

Annual Report 2018



Directors' Message

2018 YEAR IN REVIEW

Climate impacts. Throughout Alaska, this year was marked by climate extremes and impacts. Coastal flooding at Utqiagvik in September 2017 resulted in more than \$10 million damage. Near record dry conditions in November 2017 initiated the onset of drought conditions in the southern Panhandle. The 2017-2018 winter Bering Sea ice extent was the lowest on record since 1850. Alaska tied its fifth warmest July on record, with Juneau having its warmest July and calendar month on record since 1941.

Gaining research momentum. In Year 1 of the AK CASC's new 5-year cooperative agreement, we launched five pilot projects with federal and state partners that are focused on producing actionable science that informs natural resource management in Alaska. These projects tackle several current challenges including changing wildfire dynamics, permafrost impacts to wildlife habitat, and glacier-driven flood events. Research activities on these pilot projects will continue throughout Year 2, and will be used to refine our science partnership model. Visit our website at casc.alaska.edu/research to learn more.

Sharing our science. Much of this year was dedicated to building our science communication and translation capacity. The AK CASC expanded its science communication team, and developed a 5-year plan that included input from a Communication Advisory Group comprised of stakeholders and research collaborators.

Research capacity. Looking ahead, as we focus on Year 2 and beyond the AK CASC will continue to invest in education and mentoring that links research and resource management in the context of climate impacts. In this issue you will meet one of our Fellows.

Please visit us online or contact us directly about our research, communication, and outreach efforts.

NORTHERN NOTES

PUBLICATIONS

AK CASC researchers published 38 peer-reviewed publications/reports during Year 1. See last page for some featured publications.

AK CASC WELCOMES NEW FACES

Molly Tankersley has joined the AK CASC communication team as Science Communication Specialist.

Christian Kienholz became a postdoctoral fellow on the Suicide Basin pilot project.

Rick Lader will be joining the streamflow modeling pilot project as a fellow in 2018.

AK CASC COMMUNICATIONS PLAN AVAILABLE
The AK CASC recently launched a five-year communications plan intended to guide AK CASC outreach activities, identify target audiences, and keep track of progress during our current five-year hosting agreement. The report can be viewed on the AK CASC website.

AK CASC PROGRAM COORDINATOR JOINS VOICES FOR SCIENCE

Program coordinator **Jane Wolken** was accepted into the inaugural American Geophysical Union Voices for Science Program in the Media/Public Communications Track. This program provides participants with access to science communication and outreach training as well as the support needed for outreach activities in their local community.

By Rope, Raft, and Air: A Season of Research on Glacier-Dammed Lakes

Rappel down rock cliffs, raft across glacial lakes, and traverse icy crevasses, all in the presence of a massive, ever-changing glacier – it's all part of the job for glaciologists monitoring glacial outburst floods (also known as jökulhlaups) in Alaska.

Suicide Basin, a dead ice branch off of the Mendenhall Glacier in Juneau, unleashed more than one billion cubic feet of water (the equivalent of over ten thousand olympic-sized swimming pools) into the highly populated valley below in July of 2018. Such outburst flood events have occurred almost every year since 2011, when the glacier-dammed lake first began forming during the summer months.

Glacier lake outburst floods, which occur when water dammed by a glacier suddenly releases and floods surrounding areas, happen across Alaska and in glacial landscapes around the world. Outburst floods threaten and destroy infrastructure, towns, and often catch communities off guard without monitoring systems in place. AK CASC scientists Eran Hood, Christian Kienholz, and Gabriel Wolken are collaborating with teams from the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) who have been monitoring Suicide Basin for several years. The goal is to better understand and predict outburst floods at Suicide Basin. "Combining resources and personnel allowed us to conduct essential measurements this season," said Kienholz, who visited the basin more than ten times, mostly with Jamie Pierce from the USGS.

Massive Calving

This summer, the evolution of filling and drainage at Suicide Basin took several unusual turns. The basin was filling at a steady rate through rainfall and snow and ice melt, when the rising water in the basin caused the connection between the Suicide Basin branch and the main glacier to break. Previously held down by the weight of the main glacier to which it was connected, the ice floated to the surface and caused the water levels in the basin to drop by 2.5 feet. According to Kienholz, who was coincidentally on site with other AK CASC and USGS researchers, "a section of ice one-fifth of a mile wide sprung upwards over 15 feet, and 60 feet into the basin." The impressive occurrence appeared to be the beginnings of a drainage event, prompting a flood warning for Mendenhall Valley below before close monitoring showed the ice dam was still intact. The basin continued to fill for several weeks after this event. Juneau residents watched and waited, unsure what the summer would bring.

While the water levels rose, the researchers continued to monitor the situation and conduct maintenance on their instruments. Doing so became increasingly complicated because of the growing lake size. During peak levels, the researchers had to raft across the water to reach their site – rather than rappelling down cliff faces as they had done earlier in the season.



▲ AK CASC Fellow Christian Kienholz collects measurements at Suicide Basin. Photo by Dina Abdel-Fattah.

Drainage Begins

In mid-July, water volumes in the basin approached volumes of the 2016 record-breaking flood event that caused extensive flooding in Juneau's most highly-populated neighborhood. Still short of the 2016 record level, the water started spilling over the top of the glacier dam, which had thinned considerably since 2016. It then ran along the edge of the glacier for several hundred feet before draining beneath the glacier.

The spillover lasted for nearly two days, and the glacier dam started to show signs of erosion. Kienholz, who did a flyover with Tom Mattice (Emergency Manager at the City and Borough of Juneau), described the scene as "spectacular." "Eventually, the water in the basin found an outlet near the bottom of the glacier dam and the lake drained through this outlet as it had in previous years," Kienholz elaborated.

The use of time lapse cameras and pressure gauges, along with the extensive aerial imagery the team collected at the basin, allowed the agencies involved to predict potential flood patterns and prepare local authorities for impacts. Flood warnings, evacuations and road closures were put in place along Mendenhall Lake and River with the advance notice given to authorities.

Partly due to the cool and dry weather, the 2018 flooding peaked below the 2016 record level (10.92 in 2018 vs 11.99 feet in 2016), but inundated nearby campgrounds, trails, homes, and roads. Fortunately, no major infrastructure damage or injury occurred. Standing on bridges and nearby vantage points, onlookers watched raging flood waters course through Mendenhall River, eroding river banks along the way. In one spectacular case, the flood waters cut through a large meander, which will have lasting effects on the river's course and nearby infrastructure.

The Aftermath

Following the drainage event, the researchers returned to the basin to conduct surveys and recover some of their instruments. "The water level dropped by 180 feet during drainage," Kienholz explained. The big calving event earlier in the season had produced many icebergs, some of which were stranded high up on the sides of the basin,

burying monitoring instruments under up to 60 feet of unstable ice. Some of this ice may still melt and collapse this season, so the researchers remain optimistic that the instruments will be recovered.

Using digital images and elevation models from drone surveys, the researchers are currently creating better estimates of the storage volume of the basin. These estimates will be instrumental in creating more accurate predictions of glacier outburst floods in the future, for Suicide Basin as well as other glacier-dammed lakes in Alaska. The researchers also plan to overlay jökulhlaup and rain-induced high flow events to assess potential flooding from a large, combined flood event. In a complementary effort, a graduate student from the University of Alaska



▲ USGS Glaciologist Jason Amundson prepares to raft across the basin to access instruments. Photo by Christian Kienholz.

Fairbanks, Dina Abdel-Fattah, has gathered information on the needs of stakeholders, city officials, and local residents. Her work will help improve tools and response efforts for future flood events.

Gabriel Wolken Awarded Avalanche Research Fellowship

AK CASC scientist Gabriel Wolken, who manages the Alaska Division of Geological & Geophysical Surveys Climate & Cryosphere Hazards Program, has been awarded an international research fellowship to study and map Alaska's snow avalanche hazards. The six-month fellowship beginning September 1 in Davos, Switzerland, promotes collaboration between visiting senior-level scientists and the Swiss Institute for Snow and Avalanche Research.

Snow avalanches are a clear threat to public safety, infrastructure and commerce in Alaska, and climate change is expected to increase Alaska's vulnerability.

"Baseline avalanche hazard information is missing in much of the state. As the climate continues to change, it becomes increasingly important for us to understand how and where snow avalanche hazards will change throughout the state," Wolken said.

"This fellowship and long-term collaboration with international scientists will lead to important advances in Alaska avalanche research, help the State of Alaska develop science-based adaptation and response strategies to avalanches, and improve community resilience in a



▲ Wolken logging snow stratigraphy, snow height and snow water equivalence in the Alaska Range.

changing climate," said Steve Masterman, director of the Division of Geological & Geophysical Surveys.

New Tool Offers Climate Change Information

A team in the AK CASC created a new web-based tool that allows communities in Alaska and western Canada to see how global climate change could affect their region. The tool transforms predictions from global climate models into more detailed information about local conditions.

With the help of the Scenarios Network for Alaska & Arctic Planning group, the climate research center's team looked at 30 global models and identified five that worked best for Alaska and the Arctic. They compared what the models said should have happened from 1958-2004 to actual historical data from that period.

"Since climate in Alaska varies considerably from year to year and decade to decade, we want to use the longest

record possible," explained co-author Jeremy Littell, an AK CASC scientist with the U.S. Geological Survey in Anchorage. "Averages for 50 or 100 years are more reliable than 10 or 20 years."

Based on this, the team created a community charts tool to help people see and interpret the data. The tool displays temperature and precipitation projections through 2100 under three scenarios for more than 4,000 communities in Alaska and western Canada. The tool can be customized as well. For instance, it allows users to ask questions like which winter months may transition to above-freezing temperatures.

To access the tool and others, visit the tools and data section at snap.uaf.edu.

NORTHERN NOTES

'ASK A CLIMATE SCIENTIST' FEATURE LAUNCHED

AK CASC has launched a new platform for helping people understand and apply Alaska climate projections in their work. The climate questions page on the AK CASC website, gives users the opportunity to ask questions about how information is produced and used in climate change research and adaptation planning. Users can either read the frequently asked questions or use the form to simply ask a climate scientist!

AK CASC SOCIAL MEDIA PRESENCE GROWING

In 2017, AK CASC established a Facebook and Twitter presence in order to provide essential scientific information to audiences interested in land, water, wildlife, and cultural resources in Alaska. This also includes any updates on staff/student activities, events, accomplishments, and career and academic opportunities that are relevant to AK CASC work. Since then, AK CASC has branched out to reach a new audience through Instagram to give followers a behind-the-scenes look at AK CASC work and science.

NAME CHANGE

In the fiscal year 2018 budget, the name of the Climate Science Centers (CSCs) was changed to the Climate Adaptation Science Centers (CASCs). Although we are now the Alaska Climate Adaptation Science Center our mission remains the same.

Looking Ahead: Historic Avalanche Study to Begin 2019

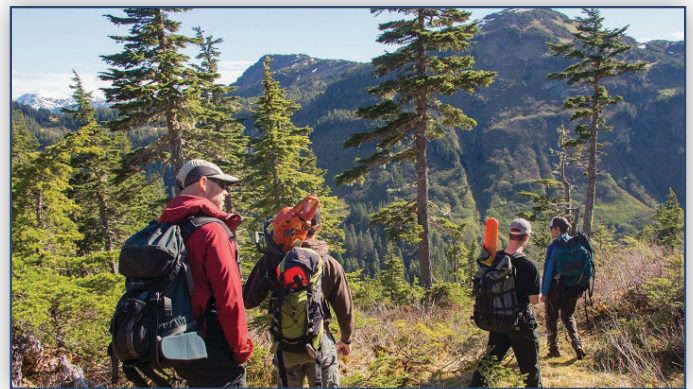
Come late May in southeast Alaska, AK CASC scientists Eran Hood and Gabriel Wolken have something unexpected on their minds: snow. Specifically, avalanches. Standing among snags and downed trees on a steep slope near Eaglecrest Ski Area in Juneau, the evidence of disturbance is obvious to any bystander.

To Hood and Wolken, this landscape could be a vast source of information about the avalanche events that have occurred here over the past five, ten, or even 100 years. They are scouting field sites for an upcoming historic avalanche reconstruction project that will use dendrochronology (the study of tree rings) as a method for dating large magnitude avalanche events.

“When you’ve looked at thousands of tree rings like they have, you can read them like a book,” Hood says of Erich Peitzsch and Danny Stahle, two researchers from the U.S. Geological Survey (USGS) Northern Rocky Mountain Science Center that have flown in to collaborate on the project.

The story of past avalanches is preserved in thick cross sections of wood harvested from downed and dead trees in the avalanche path. Impacts from past avalanches leave scars on the bark and irregular rings in the core of the wood. By comparing records from multiple trees located in a particular path, and comparing these dates with climate data, the team can get a better sense of the climatic influences that are associated with large magnitude avalanche events.

Ultimately, the tree ring records collected in this project could do more than describe the avalanche history of the four main study



▲ AK CASC and USGS researchers scout for field sites at Eaglecrest Ski Area.

sites for the project; they may provide insight into future avalanche risk for infrastructure in the Juneau region.

In partnership with the USGS Northern Rocky Mountain Science Center, the project will officially begin in Summer 2019 with four expected study sites around Juneau.

Meet Fellow Christian Kienholz

Growing up in Switzerland, Christian Kienholz acquired an interest in the cryosphere early on, spending time outdoors witnessing swift change in mountainous landscapes. Geohazards such as avalanches and landslides have been a key concern in many regions in which he lived, naturally sparking his interest in the field. Like in Switzerland, the cryosphere and geohazards play an important role in Alaska. Eager to experience new terrain while pursuing his main interests, Kienholz applied as an exchange student at UAF.



“Studying at UAF was unique. For example, many professors are also pilots, and have their planes parked a 15 minute drive from the university. We would sometimes hop into the plane in the morning, fly out to a remote research site at a glacier, and be back in time for dinner,” said Kienholz. Two years after his exchange and a job in Switzerland’s geohazard industry, Kienholz returned to the Geophysical Institute at UAF, where he pursued a master’s degree and ultimately a PhD in Snow, Ice and Permafrost Geophysics. For his PhD, he studied a surge-type glacier in the Alaska Range, which allowed him to combine his interests in geohazards and glaciology.

Following his PhD, Kienholz relocated to UAS to study glacier-ocean interactions. It was then that Kienholz became involved with the AK CASC Suicide Basin outburst flood project. Over the summer, he made frequent trips to the basin to conduct surveys and service instruments. For Kienholz, the field component in this project was particularly exciting given the rapid changes of the lake and glacier at the field site. He enjoyed contributing to a project with a direct and immediate impact on the local community. “Gathered information was typically ready for stakeholders in a matter of hours or even in real-time,” he said. He also enjoyed the collaborative and interdisciplinary aspect of the project, working alongside researchers from the university and agencies such as USGS and NOAA.

Featured 2018 publications

Lader, R., Walsh, J.E., Bhatt, U.S., and Bieniek, P.A. 2017. Projections of Twenty-First-Century climate extremes for Alaska via dynamical downscaling and quantile mapping. *Journal of Applied Meteorology and Climatology*, 56:2393-2409 (<https://journals.ametsoc.org/doi/abs/10.1175/JAMC-D-16-0415.1>)

Littell, J.S., McAfee, S.A., Hayward, G. 2018. Alaska snowpack response to climate change: Statewide snowfall equivalent and snowpack water scenarios. *Water*, 10:668, doi:10.3390/w10050668.

Parazoo, N.C., Koven, C.D., Lawrence, D.M., Romanovsky, V.E., and Miller, C.E. 2018. Detecting the permafrost carbon feedback: Talik formation and increased cold-season respiration as precursors to sink-to-source transitions. *The Cryosphere*, 12:123-144, <https://doi.org/10.5194/tc-12-123-2018>.

Roth, A., Hock, R., Schuler, T.V., Bieniek, P.A., Pelto, M., and Aschwanden, A. 2018. Modeling winter precipitation over the Juneau Icefield, Alaska, using a linear model of orographic precipitation. *Frontiers in Earth Science*, 21, <https://www.frontiersin.org/articles/10.3389/feart.2018.00020/full>

Wolken, G.J., and Wikstrom Jones, K. 2017. Valdez Glacier ice-dammed lake: June 2017 glacial lake outburst flood. Alaska Division of Geological & Geophysical Surveys Preliminary Interpretive Report 2017-4, 5 p., <http://doi.org/10.14509/29743>

▲ Find more publications at casc.alaska.edu/publications.

Stephen Gray, USGS Director
Alaska Climate Adaptation Science Center
sgray@usgs.gov

Scott Rupp, University Director
University of Alaska Fairbanks
tsrupp@alaska.edu

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casc.alaska.edu or casc.usgs.gov/alaska

