Science, decision-support, and capacity building for climate resilience in Alaska

ACCAP ANNUAL REPORT
JUNE 1, 2017 – MAY 31, 2018

This performance period covers year 2 of Award NA16OAR4310162.

An Utqiagvik whaling team during a skin boat race. Photo by Rob Wilder (PolarTREC 2007), Courtesy of ARCUS.
Climate change is being felt acutely in Alaska and the Arctic. It is already altering seasons, landscapes and life in the North. These changes are impacting the safety and wellbeing of Alaska’s people, wildlife, and landscapes. ACCAP, one of 11 NOAA funded Regional Integrated Sciences and Assessment (RISA) programs, was established in 2006. We conduct interdisciplinary and regionally relevant research to inform resource management, planning and public policy, and to build the Alaskan’s capacity to prepare for and adapt to climate change. We work at the boundary between university research and decision makers. We strive to make complex climate science usable and applicable in a decision context and to facilitate the science being informed and driven by stakeholder needs and questions. We build downscaling models as well as develop, test, and evaluate research products and tools.

**ACCAP stakeholders include:**
- Scientists and engineers
- State and local planners, policy-makers and governments
- Transportation, natural resource and land management agencies
- Industry
- Native non-profit organizations and Alaska Native tribes
- Non-governmental organizations
- Anyone whose decision-making is influenced by climate-related events
ACCAP’s Team

**ACCAP BY THE NUMBERS**

- **7** Workshops facilitated
- **22** Projects
- **35** Webinars (3 series) with participation of 1000+
- **40+** Public and academic presentations
- **840+** Direct mentions of ACCAP research & researchers by media
- **$1.5 M** $1,508,632 in leveraged funds

**Team members**

- **Co-Directors:** Sarah F. Trainor and John Walsh
- **Co-I:** Nathan Kettle
- **Coastal Community Resilience Specialist:** Davin Holen
- **Post-Doctoral Fellows:** Brian Brettschnieder, Melanie Colavito, Norman Shippee, Casey Brown, Soumik Basu
- **Graduate Students:** Rick Lader, Dina Abdel-Fattah, Stefan Tangen, Kristin Timm
- **Intern:** Danielle Meeker
- **Staff:** Tina Buxbaum (Program Manager), Alison York, Carolyn Rosner, Lindsey Heaney
- **Key Partner:** Bureau of Indian Affairs (BIA) Climate Tribal Liaison: Malinda Chase, National Weather Service: Rick Thoman

**ACCAP steering committee**

**Ex officio members**

- **Paula Cullenberg,** Director, Alaska Sea Grant (Retired Spring 2018)
- **Carven Scott,** Director, Alaska Region, National Weather Service Alaska Region
- **Stephen Gray,** Director, DOI Alaska Climate Science Center
- **Amy Holman,** Coordinator, NOAA Regional Collaboration Team, Alaska Region
- **Molly McCammon,** Director, Alaska Ocean Observing System
- **James Partain,** Director, NOAA Regional Climate Services, Alaska Region (Retired Fall 2017)

**Members-at-large**

- **Lawson Brigham,** Professor of Geography & Arctic Policy, UAF
- **Ralph Townsend,** Director, Institute of Social and Economic Research, University of Alaska Anchorage
- **Vera Metcalf,** Director, Alaska Eskimo Walrus Commission, Kawerak Inc.
- **Cheryl Rosa,** Deputy Director, U.S. Arctic Research Commission
- **Aimee Devaris,** Director, USGS, Alaska Region
- **Kathy Jacobs,** Director, Center for Climate Adaptation Science and Solutions, University of Arizona

**Workshops & training participation:**

- **3** at an international level
- **9** at a national level
- **18** in Alaska
New areas of focus and partnership

National Weather Service
Improving NWS forecasts for rural Alaska communities

Continuing our partnership with the National Weather Service (NWS), ACCAP is working on two projects. The first assess stakeholder needs for weather and climate information and decision-support tools. The goals and objectives of this project are to:

1. Understand what information is important in a forecast for making decisions regarding community response and coastal inundation, including communication of forecast confidence.

2. Document how residents use local knowledge of weather, and how this is integrated into their understanding of weather forecasts.

3. Define a process in collaboration with the NWS for developing improvements in meeting stakeholder needs.

4. Test the improvements with a small sample of interested stakeholders in the target region.

Coastal Resilience Specialist Holen and the NWS Fairbanks and Anchorage regional offices are collaborating to improve daily forecasts for Western Alaska. Holen and NWS colleagues held workshops in Nome and Dillingham to ask residents and public safety and infrastructure management decision makers about their needs for daily weather forecasting. Results included the need for better methods of communicating information such as wind speed, wave height, wind direction, snow depth, and other factors that may influence daily decisions. Tools that are especially useful for local residents were also identified such as social media regionally specific pages for providing critical daily weather information and warnings. Workshops were followed up with individual interviews with key decision makers in Dillingham and Nome. A report is due out in July 2018.

Dept. of Homeland Security
Sea ice and weather modeling data use in search and rescue operations in the Arctic: a case study in Utqiagvik, Alaska

This project in partnership with the Department of Homeland Security (DHS) funded Arctic Domain Awareness Center (ADAC) assessed a July 2017 marine search and rescue (SAR) operation in Utqiagvik (Barrow), Alaska to understand challenges and lessons learned regarding information use in the Arctic. Findings suggest there are several potentially relevant tools and knowledge sources to support SAR in the Arctic (e.g., International Arctic Buoy Program, High-resolution ice-ocean modeling and Assimilation System, Windy.com, traditional and local knowledge, ice tracking drifters mapping tools, USCG SAROPS). Several challenges to information use were identified. First, many potentially relevant tools were not known to operators. Second, several information sources were not specifically designed for SAR and required pre- or post-processing analysis to be adapted for SAR application. Third, most data resources are dependent on internet connections which are limited in the Arctic. These findings suggest that SAR efforts in the Arctic may be improved by further understanding decision contexts, identifying potentially relevant tools and resources, and understanding how they may be adapted to decision maker needs.

The beach in Utqiagvik (Barrow), Alaska. Photo courtesy of the Arctic Domain Awareness Center (ADAC).
**US Navy**  
*Sea ice support for ICEX 2018*

ACCAP (Brettschneider, Basu and Walsh) was involved in ICEX2018. ICEX is a five-week biennial exercise conducted by the US Navy that allows the Navy to assess operational readiness in the Arctic, increase experience there, advance understanding of the Arctic environment and continue to develop relationships with other services, allies and partner organizations. Postdoc Brettschieder’s analog forecasting technique was used in two ways, first for daily forecasts and second for historical break up match for when sea ice would deteriorate to a point where the camp was no longer usable. His technique was used to prepare daily forecasts by matching sea level pressure initialization and 5-day forecast with historical sea level pressure fields using the NCEP/NCAR R1 Reanalysis data set. In addition, Basu provided climatological information on storms and winds during the floe selection phase, while Walsh (with IARC scientist Uma Bhatt) provided daily summaries of weather conditions and model forecasts that were transmitted to the ICEX camp.

**Building capacity**  
*Actionable climate science in Alaska*

Recent decades have produced significant advancements in climate science, but it can be challenging to apply climate science to local and regional scale resource management, adaptation planning, and decision-making. This has created usability “gap” between climate science and decision-making processes. Numerous assumptions have been made about how best to bridge this gap, including knowledge co-production, sustainability science, translational ecology, and other boundary spanning efforts.

To date, many of the people involved in these processes learn how to do them through first-hand experience. However, in order to expedite the adoption of these approaches, many people have called for more training. Numerous organizations are also independently hosting efforts to build capacity in actionable climate science. ACCAP undertook a study of these efforts with the goal to develop a better understanding of existing training activities in the co-production of climate and conservation science, and to specifically understand who these efforts are reaching, what they are teaching, and how the training programs are conceived.

The study was started in June 2017 and consists of two parts. First, a systematic web search was conducted to identify existing training activities. Using a series of key words and a snowball sampling technique, 42 training activities were identified in the U.S. (28 In-person, 7 Fellowships, 3 Transdisciplinary Conferences, and 3 Customized Training). Materials associated with each activity, such as syllabi, reports, webpages, and other documents were downloaded and analyzed with an inductive coding process. As themes emerged, these were cross-referenced to existing literature. The preliminary results show that approximately half of the trainings focus on practitioners (natural resources, tribal) and half focus on scientists (graduate students, early career scientists, and later career scientists), with about 20% including both groups of people. Participants were most often taught about climate change and local climate impacts. They were taught communication, facilitation, and occasionally more technical skills (i.e. accessing data, GIS). The combined trainings often focused on relationship building and networking.

**Program impacts & project evaluation**

During this period ACCAP has begun scoping the possibility and functionality of hiring an external evaluator to conduct a programmatic evaluation of ACCAP as a whole. Through several internal conversations we have determined that an external evaluator is best suited to look at the ACCAP program in a systematic and subjective manner. Additionally, we have realized we would need to build internal capacity in order to conduct the evaluation internally and have concluded that an external evaluator would be the most efficient path to choose. We hope to have more to report about a full programmatic ACCAP evaluation in subsequent annual reports.

Beyond evaluating ACCAP as a program, we have expanded our ability to evaluate other groups and efforts to build capacity and ability of decision-makers to respond and adapt to climate change. We have several projects either directly working with groups to evaluate specific efforts or to assess needs and an additional project to evaluate a select set of past trainings to better understand how to train people in the process of co-production.
Following the content analysis, several trainers from the identified organizations and programs were invited to participate in an in-depth interview about their training activities and their role in shaping them. Interviews (40-60 minutes) with 11 trainers or program managers were conducted in April through May 2018. The analyses of the interviews are still underway, but are likely to add valuable context to the results of the content analysis.

This study was broadly motivated by our interest in hosting a training and building greater capacity for actionable climate science in Alaska. It will likely guide future practical efforts to achieve these goals. However, the results are likely to be broadly applicable to a range of organizations and programs. To that end, the results will also be compiled in a white paper and peer-reviewed publication during the summer of 2018. This study will build on the work of several recent studies that aim to uncover the knowledge, skills, and abilities needed for knowledge co-production in climate and conservation science and how knowledge and experience is deployed in these efforts.

**NWS needs assessment**

*NWS Alaska Region, climate service providers needs assessment*

Arctic-focused climate training is not currently available in the Alaska Region of the National Weather Service (NWS) to support decision support services. The goal of this effort is to identify recommendations for user engagement in the Arctic region. In partnership with the Alaska Region NWS, this project surveyed climate services providers within the Alaska Region NWS to better understand the training they desire, what tools can be improved, and their desire to partner with Alaska stakeholders to develop more usable climate science. Findings from 11 completed surveys (52% response rate) identified specific data needed to improve analysis and prediction of weather, climate, and environmental related phenomena, recommendations to improve existing tools for analysis of historical data and prediction, constraints to partnering with stakeholders, and a high level of interest in partnering with stakeholder to provide more usable science. xmACIS was the most frequently used tool to analyze historical data and the tool cited as in need of the most improvements (need for easier navigation, more simple naming conventions, query capability, additional variables needed). Developing a 1-stop science shop was the most frequently identified need (71%) to improve data access in Alaska.

**Tribal community support**

*Supporting Alaska tribal communities responding to climate change*

ACCAP continues to strengthen and expand our connections in support of tribal climate adaptation efforts and planning in Alaska. Our efforts during this reporting period are multifaceted and diverse. New activities include increased networking among researchers across different departments at the University of Alaska Fairbanks (UAF), including the Tribal Management Program and the College of Rural and Community Development. Several meetings were held to discuss potential synergy and future collaboration and groundwork has been laid for a fruitful relationship in the future.

ACCAP, along with the Alaska Climate Adaptation Science Center BIA Resilience Liaison, has begun an evaluation of the Institute for Tribal Environmental Professionals (ITEP)/Alaska Native Tribal Health Consortium (ANTHC) tribal climate adaptation planning trainings that have been held in Alaska. The evaluation was co-developed between ACCAP researchers and ANTHC and ITEP organizers. We have
developed a questionnaire to distribute to training participants in Alaska to further understand the status of planning efforts, how to best support participants following the training, the effectiveness of past trainings, and information and resources needed to complete climate adaptation plans. Data collection will begin in June 2018 and reports will be shared with the Bureau of Indian Affairs Tribal Resilience Program.

In addition to the evaluation of adaptation trainings, Coastal Resilience specialist Davin Holen is working collaboratively with the ANTHC on several fronts including working with the Environmental Threatened Communities program to find funding for communities to draft resilience and adaptation plans, or to identify funding that could provide tools for communities to draft these plans themselves. In addition, Holen has worked with the Environmental Health section of ANTHC to assist in drafting an adaptation plan for the community of Port Heiden. This plan identifies public health needs, but also ways to improve community well-being and resilience through increased infrastructure to build a broader economic base.

During this period ACCAP also furthered our collaboration with the NSF funded project Community Research Partnerships (CRP) conducted by the Community Partnerships for Self-reliance (CPS) group located at UAF. Post-doctoral fellow Brown is working in partnership with CPS staff, community members, and researchers to evaluate both the outcomes of the project but more importantly the process of co-production throughout the community-university partnerships. An all-hands workshop was held in May as part of this project and further data collection and analysis is underway.

ACCAP is also leveraging funds from the US Department of Agriculture (USDA) through both the USDA NW Climate Hub and an additional grant from the NIFA program, which aims at building climate literacy and adaptation capacity state-wide. ACCAP (Brown) is revisiting a previous assessment of documented climate information and research needs in rural Alaska conducted through 2014 and updating this effort with newly expressed needs. This will be used in conjunction with the survey of climate adaptation planning efforts in rural communities done by intern Danielle Meeker in 2017 to further assist rural communities in their climate adaptation planning needs. Meeker has continued her career and engagement with climate science in Alaska by being named an Alaska Sea Grant Fellow and taking a position on Alaska Lt. Governor Mallot’s Climate Action for Alaska Leadership Team.

### Extreme events

**Projected changes in Alaska**

The frequency and intensity of certain extreme weather events in Alaska are increasing, largely due to climate warming from greenhouse gas emissions. Future projections indicate that these trends will continue, potentially leading to billions of dollars in climate-related damages this century. These relate to increases in extreme precipitation, severe wildfire, altered ocean chemistry, land subsidence from permafrost thaw, and coastal erosion. To predict how these hazards will change, it is necessary to accurately assess how the distributions of temperature and precipitation are anticipated to shift. This is accomplished using a combination of observations, and downscaled reanalysis and climate model simulations. The analysis is arranged into 30-year periods: one historical (1981-2010) and three projected (2011-2040, 2041-2070, 2071-2100), with the latter from the RCP8.5 emissions scenario.

Based on our downscaling of climate model simulations, unprecedented heat and precipitation are expected to occur when compared to the historical period. Maximum 1-day and consecutive 5-day precipitation amounts are expected to increase by 53% and
50%, respectively, and the number of summer days per year (Tmax > 25°C) increases from a statewide average of 1.5 from 1981–2010 to 29.7 for 2071–2100. Major alterations to the landscape of Alaska are anticipated due to a decreasing frequency of freezing temperatures. Growing season length extends by 48–87 days by 2071–2100 with the largest changes in northern Alaska. In contrast, projections indicate a reduced snow season length statewide and many locations in southwest Alaska no longer have continuous winter snow cover. Changes to these metrics indicate that a climate-warming signal emerges from the historical inter-annual variability, leading to future distributions entirely outside of previously observed.

The largest projected changes tend to occur during the mid (2041–2070) and late-century (2071–2100) periods, coinciding with when the forcing scenarios (RCPs) diverge the most. This indicates that planning decisions that are currently being made have the capacity to effect substantial future change. Furthermore, many adverse impacts to human health correlate with extreme events and hazards. As the frequency of severe wildfire, flooding, and habitat loss are projected to increase due to climate warming, so too are the dangerous health effects associated with poor air quality, accidents, and mental wellbeing. Alaska stands at the forefront of impacts due to changing climate extremes; these projections can serve as guidance for informed decision-making that will help shape the state’s future.

Alaska climate adapters
Update existing review of stakeholder information needs documents

Rural indigenous communities in Alaska are on the front lines of climate change impacts and adaptation, with direct and immediate impacts on infrastructure, water supplies, health, safety and the ecosystems that they rely on for food and cultural identity. There are over 30 communities that face imminent threats from flooding and erosion (US GAO 2009). While spontaneous adaptations are occurring, especially in the realm of subsistence food harvest, these communities and others recognize the need for climate adaptation planning on both community and regional scales (Huntington et al. 2015). While guidebooks and adaptation planning trainings exist for Tribal communities several communities have reached out to the ACCAP for assistance in creating an ongoing climate adaptation planning training that can meet the specific needs of indigenous and Tribal communities in Alaska.

Previous work analyzing needs document found that stakeholders were wanting more transparency, better collaboration with indigenous communities, and interdisciplinary research that can directly meet community needs (Knapp & Trainor 2013, 2015). Stakeholders suggested changing practices including maintaining accessible data sharing archives, networks for knowledge sharing, and long-term science-community partnerships at a regional scale. Data collection on this project ended in March 2013. This review expanded upon this effort to include updated sources of information (2013–2018) and
an analysis that synthesized what stakeholders are saying about what climate adaptation research is needed in their communities.

Updated results show that stakeholders in Alaska have identified several key research needs including more information on subsistence species, human safety, infrastructure, and sea ice conditions. In addition, stakeholders would like to see new monitoring efforts with an emphasis on better coordination and inclusion of local knowledge. Stakeholders would like to see more decision-making tools resulting from climate change projects. Our findings matched several key results that were identified by Knapp and Trainor 2013 & 2015. A key match included the need for increased collaboration and the integration of local knowledge in climate change research. However, we found some difference between the 2013 and 2018 results. Knapp

and Trainor found that ‘better understanding of uncertainty’ was the most important theme related to research outcomes. We found that uncertainty was the least important theme and that the production of decision-making tools was a more important research outcome. This could suggest that contemporary Alaskan climate change research has been more effective communicating uncertainty to the public. Or, that stakeholders have become more concerned about how climate change research can be used in planning efforts. Future researchers should make an effort to apply key results towards products that could aid regional decision-making and planning efforts.

Complimenting and informing the work above was an additional project conducted by ACCAP. While some efforts have been made to catalog existing climate adaptation planning efforts in Alaska, they were are incomplete and ACCAP was regularly learning of new climate adaptation planning efforts. One of the challenges of this type of assessment is that climate adaptation planning in rural indigenous communities often occurs in conjunction with other kinds of planning such as hazard mitigation planning and flood risk mitigation planning. Through our existing network and the new contacts made in creating a project steering committee we (intern Meeker) assessed existing climate adaptation planning, including mainstreaming adaptation measures into other planning efforts. A database of findings was created as well as a written report of findings. Key features of analysis included: location, stage of planning effort (initial, in progress, plan complete, and implementation underway), entities involved, degree of stakeholder involvement, and inclusion of evaluation component. You can access the report here (https://accap.uaf.edu/Tribal_synthesis_report).
ICEX is a five-week biennial exercise conducted by the US Navy that allows the Navy to assess operational readiness in the Arctic, increase experience there, advance understanding of the Arctic environment and continue to develop relationships with other services, allies and partner organizations. ACCAP was involved in ICEX2018. Brettschieder’s analog forecasting technique was used in two ways, first for daily forecasts and second for historical break up match for when sea ice would deteriorate to a point where the camp was no longer usable. His technique was used to prepare daily forecasts by matching sea level pressure initialization and 5-day forecast with historical sea level pressure fields using the NCEP/NCAR R1 Reanalysis data set.

This technique was used to generate a 5-day forecast for the ICEX camp location. The program Brettschneider wrote ingested the 12 UTC data and systematically evaluated the dynamic model initial conditions (hour-0) against the 12 UTC conditions for each day in the R1 reanalysis period (since 1948). The best analog matches from previous years during each season were determined and a point forecast was generated using the best analog matches. The output was loaded to a publicly available webpage for ICEX members to view or to generate a new forecast using different parameters.

Additionally, a tabular list (Historical Breakup Match) was generated during each forecast run showing the correlation score and percentile match of each day in the numerical guidance versus the known breakup dates in 2014 and 2016 and the dates leading up to the known breakup events.

The daily analog forecast allowed for near real-time ability to compare numerical guidance with historical analogs, the ability to generate user-friendly output for multiple uses on the fly, and ability to contextualize the pattern evolution as shown in the models, with historical pattern evolution. This product really provided a “reality check” for the forecast team when assessing raw numerical output. Analogs-based forecasting captured the evolution of the sea level pressure pattern in the Beaufort Sea nearly every day of the ICEX project. Using monthly data, analogs outperform numerical models north of 70°N quite consistently. One important thing to note is that the size and shape of the selection domain is critical for identifying analogs that are useful for generating a point forecast. A large domain is ideal for finding analogs that will generate good forecasts several days out – but sacrifices short-term forecast skill. The opposite is also true. For the ICEX project period, the analogs-based forecast did not “beat” the numerical guidance at forecast ranges of one to several days. However, at Days 3, 4, and 5, analogs nearly outperformed the numerical guidance. This is an extremely significant finding. If an analogs approach can outperform numerical guidance, the applications are nearly limitless.

For the second product (the Historical Breakup Match), most of the ICEX staff participated in earlier ICEX programs and have an “institutional knowledge” of the previous breakup events in 2014 and 2016. The historical breakup match tool was particularly useful to the ICEX team for relating their institutional knowledge with the evolution of the numerical guidance. Anecdotal reports from the ICEX team indicate the people at Camp Skate
(ICEX Camp) found it to be a popular product that filled a niche need and was widely circulated amongst the team. A product that is used and appreciated by the team is a key selling point.

Daily Forecast Next Steps: ACCAP plans to a further exploration of match domain size/shape, as well as other statistical modifications that should improve the verification score of the analogs project. We would also like to work with the ICEX programming team to automate the forecast process so that it automatically runs every 12 or 24 hours.

Historical Breakup Match Next Steps: We intend to work with the ICEX team to identify all dates where ice integrity deteriorated for input into the database. We will then generate map-based or chart-based graphical output to supplement the existing tabular output.

2. Climate adaptation planning

Recommendations for partnering with rural indigenous communities in NW Alaska on the front-line of climate change

Climate-related environmental change in Alaska contributes to several environmental hazards including floods, storm surge, and erosion, which impact food and water security, transportation, public health, and infrastructure. Alaska Natives have spontaneously adapted to climate change and are also increasingly interested in building community resilience via formal planning. This need is especially paramount in Northwest Alaska, where communities are faced with increasing vulnerabilities to storm surge and coastal erosion. We interviewed 15 tribal members in Nome and Shaktoolik and analyzed climate adaptation guidebooks and reports to learn about the challenges facing rural indigenous communities and identify lessons for supporting tribal climate adaptation planning.

Identified challenges to climate adaptation include lack of information, funding, leadership, coordination, institutional rules, and uncertainty. Indigenous peoples also face several legal and policy obstacles, high employee turnover, limited technical and human capacity, and in some cases, limited trust of external partners. Competing priorities or concerns including alcohol abuse, affordable and safe housing, and suicide prevention, can overshadow climate change initiatives. Communities can be hesitant to work with outside consultants because of a legacy of limited understanding of local issues, priorities, and ways of knowing. A multi-level governance structure and jurisdictional boundaries make planning and implementing actions challenging. Finally, damaging colonial legacies that changed societal structures, economies, and excluded local experts from decision-making exacerbates climate-related vulnerabilities.

Based on our experiences and interviews in Nome and Shaktoolik and a literature we propose the following recommendation in supporting tribal climate adaptation planning in Alaska: build trusted relationships, conduct preliminary scoping, recognize and respect tribal sovereignty, engage communities in the design and implementation, respect traditional knowledge along with climate science, focus on outcomes, identify steps required for implementation, integrate efforts and support capacity building, support formal and informal network building.

Figure 3: Five keys to supporting climate adaptation in Alaska.
PhD student Dina Abdel-Fattah is working on ACCAP Co-I Kettle’s Arctic Domain Awareness Center (ADAC) funded project, developing sea ice and weather forecasting tools to improve situational awareness and crisis response in the Arctic. The project seeks to create a prototype sea ice and weather forecasting module for hazard planning in Utqiaġvik. Abdel-Fattah investigated the potential use and application of radar, satellite, and other tracking data for sea ice and weather conditions in maritime-related Search and Research (SAR) operations in the Arctic. Specifically, her research looked into how sea ice and weather modeling data can help support emergency responders by looking at a recent SAR event for a missing small vessel due into Utqiaġvik in July 2017.

She investigated data generated during the SAR event via an archival analysis of email communications about the SAR as well as the U.S. Coast Guard event case file. Interviews (n=17) with relevant stakeholders were also conducted over the course of Fall 2017 and Spring 2018 to understand how this SAR event unfolded and SAR data needs more broadly. Data needs in this study were defined as those related to supporting an emergency response.

This research holds implications for future use and uptake of modeling data in local SAR operations in Utqiaġvik specifically and potentially across Arctic Alaska. Given that local SAR operators are predominantly the first line of response to maritime emergencies in the North Slope, the ability to share and provide a set of resources to support SAR operators can be beneficial, particularly in a rapidly changing Arctic. She recently presented her research in Washington DC for the U.S. Department of Homeland Security’s Centers of Excellence Science and Technology Summit.
webinars on topics ranging from river ice breakup to knowledge coproduction. Recordings are available at: http://accap.uaf.edu/webinars.

**NWS Alaska climate outlook briefing**

In the fourth year of ACCAP’s collaborative webinar series with the NWS, this monthly series delivers climate outlook briefings on recent climate conditions around Alaska and predictions for the next month and season. Briefings are well attended with 30-40 participants (online and in-person)/webinar. This collaboration is fostering closer connections between NWS, the UAF research community and the broader climate and weather community including the National Park Service and US Army.

**Virtual Alaska weather symposium webinar series**

The Virtual Alaska Weather Symposium (VAWS) webinar series is a joint venture with the Geographic Information Network for Alaska (GINA), ACCAP, and the National Weather Service. This series brings cutting edge satellite based presentations to a broad audience while avoiding the costs (both time and money) of an in-person symposium. In this reporting period, 12 successful webinars (30-50 participants/webinar) were held with other presentations identified for the remainder of 2018.

**Decision support tools**

**Climate and weather highlights tool**

Designed in collaboration with the NWS, the Climate and Weather Highlights Tool provides information about notable historical weather and climate events. Data reported are preliminary observations and are reported in daily, multi-day, monthly, and longer time scales. Users can select date ranges, filter results, click on individual events for further information, and zoom in/out of the map. Events are updated in near real-time. (https://accap.uaf.edu/?q=tools/climate_highlights).

**Historical sea ice atlas**

In collaboration with the National Snow and Ice Data Center, we compiled a pan-Arctic sea ice dataset spanning 1850-present. The dataset is a gridded synthesis of information from approximately 15 different sources of sea ice information, ranging from whaling ship reports to more recent passive microwave satellite data. The monthly archive lists sources as well as areas of estimation by interpolation or analog methods. The dataset extends ACCAP’s Historical Sea Ice Atlas for Alaska to an Arctic-wide scale. In addition to the work on the pan-Arctic database, ACCAP, with support from AOOS, has continued to update the Historical Sea Ice Atlas for Alaska. The most recent update extended to December 31, 2017 and is available at http://seaiceatlas.snap.uaf.edu/. The web interface for the pan-Arctic Atlas is under development.

**Cook Inlet response tool - harvest assessment**

The Cook Inlet Response Tool is a decision support tool available on the AOOS Ocean Data Portal for responding to potential technological disasters in the Cook Inlet region. The layer Wild Resource Harvests and Use by Cook Inlet Communities has been added to give decision makers an idea of wild resource harvesting activities occurring in Cook Inlet. The layer can be sorted by community (5 communities are included in the data layer), how area residents access resources, method of harvest, species category, and month. This project is a test case and efforts are underway to expand this to the Bering Sea Region for 26 additional communities as there is increasing ship traffic and exploratory activity in this region. Holen has been the ACCAP connection on this effort.

**Students and post docs**

**Matriculation and recruitment**

Rick Lader successfully defended his PhD thesis: Emergent impacts of rapidly changing climate extremes in Alaska.

Stefan Tangen successfully defended his Master of Science thesis: Multi-actor perceptions of success: planning for climate change in rural Alaska.

Danielle Meeker successfully completed her internship and was awarded an Alaska Sea Grant fellowship. She is currently assigned to Alaska Lt. Governor Byron Mallot and is working on his Climate Action Leadership Team helping draft a climate action policy for Alaska.

Josie Sam, former post-doctoral fellow, accepted a position as research scientist at the International Arctic Research Center (IARC) at the University of Alaska Fairbanks.
There is increasing interest among rural coastal communities to engage in climate adaptation planning to reduce address climate-related risks. Interviews with tribal members in Nome and Shaktoolik (n=15) and an analysis of climate adaptation guidebooks/reports identified several challenges facing rural indigenous communities and lessons for supporting climate adaptation planning. In addition to lack of information, funding, leadership, coordination, institutional rules, and uncertainty, indigenous peoples also face several legal and policy obstacles, high employee turnover, limited technical and human capacity, and complex governance.

To support tribal climate adaptation planning in Alaska, we recommend others build trusted relationships, conduct scoping, recognize and respect tribal sovereignty, engage communities in the design and implementation of projects, respect traditional knowledge, focus on outcomes, support capacity building, and support formal and informal network building.

Climate change is expected to alter the frequencies and intensities of at least some types of extreme events. This study uses regional dynamical downscaling with the Weather Research and Forecasting (WRF) Model to investigate projected twenty-first-century changes of daily maximum temperature, minimum temperature, and precipitation over Alaska. Results indicate an asymmetric warming of climate extremes; namely, cold extremes rise fastest, and the greatest changes occur in winter. Maximum 1- and 5-day precipitation amounts are projected to increase by 53% and 50%, which is larger than the corresponding increases for the contiguous United States. When compared with the historical period, the shifts in temperature and precipitation indicate unprecedented heat and rainfall across Alaska during this century.

Climate change is expected to alter the frequencies and intensities of at least some types of extreme events. This study uses regional dynamical downscaling with the Weather Research and Forecasting (WRF) Model to investigate projected twenty-first-century changes of daily maximum temperature, minimum temperature, and precipitation over Alaska. Results indicate an asymmetric warming of climate extremes; namely, cold extremes rise fastest, and the greatest changes occur in winter. Maximum 1- and 5-day precipitation amounts are projected to increase by 53% and 50%, which is larger than the corresponding increases for the contiguous United States. When compared with the historical period, the shifts in temperature and precipitation indicate unprecedented heat and rainfall across Alaska during this century.

The National Climate Assessment summarizes the impacts of climate change on the United States, now and in the future. The Alaska region includes the state of Alaska and its surrounding waters. Trainor was a contributing author on the Alaska Chapter for the 2018 National Climate Assessment.

The report synthesized tribal climate adaptation needs assessments, workshop reports, and adaptation plans in Alaska to document barriers to climate adaptation planning, understand the current level of support for climate adaptation planning, examine the extent that climate science and traditional knowledge are being used in tribal climate adaptation plans, and identify climate science needs related to climate adaptation planning among Alaska Native tribes.

The 2016 Alaska marine heat wave was unprecedented in terms of sea surface temperatures and ocean heat content, and CMIP5 data suggest human-induced climate change has greatly increased the risk of such anomalies.
Additional publications

**Peer reviewed**

**Articles**


**Non-peer reviewed**


Abdel-Fattah, D. 2018. *Applications of sea ice and weather modeling data in search and rescue operations in the Arctic: case study in Utqiaġvik, Alaska*. The Alaska Center for Climate Assessment and Policy (ACCAP) and Arctic Domain Awareness Center (ADAC) May 2018.

**Attachments/appendix**

- Alaska Climate Dispatch (2)