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American Water Resources Association

2023 Annual Conference Program

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Alaska Section American Water Resources Association

2023 Annual Conference

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Suggested Citation

Levine, K. Kubacki, E. Larquier, A. (2023). Alaska Section American Water Resources Association 2023 Annual Conference Program. Alaska Section, American Water Resources Association Ad-Hoc Communications Committee. www.akawra.org

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Acknowledgements

Thank You!

This conference would not have been possible without the work of these committees and the donations from our conference sponsors. Thank you everyone!

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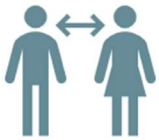
Safety Protocols

Covid-19 Practices

Wash your hands

Wear a face mask

Minimize touch



Maintain a safe distance

Transmissible Symptoms

A Covid-19 vaccination is not required to attend the conference in-person, but if you experience any of the following transmissible symptoms, please return home:

- Coughing
- Fever
- Runny Nose

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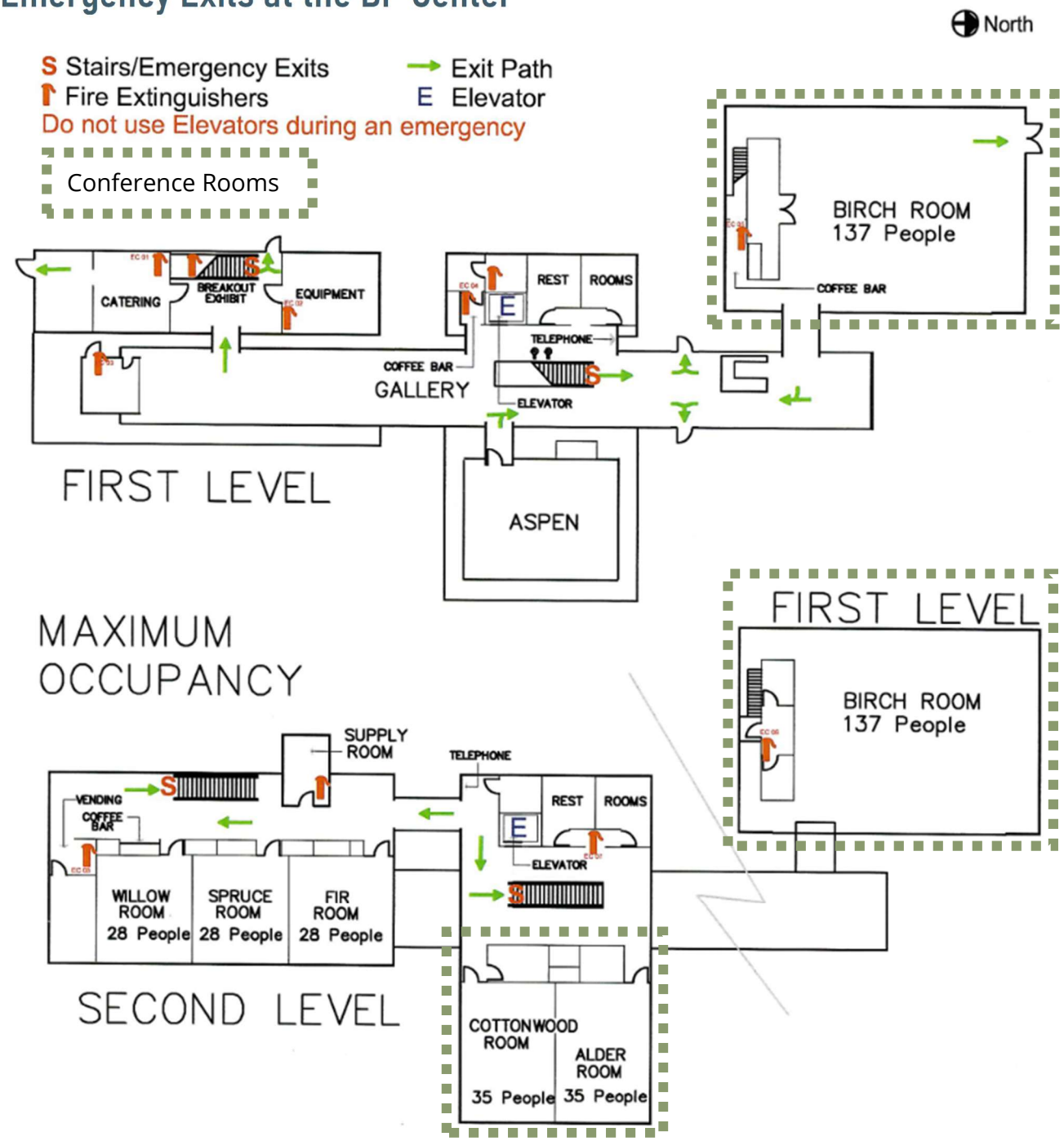
If you are outside, stay away from buildings, walls, and power poles. If you are inside, follow the instructions below:

Pacific ADA Center ECA

Emergency Exits at the BP Center

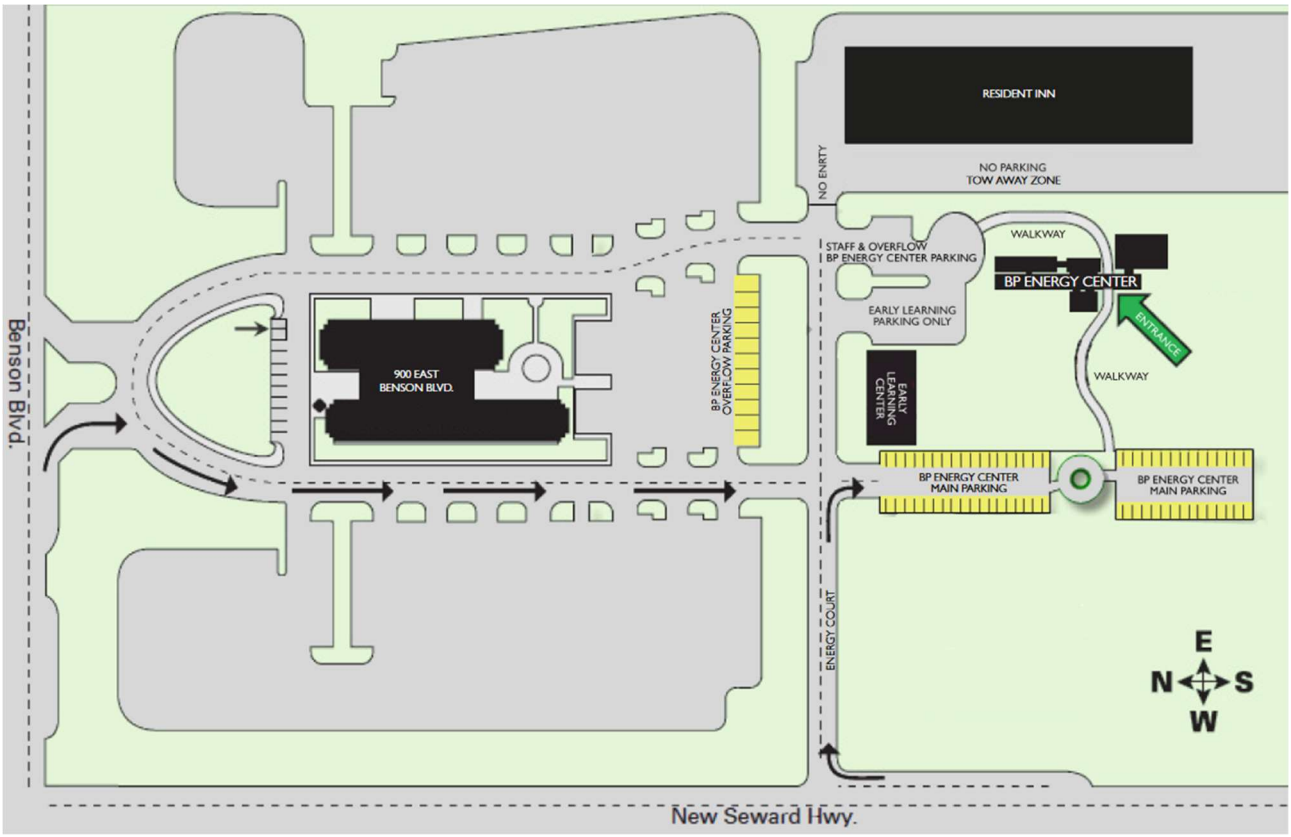


Access

In-person Attendees

Location & Parking Map

BP Energy Center - 1014 Energy Court, Anchorage, AK



Daily Schedule

Monday, March 6th - Birch Room (First Floor)

12:00	*Registration Open*	
Session 1: Eklutna		
13:00	Ann Marie Larquier & Aaron Leggett	Opening Remarks/Land Acknowledgement
13:40	Samantha Owen	Eklutna Hydroelectric Project - Fish and Wildlife Agreement Implementation
14:20	Kathy Dube	Geomorphology and Sediment Transport in the Eklutna River, Alaska
14:40	*Rapid Talks/Break*	
Session 2: Cryosphere Hydrology/Climate Change/Modeling & Geospatial		
15:00	Johnse Ostman	A Synthesis of Long-Term Hydrometeorological Data Series for Eklutna Watershed, Alaska
15:20	Molly Tedesche	A Perennial Snowfield Melt Model as a Synthesis of Climate, Field, and Remotely Sensed Data from the Brooks Range, Alaska
15:40	Kelsey Stockert	Sublimation Measurements From Tundra and Taiga Snowpack in Alaska
16:00	Marcus Geist (First Author – Rebecca Shaftel)	AKTEMP: Presenting a fully functional stream and lake temperature database for Alaska
16:20	Rebecca Shaftel	Modeling stream temperature and flow from gridded climate datasets in Alaska's Yukon and Kuskokwim basins
16:40	Shawn Carter	Remote Sensing Alaska with SARRIS

Daily Schedule

Tuesday, March 7th - Birch Room (First Floor)

08:30	*Registration and coffee*	
Session 3: Habitat - Fish, Wildlife, and Aquatic Species		
09:00	Angela Coleman (First Author – Brian Bair)	Mining Helps Resurrect A Creek on the Chugach National Forest
09:20	Lisa Docken	A Recipe for Maximum Benefit from Restoration Dollars in Support of Fish Passage and Fish Habitat
09:40	Tori Brannan	Sleuthing the Slough: Engaging (and Managing) Schoolwide Authentic Science in K-6 Students, a Ten-Year Study
10:00	Carrie Ann Brophil	Restoration of Eklutna River
10:20	*Rapid Talks/Break*	
Session 4: Drinking Water		
10:40	Michael Pollen	Rotary District 5010 Alaskan Emergency Water Treatment System Project
11:20	Charley Palmer	Alaska DEC Drinking Water Source Protection
11:40	Barbara Johnson	Unrestricted Cash Transfers and Access to In-Home Water Services a case study of the Alaska Permanent Fund Dividend
12:00	*Membership & Board Meeting (Lunch provided for all participants)*	
Session 5: Weather and Water Extremes/Hazards		
13:20	Jessica Cherry	NOAA's Planned Updates to the Precipitation Frequency Atlas and Probable Maximum Precipitation
13:40	Janet Curran	Large floods in Alaska: Considerations of flood-generating mechanisms and contributing factors
14:00	Jacquelyn Overbeck (First Author – Leslie Jones)	All Hands-on Deck Data Collection Response to 2022 Bering Sea Storm from Typhoon Merbok
14:20	Melanie Engram	Detecting Early Winter Open-Water Zones on Alaska Rivers Using Dual-Polarized C-Band Sentinel-1 Synthetic Aperture Radar (SAR)
14:20	*Rapid Talks/Break*	
15:00	*Poster Session until 17:00 in the foyer area (first floor)*	

Daily Schedule

Wednesday, March 8th - Adler/Cottonwood Room (Second Floor)

08:30	*Registration and coffee*	
Session 6: Watershed Management (Surface Water, Groundwater, Water Quality, & Conservation)		
09:00	Kevin Petrone	Alaska Water Budget and the Alaska Water Use Data System (AKWUDS)
09:20	Jeff Conaway (First Author – Jenn Hamblen)	Preliminary Results of the US Geological Survey Alaska Transboundary Rivers Monitoring Project
09:40	Benjamin Meyer	Alaska's Kenai River Water Quality Monitoring Project: 22 Years of Community Supported Research
10:00	Ann Marie Larquier & Leah Ellis	Protecting Fish and Wildlife Habitat: Alaska's Instream Flow Program
10:20	*Rapid Talks/Break*	
Session 7: Hydrology Design and Engineering		
10:40	Erica Betts	Culvert Sizing for Climate Change, Case Studies in Alaska
11:00	Daniel Miller	Roughened Channel Design and Construction
11:20	Irene Turletes & Kacy Grundhauser	Dave's Creek Substation Flood Mitigation
11:40	Jim Munter	A Fresh Look at Ground- and Groundwater-Sourced Heat Pumps An Alaska Heat Rush?
12:00	*Lunch (provided for all in-person participants)*	
Session 8: Hydropower		
13:00	Bryan Carey	Hydropower Opportunities with Change
13:20	Dave Brailey	Groundwater Inputs to an Alpine Hydroelectric System
13:40	Merrick Jackinsky	Advancements in River and Tidal Energy Production in Alaska
14:40	*Closing Remarks & Announcement of the New Board of Directors*	

March 9-10th	IHCA Spring 2023 Meeting will be held at Dr. Glenn A. Olds Hall (USGS) in Anchorage. Address: 4210 University Drive, Anchorage, Alaska 99508

Eklutna Hydroelectric Project - Fish and Wildlife Agreement Implementation

Owen, Samantha J. McMillen

The Eklutna Hydroelectric Project is located in Southcentral Alaska approximately 30 miles northeast of downtown Anchorage. The Project was originally constructed by the Federal government in the 1950s but was later sold to and is currently owned by Chugach Electric, Matanuska Electric, and the Municipality of Anchorage. As part of this sale, the three Project Owners entered into a Fish and Wildlife Agreement with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the State of Alaska. This Agreement requires the Project Owners to develop and propose to the Governor a program that protects, mitigates damages to, and enhances fish and wildlife impacted by the development of the Project. The Project Owners initiated consultation in 2019 and have just completed a comprehensive 2-year study program. These study results will help inform the development of the Fish and Wildlife Program for the Project.

Geomorphology and Sediment Transport in the Eklutna River, Alaska

Dube, Kathy V. Watershed GeoDynamics

A geomorphology and sediment transport analysis of the Eklutna River was conducted as part of comprehensive studies related to the 1991 Fish and Wildlife Agreement for the Eklutna Hydroelectric Project. Geomorphic and sediment transport processes in the Eklutna River downstream from Eklutna Lake have been altered by several management actions over the past century including water withdrawals, retention of sediment within constructed reservoirs, removal of the lower dam at River Mile (RM) 4, gravel removal from the river and floodplain, construction of the AWWU pipeline and access road, and channel confinement by roads and bridges. Sediment input, transport, and deposition are important processes that help to provide high quality aquatic habitat. An understanding of substrate conditions and sediment input and transport rates in the Eklutna River provides information that can be used to assess the effectiveness of potential future flow releases and aquatic habitat improvement measures under the 1991 Agreement.

The geomorphology and sediment transport study included:

- Remote sensing analyses using historic aerial photographs and sequential LiDAR data to determine sediment input rates from large natural source areas along the river and to delineate channel migration areas;
- Field work to measure substrate grain size, substrate movement and riverbed profile changes at monitoring transects following test flow releases; and

- Development of a 1-D HEC-RAS model sediment transport model to calculate sediment transport rates under potential future flow regimes and assess the magnitude and effectiveness of high flow alternatives to flush accumulated fine-grained sediment from the river without moving the limited supply of spawning-sized gravel/cobble material out of the channel.

A Synthesis of Long-Term Hydrometeorological Data Series for Eklutna Watershed, Alaska

Ostman, Johnse Alaska Pacific University; Geck, Jason Alaska Pacific University; Loso, Mike National Park System; Conaway, Jeff US Geological Survey

Anchorage, Alaska's 300,000 residents are critically dependent on the Eklutna Lake watershed for hydropower and drinking water. Eklutna Lake receives runoff from the thinning and retreating Eklutna Glacier, with resulting mass loss enhancing short-term runoff. The headwater catchment contributes ~80% of the total runoff into Eklutna Lake, and yet historically the hydrometeorology has not been monitored. Here we present the 2008-2021 continuous seasonal on- and off-glacier West Fork catchment weather, and West Fork Eklutna River and East Fork Eklutna River discharge time series based on a combined 112 discrete discharge measurements and their associated stage-discharge relationships. Although not significantly correlated, air temperatures increased at a rate of 0.5 ºC per decade on-glacier at the equilibrium line altitude and 1.2 ºC per decade off-glacier, and rainfall was variable with no trends observed. Hydrometeorological comparison showed positive significant correlation between air temperature and basin runoff, although annual flood peaks more strongly correlated with Gulf of Alaska atmospheric rainfall events. Average June-September discharge in the West Fork Eklutna River was 4% greater than in the East Fork Eklutna River, whereas water yield from the West Fork produced 58% greater specific discharge. Average day of year when half the runoff season total flow volume had accumulated and hydrographic daily maximum were ~9 days earlier in the East Fork. Distributions of accumulated annual specific discharge highlighted how glacier buffering contributes to lower interannual variability, providing insight into future runoff patterns from the West Fork as Eklutna Glacier dividends diminish. The data presented here together with continuation of this robust hydrometeorological monitoring program are essential for informing water resource utility management strategies into the future.

A Perennial Snowfield Melt Model as a Synthesis of Climate, Field, and Remotely Sensed Data from the Brooks Range, Alaska

Tedesche, Molly E. - Cold Regions Research & Engineering Lab, US Army Engineer Research & Development Center; Fassnacht, Steven R. - Department of Watershed Science, Colorado State University; Trochim, Erin D. - Center for Energy & Power, University of Alaska Fairbanks; Wolken, Gabriel J. - Climate & Cryosphere Hazards Program, Alaska Division of Geological & Geophysical Surveys

Perennial snowfields, such as those in the Brooks Range, are critical to alpine and arctic ecosystems, as they influence hydrology, vegetation, geology, and serve as habitat for an array of wildlife, including

caribou. Caribou are a crucial food and cultural resource for Alaska Native subsistence hunters. To understand extent changes and persistence of perennial snowfields, we developed a spatially distributed perennial snowfield melt model using the temperature melt index method, paired with multivariate binary logistic regression. Input data for calibration and evaluation are a synthesis of climate reanalysis data and satellite imagery from both multi-spectral (optical) and synthetic aperture radar (SAR) imagery. Temporal and spatial scale variations among input datasets, as well as variations in distribution and extents of the snowfields themselves, were accounted for using several methods. Snowfield metrics derived from remote sensing were evaluated by comparison with field collected data.

Probabilities of perennial snowfield melt at several thresholds were modeled using terrain-adjusted gridded temperature and net solar radiation data. Conditions of snowfield disappearance or persistence, from one melt season to the next, were derived from Sentinel-2 optical imagery. Melt-onset and freeze-up dates were determined using Sentinel-1 SAR backscatter intensity differencing. The model was calibrated in a focused domain within the Brooks Range and evaluated in an alternate location around the Alaska Native village of Anaktuvuk Pass. Results of the perennial snowfield melt model indicate best performance at probability thresholds from 50% to 70%. Local community members from the village of Anaktuvuk Pass were involved in field work decision making processes and data collection. Model application is intended for quantifying one of many potential contributing factors to changes in arctic caribou herds observed by Alaska Native subsistence hunters.

Sublimation Measurements from Tundra and Taiga Snowpack in Alaska

Stockert, Kelsey A. Kuna Engineering; Stuefer, Svetlana L. University of Alaska Fairbanks; Euskirchen, Eugenie S. University of Alaska Fairbanks

Snow sublimation plays a fundamental role in the winter water balance. To date, there are few studies that quantify sublimation by direct measurements. We use Eddy Covariance (EC) data from 2010 to 2021 to calculate sublimation from six locations in northern Alaska. Three tundra sites are located at distinct topographical locations and vegetation communities within Imnavait Creek watershed, a small Arctic watershed (2.2 sq km) on the North Slope that is underlain by continuous permafrost. Three taiga sites are selected in Interior Alaska near Fairbanks in differing permafrost conditions and ecosystems. Meteorological data at or near the EC sites were analyzed to assess how site environmental conditions control sublimation rates. Preliminary results show that mean surface sublimation rates ranged from 0.08-0.15 mm/day and 21-35 mm/year among the six sites. This presentation will discuss daily, monthly, and annual sublimation measurements and environmental factors that control sublimation rates. The findings of this study are an important contribution to the sparse literature on Arctic and subarctic sublimation measurements and will benefit scientists in their understanding of how site conditions affect sublimation rates and the winter hydrologic cycle.

AKTEMP: Presenting a Fully Functional stream and Lake Temperature Database for Alaska

Shaftel, Rebecca, University of Alaska Anchorage (UAA) Alaska Center for Conservation Science (ACCS); Merrigan, Dustin, UAA-ACCS; Geist, Marcus, UAA-ACCS; Walker, Jeff, Walker Environmental Research

AKTEMP is a cloud-based database platform for storing and accessing stream and lake temperature monitoring data across Alaska. The website allows users to upload, review, explore, and download data. Data can be uploaded either as a single file or as multiple files, which can be uploaded simultaneously as a single batch. Each data file can contain either discrete or continuous measurements collected at one or more sites as well as at one or more depths or depth categories to accommodate lake arrays, paired bottom/surface stream loggers, or other multi-depth scenarios. After uploading, an interactive QA/QC tool can be used to review and flag data representing erroneous or abnormal measurements (e.g., out of water). Users can explore available data at all sites statewide or within specific hydrologic basins (i.e. HUC4, 6, or 8) using spatial filters. Additionally, users can download both the raw and daily-aggregated timeseries at one or more sites along with the accompanying station metadata. The project team has developed instructional videos, decision tree flowcharts, and a user guide to aid data providers and public users. The system architecture for AKTEMP was based on the Spatial Hydro-Ecological Decision System (SHEDS) northeast stream temperature database, which was developed by Walker Environmental Research in collaboration with USGS and currently serves over 150 million measurements collected at approx. 8,400 monitoring stations by 92 agencies across ten northeastern US states.

AKTEMP was released in early 2023 and currently serves stream and lake data in more than twenty different Alaskan sub-basins (HUC8s). Use of AKTEMP is free and open and will continue to be supported by staff at UAA's Alaska Center for Conservation Science. We invite the community to take advantage of this database by uploading your own data, and/or exploring data uploaded by others to meet your needs.

Modeling Stream Temperature and Flow from Gridded Climate Datasets in Alaska's Yukon and Kuskokwim Basins

Shaftel, Rebecca S, Alaska Center for Conservation Science, University of Alaska Anchorage; Feddern, Megan L., College of Fisheries and Ocean Sciences, University of Alaska Fairbanks; Schoen, Erik, International Arctic Research Center, University of Alaska Fairbanks; Cunningham, Curry, College of Fisheries and Ocean Sciences, University of Alaska Fairbanks; von Biela, Vanessa R., U.S. Geological Survey, Alaska Science Center; McAfee, Stephanie, Department of Geography, University of Nevada Reno; Falke, Jeffrey A., U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit

Stream temperature and streamflow are critical controls on freshwater habitat dynamics and are important for understanding climate impacts on freshwater resources. In Alaska, using empirical stream temperature and streamflow datasets for research poses several challenges: data are often unavailable for an area of interest, datasets are typically of short durations, and sites are managed independently across agencies and organizations. Fortunately, advances in gridded climate products and downscaled climate projections provide alternatives for quantifying freshwater habitat conditions in remote regions like

Alaska. For this project, we reviewed products and validated models against in situ data to develop more complete historical time series of stream temperature and streamflow. Specifically, our objectives included: 1) developing a list of gridded or modeled products available for Alaska, 2) comparing products with a focus on streamflow and temperature, and 3) comparing three different stream temperature models. We validated alternative products representing streamflow and temperature using empirical datasets associated with a case study of Chinook Salmon habitat in the Yukon and Kuskokwim basins. Our results indicated that a global modeled streamflow product had a strong positive correlation to observed streamflow (mean r = 0.79 for 11 sites). Boosted regression tree models that included daily gridded air temperatures along with other covariates had the highest positive correlation to observed stream temperatures (r = 0.97 for 31 sites) compared to other commonly used models and good prediction accuracy (mean RMSE = 0.7ºC). Overall, we found several products that could be used to develop accurate time series of freshwater habitat conditions in Alaska and utilized for fisheries research. Potential applications include predicting aquatic species distributions, spread of invasive species, food availability, fish growth potential, and generally informing fish responses to climate change for research and management.

Remote Sensing Alaska with SARRIS

Carter, Shawn, Winter Hydrology and Remote Sensing Desk Lead NOAA/NWS

The National Water Center is developing an experimental product to classify the extent and texture of river ice across the Northern Tier of the Contiguous United States and Alaska. The Synthetic Aperture Radar River Ice Surveillance (SARRIS) product is derived from Synthetic Aperture Radar (SAR) imagery acquired by European Space Agency Copernicus Programme Sentinel-1 satellites. The advantage of SARRIS over more classical river ice products produced from electro-optical satellites (i.e. VIIRS, Sentinel-2, Landsat, GOES) is the day/night and all-weather imaging capability of SAR. Through dark of night and the worst winter storms, Sentinel-1 is able to image land surface features with a 5-meter resolution. SARRIS is intended to increase situational awareness of not only the presence of river ice, but the morphology of the ice whether it is thin sheet ice, flows of frazil and pan ice, or jumbled ice at the bottom of an ice jam. This is currently the only known SAR derived publicly available river ice product at this scale. In this presentation, we will discuss how it is produced, the limitations of the product, and examples of how it has been used to coordinate emergency responses to ice jams.

Mining Helps Resurrect a Creek on the Chugach National Forest

Bair, Brian (USFS Enterprise Team); Marzullo, Corinne (USFS Enterprise Team); Williams, Austin (Trout Unlimited)

The National Forest Foundation (NFF), U.S. Forest Service (USFS), Chugach National Forest and Trout Unlimited (TU), in partnership with Kinross Gold Corporation and Hope Mining Company (HMC), have collaborated to implement instream habitat restoration on approximately 2.2 miles of a historically mined reach of Resurrection Creek, located on the northern end of the Kenai Peninsula, on the Seward Ranger District near Hope, Alaska.

The hydraulic and heavy equipment placer mining of a century ago resulted in loss of soil and significantly altered the natural complexity of stream channels and wetlands on Resurrection Creek. The impact of the disturbance and loss of the stream's ability to access the floodplain have adversely altered the aquatic habitat and riparian vegetation composition. Without mechanical intervention, adversely affected habitat will limit biologic production within the project area conceivably for centuries. The USFS's experience and success with a similar restoration project, just upstream, has shown that restoration of the stream channel corridor has a high potential to restore natural stream channel processes and aquatic habitat, increasing aquatic spawning and rearing habitat, producing higher densities and larger more fit juvenile Chinook and coho salmon, consequently improving fish populations.

Today this unique partnership is working to restore habitat, in one of the Chugach National Forests priority watersheds, for healthy populations of fish and wildlife that future generations will enjoy.

A Recipe for Maximum Benefit from Restoration Dollars in Support of Fish Passage and Fish Habitat

Docken, Lisa V. Copper River Watershed Project; Morse, Kate. Copper River Watershed Project

Improperly designed or deteriorating culverts can block fish passage and degrade water quality in fish streams. A 2002 survey by Alaska Departments of Fish & Game and Transportation surveyed all culverts on state roads in the Copper River watershed and determined 64 percent of them were inadequate for passing juvenile fish at all flows. With the potential for a single failed culvert to block miles of upstream spawning and rearing habitat, and limit productivity of that fish stream, the Copper River Watershed Project (CRWP) and partners saw a need for evaluating these culverts with respect to watershed health and productivity. Our assessment project determined culverts that should be replaced to achieve maximum benefit for fish habitat in relation to the anticipated cost of replacing a given culvert. From 2011-2016, CRWP utilized their developed Culvert-Ranking Protocol that factored in ecological and culvert conditions and surveyed every crossing in the Copper River watershed. By identifying poorly functioning culverts on high quality fish habitat, we are able to identify priority restoration projects that maximize the benefit for fish and use limited resources efficiently. Work stemming from the culvert ranking system in

the watershed has resulted in CRWP being nationally recognized by our partners USFS and USFWS, celebrating this impactful partnership and the subsequent restoration outcomes.

CRWP will share their recipe for success building on 15 years of fish passage and restoration experience, describing effective tools for identifying top projects in a way all partners agree, the methods for transparent and consistent communication, the importance of an inclusive table, creative ways to lift up partners and how and why we are emphasizing habitat components throughout each project to make the most of restoration dollars.

Sleuthing the Slough: Engaging (and Managing) Schoolwide Authentic Science in K-6 Students, a Ten-Year Study

Brannan, Tori L. Salcha Elementary School/FNSBSD Retired; Jonas, Jenna, Tanana Valley Watershed Association; Brannan, Teslin R. Ben Eielson High School/FNSBSD; Buffington, Christina, University of Alaska Fairbanks

When a multi-million dollar bridge and levee project on the Tanana River cut off the head of Piledriver Slough, the rural community of Salcha grew concerned about its health and fish populations. An authentic, ten-year scientific study ensued when the local K-6 elementary school was asked to partner with the Tanana Valley Watershed Association to study the impact of the new infrastructure on the slough, a local food source for Arctic grayling, salmon, and burbot. Staff, students, partners, and community members came together in 2012 to train in water quality and fish survey protocols, map curriculum, and develop programmatic and structural supports for a longitudinal K-6 school-wide study. These partnerships, training, and immersion into citizen and community science spurred the three times a year, decade-long study of eight sites along five miles of slough, opening pathways for our diverse learners in future STEM careers. Kindergarten through sixth-grade students and alumni collected data, studied outcomes, presented findings, and received recognition in local media, school and regional science fairs, state-wide art contests, regional student research symposiums, international scientific publications, and even the 2022 AGU Fall Meeting. Engaging and sustaining young learners ages 5-12 in outdoor conditions while collecting 1200 data points over multiple years at sites miles from the school required extensive logistical planning, flexibility, and revision. Successfully doing so has taught our young scientists the importance of their voice and stewardship of the lands and waters, leading to additional grants, paid seasonal work for elementary alumni, the pursuit of post-secondary STEM education, and a generation of young people who are invested in science and their community.

Restoration of Eklutna River

Brophil, Carrie Ann. NVE; Robillard, Kyle. NVE; Beadle, Michelle. NVE; Galvin, Corey. NVE; Lamoreaux, Marc. NVE

Idlughetnu, Eklutna river, is a smaller river in the anchorage bowl of Alaska. This river was once the lifeline of Eklutna Dena'ina, providing year-round sustenance to a flourishing community. In the early 1900s the river water was cut off by a dam without consulting the community. A second dam was added in the 1950s, effectively cutting off all water flow from the lake downstream and making the lower dam defunct. Native Village of Eklutna and partners have been working for over 20 years on restoration efforts, not only to restore the salmon population, but to restore the unique ecosystem surrounding the river. In recent years monitoring efforts on the river have increased. Spawning surveys, redd counts, and habitat characterization Is leading the way for future modifications to increase salmon habitat.

Rotary District 5010 Alaskan Emergency Water Treatment System Project

Pollen, Michael R., NTL Alaska, Inc.; Jon Dufendach, CampWater Systems, LLC

This project was to design, build, test, and deploy rapidly-transportable emergency water treatment systems that could respond to winter outages of village potable water systems in rural Alaska. The $356,000 project was seed funded by Rotary International District 5010 (Alaska), but expanded with in-kind donations and grant funding from the Denali Commission.

The project design was a collaboration between Jon Dufendach, President of CampWater Industries, LLC in Delta Junction and Michael Pollen, President of NTL Alaska, Inc. in Fairbanks. Dufendach provided the engineering, component assembly, and equipment operation during field testing. Pollen provided water treatment process consultation and field and laboratory analytical services for the field testing program. Both Dufendach and Pollen provided operations training for the recipients of the systems.

Four systems capable of treating 7,000 GPD of potable water from clear river or lake water under an ice cover in extreme cold weather conditions were constructed by CampWater Industries. Three systems were designed as helicopter transportable units and one as a Cessna 208 Caravan transportable unit. These were gifted to several Alaskan Regional Health Corporations and the Alaska State Defense Force, and have been deployed to Bethel, Nome, Fairbanks, and Wasilla. The entire project from concept to delivery was completed in 18 months.

Alaska DEC Drinking Water Source Protection

Palmer, Charley. Alaska DEC Drinking Water Source Protection

Public drinking water systems are an important part of our communities. This presentation will share how Alaska DEC helps protect Alaska's sources of drinking water and resources for you to help begin voluntary protection efforts.

Unrestricted Cash Transfers and Access to In-Home Water Services - a Case Study of the Alaska Permanent Fund Dividend

Johnson, Barbara AL; Dr. Molina, Allen; Dr. Herrmann, Mark; Dr. Aggarwal, Srijan. University of Alaska Fairbanks

In this study, we use a panel dataset of 18 rural Alaska water and sewer utilities from 2012 to 2016 to measure the effect of the PFD on residential payments. We find that on average, the utilities are missing $11,444 in residential payments yearly and have a delinquency rate of 14%. Residential payments increase significantly in the month unrestricted cash transfers such as the PFD and ANCSA dividends occur. October residential payments are $2,287-$9,569 higher than in other months and represent 1.6% to 4.2% of the total revenue of utilities. We estimate that the PFD generates between $666,000 and $1,765,000 in additional payments for water utilities across rural Alaska. These findings suggest that the PFD and other unrestricted cash transfers play an important role in household water security.

NOAA's Planned Updates to the Precipitation Frequency Atlas and Probable Maximum Precipitation

Cherry, Jessica, NESDIS/NCEI; Johnson, Crane, NWS

This presentation will explain the transition from NOAA's Atlas-14 precipitation recurrence interval product to Atlas-15, giving an opportunity for product users to be engaged during the development. An update to a second product, Probable Maximum Precipitation, will also be discussed including methods to capture extreme events. Differences with existing climate-projected products will also be discussed.

Large floods in Alaska: Considerations of Flood-Generating Mechanisms and Contributing Factors

Curran, Janet H., USGS Alaska Science Center

Discharge-related floods in Alaska can be attributed to a range of flood-generating mechanisms. Large floods associated with spring snowmelt have occurred in relatively cold, dry areas. Elsewhere, rainfall, snow-and-ice melt from high elevation or glacierized basins, a combination of rainfall and melt, and glacier lake outburst floods (GLOFs) have generated large floods. Although some of these flood populations can be considered similar for analyses like determining flood frequency and magnitude, some form statistically distinct populations. Identifying these populations can inform flood frequency analysis and improve the understanding of the effects of climate change on floods when coupled with understanding of projected changes in the mechanisms.

Several recent floods in Alaska demonstrate factors contributing to or attenuating large floods. In one case, record fall precipitation during a cool period generated flooding in lower-elevation, smaller streams but elevational gradients in the rain/snow fraction ameliorated runoff production at higher elevations and

limited flooding in larger streams. In contrast, heavy fall rainfall coinciding with warm temperatures generated an atypically late large flood in a large stream. In a third example, intense rainfall generated record flooding from likely convective storms, less commonly documented as large-flood-generators in Alaska than atmospheric rivers. These floods help identify the role of variables like temperature, elevation, and atmospheric condition needed to address the complexity of flood-generation from rainfall.

Glacier lake outbursts have created some of the largest gaged floods in Alaska, floods that are outsized relative to non-outbursts on the same stream. Other gaged GLOFs have a distribution ranging from larger than to close to non-outburst floods, and a life-cycle of GLOF magnitude and seasonality can be seen for some glacier lakes. An in-progress inventory of gaged GLOFs will improve accessibility to streamflow data for this flood population.

All Hands on Deck Data Collection Response to 2022 Bering Sea Storm from Typhoon Merbok

Jones, Leslie. State of Alaska Geospatial Office

The remnants of Typhoon Merbok began approaching the Bering Sea Thursday, September 15, 2022 where the storm transitioned into an extratropical low pressure system. The minimum central pressure was 937 mb at 4:00 AM Friday, which is the lowest pressure ever recorded in the Bering Sea for the month of September and for any time of year along portions of its track. Storm surge and waves impacted over 1,000 miles of coastline and at least 35 communities, with over 30 ft waves measured offshore of Nome and 8-12 ft of storm surge above mean higher high water measured across communities in Norton Sound. Damages to homes, public infrastructure, and subsistence resources are still being quantified. In advance of and during the immediate aftermath of the storm, partners from all sectors reached out to contribute what they could to support Alaska's communities. Very quickly, a coordination team and communication pathways were developed to capture impacts from existing monitoring infrastructure and local partners, plan and carry out post-storm high water mark, unmanned aerial system, and satellite data collection surveys, as well as process data to feed out to emergency responders and the public. Because of this all hands on deck approach, this will be the most well documented coastal storm event in Alaska history which will help facilitate damage assessment and community assistance well into the future. These data will also inform future storm modeling efforts which enhance weather forecasting, communication of hazardous weather events, and long-term community planning. This presentation will cover the coordinated data collection effort, highlight partner inputs, and share outcomes and access points to the storm data.

Detecting Early Winter Open-Water Zones on Alaska Rivers Using Dual-Polarized C-Band Sentinel-1 Synthetic Aperture Radar (SAR)

Engram, Melanie J. Water and Environmental Research Center (WERC), University of Alaska Fairbanks (UAF); Meyer, Franz J. Geophysical Institute, UAF; Brown Dana R. N. International Arctic Research Center (IARC), UAF; Clement, Sarah IARC, UAF; Bondurant, Allen C. WERC, UAF; Spellman, Katie V. IARC, UAF; Oxtoby, Laura E. WERC, UAF; Arp, Christopher D. WERC, UAF.

River ice in Alaska provides critical natural infrastructure for winter travel, commerce, hunting, fishing, and recreation in rural areas with little or no road access. Open water zones (OWZs) in river ice are dangerous for such travel and are most common during early winter. Further, changes in the occurrence and duration of OWZs could be an indicator of broadscale changes in ice conditions in Alaska and the Arctic. To aid in detecting this hazard and fingerprint of changing winter conditions, we developed a remote sensing supervised classification for C-band synthetic aperture radar (SAR) for rivers between October and January to discriminate between ice cover and open water. This river ice classification uses backscatter intensity thresholds from both polarizations from Sentinel-1. The classification was trained using photos from shore-based cameras in early winter 2019-2020 on four Alaska rivers, two aerial photos of the Kuskokwim River, and on-ice observations collected during January 2021 fieldwork on the Tanana River. We assessed the accuracy of our classification using shore-based cameras from nine river reaches from early winter of 2020-21, along with independent citizen scientists' photo observations from multiple rivers. Overall accuracy for the classification ranged from 50-91%. SAR backscatter from ice correlated with pre-freeze-up suspended sediment load as proxied by Sentinel-2 red + NIR bands ($r^2=0.4$, $p<0.05$). We conclude that SAR thresholds can therefore be customized, depending on the suspended sediment load and possibly other variables such as river morphology and channel flow velocity to increase accuracy for different rivers. This classification, which allows for mapping long river reaches in low-light winter conditions, can be performed on historical Sentinel-1 imagery to determine areas that display OWZs year after year. Once customized to a particular river, it can be automated to provide current OWZ maps to Alaska communities to aid safer travel on ice.

Carbon Mass Estimation in Two Peatlands of the Kenai National Wildlife Refuge Using Ground-Penetrating Radar (GPR)

Kuhle, Cameron R; Klein, Eric S. University of Alaska Anchorage

Peat carbon is known to be one of the largest pools of soil carbon globally and is sensitive to environmental and climatic changes. Peatlands in the Kenai National Wildlife Refuge (KENWR) have been studied for their hydrology, vegetation composition and succession, peat accumulation, and similar characteristics, but the mass of stored carbon is yet unknown. We expect KENWR peatlands to comprise significant reserves of sequestered carbon and are using a synthesis of soil and wetland surveying techniques to better constrain estimates of regional contributions to global values. A low-frequency (100 MHz) GPR instrument was utilized at two sites selected for suitable topography and hydrology to measure peat basal layer depth. Radar velocity was calibrated with manual depth probing to ensure accuracy of measurements, allowing GPR to be used to collect many more data points than probing alone. Peat cores were extracted from each site and sampled at regular intervals for elemental analyses to conducted at the University of Alaska Stable Isotope Laboratory. Carbon content by mass percent informs the primary study objective, while ancillary analyses of carbon isotopes, organic content, nitrogen content, radiocarbon dating, and bulk density contextualize the data and potentially identify historical trends. Carbon content and bulk density data enable the calculation of total carbon mass given the basin volume estimate developed from the GPR survey. Preliminary estimates calculated from the point-depth interpolations and organic matter content data indicate an areal density of approximately 1000 metric tons carbon per hectare.

Current Ice and Flood Remote Sensing Resources and Workflow for the NWS Alaska Pacific RFC

Busey, Robert C. Alaska Pacific River Forecast Center, NOAA/NWS

In 2023 there is a plethora of remote sensing output available for the state of Alaska. This poster will overview the state of the art products the NOAA Alaska Pacific River Forecast Center currently uses to maintain awareness on river freeze-up in the fall as well as the breakup and open water season floods. A large focus will be on the Synthetic Aperture Radar River Ice Surveillance near real time spatial analysis (SARRIS).

We will overview workflow and automated tools which condense the volume of information available into easier to consume pieces for our fully tasked forecasters. The collaborative effort between analysts and users to increase the utility of the dataset will also be highlighted.

Fresh Eyes on Ice: Connecting Arctic Communities through a Revitalized and Modernized Freshwater Ice Observation Network

Arp, Christopher, WERC. Oxtoby, Laura, WERC. Spellman, Katie, IARC. Brown, Dana, IARC, Sparrow, Elana, IARC. Woods, Brooke, TCC YRITFC. Ornelas, Cristina, Bondurant, Allen, WERC. Engram, Melanie, WERC, Buffington, Christi, IARC. Chase, Malinda, IARC. Edwin, Bruce. Johnson, Crane. Sattler, Bob. Scragg, Matthew

Snow and ice are essential parts of living in cold places, and all northern peoples observe, understand, and appreciate how these change every year. Wide-scale observations of freshwater ice and how its presence has changed over time provide a fundamental need for a broad range of stakeholders, from rural communities that depend on ice for transportation and subsistence harvest, to industries that rely on winter water for ice road construction, to scientists studying climate change and ecosystem services. The Fresh Eyes on Ice observation network addresses this need by collecting data across Alaska using satellite observations, river ice cameras and lake buoys, and field campaigns by snowmachine - all integrated with a partnership of community-based monitoring teams (CBMTs) of local scientists, teachers, and school children. The design for this observation network builds on the Alaska Lake Ice and Snow Observatory Network (ALISON), a project hosted by University of Alaska Fairbanks from 1999 to 2011 that used this basic premise for hands-on data collection by K-12 students and teachers in communities across Alaska. The Fresh Eyes on Ice CBMTs have expanded to partnering with 14 Alaska communities to collect regular observations of ice thickness, snow depth, and photographs of changing river and lake ice conditions, which also provide opportunities for K-12 students and teachers in STEM education. This project, now in its 4th winter, is fostering new appreciation for environmental change in Alaska and inspiring a next generation of scientists, in addition to providing valuable data and understanding in a time of rapid change.

How a Levee Impacted Water Quality in Piledriver Slough: A Ten-Year Study

Brannan, Teslin R. Ben Eielson High School/FNSBSD, Fairbanks, AK, United States; Baker, Russell Fairbanks BEST Homeschool, Fairbanks, AK, United States; Brannan, Tori L. Salcha Elementary School/FNSBSD, Principal (retired), Fairbanks, AK, United States; Jonas, Jenna Tanana Valley Watershed Association, Fairbanks, AK, United States; Buffington, Christina University of Alaska Fairbanks, Fairbanks, AK, United States; Sparrow, Elena B. University of Alaska Fairbanks, Fairbanks, United States

A 188 million-dollar bridge and levee project on the Tanana River cut off the head of a slough in 2011, leaving it entirely groundwater-fed. The Tanana Valley Watershed Association partnered with the local Salcha Elementary School to involve its students as citizen scientists in monitoring fish passage, habitat, water quality, beaver activity, invasive plants, and riparian changes three times a year over ten years. Eight sites were visited for a total of 1,200 data points using GLOBE (Global Learning and Observations to Benefit the Environment) and Chena River Fish Sampling protocols. Two students started the whole school project in kindergarten and remained active throughout its duration, collecting samples, making observations, and analyzing data. They noticed changes in fish distribution, depth of pools with beaver

dam removal, algae blooms, variability in conductivity, but most notably, a 6-degree Celsius increase in the eight-site averaged summer water temperature.

Investigating an Southeast Alaska Impact Based Atmospheric River Scale

Jacobs, Aaron. NWS Juneau Forecast Office; Dewey, Oliver. Pomona College

An Atmospheric River (AR) is a long, narrow and transient corridor of strong horizontal water vapor transported poleward from the tropics that can lead to heavy precipitation when forced upward. Previous studies have shown that >80% of annual extreme precipitation events are associated with ARs across Southeast Alaska (SEAK) due to the complex terrain and weather patterns. ARs are beneficial when weak, but have devastating effects when extreme. ARs are well studied in the Contiguous U.S., but the relationship between their strength and impacts are not well understood in SEAK.

A multi-year study using Climate Forecast System Reanalysis (CFSR) data from 1981-2022 and the Automated Atmospheric River Detection (ARDT) algorithm from NOAA's Physical Sciences Laboratory (PSL) to identify AR events over SEAK. We looked to classify these AR events in SEAK by comparing the severity of impacts and certain AR parameters, duration of events, and strength of Integrated water Vapor Transport (IVT). Not all ARs are the same, so creating a scaled AR rating system (0-5) for SEAK will help forecasters better understand AR impacts and then message those impacts to the public and emergency management community. This work is similar to previous studies done by the Center for Western Weather and Water Extremes (CW3E) at U.C. San Diego and current studies by Environment & Climate Change Canada (ECCC) in the adjacent portion of western Canada.

This presentation will outline the findings which indicated no strong correlation between AR parameters (e.g., event duration and strength of IVT) and impacts. We also found that impactful IVT values were more condensed. In other words, we do not see the very high IVT values (>1000kg/m/s) and the very low values (IVT=250kg/m/s) really do not cause any impacts. Also, AR level 4 and 5 storms only occurred during a certain time of year (fall/early winter) and lasted greater than 36 hours. Other factors that need additional investigation include rain on snow (ROS) events and antecedent soil conditions.

Mapping Hydro-Kinetic Energy

Daanen, Ronald. Alaska Department of Natural Resources Division of Geological & Geophysical Surveys

The Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS) is expanding research in the hydrological sciences. Alaska legislators recently provided funding for a new position at DGGS focusing on in-river water energy resources mapping. This new program in the recently established Hydrology and Surficial Geology section in DGGS will research the energy available for generating distributed hydropower, such as hydrokinetic power generation, for remote locations and for potential contributions to the existing power distribution networks. The goal for this position is to find a balance

between practical energy harvesting and minimal environmental impact and costs. Close collaborations with other agencies will be established to prevent negative impacts on streams and to explore new technologies to be developed with research entities such as the Alaska Center for Energy and Power research program on hydrokinetic research. Climate variability from month-to-month, such as increasing storm intensity and violent spring breakup that generates large amounts of debris poses great challenges to the continual harvesting of hydrokinetic energy. The task is to illustrate those challenges in a map for the entire state.

Secrets of the Brooks Range: Pingo and Watershed Development in Northern Alaska

Wieland, Logan R. UAA; Klein, Eric S. UAA; Hughson, Kynan H.G.

Examining the development and formation of pingos (perennial mounds of massive ice and permafrost soils) can help reveal the response of periglacial landscapes to past and future hydroclimate variability. However, there have only been a few studies of pingo formation and development in Arctic Alaska and none of these studies include any of the densely pingo-populated Hulahula River Valley in the Brooks Range of Northern Alaska. As such, this study uses subsurface imaging (via pseudo-three-/two-dimensional frequency-domain electromagnetic conductivity surveying) and surface sample based paleoclimatological reconstructions (stable water isotopes, dendrochronology, radiocarbon dating, and carbon accumulation models) to investigate the response of pingos and their watershed in the Hulahula Valley to hydroclimate changes during the late Holocene. We find that these pingos were likely hydraulically-open system (phreatically fed ice cores), the formation of which modified the phreatic flow regimes within their host alluvial fans on the valley flanks. Since their incipient collapse, these pingos have served as a new source of groundwater through the decay of their ice cores to feed the river and surrounding landscape. Geophysical surveys also indicate an increased active layer thickness, pointing toward the ultimate degradation of once continuous permafrost. While sediment based geochronology reveals accelerated organic carbon accumulation within the last century throughout the valley, which may be related to increased precipitation from the Arctic Ocean and pingo-sourced groundwater linked to a wetter and warmer climate. These hydroclimatic changes likely extend growing season and increased active layer thickness as a result of anthropogenic climate change over the past 40+ years. Yet as the future Arctic is projected to be warmer and wetter than the present, we anticipate accelerated pingo ice and permafrost decay with a reciprocal explosion in organic growth and shifting biosphere composition throughout the Hulahula River Valley.

Spatial and Temporal Characteristics of Aufeis features in Northern Alaska

Baughman, Carson A. USGS Alaska Science Center

Aufeis fields are a significant component within the hydrologic systems they occupy. Aufeis can control erosion rates and river channel morphology by redirecting and impounding stream flow which facilitating

channel migration and the widening of river flood plains. Rapid and significant changes within the arctic are impacting many elements of the cryosphere and arctic ecosystem. Monitoring the extent, occurrence, and trends of aufeis occurrence within the major rivers of the 1002 area is important for assessing the regional impact of climate change. Our study utilizes the Landsat satellite record, the longest, most consistent remote sensing record available, to quantify historical occurrences and seasonal trends of aufeis within the 1002 area. Distribution of aufeis fields varies between river systems and prominent changes in the extent and type of aufeis distribution occurs across the 1002 area when comparing the early (1986-2002) and later (2004-2021) time periods. Additionally, four persistent aufeis fields analyzed for seasonal trends suggest that aufeis fields are melting faster and earlier within the thaw season.

Study of Waterways in the of Utqiaġvik, Wainwright, and Atqasuk Region of the North Slope

Germann, Justin T. ADNR DGGS; Daanen, Ronald P. ADNR DGGS; Wikstrom-Jones, Katreen ADNR DGGS; Stokes, Tyler B. ADNR DGGS

In the summer of 2022, the Alaska DNR Division of Geological & Geophysical Surveys (DGGS) staff in partnership with the North Slope Burrough began installing hydrological and environmental instrumentation in Alaska's North Slope between the communities of Utqiaġvik , Wainwright, and Atqasuk. The main purpose of this equipment is to inform best practices for the construction of a permanent road corridor within this region as a part of the Arctic Strategic Transportation and Resource Project (ASTAR). In August 2022, seventeen Hydrological and Meteorological stations were installed (three 7-meter weather towers, five 3-meter stream gauges, and nine 2-meter snow measurement nodes) in conjunction with the collection of river-bed profile and discharge measurements in five waterways. The stream profile measurements were published in a Raw Data File (RDF) publication by DGGS in December 2022. Each water body detailed in the RDF also has its river stage continuously monitored by a vibrating wire piezometer and a camera, this data will be made available publicly when the network is completed in 2023. Our group is currently in the process of publishing a document detailing the instrumentation and geospatial information for each installation.

During the field season of 2023, three network repeater stations will be installed to allow for the wireless upload of collected data, followed by the installation of five more gage stations. Much of the studied waterbodies have not been subject to a long-term continued study due to their remote location, and extreme environmental conditions. While the primary goal of this study is to better inform the environmental impact statement, and road construction techniques, our goal is to make this data publicly available for researchers interested in the long-term and seasonal evolution of small to large waterways within Alaska's North Slope particularly in this era of rapid environmental changes.

The River's Watchers - Learning from the Native Village of Georgetown Water Monitoring Program

Johnson, Barbara A.L. Native Village of Georgetown

The Kuskokwim River and its tributaries ensures quality of life for the region by providing food, water, and transportation to those in its care. However, the Kuskokwim is also vulnerable to climate change and residents are noticing changes. Increasing water temperature and decreasing pH could have significant consequences on the rebounding salmon populations and other fish species. An increase in contaminants, including mercury and arsenic, could be leached from the ground through water acidification. Unsafe travel conditions can occur in the winter due to decreased ice forming on the river. The Kuskokwim needs protection to ensure its vitality for future generations to come. Since 2008, the Native Village of Georgetown (NVG) has collaborated with other Middle Kuskokwim Tribes to collect data to establish the water quality baseline. In the past 15 years, NVG's water monitoring program has undergone numerous transformations and learned (and continue to learn) many lessons, including establishing and maintaining inter-tribal partnerships and agency collaborators, changing the objectives and sampling protocol and prioritizing Tribal member involvement with limited funding available.

Using "Big Data" and Ecological Stoichiometry to Inform Water Resource Management

Larson, Erin I. UAA Alaska Center for Conservation Science; Brucker, Casey. University of Wyoming; Petersen, Chad. University of Nebraska-Lincoln; Ehlers, Elise. University of Nebraska-Lincoln; Halvorson, Halvor M. University of Central Arkansas; Collins, Sarah. University of Wyoming; Corman, Jessica R. University of Nebraska-Lincoln

Ecological stoichiometry is a theoretical framework that has applications for water resource management. For example, the relative availability of different elements can trigger harmful algae blooms, affect drinking water quality, and influence the production of important species, like salmon. Compiling ecological stoichiometry data into a centralized database allows both theoretical and applied questions to be answered about how the relative availability of different elements might affect water resources. The Ecological Stoichiometry Cooperative (ESC) aims to fill some of these gaps in organismal aquatic stoichiometry data with the creation of a novel database, Stoichiometric Traits of Organisms In Their Chemical Habitats (STOICH). The STOICH project has created an open source database of new and existing data from sources such as NEON, USGS, an expansive literature survey, and author contributions. This database will allow users to test broader predictions about the role of ecological stoichiometry across landscapes to better predict changes to water resources. Specific research aims utilizing the data from STOICH include exploring structure and function of aquatic food webs and illuminating macrosystem patterns in biogeochemistry. We will present the database structure, decision-making and creation process, research aims, and current progress of the STOICH project. The water resources community is invited both to contribute data and to use the database for their own purposes.

Alaska Water Budget and the Alaska Water Use Data System (AKWUDS)

Kevin Petrone C, Alaska Hydrologic Survey, Daniels, Adam, Alaska Department of Natural Resources, Alaska Hydrologic Survey

Alaska is purported to contain up to 40% of the freshwater resources of the United States with a significant portion of U.S. freshwater runoff to the oceans. In this study, the hydrologic budget of Alaska (precipitation inputs - runoff outputs) is compared to Alaska Water Use by the population. Alaska Water Use is reported to the Alaska Department of Natural Resources, Alaska Hydrologic Survey (AHS) that maintains the Alaska Water Use Data System (AKWUDS), a database of monthly water use data records from statehood to present. Recent improvements in the AKWUDS database collect valuable metadata (surface and subsurface source type and locations, hydrologic unit, aquifer type, etc.). Overall, we find that Alaska water use is small proportion of Alaska's overall water budget, especially when compared to the lower 48 states. Alaska hydroelectric water use, a non-consumptive water use, far exceeds all other water use types. Among consumptive uses, Alaska potable supply, including public supply and self-supplied domestic, is the largest water supply category followed by industrial uses (mining, oil and gas). Although Alaska has an abundance of water, water is not always available when and where it is needed. Surface water supply is affected by frozen winter conditions and groundwater is not always readily available due to low-supply aquifers and the presence of permafrost. The future of Alaska's water budget will depend on the balance of precipitation and evapotranspiration as well as the contribution of glacier losses and human uses.

Preliminary Results of the US Geological Survey Alaska Transboundary Rivers Monitoring Project

Hamblen, Jenn. US Geological Survey; Moran, Patrick. US Geological Survey; Conaway, Jeff. US Geological Survey. Host, Randy. US Geological Survey

Proposed and ongoing mining activities in Canada have caused concern within Southeast Alaska communities and Tribes about the potential impacts from mining on local foods, especially salmon, and on the economies of commercial and sport fishing in the region. Three proposed megaprojects in this region would be larger than the current biggest mine, Red Chris in the Stikine watershed. Also, a historic mine in the Salmon watershed within a few kilometers of the US border is scheduled to reopen in 2023. These concerns led to funding from Congress for the US Geological Survey to sample water quality and measure discharge at gaging stations on five Transboundary rivers in Southeast Alaska. Sampling began on the Unuk River in 2017 and by 2020 included the Alsek, Taku, Stikine, and Salmon Rivers. To date, over 140 samples have been taken at the five stream gaging sites. Water quality sampling preliminary results mid-way through the project suggest that the two most southern rivers, the Unuk and Salmon, have elevated concentrations of metals such as copper and zinc compared to the other three rivers. The Transboundary project is ongoing, with the goal of collecting at least five years of samples in all seasons at the five gaging stations in order to describe current conditions and develop surrogate models from continuous, real-time

water quality data collected at each site. The project has also fostered new working relationships between Southeast Alaska Tribes and some Canadian First Nations via a water quality monitoring working group.

Alaska's Kenai River Water Quality Monitoring Project: 22 Years of Community Supported Research

Meyer, Benjamin E. Kenai Watershed Forum

The Kenai River in southcentral Alaska is among the world's most famed wild salmon rivers, and continues to support diverse fisheries and the people who rely on them as it has for millennia. In the year 2000 a group of local residents concerned about water quality issues worked with scientists to develop a water quality monitoring plan, which has been carried out continuously each year to present day. Today the nonprofit Kenai Watershed Forum coordinates the efforts of state, federal, tribal, municipal, and nonprofit partners to monitor water quality trends throughout the river. The twenty-two year continuous dataset represents a long and robust water quality dataset and has been applied successfully to identify and solve critical local conservation issues. For example, in the mid-2000's increases in hydrocarbon pollution from two-stroke boat motors led to their ban, as well as a tribal-supported motor buy-back program, gradually transitioning all boats to cleaner four-stroke engines. More recently, observed increases in levels of dissolved zinc and copper have helped focus future efforts towards solutions including green storm water infrastructure. The partnership serves as a model of diverse interests and institutions joining to support the common cause of keeping rivers healthy for fish, wildlife, and humans.

Protecting Fish and Wildlife Habitat: Alaska's Instream Flow Program

Larquier, Ann M.; Ellis, Leah M.; Klein, Joe P. Alaska Department of Fish and Game

The demand for water is increasing and continued wise management of water resources is essential to the overall economic and social well-being of Alaskans. The mission of Alaska Department of Fish & Game's (ADF&G) Instream Flow Program is to ensure that aquatic-dependent species have sufficient amounts of good quality water to thrive in Alaska's rivers, lakes, estuaries, and wetlands. This is accomplished primarily through three program areas: Reservations of Water, Hydroelectric Projects, and Alaska Clean Water Actions (ACWA).

By determining the amount of water available (hydrologic investigations) and how much should remain in the river or lake to sustain fish and wildlife (reservations of water), ADF&G can help promote wise development and conservation that benefits all Alaskans. The Instream Flow Program serves as the department lead in the FERC hydropower licensing process, coordinating and providing comments to FERC and the project applicant. Staff also assist the applicant with the licensing process and in developing study plans on fish, wildlife, and water resources in the project area. The Alaska Clean Water Actions Program

(ACWA) brings Alaska's three resource agencies together to manage Alaska's waters in a holistic manner by sharing data, expertise, and other information.

Culvert Sizing for Climate Change, Case Studies in Alaska

Betts, Erica D. R&M Consultants

Design engineers in Alaska are challenged with designing infrastructure in a rapidly changing environment. Methods are being explored for incorporating potential climate changes that may occur within the design life of these infrastructure components. This talk will present case studies of culvert sizing exercises for infrastructure projects across Alaska where various methods were used to assess potential changes in flow volumes over the life of the culverts. A discussion of methodology, results, and limitations will be included as well as future directions.

Roughened Channel Design and Construction

Miller, Daniel S. Inter-Fluve, Inc.

Stream bed and bank construction using roughened channel methods are a useful tool for fish passage, channel creation, grade control and ford crossings. A sampling of available aquatic organism passage (AOP) guidelines and roughened channel design references will be presented. This presentation will focus on lessons learned from the design and construction of dozens of roughened channels throughout the Pacific Northwest and Alaska. Design of roughened channels acknowledges that every project is unique; considerations for site specific goals and design criteria are presented and illustrated with project example photos. Design steps including stream flow hydrology, channel hydraulics and stone sizing and gradation are outlined; with more in-depth discussion of design for stone stability and permeability control using the Fuller/Thompson equation for sizing small stone fraction. An example of project plans and specifications are presented. The importance of in-field guidance/direction by the designer directly with the equipment operator during construction is discussed. Tips for infield inspection and adaptive management of stone placement are discussed. Examples of roughened channel construction are presented with photos to illustrate stone properties, mechanical and washing for thorough mixing of large and small stone sizes and finished product. Expectations of roughened channel performance are discussed.

Dave's Creek Substation Flood Mitigation

Grundhauser, Kacy HDR; Lowe, Cynthia HDR

The Dave's Creek Substation is located on the Kenai Peninsula near the community of Sunrise and on the banks of Quartz Creek. Channel migrations in 2021 brought floodwaters close to the substation threatening its operation. Approximately 300 feet upstream from the substation, Quartz Creek shifted main channel flow to a remnant side channel and caused flooding that created an unacceptable level of

risk to the electrical substation, adjacent transmission line and the Sterling Highway. In spring 2022, breakup revealed that Quartz Creek shifted most of its flow into the remnant channel greatly reducing main channel flow. Immediate action was taken to place flexible intermediate bulk containers (Super Sacks) to temporarily divert most of the flow back into the main channel. Two primary alternatives were evaluated to permanently protect the substation and redirect water back into the main channel: a steel sheet pile wall and a riprap guide bank. The use of riprap to create a guide bank, frontage embankment and buried trench to protect two sides of the substation and main transmission lines were selected for design and construction. Project stakeholders consisting of the Cooper Landing Advisory Planning Commission, Kenai Peninsula Borough Planning Commission, Alaska Department of Fish and Game, Alaska Department of Natural Resources, Kenai River Center, and the Army Corps of Engineers issued necessary approvals and permits for project construction. Construction began in late September 2022.The design was adjusted throughout the project to accommodate agency requests, the further migration of Quartz Creek into the side channel, and the development of sinkholes. Final quantities placed were 242 cy of filter rock and 1,430.32 cy of riprap Class III. The project was completed in late October 2022 and considered a success to the project stakeholders, who expressed their satisfaction during the final walkthrough.

A Fresh Look at Ground- and Groundwater-Sourced Heat Pumps - An Alaska "Heat Rush"?

Munter, James A., J. A. Munter Consulting, Inc.

Heat pumps are widely viewed as efficient methods for home heating, even in northern latitudes. Ground- and groundwater-sourced heat pumps in Alaska come with higher upfront costs, but yield higher efficiencies compared to air-source heat pumps. Air-source heat pumps exhibit very low efficiencies when the weather is coldest and heat is most needed.

Despite generally low ground temperatures, the southern half of Alaska possesses prodigious amounts of extractable heat in the upper 1000 feet of the earth's crust. Efficient heat pumps have the potential for reducing overall energy usage in home heating, however prior studies have shown that they are not economically competitive in areas served by natural gas. In other areas such as Fairbanks, Juneau, and Seward, however, they appear viable based on a 15-year payback period.

Studies have shown that shallow loop earth systems in the Fairbanks area work best in south-facing soils with good seasonal solar exposure to offset long-term heat extraction from the soil. An alternative long-term heat source is deep boreholes where the geothermal gradient provides warmer conditions. Groundwater provides a potential heat transfer mechanism to enlarge the heat-extraction zone.

Traditional evaluation of heat pumps based on the number of years until "break-even" are increasingly being influenced by evaluation of carbon dioxide emissions of heating alternatives. At Fairbanks, wood stove air quality concerns and climate-warming soot are also potential factors. In Anchorage, potential long-term limitations on supplies of natural gas in Cook Inlet may also be a factor. Recent changes to tax

law may also favor heat pump installations. These factors all may have the potential to cause a new "Heat Rush" in Alaska by increasing the overall long-term economic and environmental viability of air-, water-ground- and groundwater-sourced heat pumps.

Hydropower Opportunities with Change

Carey, Bryan E Alaska Energy Authority

Changes in glaciers and streams are presenting new opportunities hydropower generation that were not present a decade or two ago. Presentation will be on one such opportunity.

Groundwater Inputs to an Alpine Hydroelectric System

Brailey, David E. Brailey Hydrologic

The Juniper Creek hydroelectric system displaces 2 million pounds of carbon dioxide annually and meets the annual energy demand for 200 homes. With 370 feet of head and a design flow of 13.3 ft3/s, the system delivers a constant 300 kW baseload from June through October, declining toward an annual low in May. Up to half of the winter flow consists of groundwater sourced from a series of springs. The spring water increases annual power production by about 15 percent and prevents ice formation on the intake screen. For year-round operation, a 50 percent increase in minimum generation capacity allows a corresponding increase in the maximum design flow.

Juniper Creek flows through an underfit gorge cut by receding glacial meltwaters. An upstream tarn limits bedload to weathering of the armored streambed, resulting in minimal sediment accumulation in the spillway pool. Providing groundwater freeze-protection, sediment control, and by eliminating woody debris, the alpine environment results in a nearly maintenance-free intake. After initial balancing of control parameters, the system has been 100 percent reliable for its first 18 months of operation.

Advancements in River and Tidal Energy Production in Alaska

Jackinsky, Merrick F. ORPC

This presentation will provide and update on ORPC's RivGen Power System operations in Igiugig, AK and it's interactions with the Kvichak River as well as address initial findings for the potential to produce Hydrogen using tidal power systems in Alaska.

Rapid Talks

Rapid talks are a category of short presentations on each day of the meeting during session breaks. These will be up to 5 minutes (0-2 slides) on topics of interest to our membership that aren't conducive to a full-length presentation. You may sign up to give a rapid talk while at the conference if space is available.

Alaska Pacific River Forecast Center Will Get a First Look at the Operational National Water Model for Alaska in 2023

Streubel, David. National Weather Service

Applications of Various Camera and Images Types for Understanding Groundwater and Surface Water Interactions

Lilly, Michael. Wilson, Phillip. Geo-Watersheds Scientific

Campbell Scientific Solutions for Cold Climate Hydrologists

Laudenklos, Tyler. Campbell Scientific

DEC Marine Water Quality Monitoring Activities

Fidel, Maryann. State of Alaska, Department of Environmental Conservation, Division of Water

Rising Groundwater Levels Observed in a USGS Monitoring Well in Fairbanks

Conaway, Jeff. U.S. Geological Survey

RiverRay ADCP Discharge Measurements and Capabilities

Devon, Roe. Michael Baker International

Salmon Watershed Stewardship: Engaging Diverse Communities in Stewardship of Wild Salmon in Cook Inlet, Alaska

Larson, Erin. UAA Alaska Center for Conservation Science

Tanana Sponsors

Geo-Watersheds Scientific

Campbell Scientific

Individual Stations to Large Data Networks

Research – Monitoring – Compliance
Winter Hazards – Emergency Response
Hydrology – Weather – Transportation
Combined Multi-Purpose Networks

Over Three Decades of Proven Alaska Performance
Reliable Quality – When and Where You Need It

Atigun Pass – Advanced RWIS
Winter Hazards Station

Seward Highway – Mini-RWIS
Active Avalanche Zone