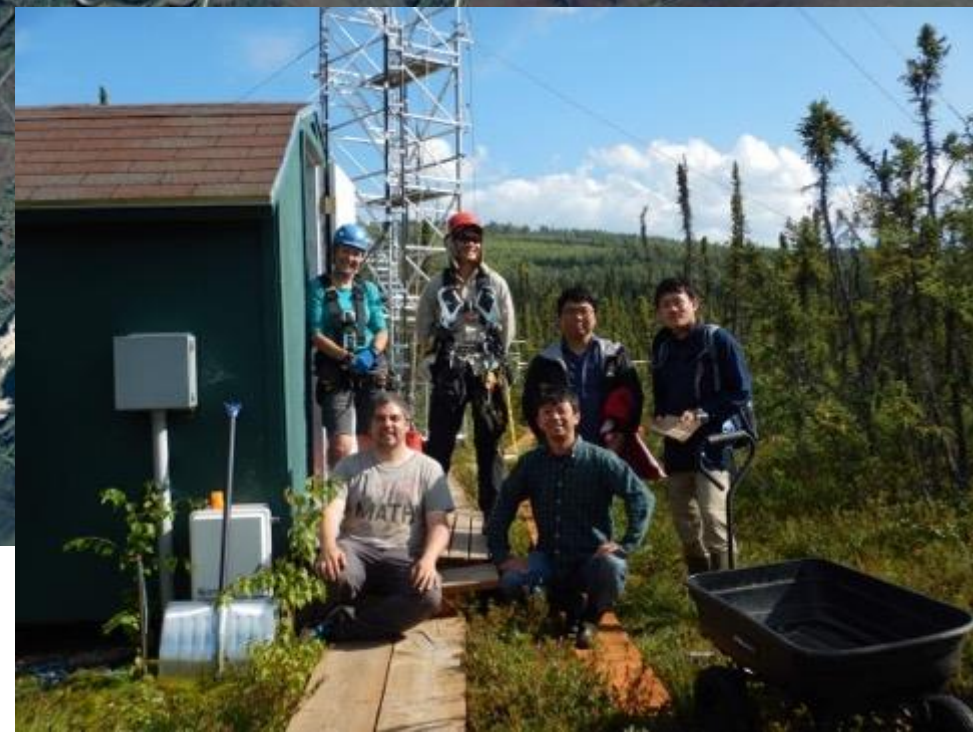


Transitions in the boreal forest & permafrost belt

- Boreal forests & permafrost as carbon sources & sinks
- Long-term studies of changing boreal forest, permafrost and seasonal snow environments at UAF's Poker Flat Research Range – Ameriflux Supersite
- JAMSTEC (Kobayashi, Saito et al.) & IARC (Iwahana, Kim et al.) collaborative research; NIPR & UAF infrastructure support





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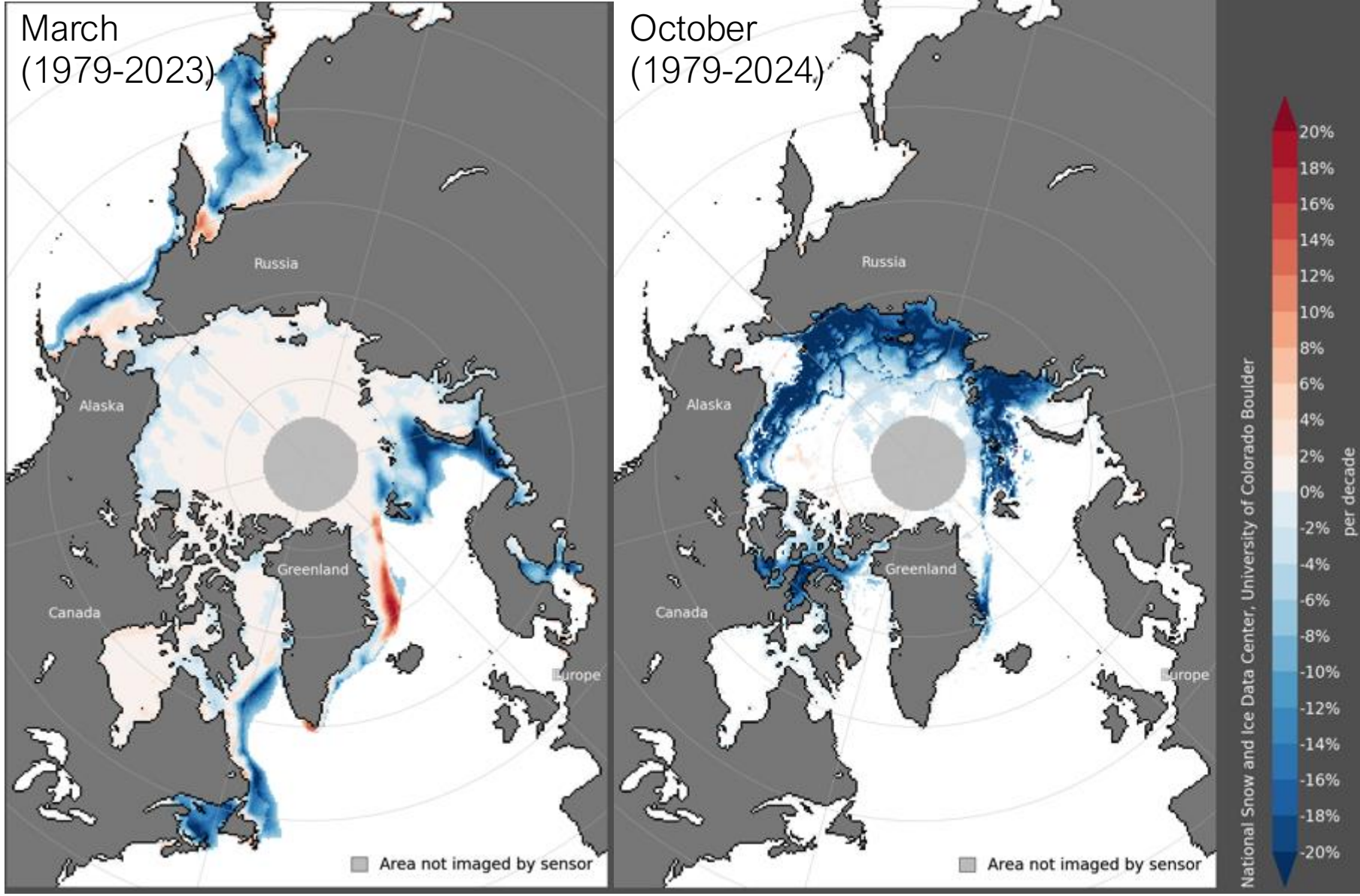
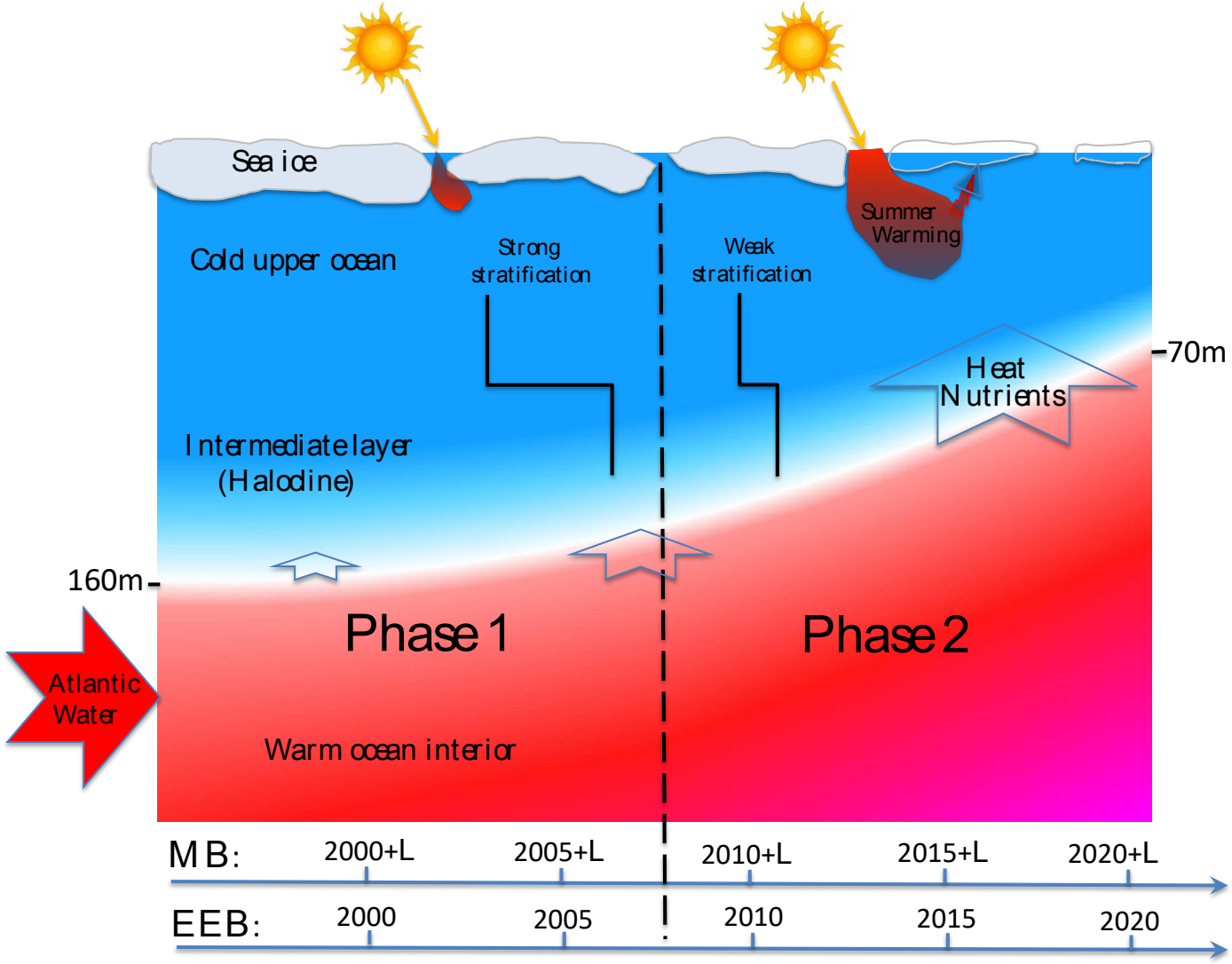
Sea ice loss

- Winter ice loss in Okhotsk, Bering, Kara Labrador Seas
- Summer ice loss centered on Pacific Arctic sector
- Incipient winter ice loss across Siberian shelves

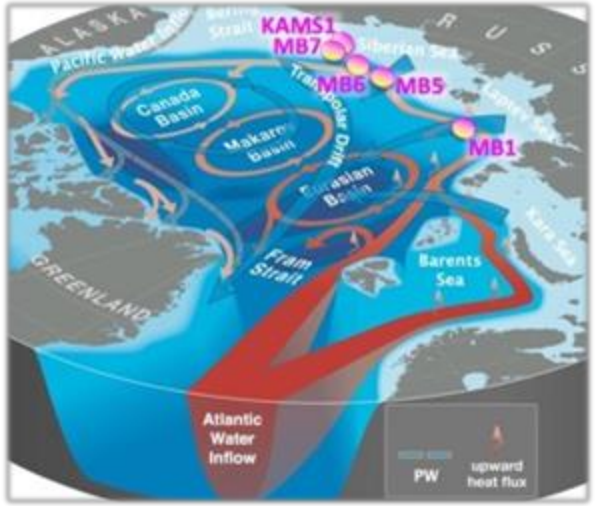


National Snow and Ice Data Center (2024)

Atlantification has reached Amerasian Basin Center of action – Siberian Arctic Ocean



Polyakov et al. (in prep.)



- Oceanic heat fluxes explain up to 1m (!) of sea ice loss in the Eurasian Basin in 2021-2023
- Implications for loss of winter sea ice?

Igor Polyakov, International Arctic Research Center

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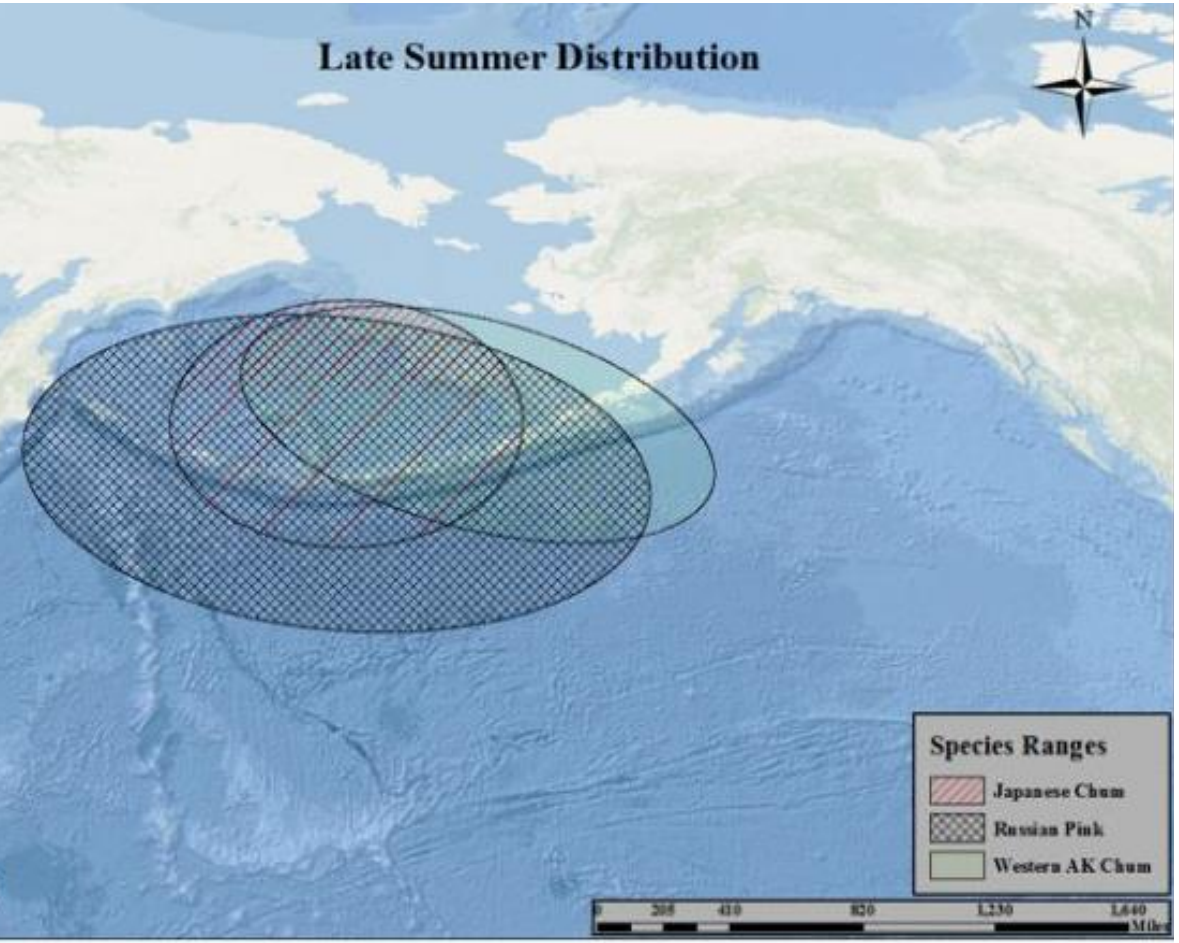
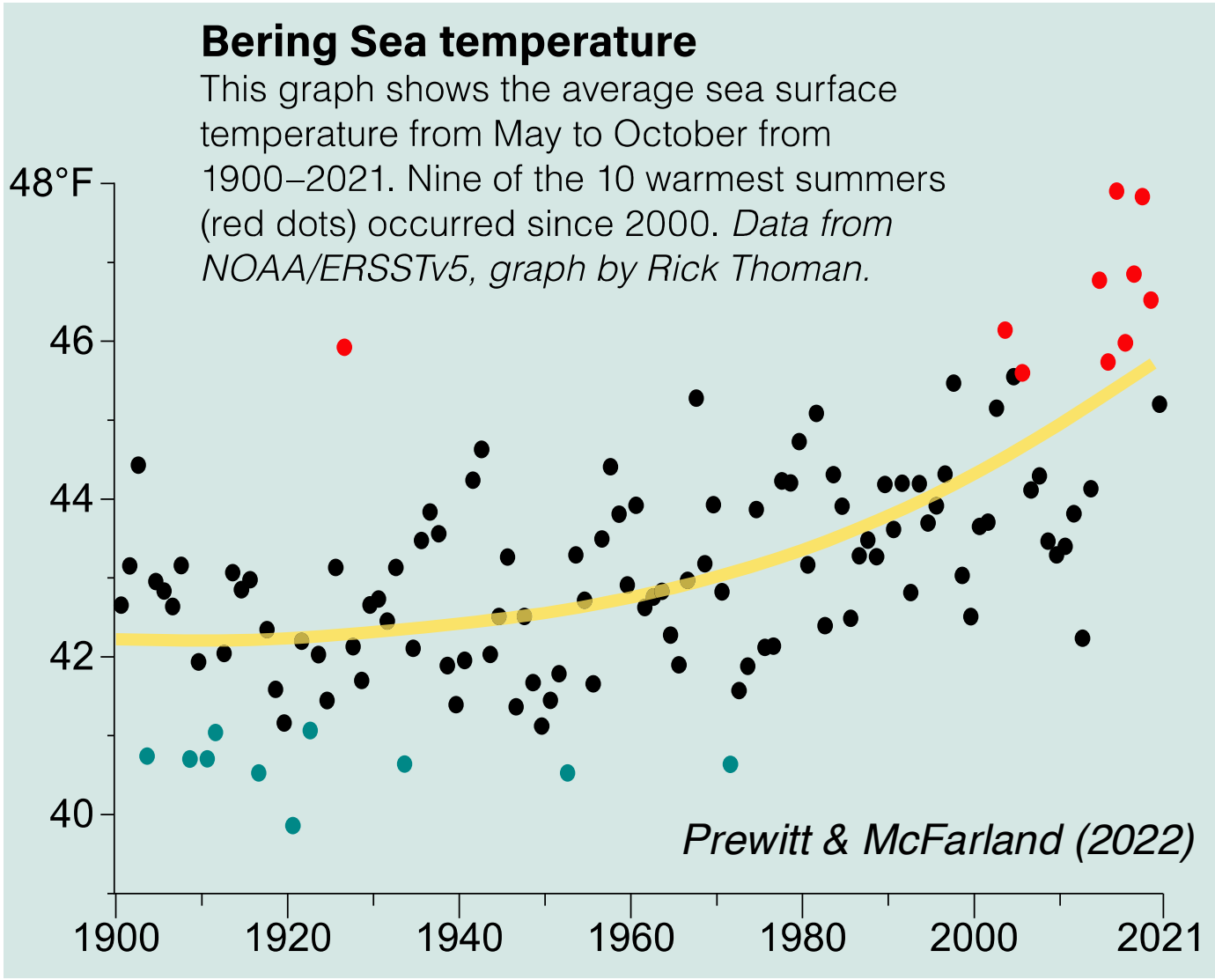
Heatwave & warming impacts on ecosystems: e.g. salmon



McPhee & Minicucci (2018)



Heatwave & warming impacts on ecosystems: e.g. salmon

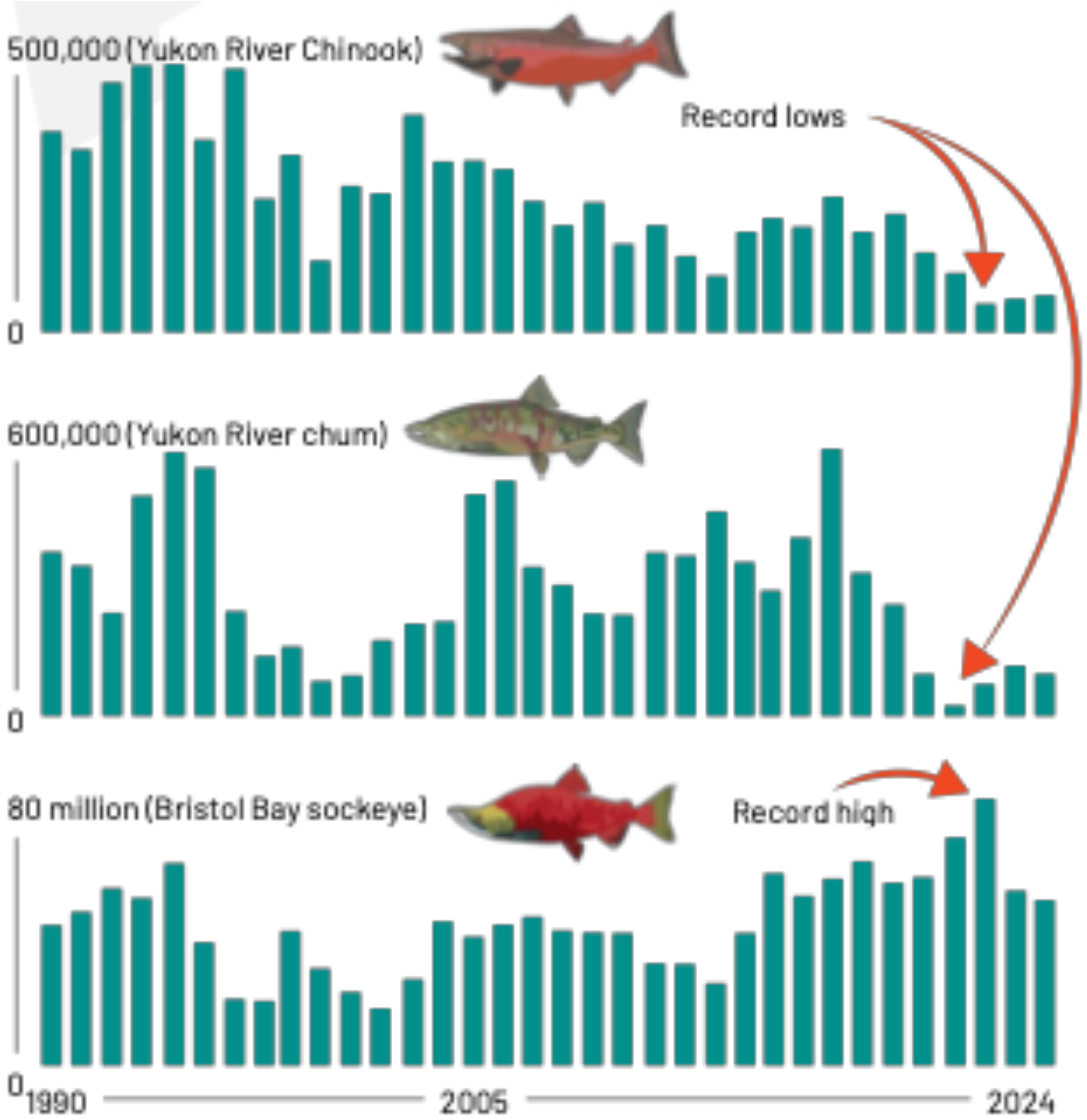
Photos by **MARC LESTER** / ADN

In a normal year, Herman Hootch said, his Emmonak smokehouse would be filled with chum salmon. "We haven't been able to fish to date, all summer, not even once," he said.

SPECIAL REPORT

'We've never seen this before'

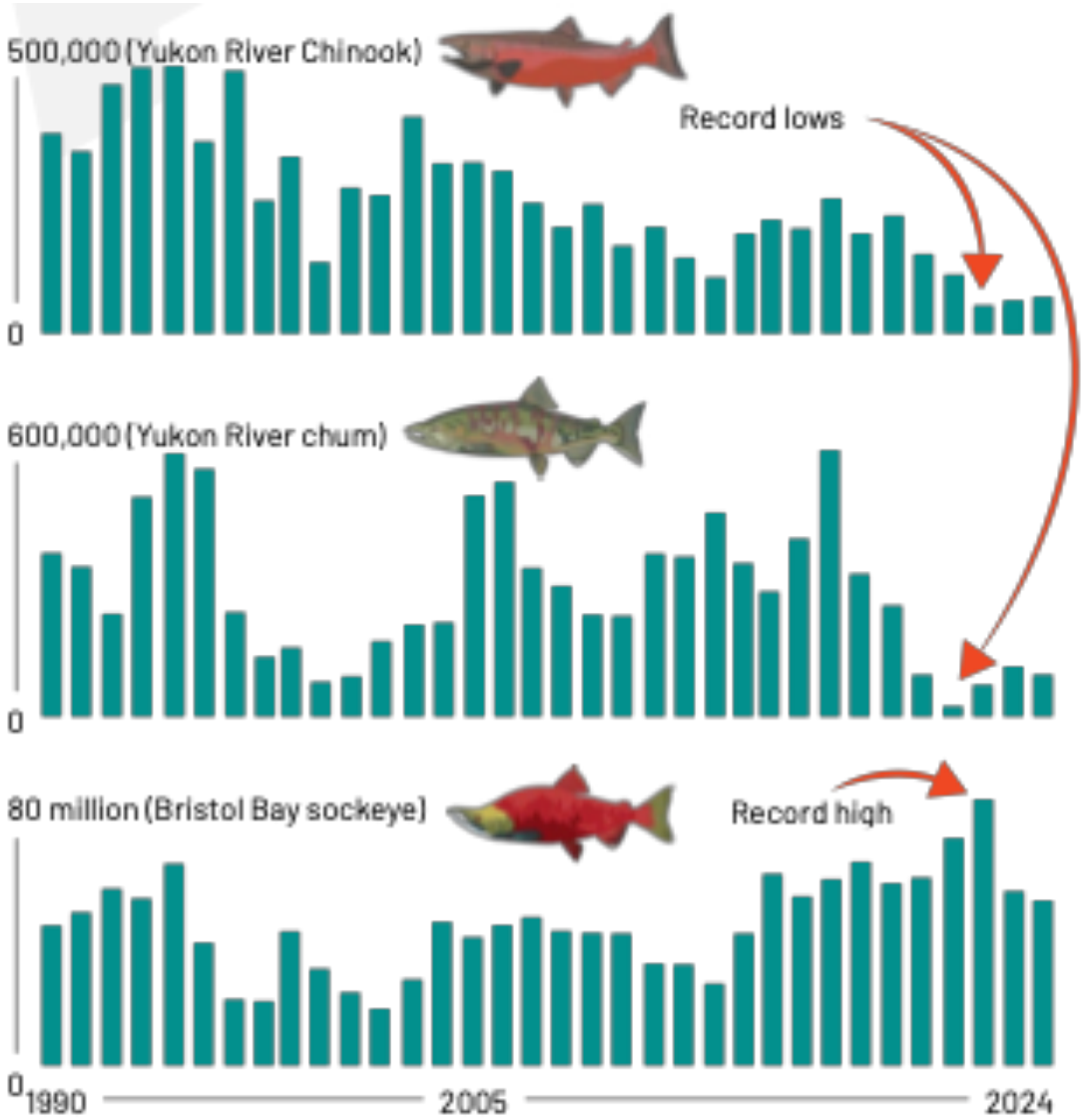
Salmon collapse sends Alaskans on the Lower Yukon River scrambling for scarce food alternatives as winter approaches



Thoman & McFarland (2024) Alaska's Changing Environment 2.0

Heatwave & warming impacts on ecosystems: e.g. salmon

- IARC researchers help stand up a Salmon Expert Panel to improve coordinated long-term observations
- Collaboration with Japanese research centers (e.g., Hokkaido University's Arctic Research Center)



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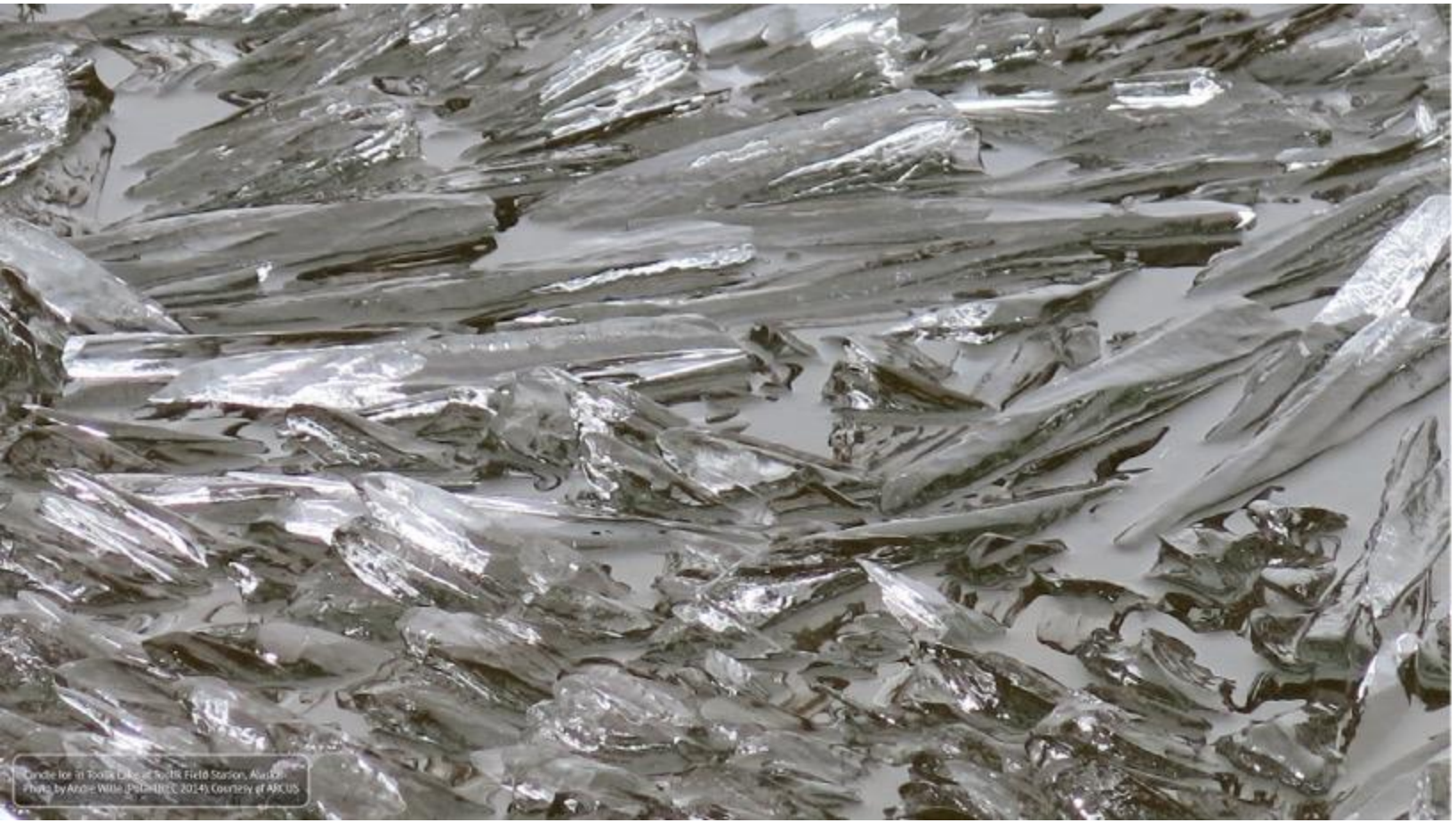

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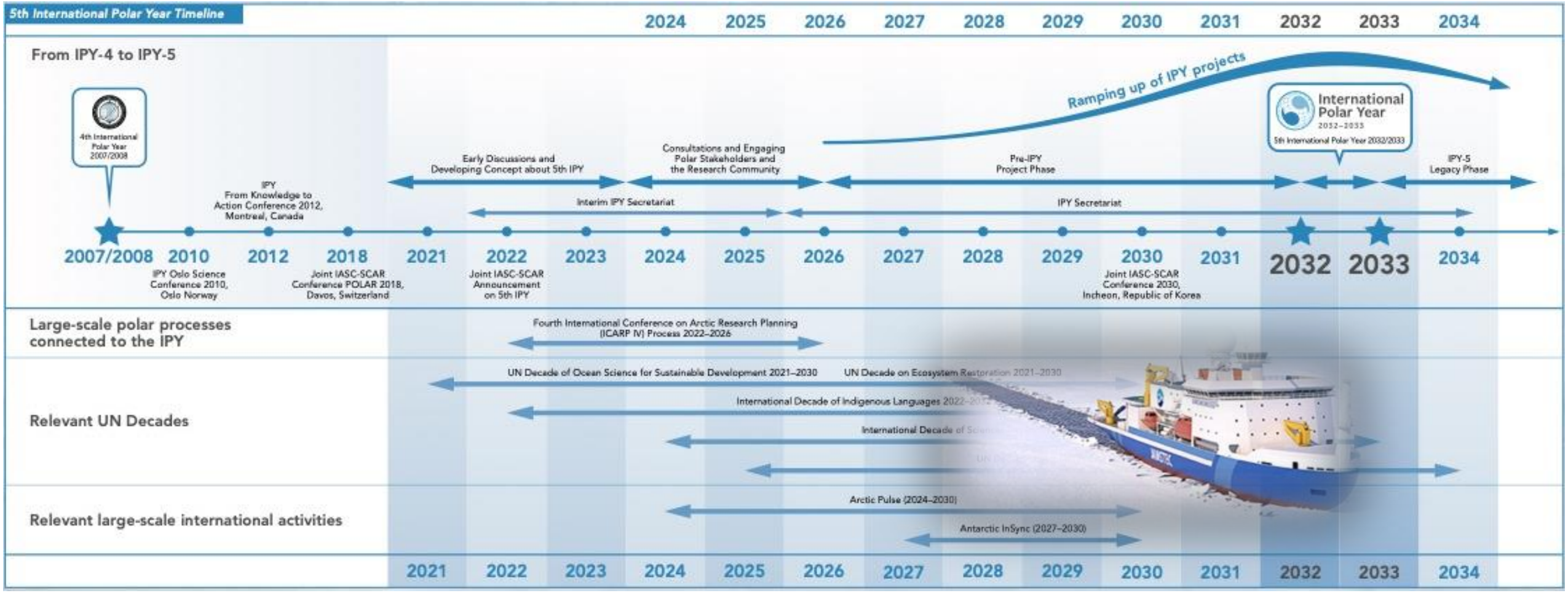
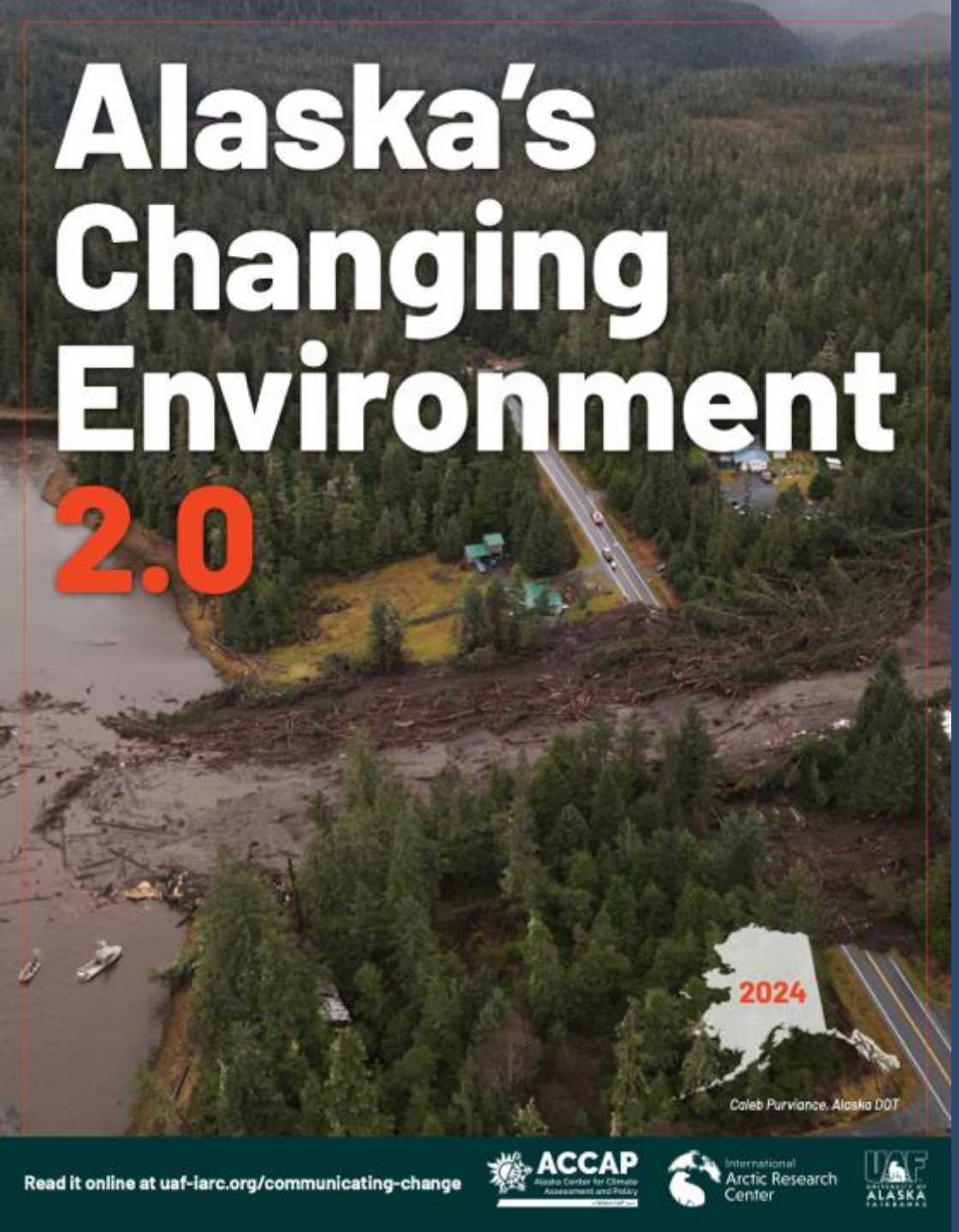
Central Arctic Ocean Fisheries Agreement (CAOFA) as an opportunity for collaboration

- Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean requires Joint Program of Scientific Research and Monitoring (JPSRM)
- JPSRM has to take ”into account the work of relevant ***scientific and technical*** organizations, bodies and programs, as well as ***indigenous and local knowledge***”

International Polar Year 2032-33 as opportunity to advance societal benefits, collaboration & decision support



IASC (2024)



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