Attendee Rules

- ❑ Mute yourself
- ❑ Turn off your camera

2022 Alaska Coastal & Ocean Mapping Summit

The Path Forward

November 16th, 2022

Coastal National Elevation Database Update

Jeffrey J. Danielson – U.S. Geological Survey

USGS Coastal National Elevation Database (CoNED) Update

Jeffrey J. Danielson
USGS EROS / ISAB
CoNED Applications Project Chief

November 16, 2022

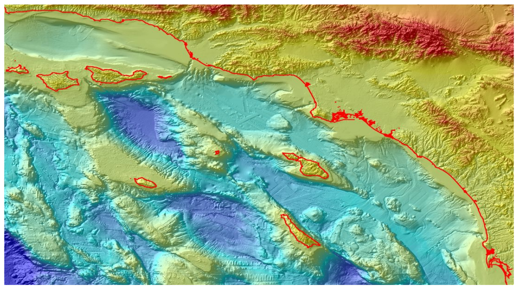
U.S. Department of the Interior
U.S. Geological Survey

USGS Coastal National Elevation Database (CoNED) Applications Project

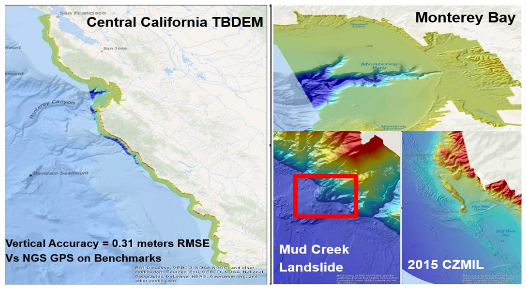
1) Support coastal and marine spatial planning, by constructing the Coastal National Elevation Database (CoNED) at select focus regions thereby establishing a topobathymetric elevation model (tbdem) baseline product for scientific investigations and applications.

2) Conduct 3D point cloud and satellite-based remote sensing research to extend topography and bathymetry data structures for topobathymetric elevation models and create methods for fostering land change science studies.

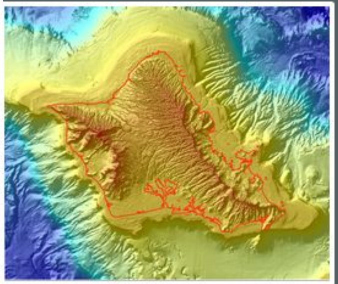
San Francisco Bay



Southern California



Central California



Hawaii - Oahu

Stakeholders: USGS Coastal Storm Modeling System (CoSMoS), NOAA-OCM Sea Level Rise Viewer, NOAA National Water Model, LA CPRA Coastal Master Plan, ADCIRC Hydrodynamic Model, VIMS SCHISM Model, Nature Conservancy Coastal Resilience Viewer, and DOI Pacific Islands Climate Adaptation Science Center

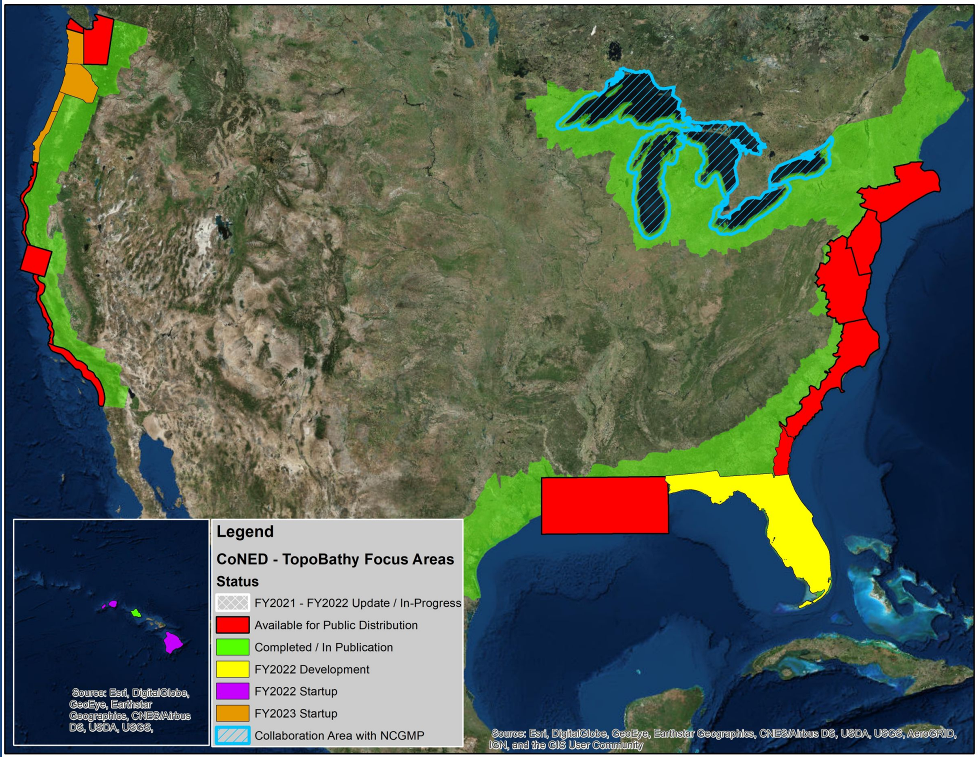
Point of Contact: Jeffrey Danielson, CoNED Applications Project Chief, daniels@usgs.gov

USGS CoNED: Topobathymetric Elevation Model – Requirements / Specifications

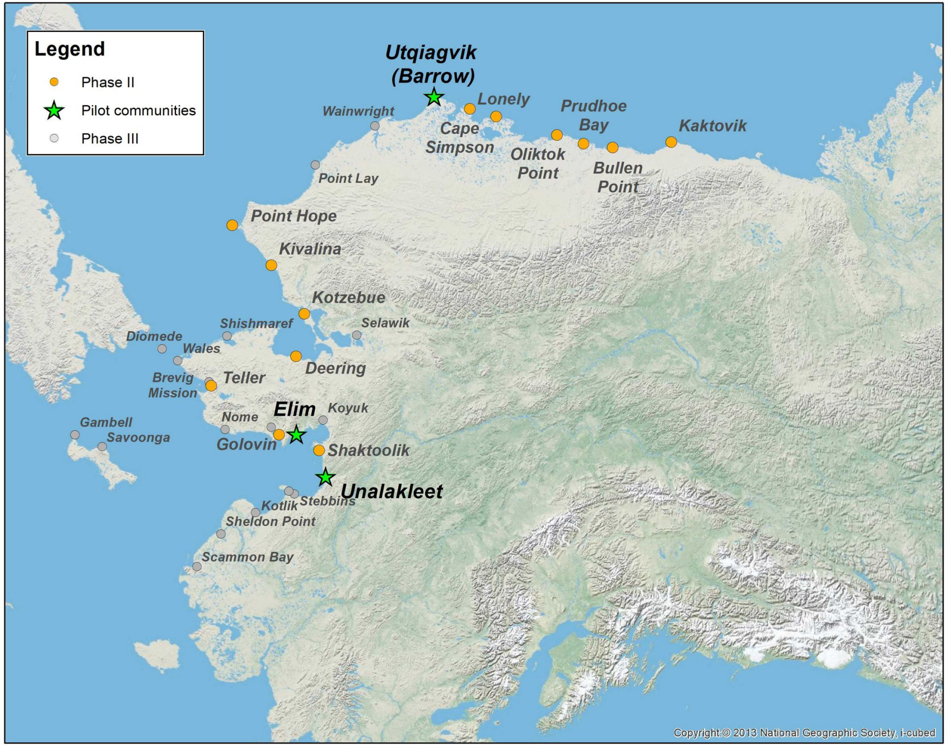
- **Spatial Resolution:** *1-Meter*
- **Projection:** UTM Based
- **Horizontal Datum:** *North American Datum of 1983 (NAD83 2011)*
- **Vertical Datum:** *North American Vertical Datum of 1988 (NAVD88)*
  - *Geoid – Geoid18 or most current geoid*
- **Lidar Accuracy Specifications:**
  - Topographic Lidar: Quality Level 2 (QL2) – 0.7 meter pulse spacing, 2 points per sq. meter, 10cm RMSEz
  - Bathymetric Lidar: Quality Level 2 (QL2B) – 0.7 meter pulse spacing, 2 points per sq. meter, 0.25, 0.0075 vertical accuracy coefficients (IHO S-44), 10cm RMSEz
- **TBDEM Uncertainty**
- **Gap–Filling:** *For areas void of source data, Smooth interpolated areas*
- **Land / Water Masking:** *20m (Land) and 200m (Water)*
- **Interpolation:** *Terrains (Lidar) and Empirical Bayesian Kriging (Sonar)*
- **Nesting:** *Consistent Resampling, Cell Alignment (Pixel Edge), and Spatial Resolution*
- **Federal Geographic Data Committee**

2023 Mapping Activities: TBDEM Mapping Plans

USGS CoNED – TBDEM Integration Plans (FY22 – FY23)



Alaska – Integrated Topobathymetric DEM Development to Support Coastal Flood Hazards



- ❑ Pilot Communities = FY23
- ❑ Phase 2 = FY24 (CoNED)
- ❑ Phase 3 = FY25

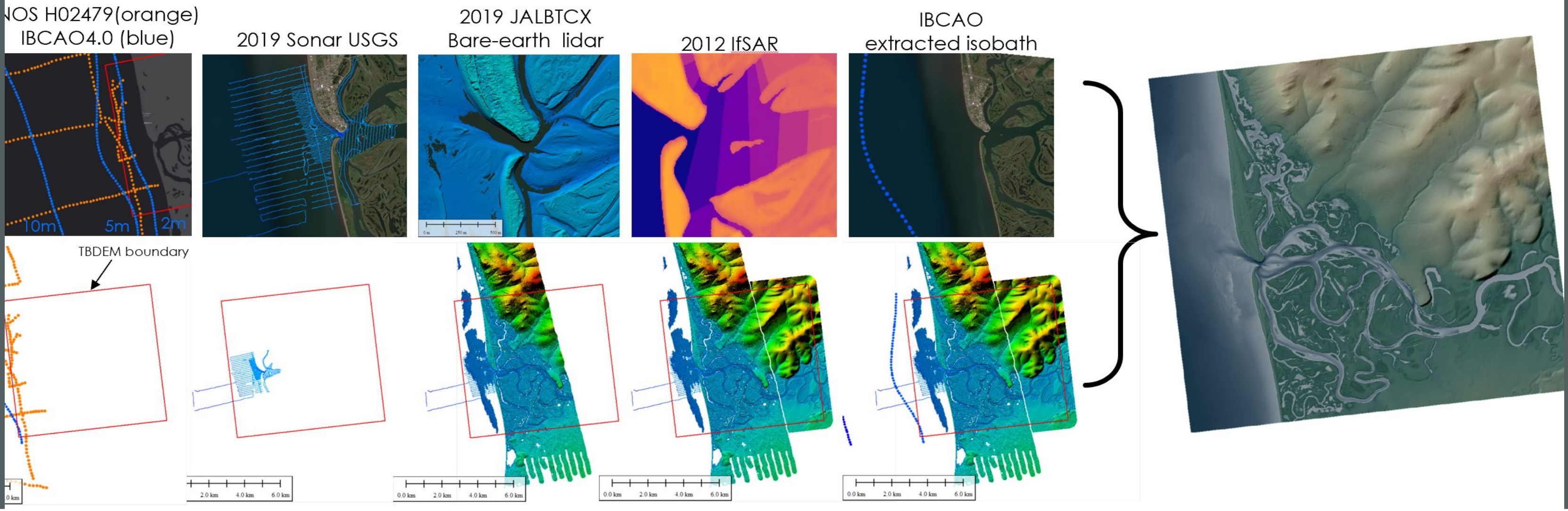
USGS

Alaska – Integrated Topobathymetric DEM Development to Support Coastal Flood Hazards

Accuracy of the flood hazard model is strongly influenced by nearshore bathymetry (< 20-30 m; depending on coastal morphology; e.g. bay vs open coast) **and elevation surface** (overland flow).

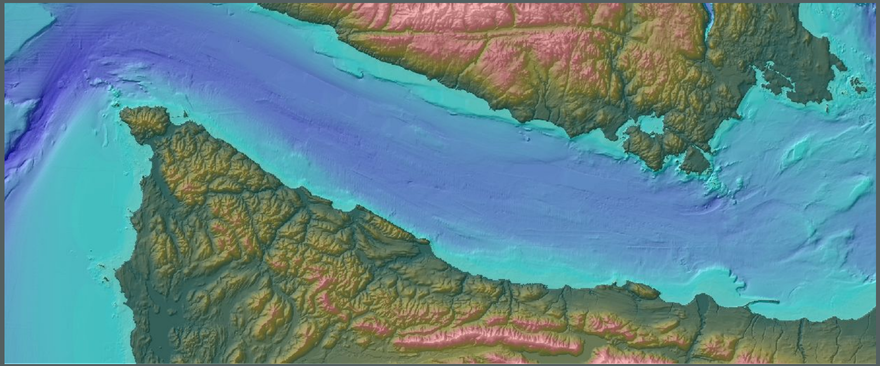
Currently: Building seamless TB-DEMS with available bathymetry and elevation data.

Expand USGS CoNED efforts beginning FY24

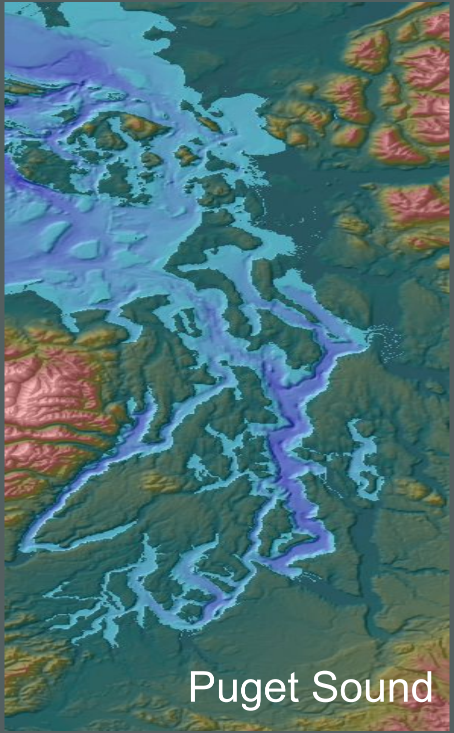


USGS

Pacific Northwest Topobathymetric DEM - CoNED Puget Sound and Juan de Fuca: 1-Meter TBDEMs



Strait of Juan de Fuca

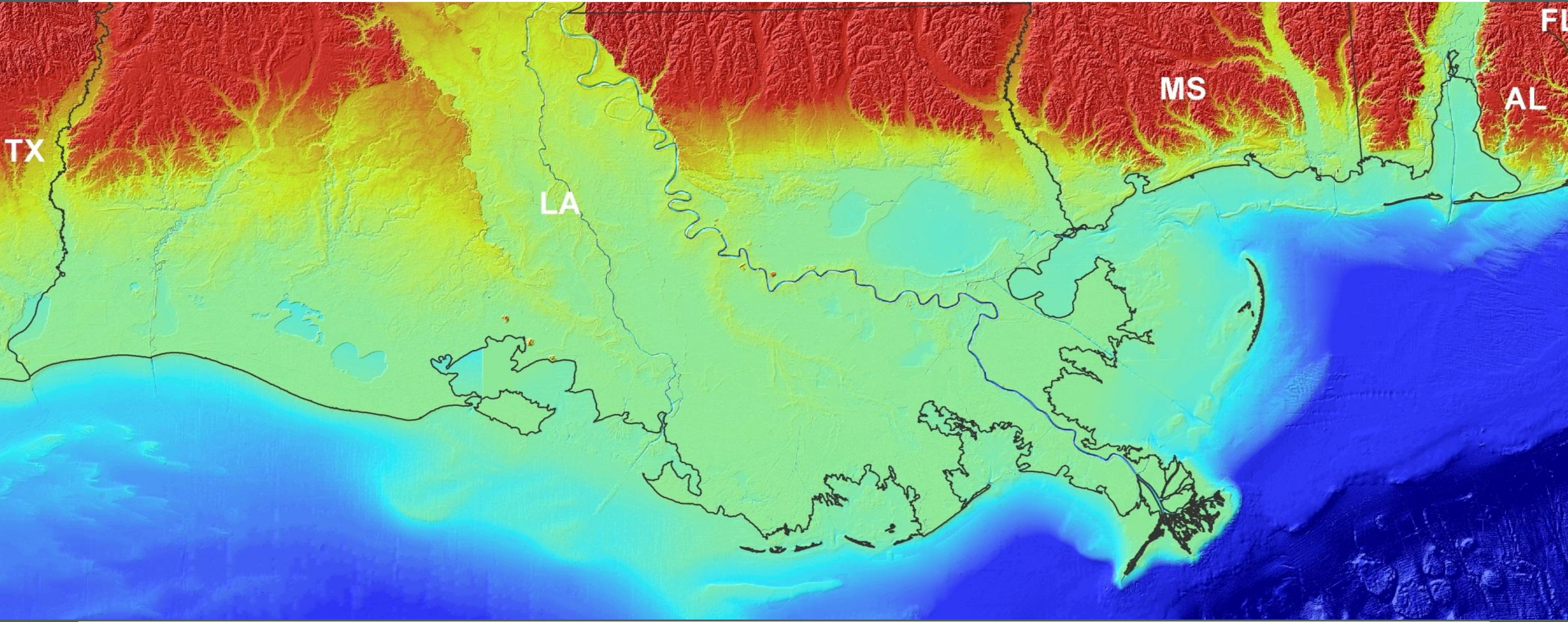


Puget Sound

USGS

Interagency Working Group On Ocean And Coastal Mapping

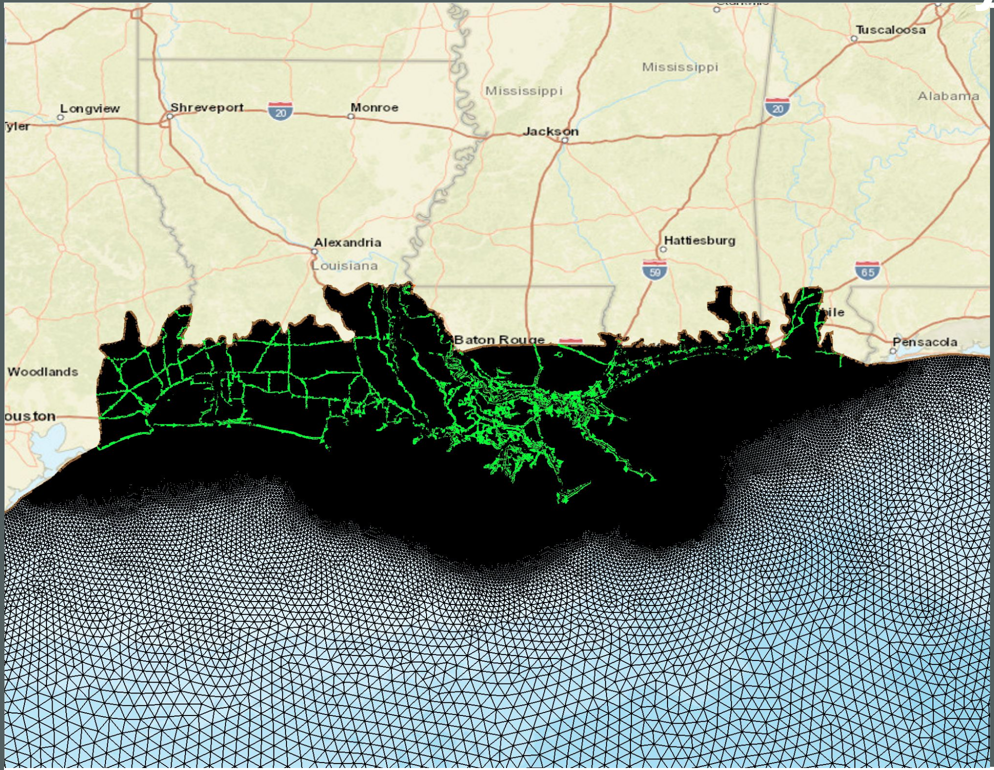
Northern Gulf of Mexico (NGOM2) – USGS CoNED (2022) Integrated Topobathymetric Elevation Model



USGS

USGS CoNED–LA CPRA NGOM2 Collaborative Update

NGOM2 Stakeholder User Community



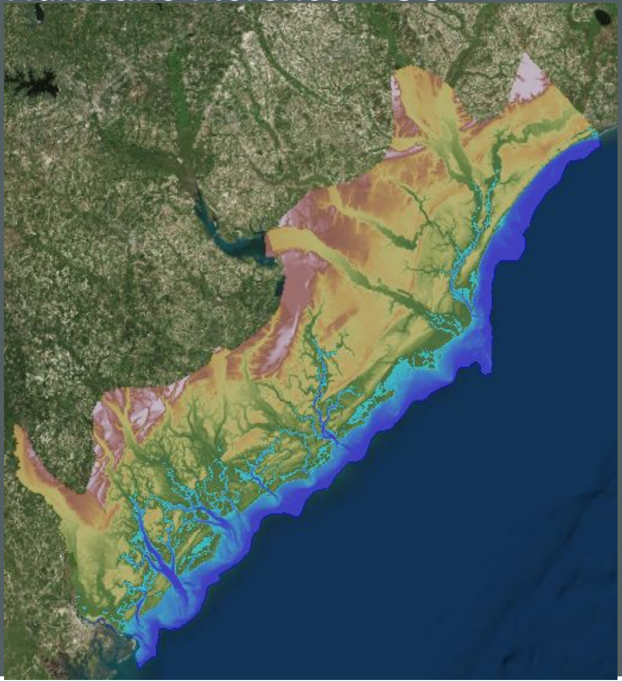
- ❑ ERDC-CL (ADCIRC)
- ❑ Tulane Geology and Modeling
- ❑ The Water Institute of the Gulf
- ❑ USGS CoSMoS, SPCMSC
- ❑ LSU Coastal Studies Institute / LSU Center for Coastal Resiliency
- ❑ LA CPRA Coastal Master Plan
- ❑ NOAA National Water Model

USGS

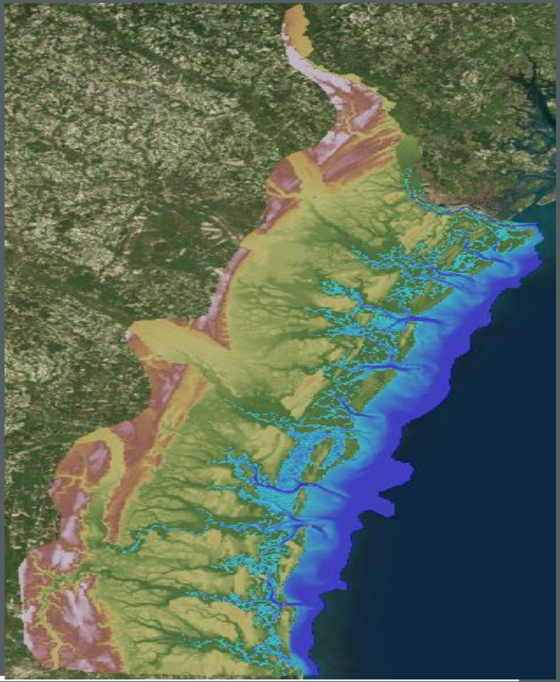
Topobathymetric DEMs – USGS CoNED Update
Hurricane Florence 1-Meter TBDEMs (NC to GA)

Hurricane Florence – NC

Hurricane Florence – SC



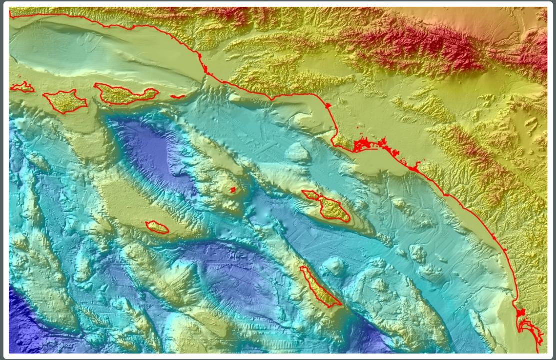
Hurricane Florence – GA



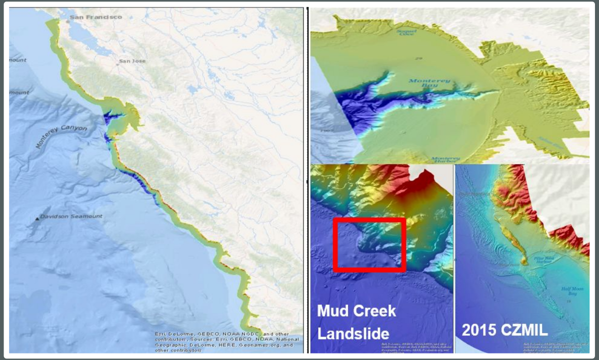
USGS

Questions (Jeffrey Danielson, daniels@usgs.gov)

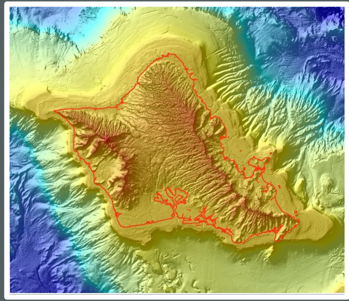
San Francisco Bay



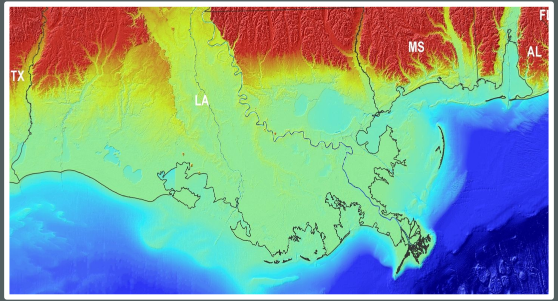
Southern California



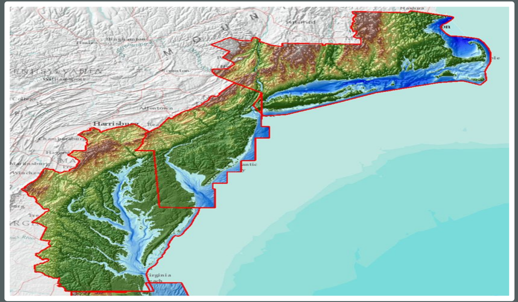
Central California



Hawaii - Oahu



Northern Gulf of Mexico (NGOM)



Hurricane Sandy Region

USGS

Interagency Working Group On Ocean And Coastal Mapping

End of Presentation

Thank you!

GRAV-D & CORS Updates

Nic Kinsman, Steve Bassett, & Will Freeman – NOAA

2022 Alaska Coastal Mapping Summit
The Path Forward - November 16

NSRS Component Updates

ACMS Objective 2.2: Upgrade Alaska National Spatial Reference System Components to Support Mapping Data Acquisition

Nic Kinsman
NGS Alaska Regional Geodetic Advisor

Jeff Johnson
NGS GRAV-D Project Manager

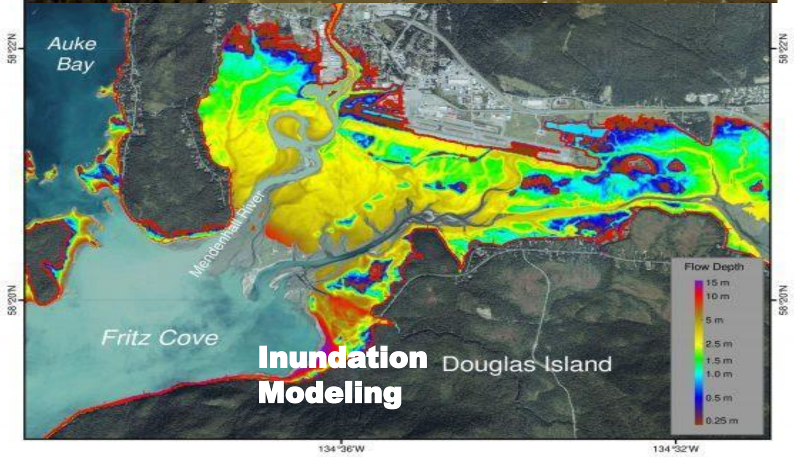
Kevin Ahlgren
NGS Geodesist

Will Freeman
NGS CORS Program Manager

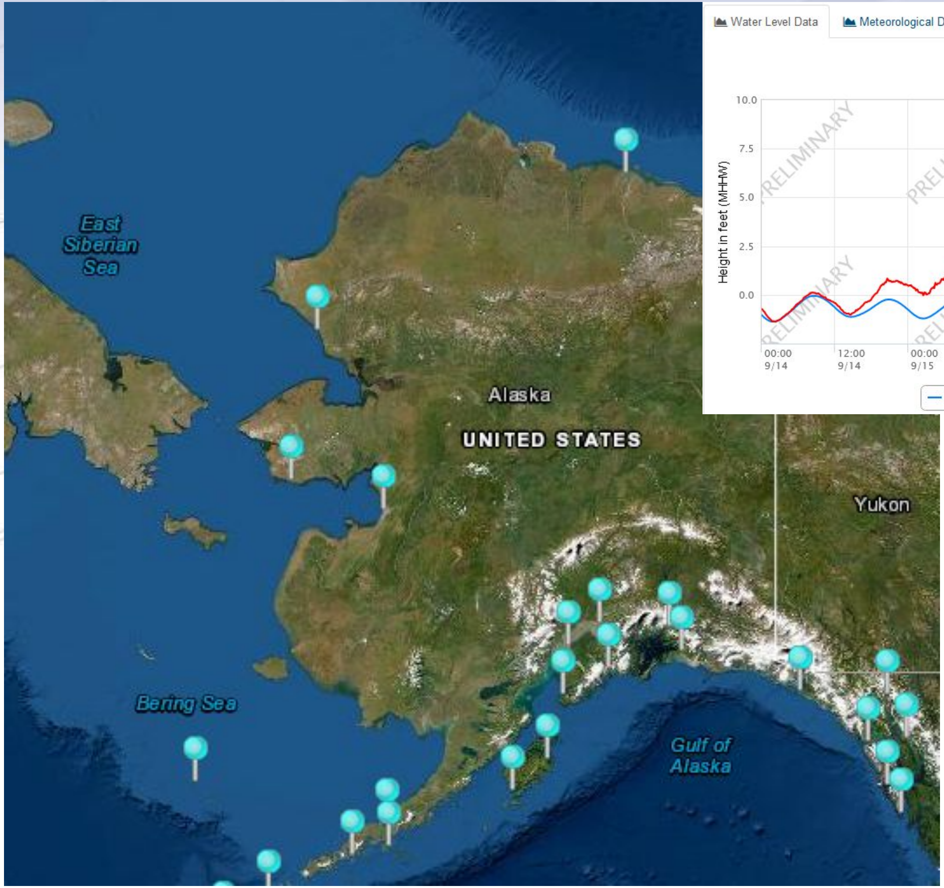
Steve Bassett
Physical Scientist, CO-OPS Tides & Currents

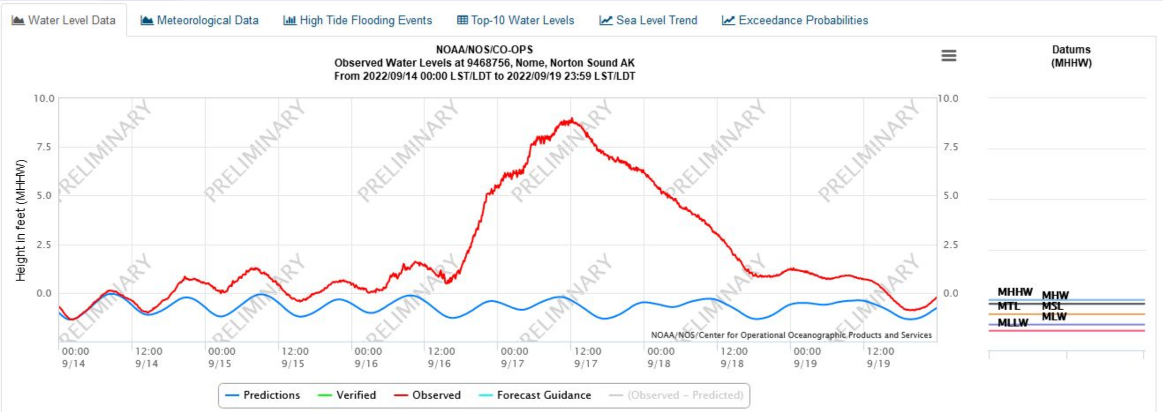
Stephen White
NGS Remote Sensing Division

NSRS & VDatum Support Resilient Infrastructure



NWLON Supports Real-Time Water Levels





9464212 Village Cove, St Paul Island, AK - 3.03 feet above MHHW exceeds the prior record of 2.19 feet set in December 2021. This station dates back to 2002.

9468333 Unalakleet, AK - 9.74 feet above MHHW exceeds the prior record of 8.29 feet feet set in August 2019. Observations date back to 2016.

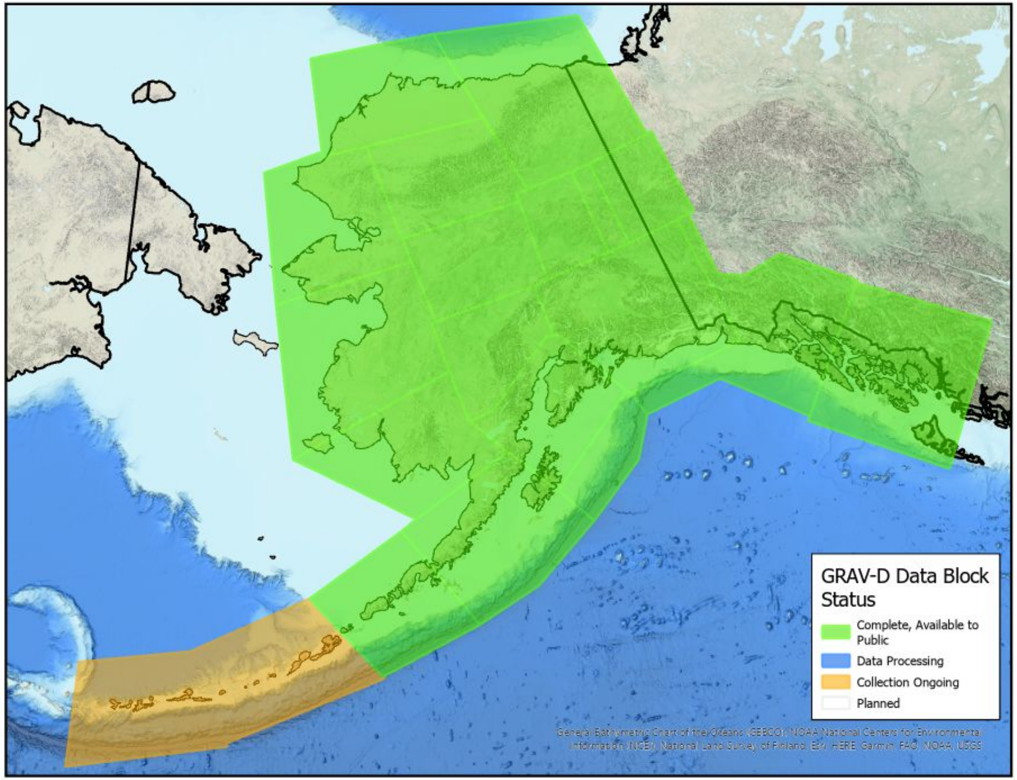
9468756 Nome, Norton Sound, AK - 8.99 feet above MHHW exceeds the prior record of 8.76 feet feet set in October 2004. Water levels peaked at 8.34 feet during the Bering Sea Storm in 2011. Observations date back to 1994.

Implementation Plan Milestones

2.2 Upgrade Alaska National Spatial Reference System Components to Support Mapping Data Acquisition				
2.2.1.1	Remaining areas of AK GRAV-D project completed over Aleutians for 100% Alaska coverage	Oct-2024		In Progress
2.2.1.2	Absolute Gravity Network and Geoid Monitoring Service (GeMS) established to support dynamic geoid (DGEOID) model	Oct-2025		In Progress
2.2.1.3	GRAV-D data fully incorporated into gravimetric geoid model (GEOID2022)	Oct-2025		In Progress
2.2.2	Establish five NOAA Foundation CORS in Alaska	Oct-2023		In Progress
2.2.3.1	Cost assessment to add GNSS to 27 existing AK NWLON sites and 31 new NWLON station to fill Alaska gaps completed	Oct-2022		Not Yet Started
2.2.3.2	Improved geodetic control at water level stations in Sand Point, Sitka, Seward, and Unalaska (Global Sea Level Observing System stations)	Oct-2025		In Progress
2.2.4.1	Short term tidal observations acquired	Oct-2027		In Progress
2.2.4.2	GNSS observations taken on tidal benchmarks	Oct-2027		In Progress
2.2.4.3	Models of transformation grids developed and published for use	Oct-2028		Not Yet Started

Remaining areas of AK GRAV-D project completed over Aleutians for 100% Alaska coverage

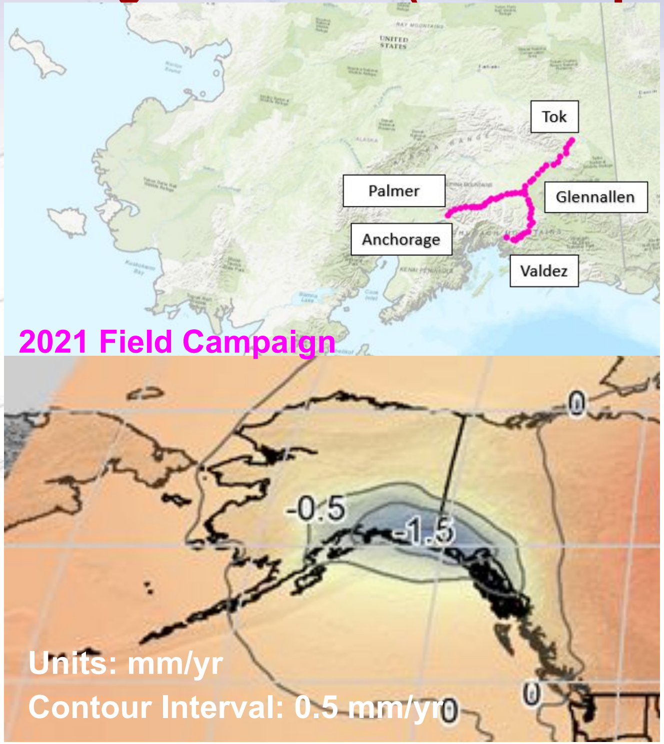
Target: Oct 2024 (In progress)



- Collection of remaining Aleutian Island Block planned for April 2023
- 13 flights remain: Weather must cooperate to complete all required flight lines
- Base of Operations will be Anchorage with the NOAA WP-3D Orion

Absolute Gravity Network and Geoid Monitoring Service (GeMS) established to support dynamic geoid (DGEOID) model

Target: Oct 2025 (Pilot completed 2021; on hold to accelerate NSRS modernization)

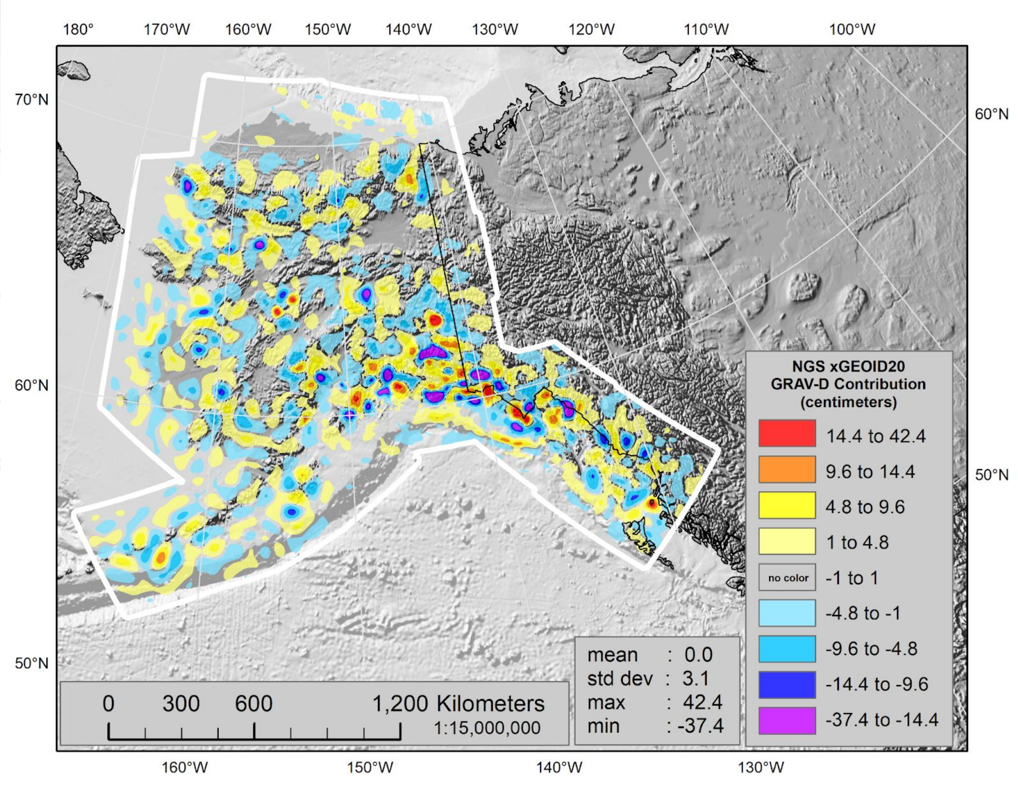


Alpha xDGEOID20 model based on GRACE (NASA GSFC mascon v02.4, Luthcke, et al. 2013).

- In modernized NSRS, dynamic geoid model includes a "time-dependent component" with monitored geoid changes over space and time
- 2021 field work updated observations on ~50 passive marks (GNSS, gravity, DOV)
  - 40+ hour static GNSS
  - Gravity: 20 uGal precisions
  - DOV profile of 2021 geoid
- DGEOID updates will be released with GEOID2022 beta version in 2023 and a final version ~2025

GRAV-D data fully incorporated into gravimetric geoid model (GEOID2022)

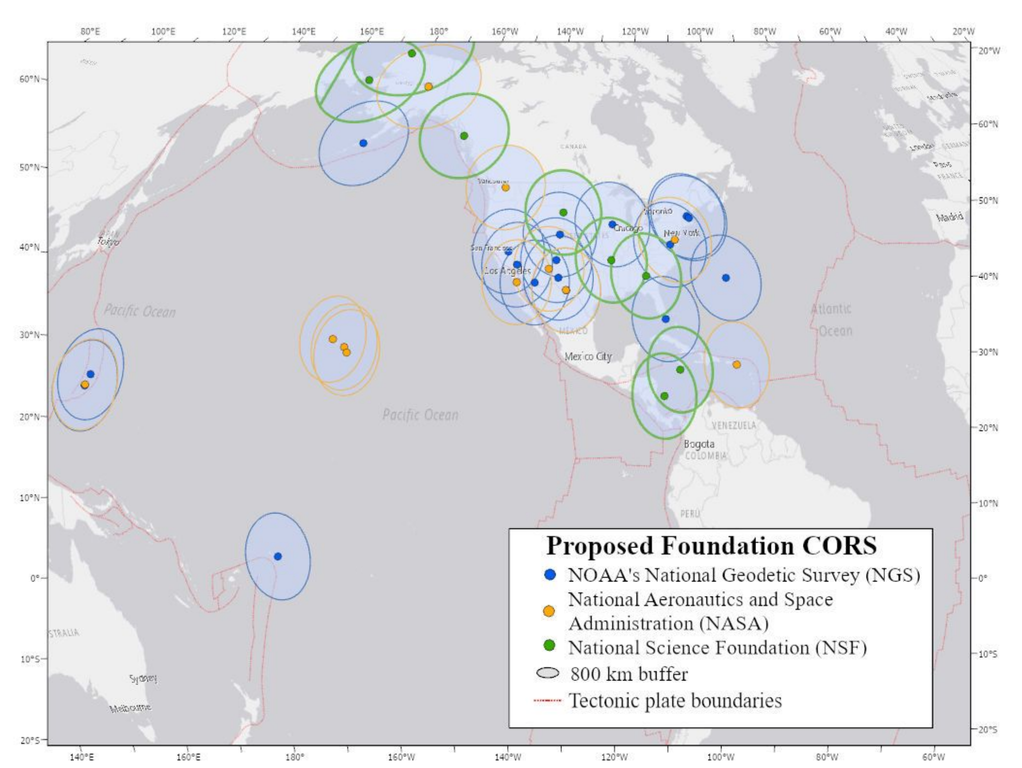
Target: Oct 2025 (In progress)



- xGeoid20 includes all GRAV-D data to date and covers all of mainland Alaska
- xGeoid20 available for use in scientific, research, and pilot applications
- GRAV-D data also in use by State of Alaska DGGS for natural resource exploration

Establish five NOAA Foundation CORS in Alaska

Target: Oct 2023 or Oct 2024 (In progress)



- Adopted FCORS stations in Alaska:
  - AB09 Wales (NSF)
  - AB51 Petersburg (NSF)
  - ATQK Atqasuk (NFS)
  - FAIR Fairbanks (JPL)
  - GCGO Fairbanks (JPL)

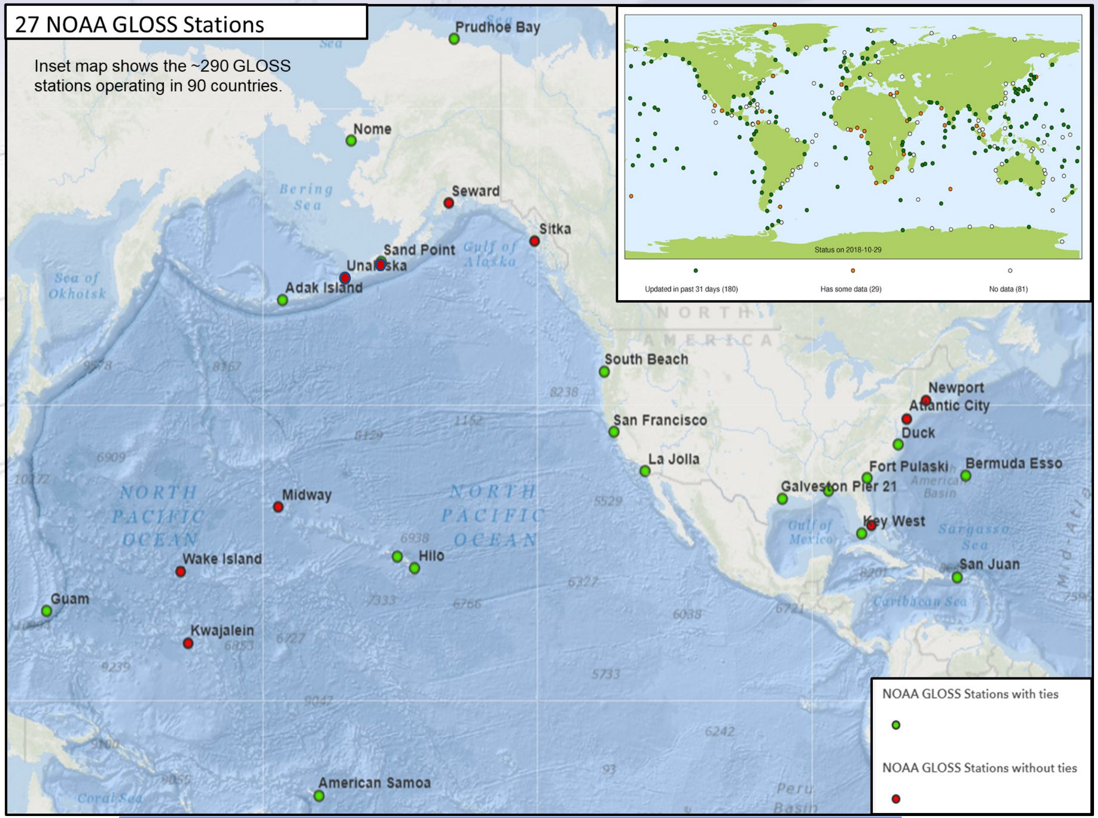
- Field work planned to establish two NGS-owned FCORS station in Summer 2023 or 2024 at
  - Fairbanks (possibly two FCORS)
  - Cold Bay (one FCORS)

Cost assessment to add GNSS to 27 existing AK NWLON sites and 31 new NWLON stations to fill Alaska gaps completed

- It costs CO-OPS $400K-$600K to install an NWLON station in Alaska, depending on many variables including site-readiness and whether it is contracted or not, among others.
- The remote nature of most Alaska NWLON stations presents an accessibility challenge for conducting O&M, which increases *annual* costs above the installation expense.
- CO-OPS will continue to work with AWLW to increase access to important water level data.

Improved geodetic control at water level stations in Sand Point, Sitka, Seward, and Unalaska (GLOSS stations)

Target: Oct 2025



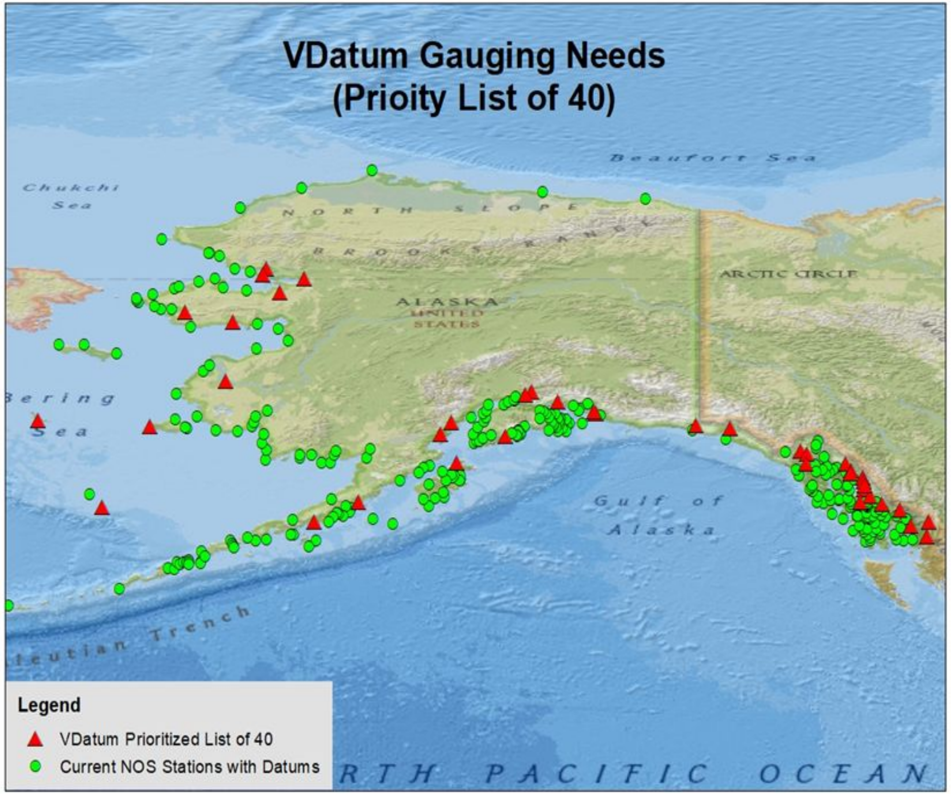
- CO-OPS is evaluating the logistics required for leveling ties between NWLON water level sensors and the existing NGS CORS stations for GLOSS
- CO-OPS is evaluating and testing feasibility of co-locating new cGNSS at NWLON stations

<u>AK GLOSS Stations with untied CORS</u>

Location	NWLON ID	CORS ID	Separation (meters)	Status	GPS at Tidal Benchmark (number(year))
Sitka	9451600	AKSI	396	CORS working Intermittently, no published ties between ARP and WL station	4 (2006 - 2022)
Seaward	9455090	AKSE	1554	No published ties	6 (2006 - 2022)
Unalaska	9462620	AV09	950	CORS working Intermittently, no published ties between ARP and WL station	6 (2006 - 2022)
Sand Point	9459450	AB07	2584	CORS installed but not working, no published ties between ARP and WL station	5 (2006 - 2020)

Short term tidal observations acquired

Target: Oct 2027 (In progress)

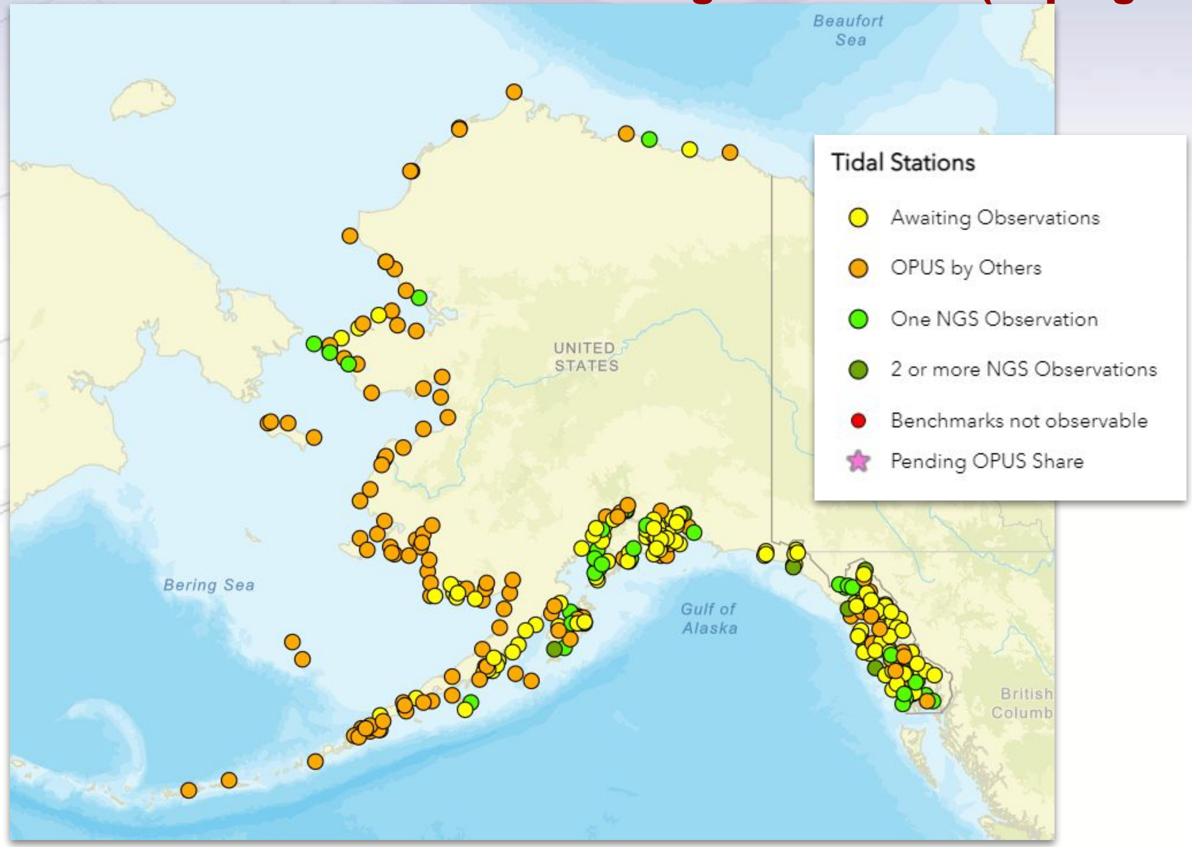


- 14 stations completed thus far; additional stations planned to be accelerated by proposed State of Alaska project in FY22
- Completed:

• Palmer • Yale Arm, College Fiord • St. George Island Airport • Beartrap Bay, Port Gravina • Taan Fiord • Nuka Bay • Eklutna	• Mountain Village • Grantley Harbor • North Kotzebue Sound • Buckland • Iniskin Bay • Lagoon Island, Bartlett Cove • Hyder

GNSS observations taken on tidal bench marks

Target: Oct 2027 (In progress)



- GPS on tidal bench marks support sole-station offsets and VDatum improvements
- Top priorities are water level stations in Alaska where local tidal datums exist, but no corresponding NSRS heights (NAVD 88) appear in the OPUS Shared Database
- Community OPUS Shares have significantly advanced progress since 2014 efforts to prioritize this (see orange)

End of Presentation

Thank you!

Alaska Water Level Watch

Carol Janzen – AOOS

AOOS
Alaska Ocean Observing System

The Eye on Alaska's Coasts and Oceans

Alaska Water Level Watch – AWLW

Update on Activities and Successes

Alaska Coastal Mapping Summit
November 16-17, 2022

Carol D. Janzen (AOOS)
Jaci Overbeck, NOAA OCM, AK Regional Geospatial Coordinator
Autumn Poisson, Alaska Department of Natural Resources-DGGS
Rob Bochenek & Will Koeppen (Axiom Data Science)

U.S. Integrated Ocean Observing System
CERTIFIED
REGIONAL ASSOCIATION

Photo courtesy of Kathy Kuletz

What is the Alaska Water Level Watch – AWLW?

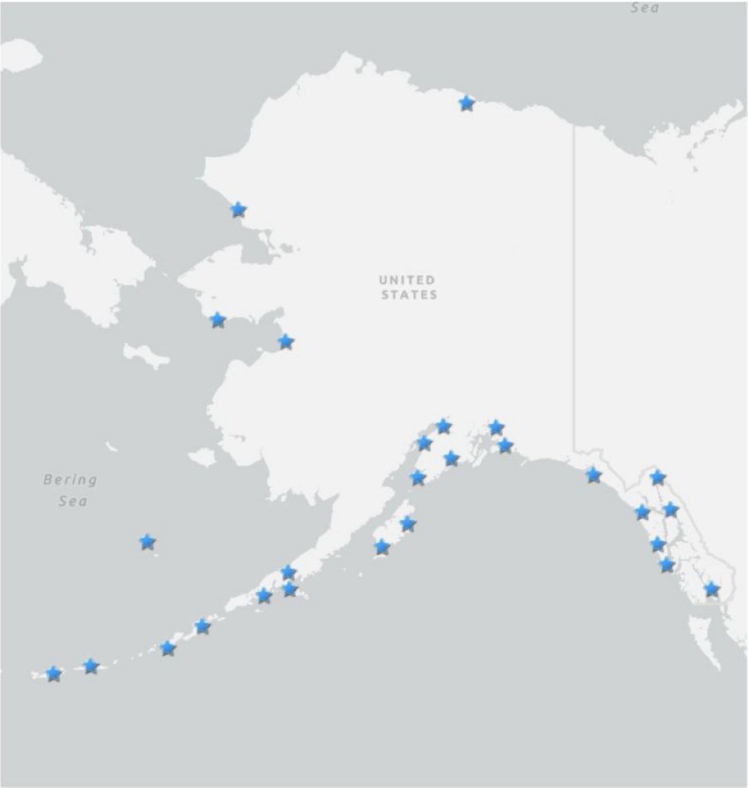
- The Alaska Water Level Watch (AWLW) is a collaborative group working to improve the quality, coverage, and accessibility to water level observations in Alaska's coastal zone.
- Steering Committee (6) representing NOAA, AKDNR, NWS, AOOS and Private Industry
- Annual water level workshops
- Solicits inputs for Alaska's water level build-out plans

Kivalina water level installation, 2022 (courtesy: Autumn Poisson, AKDNR-DGGS

Why Alaska Water Level Watch?

CHALLENGE

- Alaska's remote coastline among the nation's most vulnerable to geohazards
- NOAA's CO-OPS National Water Level Observation Network (NWLON ★) in Alaska consists of 27 active sensors for ~ 66,000 miles of coastline
- CO-OPS Tides & Currents online system hosts only the NOAA NWLON data
- Additional water level data exist and easy comprehensive access is needed for storm-surge forecasting, informed emergency response, safe navigation, and charting



Why Alaska Water Level Watch?

CHALLENGE

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- Additional water level data exist and easy comprehensive access is needed for storm-surge forecasting, informed emergency response, safe navigation, and charting

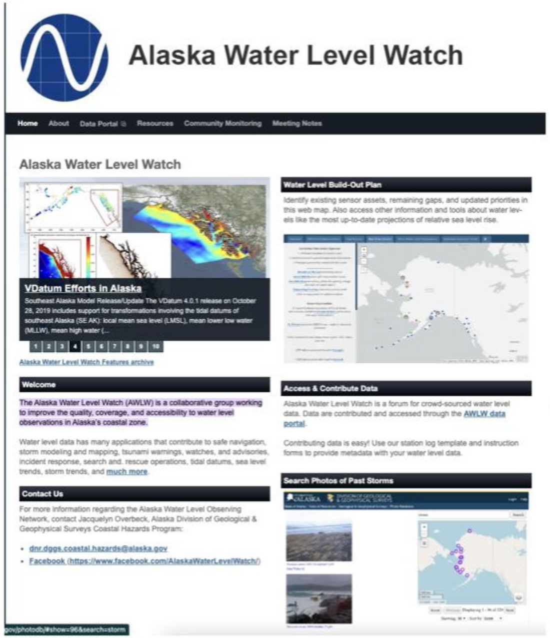
SOLUTION

- The Alaska Water Level Watch (AWLW) augments existing NWLON information with tiered-quality coastal water level observations and data products through the AWLW Data Portal
- https://aoos.org/alaska-water-level-watch/

AKDNR-DGGS staff re-install an iGage® at Kwigillingok.

AWLW Vision: Fill Gaps in Water Level Observations & Increase Public Access to Water Level Information

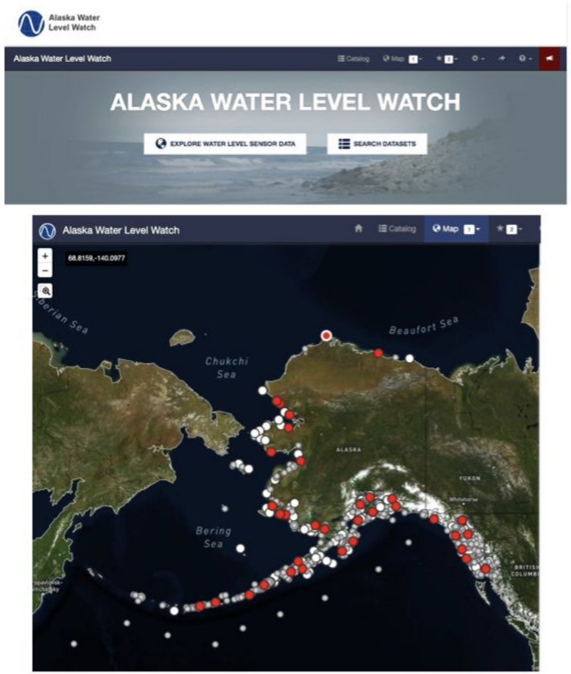
AWLW Website



Public access point for reference materials, portal links, contacts, meetings, other resources: https://legacy.aoos.org/alaska-water-level-watch/

Through innovative technologies and collaborative partnerships, AWLW is expanding coastal water level observation capacity across Alaska's coastline.
&
Making data Accessible through an online AWLW Data Portal

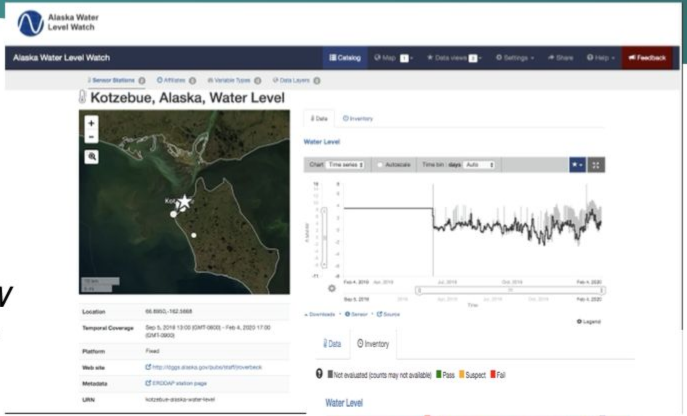
AWLW Data Portal



AWLW Data Portal map showing active (red) and historical water level stations (white). https://water-level-watch.portal.aoos.org/#map

The AWLW Data Portal Provides Public Access to Alaska Water Level and Information Products

NWLON, non-NWLON and predicted water level information served through the AWLW Portal



Acoustic iGage® in Kotzebue and AWLW Portal Station Page

Streamlined data ingestion and station page identification procedures allow simplified submission from various providers

Visual of data quality flags

Data are qualified as Tier A, B, and C on portal based on accuracy of data and associated NOAA sanctioned uses

Tier	A	B	C
Minimum Accuracy	10 cm (on tidal datum)	30 cm (on tidal datum)	30 cm Or undetermined
Benchmarks	5	3	Not required
Leveling Order	Annual 2nd Order Class 1 better	Biannual 3rd Order or GPS derived ellipsoid based	Not applicable
Applications	▪ Real-time navigation ▪ Marine boundaries ▪ Sea level anomalies ▪ Vdatum ▪ Hydrodynamic model forcing and skill assessment ▪ CO-OPS MAPTITE App	▪ Hydrographic surveys ▪ Shoreline mapping ▪ Marsh restoration ▪ Storm surge ▪ Exceedance ▪ Inundation dashboard	▪ Academic research ▪ Background oceanographic information ▪ Tsunami

AWLW Portal Hosts Other Useful Information

New Flood Event Layer from AKDNR

Select stage information & view photos from multiple locations in communities

Storm Surge: August 3, 2019

Event type	Storm Surge
Flood impact	moderate
Height (NAVD88)	3.35 (m)
Water level type	still water

Click to enlarge image

AWLW Observing Updates from Partners

Tununak iGage ™ 2022 (photo courtesy Autumn Poisson, AKDNR-DGGS

Dillingham City Dock Bubbler Water Level Station 2022 (photo courtesy JOA Surveys)

Stebbins/St. Michaels GNSS-R Station, AOOS/UNAVCO (photo courtesy UNAVCO)

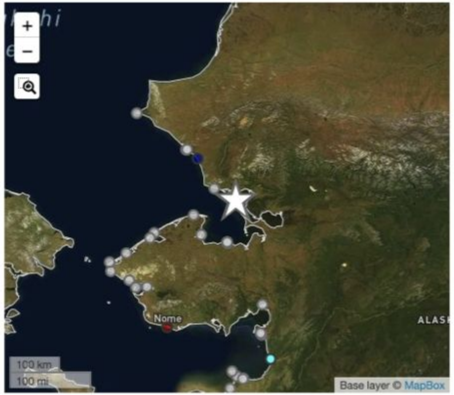
AWLW Obs Update with Partner AKDNR-DGGS

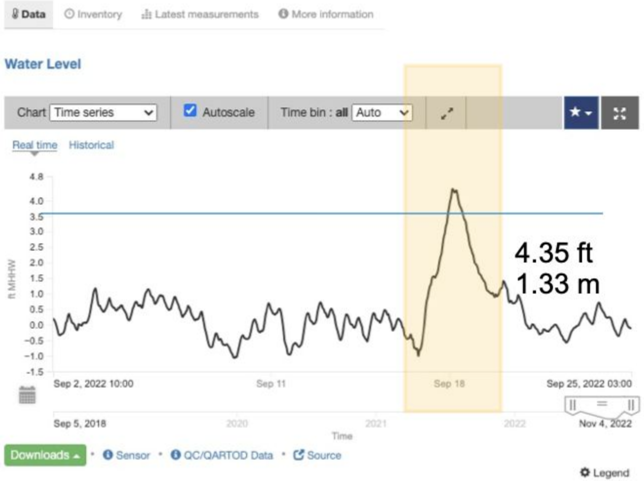
9 iGage™, iRdar ™ Stations were operational during 2022

Kivalina	Kipnuk	Homer
Kotzebue	Kwigillingok	Whittier
Deering	Bethel	Nelson Lagoon

Alaska Division of Geological & Geophysical Surveys (AK-DGGS)

Kotzebue, Alaska, Water Level



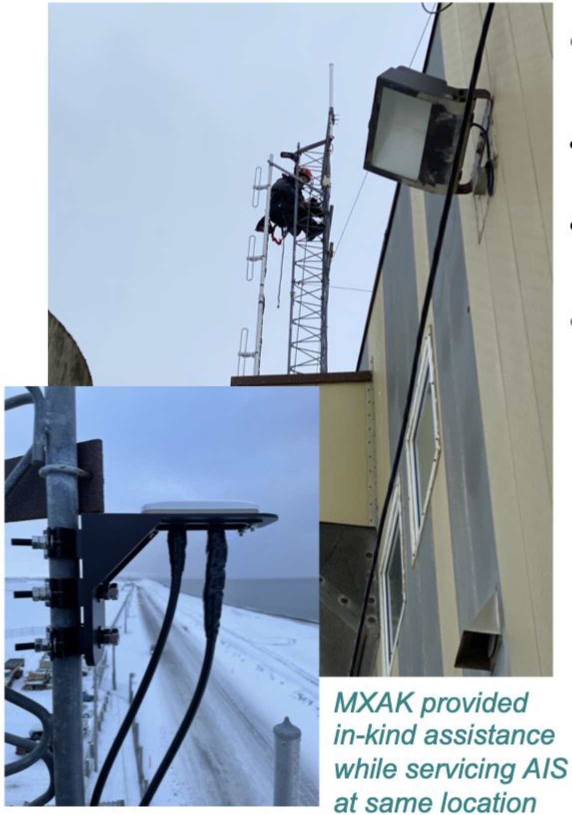


Location	66.8950,-162.5668
Temporal Coverage	Sep 5, 2018 13:00 (AKDT) - Nov 4, 2022 08:00 (AKDT)
Tags	Tier C
Platform	Fixed

2022 Bering Storm Peak Water Level Kotzebue – September 18, 2022

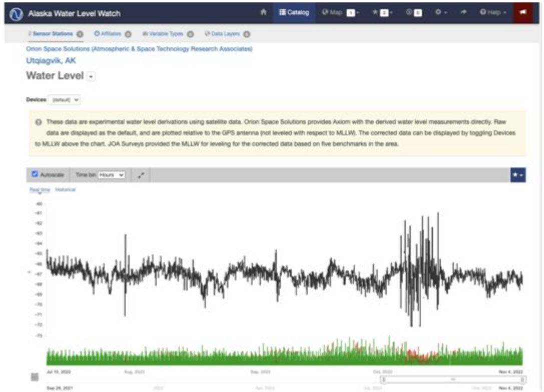
AWLW Obs Update with Partner Orion Space Solutions

Utqiaġvik GPS-R water level installation & GNSS-R Data Processing



MXAK provided in-kind assistance while servicing AIS at same location

- Oct 2021 Utqiaġvik GPS-R installation completed before freeze-up
- Collaborators: North Slope Borough, AOOS, JOA Surveys & Marine Exchange of Alaska
- Onboard processed real time data reporting on the AWLW Data Portal for 1 year
- JOA Surveys providing MLLW based on 5 benchmarks in the area



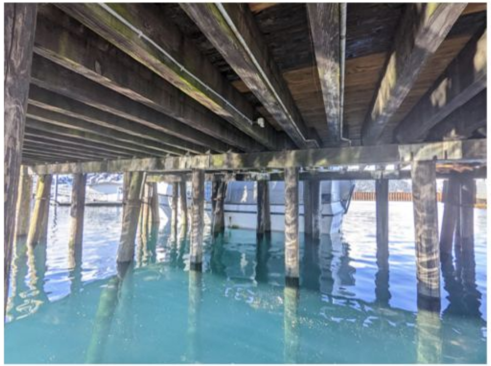
AWLW Obs Update with Partner JOA Surveys

2 NWLON-Lites, iRadar ™ Installation, and GNSS-R Data Processing

JOA Surveys supports NOAA CO-OPS, AKDNR and AOOS Coastal Hazards Portfolio

Recent projects:

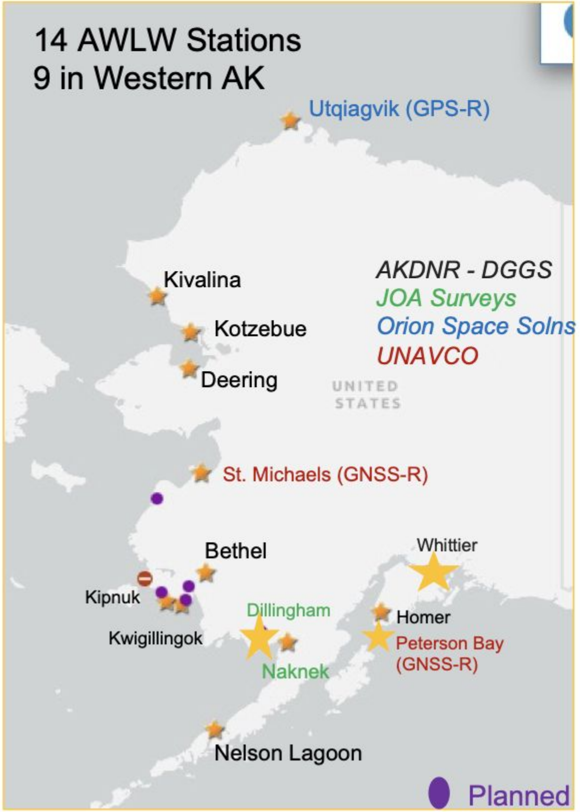
- 2020 Naknek - Installed dual bubbler water level station
- 2021 Utqiagvik - assist with GPS-R Install
- 2021 Dillingham - Installed bubbler & downward looking Radar water level station
- 2022 Whittier – Installed iRadar™ water level station with equipment from AKDNR
- Processing GNSS-R data and datum assessments for 3 UNAVCO GNSS-R stations



Tide Gauge Installation at Whittier City Dock, March 2022, (Photo: Drew Lindow, JOA Surveys)

AWLW Portal Reporting 50% More Water Level Stations

Many came online in 2021-22 and captured peak water levels during the 2022 Bering Sea Storm (Merbok)



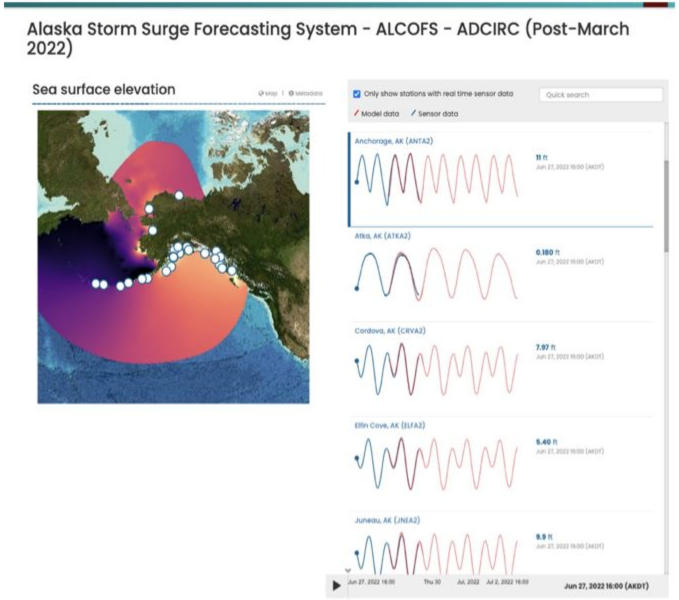
AWLW Data Inform Alaska Storm Surge Forecasting Models

Current modeling efforts are working to improve water level and storm surge forecasting skill for western Alaska

Modelers have been using AWLW water level stations to compare with model outputs throughout development

A model forecast and in situ observational data comparison tool for the AOOS Data Portal will launch in December 2022

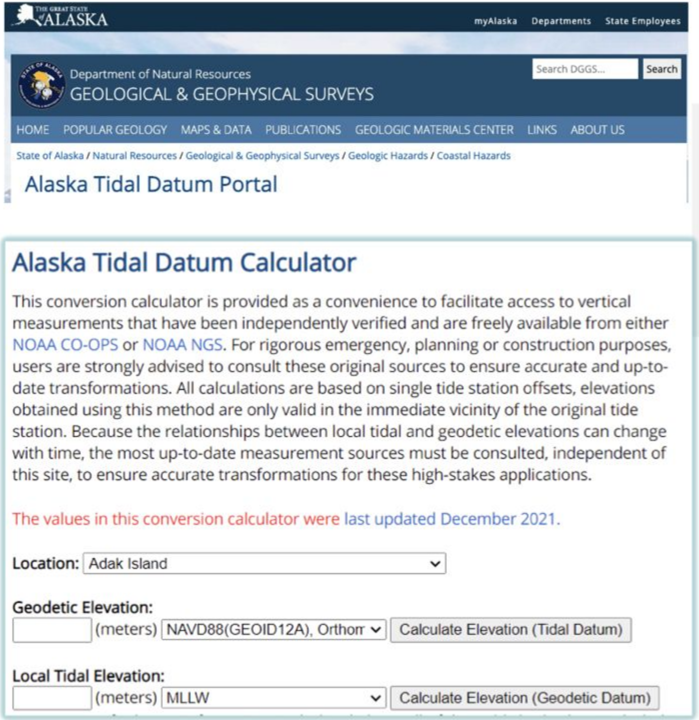
For more information on these efforts:
https://legacy.aoos.org/western-alaska-storm-models/



The ALCOFS-ADCIRC model output comparisons with in situ observational data informs model improvements and also provides a quantitative sense of model accuracy. Red predicted water level, Blue sensor data.

AWLW Tidal Datum and Other Resources & Tools

Regular updated priorities reflect Vdatum grid development needs



THE GREAT STATE OF ALASKA

myAlaska Departments State Employees

Department of Natural Resources
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Alaska Tidal Datum Portal

Alaska Tidal Datum Calculator

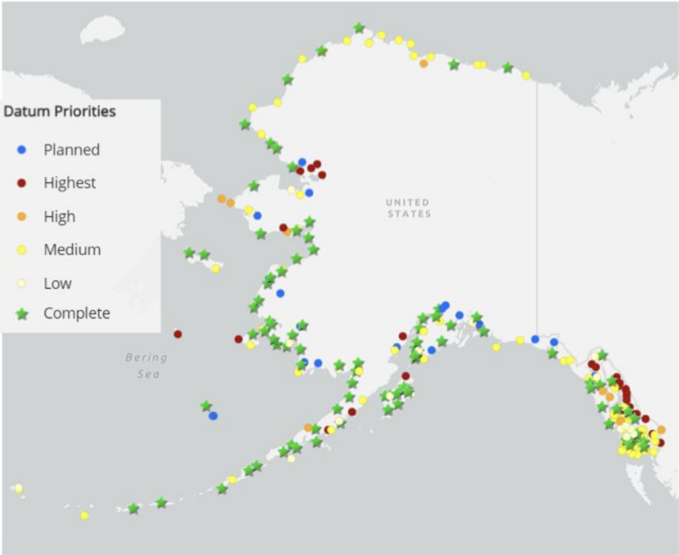
This conversion calculator is provided as a convenience to facilitate access to vertical measurements that have been independently verified and are freely available from either NOAA CO-OPS or NOAA NGS. For rigorous emergency, planning or construction purposes, users are strongly advised to consult these original sources to ensure accurate and up-to-date transformations. All calculations are based on single tide station offsets, elevations obtained using this method are only valid in the immediate vicinity of the original tide station. Because the relationships between local tidal and geodetic elevations can change with time, the most up-to-date measurement sources must be consulted, independent of this site, to ensure accurate transformations for these high-stakes applications.

The values in this conversion calculator were last updated December 2021.

Location: Adak Island

Geodetic Elevation:
(meters) NAVD88(GEOID12A), Orthom Calculate Elevation (Tidal Datum)

Local Tidal Elevation:
(meters) MLLW Calculate Elevation (Geodetic Datum)



Tidal Datum Calculator still undergoing updates, last made December 2021: https://dggs.alaska.gov/hazards/coastal/ak-tidal-datum-portal.html

AOOS
Alaska Ocean Observing System

The Eye on Alaska's Coast's and Oceans

Join the AWLW email list by contacting Jacquelyn.Overbeck@noaa.gov

U.S. INTEGRATED OCEAN OBSERVING SYSTEM
CERTIFIED
REGIONAL ASSOCIATION

End of Presentation

Thank you!

Imagery & Elevation Acquisition Dashboard

Hillary Palmer – Dewberry

End of Presentation

Thank you!

Topobathy Lidar

Karen Hart – Woolpert

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

Importance of Near Real-time Data Processing for Topo-bathymetric Lidar Operations

Karen Hart

Colorized point cloud – Kauai, HI

MARITIME SOLUTIONS

By the Numbers

65
Hydrographic Professionals

10
Certified Hydrographers

20+
Vessels

60,000+
Square Miles of Bathymetry Collected Since 2016

13+
Aircraft in Fleet

4
(Lidar) Sensors in Use

Clients

NOAA

US Army Corps of Engineers

USGS
science for a changing world

NAVAL METEOROLOGY AND OCEANOGRAPHY COMMAND

Pacific Community
Communauté du Pacifique

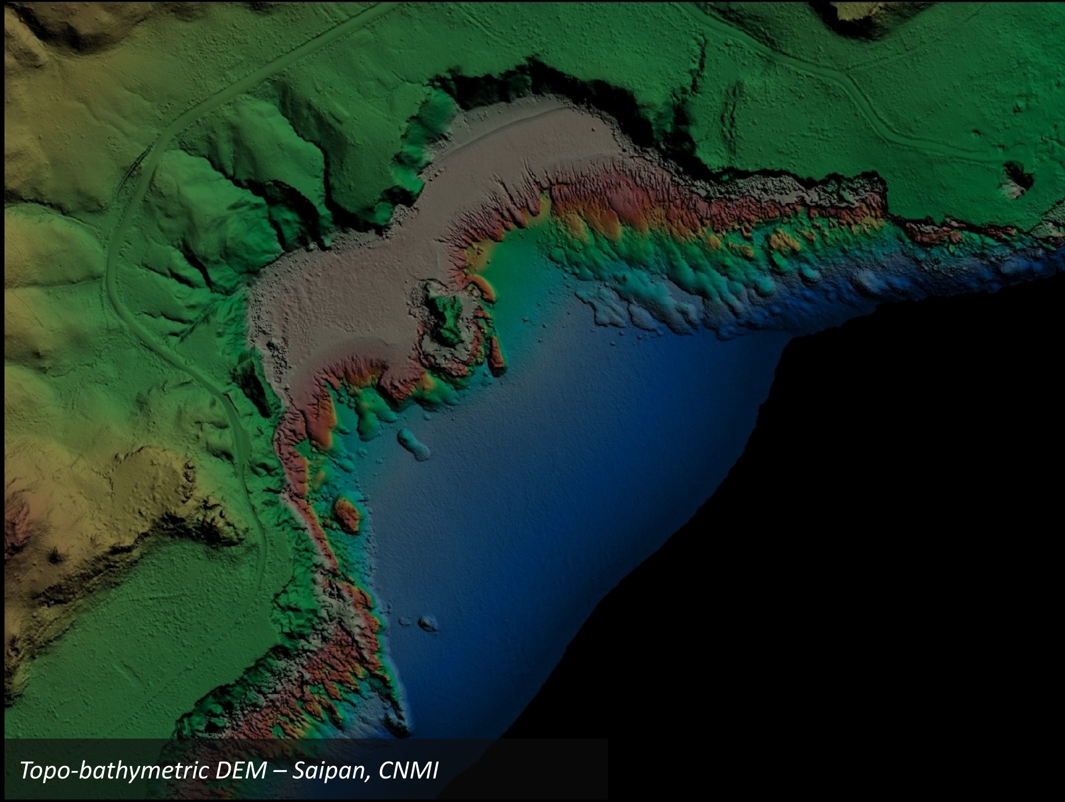
JALBTCX
Joint Airborne Lidar Bathymetry Technical Center of Expertise

NATIONAL GEODETIC SURVEY

SHOM

Woolpert Topo-bathymetric Lidar Operations

- Missions lasting weeks to months
  - Deployment of Leica sensors (Chiroptera and HawkEye)
  - CONUS or OCONUS
  - Collection of 10s of TBs data
- Field processing
  - General corrections
  - GPS Trajectory
  - Daily coverage
  - Data uploaded to office/servers
- Office processing
  - Data management
  - Coverages made for field
  - Fully corrected
  - Manual edits and advanced classification
  - Products

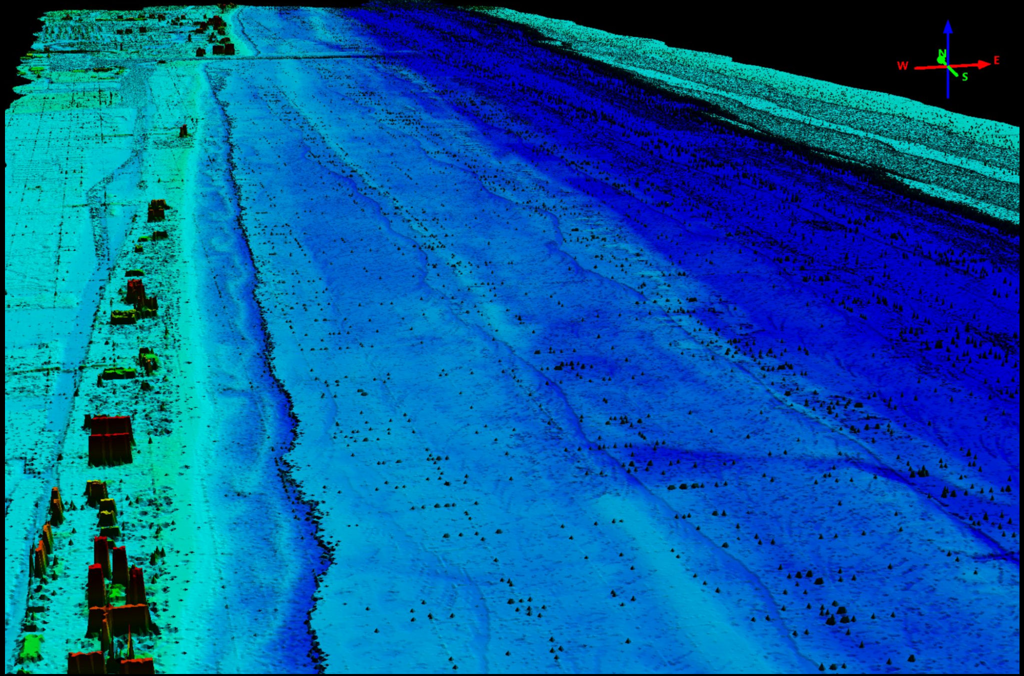


Topo-bathymetric DEM – Saipan, CNMI

Software to Aid Processing in the Field

- FLiDAR – "Fast lidar" – software created to assist field data processing
  - Sensor agnostic
  - Near-realtime

- Digital Surface Model (DSM) Coverage
  - Generation of multipurpose raster images in seconds
  - Various statistics from LAS data based on point data fields
  - Input:
    - One or more LAS files
    - Resolution of surface
    - Raster type



BULLDOG topo-bathy sensor, deep green channel, all flightlines, 5m Minimum DSM, illustrating seafloor

Digital Surface Model Creation Features

- Processes are run in parallel
  - Leverage multi-core CPUs and solid-state drives
- LAS points are indexed prior to rasterization
- Fast execution of rasters: dozens of files / several hundred GBs of data can be rasterized in less than 2 minutes
- Software architecture allows handling of large datasets
  - No need to merge files ahead of time
- Creates singular output DSMs which can then be tiled
  - Provides advantage over individual tile processing into raster outputs which then must be mosaicked together

Proof of Concept

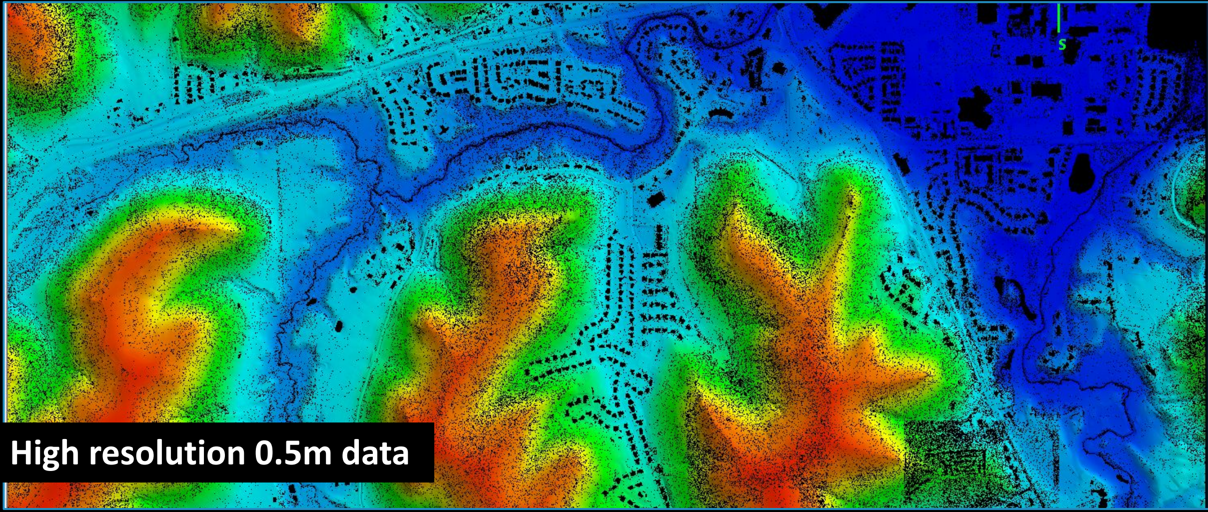
- Testing on multiple sensor types
  - BULLDOG topo-bathy sensor testing
  - Chiroptera / HawkEye topo-bathy data
  - JALBTCX (CZMIL) data

- Field testing during topo-bathy projects :
  - NOAA NGS FY23 (Chiroptera/HawkEye):
    - Hurricane Ida Supplemental - Louisiana Coast
    - American Samoa
    - Chesapeake Bay (IIJA)
  - Cook Islands (Chiroptera/HawkEye)

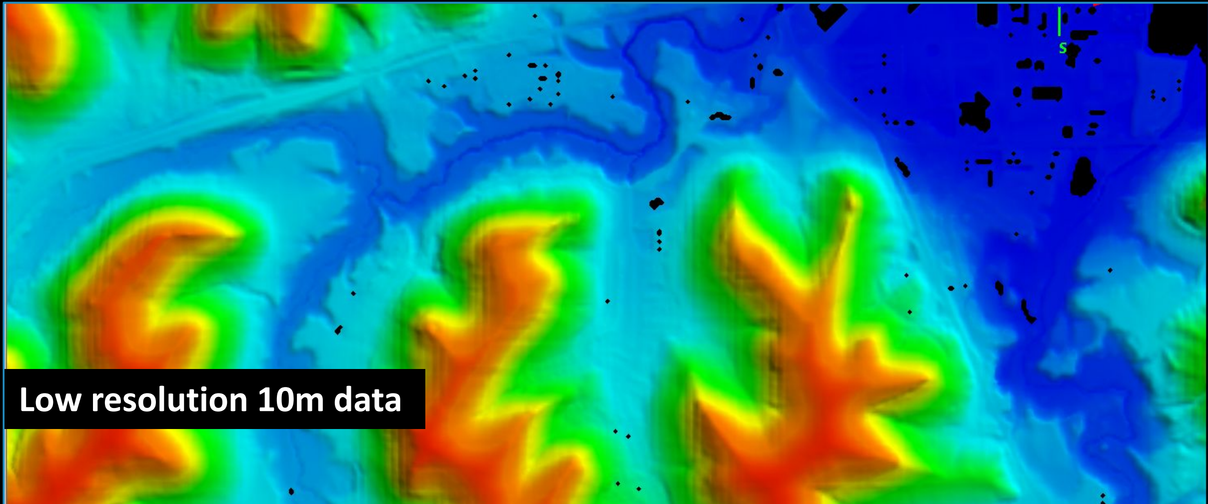
Preliminary field coverage, Chincoteague Sound (NOAA NGS)

High Resolution vs. Low Resolution DSMs

- High resolution: detailed view of the topology
- Low resolution: high-level overview of AOI topology
  - Requires less time to generate
  - Smaller file size
- Ability to combine High Res DSM with corresponding Low Res DSM to fill the gaps in input data



High resolution 0.5m data



Low resolution 10m data

DSM Output – Statistical Surfaces

Statistical Surfaces include:

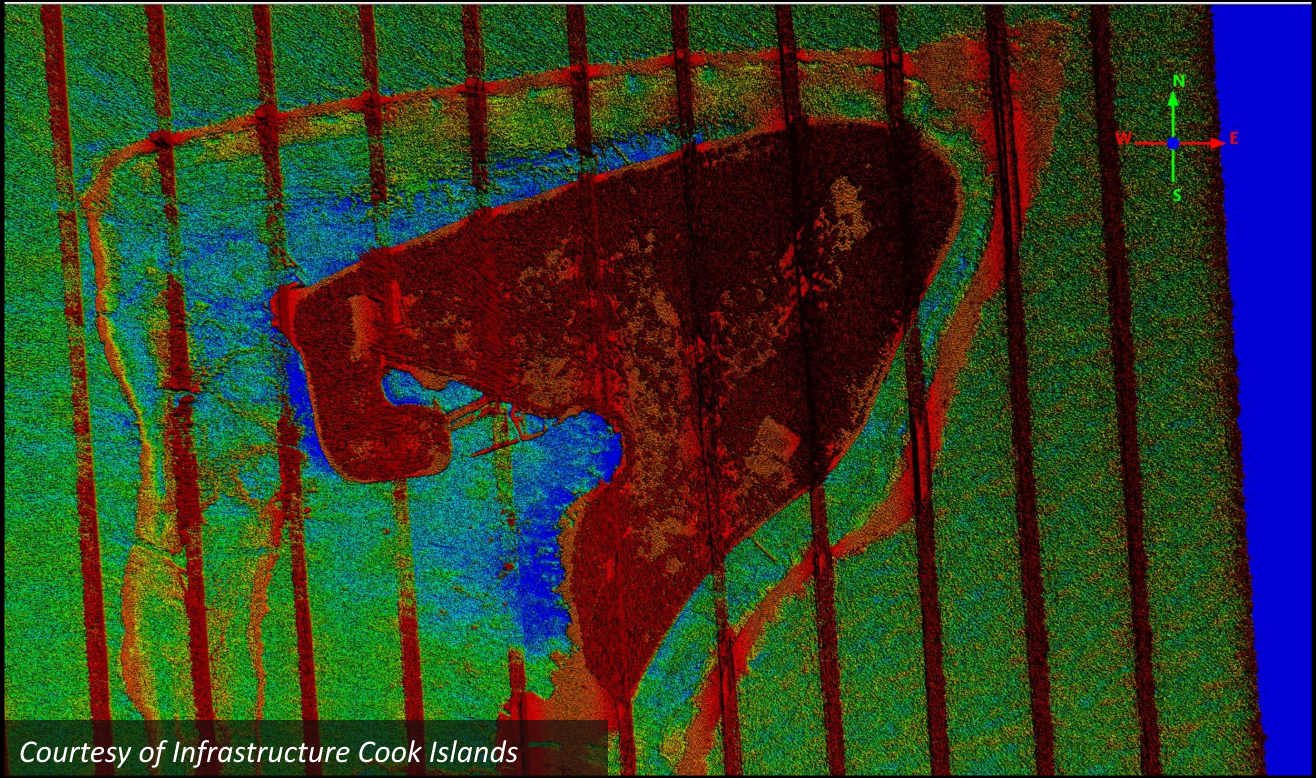
- Count: overview of the density of input data
- Max/Min: impact of noise data to the output, depth estimates
- Mean: overall average of the resolution-sized area
- Median: indicator of surfaces less sensitive to outliers
- Mode: most common value with an algorithmically chosen bin width – comparisons of surface density/reflectivity
- Range: spread of values within a resolution-sized area – bathymetry likely to stand out
- Standard Deviation: measure of overall distribution – building outlines may stand out
- Skew: measure of the asymmetry of distribution – certain noise profiles, building outlines may stand out
- Kurtosis: measure of the 'tailedness' of a distribution – certain noise characteristics, shorelines may stand out

Median DSM

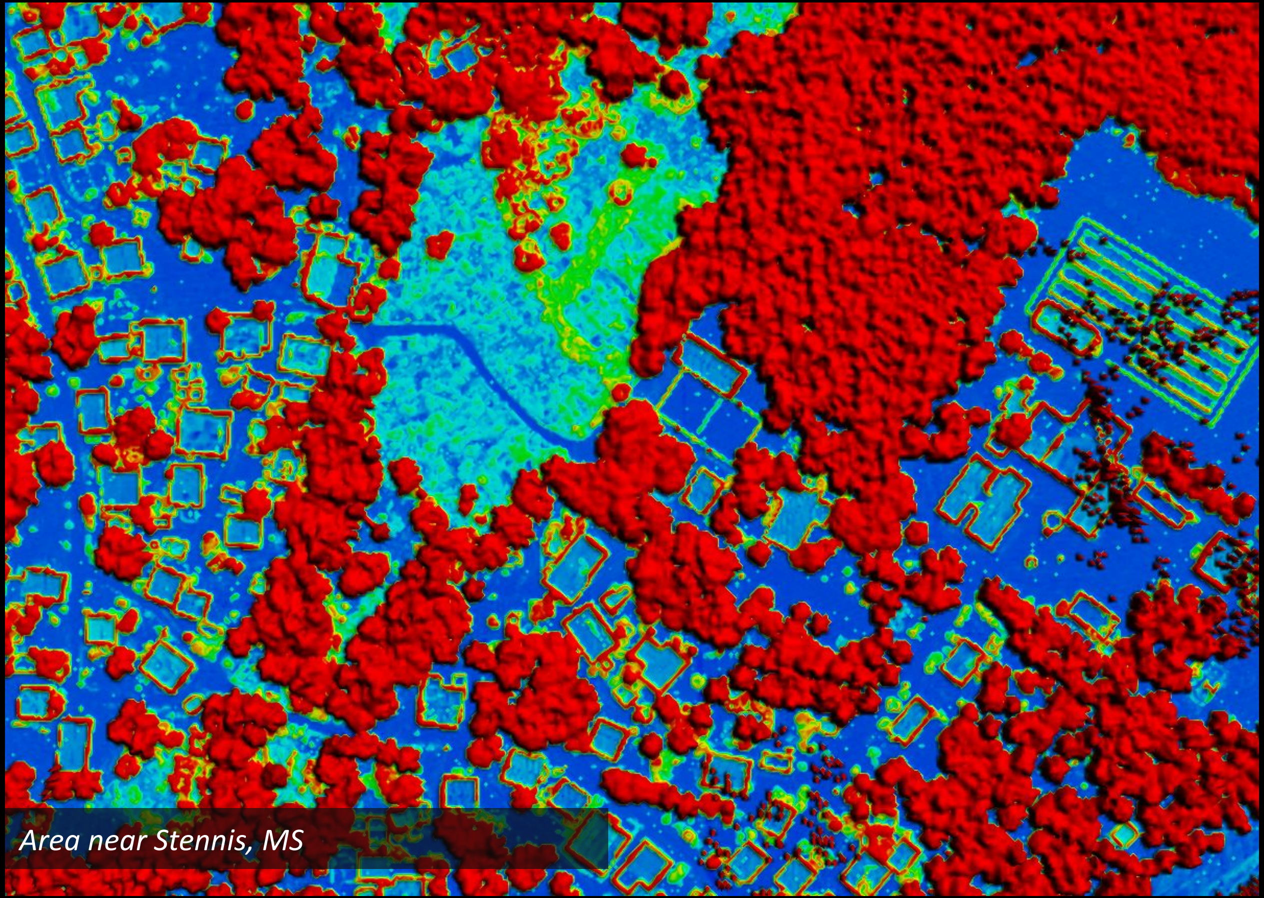
- Merged 1m DSM of BULLDOG data

Count DSM

- Shows data density
- Leica Hawkeye 4X data



Standard Deviation DSM

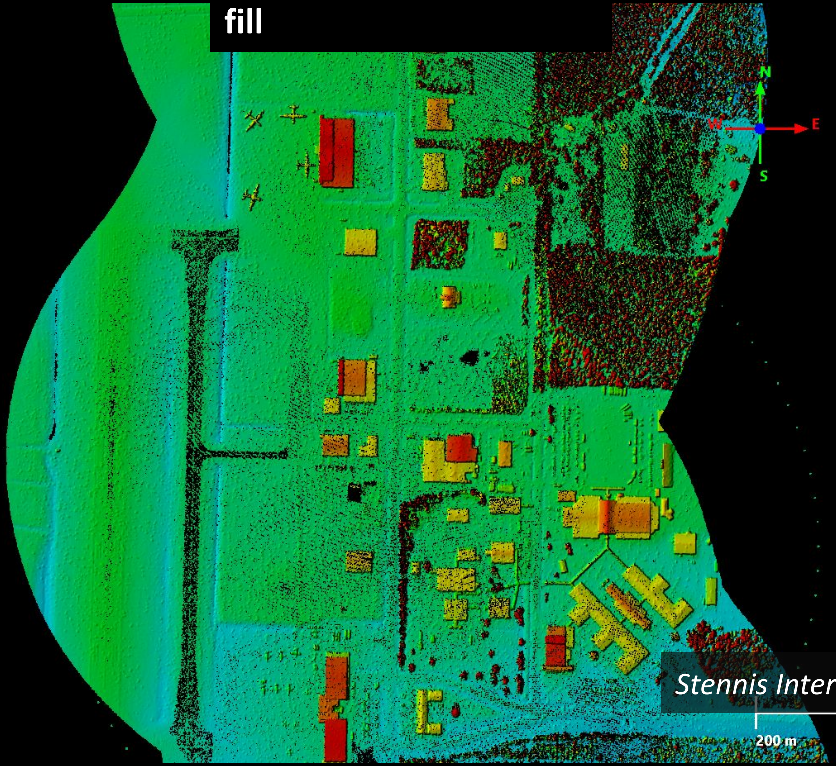


- Building outlines are prevalent
- Data collected by BULLDOG sensor

Gap Filling

- Data filling algorithm fills the void contours one pixel depth at a time with multiple iterations as needed

1m Median DSM – no fill

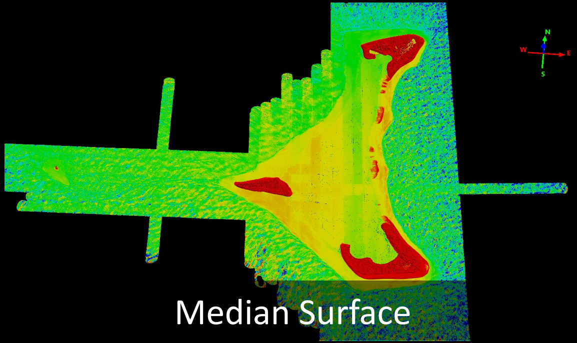


1m Median DSM – fill, 100 iterations

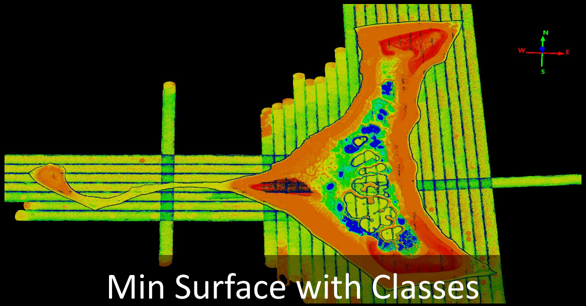
Stennis International Airport, MS

Cook Islands DSMs

- Data courtesy of Infrastructure Cook Islands

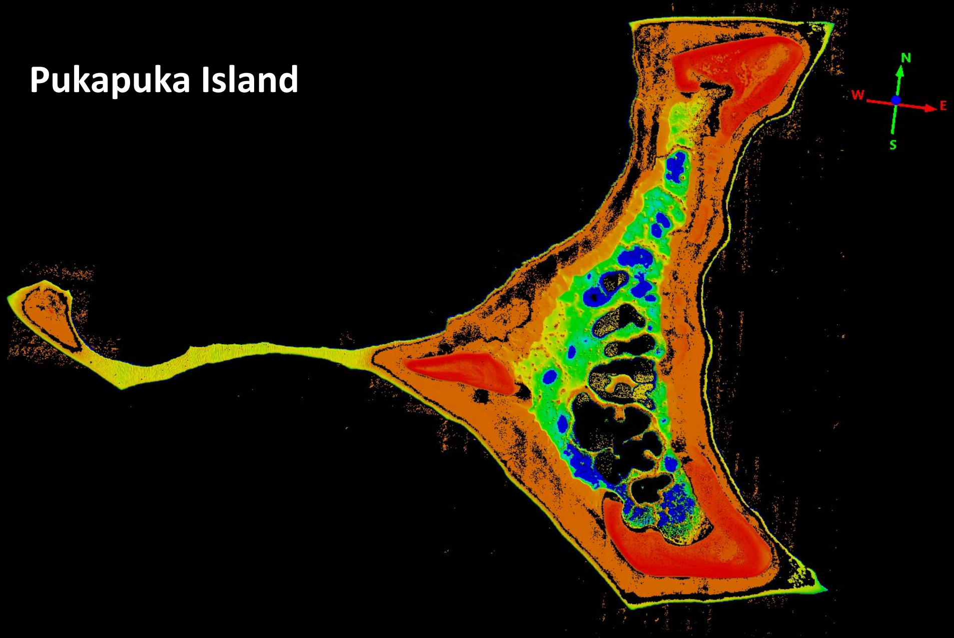


Median Surface



Min Surface with Classes

Pukapuka Island



Production Coverage Surface

Summary and Preliminary Results

- Benefits
  - Sensor agnostic
  - Near realtime data processing
  - Edge execution / processing (running on collection platforms)
    - Realtime coverage
    - Performance is optimized
    - Meet specifications
    - Mitigate reflight wait time (fly again immediately)

- Preliminary field assessment:
  - Quick coverage creation is useful for identifying gaps (voids, sliver, MPIA)
  - Not yet a replacement in the field as it does not give a good indication of seabed coverage

Further Development

- Improving capabilities to fill building footprints, find seabed features, remove sea surface, and other advanced processes in order to create deliverable outputs
- Integrating differencing, adding, masking, and other options between user-selected statistics or resolutions in order to customize outputs
- Using particular statistical outputs to extract building footprints, vegetated areas, water surfaces, and other features from totally unclassified data with the goal of creating better elevation models or classified data sets
- Integrating GPU processing for even greater speed and parallelization improvements

Thank you!

Karen Hart
karen.hart@woolpert.com
Woolpert

Single BULLDOG flight - 1m Stdev DSM – shows building outlines

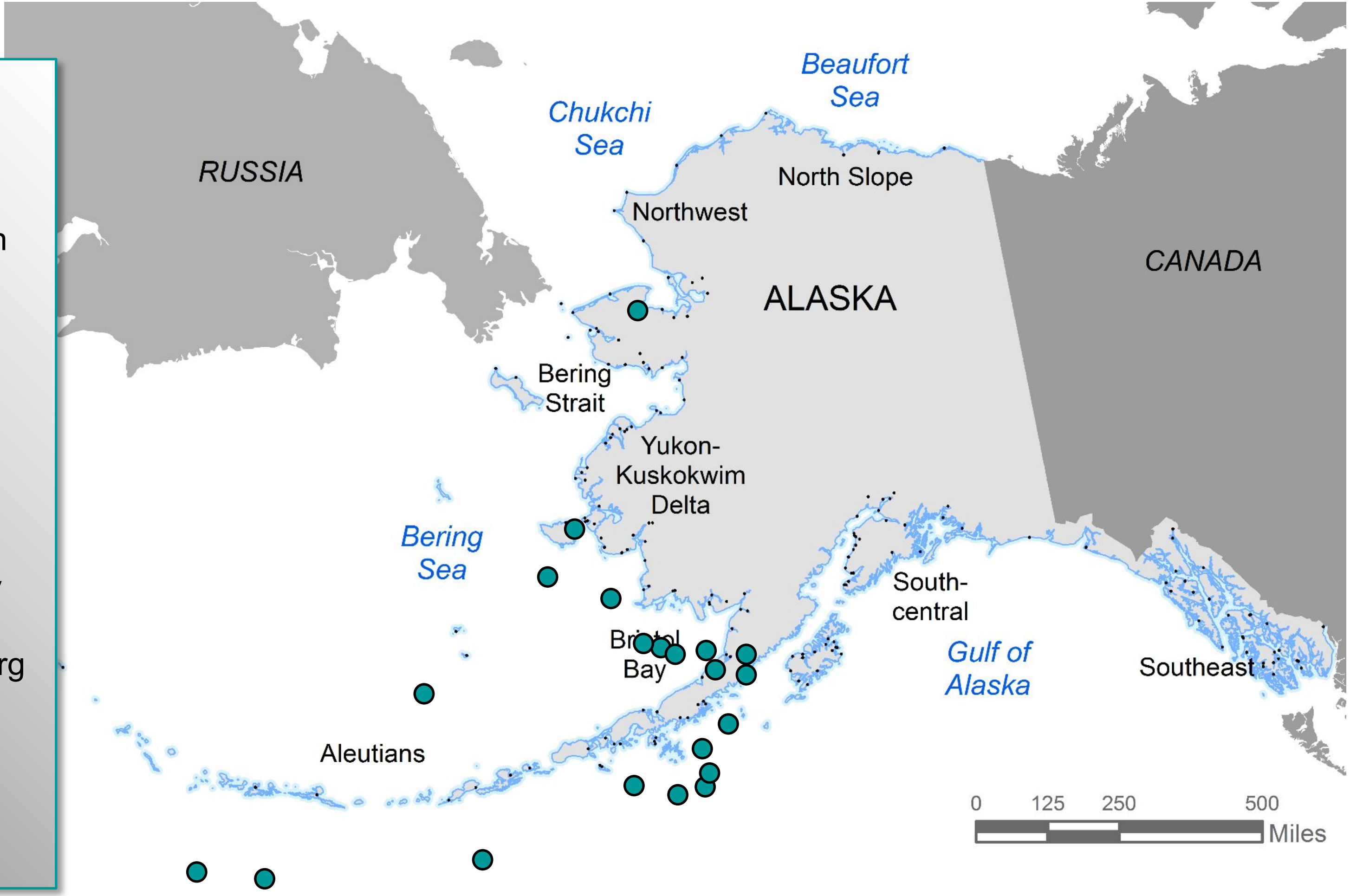
Workforce Development

Reyce Bogardus – University of Alaska Fairbanks

WORKFORCE DEVELOPMENT THROUGH COMMUNITY-BASED MAPPING

Reyce Bogardus | UAF Geophysical Institute

Port Heiden
Levelock
Ekuk
Chignik Bay
Chignik Lagoon
Dillingham
Nelson Lagoon
Togiak
St. Paul
Twin Hills
Pilot Point
Ivanof Bay
Naknek
Goodnews Bay
Unalaska
Cape Espenberg
Chevak
Kongiginak
Mekoryak
Adak
Atka



Mapping with Tribal Partners

Nelson Lagoon, AK; others

- Unmanned aerial vehicle (UAV) Quality Assurance Project Plans (QAPPs)
  - Event-based change detection
  - Transportation corridor mapping
- Funding synergy through collaborative data collection

Port Heiden
Levelock
Ekuk
Chignik Bay
Chignik Lagoon
Dillingham
Nelson Lagoon
Togiak
St. Paul
Twin Hills
Pilot Point
Ivanof Bay
Naknek
Goodnews Bay
Unalaska
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Kongiginak
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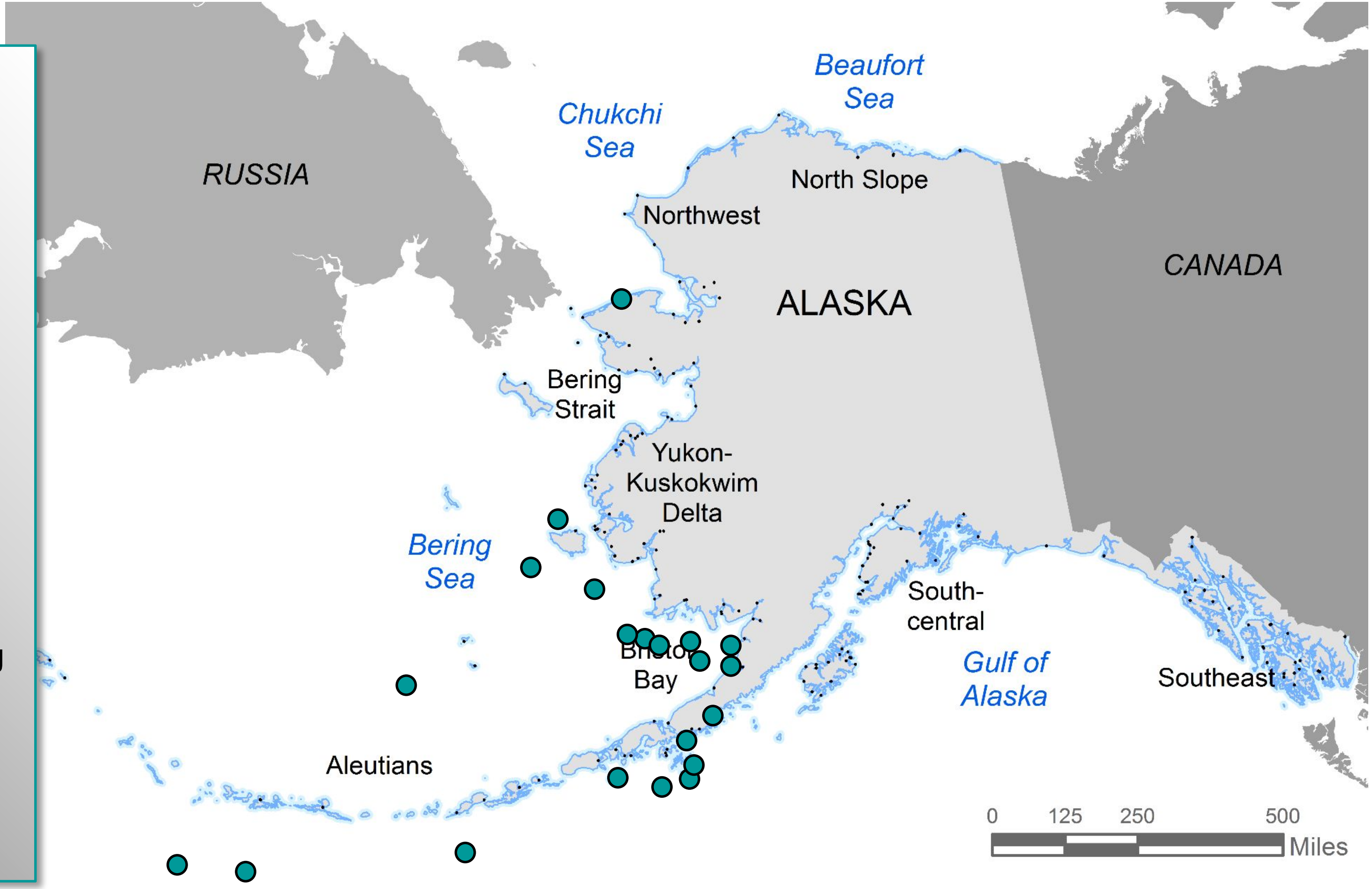
Adak
Atka

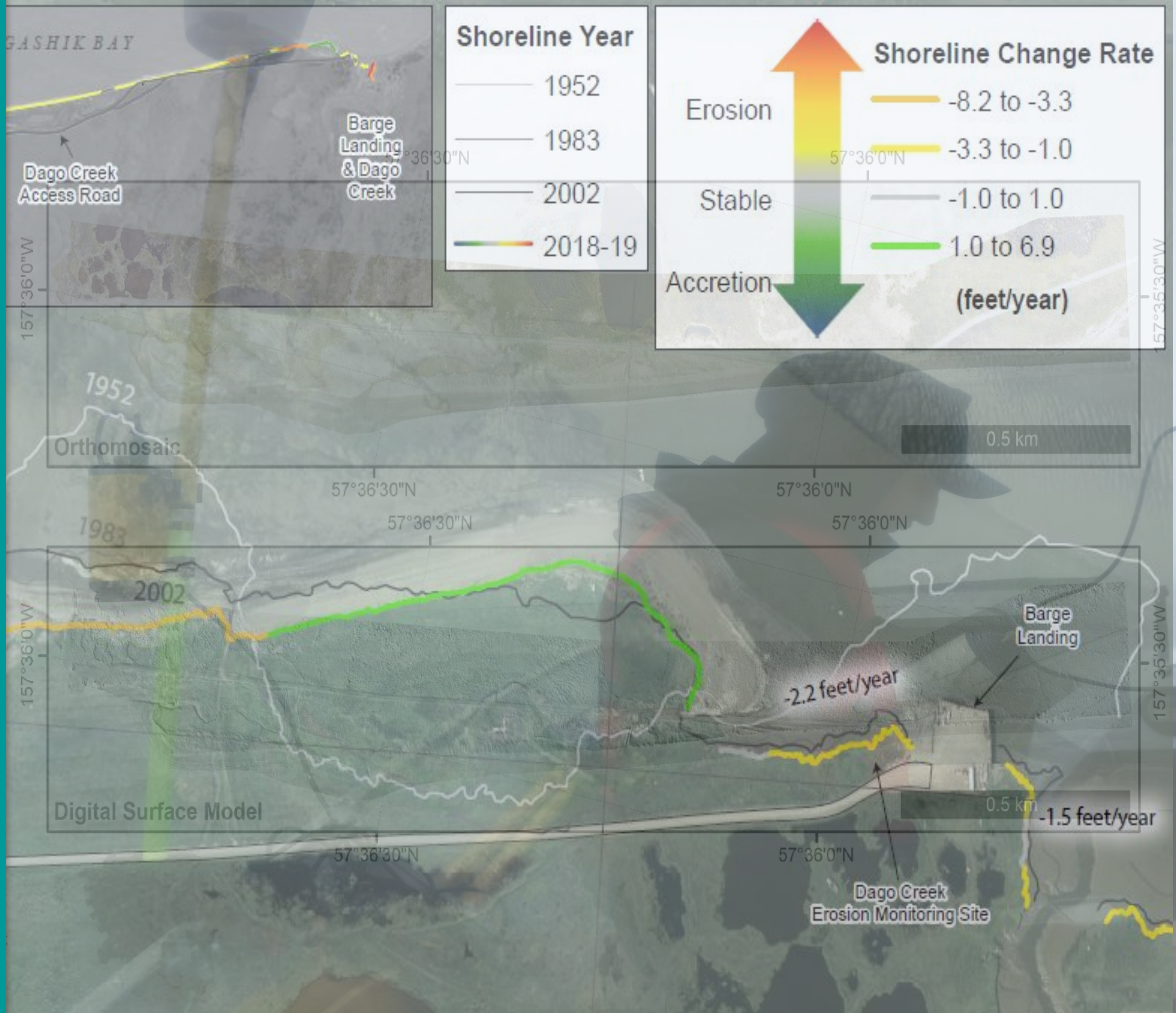


Mapping with City Partners

Pilot Point, AK; others

- Working directly with engineering firms
  - Project based mapping

- Iterative mapping with community members
  - Identifying areas of interest
  - Cataloging local place names



Port Heiden
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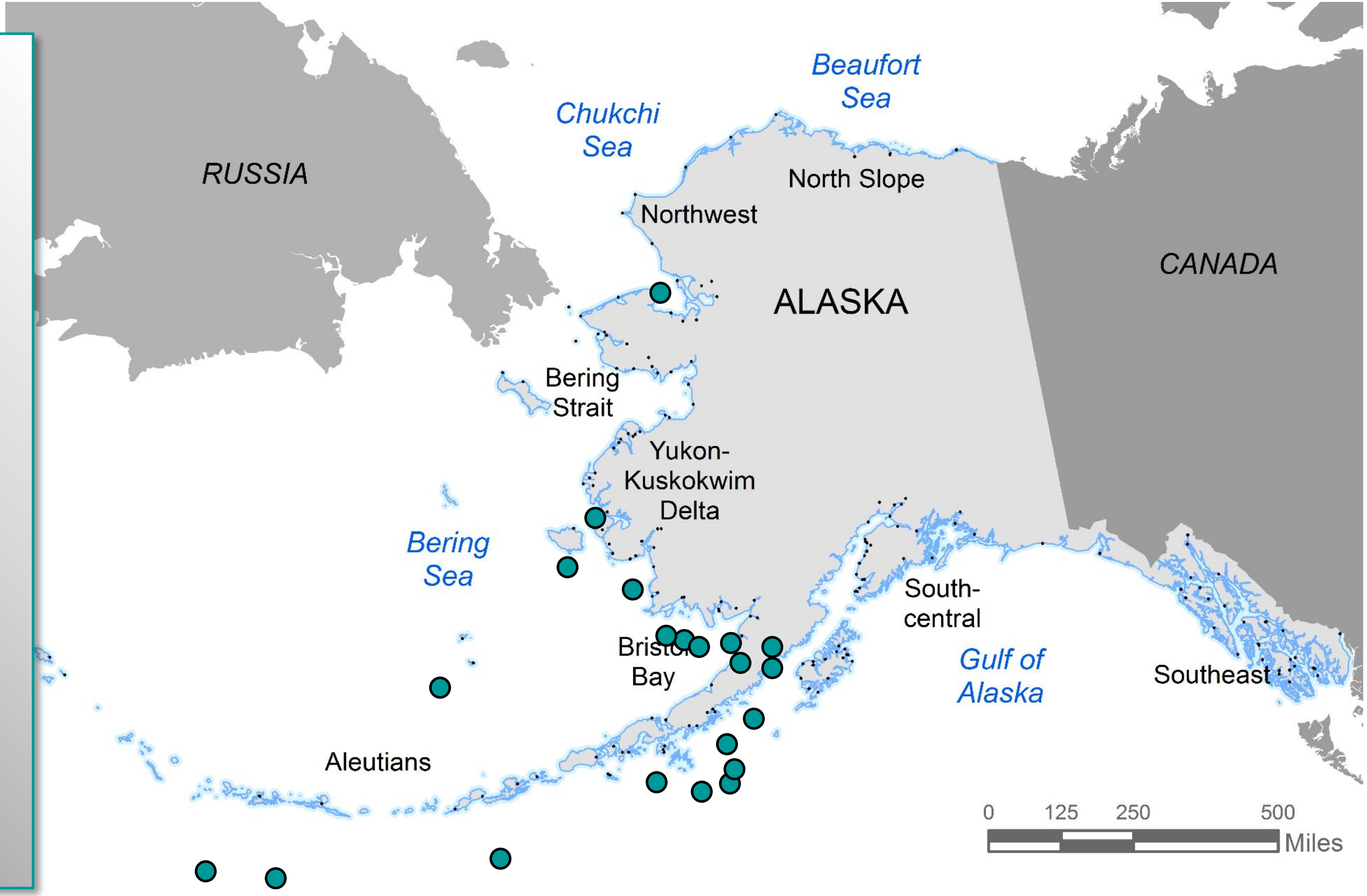

Mapping with State Partners

St. Paul, AK; others

- Internship(s) with DGGS Coastal Hazard Program
- Workforce development through continued collaboration and product-driven mapping
- Integrating academics with real-world needs

Port Heiden
Levelock
Ekuk
Chignik Bay
Chignik Lagoon
Dillingham
Nelson Lagoon
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St. Paul
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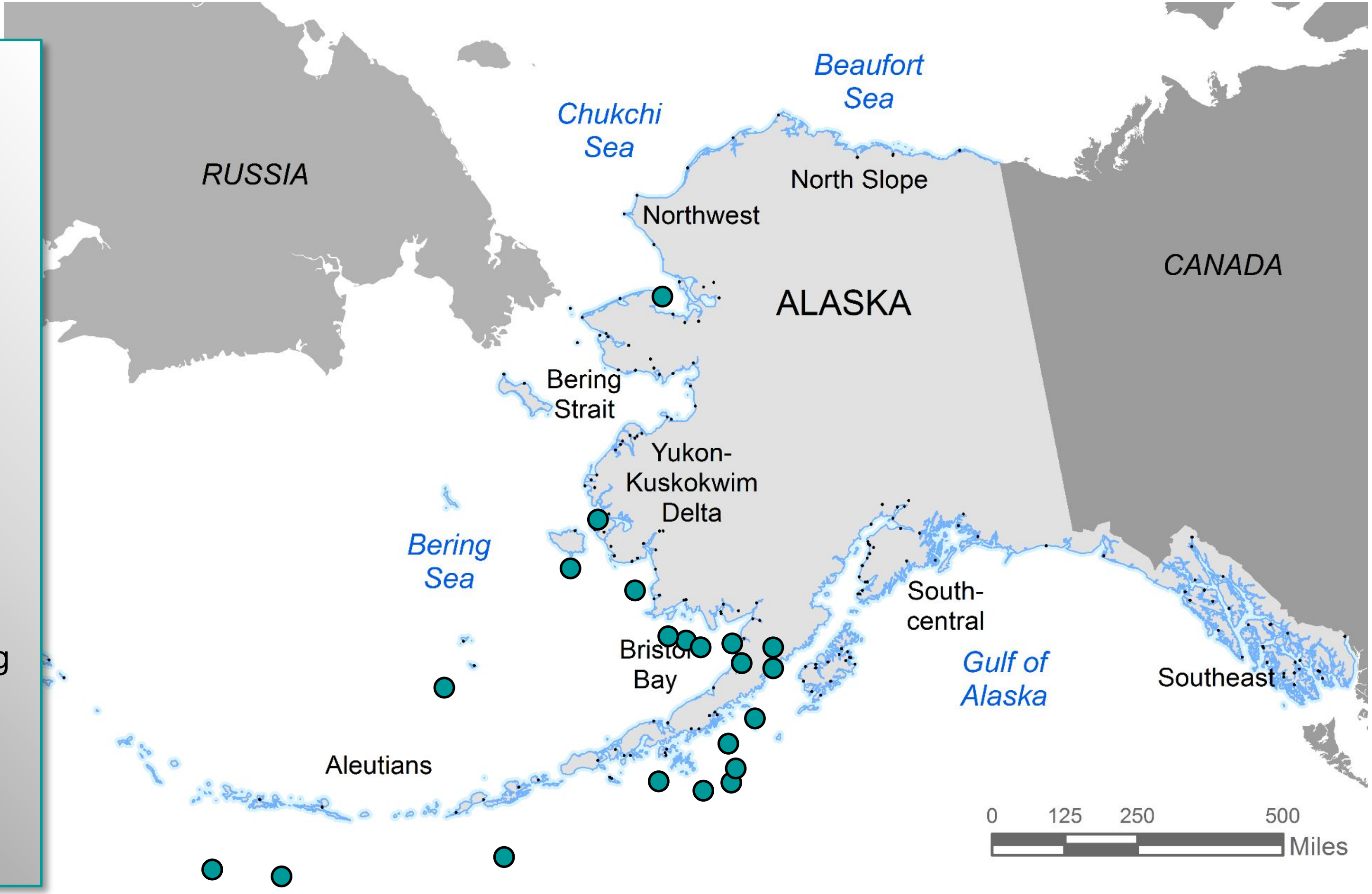


Mapping with K-12 Students

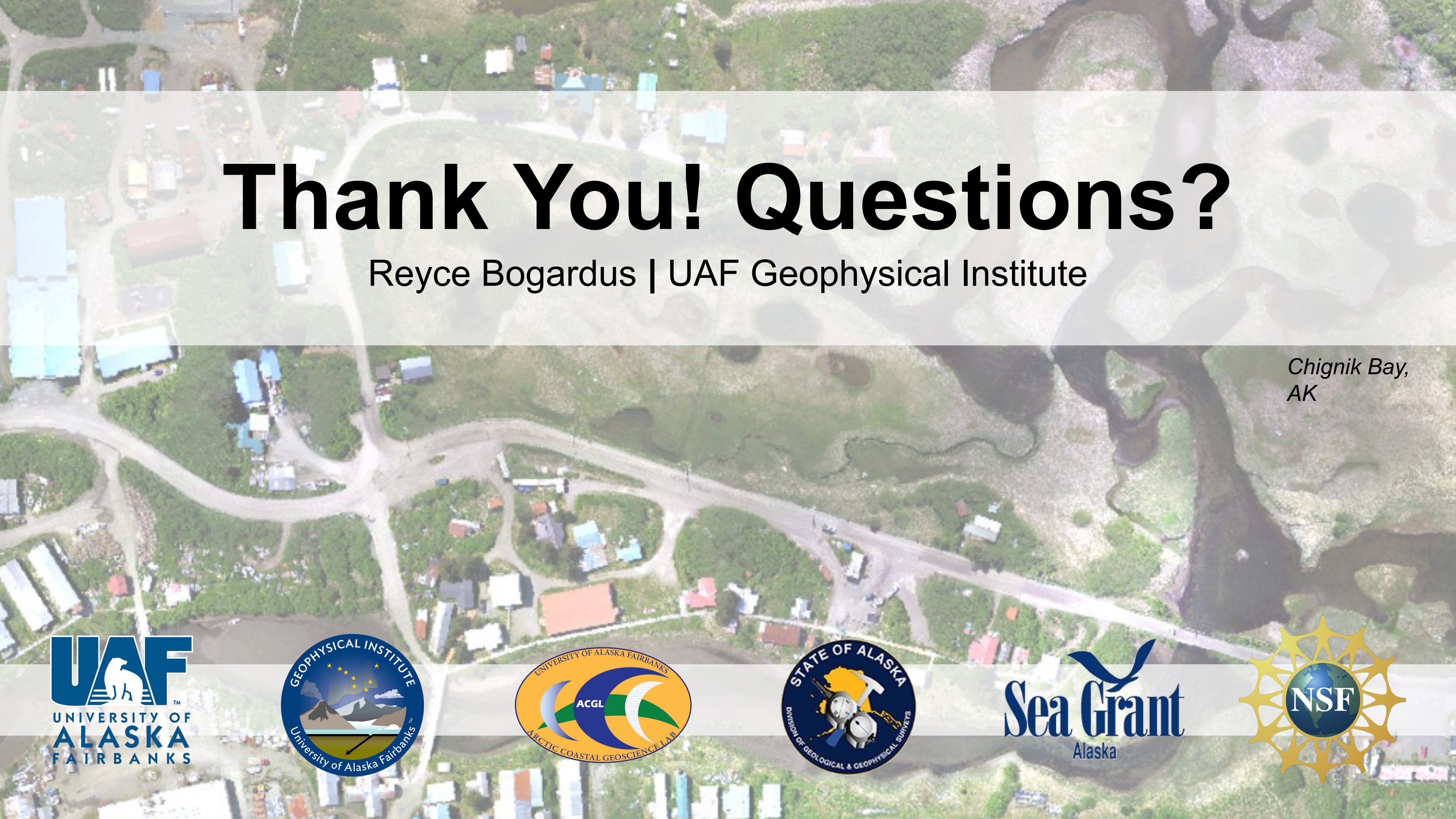
Naknek, AK; others

- Geohazard education modules

- Application-driven workforce development
  - Mapping with Structure-from-Motion (SfM)
  - Geovisualization using Virtual Reality (VR)

Thank You! Questions?

Reyce Bogardus | UAF Geophysical Institute



Chignik Bay, AK

UNIVERSITY OF ALASKA FAIRBANKS

GEOPHYSICAL INSTITUTE University of Alaska Fairbanks

UNIVERSITY OF ALASKA FAIRBANKS ACGL ARCTIC COASTAL GEOSCIENCE LAB

STATE OF ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

Sea Grant Alaska

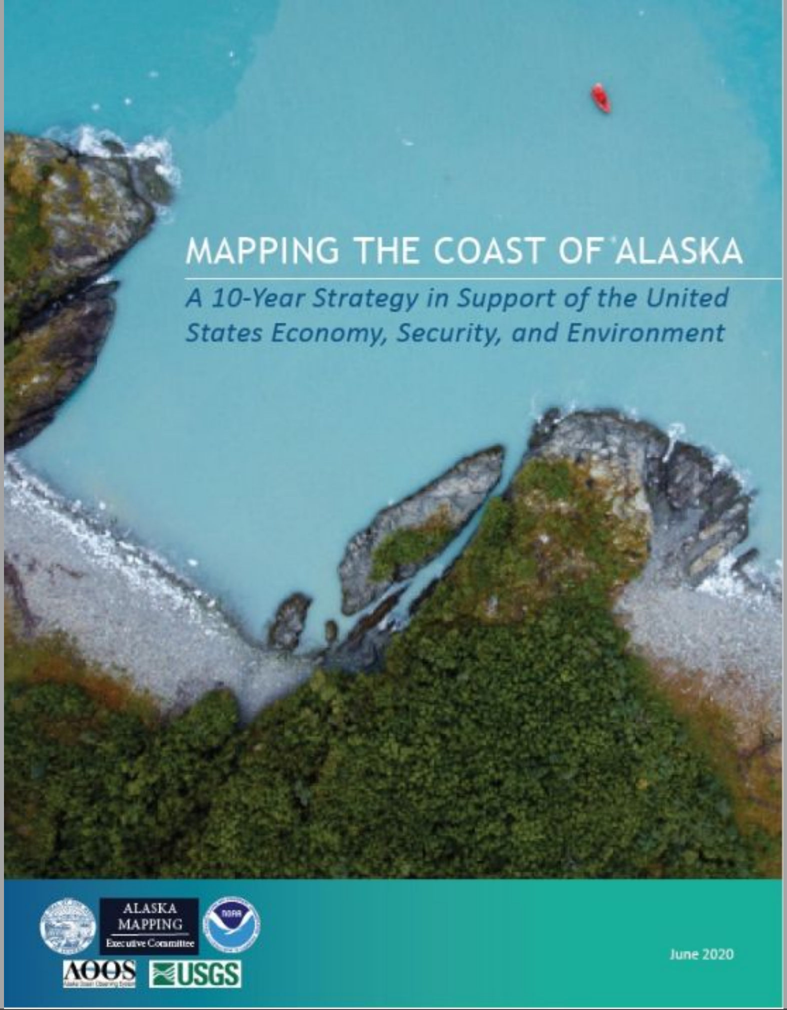
NSF

Prioritization Survey Results & Mapping Partner Finder

Hillary Palmer – Dewberry

A Coastal Mapping Strategy for Alaska is Born!

- Imagery
- Elevation
- Shoreline Delineation
- Supporting Positional Control Framework



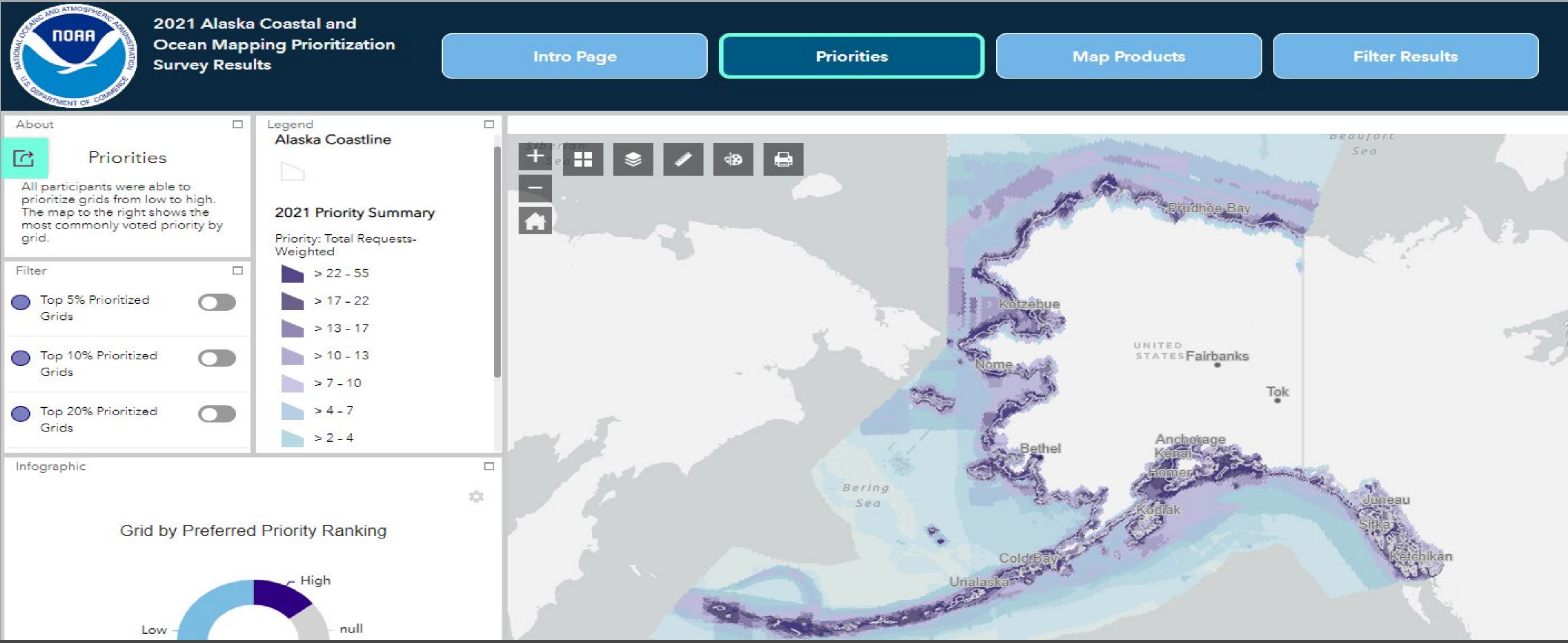

Alaska Coastal Mapping Strategy Tools
Mapping Plan of Action
Synthesis of Prioritization Survey Results + Community Mapping Areas (equity). Map most needed places first..
Prioritization Survey Results
What areas are important? What map products are needed? How soon?
Mapping Partner Finder Tool
Who else is interested in my area? Maybe we can share mapping costs!
Acquisition Tracker
What data already exists? Who's planning to collect new data? Where? When?

Feedback Required – Do a Survey!

- All NOAA Agencies
- All Federal Entities
- Alaska Regional Survey

Prioritization Survey Results

akmappingpriorities.com



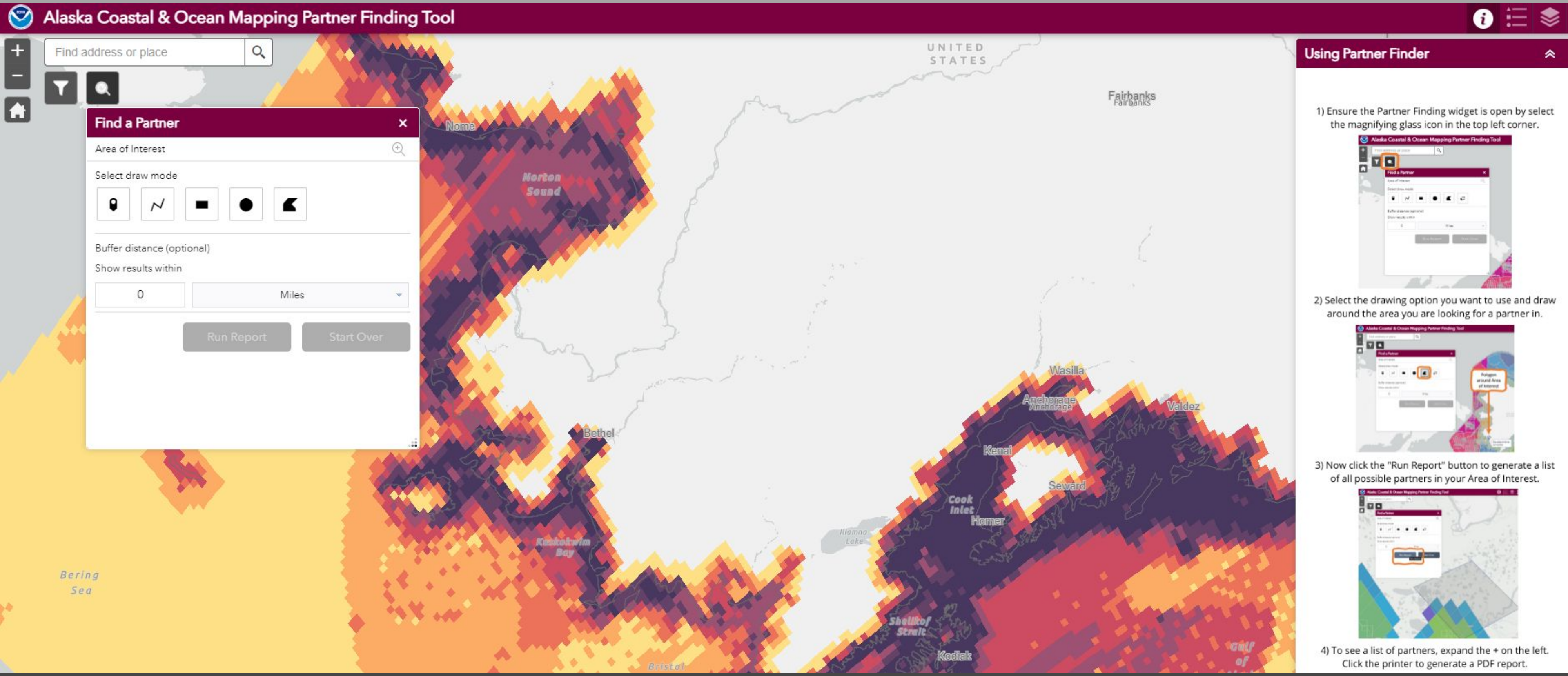
Demo video of Prioritization Survey Results

How do we find partners to leverage resources?

- Alaska is BIG…
- Finding mapping partners is like playing Pin the Tail on the Donkey, blindfolded, on a football field!
- Where's the "easy" button?

Mapping Partner Finder Tool

akmappingpartnerfinder.com



Demo Video of Mapping Partner Finder Tool

Mapping Partner Finder Reports

- I have a list of potential mapping partners… now what?
- Many have a “Contact Us” website form
- If you need help reaching out to these agencies to discuss potential mapping partnerships, send your Partner Finder Report to:

iwgocm.staff@noaa.gov

End of Presentation

Thank you!

Coastal Mapping Plan of Action Dashboard

Hillary Palmer – Dewberry

ACMS PLAN OF ACTION

DATA DEVELOPMENT OVERVIEW

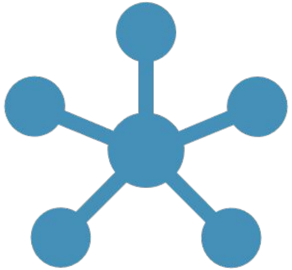
ALASKA COASTAL MAPPING STRATEGY GOAL

- Develop a 10-year Mapping Plan of Action!

OPTIONS FOR DEVELOPING A COASTAL MAPPING APPROACH

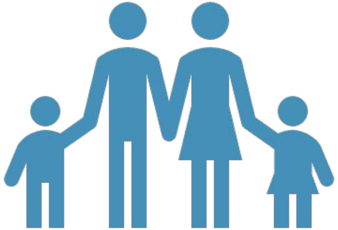
- No shortage of ways to map Alaska's coast.
- Everybody has a different view of what should be done.
- Try to build consensus using data-driven decisions and transparency.
- Yep, you guessed it! We made ANOTHER dashboard to facilitate this.
- Let's look at some of the options for solving this problem and the pro's and con's for each.

MAPPING APPROACH – THE OPTIONS



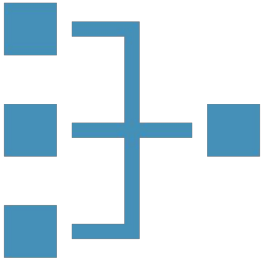
Prioritization Survey

PRO • Some priority areas unpopulated
CON • Only 28 survey participants



Community Mapping Areas (CMA)

PRO • Equitable
CON • Ignores survey results



Hybrid ★

PRO • Best of both worlds
CON • More complicated

DATA DEVELOPMENT DOCUMENTATION

- Prioritization Survey Results available here: https://www.akmappingpriorities.com
- CMA Documentation
  - ACMS mapping area = 2 miles inland and 2 miles seaward or to 10m depth contour (whichever comes first) aka "buffered coastline"
  - Alaska community points clipped to ACMS mapping area, then buffered to 5-mile radius; buffers clipped again by ACMS mapping area
  - CMA's evaluated against complied existing data inventory & designated "mapped" or "unmapped"
  - Unmapped CMA's are a higher priority; Also incorporated Environmentally Threatened Communities ranking to further prioritize amongst Unmapped CMA's

DEVELOPING THE COMMUNITY MAPPING AREAS (CMA'S)

Elevation CMA's

(Goal: QL2/QL2B or better, and 5 yrs old or newer)

- "mapped" = existing data meets goal
  - Sort by most recent elevation data by age and map CMA's with oldest data first
- "unmapped" = existing data does not meet goal OR no data exists
  - Incorporate the Statewide Environmental Threat Assessment ranking to ensure we map "threatened" communities first

Imagery CMA's

(Goal: 5 yrs old or newer)

- "mapped" = existing data meets goal
  - Sort by most recent elevation data by age and map CMA's with oldest data first
- "unmapped" = existing data does not meet goal OR no data exists
  - Incorporate the Statewide Environmental Threat Assessment ranking to ensure we map "threatened" communities first

CREATING THE MAPPING TARGET GROUPS

Combining the **prioritization survey results** with the **CMA's**

Target 1 = top 10% of priority areas + "Unmapped" CMA's

- 1A: top 5% of priority areas + Unmapped CMA's that are "Threatened"
- 1B: top 10% of priority areas + Unmapped CMA's that are not "Threatened"

Target 2 = remaining CMA's + all high priority cells from survey

Target 3 = remaining unpopulated, lower priority areas

Lidar Mapping Plan of Action Dashboard

Onshore or Offshore?
Onshore

Target 1

5,091
Sq Miles

Target 1A	Target 1B
1,410 sq mi	3,681 sq mi
Threatened Communities, Top 5% Survey Priorities	Unmapped Communities, Top 10% Survey Priorities

Target 2

29,676
Sq Miles

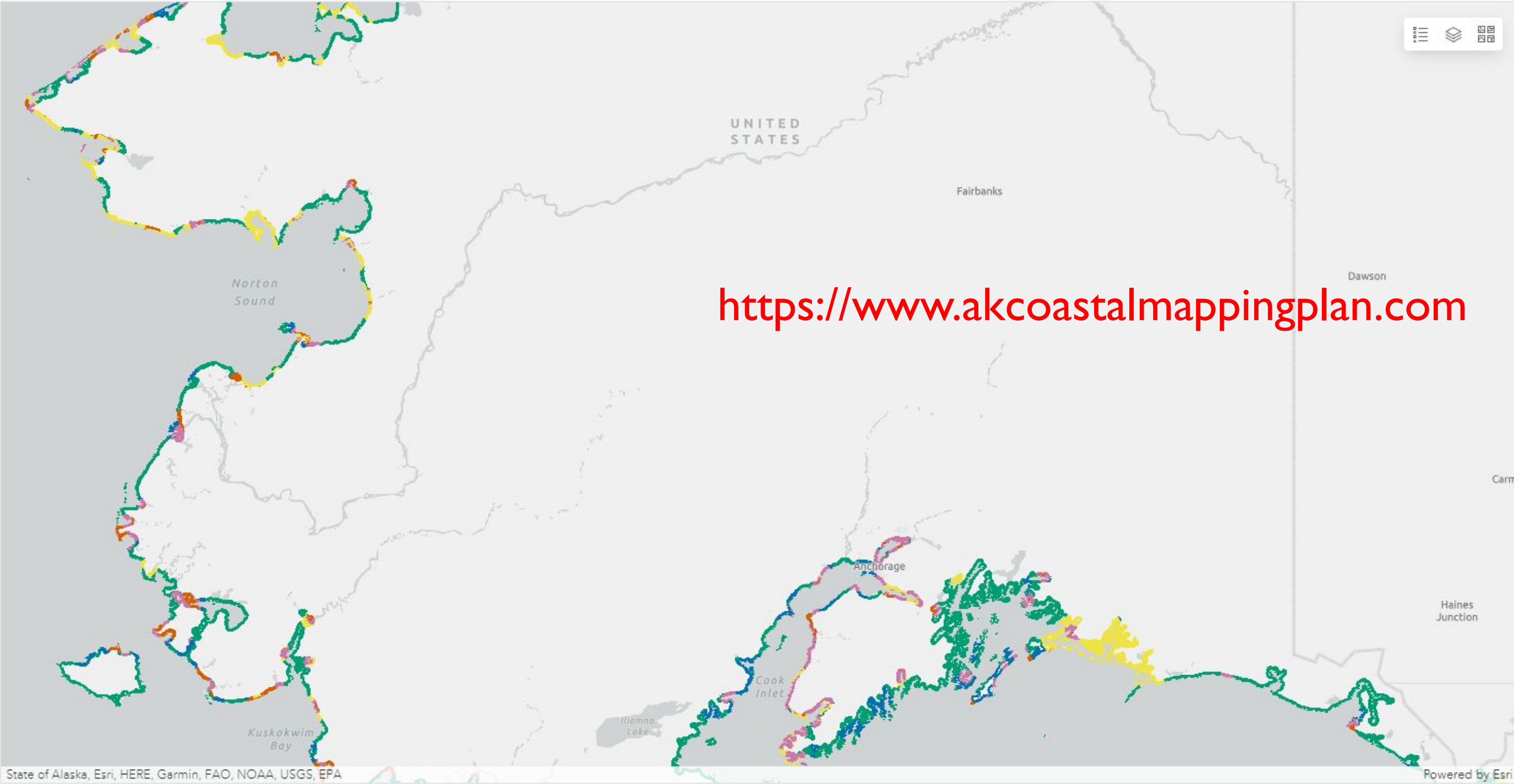
Target 2A	Target 2B
3,732 sq mi	25,944 sq mi
Remaining Communities	All High Priority Areas from Survey

Target 3

7,082
Sq Miles

Total Square Miles to Map

41,849
Sq Miles



https://www.akcoastalmappingplan.com

Imagery Mapping Plan of Action Dashboard

Onshore or Offshore?
Onshore

Target 1	
5,353 Sq Miles	
Target 1A	Target 1B
1,409 sq mi	3,945 sq mi
Threatened Communities, Top 5% Survey Priorities	Unmapped Communities, Top 10% Survey Priorities

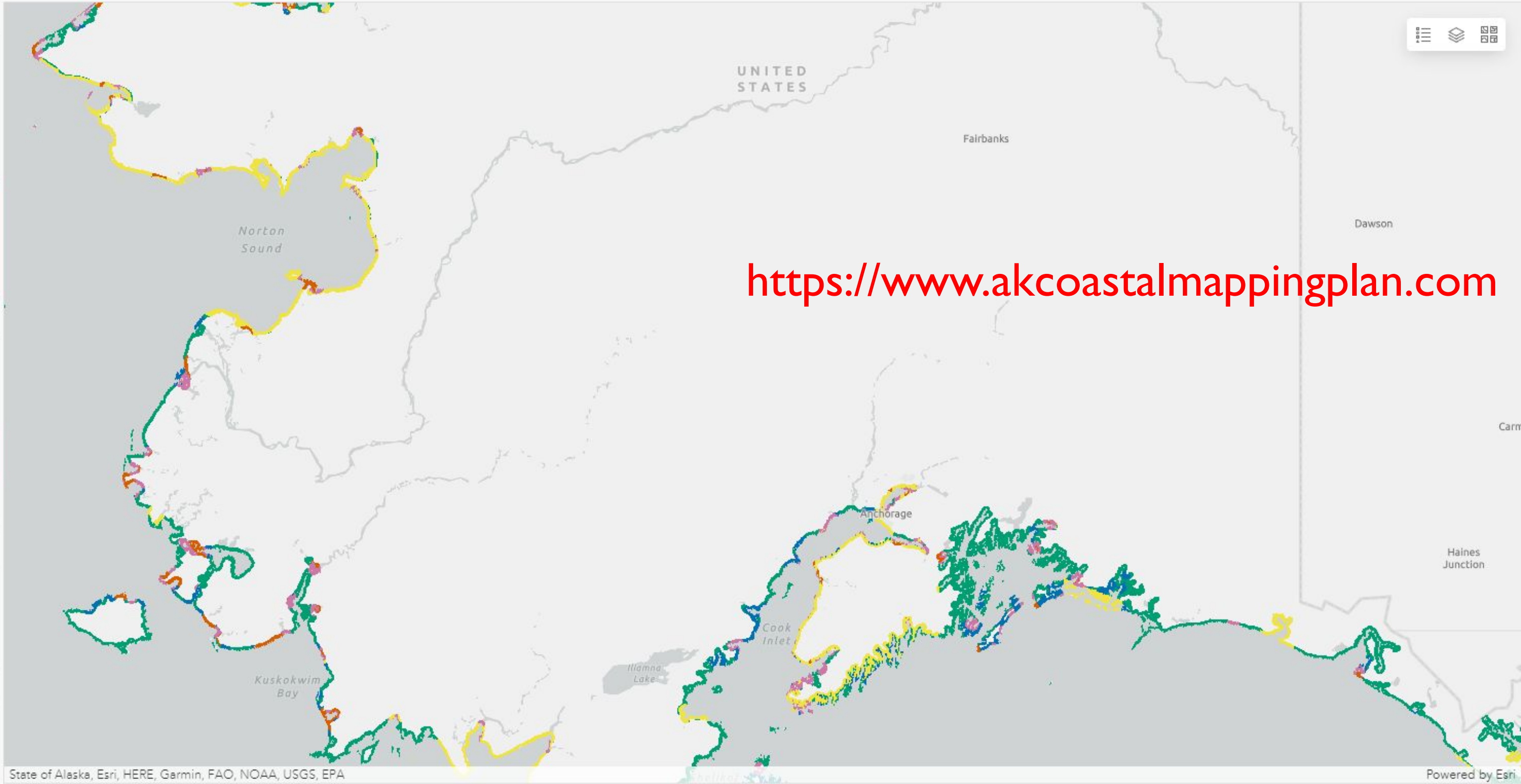
Target 2	
31,332 Sq Miles	
Target 2A	Target 2B
3,803 sq mi	27,529 sq mi
Remaining Communities	All High Priority Areas from Survey

Target 3

5,163 Sq Miles

Total Square Miles to Map

41,849 Sq Miles



https://www.akcoastalmappingplan.com

GREAT! WHAT'S IT GOING TO COST?

INITIAL DRAFT COST ESTIMATES

Onshore Elevation Data				
Target ID	Area (sq. miles)	TBL QL2B	Topographic Lidar QL1	Topographic Lidar QL2
1A	498	$ 1,245,000	$ 423,399	$ 209,160
1B	4,593	$ 11,482,500	$ 3,904,050	$ 1,929,060
2A	3,732	$ 9,330,000	$ 3,172,200	$ 1,567,440
2B	25,944	$ 64,860,000	$ 22,052,400	$ 10,896,480
3	7,082	$ 17,705,000	$ 6,019,700	$ 2,974,440
Total	**41,849**	**$104,622,500**	**$ 35,571,650**	**$ 17,576,580**

Imagery				
Target	Area (sq. miles)	TCORTHO	ORTHO 3-in	ORTHO 6-in
1A	1,409	$ 1,409,000	$ 1,373,775	$ 338,160
1B	3,945	$ 3,945,000	$ 3,846,375	$ 946,800
2A	3,803	$ 3,803,000	$ 3,707,925	$ 912,720
2B	27,529	$ 27,529,000	$ 26,840,775	$ 6,606,960
3	5,163	$ 5,163,000	$ 5,033,925	$ 1,239,120
Total	**41,849**	**$ 41,849,000**	**$ 40,802,775**	**$ 10,043,760**

TBL: Topobathy Lidar

TCORTHO: Tide-controlled orthorectified imagery

NEXT STEPS

- Generalize the piecemeal mapping target groups into 10K sq mi chunks, each a reasonable amount for a single acquisition season.
- NOAA might issue an RFI soon for 2 of these as pilot areas to refine cost estimates.
- We need your help! This initiative will only be successful through collaboration and cost-share partnerships.

AKCOASTALMAPPINGPLAN.COM

DRAFT ALASKA COASTAL MAPPING PLAN OF ACTION

Send us your feedback!

Either use the chat or email me at:
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End of Presentation

Thank you!