



The Alaska Coastal Cooperative

A community-first approach to climate resilience



APPLIED SCIENCE RESEARCH MENU

The Alaska Coastal Cooperative seeks to contribute towards actionable science that directly addresses locally identified priorities. As part of this goal this Menu provides a plain-language overview of the existing research expertise and capabilities of the Alaska Coastal Cooperative's ACTION project. Have a look inside and help to identify potential research areas that might benefit your community. When the expertise and capacities listed in the Menu dovetail with the expertise, capacity, and research needs of your community we can create synergy and effectively work together to respond to environmental change and variability.



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Photo by Alex Zaachney.



1. People and Change:

Establish key baseline and monitor societal impacts of multi-faceted change on health and well-being

Our Team:

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“ Through studying relationships between people, places, and values within your community we can better assess how environmental impacts are affecting the well-being of the community and effectively develop strategies that contribute towards solutions. ”
— Chris Maio

Description of work:

We will work with communities to better understand and document the relationships between people, places and values within the context of multi-faceted change, loss, prior efforts, new opportunities and community priorities. Our goal is to also highlight multi-generational perspectives. Visioning workshops are planned to establish critical questions each community would like to answer.

ACTION team members have expertise in investigating:

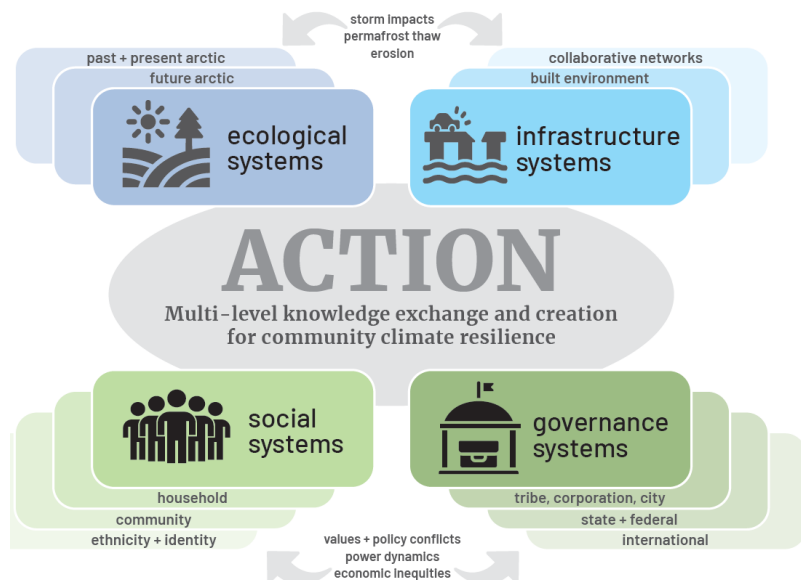
- How decisions are made across complex and multiple layers of governance enabling communities to influence policy more strategically
- Risk associated with a changing environment affecting livelihoods and infrastructure
- Sustainable economic development alternatives such as nature-based visitation, alternative energy, and food systems
- Public health and the environment, including mental health, housing, and concerns related to contamination

What we can provide:

Community reports for decision-making that account for the complex interlinkage of multiple issues. A report or reports will include community-prioritized social, cultural and economic questions and note impacts of multi-faceted change on livelihoods.

Community research lead:

The CRL will assist in preparing visioning workshops, learn how to conduct social science research, and guide research focus areas.





2. Reading Your Land:

Coastal mapping, change detection, and erosion monitoring

Our Team:

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Through a combination of listening to local and Indigenous knowledge holders and using our equipment, we can map and measure environmental changes and create data products such as maps of erosion areas, flood hazard maps and other things such as graphs showing the rate of change. This information will be actionable and contribute to good planning and decision-making.



— **Chris Maio**

Description of work:

Identify geographic data gaps (for example: aerial imagery, bathymetry and digital topographic models) for coastal hazard assessments and develop plans to fill them. Work with local and Indigenous knowledge holders to identify areas of environmental change and historical hazard events. Based on these local observations conduct baseline and repeat topographic surveys using GPS and drones. Train tribal staff to establish, maintain and operate environmental monitoring sites.

What we can provide:

- A variety of mapping products in both digital and paper form. For example, showing the community coastal hazard zones and at-risk infrastructure.
- Decadal-scale changes of coastal features in and adjacent to each community to aid in community planning.
- Detailed GPS data for applications such as identifying annual erosion rates, measuring flooding risks and for creating site assessments.
- Community-based monitoring training and operation, including for erosion, weather and water levels.
- Hazard analysis summary document detailing and interpreting data products and describing hazard areas.
- Other data products specific to community priorities such as maps of culturally important lands labeled with Indigenous place names or coastal hazard zone maps at particular locations such as sewage lagoons or other threatened infrastructure or resources.

Community research lead:

CRL will acquire training in research tasks and carry out repeat topographic surveys, collect measurements from monitoring equipment, facilitate use of local and Indigenous knowledge and assist with creating data products and reports. The CRL will attend training workshops and collect natural and social data. Opportunities will be provided for training in the use of drones and other instruments for environmental monitoring.



3. Gauging the Risk:

Storm surge modeling and coastal flood hazard mapping

Our Team:

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Description of work:

Expand ongoing modeling efforts that map coastal flooding and erosion hazards from possible future storms and sea level rise.

What we can provide:

High resolution (1-2 meters) topography and bathymetry digital elevation models in which to model waves and storm surge data products such as digital and paper maps of projected erosion and flood extents and depths for seven sea level rise scenarios (0, 0.25, 0.50, 1.0, 1.5, 2.0, and 3.0 meters) and five projected annual and extreme storm events plus the "no storm" condition.

Community research lead:

Review model results of past flood events for accuracy. Provide feedback and guidance on geographic model extents to ensure inclusion of regions of importance to the community members. Help identify asset layers such as critical infrastructure and subsistence use areas that can be used to guide risk assessments.

“ Climate-informed flood hazard maps will provide the information needed for effective planning and decision-making. ”
— Chris Maio

SLR: 50 cm | 1.6 ft
100-Year Storm



Flood Depth	
	< 1 ft (0.31 m)
	1-3 ft (0.31-0.91 m)
	3-5 ft (0.91-1.52 m)
	> 5 ft (1.52 m)

Unalakleet



4. Workable Tools:

Coastal hazard analysis of online tools and digital data products

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“ The online tools and data products provided will help communities visualize and understand environmental change. ”
— **Chris Maio**

Description of work:

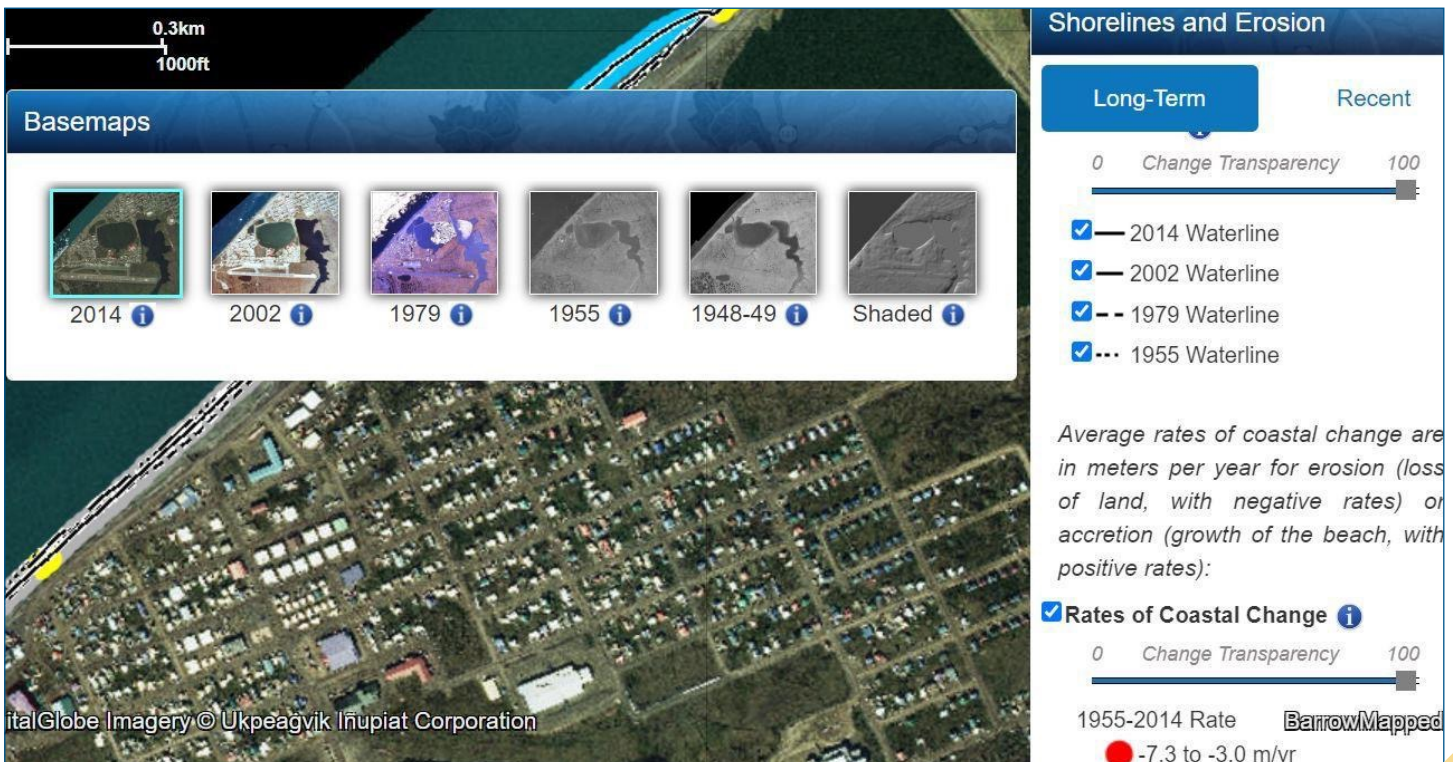
We will review national and international examples of existing online tools and digital data products. The review will assess what tools and datasets are working for the community and which are not. We will produce workflows, mockups and tools to guide development.

What we can provide:

- Data archive of needs assessments, response plans and summary of approaches across communities.
- Create a list of online tools and data products that are being used now or could be used.
- Create proposed workflows for new online tools that integrate decision-making, data products and desired products such as maps, reports and statistics.

Community research lead:

This person will contribute to and review a list of tools and digital data products and provide feedback highlighting how tools can be integrated into decision-making and other community-led activities.





5. Eyes on the Ocean:

Hydrographic observation and monitoring

Our Team:

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“ Empowering our community partners with technical knowledge and resources so that they can take a leading role in monitoring their environment is a key priority of ACTION. We will provide the training and resources needed to make this happen with the motivation to increase your technical capacity to collect and manage your own data and apply it to planning and decision-making. ”

— Kay McMonigal

Description of work:

Expand work such as Alaska Water Level Watch to contribute toward a network of hydrographic sensors and moorings across coastal communities and the Bering Sea. Design and implement questionnaires to identify local priorities in environmental monitoring and sensors and research activities to support this. Sensors and activities may include tide gauges, wave buoys, weather stations and bathymetric mapping.

What we can provide:

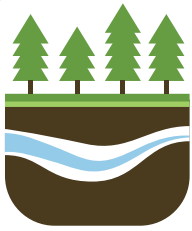
We will provide sensor loggers and near real-time data through online and mobile applications. For example, cellphone-accessible data on waves, air pressure and tides to support activities and safety. Ocean mooring data of waves and currents will be provided after mooring recovery. Ocean depth data from shipboard surveys will be provided after the research cruises. Other submerged loggers (e.g., conductivity, temperature) may also be deployed in areas that aren't conducive to mooring installations.

Community research lead:

They will be trained on how to use the instruments, find the data and provide information to community residents. During storms or other coastal hazard events, the CRL will collect photographs and be the eyes on the ground for the National Weather Service and other emergency management personnel. CRLs will also have the opportunity to participate on research cruises aboard the R/V *Sikuliaq*.



Left: Hohonu water level sensor mounted overland for inundation event alerts in Boston, MA



6. Eyes on the Ground & Below:

Permafrost assessment and monitoring (Gambell, Point Lay, Hooper Bay, Tuktoyaktuk)

Our Team:

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“ In the face of changing climates, our mission harnesses state-of-the-art technology and collaborative research to pioneer comprehensive permafrost monitoring. Our team’s efforts, spanning from ground-based observations to digital analysis, are dedicated to understanding and mitigating the impacts of permafrost dynamics on local and global scales. ”

— Benjamin M. Jones

Description of work:

We are launching a cutting-edge environmental monitoring project to track ground temperature, snow depth, water levels and thaw settlement near communities and infrastructure. Using drones and ground-based LiDAR, we will generate detailed maps and models of permafrost terrain and coastal environments. This initiative will also include creating permafrost maps for communities and analyzing environmental changes through historic and recent imagery. This streamlined, technology-driven approach aims to enhance understanding and responses to permafrost dynamics, supporting environmental change adaptation efforts with precise, actionable data.

What we can provide:

- **Permafrost data summarization:** We’re systematically gathering and organizing environmental sensor data related to permafrost, categorized into daily, monthly, seasonal and annual summaries.
- **Permafrost terrain mapping:** Utilizing high-resolution drone data, our project is at the forefront of developing permafrost maps and other products.
- **Community engagement via myThaw app:** Our monitoring efforts extend to community engagement through the myThaw app, which benefits from data collected along each community’s monitoring transect. This initiative aims to empower communities with real-time permafrost data, enhancing local decision-making and adaptation measures.
- **Decadal permafrost change detection:** Focused on long-term observation, we analyze decadal shifts in permafrost terrain near communities to inform and improve local planning and infrastructure development.
- **Academic contributions:** Committed to advancing permafrost science, we target the publication of one or two peer-reviewed journal articles annually contributing valuable insights to the global scientific community and stakeholders.

This focused approach underscores our commitment to advancing permafrost science through comprehensive monitoring, community-based engagement and scholarly communication, aiming to mitigate risks and enhance resilience in permafrost-affected landscapes.

Community research lead:

This person will contribute to and review a list of tools and digital data products and provide feedback highlighting how tools can be integrated into decision-making and other community-led activities.



7. Eyes on the Ice:

Hydrographic observation and monitoring

Our Team:

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“Facing receding Arctic sea ice cover, coastal communities are seeing drastic change: thinner, weaker ice makes for a less stable ice. What used to be an advantage for hunting is slowly transformed into a more dangerous platform and less resistant anti-erosion embankment. Our collaborative mission is to remember historical changes and monitor current evolution. Through dedicated data collections, observations and inter-community exchange our effort aims to understand concerns and hazards in a changing Arctic and carve a path for adaptation..”

— Marc Oggier

Description of work:

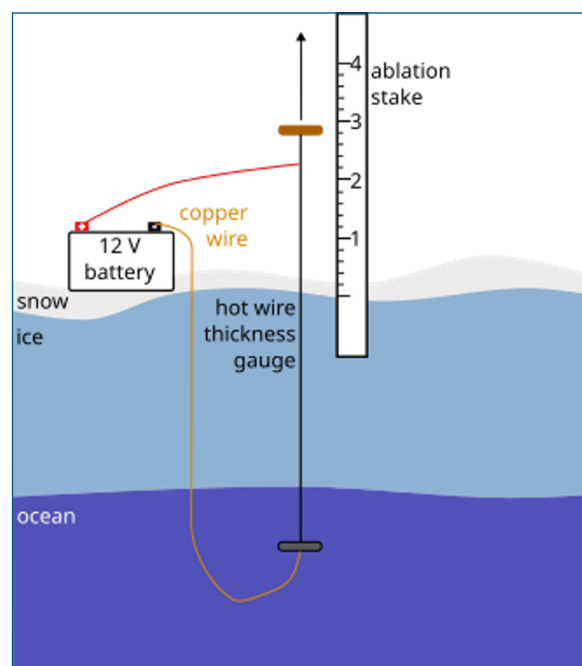
Expand ongoing work with entities such as Alaska Arctic Observatory and Knowledge Hub or Local Environmental Observer to understand concerns or hazards related to changes in sea ice cover and develop an observing network of local snow and ice experts.

What we can provide:

We will provide a time series of coastal ice presence and sea ice thickness evolution. Observation will contribute to the SIKU/Alaska Arctic Observatory and Knowledge Hub and Indigenous Sentinel Network app and added to a database curated by the Exchange for Local Observations and Knowledge of the Arctic (ELOKA) program.

Community research lead:

The community research lead will observe and monitor sea ice dynamics. Assessment and monitoring data could be linked into the Indigenous Sentinels Network (ISN) or ELOKA phone apps. The CRL could establish sea ice monitoring stations to monitor snow and ice thickness using a hot-wire system and ablation stake. The CRL will be shown how to build a hot-wire mass balance site.



Left: Figure 1. A hot-wire system consists of a 12-volt battery, metallic wire gauge and copper wire to close the electric loop. When the circuit is closed, the metallic wire heats up. The melting of the ice sets the wire free, allowing the handle to be pulled. When the weight touches the ice bottom, the ice thickness can be measured on the ablation stake.