

Joint Effort Launched to Enhance Water Level Observing in Arctic

Pilot projects are underway along western and northern Alaska coasts in the summer and fall of 2016 as part of a new collaboration to develop an Alaska-wide integrated water level sensor network.

These shorelines are some of the most critically under-instrumented coastal and nearshore areas in the U.S., even as many communities face frequent flooding, erosion and possible relocation. Accurate water level observations are critical for flood forecasting, informed emergency response, ecosystem management, safe navigation, efficient mapping and charting, and scientific research. Yet traditional measurement methods are often precluded by remote locations, harsh weather conditions and high costs.

The National Weather Service Alaska Region and AOOS have joined forces with a host of other partners to test the use of low-cost sensors, land-based technologies and rapid deployment strategies to densify and improve coastal water level and inundation observations for Arctic Alaska through innovation and data standardization. These efforts are designed to knit together diverse observation strategies into an integrated system. The effort began in 2015 with a 2-day workshop that informed the synthesis report *Coastal and Nearshore Water Level Observations in Alaska: Challenges, Assets, Gaps, and Next Steps* (available at <http://www.aos.org/workshops-and-reports/>).

The efforts include the installation of a new National Water Level Observation Network (NWLON) tide station at the Unalakleet city dock in July (see Figure 1). NWLONs are considered the “gold standard” for water level observations nationwide. With seasonal sea ice, steep operation costs in remote Alaska, and few existing structures such as ports and docks, the opportunity to close observing gaps in western and northern Alaska with NWLON stations alone is limited. NWLON stations are presently located in this region only in Village Cove (St. Paul Island), Nome, Red Dog, and Prudhoe Bay.

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Figure 1: Aerial view of Unalakleet NWLON station located on the city dock northeast of the Unalakleet River mouth (ADNR 2014 image), inset photo looking south towards the station well attached to the sheet pile wall.

Photo courtesy of Cody Mayfield, JOA Surveys

New Stakeholder Products and Tools Being Tested

Viewing Change in Western Alaska

A new data product is now available on the AOOS Ocean Data Explorer that broadly depicts locations where land is eroding or where sediment is being deposited in western Alaska. The product is based on Landsat satellite imagery from 1972-2014, which was compiled and analyzed by ABR, Inc. with support from the Western Alaska LCC. It documents significant landscape changes such as spit or barrier island migration, extreme coastal bluff retreat, estuary contraction or expansion, water channel migration, and draining/infilling or formation of lowland lakes close to the coast.

AK Shoreline Coastal Profile Database Tool

A new interactive mapping application will be available in September that allows users to visualize and assess changes in coastal elevation profiles of Alaska shorelines. The tool will display “elevation snapshots” (imagery and survey data collected perpendicular to the coast) provided by the Alaska Dept. of Natural Resources, the USGS, and local academic and community partners for a number of coastal beaches throughout Alaska.

Color indexed maps help interpret flood forecasts

A pilot project of color-indexed maps for five flood-vulnerable communities in western Alaska will soon be expanded to more communities (see Figure 2). Since flood forecasts from the National Weather Service are often provided using terms that are unfamiliar to rural communities, this project converts storm surge, tide and elevation data into a digestible visual format and displays that information overlain on familiar state community planning maps (<http://www.dggs.alaska.gov/pubs/id/29129>).

More Tidal Predictions Available

Since there are only a limited number of fixed tide stations or established prediction points based on historical tide data in Alaska, forecasting tides for much of Alaska’s coastline is challenging. AOOS is using data from a modeling project funded by the National Weather Service and Western Alaska Landscape Conservation Cooperative to provide community managers access to more accurate tidal information for specific locations along the entire coastline of Alaska. ■

These new tools will be available on the Ocean Data Explorer (<http://portal.aos.org/>) at the AOOS website (AOS.org) when finalized.



Figure 2: Color-indexed elevation map for Golovin for flood communication.

Observation Pilot Projects Underway

Freeze-up Detection Trial Mooring – In 2015, a prototype mooring designed to inexpensively and accurately predict the onset of fall ice formation successfully reported real-time temperature and salinity on the Chukchi Sea shelf during the fall freeze-up cycle. A repeat is planned for 2017 with real-time data to be provided to the NOAA NWS GTS (Global Telecommunication System) for evaluation in real-time ice forecasting models.

Beaufort Bottom Pressure Observations – Simultaneous and co-located measurements from a conductivity, temperature and depth (CTD) instrument equipped with a highly accurate pressure sensor alongside an acoustic Doppler current profiler (ADCP) will provide valuable information on the combined effects of waves and high sea levels, especially during storm events. Although not real-time, these data will help improve storm surge predictions and an understanding of the impact of shelf waves on Beaufort coastal erosion.

Acoustic Water Level Sensors – Three new and six existing bridge-mounted, satellite telemetered water level gauges will be installed and maintained over tidal rivers in nine remote Alaska communities (Figures 3 and 4). These low-cost, easily deployed instruments produce real-time data that supports timely and accurate forecasts and warnings for hazardous weather and flooding. Data are available on the AOOS Ocean Data Explorer (Figure 5). The devices, called iGages, were designed and tested by the NWS Alaska-Pacific River Forecast Center, built in-house, and are battery and solar powered.

LiDAR Mapping – A 2016 project will collect light detection and ranging (LiDAR) imagery to derive spatially expansive, high-resolution elevation data over the Yukon and Kuskokwim River Delta region for mapping, emergency response planning, and other resource management activities across this impacted region. The area is home to multiple communities highly susceptible to coastal flooding associated with storm surges, which are exacerbated by shallow bathymetry, orientation and low topographic relief along the coast.

Rapid Deployment Water Level Sensors – A rapid deployment water level sensor system, modeled after a response tool used by USGS on the east coast during Hurricane Sandy, will be tested in western Alaska this fall. The pilot project will allow residents in Shishmaref, Shaktoolik and Kivalina – communities impacted by fall-winter storm surges – to quickly deploy water level sensors during storm events. Post-storm data will be used by the National Weather Service to improve future storm surge forecasts. Each mount will be equipped with an internally recording, Bluetooth-capable water level sensor and deployed by a trained community member prior to predicted storms.

Testing Use of GPS Reflectometry – AOOS is researching the efficacy of land-based GPS/GNSS reflectometry water level measurement techniques. A pilot project is planned for 2016 near Anchorage to evaluate reflectance data collected using an ASTRA GPS receiver. Also in 2016, UNAVCO, a national non-profit geodetic research consortium, will perform reconnaissance at candidate sites in remote western Alaska that would satisfy both geophysical research and water level monitoring objectives for an interdisciplinary GPS/GNSS installation in the near future. ■

Figure 3, right: John Henry Jr. (IGAP Coordinator, Native Village of Unalakleet) and summer assistants checking water levels with a lead-line after re-installing the iGage at the Unalakleet River.

Photo courtesy of Nicole Kinsman, July 2016

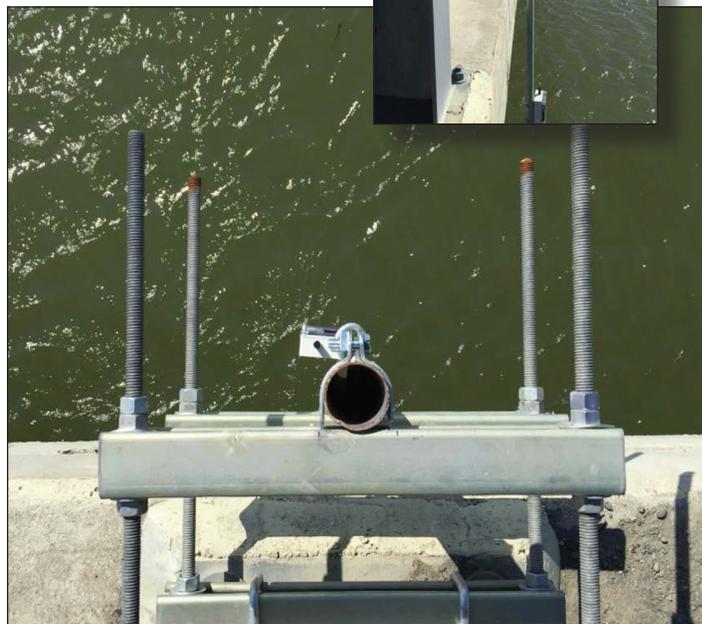


Figure 4: Downward facing view of the re-installed iGage at the Unalakleet River. *Photo courtesy of Nicole Kinsman, July 2016*

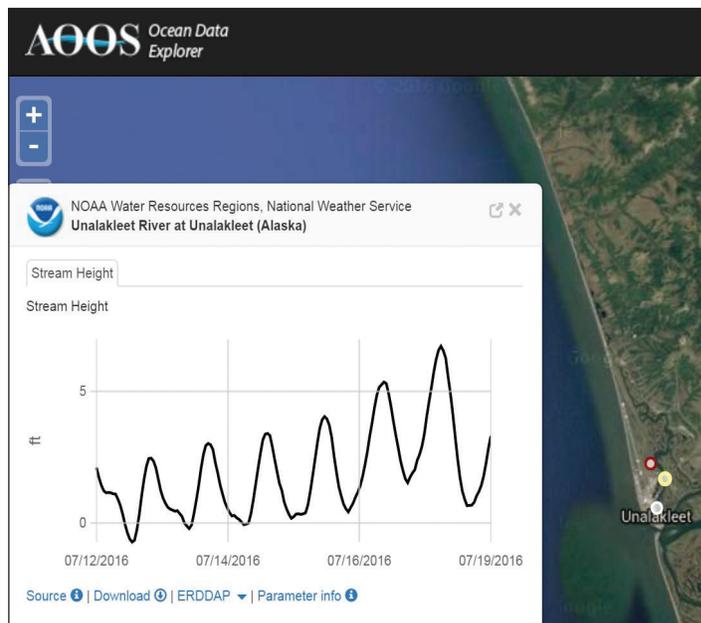


Figure 5: AOOS real-time sensor map showing data from the Unalakleet River iGage after re-installation.

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That's why technical experts from multiple agencies are looking at other approaches to provide data that may not be as accurate, but can be gathered more cost-effectively and in more remote locations. This effort will require collaborative, opportunistic, and innovative instrumentation in close coordination with established monitoring strategies. For example, in 2014-15, AOOS partnered with the Alaska-Pacific River Forecast Center and Alaska Department of Natural Resources to install down-looking acoustic water level sensors on coastal bridges and docks in places like Tununak and Goodnews Bay.

AOOS and its partners plan to evaluate the results of these pilot efforts in 2017 and determine options for sustaining an integrated water level sensor network in the future. ■

Developing the Alaska Integrated Water Level Sensor Network is a joint effort of AOOS, NOAA's National Weather Service (NWS), NOAA's Center for Operational Oceanographic Products and Services (CO-OPS), NOAA's National Tsunami Warning Center, Department of Interior's Landscape Conservation Cooperatives, IOOS Ocean Technology Transition Program, National Park Service, Pacific Gyre, US Army Corps of Engineers, US Geological Survey, Alaska Departments of Natural Resources and Commerce, Community and Economic Development, Alaska Native Tribal Health Consortium, University of Alaska Fairbanks and UNAVCO's NSF-funded Plate Boundary Observatory Program.



Building at Meshik, the old site for the community of Port Heiden, near an eroding bluff. Photo 2013, Nicole Kinsman

AOOS Helps Launch New Alaska Ocean Acidification Network



Alaska Ocean Acidification Network

The Alaska Ocean Acidification Network is now official. The network is designed to

expand the understanding of ocean acidification (OA) processes and consequences in Alaska, as well as potential adaptation and mitigation actions. Coordinated by AOOS Program Manager Darcy Dugan, the network is the fourth regional OA network in the US, and will help connect scientists and stakeholder communities, recommend regional priorities, share data and determine best practices for monitoring.

The network hosts a comprehensive website with resources for both researchers and the general public, including information on monitoring projects around the state, current trends and forecasts, impacts to Alaska marine life, links to databases and journal articles and a listing of experts and their specialties.

Other network activities include facilitating researchers to speak at venues around the state, hosting webinars, convening scientists to coordinate on research and holding a "State of the Science" workshop in Anchorage Nov 30-Dec 1.

A 12 member advisory committee helps guide the network, with representation from government agencies, research institutions, non-profits, tribes, and the fishing and aquaculture industries. Visit <http://www.aos.org/alaska-ocean-acidification-network/>. ■

Watch for Upcoming Workshops

- AOOS is partnering with Alaska Sea Grant to host a workshop in Anchorage December 8-9 on Harmful Algal Blooms (HABs).
- AOOS and the Alaska Ocean Acidification Network are hosting an OA State of the Science workshop in Anchorage November 30 – December 1. For more information, go to the OA Network site on the AOOS web page.
- AOOS will be working with the Office of Naval Research and IOOS Program Office to host an animal telemetry workshop sometime this winter. Contact Carol Janzen at AOOS if you would like to be involved.
- The workshop series 'Promoting Coastal Resilience and Adaptation in Alaska' continues from the initial effort in Nome in May to Unalaska in August, King Salmon September 21-22, and Kotzebue December 7-8. These workshops are part of a project funded by the Alaska Landscape Conservation Cooperatives (Western Alaska, Arctic, Aleutian and Bering Sea Islands and Boreal) and the Aleutian Pribilof Islands Association. AOOS is co-sponsoring the Kotzebue workshop, as well as ocean acidification sessions at all of them. ■

Annual AOOS Film Contest is Underway

Films of any genre relating to the ocean (e.g., people using the ocean and coast, marine research, marine wildlife, ocean-related policy issues, etc.) are welcome. You don't need to be a professional to submit a film! Rules and submission information can be found on our website. The submission deadline is September 16, 2016. Learn more at <http://www.aos.org/film-contest/>. ■

