Current and Future Challenges to Alaska Coastal Resilience

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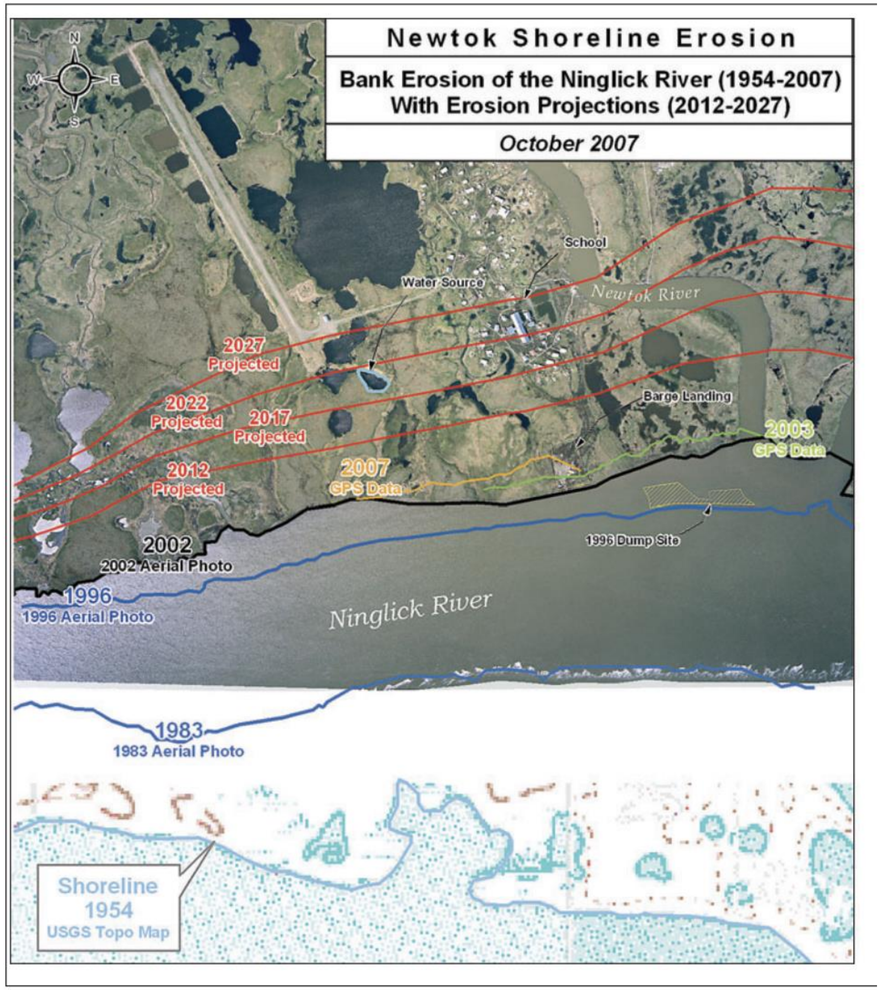
https://toolkit.climate.gov/image/1184

Kivalina

Shishmaref

Figure 6: Shoreline Erosion Map for the Village of Newtok, Alaska, October 2007



Newtok

https://dggs.alaska.gov/hazards/coastal/monitoring-shishmaref.html

https://www.gao.gov/new.items/d09551.pdf

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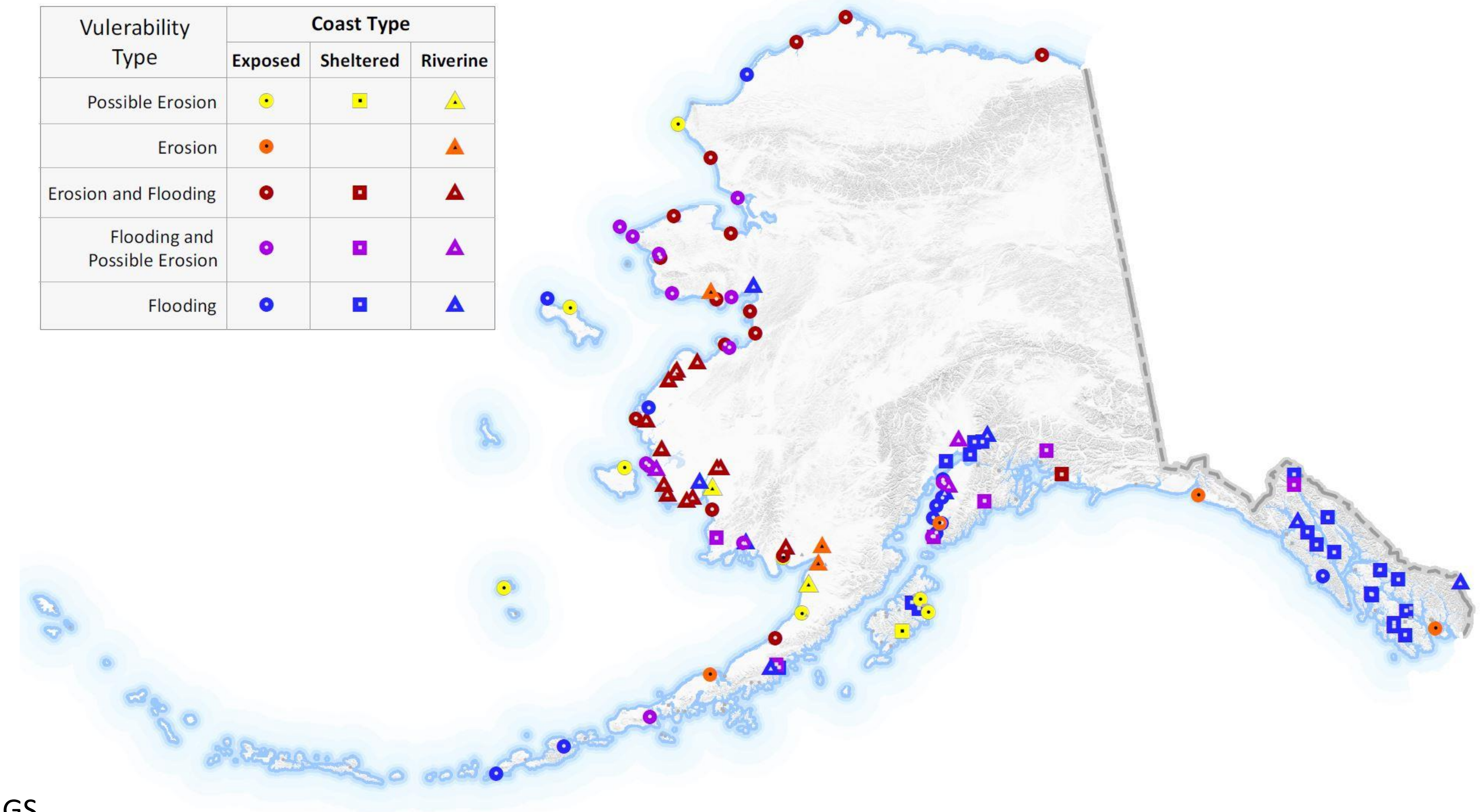

Figure: AK DGGS

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http://dggs.alaska.gov/hazards/coastal/index.html

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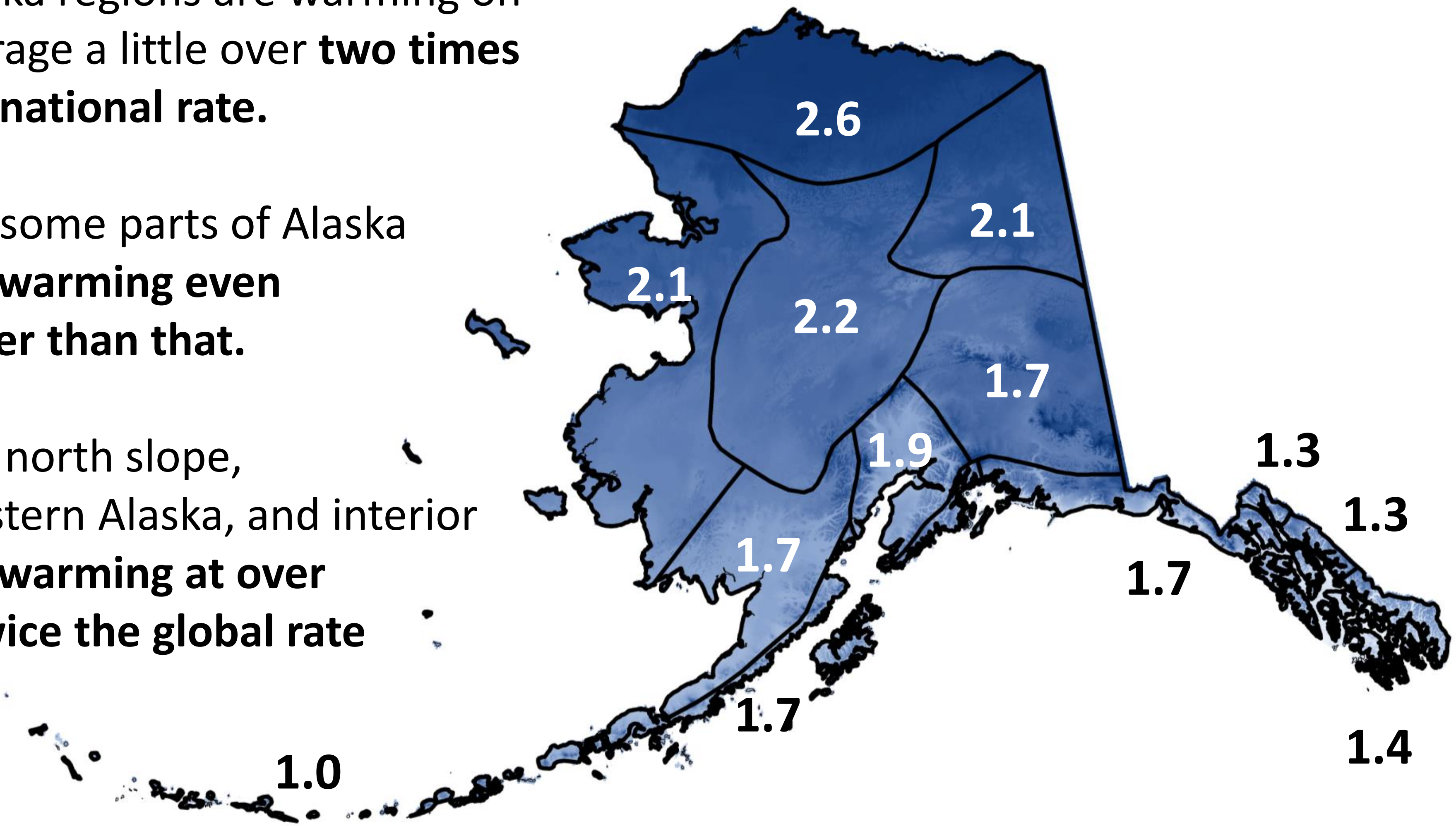
Alaska regions are warming on average a little over **two times the national rate.**

But some parts of Alaska **are warming even faster than that.**

The north slope, Western Alaska, and interior **are warming at over twice the global rate**



This map shows climate divisions of Alaska. The number for each climate division indicates the rate of warming compared to the CONUS; 2.6 means *2.6 times the rate of US warming*

1970-1999 average annual temperature, with state climate division rates of change compared to US average for 1970-2016. Data: NOAA NCEI

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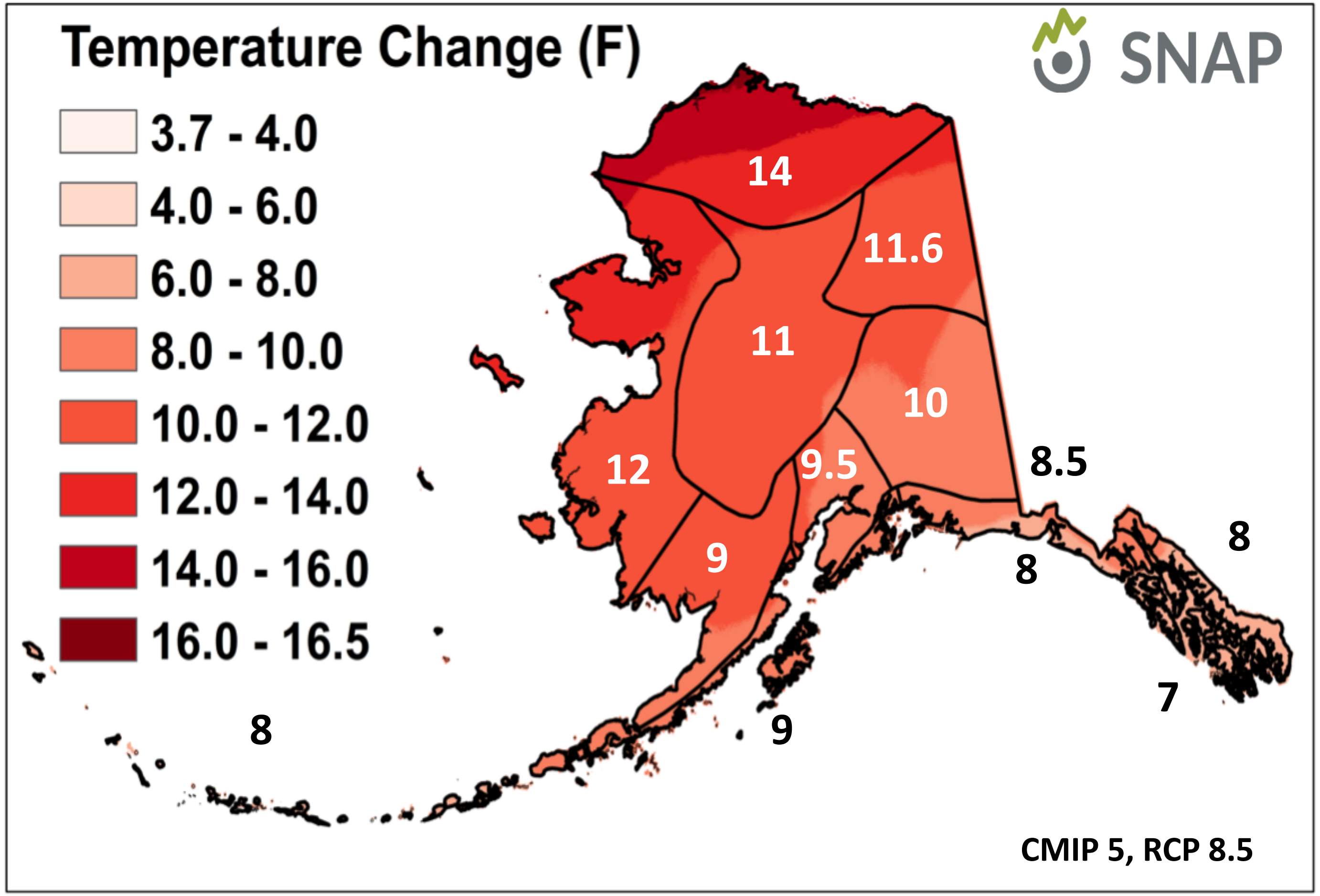
Temperature changes by the late 21st century



2070-2099 projected change in annual average temperature compared to 1970-1999 for AK. 5 climate model average, higher emissions. NCA4 Ch. 26, 2018. Climate division averages also from UAF/SNAP data.

Projected warming is greater than the historical variability by the 2050s.

For planning and adaptation purposes, however, ***the timing and magnitude of fundamental change*** is key.

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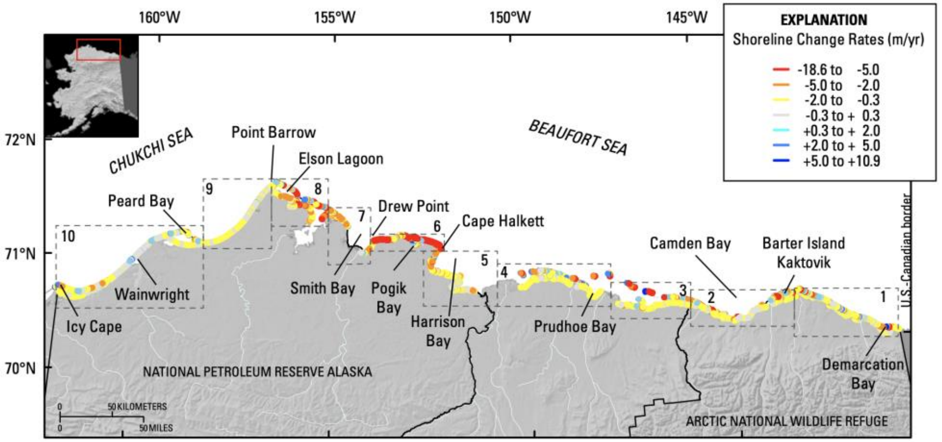
Permafrost Thaw

Barter Island, near Kaktovik, AK (Credit: S. Harrison, USGS Pacific Coastal and Marine Science Center. Public domain.)

In places where there is a long history of western science shoreline and permafrost data, rates of erosion due to permafrost thaw can be calculated.

Much of the western coast of Alaska has insufficient observations to conduct community-level analysis.



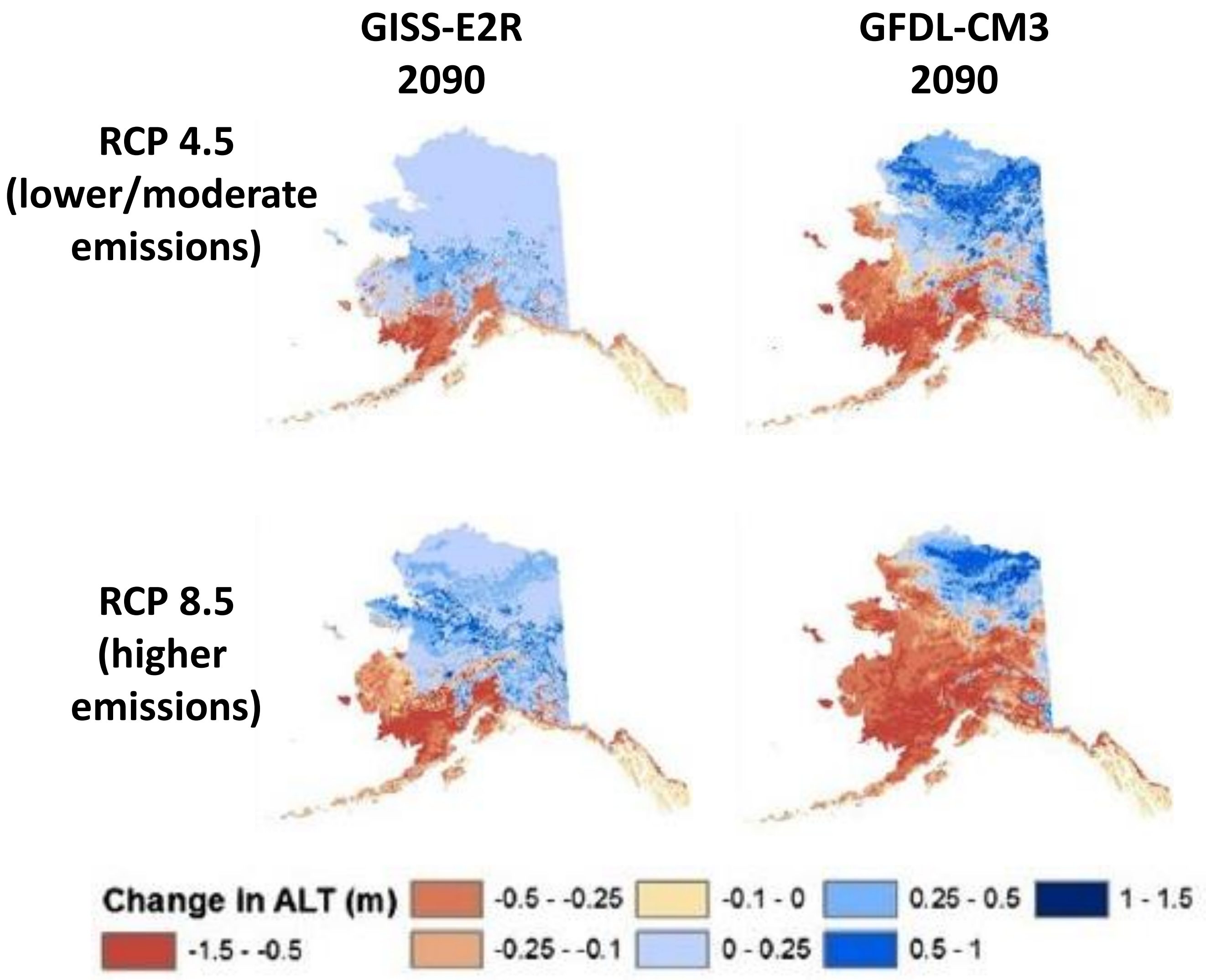
Map of the north coast of Alaska study area showing color-coded shoreline change rates, the boundaries of the ten analysis regions (dashed boxes and numbers), and key geographic locations discussed in the report.

Permafrost Thaw

Permafrost is projected to continue to thaw.

Projections indicate active layer (seasonal thaw) depths Inconsistent with near-surface permafrost over much of the Bering Sea coast under a model with less warming under moderate (RCP 4.5) emissions.

Thaw is projected over the entire west coast of Alaska under a model with more warming under higher (RCP 8.5) emissions.

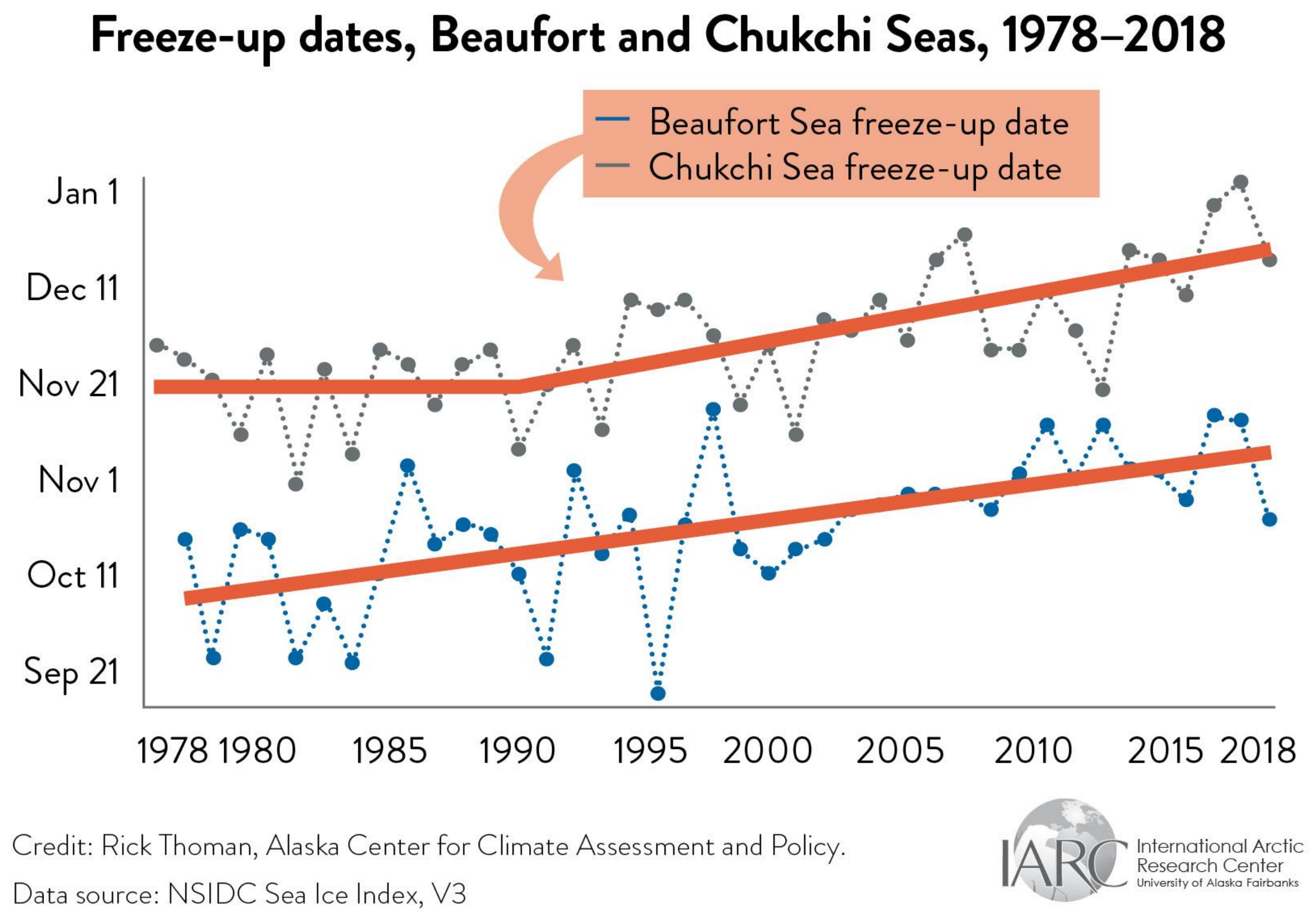


Relative to 1986-2005 baseline.
Modified from Melvin et al. 2017, PNAS

Sea ice-free season

Ice-free conditions in the Bering, Chukchi, and Beaufort seas are projected to increase roughly 1 week per decade south of latitude 60N and about two weeks per decade north of latitude 65N.

This would result in considerably longer ice-free seasons, during which storms (usually fall and winter) of even historical magnitude would be more likely to cause erosion and flooding events.



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https://www.pnas.org/content/pnas/114/2/E122.full.pdf

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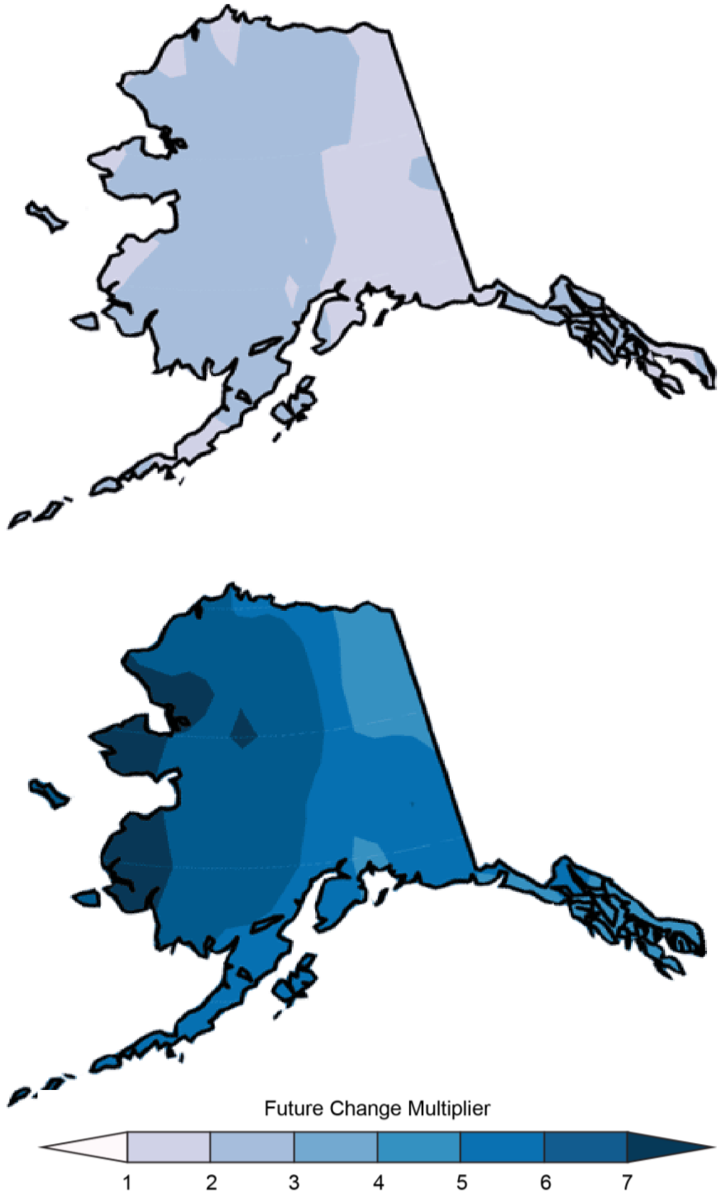
Extreme precipitation

- The frequency of extreme (1yr in 20yrs historically) precipitation events doubles in much of Alaska under low emissions (RCP 2.6).
- Under higher emissions, the frequency of these events becomes much more frequent, 1 in 5 in southeast Alaska and 1 in 3 in parts of the YK Delta and western Alaska.



34 GCMs, 2081=2100 relative to 1981-2000. NCA3, 2014

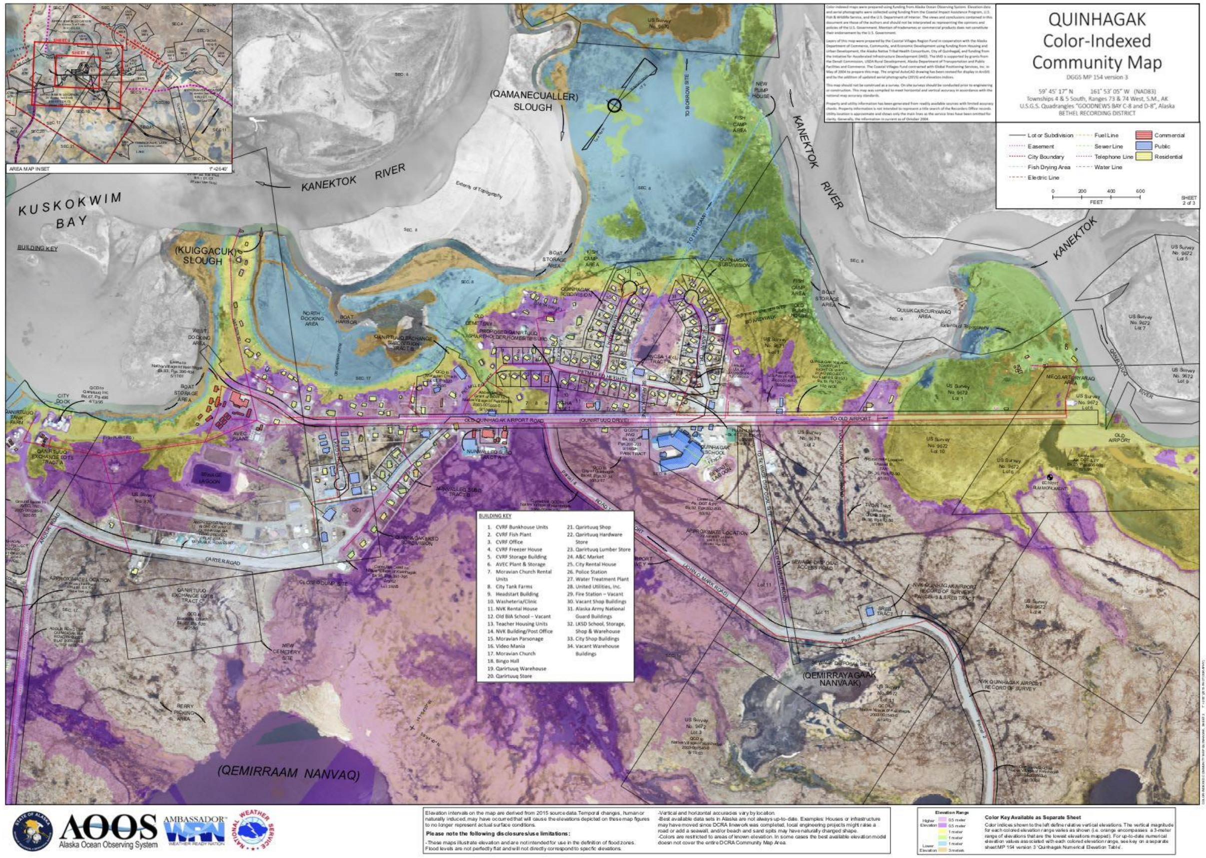
Adaptation needs

Ideally, hazard projections and data would result in risk maps for existing communities and potential relocation sites.

Much of coastal Alaska does not have adequate elevation data to project community level flood risks.

Shorelines are changing so quickly, both in position and topography, that ”baseline”, if it existed, is fluid.

A number of community collaborations with Alaska DGGS and other federal, state, and Tribal entities are collaborating to meet such needs, but the rate of change and absence of even basic data represent considerable challenges.



Detailed color-coded flood elevation map for Quinhagak, AK. Collaboratively developed by Alaska DGGS, AOOS, NWS, and City of Quinhagak, among others. Source: Alaska DGGS

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Socioeconomic complexity

- Food and energy security
- Decolonization
- Sovereignty

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Information Successes, Needs and Opportunities

- Coastal Mapping Strategy – Alaska DGGS
- Capacity to bridge between western science and indigenous knowledge
  - Example: BIA Tribal Climate Science Liaison Malinda Chase
  - Example: NWS community partners / observers
- Scientific capability:
  - Coastal mapping – shoreline, bathymetry, elevation
  - Forecasting – improving models and new capabilities all the time