III. PRESENTATION PDFS

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AOOS
Alaska Ocean Observing System

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
U.S. DEPARTMENT OF COMMERCE

ALASKA DEPARTMENT OF NATURAL RESOURCES

Alaska Coastal Mapping Summit

Dena'ina Center
Anchorage, Alaska
February 9, 2018

FAIRBANKS FODAR
If your topography is changing, we can measure it. Affordably.
www.fairbanksfodar.com

FUGRO

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

quantum SPATIAL

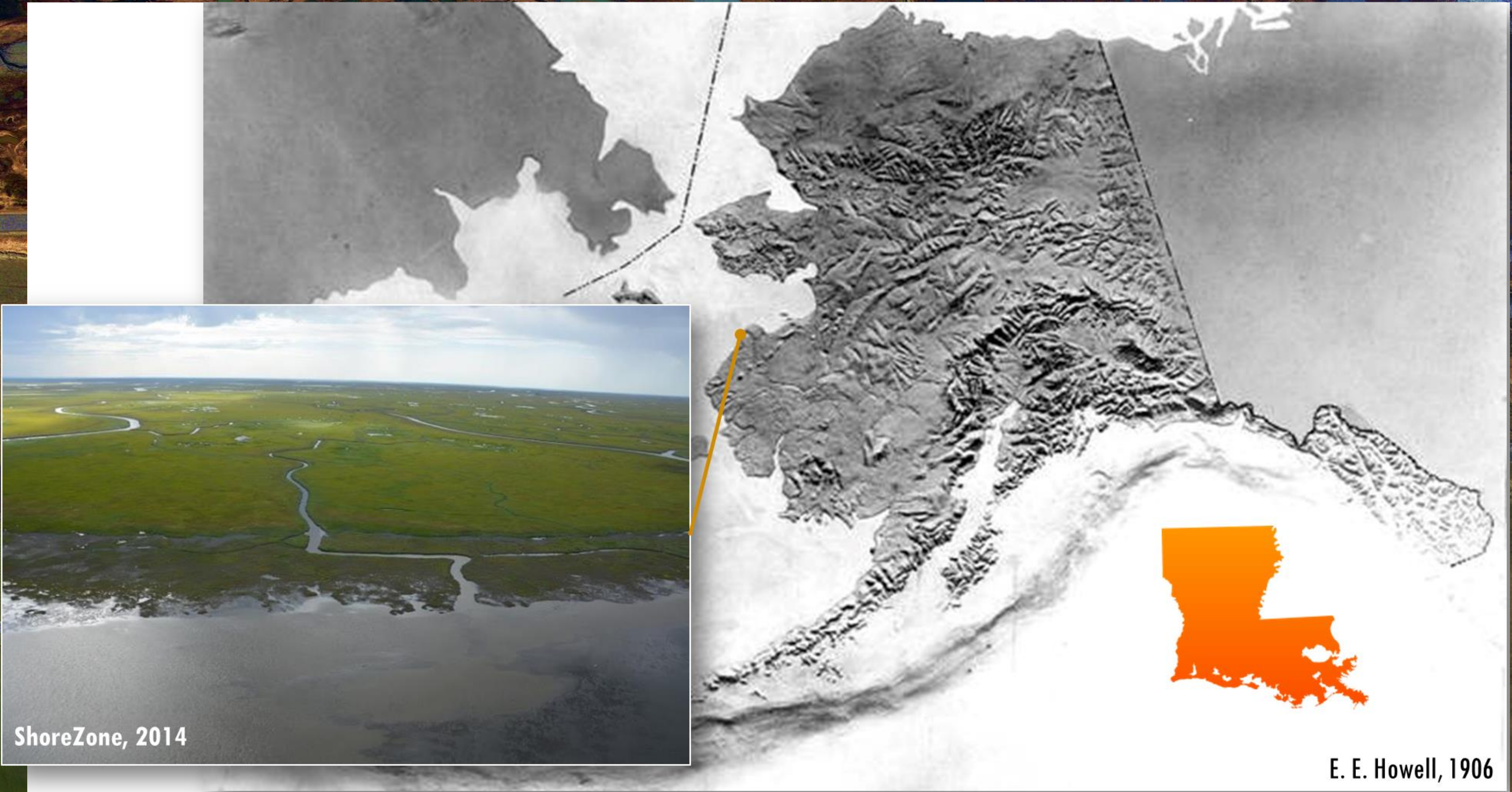
GeoNorth
Information Systems

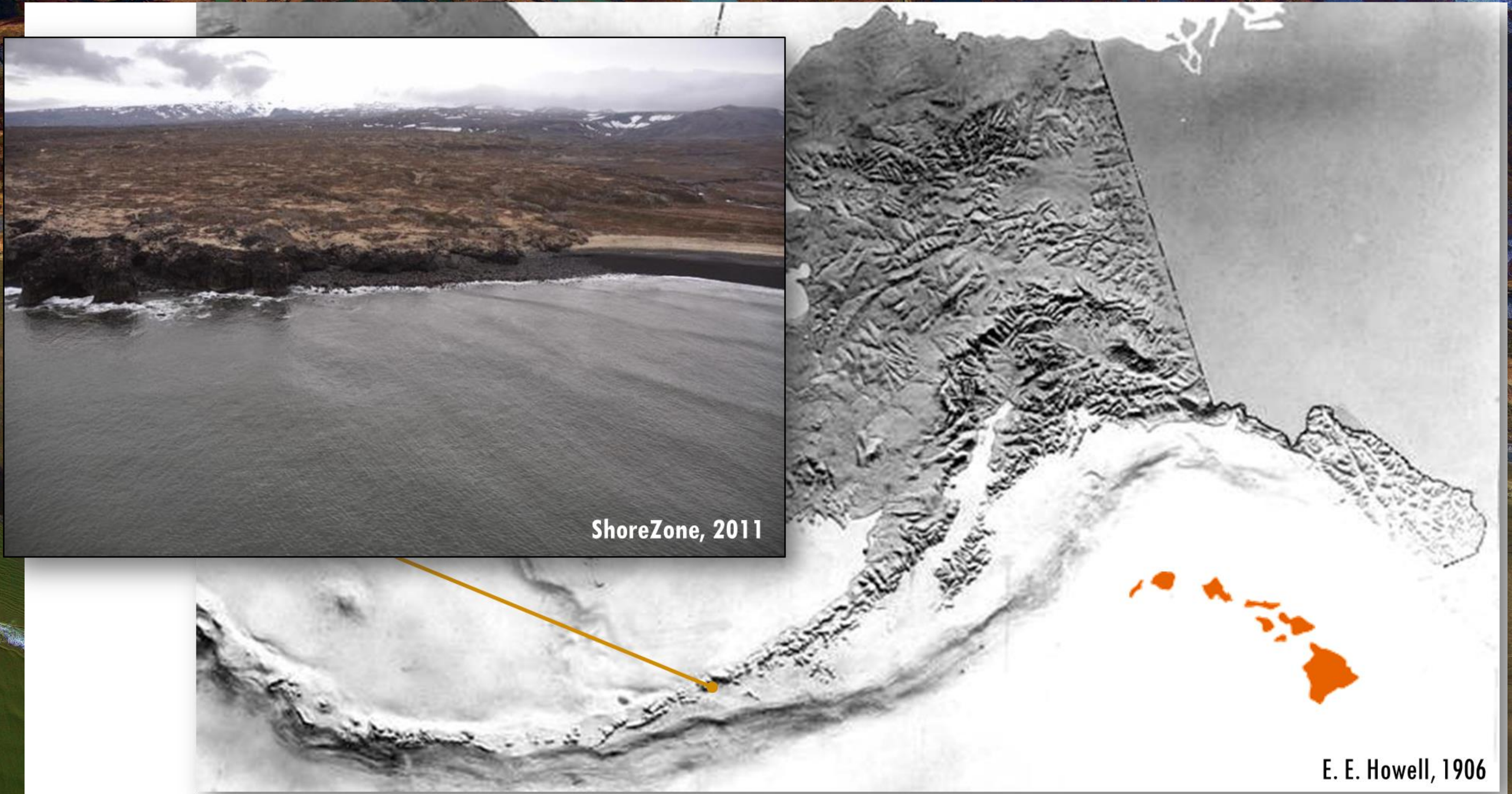
FRONTIER PRECISION

WELCOME

E. E. Howell, 1906

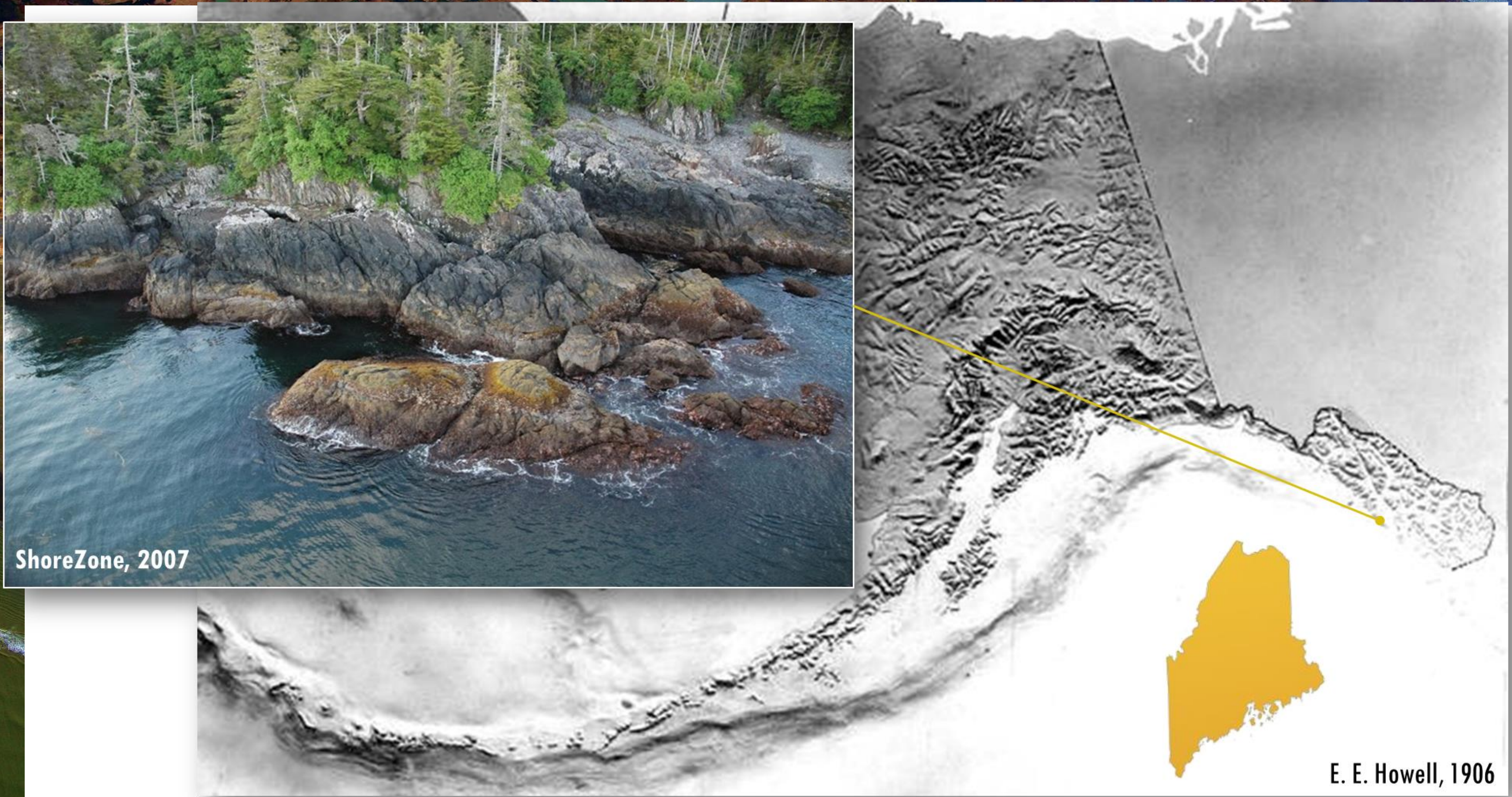

ShoreZone, 2012
E. E. Howell, 1906


ShoreZone, 2014
E. E. Howell, 1906


ShoreZone, 2011
E. E. Howell, 1906

ShoreZone, 2009

E. E. Howell, 1906


ShoreZone, 2007
E. E. Howell, 1906

FORMAT

National Coordination Overview

Three Rounds of Lightning Talks

Three Discussion Group Sessions

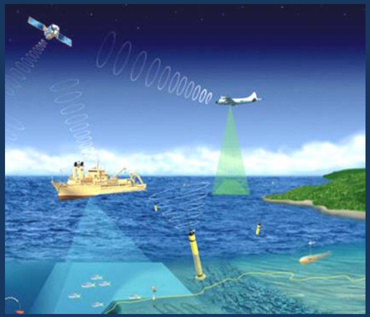
GOALS

Share Knowledge

Discuss New Ideas

Groundwork for a Tangible Roadmap & Strategy

Alaska Coastal Mapping Summit 2.0



Data Supporting Science
and Sound Decision-Making

Ashley Chappell

February 9, 2018

Alaska Coastal Mapping Summit 2016

June 14, 2016
Girdwood Alaska

- 4 hour inaugural coordination meeting
- Over 75 attendees from over 50 stakeholder entities

2016 Alaska Coastal Mapping Summit

NOAA — National Oceanic and Atmospheric Administration, U.S. Department of Commerce

USGS science for a changing world

Western Alaska LCC

National Park Service

National Geospatial-Intelligence Agency, United States of America

Alaska Department of Natural Resources

Federal Emergency Management Agency

United States Coast Guard 1790

ARCTIC DOMAIN AWARENESS CENTER

NSF

The Nature Conservancy
Protecting nature. Preserving life.

NRCS Natural Resources Conservation Service

NUNA TECHNOLOGIES

Coastal and Ocean Resources
a MER company

U.S. Fish & Wildlife Service, Department of the Interior

Sea Grant Alaska

State of Alaska Division of Geological & Geophysical Surveys

quantum SPATIAL

AK Hydro

Michael Baker INTERNATIONAL

JOA Surveys, LLC
At the boundary between land and sea

KODIAK MAPPING

BSEE Bureau of Safety and Environmental Enforcement

Resource Data Inc.
PEOPLE • TECHNOLOGY • RESULTS

The University of Texas at El Paso

Division of Homeland Security & Emergency Management, State of Alaska

U.S. ARMY

TERRASOND PRECISION GEOSPATIAL SOLUTIONS

FishEye Real-Time

Virginia Tech

FAIRBANKS FODAR
If your topography is changing, we can measure it.

Department of Commerce, Community, and Economic Development, State of Alaska

Canadian Hydrographic Service / Service Hydrographique du Canada

AECOM

GEONORTH
A Wholly Owned Subsidiary of The Tatitlek Corporation

Dewberry

ASHSC Alaska Seismic Hazards Safety Commission

UAF UNIVERSITY OF ALASKA FAIRBANKS

FUGRO

UAA UNIVERSITY of ALASKA ANCHORAGE

BOEM Bureau of Ocean Energy Management

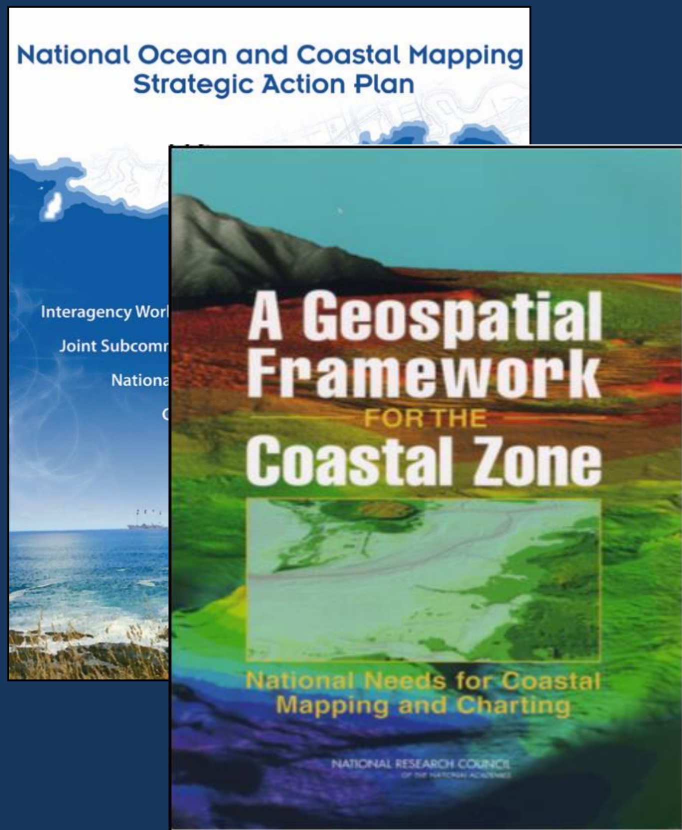
Northern Land Use

ILLINOIS STATE GEOLOGICAL SURVEY
PRAIRIE RESEARCH INSTITUTE

The Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM)

WHO:

- NOAA
- USGS
- USACE
- NAVO
- BOEM
- NSF
- NGA
- USCG
- EPA
- FEMA
- NASA
- USDA
- *and other appropriate Federal agencies involved in ocean and coastal mapping.*



- **Co-chaired by NOAA, USGS, and USACE**
- **Charged with facilitating "the coordination of ocean and coastal mapping activities and avoid[ing] duplicating mapping activities…"**

Recent Mandates

Ocean and Coastal Mapping Integration Act, 2009:

- Validated NOAA's vision for IOCM
- Provided focus for interagency coordination
- Authorized previously ad-hoc efforts

SOST implementation plans (stemming from NOP)

- Identifies mapping actions to meet OCMIA
- Provides long term road map
- Coordinates across mapping agencies

National Strategy for the Arctic Region

- Identifies charting as an objective
- Coordination role

The term "ocean and coastal mapping" means the acquisition, processing, and management of physical, biological, geological, chemical, and archaeological characteristics and boundaries of ocean and coastal areas, resources, and sea beds through the use of acoustics, satellites, aerial photogrammetry, light and imaging, direct sampling, and other mapping technologies.

What is IOCM?

IOCM is *planning, acquiring, integrating, and managing* ocean and coastal geospatial data and derivative products for easy access and use by the greatest range of users.

<u>Three primary tasks:</u>

1. Data Acquisition

2. End-to-End Data Management

3. Maximum Use and Re-Use of data

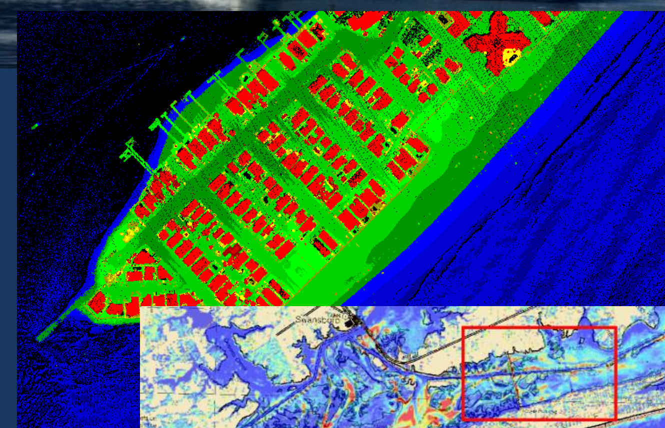
Ocean and Coastal Mapping Integration Act of 2009

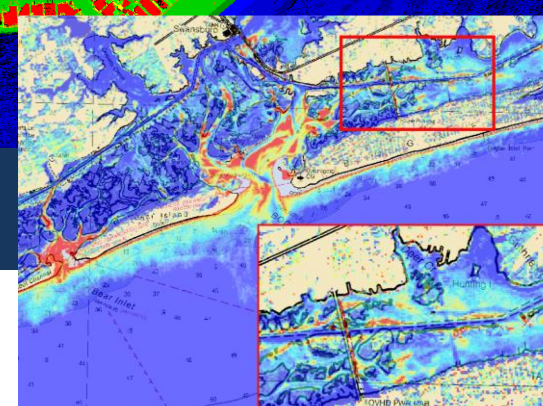
Why coordinate & collaborate on Data Acquisition?

- Avoid costly duplication of effort
- Maximize survey time
- Meet science & mission requirements
- R&D on technology, techniques

IOCM:

- Identifies mapped areas
- Improves planning
- Enables cross-agency collaboration

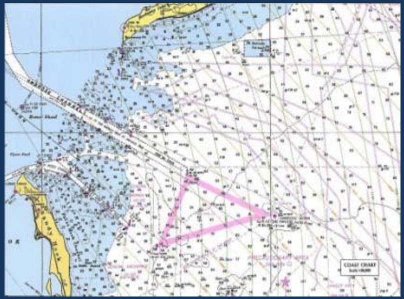




NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE

Why manage data?

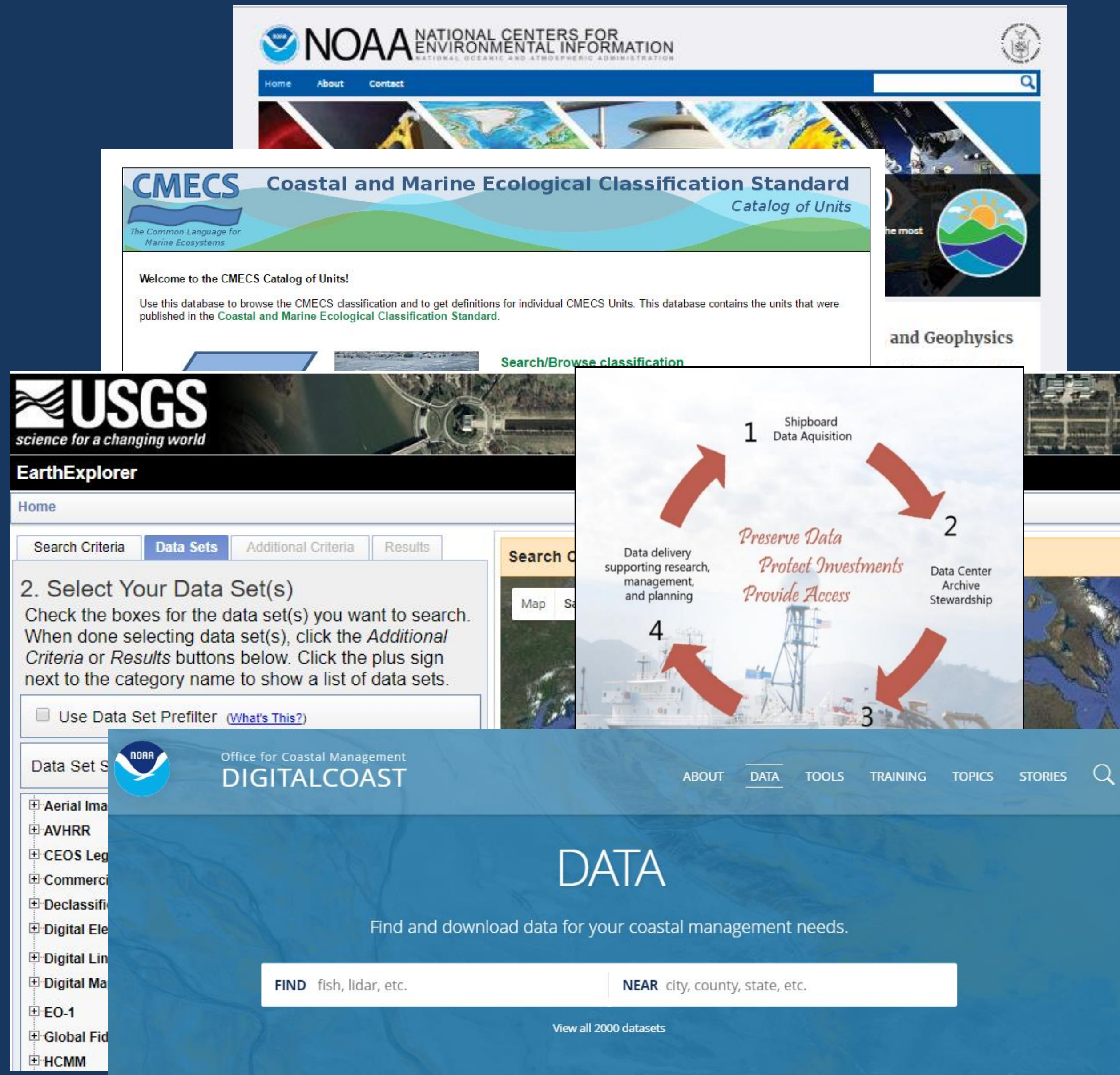
- Enable Agency missions requiring scientific data
- Maximize use of data for multiple purposes
- Avoid costly data loss



- IOCM:
  – Ensures data collected are available for use
  – Processes data for multiple uses
  – Delivers bang for the buck

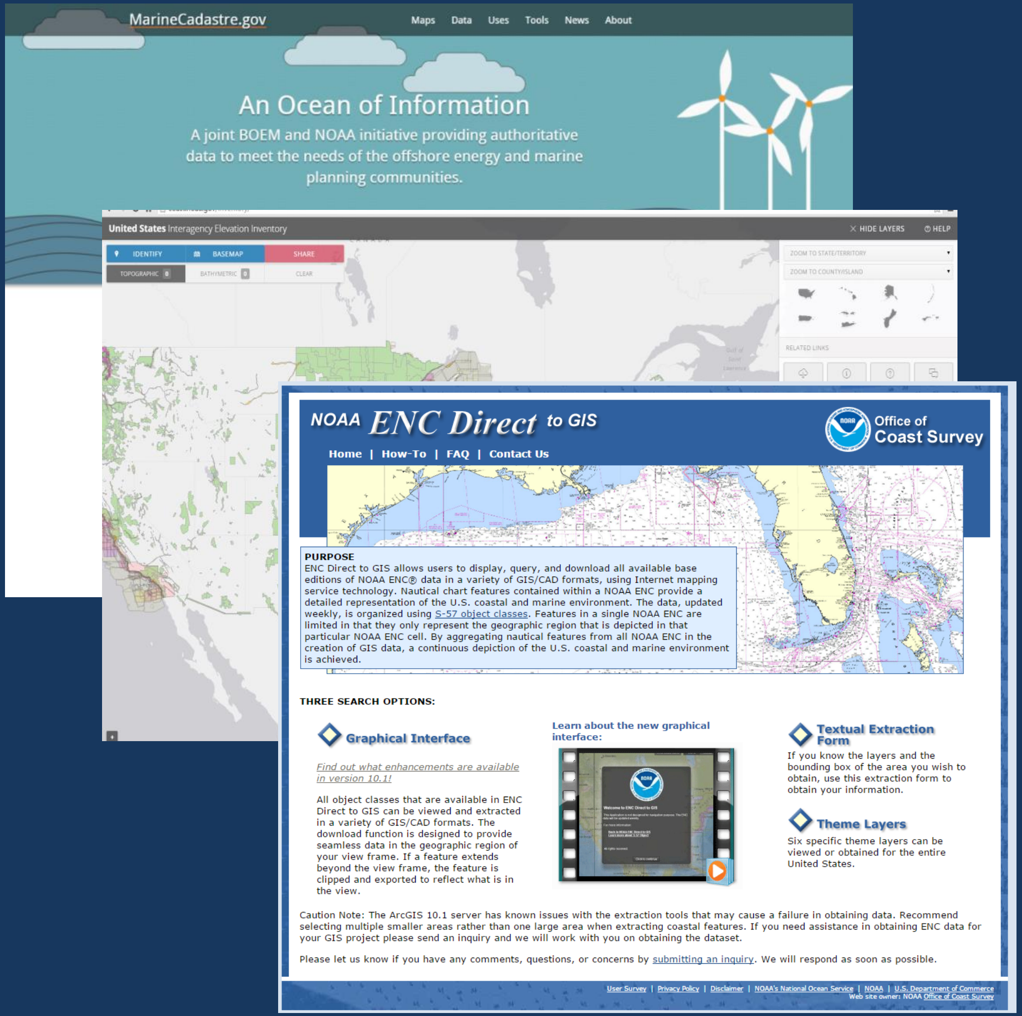
Data Stewardship, Access

- National Centers for Environmental Information
- Digital Coast
- Earth Explorer
- Rolling Deck to Repository
- Coastal and Marine Ecological Classification Standard
- Crowd-sourced Bathymetric Database



Why re-use data?

- Scientifically sound decisions require data
- Data expensive to collect
- Scientific data management is cost-effective
  - 3-month study, 2000% return on investment



- IOCM:
  - Ensures data are available
  - Enables use/re-use of data
  - Supports scientific and management missions

NOAA INTEGRATED OCEAN AND COASTAL MAPPING (IOCM)
UNITED STATES DEPARTMENT OF COMMERCE

"Map Once, Use Many Times"

National Coastal Mapping Strategy 1.0

Coastal Lidar Elevation for a 3D Nation

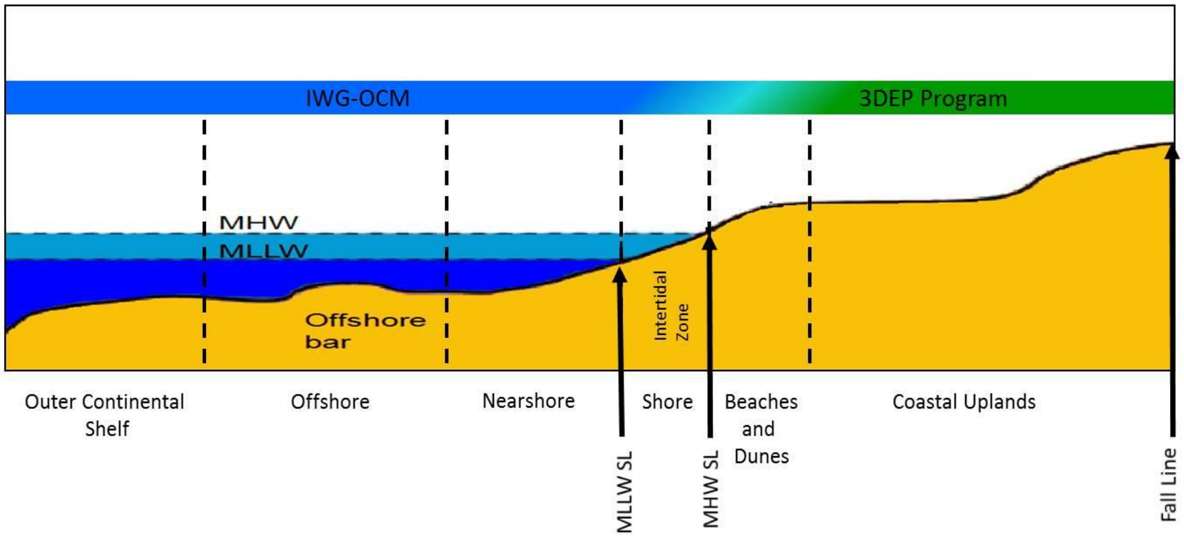
Components:

Regional Coastal Mapping Summits for coordination

Common standards – Bathy Quality Levels aka 3DEP topo QL's

Whole life cycle approach to data

R&D on new tools/techniques for data collection and use.



INTERAGENCY WORKING GROUP ON

Ocean and Coastal Mapping

Regional/State Summits

JALBTCX meetings -- national (Mobile 2014, Corvallis 2015)
California 2014
Washington 2014, 2016, *2018*
Northeast 2015, 2016, *2018*
Alaska 2016, 2018
Great Lakes 2017
Southeast 2016, *2018*
Florida 2018
Gulf *2018*

Florida Coastal Mapping Program

Vision

Accessible, high resolution seafloor data of Florida's coastal waters to support infrastructure, benthic habitat mapping, restoration projects, resource management, emergency response, and coastal resiliency and hazard studies for the citizens of Florida.

Mission

Coordinate across Federal and FL State agencies, academics, NGOs, and other stakeholders to evaluate the state and quality of existing data, establish and implement a prioritization for new data collection, and develop and implement a strategy to create a seamless, modern, high resolution topo-bathymetric map for Florida's coastal waters from the shoreline to 200m water depth within 10 years.

COORDINATOR

National Coastal Mapping Strategy 1.0

Coastal Lidar Elevation for a 3D Nation

Components:

Regional Coastal Mapping Summits for coordination
Common standards – Bathy Quality Levels aka 3DEP topo QL's
Whole life cycle approach to data
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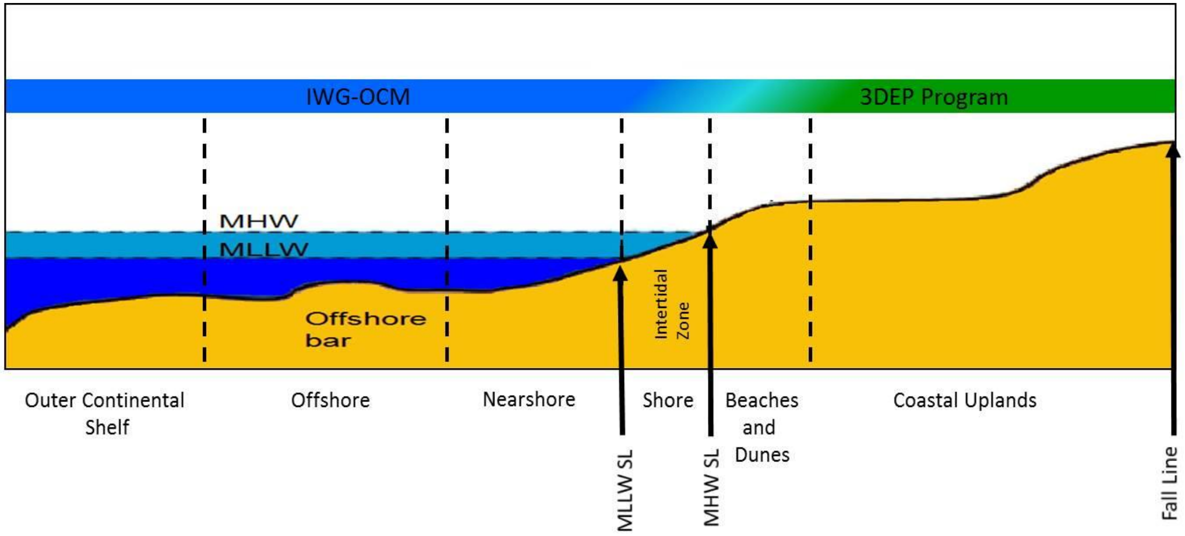
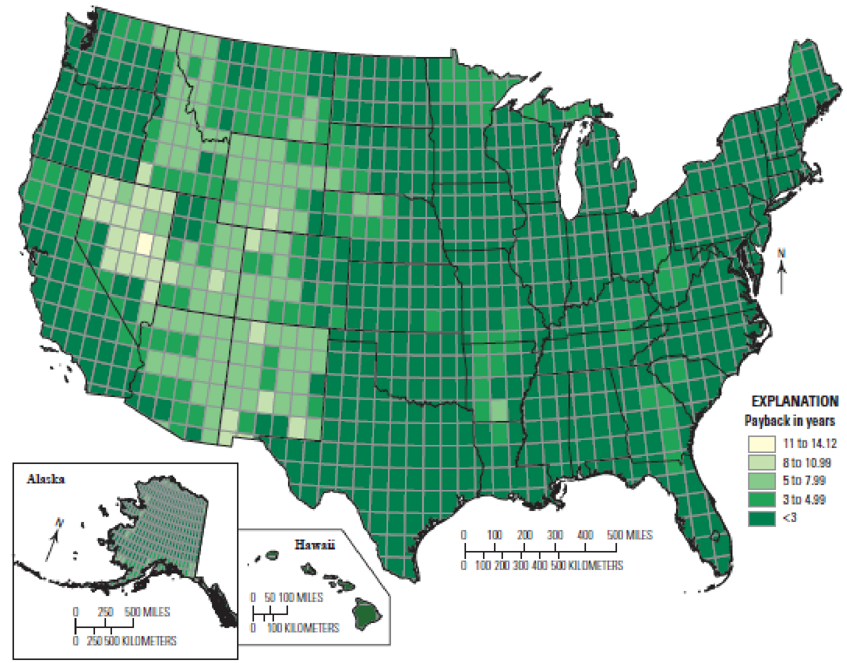


3D Nation?
Refresh cycle?
ROI?
NEEA-like study?

National Enhanced Elevation Assessment (NEEA)

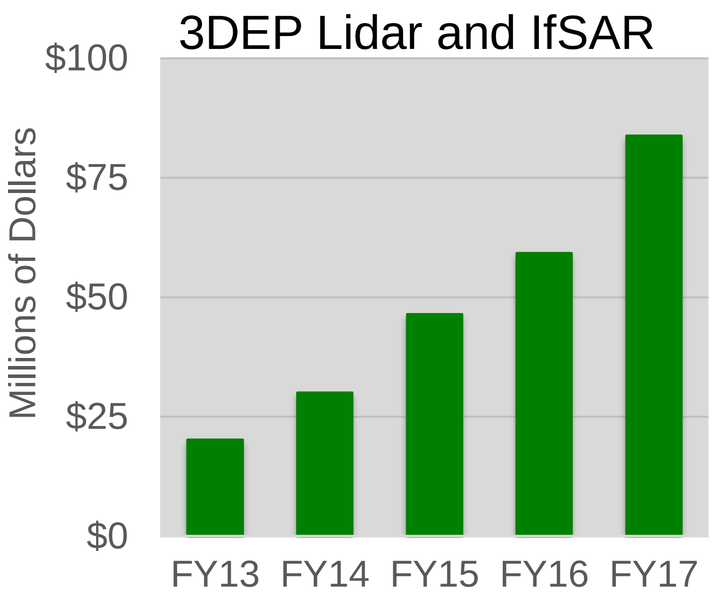
A comprehensive inventory of user requirements and benefits for elevation data



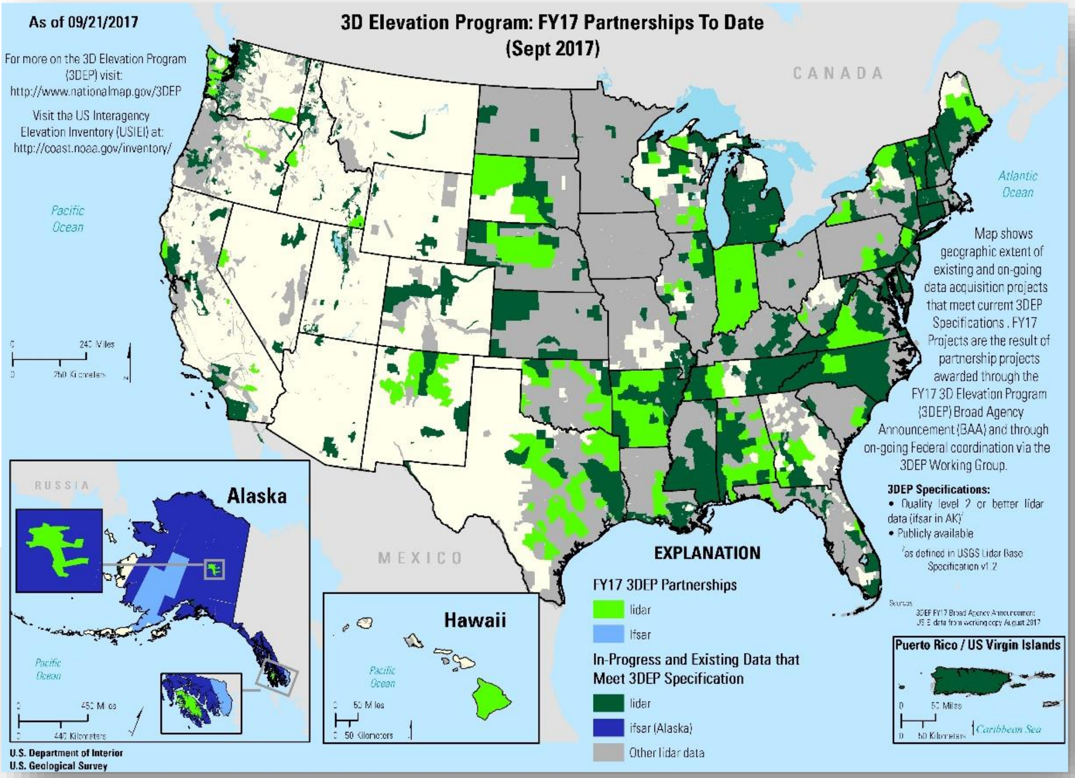
- Conducted in 2010 – 2012
- Data collection
  - 34 Federal Agencies
  - 50 States
  - Local Government, tribal, private, not-for-profits
- Results
  - 602 Mission critical activities that need significantly better data than are currently available
  - Between $1.2 billion and $13 billion in benefits annually
  - Increases in President's budget in FY14-17
  - http://nationalmap.gov/3dep

3DEP Growth - Partnerships To Date

Strong coordination and increasing investments (FY13-17)



Map shows lidar from FY13 – FY17



- Between FY13 and F17, 3DEP data (lidar and IfSAR) have been contracted for 37% of the entire US
- Alaska IfSAR – 92% of state available or in work to date in FY17

In FY17, 3DEP data have been contracted for 11.4% of the Nation

Updating User Requirements and Benefits for 3DEP

- Be able to assess new technologies against user requirements and identify the tradeoffs between different approaches
- Plan for the next round of 3DEP after nationwide coverage has been completed
- Improve our understanding and data about requirements and benefits at the state level for the existing and future program
- Improve our understanding of needs to guide development of the next generation of 3DEP Products and Services

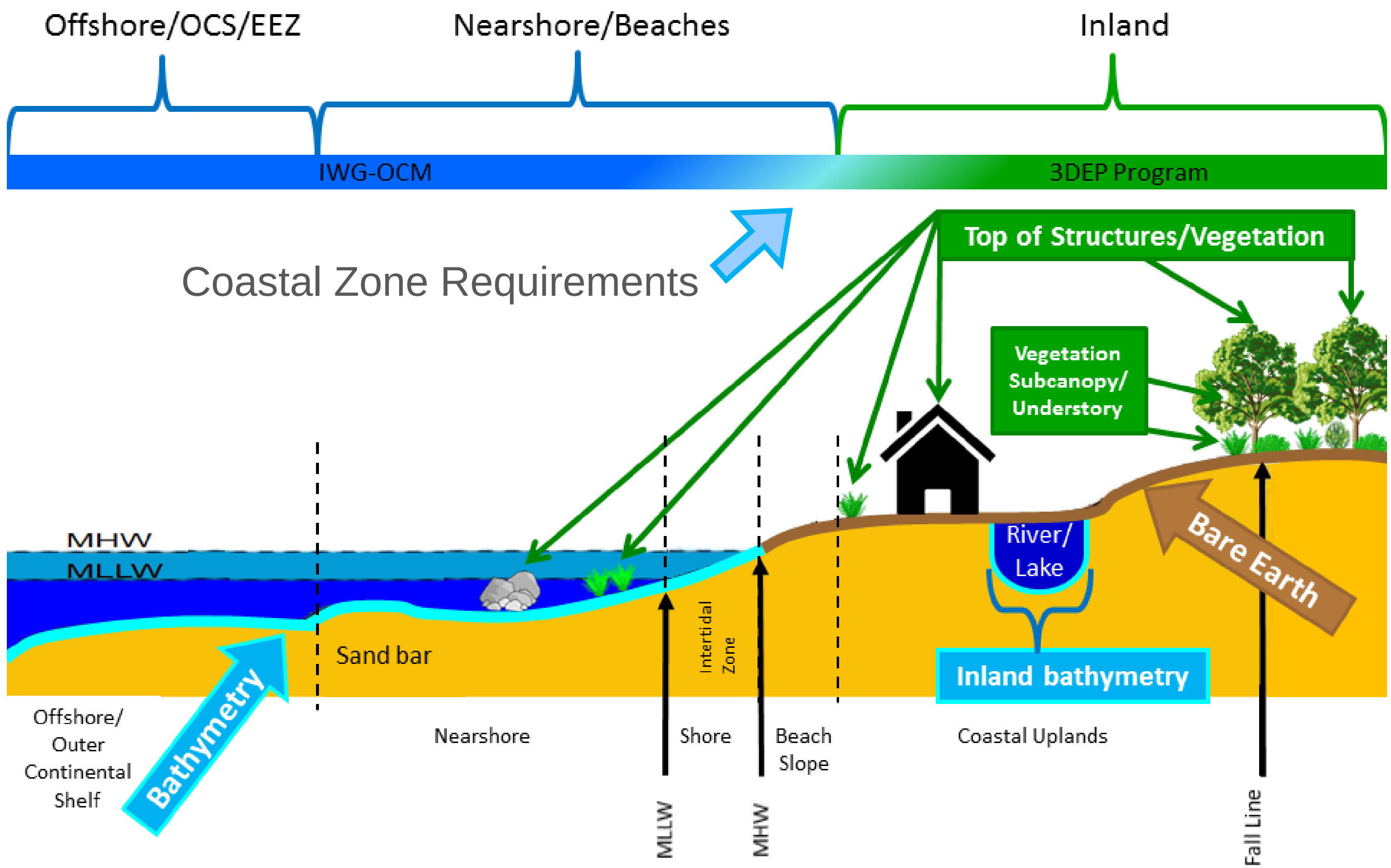
Mapping a 3D Nation: Requirements and Benefits Study Goals

Understand 3D Data Requirements

- Refresh NEEA for the years beyond the initial 8-year acquisition program
- Understand inland, nearshore, and offshore bathymetric data requirements and benefits
- Understand how requirements and benefits dovetail in the coastal zone
- Sensor agnostic/Technology Neutral
  - Focused on need for, and value of, elevation data

3D Nation Study Context

Inland, Nearshore, Offshore and Topo, Bathy, Topo/Bathy



Technology Neutral Approach

Study Phases Timeline

Information Gathering Phase

Follow on Study Tasks

Study Preparation (7 months)	Initial Data Collection (6 months)	Data Validation (6 months)	Aggregate/ Report (3 months)	Analysis/ Development (6 months)
Study Design	Identify Fed POCs/ State Champions	Conduct Interviews	Aggregate Benefits by Business Use	Develop Program Scenarios
Questionnaire Development	Questionnaire Open	Validate Interview Results (Reports & Geodatabase)	Final Report & Geodatabase	Analyze Benefit/Cost and ROI
OMB Approval	Summary Reports for Interviews			Determine Program Direction
9/2017 – 3/2018	1/2018 – 6/2018	7/2018 – 12/2018	1/2019 – 3/2019	4/2019 – 9/2019

2017 2018 2019

USGS science for a changing world

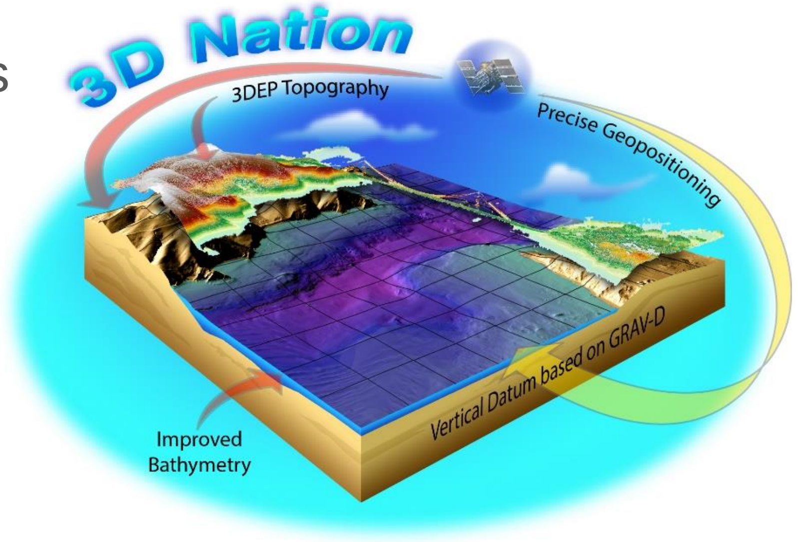
The National Map Your Source for Topographic Information

NOAA

3D Nation Stakeholders

Federal, State, Local, Non-Profit, Private, & Academia

- Federal departments and agencies
- Federal commissions or committees
- 50 states plus D.C. and territories
- Local, regional, and Tribal stakeholders
- Non-profits
- Private/commercial
- Academia



USGS science for a changing world · The National Map Your Source for Topographic Information · Dewberry · Interagency Working Group on Ocean and Coastal Mapping · NOAA

State Agency Participant Types

- Archaeology/cultural heritage
- Biological survey
- Coastal resource management/Coastal zone management
- Economic and community development
- Emergency management
- Energy
- Environmental protection/management
- Fisheries management/aquaculture
- Forestry/rangeland management
- Geology
- GIS
- Habitat management
- Mining
- Natural resources/conservation
- Oil and gas
- Permitting/planning
- Recreation
- Regulatory
- State university
- Transportation
- Water management/resources
- Water quality
- Wildlife management

State Champions will help identify participants

Local and Regional Participant Types

- Tribal entities
- Local government agencies
- Integrated Ocean Observing System (IOOS) regional associations
- Metropolitan and/or regional councils/districts
- Port authorities
- Regional commissions or councils
- Scientific and research organizations
- Non-profits

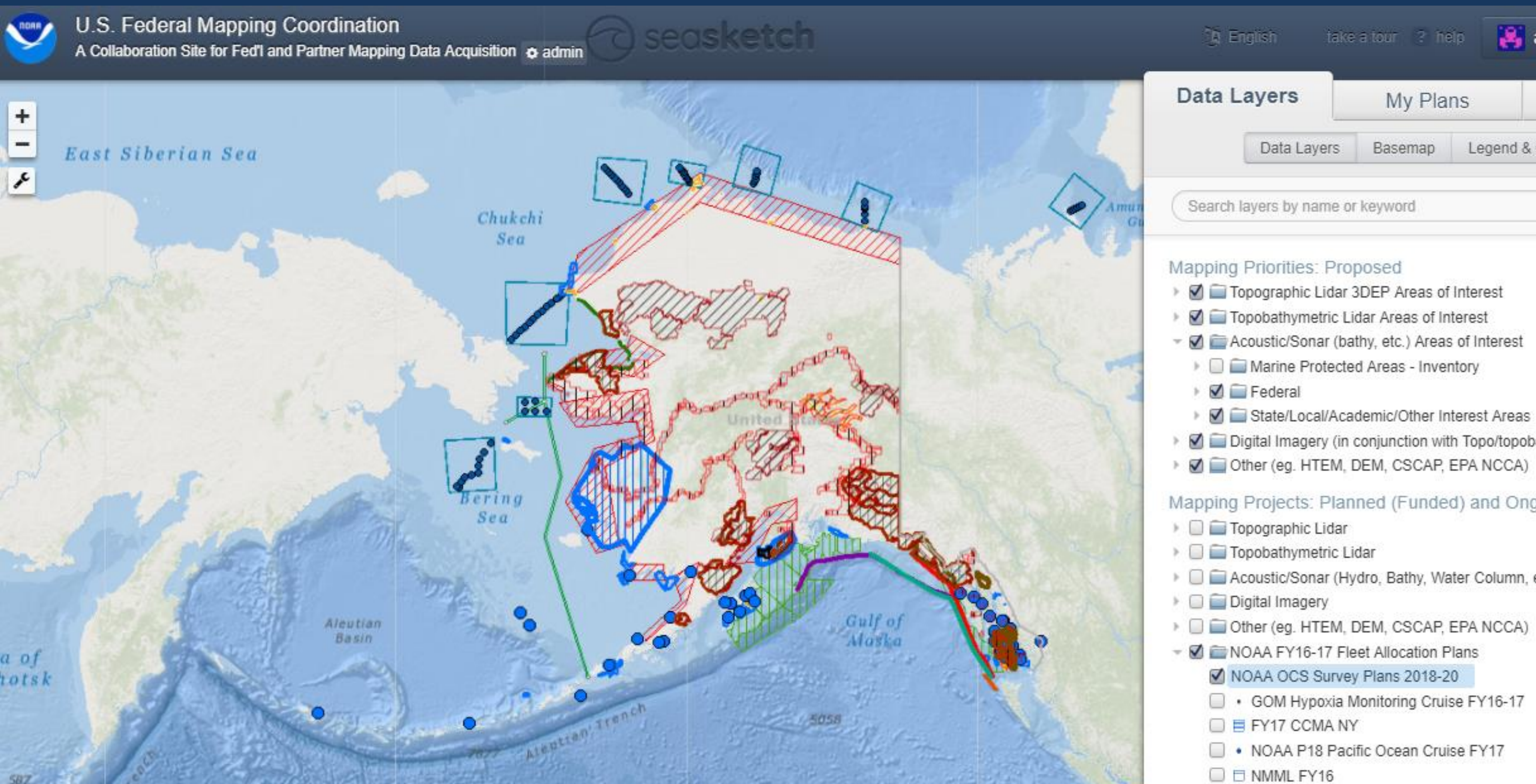
What We Need Your Help With

- Take the survey
- Get the word out to your colleagues and associates
- Identify study participants and their contact information
- Help with questionnaire – invitations and follow ups with non-respondents if needed
- Participate in follow up interviews/workshops
- Help gain consensus on responses
- Review and sign off on validated responses

USGS science for a changing world · The National Map Your Source for Topographic Information · Dewberry · INTERAGENCY WORKING GROUP ON Ocean and Coastal Mapping · NOAA

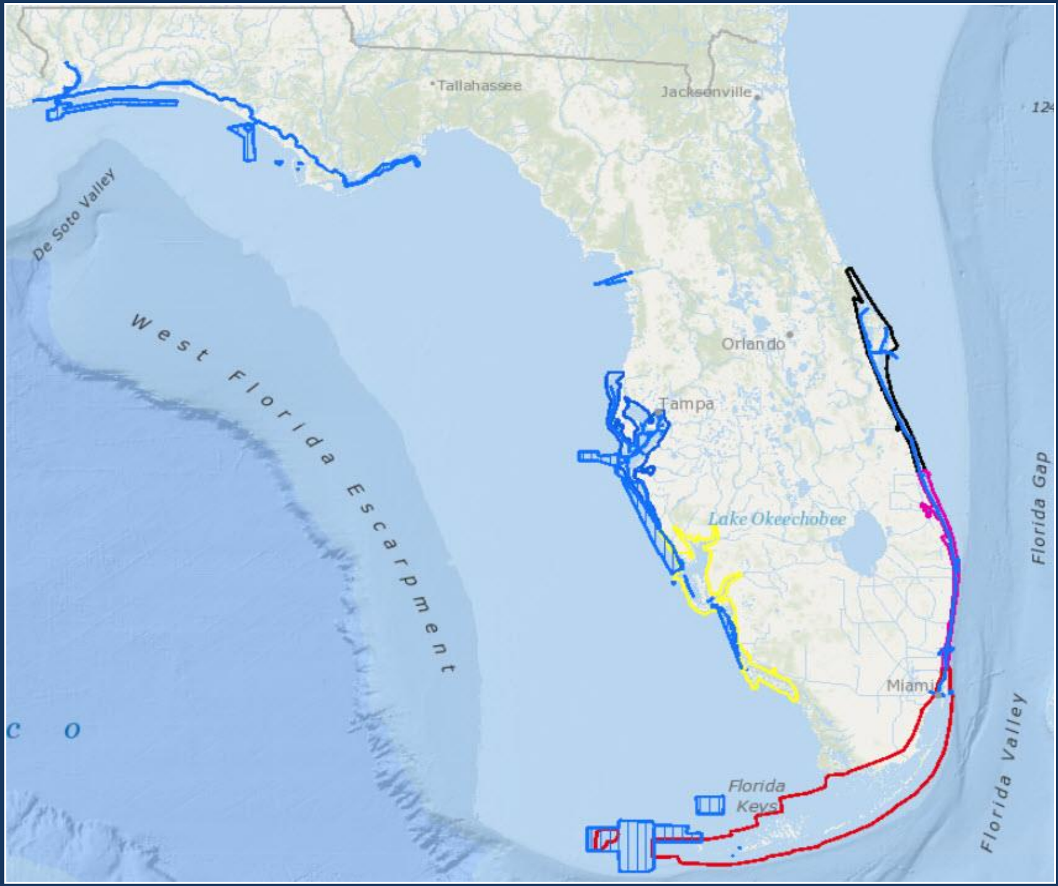
U.S. Federal Mapping Coordination Site

- IWG-OCM and 3DEP agencies are using Seasketch tool to share info on acquisition plans, data needs, coordination
- Additional tools available for use – forums, sketching



Hurricane Season 2017
Hurricane Supplemental Funding Request-- *Pending*

- NOAA Hurricane Supplemental Funding Request pending approval through Congress
  - $20M Pres Request
  - $40M House Mark
- Outlined/highlighted areas in graphic represent impacted areas from Hurricane Irma and interagency priorities for mapping
- Collaborative effort involving NOAA's OCS, NGS, CO-OPS, IOOS and other partner agencies and stakeholders
- Coordinated recovery mapping effort that brings the full suite of NOAA navigation, observation and positioning capabilities to impacted areas



SEABED 2030

Seabed 2030 is a global initiative led by the General Bathymetric Chart of Oceans (GEBCO) Guiding Committee and The Nippon Foundation with the aim to facilitate *the complete mapping of the ocean floor by the year 2030*.

GEBCO

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

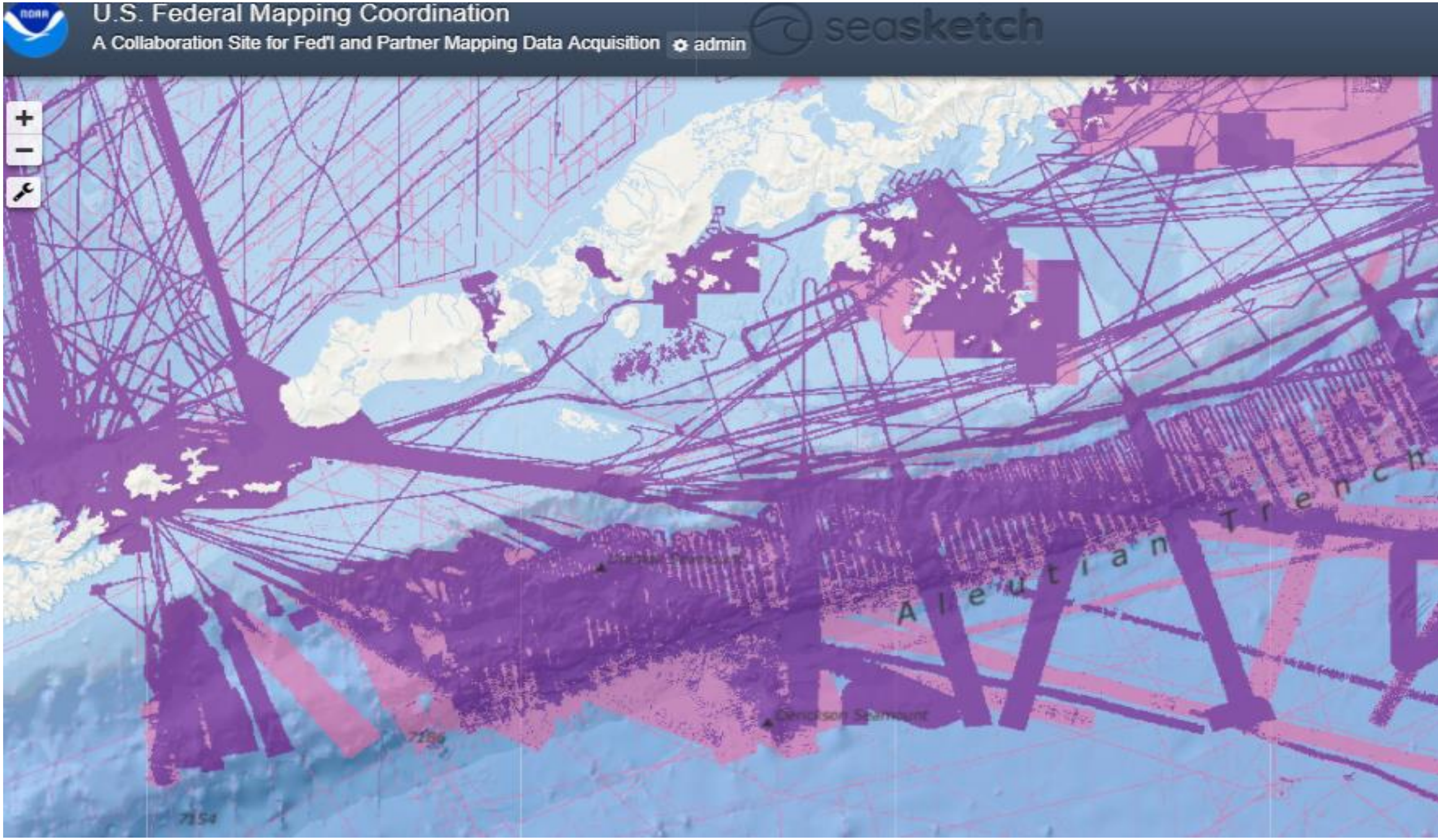
THE NIPPON FOUNDATION

TARGET RESOLUTIONS

Depth range	Grid-cell size	% of World Ocean
0-1500 m	100 x 100 m	13.7
1500-3000 m	200 x 200 m	11
3000-5750 m	400 x 400 m	72.6
5750-11000 m	800 x 800 m	2.7

Feasible resolution based on state-of-the-art 2 deg x2 deg deep water multibeam installed in surface vessels, calculated at 60 degree from nadir

Bathymetric Gap Analysis



HOW CAN YOU CONTRIBUTE

U.S. Mapping Agencies and Partners will be KEY:

- U.S. is responsible for U.S. waters – EEZ, shelf
- U.S. leadership recognized: Will continue mapping international unknown ocean to explore & discover
- 24 govt/research institutions, universities, businesses already participating, and this number is growing
- First big step – Discovery, sharing of existing data to fill gaps
  - Anything not already at NCEI or other accessible site
  - Agency, partner, stakeholder data with good metadata
- Agreement on, and use of, common standards
- Sharing of plans at FEDMAP and collaborative mapping campaigns to fill more gaps
- IHO Crowdsourced Bathymetry initiative

Alaska Mapping Executive Committee

Updated AMEC Charter:

New AMEC charter runs 2018 through 2022

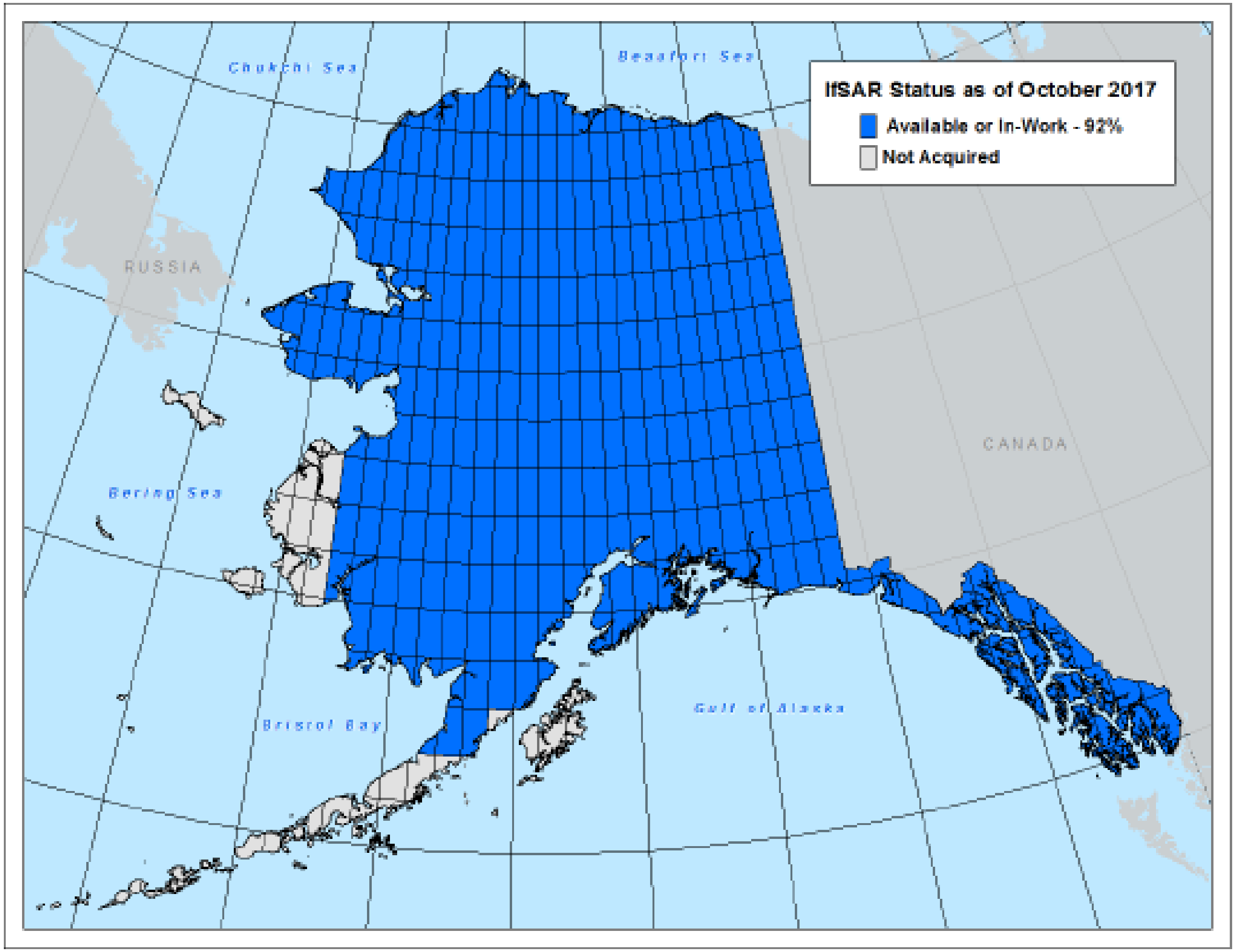
Language expanded to note additional Alaska mapping requirements that AMEC can consider in the future:

- imagery
- bathymetric mapping
- targeted lidar acquisitions
- continued improvements to hydrography
- geologic mapping
- geophysical surveys
- land classification

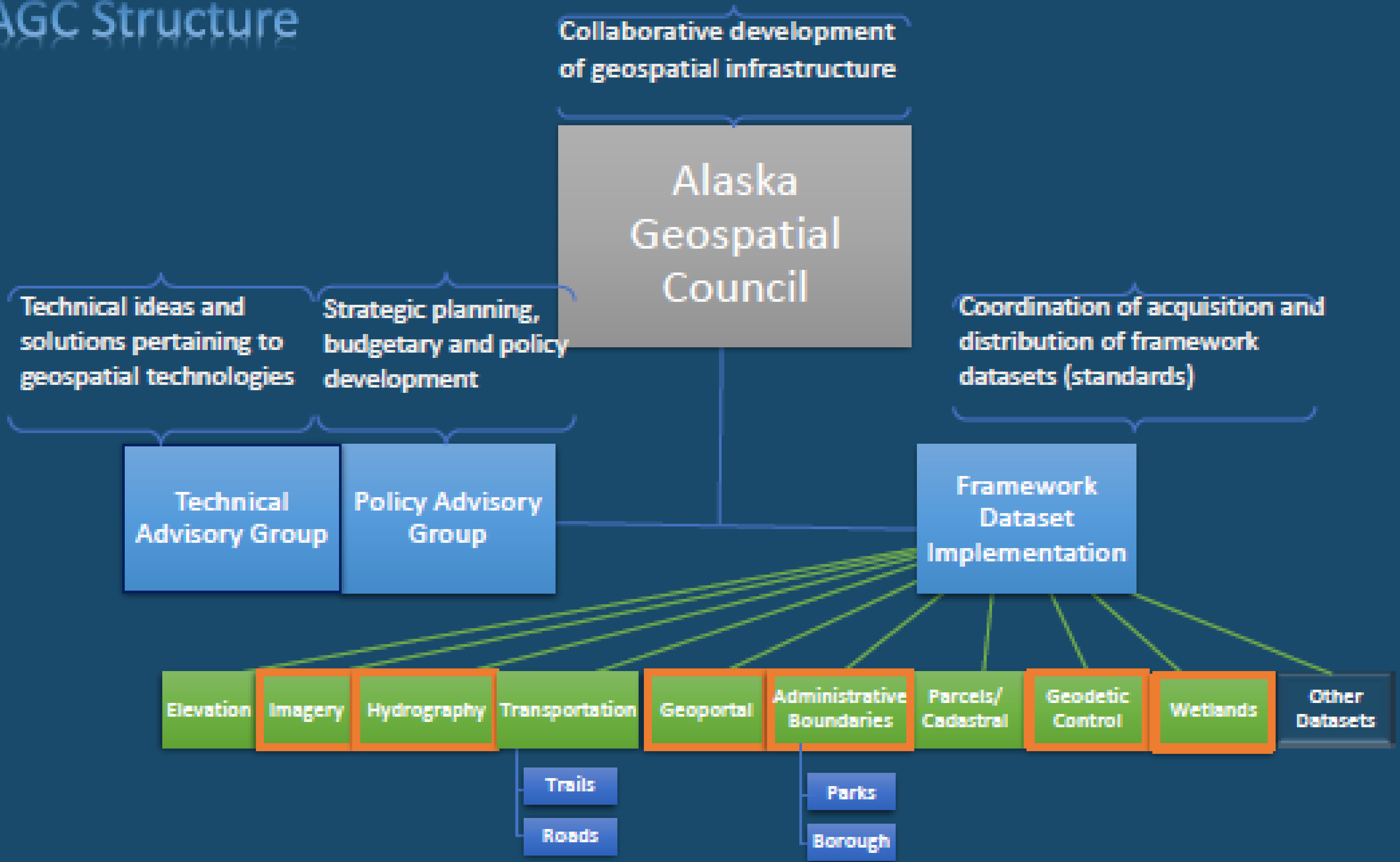
Theme	Metric	2013 Goal	October 2017 Status
Elevation	% IFSAR acquired	Complete in 4 years	92% statewide coverage achieved
Hydrography	% NHD updated	Complete in 6 years	20% updated
Transportation	% of State completed and publicly available	Complete in 5 years	Baseline AK DOT roads dataset 100% complete; ongoing maintenance
GRAV-D	% GRAV-D acquired	Complete in 2019	78.4%
Coastal Mapping	% AK shoreline updated	Complete in 5 years with budget increase, longer term if no budget increase	48.5%

Alaska IfSAR Status EOY FY2017

- 15% Statewide coverage acquired in FY2017
- 92% of the State Available or In-Work at end of FY2017



AGC Structure



Working Groups: develop strategic plans and implementation plans for data acquisition, maintenance and distribution, set data standards, and define data models. Additional working groups and subgroups can be deployed as needed. Orange border indicates groups with approved charters.

TODAY – Set Some Goals for Alaska Coastal Mapping

- 2016 Alaska Coastal Mapping Summit
- Strategist position jointly funded by State of Alaska and NOAA – Marta Kumle
- 2nd Alaska Coastal Mapping Summit (Feb 9, 2018)
- Alaska Coastal Mapping Roadmap, Strategy, Prioritization, Standards, Leveraging -- ACTION

June 2016 Summit
Girdwood, AK

Questions?

Ashley.Chappell@noaa.gov
240.429.0293

Alaska Geospatial Council

2018 Alaska Coastal Mapping Summit

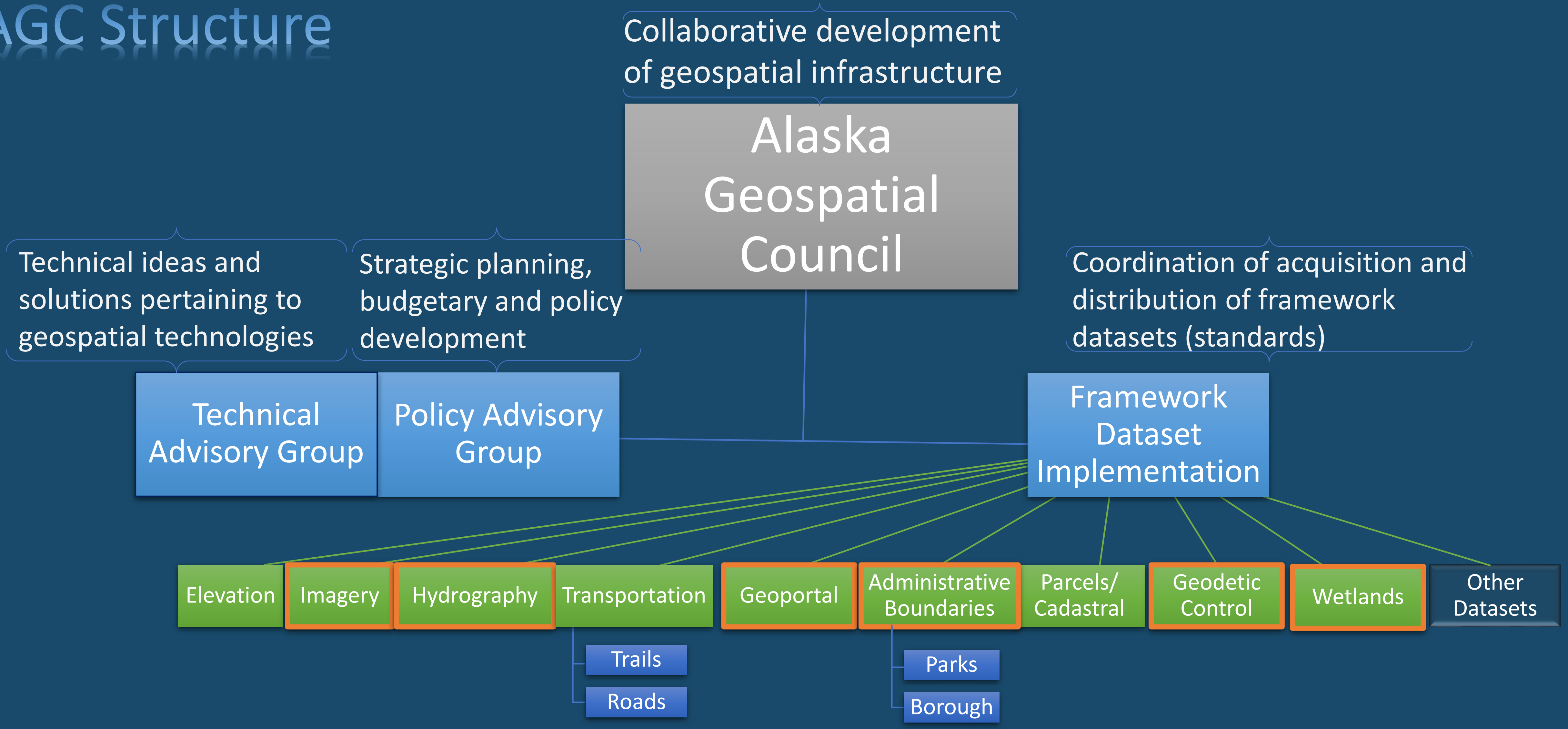
February 9, 2018

Ken Woods, System Administrator, SOA/DNR/DGGS

AGC Members and Technical Representatives

Agency	Delegate/Alternate	Technical Advisor(s)
Alaska Dept. of Natural Resources	Steve Masterman, State Geologist	Anne Johnson
Alaska Dept. of Transportation and Public Facilities	Commissioner Marc Luiken	Gerry Remsberg
Dept. of Military and Veteran's Affairs	Commissioner Brig. Gen. Laurel Hummel; Mike O'Hare alternate	Dave Caplan
Dept. of Fish & Game	Commissioner Sam Cotton; David Rogers alternate	Jason Graham
Dept. of Commerce, Community & Economic Development	Commissioner Chris Hladick; Fred Parady alternate	George Plumley
Dept. of Environmental Conservation	Commissioner Larry Hartig; Alice Edwards alternate	Jason Seifert
University of Alaska Geophysical Institute	Director Robert McCoy	Lisa Wirth
USGS	Steve Wackowski, Alaska DOI liaison	Brian Wright
NOAA	Amy Homan	Nicole Kinsman
USDA-NRCS	Bob Jones	Sydney Thielke
ANCSA Regional Association	Mischa Ellanna	
Alaska Municipal League	Eric Wyatt	Matt Rykazewski

AGC Structure



Working Groups: develop strategic plans and implementation plans for data acquisition, maintenance and distribution, set data standards, and define data models. Additional working groups and subgroups can be deployed as needed. Orange border indicates groups with approved charters.

2017 Accomplishments

- Active, chartered technical working groups identifying existing data and authoritative data sources for framework themes
- Coastal Strategist position NOAA/DNR/AOOS jointly funded (and filled!) for 2018
- Data Distribution & Access
  - Elevation

    http://elevation.alaska.gov 259.71GB downloaded per day. **94.794TB total**
    539,425 square miles of ifsar, lidar, and SfM data available for download via map interface
  - AK hydro

    State hydrography layer used to inform the National Hydrographic Dataset with high-resolution updates hosted at AK DNR
  - Imagery

    14M data requests from 1,487 unique users for the first 6 months of service starting in April 2017--Demand is growing exponentially

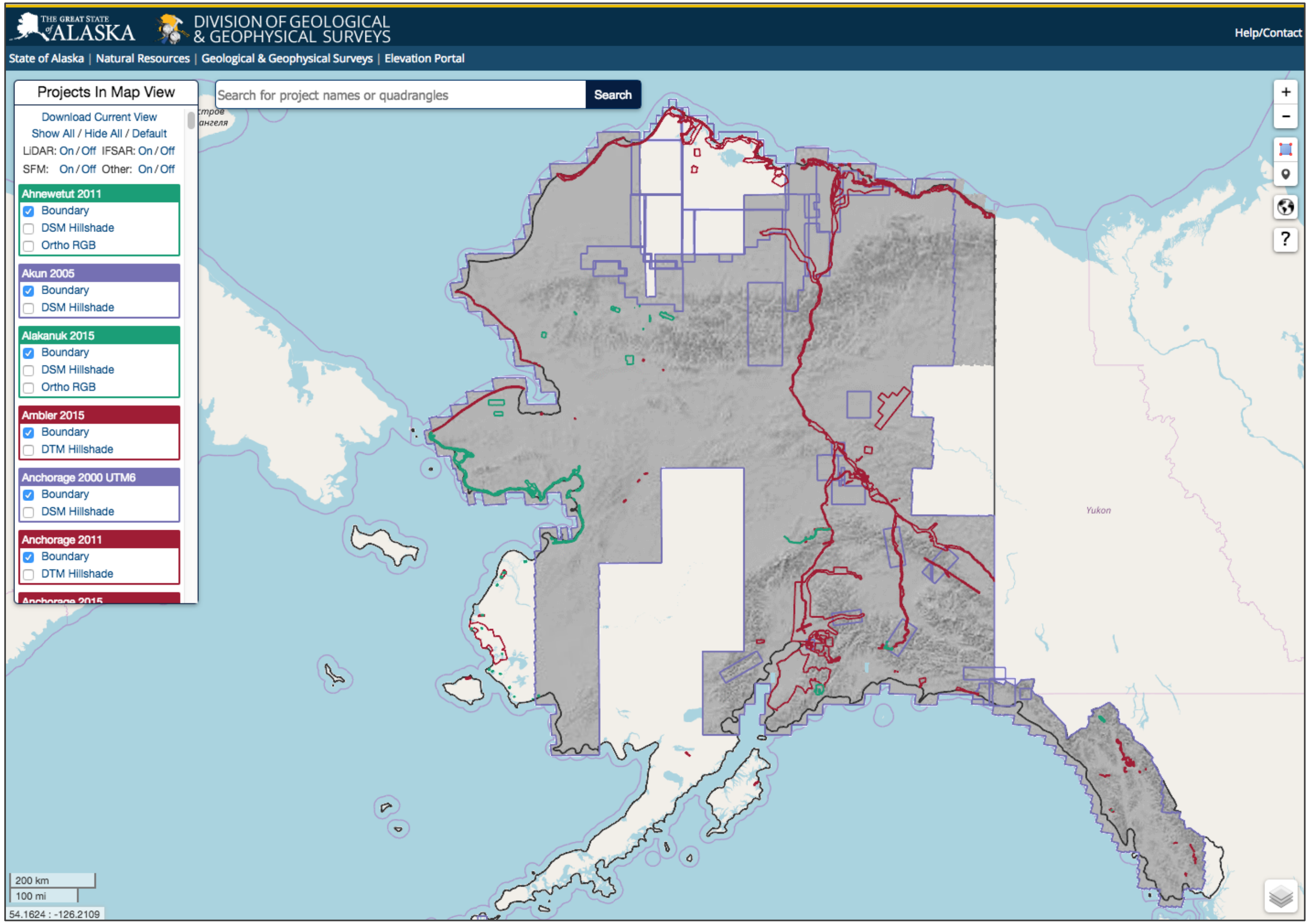
1. Elevation

~92%

(funded)

Chris Noyles, BLM

Ken Woods, DNR/DGGS



http://elevation.alaska.gov

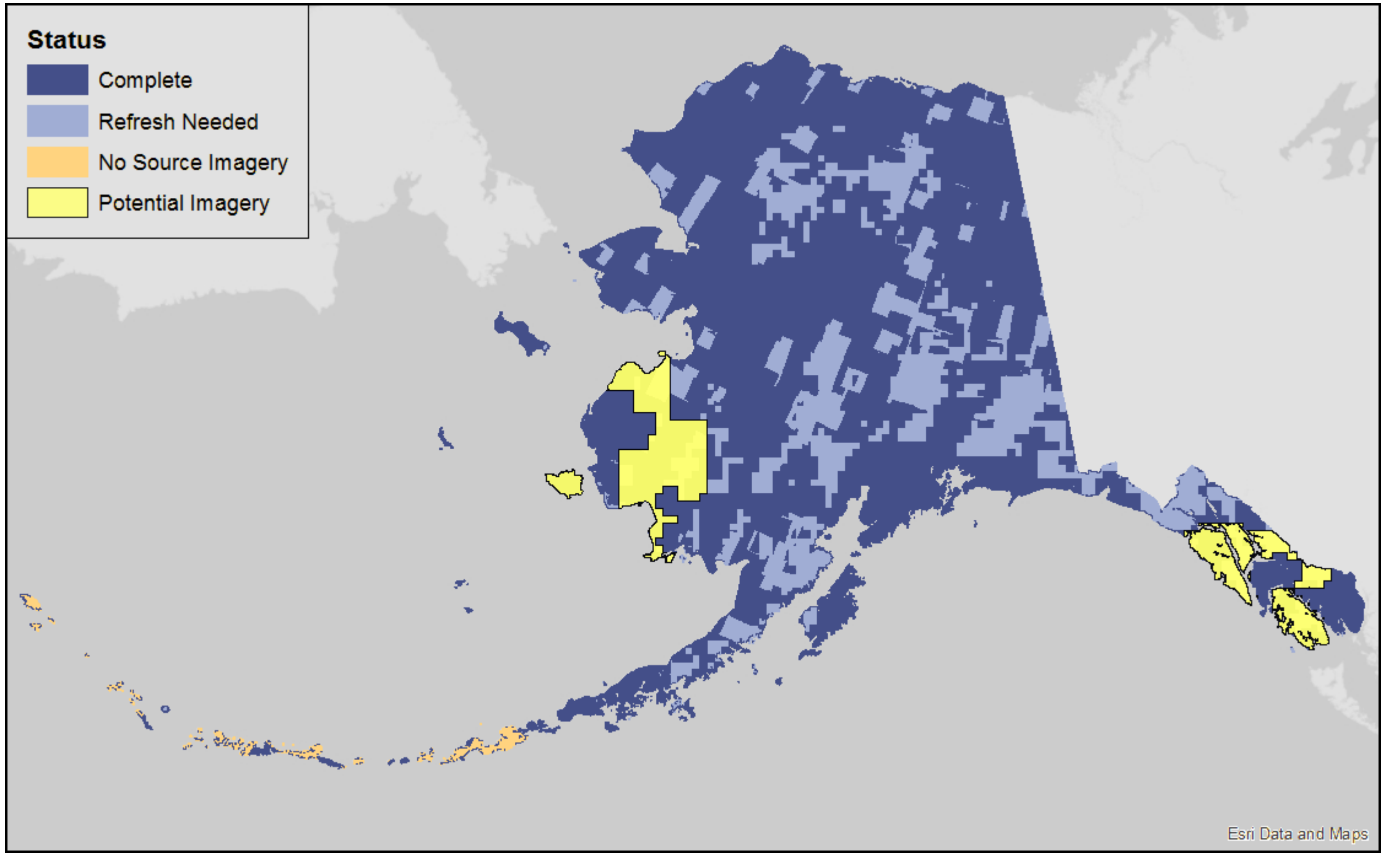
2. Imagery

72%

Sydney Thielke, USDA-NRCS

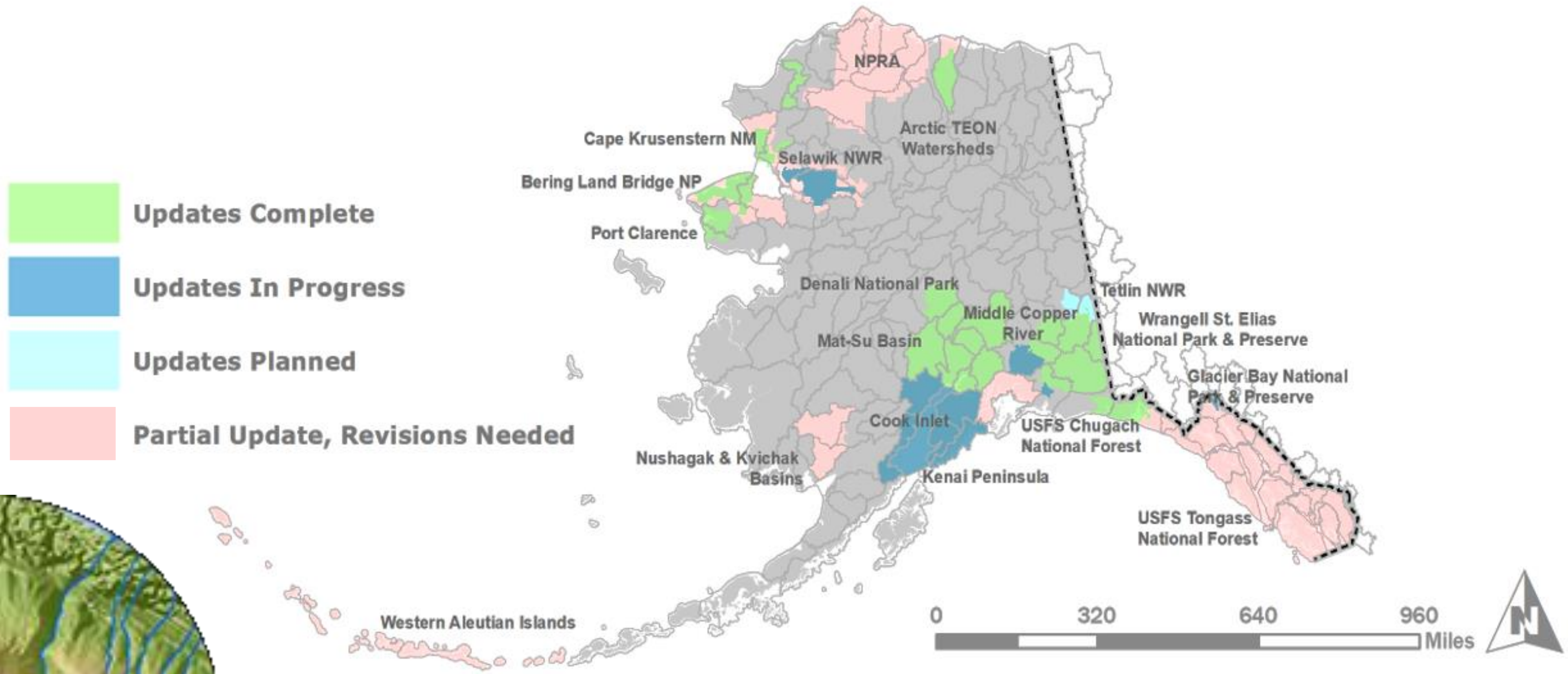
Parker Martyn, NPS

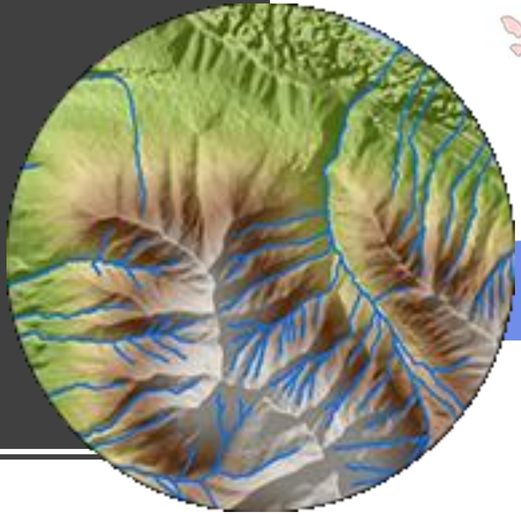
Dayne Broderson, UA



3. Hydrography

22%





4. Wetlands

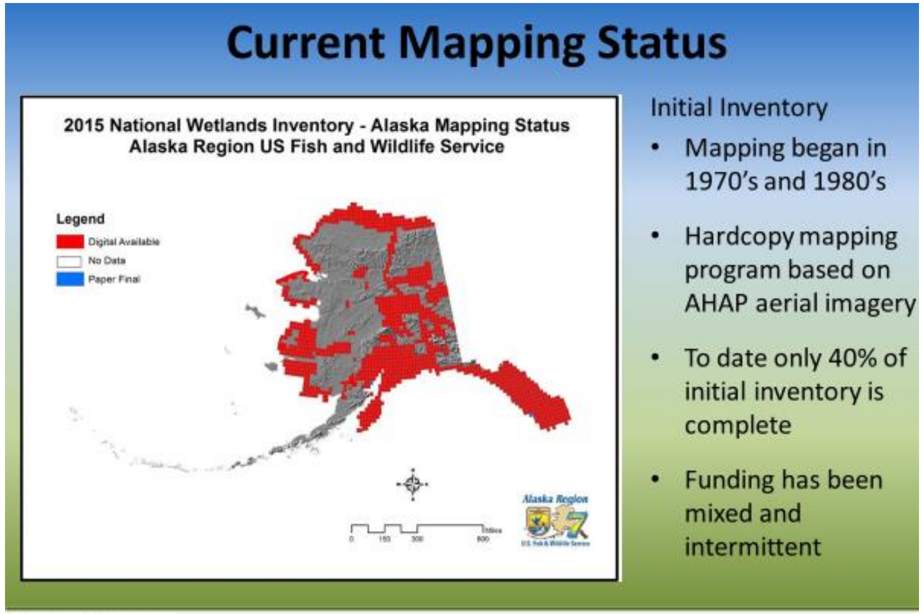
5%

Jason Seifert, DEC

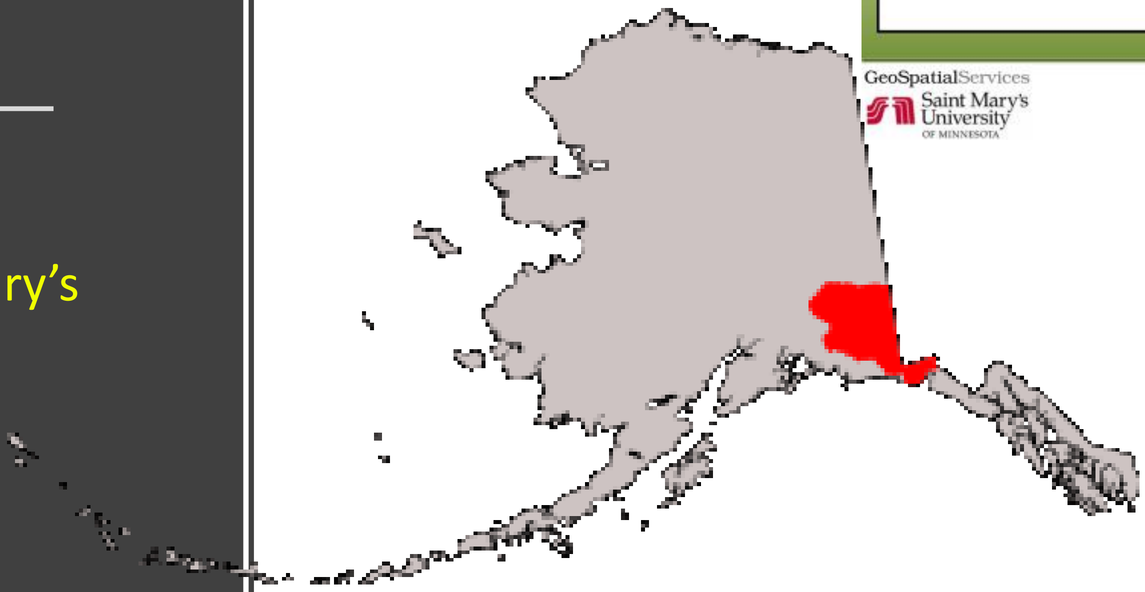
Andy Robertson, St. Mary's University

Inventory of existing data: 40% complete

High-resolution updates complete for Wrangell-St. Elias National Park



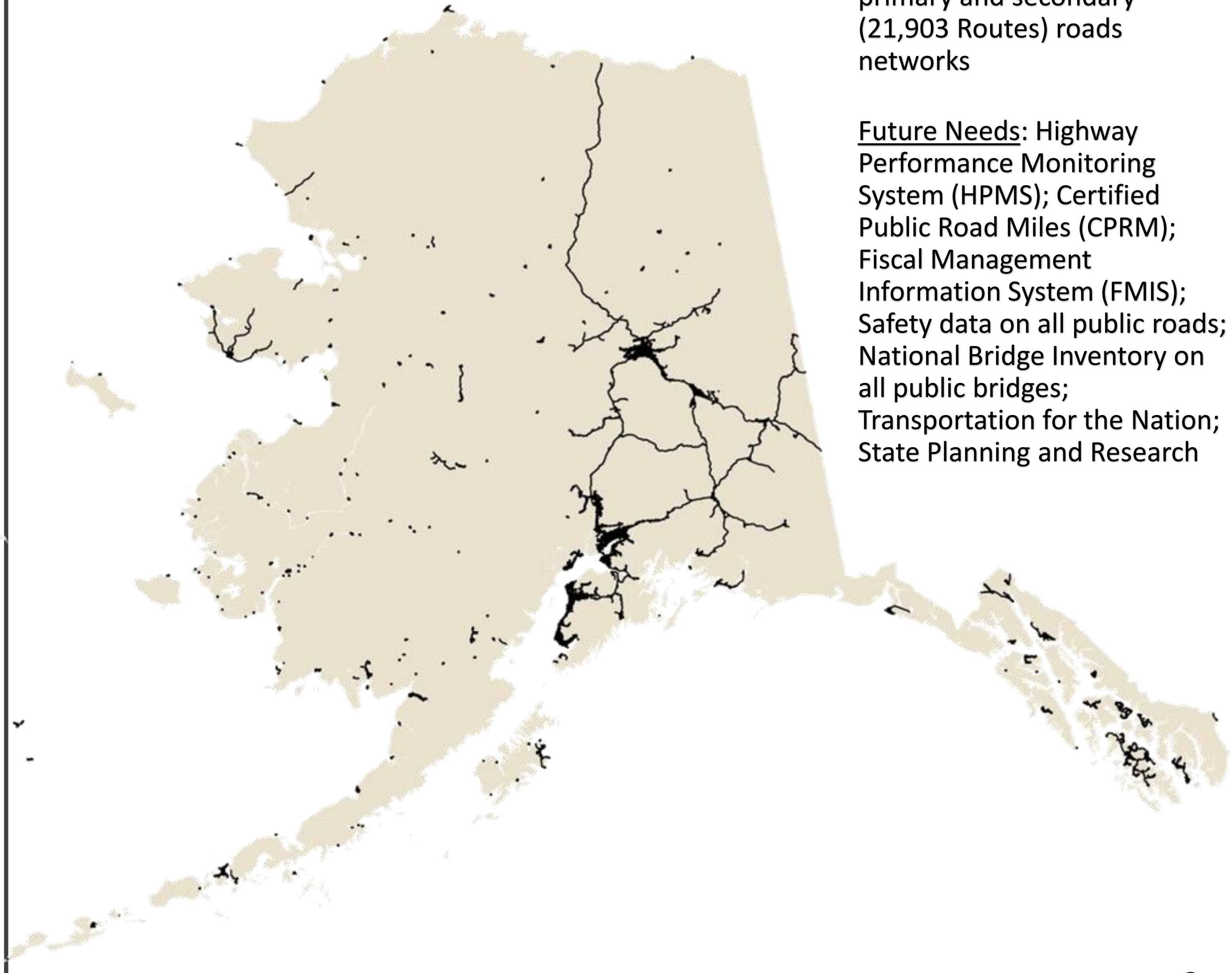
GeoSpatialServices Saint Mary's University of Minnesota



5. Transportation

Roads 100%

Brian Wright, USGS



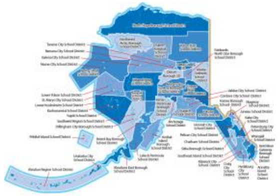
<u>Completed to date</u>: 100% primary and secondary (21,903 Routes) roads networks

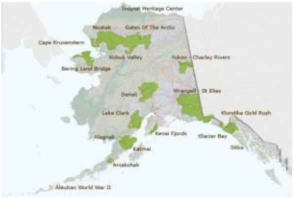
<u>Future Needs</u>: Highway Performance Monitoring System (HPMS); Certified Public Road Miles (CPRM); Fiscal Management Information System (FMIS); Safety data on all public roads; National Bridge Inventory on all public bridges; Transportation for the Nation; State Planning and Research

6. Administrative Boundaries

unknown %

Carrie Marvel, AKDNR





Examples:

ANCSA boundaries

city limits

coastal zone boundary

designated scenic areas

drinking water protection areas

election districts

emergency communications districts

federal agency organizational boundaries

fire management zones

fish management districts

forest protection districts

health districts

highway lighting districts

national memorials, parks, scenic areas, etc.

national forest boundaries

natural hazard regions

neighborhood associations

oil spill geographic response areas

park and recreation districts

places

rural fire protection districts

sanitary districts

school districts

service districts

shellfish management program areas

soil & water conservation districts

soil water conservation district zones

special road districts

state agency administrative subdivisions

state boundary

state forest boundaries

state park boundaries

transportation districts

voting precincts

wilderness areas

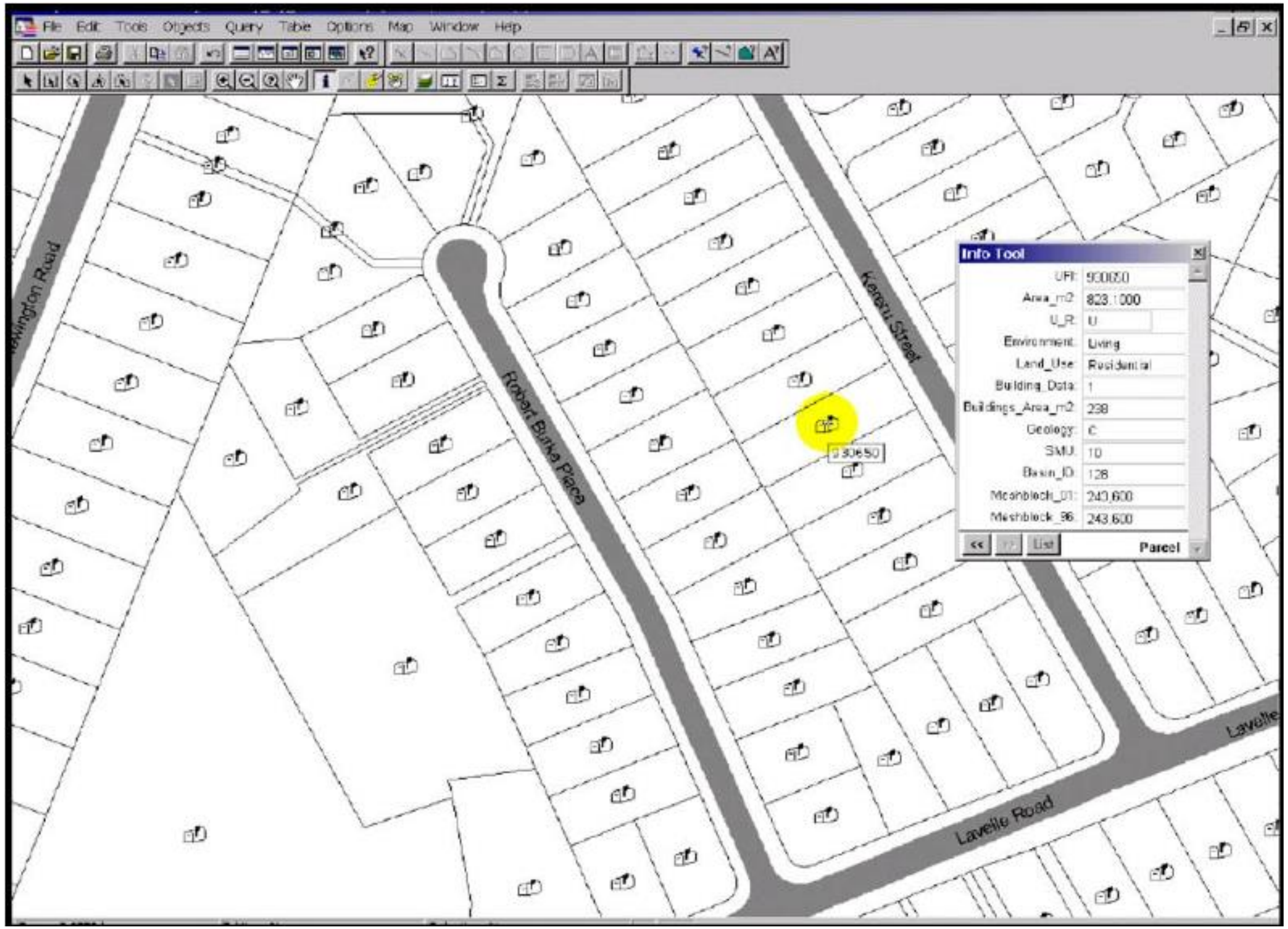
wildlife management units

zoning (all lands)

7. Cadastral

unknown %

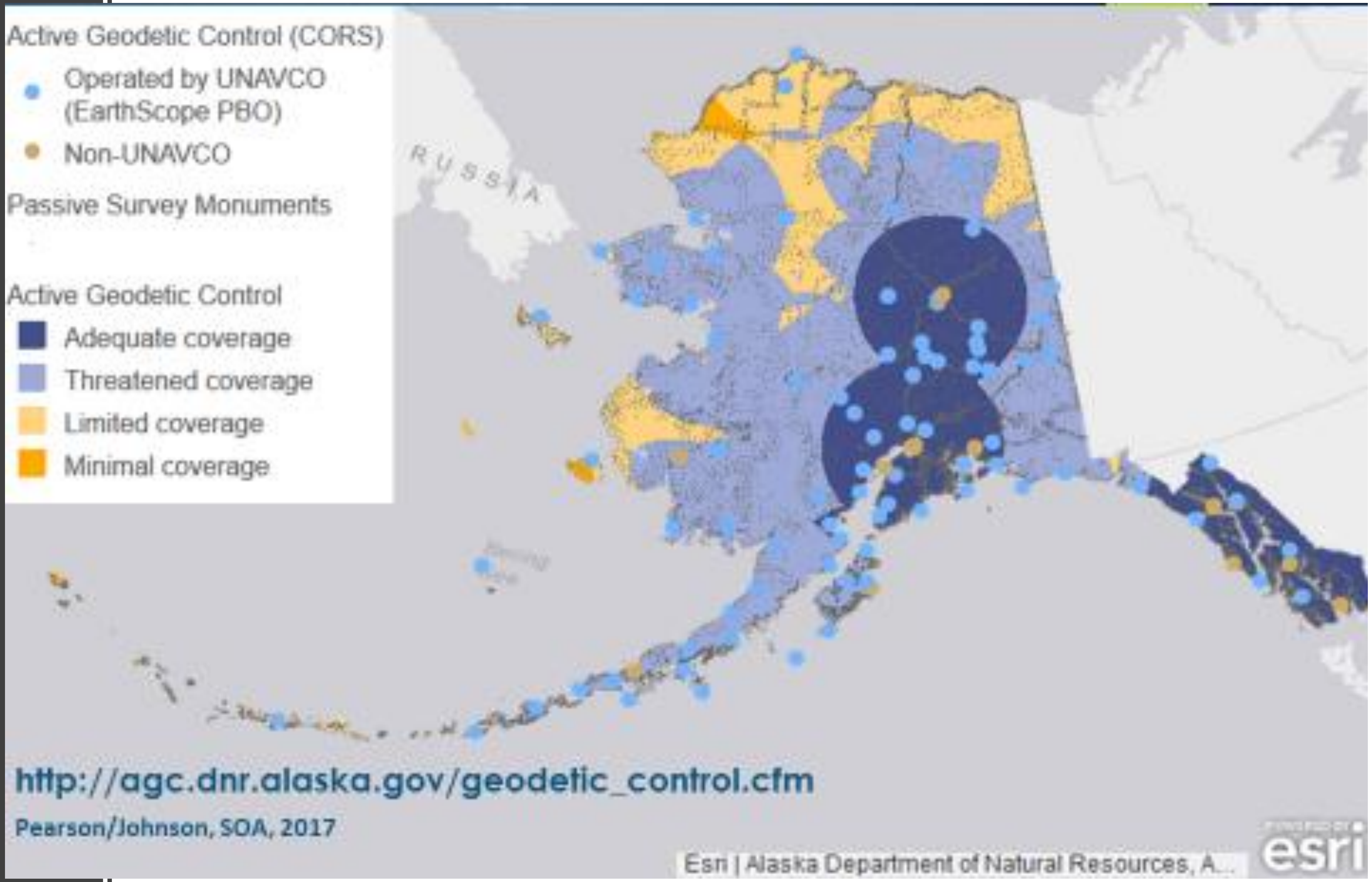
Gwen Gervelis, AKDNR



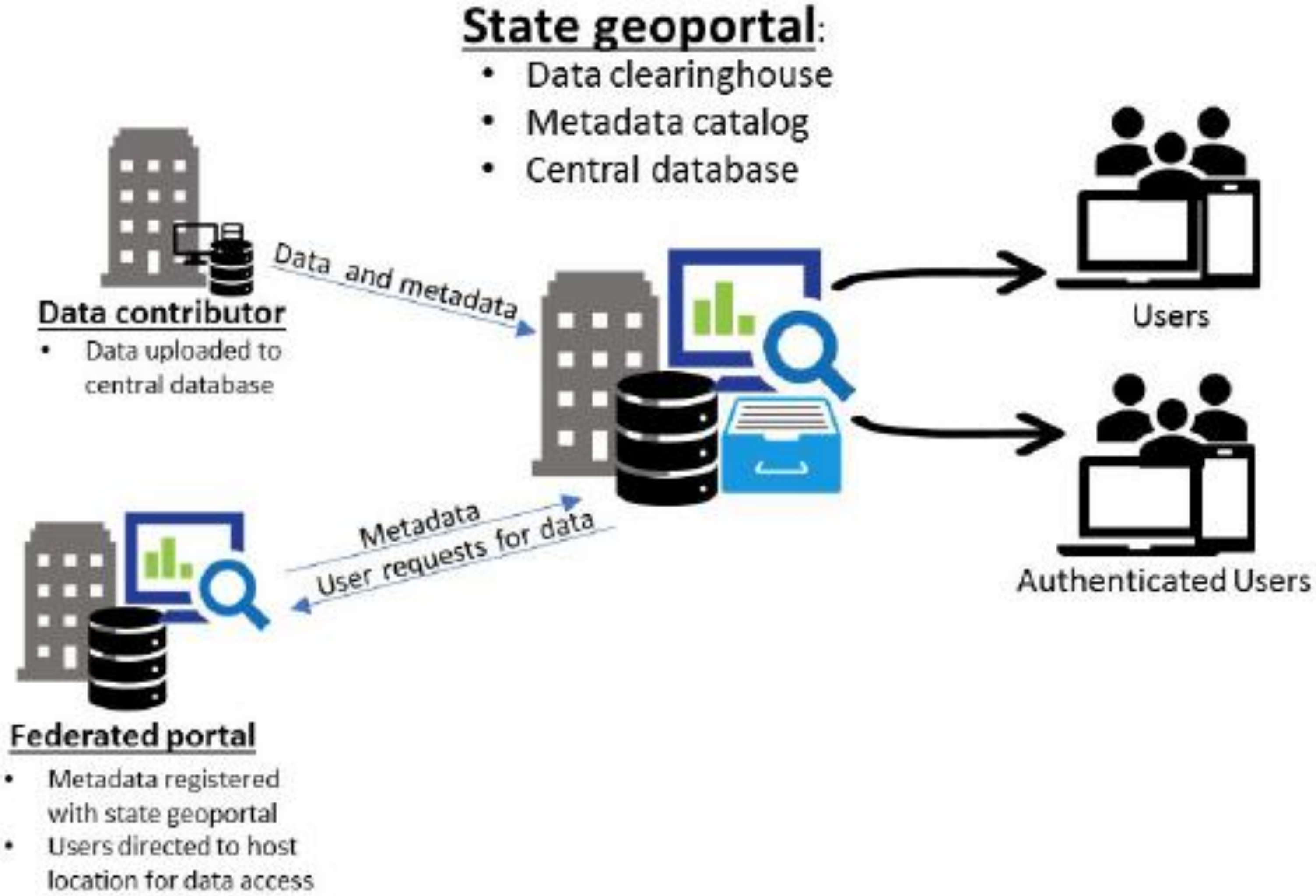
8. Geodetic Control

74%

- Nicole Kinsman, NOAA
- Jeffrey Freymueller, UA



Geoportal



State geoportal:
• Data clearinghouse
• Metadata catalog
• Central database
Data and metadata
Data contributor
• Data uploaded to central database
Users
Authenticated Users
Metadata
User requests for data
Federated portal
• Metadata registered with state geoportal
• Users directed to host location for data access

Top State Priorities for 2018, in order:

1. Continue IfSAR elevation collection for the state

2. Fund sustainable imagery refresh program
   - Leaf-on
   - 1-meter pixel resolution or better
   - Refresh every 3-5 years (collect 1/3 to 1/5 state annually)

3. Continue to update hydrography and wetlands framework datasets

The Alaska Geospatial Council

- AK Dept. of Natural Resources
- AK Dept. of Transportation
- AK Dept. of Military and Veterans Affairs
- AK Dept. of Commerce, Community and Economic Development
- AK Dept. of Fish and Game
- AK Dept. of Environmental Conservation
- University of Alaska
- Dept. of the Interior Alaska Liaison
- National Oceanic and Atmospheric Administration
- Natural Resources Conservation Service
- ANCSA Regional Association
- Alaska Municipal League

Questions?

Hydrographic Charting Activities in Alaska

Alaska Coastal Mapping Summit 2018

LT Bart Buesseler, NOAA

Navigation Manager, Alaska

NOAA's Office of Coast Survey

O: 907.271.3327
C: 907.231.7112
Bart.O.Buesseler@noaa.gov

Overview of 2017 Survey Activities:

- 2017 Office of Coast Survey Story Map
  - http://noaa.maps.arcgis.com/apps/MapSeries/index.html?appid=84f1127b56d7464c8deaae9d88f5ac94

Preview of planned 2018 Survey Activities:

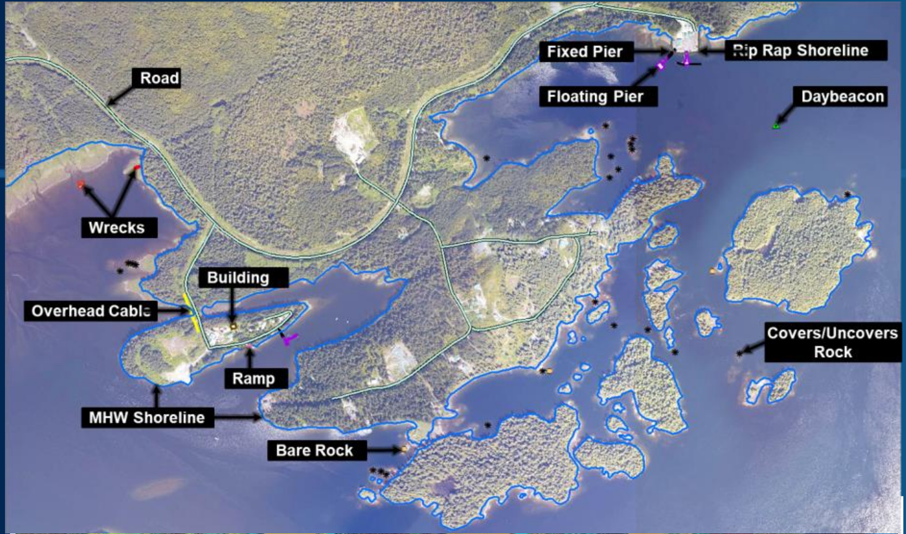
- Future survey plans as a layer of SeaSketch
  - https://www.seasketch.org/#projecthomepage/5272840f6ec5f42d210016e4
- 2018 Office of Coast Survey Story Map – **NEW!**
  - http://noaa.maps.arcgis.com/apps/MapJournal/index.html?appid=7007abd6aa81440f9a360d9e71f8cbca

Note: Survey plans are always subject to change due to federal funding and other operational factors.

NOAA's Coastal Mapping Program

- Define the National Shoreline and nearshore elevation data
- NOAA nautical charts
- Other important applications:
  - Used in defining the United States' territorial limits
  - Coastal resource management
  - Storm surge and coastal flooding modeling
  - GIS analysis
  - Benthic habitat mapping
- Coastal Intelligence and Resiliency…

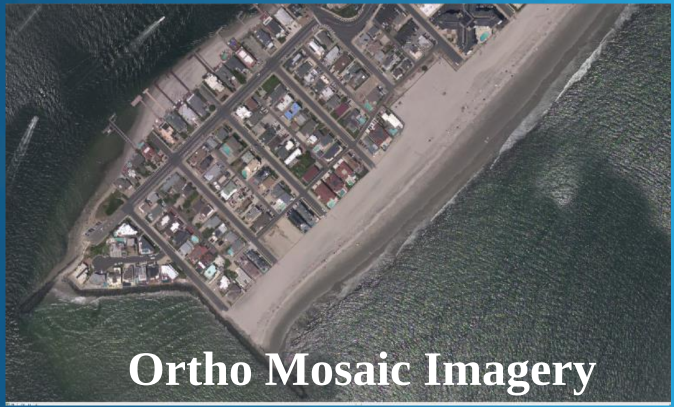
  Map once use many times!
- Emergency Response Imagery



https://storms.ngs.noaa.gov/

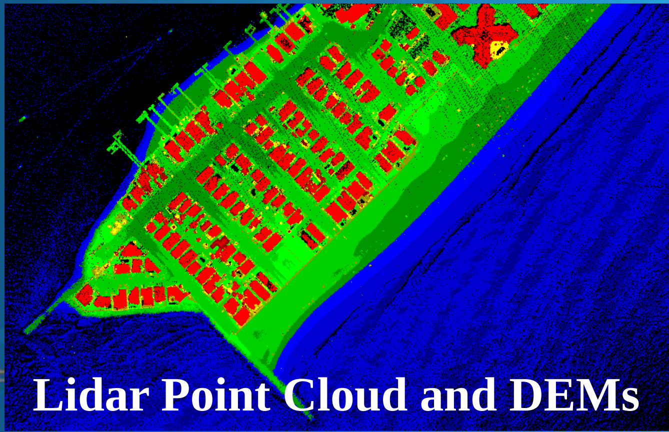
Shoreline

https://www.ngs.noaa.gov/NSDE/



Ortho Mosaic Imagery

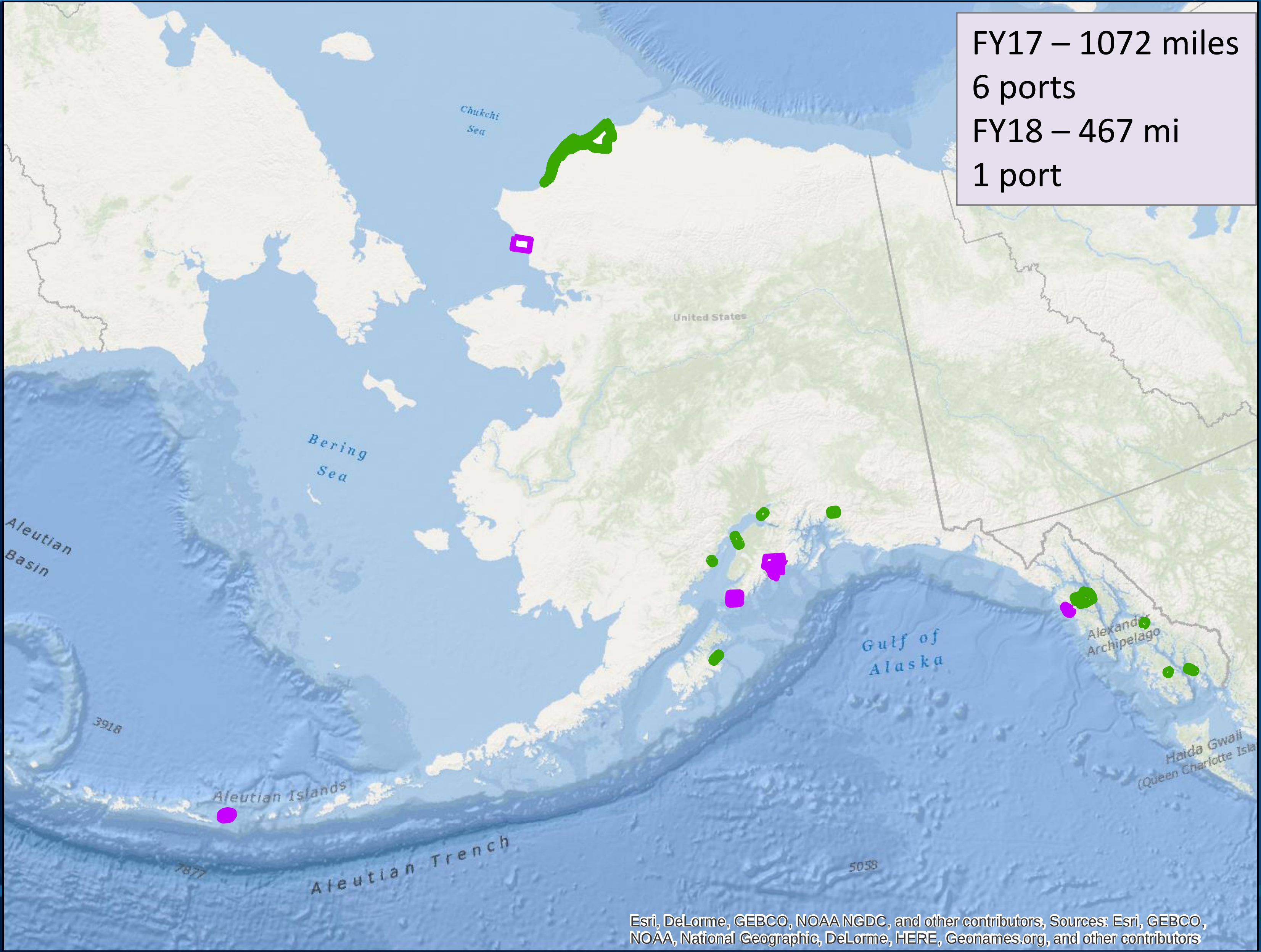
https://coast.noaa.gov/digitalcoast/



Lidar Point Cloud and DEMs

NOAA Shoreline Update

National Shoreline (CMP for Chart Update)

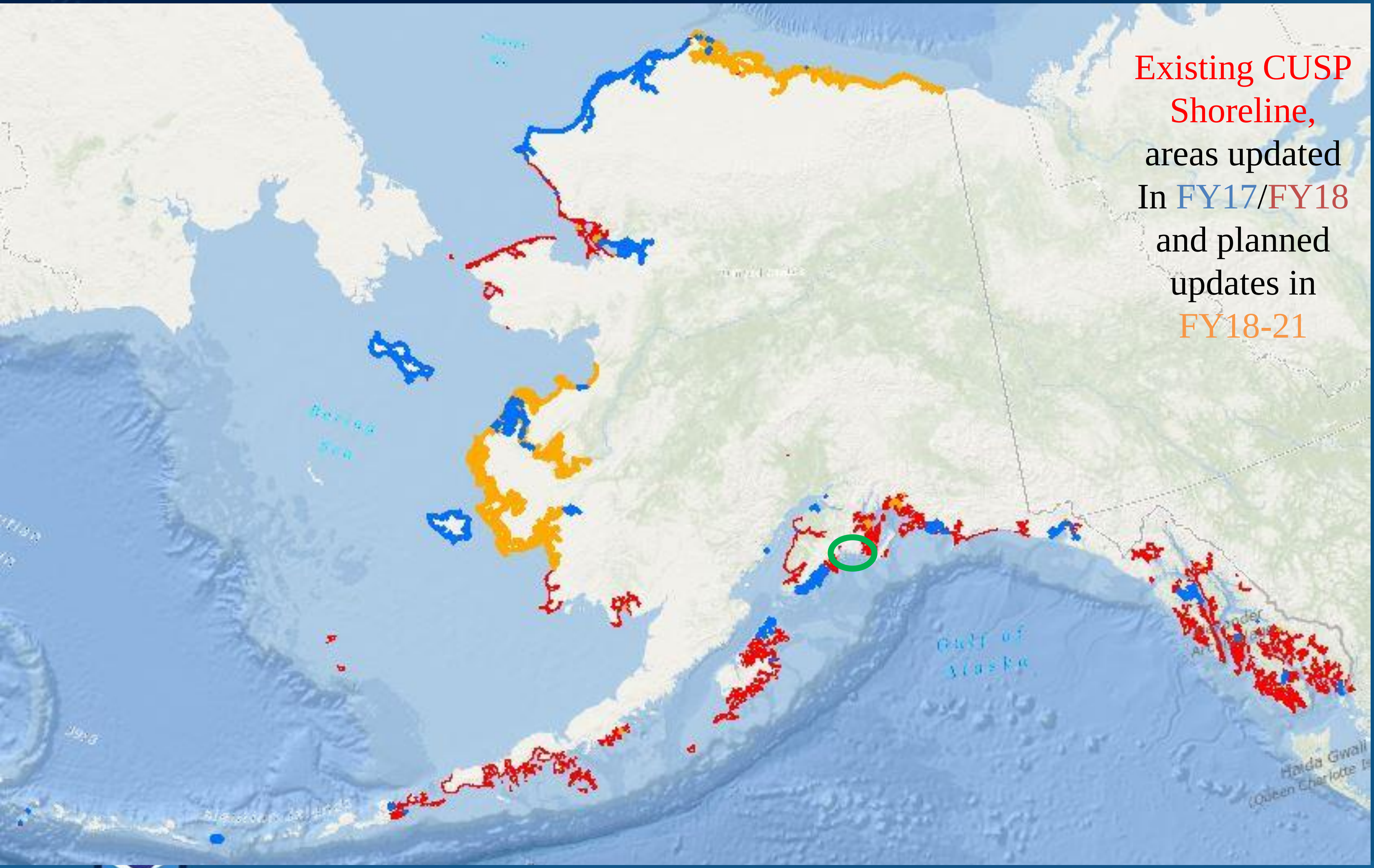


National Shoreline updates focus on navigational-significant areas (harbors, ports, approaches, etc.) primarily for nautical charting applications – each year NOAA/NGS maps 3-5 % of U.S. National Shoreline (equivalent to <500 mi/year in Alaska).

Primary sources to derive shoreline and features are stereo imagery from aircraft and satellite.

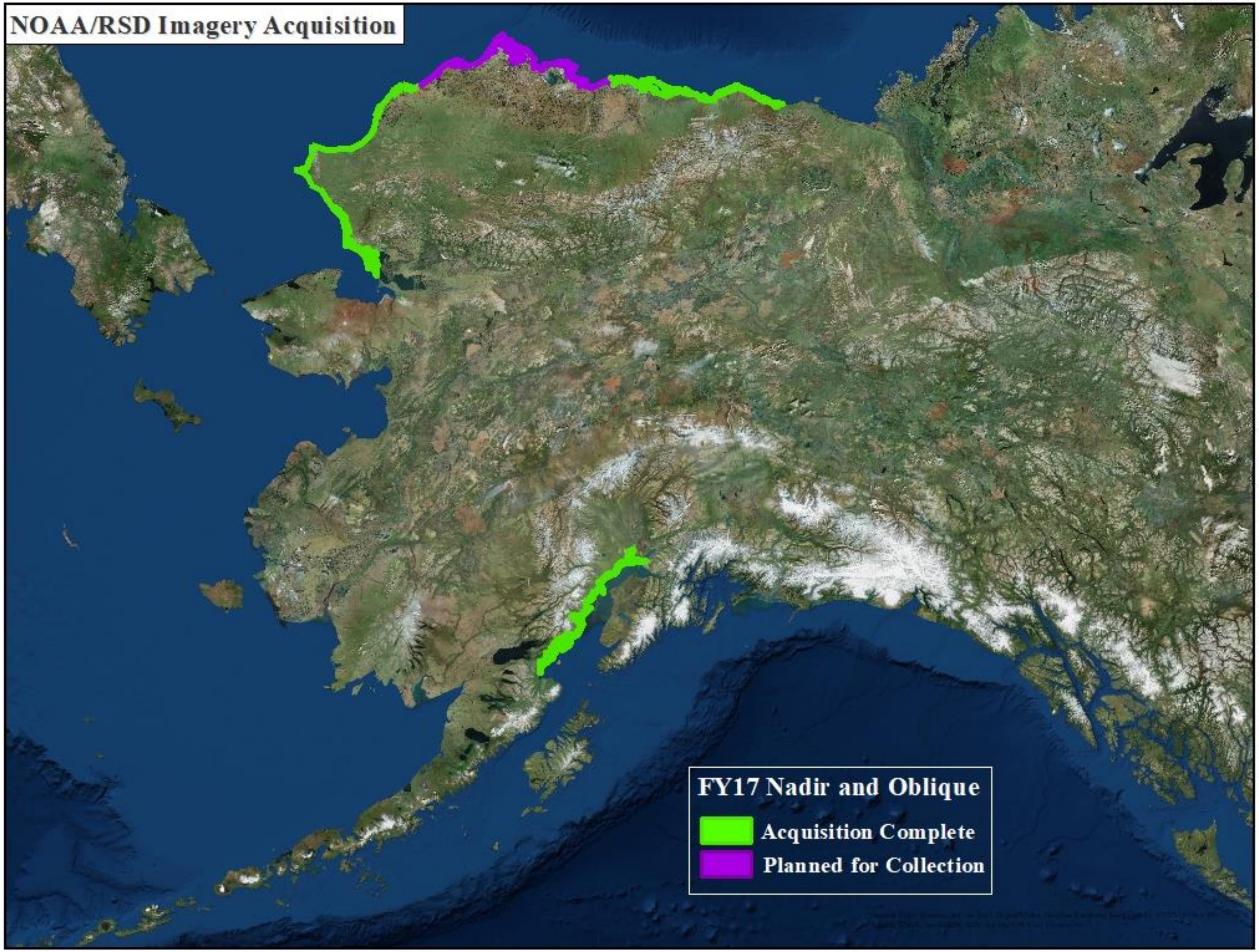
MERICA FOR THE FUTURE

Continually Updated Shoreline Product (CUSP)



CUSP benefits/purpose:
To provide the most current shoreline representation
Designed to deliver continuous shoreline with frequent updates (available via WMS and online at NOAA Shoreline Data Explorer)
Referenced to Mean High Water datum (where applicable)
Includes NOAA and non-NOAA contemporary sources

NGS is presently working with partners in the region such as AK Hydro, The State of Alaska, USGS, NPS, BLM, and US Forestry to identify improved mechanisms for delivering MHW shoreline vectors to NOAA for validation and considered inclusion into CUSP.



Coastal Nadir imagery 2017

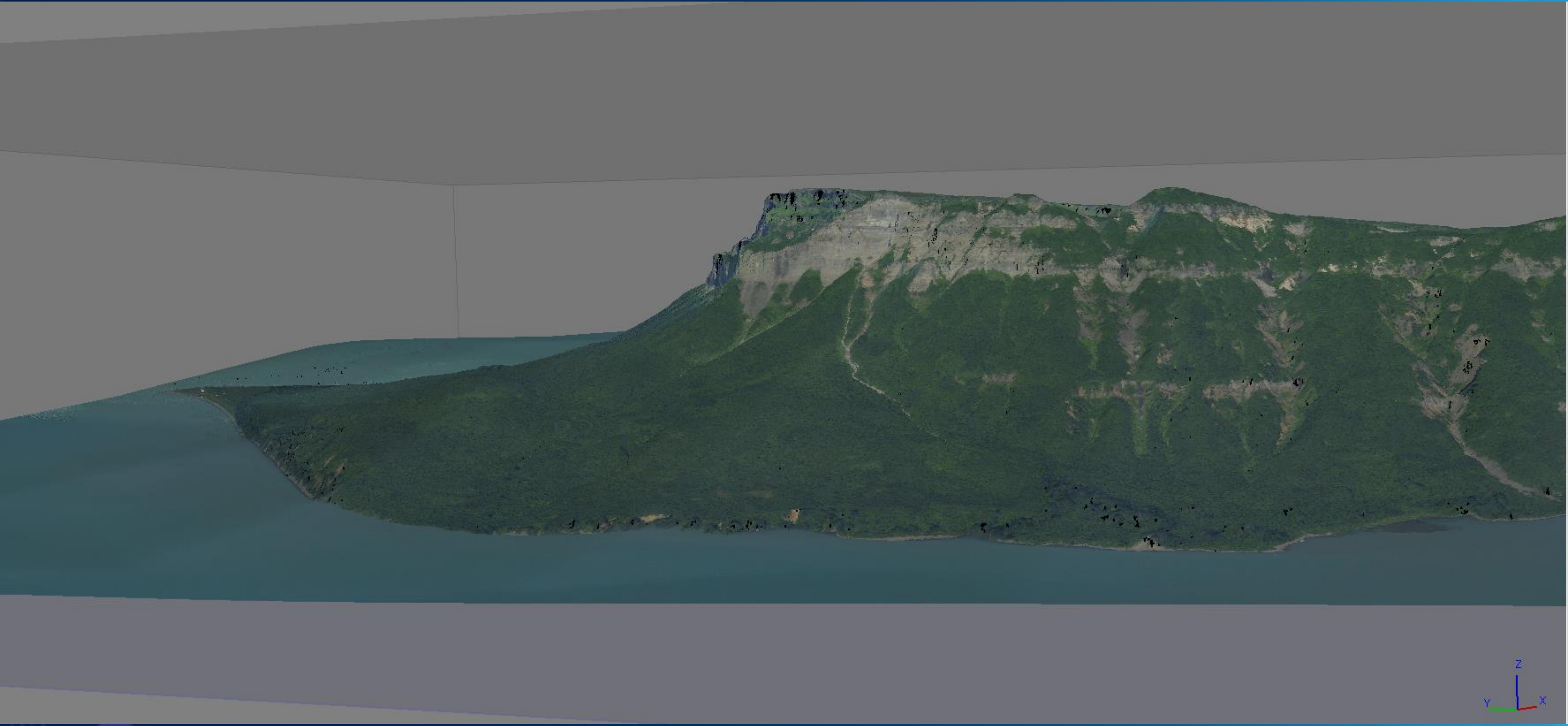
https://geodesy.noaa.gov/storm_archive/alaska/index.html

2017 imagery was collected to support SfM analysis and available for download

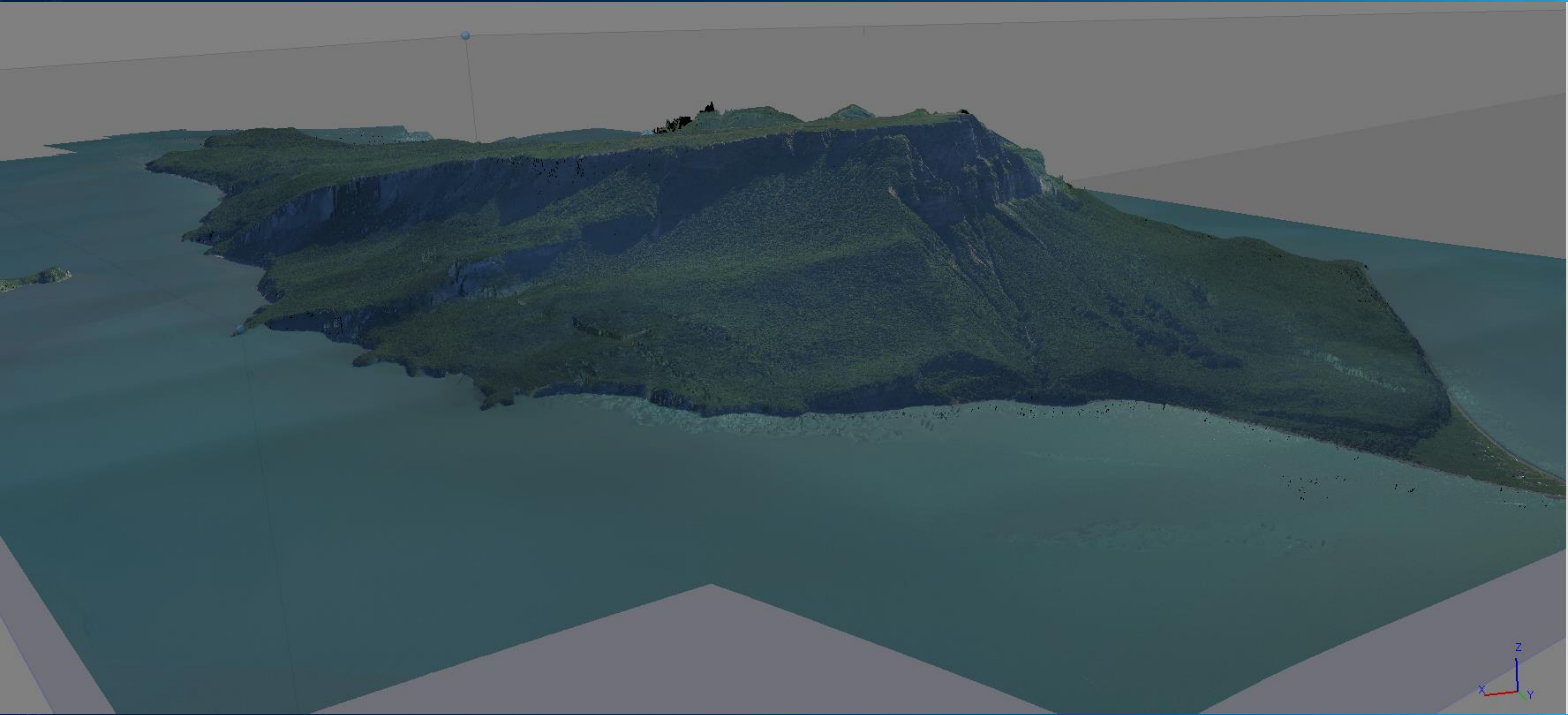
Coastal Oblique imagery 2016

https://geodesy.noaa.gov/storm_archive/coastal/viewer/index.html

Chisik Island



Chisik Island



Contacts

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Chief, Remote Sensing Division

NOAA National Geodetic Survey

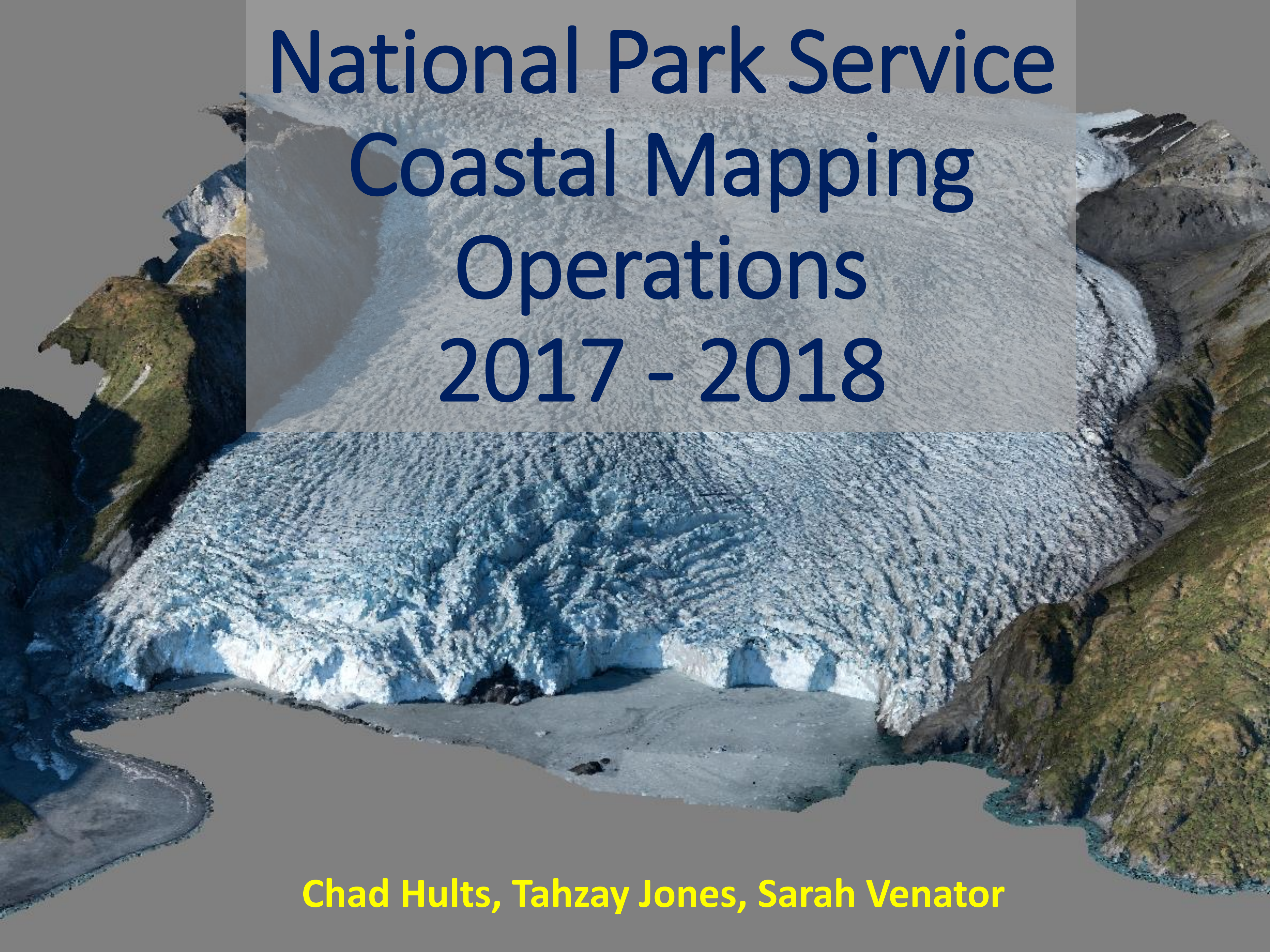
Mike.Aslaksen@noaa.gov

301-801-9024 mobile

240-533-9576 office

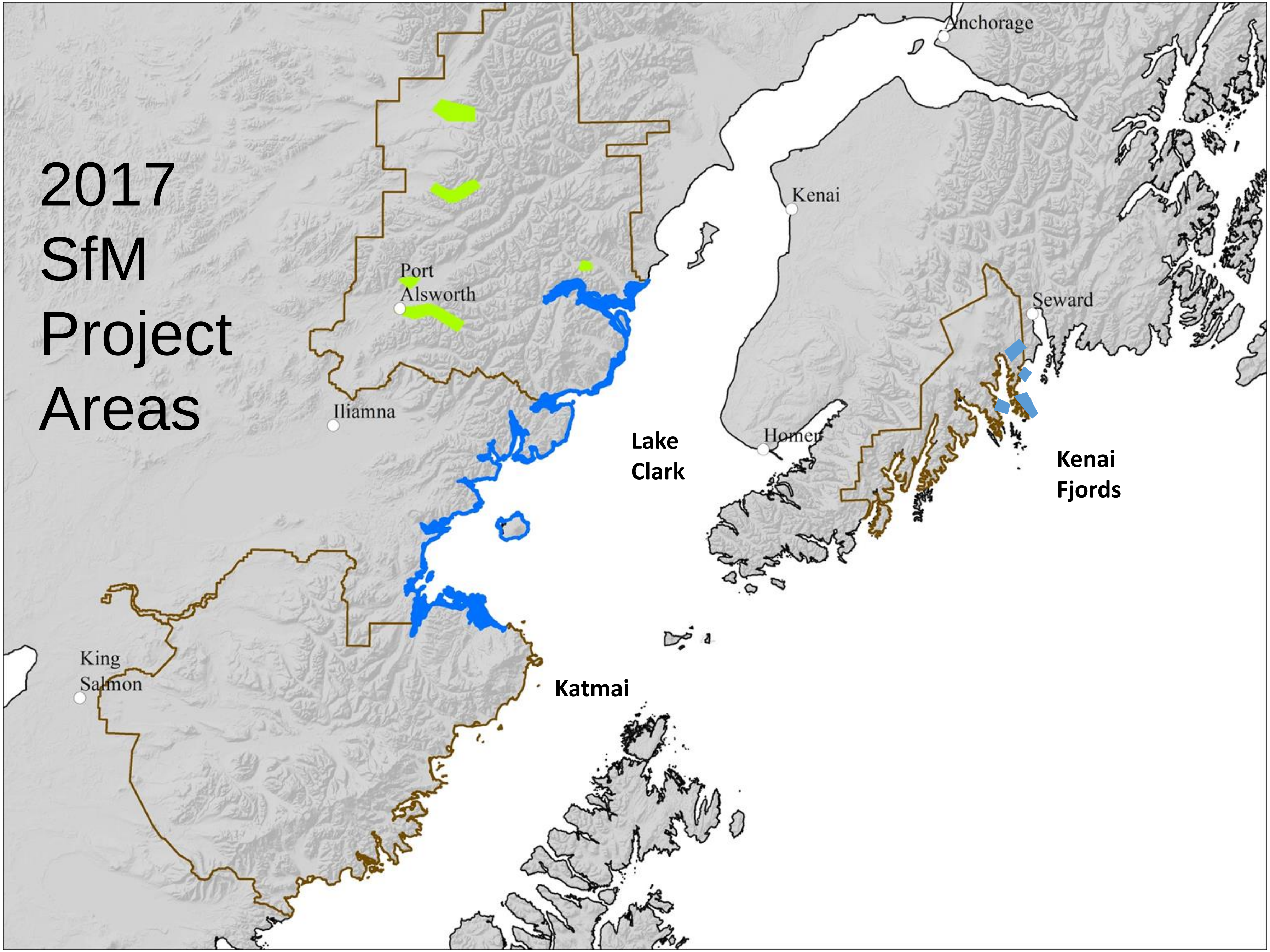
Nicole Kinsman
Alaska Regional Advisor
NOAA National Geodetic Survey
nicole.kinsman@noaa.gov
Telephone (mobile): 202-306-5736

National Park Service Coastal Mapping Operations 2017 - 2018

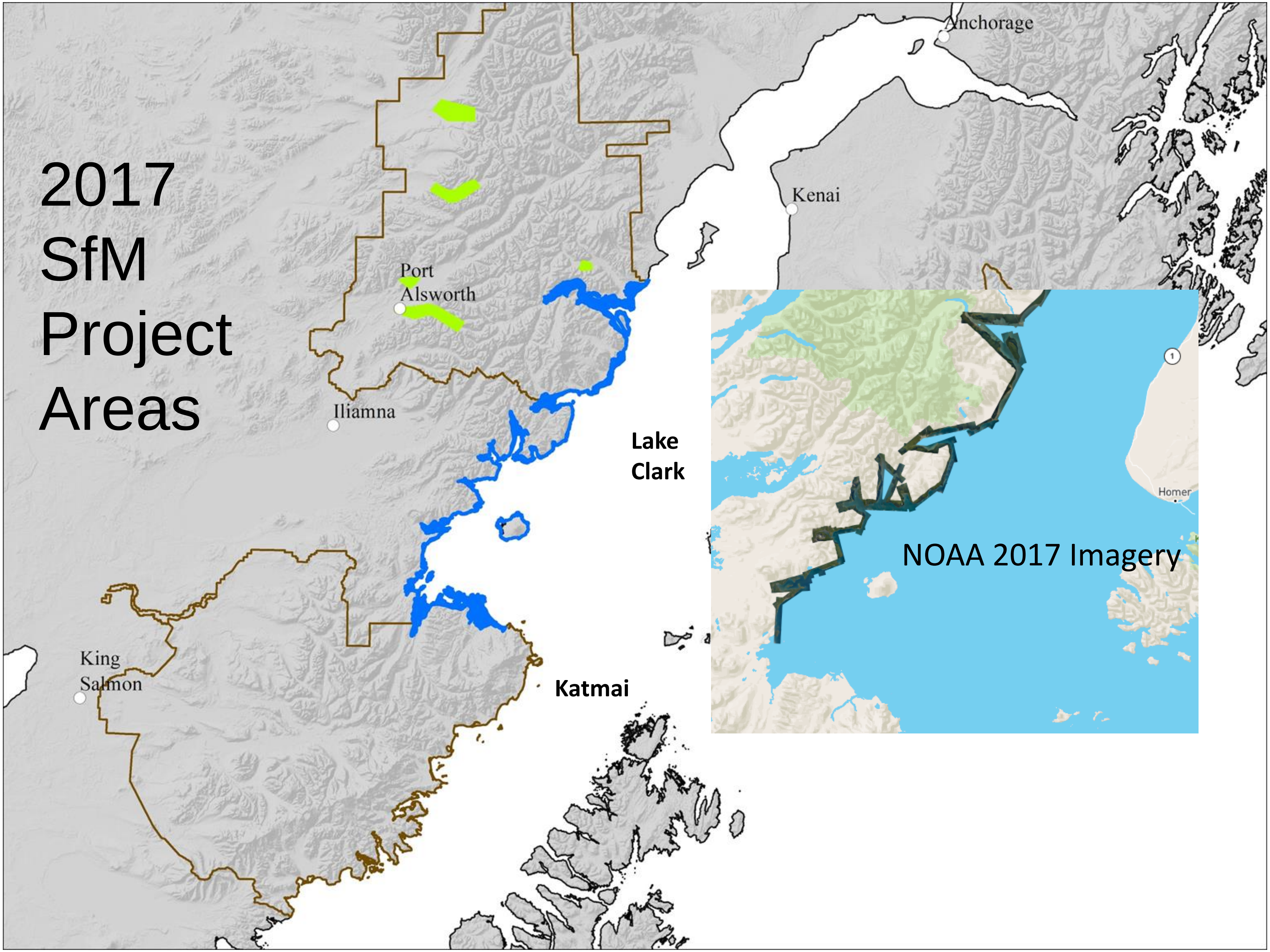


Chad Hults, Tahzay Jones, Sarah Venator

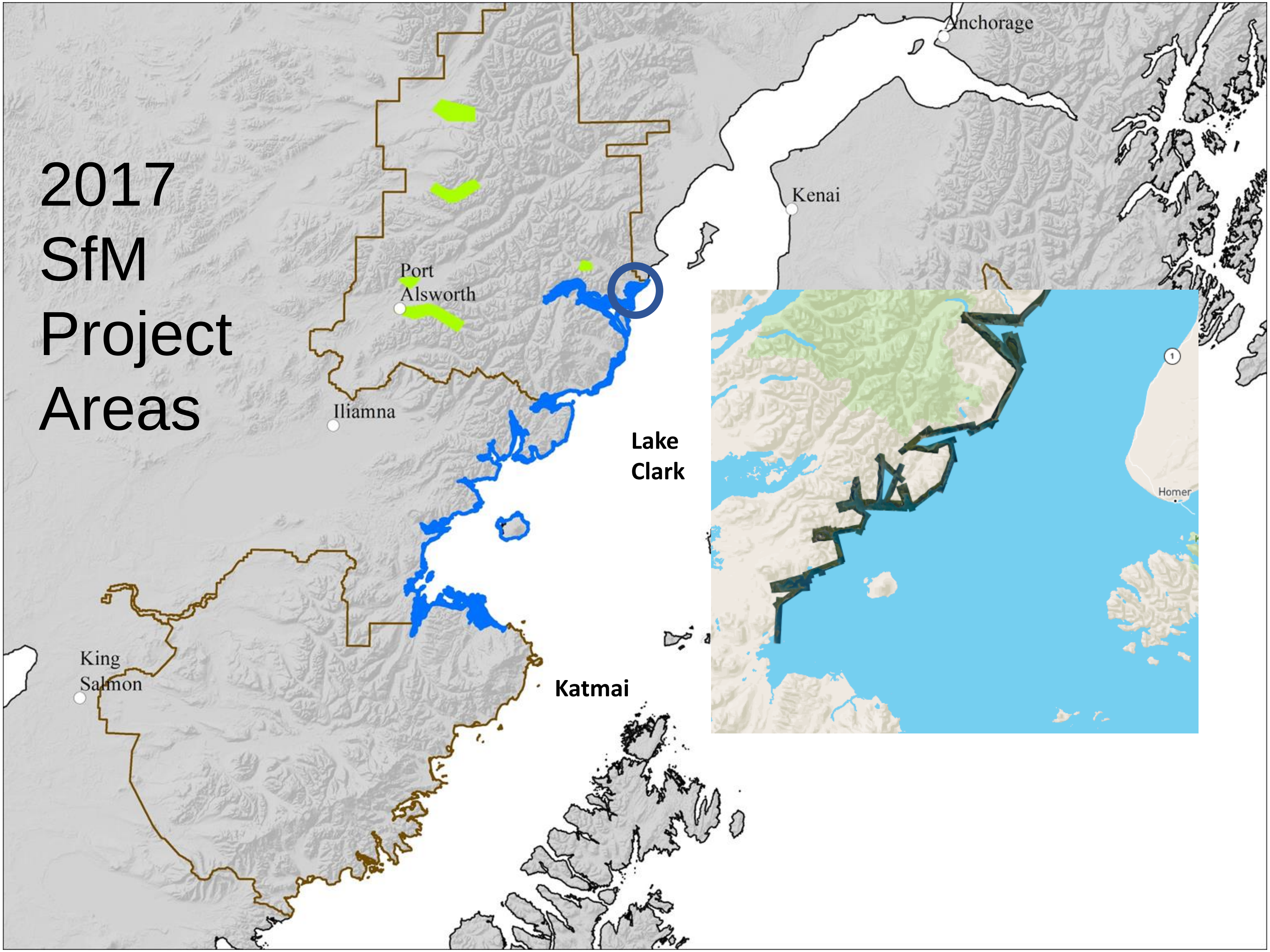
2017 SfM Project Areas

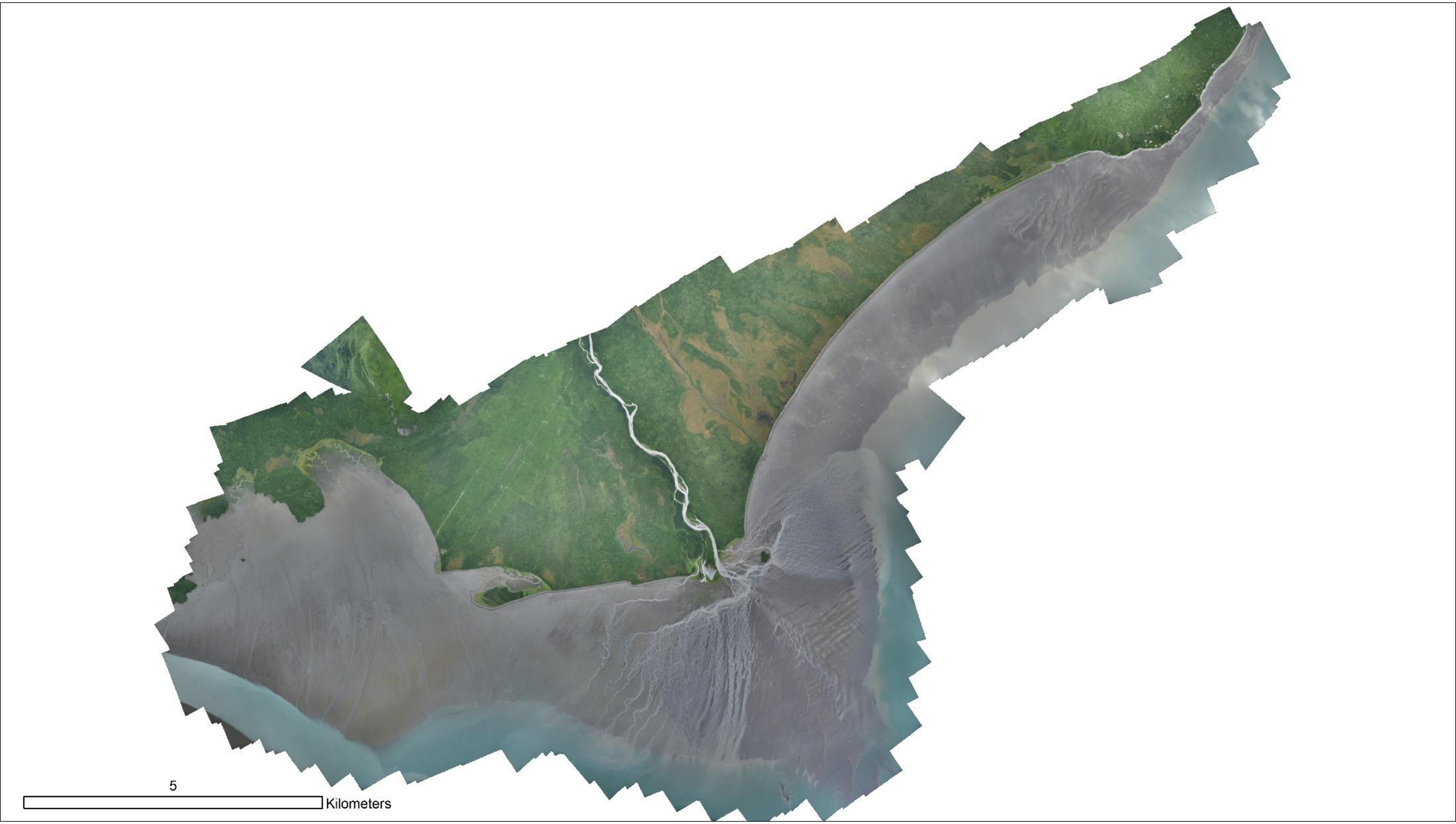


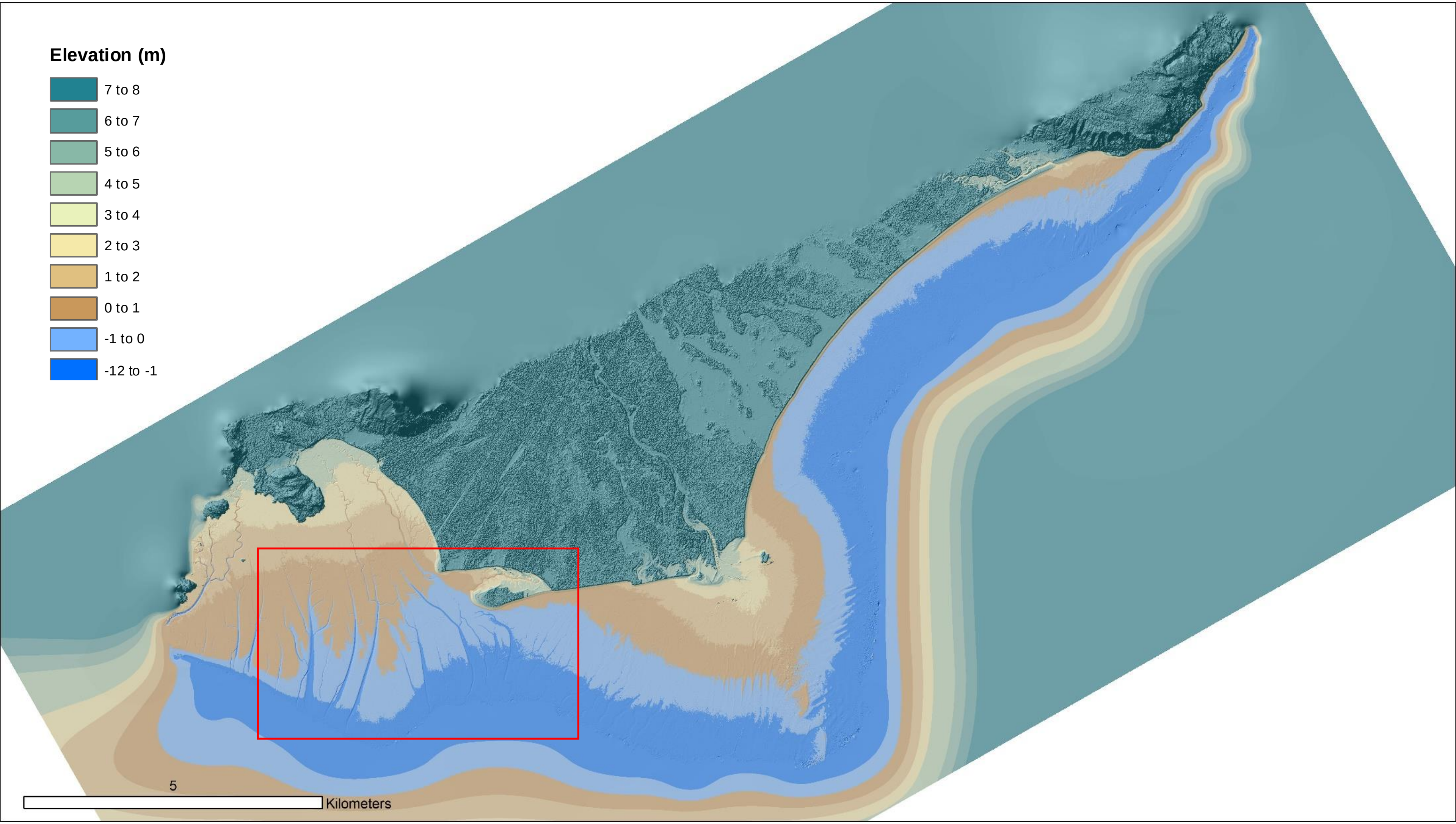
2017 SfM Project Areas



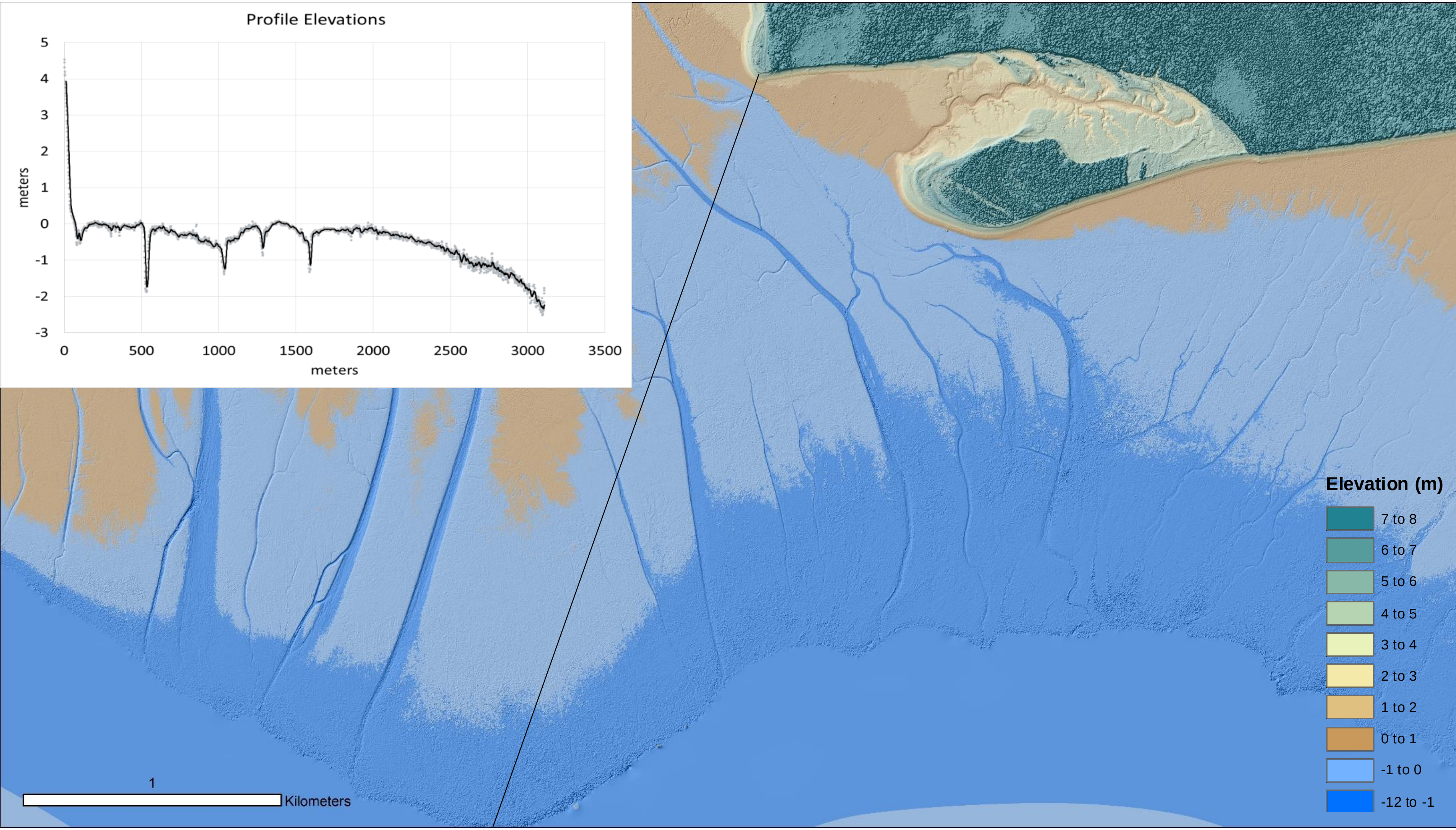
2017 SfM Project Areas

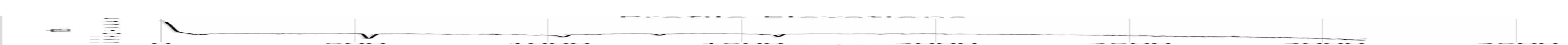


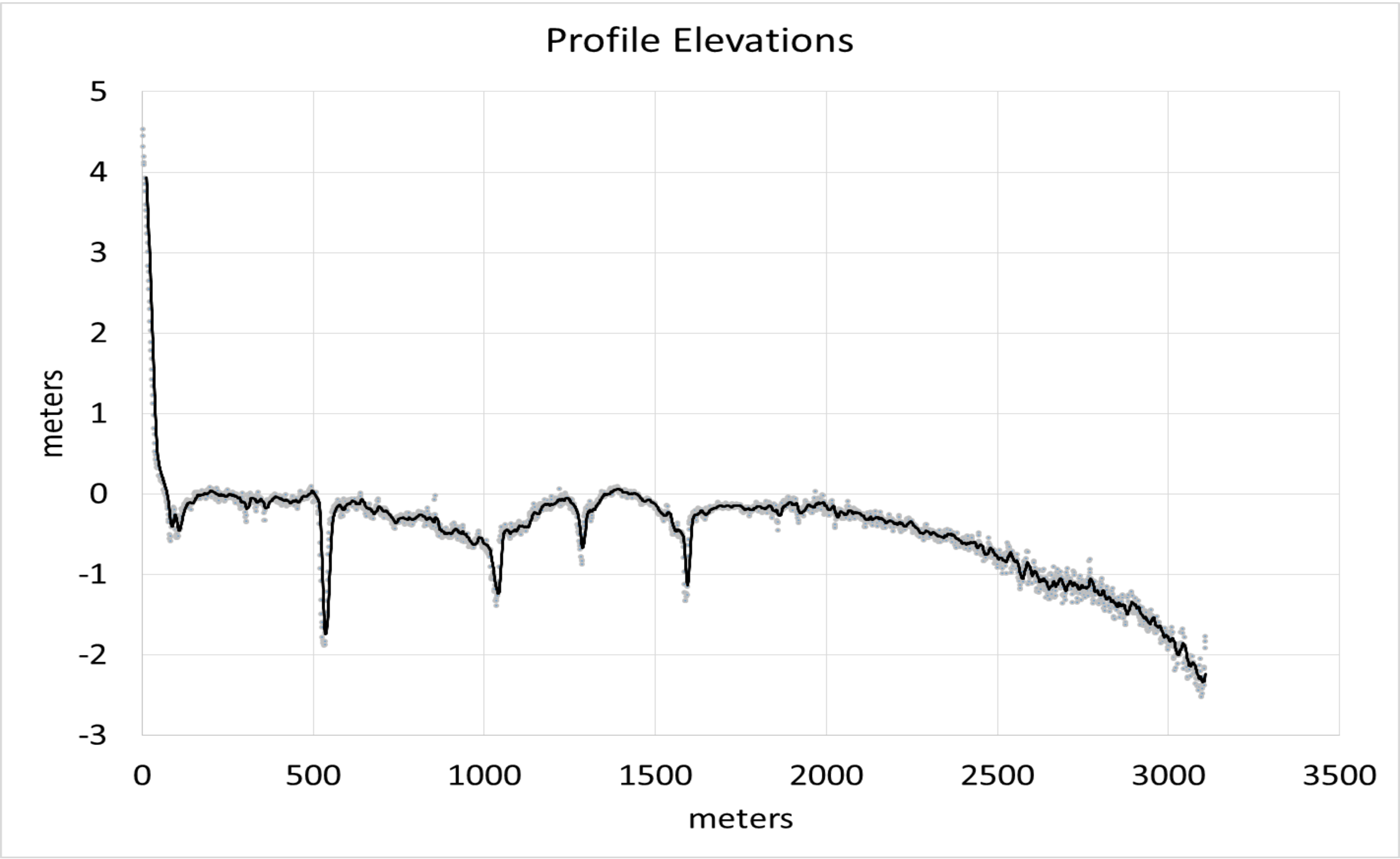

5
Kilometers


Elevation (m)
7 to 8
6 to 7
5 to 6
4 to 5
3 to 4
2 to 3
1 to 2
0 to 1
-1 to 0
-12 to -1
5
Kilometers

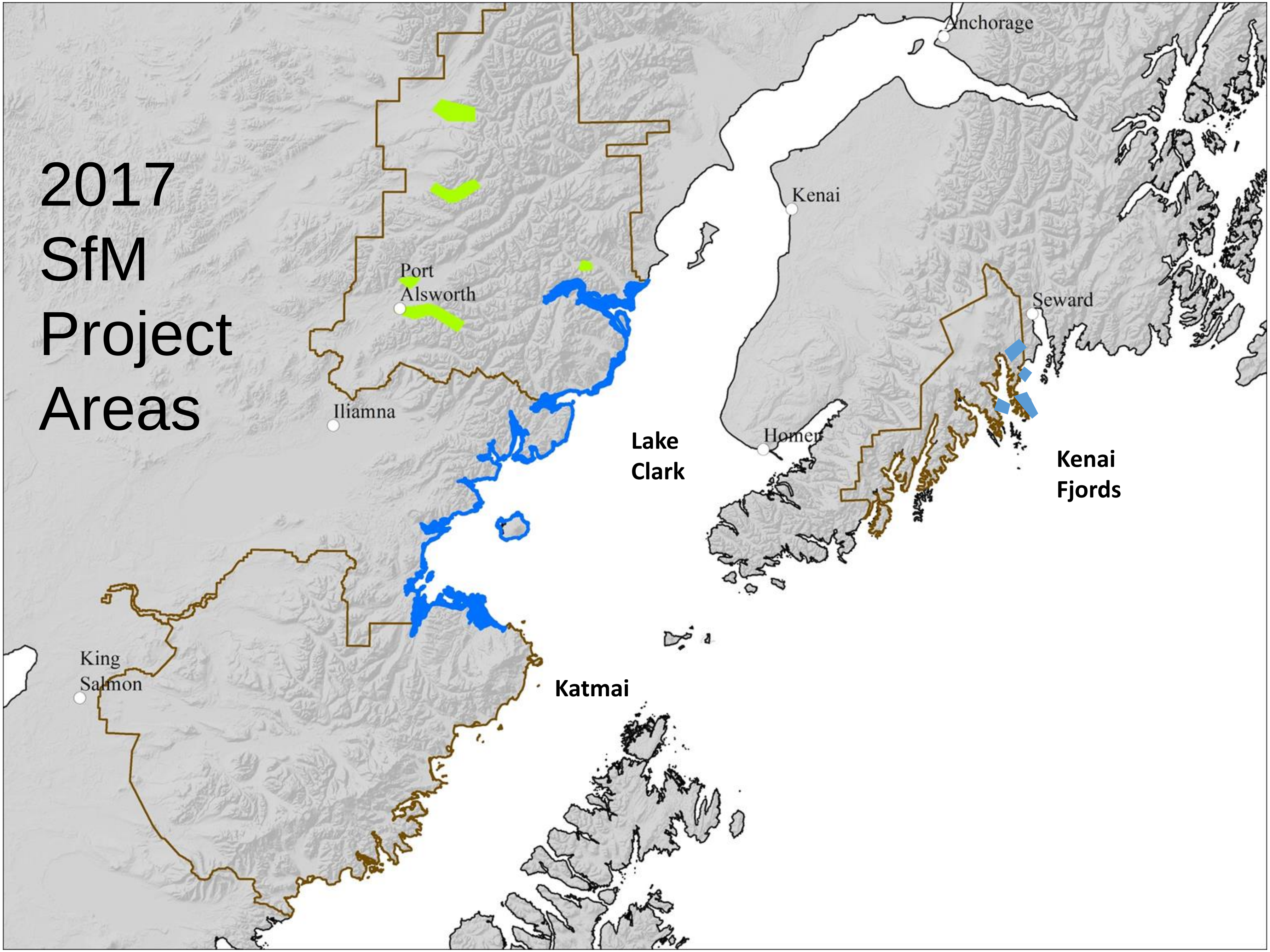

1
Kilometers

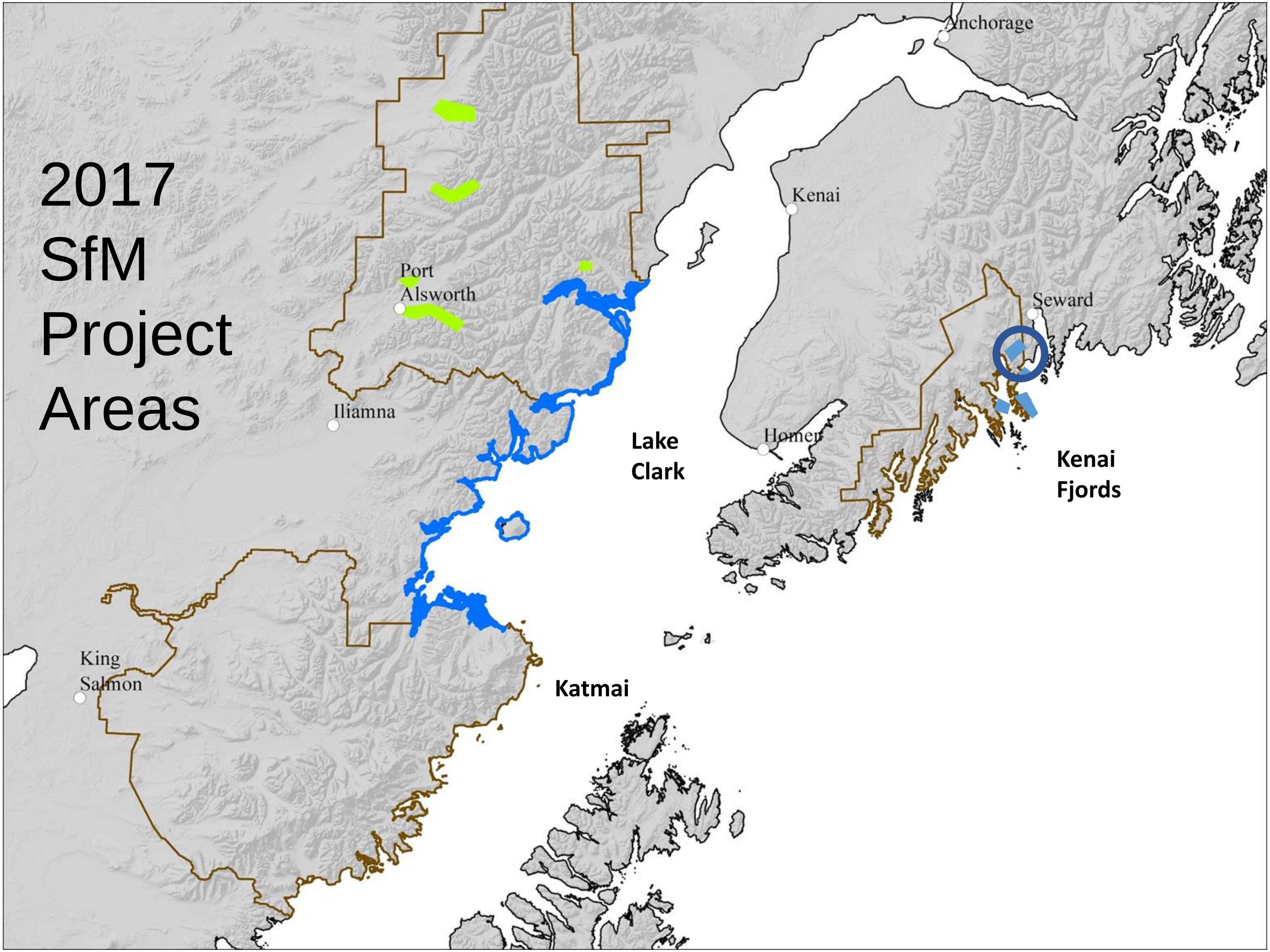

Profile Elevations
meters
5
4
3
2
1
0
-1
-2
-3
0
500
1000
1500
2000
2500
3000
3500
meters
Elevation (m)
7 to 8
6 to 7
5 to 6
4 to 5
3 to 4
2 to 3
1 to 2
0 to 1
-1 to 0
-12 to -1
1
Kilometers



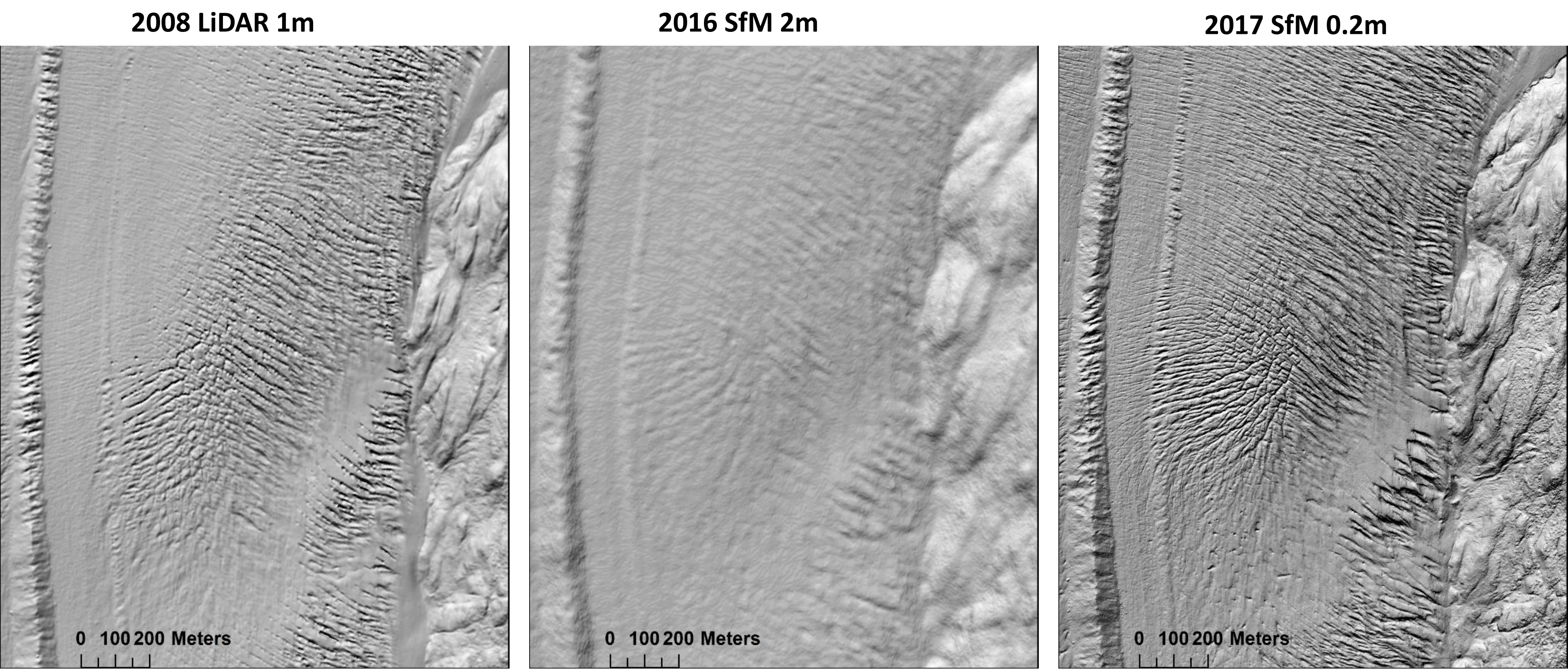

Profile Elevations
meters
5
4
3
2
1
0
-1
-2
-3
0
500
1000
1500
2000
2500
3000
3500
meters

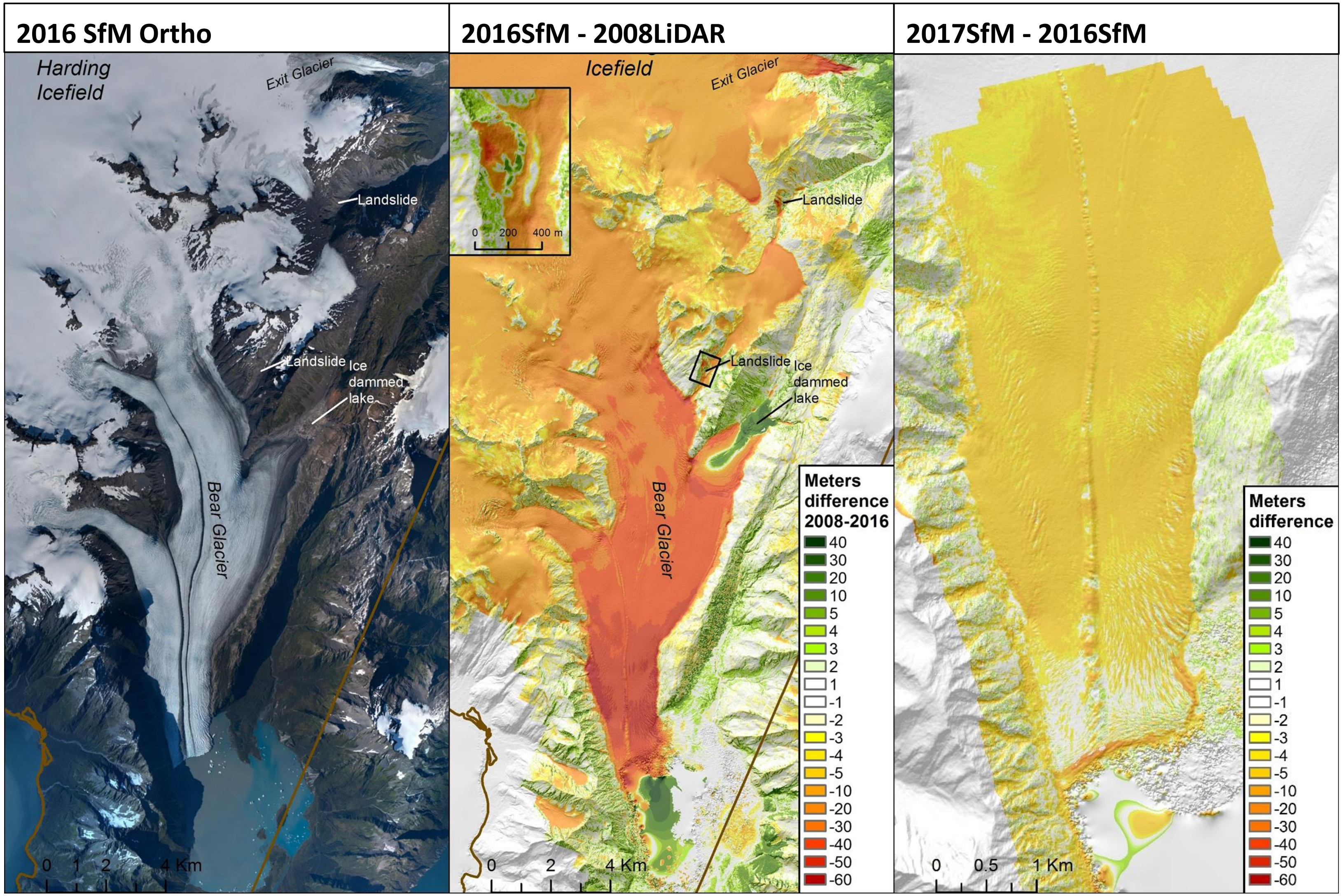
2017 SfM Project Areas

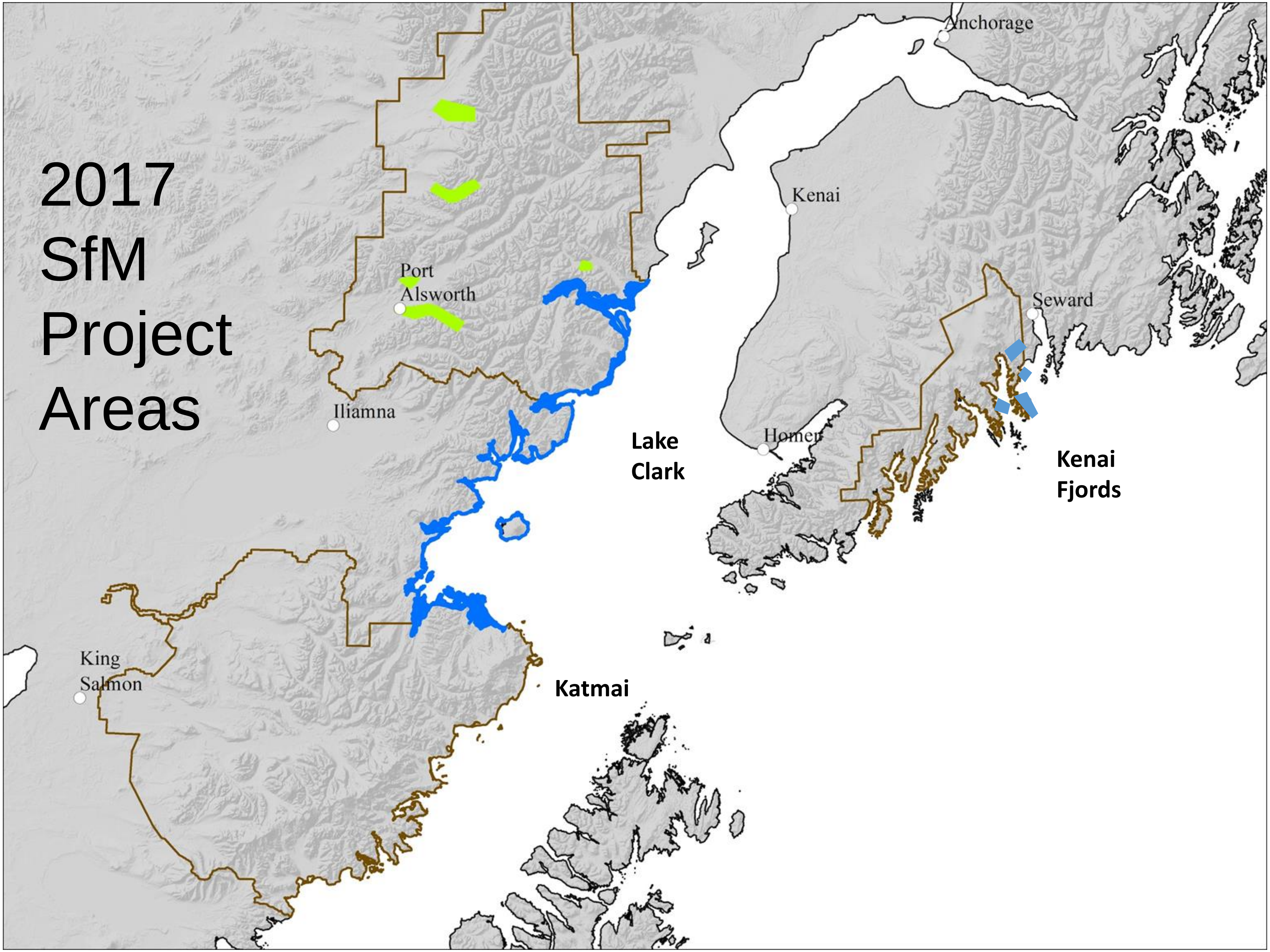




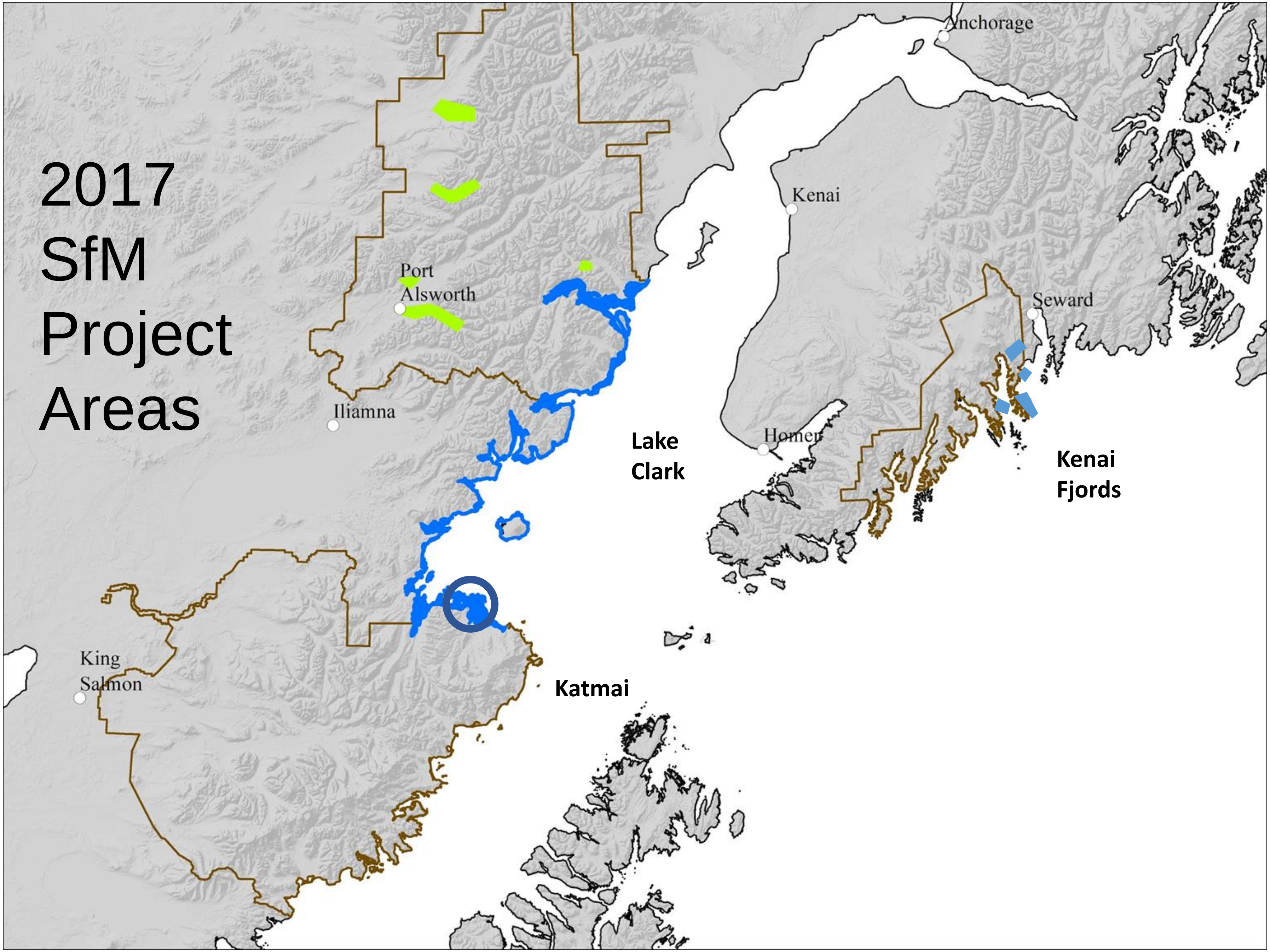
2017
SfM
Project
Areas
Anchorage
Kenai
Port
Alsworth
Seward
Iliamna
Homer
Lake
Clark
Kenai
Fjords
King
Salmon
Katmai

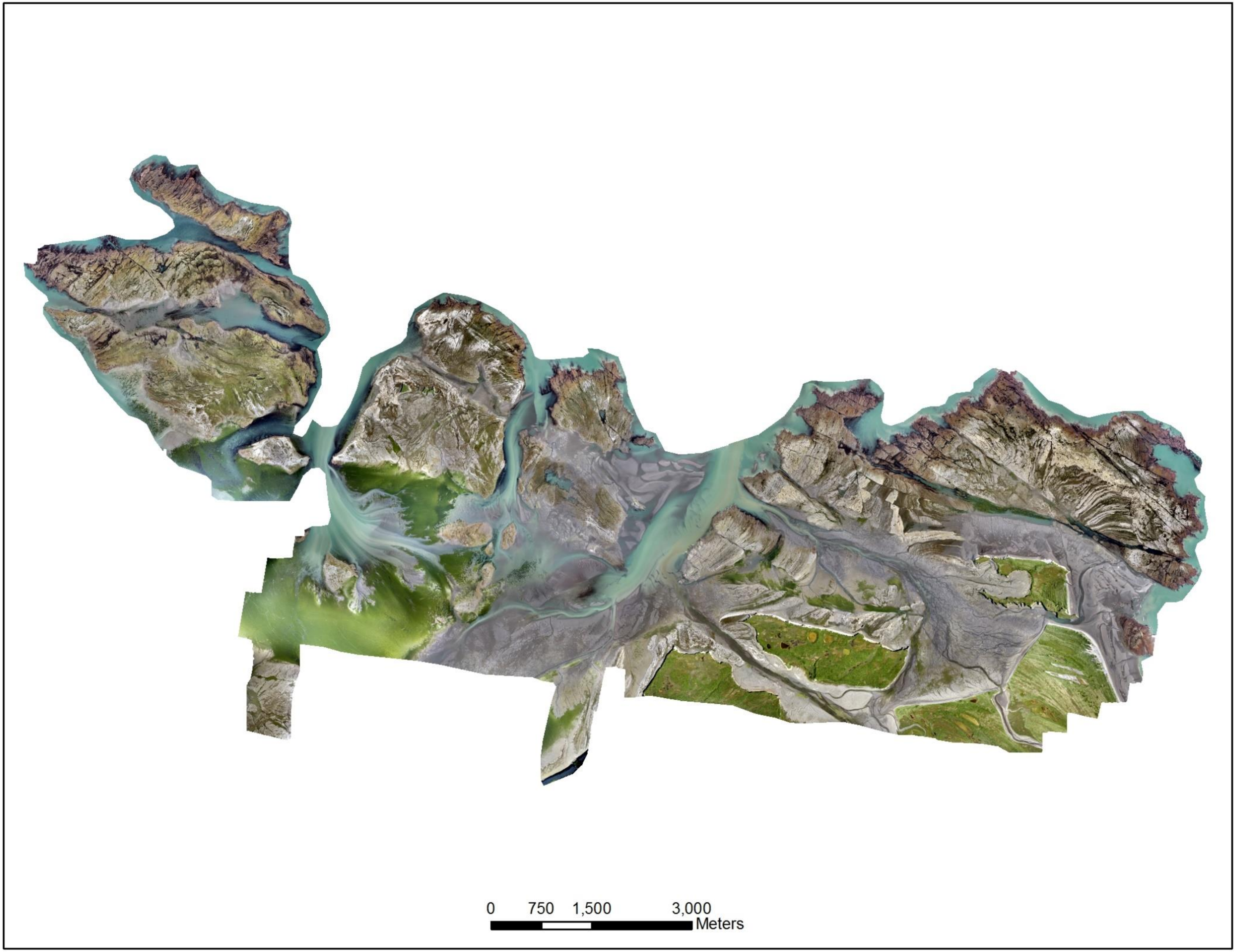

2008 LiDAR 1m
2016 SfM 2m
2017 SfM 0.2m
0 100 200 Meters
0 100 200 Meters
0 100 200 Meters


2016 SfM Ortho
Harding
Icefield
Exit Glacier
Landslide
Landslide
Ice
dammed
lake
Bear Glacier
0 1 2 4 Km
2016SfM - 2008LiDAR
Icefield
Exit Glacier
0 200 400 m
Landslide
Landslide
Ice
dammed
lake
Bear Glacier
Meters
difference
2008-2016
40
30
20
10
5
4
3
2
1
-1
-2
-3
-4
-5
-10
-20
-30
-40
-50
-60
0 2 4 Km
2017SfM - 2016SfM
Meters
difference
40
30
20
10
5
4
3
2
1
-1
-2
-3
-4
-5
-10
-20
-30
-40
-50
-60
0 0.5 1 Km


2017
SfM
Project
Areas
Anchorage
Kenai
Port
Alsworth
Seward
Iliamna
Homer
Lake
Clark
Kenai
Fjords
King
Salmon
Katmai

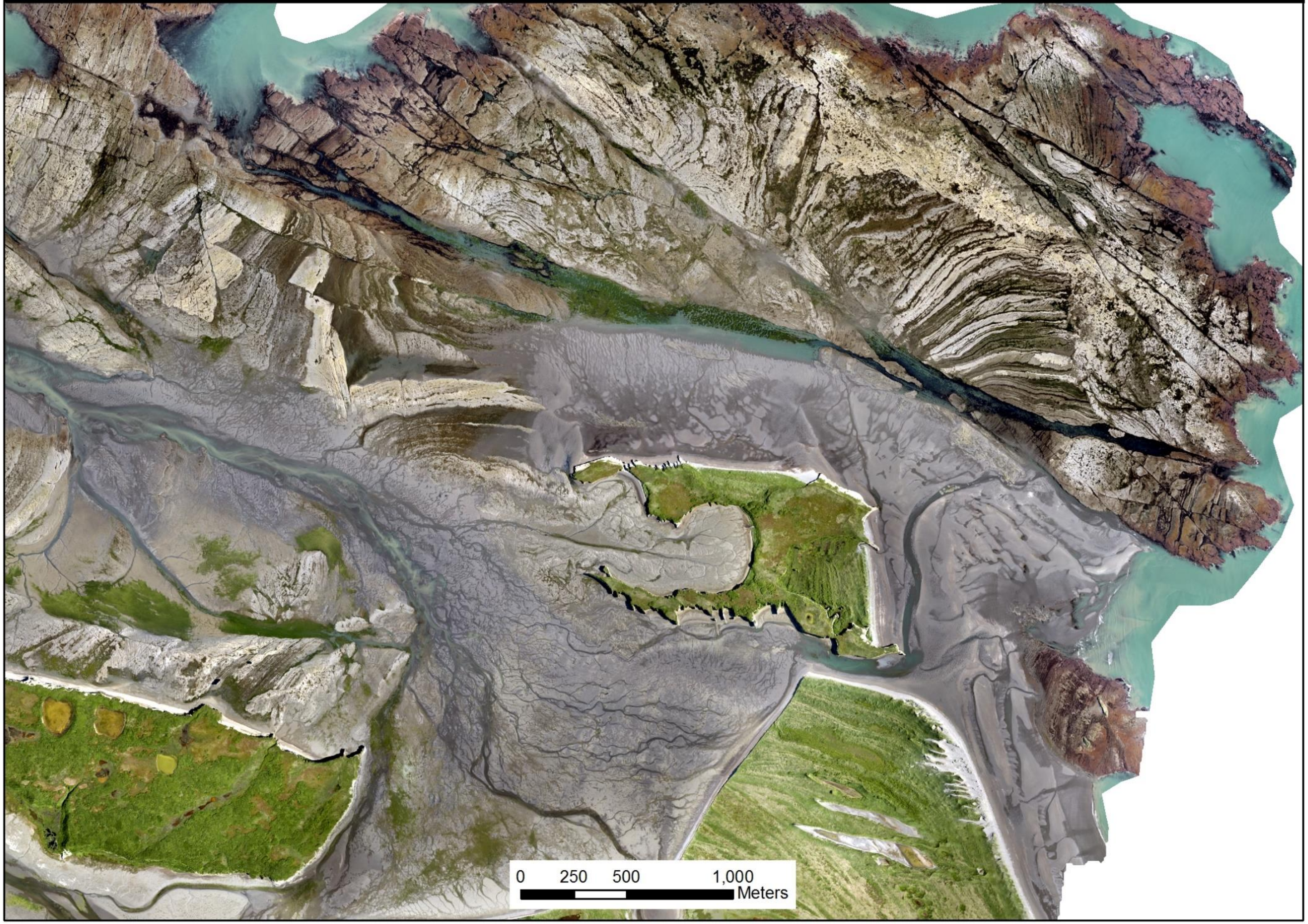
2017 SfM Project Areas

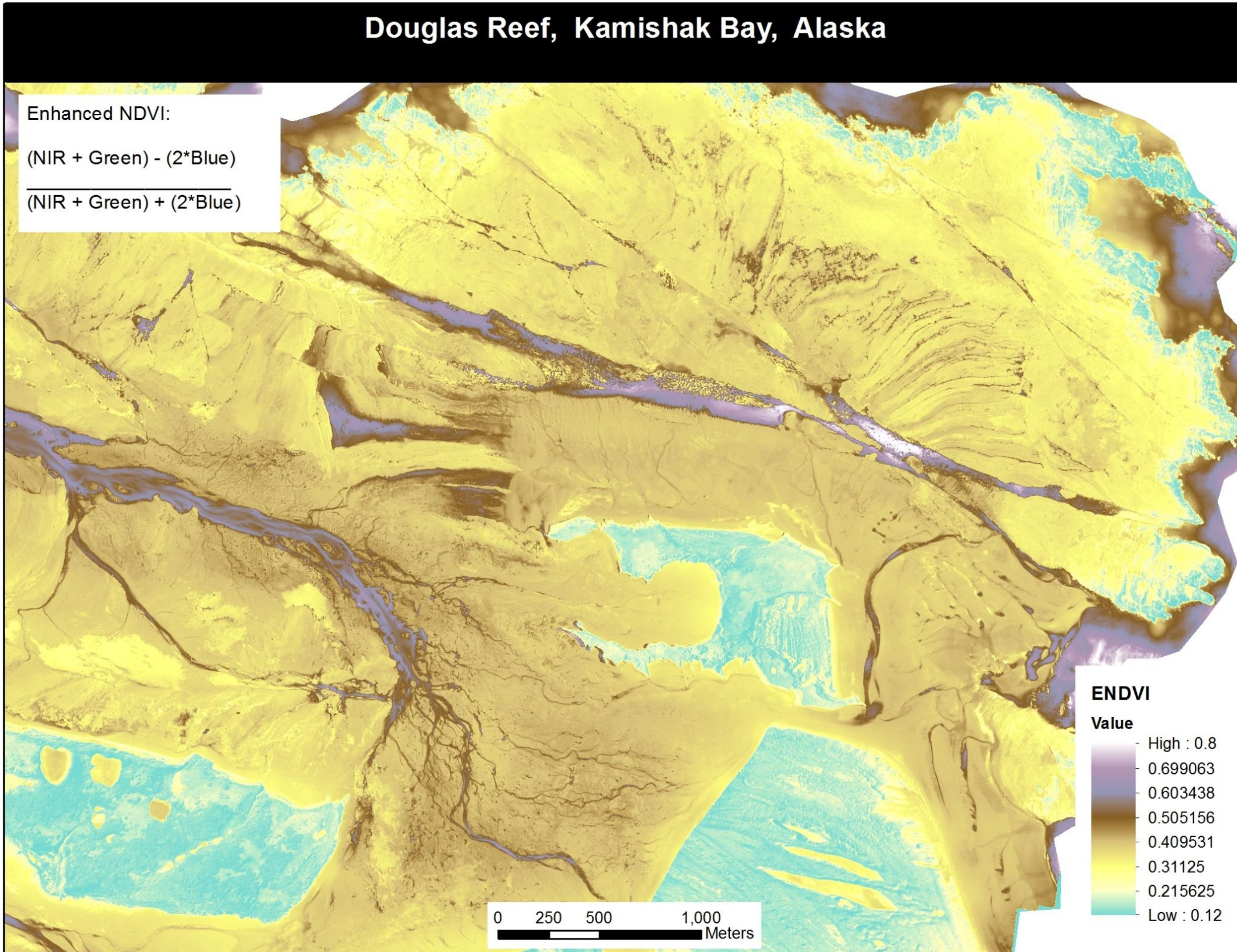



0
750
1,500
3,000
Meters


0 250 500 1,000
Meters

Douglas Reef, Kamishak Bay, Alaska





Douglas Reef, Kamishak Bay, Alaska
Enhanced NDVI:
(NIR + Green) - (2*Blue)
(NIR + Green) + (2*Blue)
ENDVI
Value
High : 0.8
0.699063
0.603438
0.505156
0.409531
0.31125
0.215625
Low : 0.12
0
250
500
1,000
Meters

LIDAR for 2018

Katmai NP

- Hallo Bay
- Takli Island
- Katmai Bay

Lake Clark NP

- Silver Salmon
- Chinitna Bay

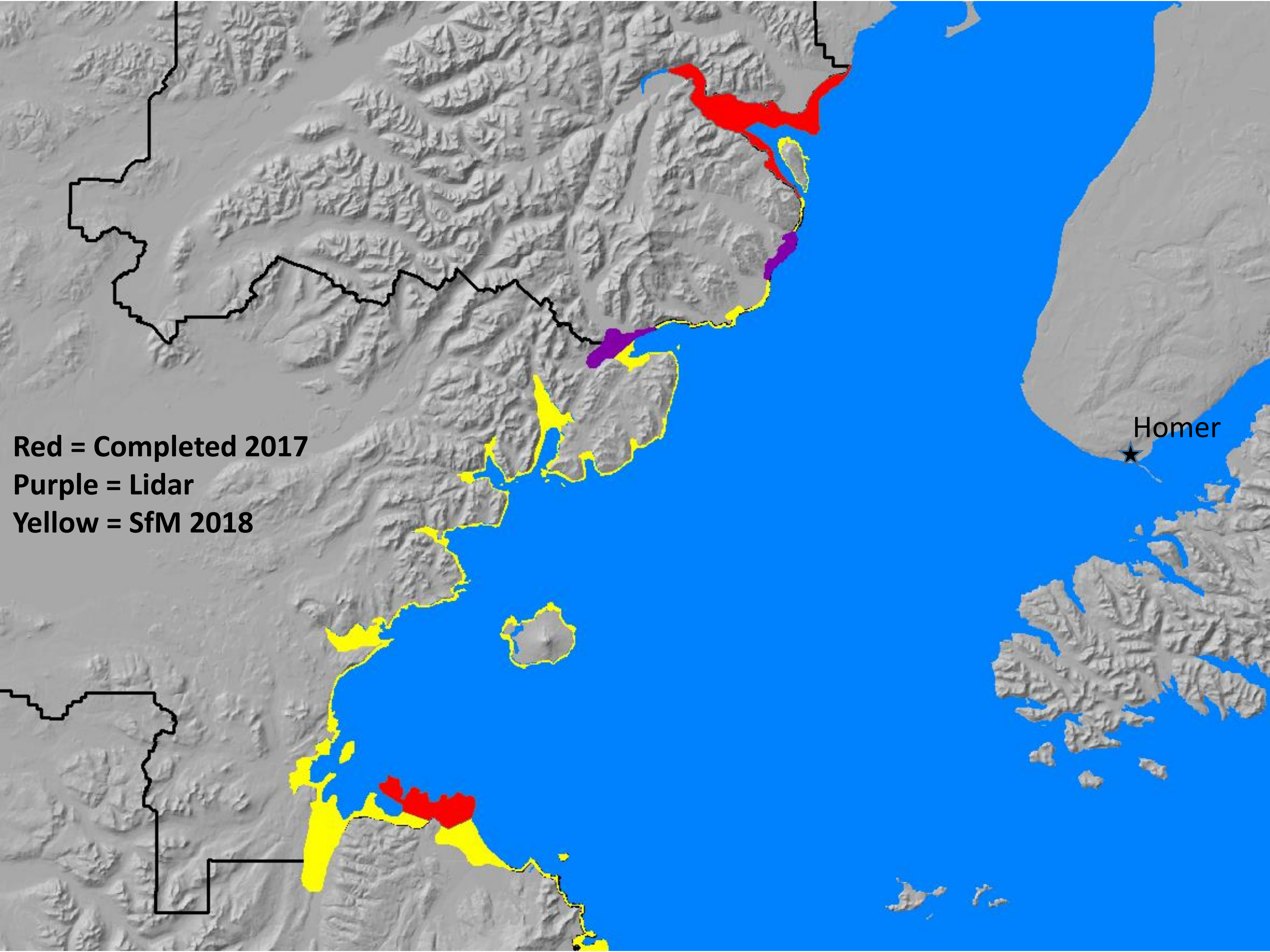
SfM for 2018

Katmai & Lake ClarkNP

- Salt Marshes
- I&M Coastal Monitoring Plots
- Complete Lower Cook Inlet

Northwest Arctic

- Seward Peninsula Outer Coasts, Lagoons, and River Mouths


Red = Completed 2017
Purple = Lidar
Yellow = SfM 2018
Homer

New SfM Acquistion Areas NW AK

2004 NOAA Lidar

2018 SfM Collection AOI

Thank You

Chad Hults, Tahzay Jones, Sarah Venator

Alaska Coastal Mapping Gaps & Priorities

For the assessment of coastal flood & erosion hazards

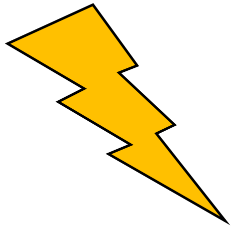
State of Alaska
Department of Natural Resources
Jacquelyn Overbeck

Lightning Talk

State of Alaska Coastal Hazards Program

The State of Alaska established the Division of Geological & Geophysical Surveys (DGGS) to carry out Alaska Statute 41.08.020

> "Determine the potential of Alaskan land for production of metals, minerals, fuels, and geothermal resources, the locations and supplies of groundwater and construction material, and the **potential geologic hazards to buildings, roads, bridges and other installations and structures**"



Coastal Hazards

Changing Ocean Processes

Permafrost Thaw

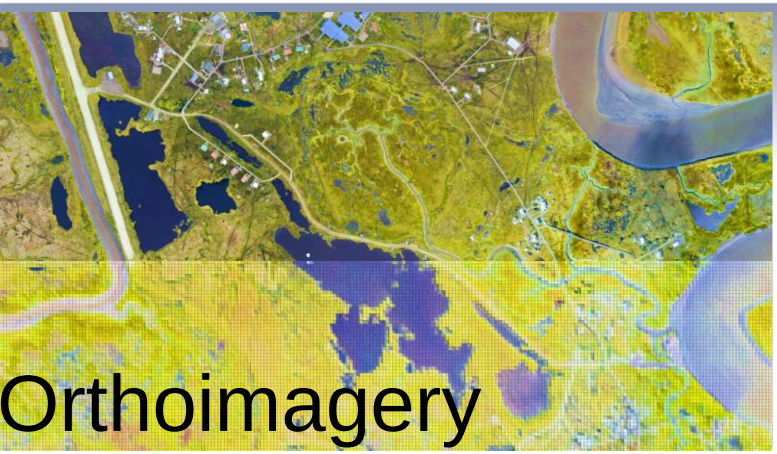
Reductions in Sea Ice Concentration & Extent

Relative Sea Level Change

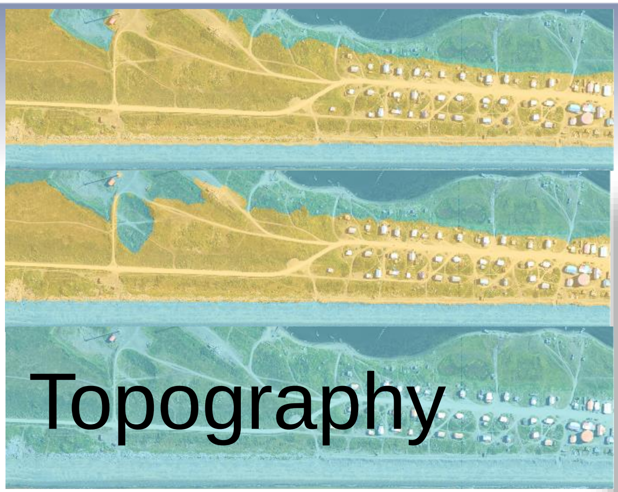
Coastal Flooding

Coastal Erosion

Coastal Mapping Baseline Datasets

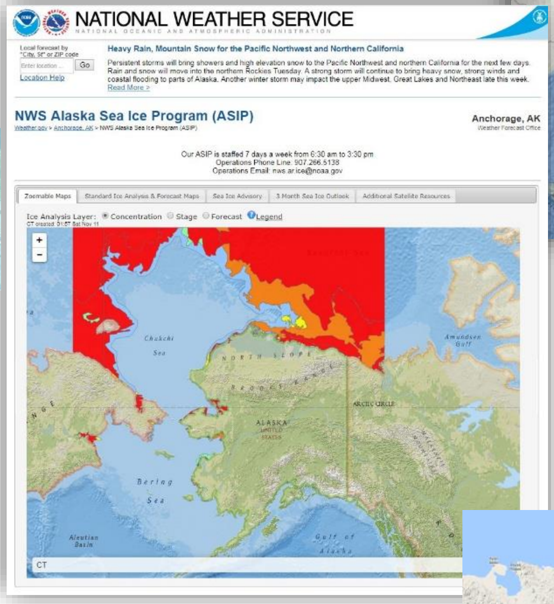


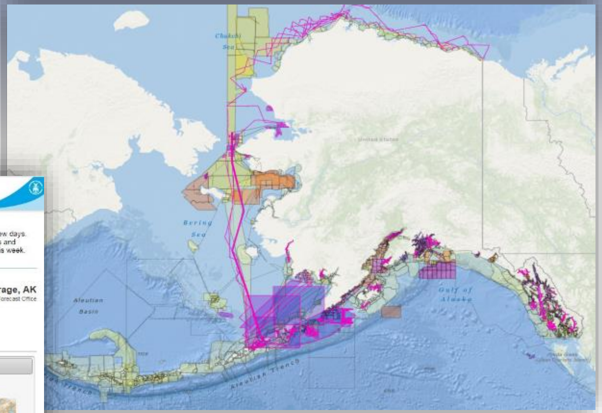
Orthoimagery



Topography

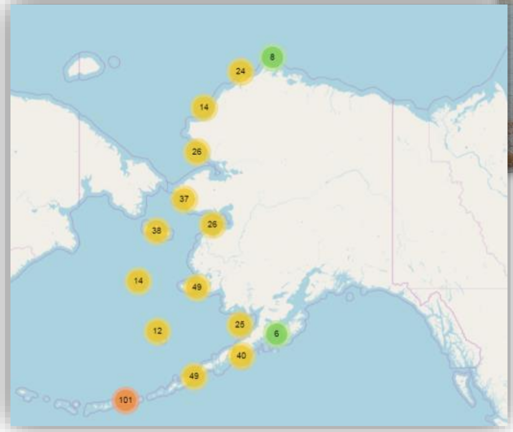
Sea Ice





Bathymetry

Waves

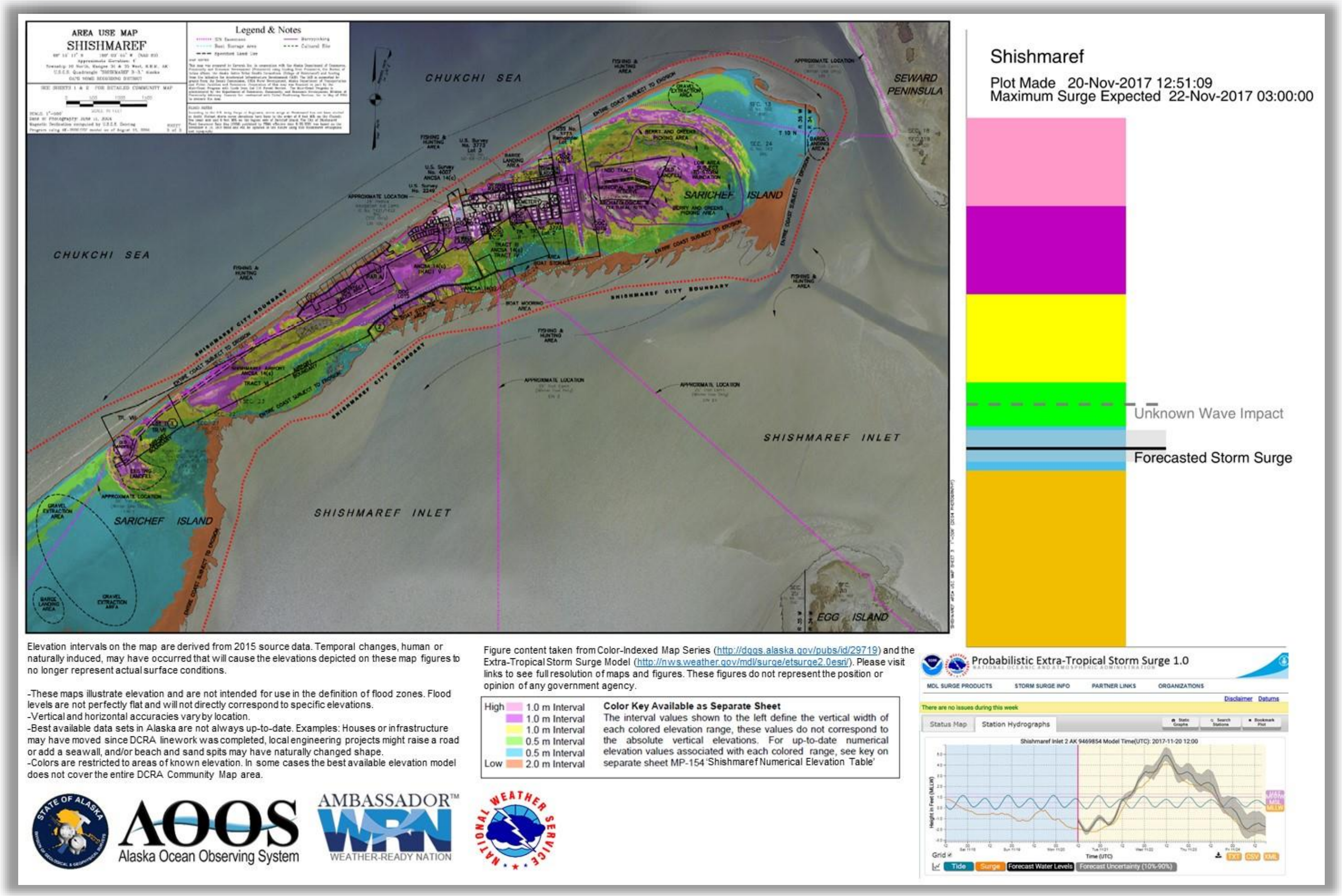


Water levels

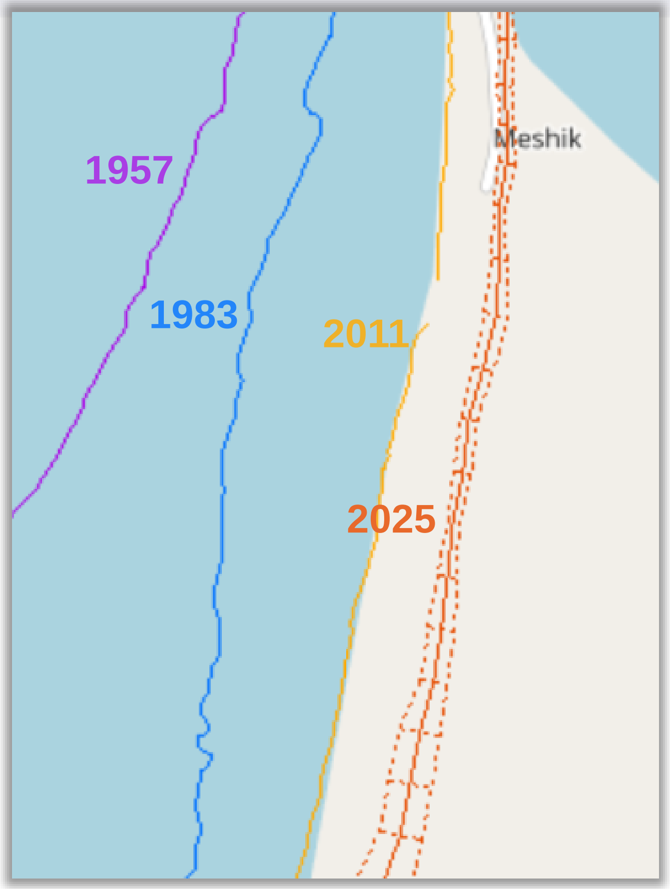
Continually Operating Reference Systems (CORS)

Coastal Hazards Mapping & Forecasting

Coastal Flooding



Coastal Erosion

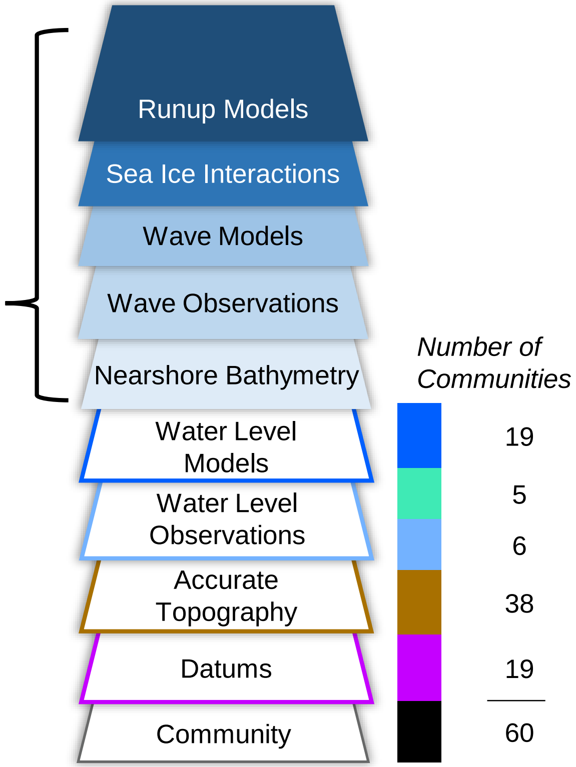


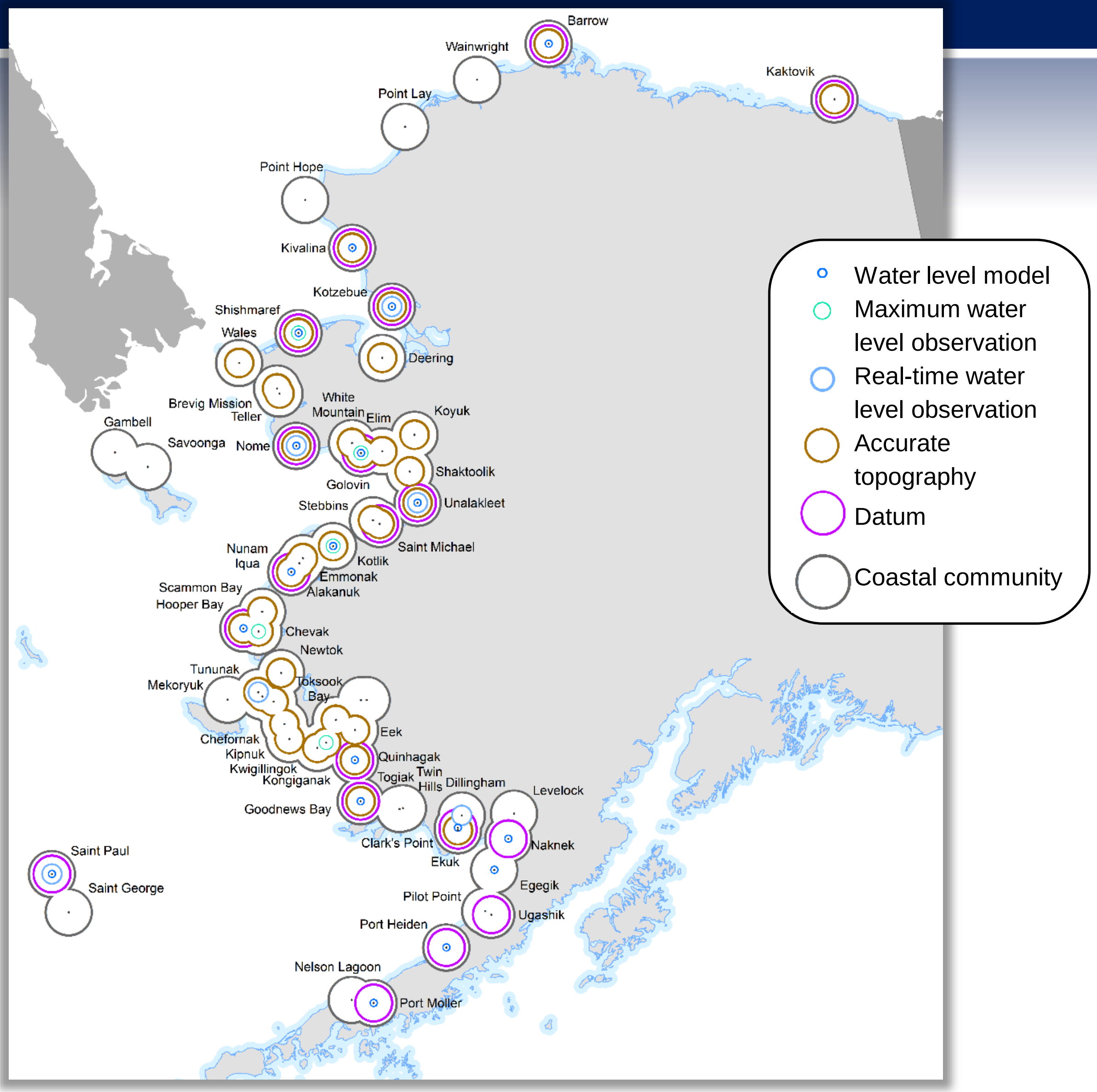
http://maps.dggs.alaska.gov/shoreline/

Flood Mapping & Forecasting

Baseline data layers used for coastal flood modeling and forecasting in northern and western Alaska communities.

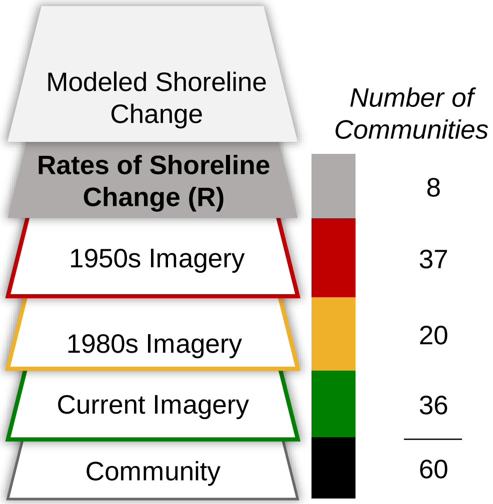
Requiring research or needed at all locations.





Erosion Mapping & Forecasting

Baseline data layers used for coastal erosion modeling and forecasting in northern and western Alaska communities.



Impacts on Alaskans

- Effective flood and erosion **mapping**
- Continuous and consistent flood and erosion **forecasting**
- Accurate flood and erosion **long-term modeling** and prediction

- Informed state, regional, and local community and climate adaptation planning
- Effective engineering in the coastal zone
- Disaster preparation and mitigation

For More Information

This has been a lightning version of:
Overbeck, J.R. [ed], 2018, **Alaska Coastal Mapping Gaps and Priorities for the assessment of coastal flood and erosion hazards** [in prep]: Alaska Division of Geological & Geophysical Surveys.

Jacquelyn Overbeck
State of Alaska
Division of Geological & Geophysical Surveys
Coastal Hazards Program
907-451-5026
Jacquelyn.overbeck@Alaska.gov

DENALI COMMISSION

Statewide Threat Assessment

Coastal Mapping Summit

February 9, 2018

Village Infrastructure Protection (VIP) Program

- Coordination and Facilitation vs. Implementation
- Threats: Coastal Erosion, Flooding, and Permafrost Degradation
- Impacts to Infrastructure
- GAO Report 551—2009

Photos Courtesy of Lemay Engineering

Statewide Threat Assessment Project

- Rural Communities with Population > 20
- Evaluate Erosion, Flood, and Permafrost Data
- Assign Risk Index for Each Threat
- Establish Aggregate Risk Index

US Army Corps of Engineers

CRREL

UAF UNIVERSITY OF ALASKA FAIRBANKS

Photos Courtesy of Romy Cadiente

Assessment

Erosion Ranking

Criteria & Ranking	Critical Infrastructure	Health & Safety	Subsistence & Shoreline Use	Geographic Location	Population Affected	Housing in Parallel	Environmental Hazard	Cultural Importance	Commercial/ Non-Residential	Baseline Erosion Ranking Score
Akhiok, Native Village of	Low	Low	Low	Low	Low	Low	Low	Low	Low	32
Akiak, Native Community	Low	Low	Low	Low	Med	Low	High	High	Med	93
Akutan, Native Village of	Low	Low	Low	Low	Low	Low	Low	Low	Low	19
Alakanuk, Village of	Med	Low	Low	Low	Med	Med	Med	Low	Med	93
Alatna Village	Low	Low	Med	Low	Low	Low	Med	Low	Low	48
Barrow, Native Village of	High	Low	Low	Med	Low	Low	Low	High	Low	84
Dillingham, Curyung Tribal Council (for	High	Low	Low	High	Low	Low	High	Low	Med	105
Huslia Village	High	Low	Med	High	Low	Low	High	Low	Med	111
Kivalina, Native Village of	High	Med	High	High	High	High	Med	High	High	153
Port Heiden, Native Village of	Med	Med	Low	Med	High	Med	High	Med	Low	117

Flood Ranking

Criteria & Ranking	Critical Infrastructure	Health & Safety	Subsistence & Shoreline Use	Land Use/Geographic Location	Population Affected	Housing Distribution	Environmental Hazard	Cultural Importance	Commercial Infrastructure	Flood Ranking Score
Akhiok, Native Village of	Low	Low	Med	Low	Low	Low	Low	Low	Low	21
Akiak, Native Community	Med	Low	Low	Low	Med	Low	High	High	Med	68
Akutan, Native Village of	Med	Low	Low	High	High	Low	Med	Med	Med	68
Alakanuk, Village of	High	Med	Low	Med	High	Med	High	Med	Med	132
Alatna Village	Med	Low	High	Low	Low	Low	Med	Med	Low	30
Barrow, Native Village of	Med	Low	Low	High	Med	Low	High	Med	High	74
Dillingham, Curyung Tribal Council (for	Med	Low	Low	Med	Low	Low	Med	Med	Med	29
Huslia Village	Med	Med	Low	Med	Med	Low	Low	Low	Low	84
Kivalina, Native Village of	Med	Med	Med	High	High	Med	Med	Med	Med	82
Port Heiden, Native Village of	Med	Med	Low	Low	Med	Low	Low	Low	Low	27

Permafrost Ranking

Criteria & Ranking	Critical Infrastructure	Health & Safety	Access to Subsistence	Land Use/Geographic Location	Population Affected	Housing Distribution	Environmental Hazard	Cultural Importance	Commercial Infrastructure	Weighted Criteria Total	Confidence	Permafrost Ranking Score
Akhiok, Native Village of	None	None	None	None	None	None	None	None	None	0	***	0
Akiak, Native Community	None	None	None	None	None	None	None	None	None	0	***	0
Akutan, Native Village of	None	None	None	None	None	None	None	None	None	0	***	0
Alakanuk, Village of	Med	Low	Low	Low	Low	Med	Low	Low	Low	24	**	24
Alatna Village	Med	Low	Low	Med	Med	High	Med	Low	Low	32	**	32
Barrow, Native Village of	Med	Low	Med	High	High	High	Med	High	Med	41	***	41
Dillingham, Curyung Tribal Council (for	Low	Low	Low	Low	Low	Low	Low	Low	Low	19	***	19
Huslia Village	Med	Low	Med	Med	Med	Med	Med	Low	Low	32	**	32
Kivalina, Native Village of	Low	Low	Low	Med	Med	Med	Low	Low	Low	24	**	24
Port Heiden, Native Village of	None	None	None	None	None	None	None	None	None	0	***	0

- Erosion, Flood and Permafrost evaluated by similar criteria
- Individual condition score and certainty of evaluation determined

Objectives and Uses

- Consolidated Data
- Better Understanding of Environmental Vulnerabilities and Threats
- State and Federal Prioritization of Resources
- Scoring Criteria
- Quantify and Communicate Needs
- Inform Agency Investment Decisions

Next Steps

- Finalize evaluation criteria and determine composite indices
- Conduct public meetings in communities to "ground truth" assessment methodology
- Develop public-facing static display (ex. Google Earth kml) of assessment results
- Participate in Silver Jackets Yukon-Kuskokwim Delta Resiliency Workshop in cooperation with Western Alaska LCC.
- Determine where and how dataset will be housed and updated

Feedback / Questions

Wave and Hydrodynamic Modeling within the Nearshore Beaufort Sea

5-Year BOEM Funded Study (2017-2022)

BOEM
Bureau of Ocean Energy Management

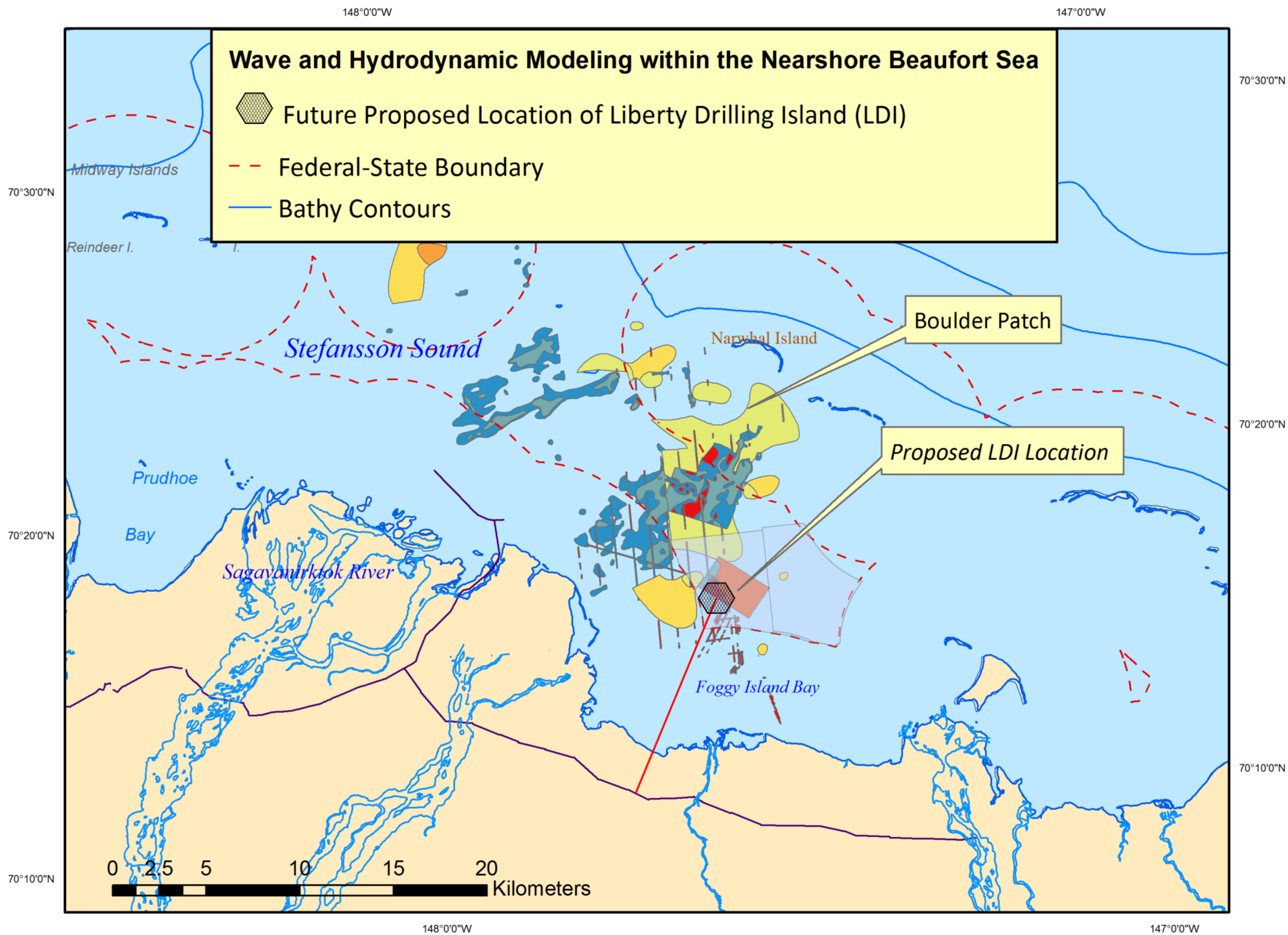
By Warren Horowitz
Project Officer

UAF University of Alaska Fairbanks

USGS
science for a changing world

UAA
University of Alaska Anchorage

AOOS
Alaska Ocean Observing System



148°0'0"W
147°0'0"W
Wave and Hydrodynamic Modeling within the Nearshore Beaufort Sea
Future Proposed Location of Liberty Drilling Island (LDI)
Federal-State Boundary
Bathy Contours
70°30'0"N
Midway Islands
70°30'0"N
Reindeer I.
Stefansson Sound
Narwhal Island
Boulder Patch
70°20'0"N
Proposed LDI Location
Prudhoe
Bay
70°20'0"N
Sagavanirktok River
Foggy Island Bay
70°10'0"N
0 2.5 5 10 15 20
Kilometers
70°10'0"N
148°0'0"W
147°0'0"W

Why BOEM is Funding this Study?

- Hilcorp, Alaska plans to develop an offshore Oil Field in Foggy Island Bay called the Liberty Development Project.
- During the winter months, Hilcorp, Alaska will construct the offshore Liberty Development Island (LDI) in Foggy Island Bay and excavate a pipeline trench from the LDI to shore.
- Once production begins, oil will be transported to shore via a sub-seabed pipeline connecting to existing onshore infrastructure.
- The LDI will be maintained for the life of the proposed production, which is approximately 20-30 years.

What Information is BOEM going to Obtain from this Study?

- Past, present, wind, wave and storm surge conditions and outputs (1979-2019).
- Similar forecast products as ice recedes in the area (2020-2049).
- Changes in coastal erosion and sediment impacts.
- Validated wave, hydrodynamic, and sediment transport models.
- Model outputs of sediment transport and concentrations from construction activities associated with proposed Liberty Development Project and long term trends (outputs) due to expected changes in region-wide environmental conditions.

Expected Environmental Changes

Warmer Air and Water Temperatures

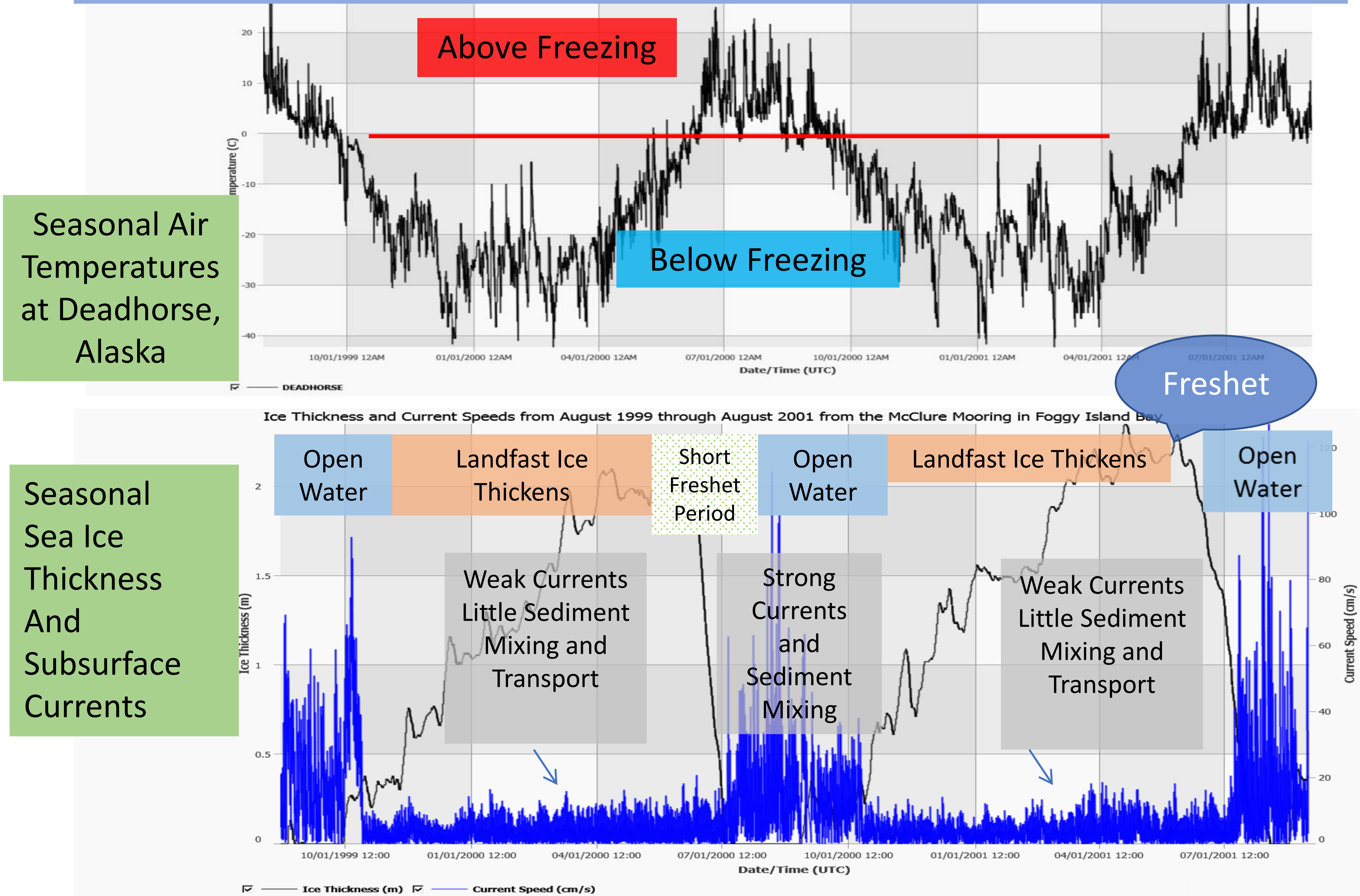
Diminishing Sea Ice Cover

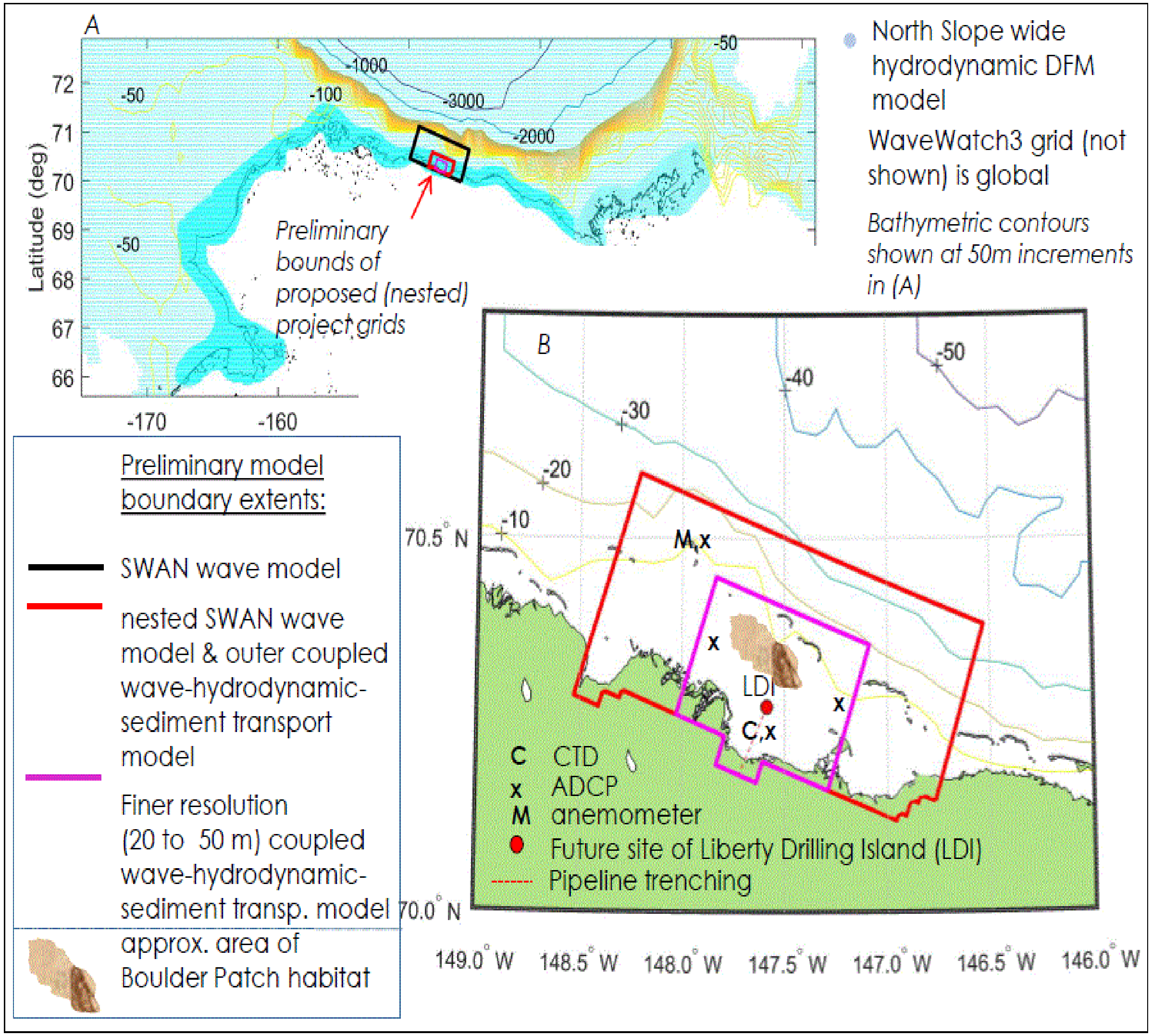
Increased Precipitation?

May lead over time to:

- Longer periods of open water
- Increased wave intensity and duration
- Increased storm surge extents
- Increased coastal erosion of permafrost cliffs
- Increases in fresh water and sediment flux into the coastal lagoons.

Seasonal Cycles of Landfast Ice Growth and Ablation within Foggy Island Bay 1999-2001





GOAL

to characterize and quantify

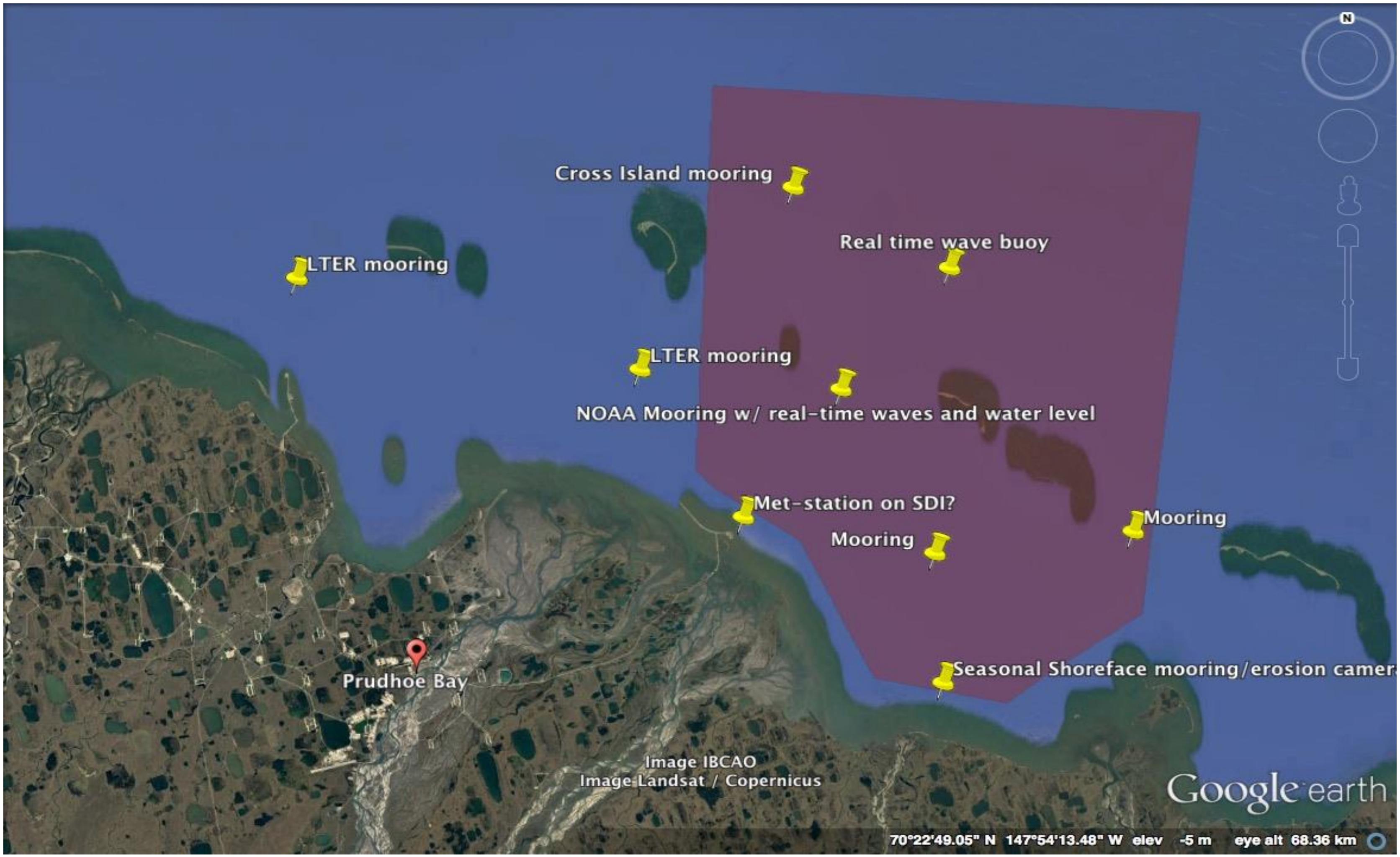
- **wave conditions, storm surge**, and **currents** (Stefansson Sound and surrounding coastline)
- **sediment transport** (Foggy Island Bay)

- **hindcast 40 years** (1979 – 2019)
- **project 30 years** into the future (2020–2049) (using projected changes in atmospheric conditions and sea ice)

Modeling

- WaveWatch (Deep Water) forced SWAN (Shallow Water) simulations.
- North Slope Wide DFM (Hydrodynamic) and WaveWatch models (40-year hindcast (1979 – 2019)
- Arctic Xbeach modeling of coastal change and the supply of sediment to the nearshore via erosion (hindcast and forecast)
- Higher resolution coupled wave-sediment-hydrodynamics simulations for select *seasonal scenarios* (**open water**, **landfast ice**, **spring freshet** and **no island(LDI)**, **artificial island (LDI**), **pipeline trenching** etc.)
- Two 30-year projections using calibrated and validated hydrodynamic, wave and sediment transport models

Planned Observations for Model Validation

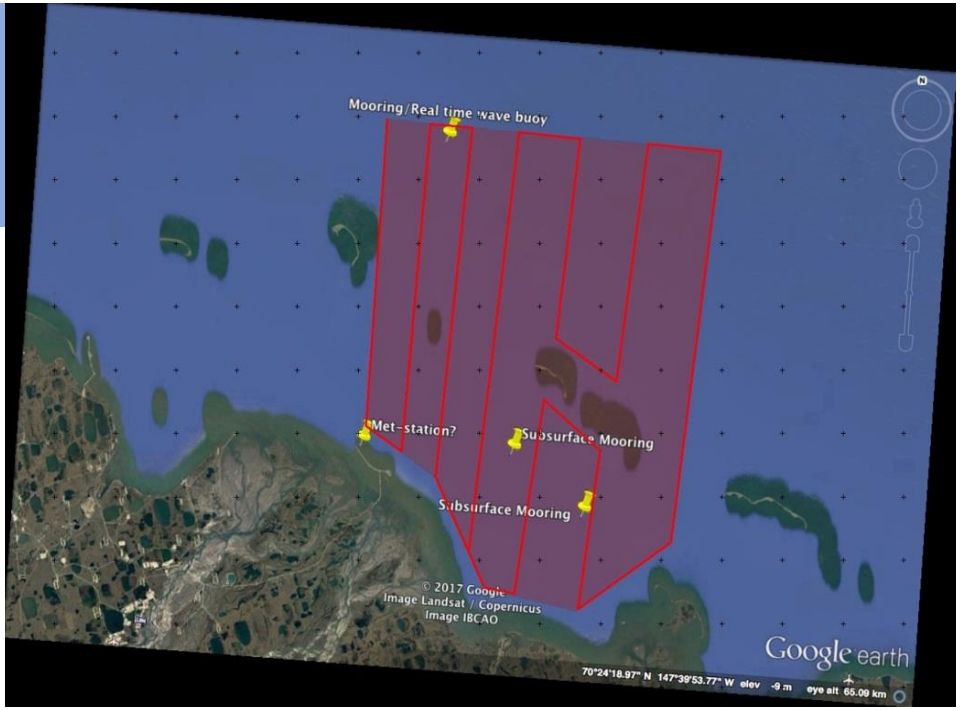


Observations for Model Validation

- **Historical data collection** *plus* **new observations** to include:
- Repeat **bathymetric surveys** to estimate bedload transport and bed elevation changes.
- **Hydrographic surveys** to map fronts, hydrography, suspended sediment and transport.
- 4 year-round **oceanographic moorings** (ADCP, CTD etc..).
- Seasonal shore face mooring to measure sediment flux.
- **Met-station**, time-lapse camera to assess coastal erosion.
- 2 **real-time wave buoys (Offshore and Nearshore)**
- **Coastal elevation** transects to quantify coastal change
- **Seasonal** through **ice measurements. (water column)**
- **(Partnering) L**ong**T**erm**E**cological**R**esearch **LTER "Beaufort Sea Lagoons: An Arctic Coastal Ecosystem in Transition"**

Tentative Field Schedule

- ~9 days of CTD, multi-beam sonar surveys and mooring deployments in 2018, 2019 from the R/V Ukpik.
- Most of the vessel-based work concentrated in- and around- Foggy Island Bay (red shaded area)
- Final mooring recoveries in 2020
- Real-time wave data Summer/Fall 2018 and 2019
- Real-time met station (location TBD)



Multiple Collaborators

- **University of Alaska Fairbanks (INE and IARC)**
  - UAF: Project Management, Observations of waves, sediment transport and hydrography, model validation
  - IARC: Dynamical downscaling of hindcast and forecast GCM output
- **USGS Pacific Coastal and Marine Science Center**
  - Wave, sediment transport, surge and hydrodynamic modeling (hindcast and forecast), Model validation
- **University of Alaska Anchorage**
  - Modeling of coastal erosion, sediment characterization and sediment transport observations
- **Alaska Ocean Observing System and Axiom Data Science**
  - Project Website, Data Compilation and Management and Outreach

U. S. Coast Guard Seventeenth District Brief

SERVING THE LAST FRONTIER

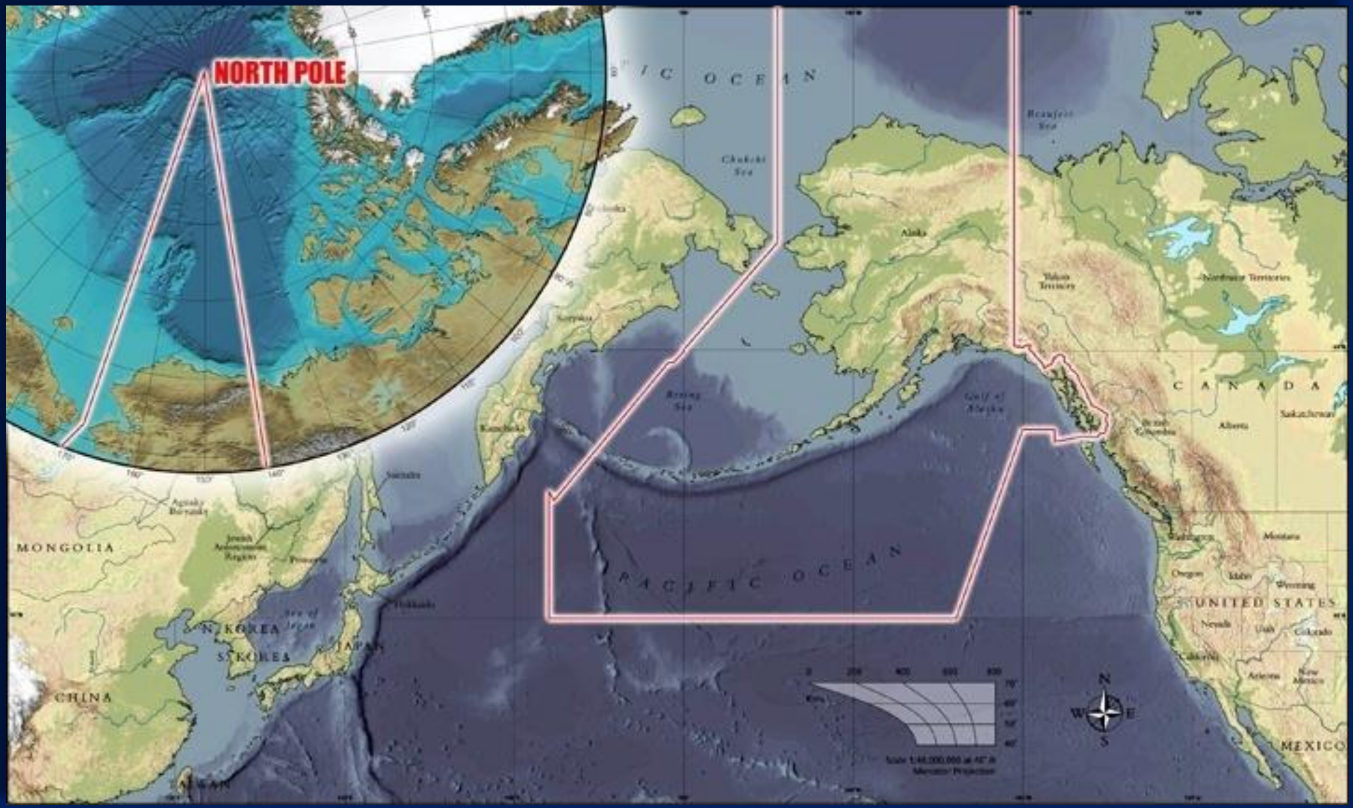
U.S COAST GUARD

1867 - 150 YEARS - 2017

IWG-OCM Alaska Coastal Mapping Summit, Feb 2017

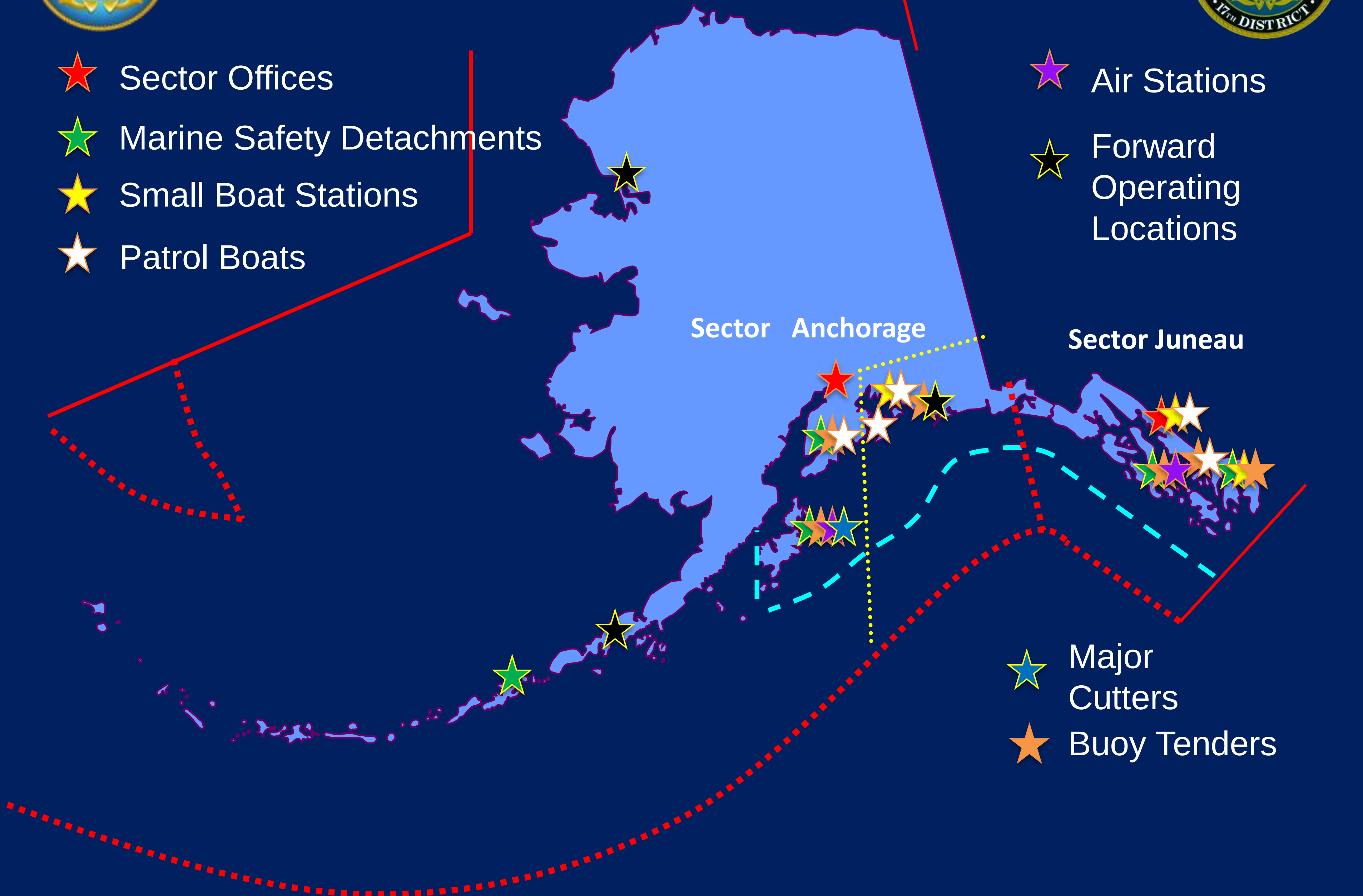
We Stand the Watch
on the Last Frontier

Seventeenth District



2,500 active duty, reserves, auxiliarists & civilians support operations in Alaska encompassing 3,853,500 sq. miles and more than 44,000 miles of coastline.

Seventeenth District Assets



Coast Guard Arctic Strategy

D17 Supporting Operational Activities

– **Improving Awareness**

- D17 Arctic Fusion Center
- Arctic Domain Awareness Center
- Information sharing with Canada/DoD

– **Modernizing Governance**

- Port Access Route Study
- Polar Code outreach
- Arctic Waterways Safety Committee

– **Broadening Partnerships**

- International Coordination (oil spills, search and rescue, fisheries)
- Tribal engagement
- Federal/State/local coordination
- Support to Arctic commissions, councils, etc.

\- ***Perform Coast Guard missions in the Arctic – SAR, environmental protection, aids to navigation, science support, marine safety***

Typical Arctic Shield Force Lay-Down

Cutter/Air Ops

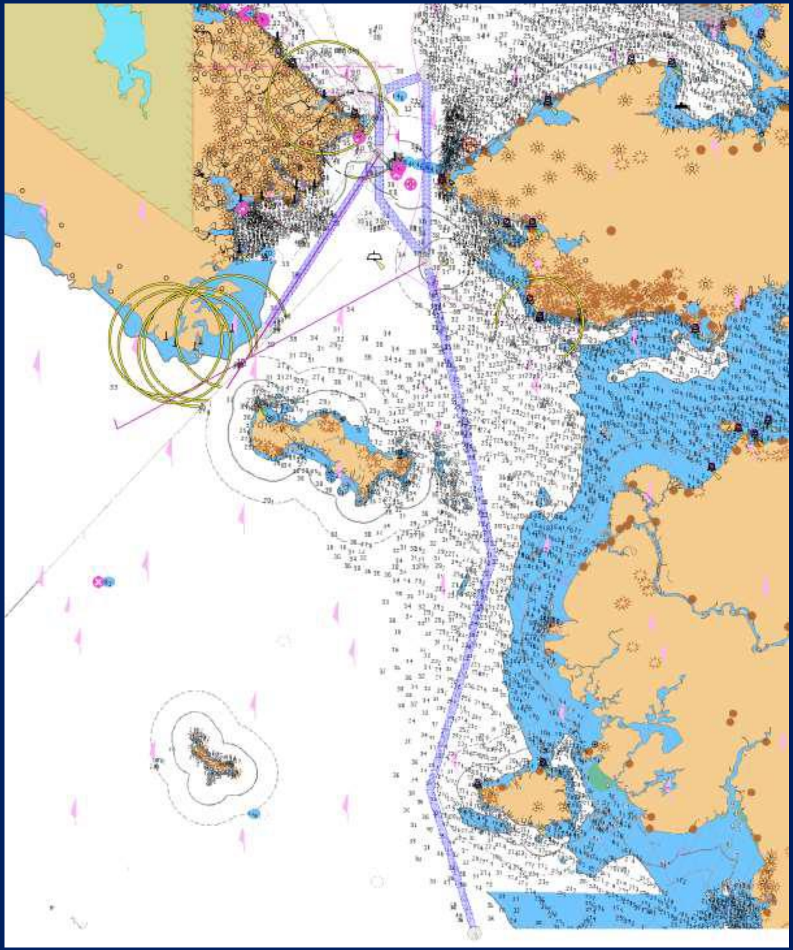
- High Endurance Cutter
- Medium Endurance Cutter
- Sea Going Buoy Tender
- Polar Ice breaker
- Rotary/Fixed Wing Aircraft

Multiple Missions

- Law Enforcement
- Response Operations
- Sovereignty Presence
- Command/Control
- Defense Support
- Community Relations
- Aids To Navigation
- Scientific Support

Port Access Route Studies

- Bering Strait PARS:
  - Four-mile-wide two-way route from Unimak Pass through Bering Strait.
  - “Areas to Be Avoided” established around areas of heightened environmental concern.
  - Russian Participation led to joint proposal to IMO for adoption.
  - Extensive assistance from NOAA OCS to survey proposed route.

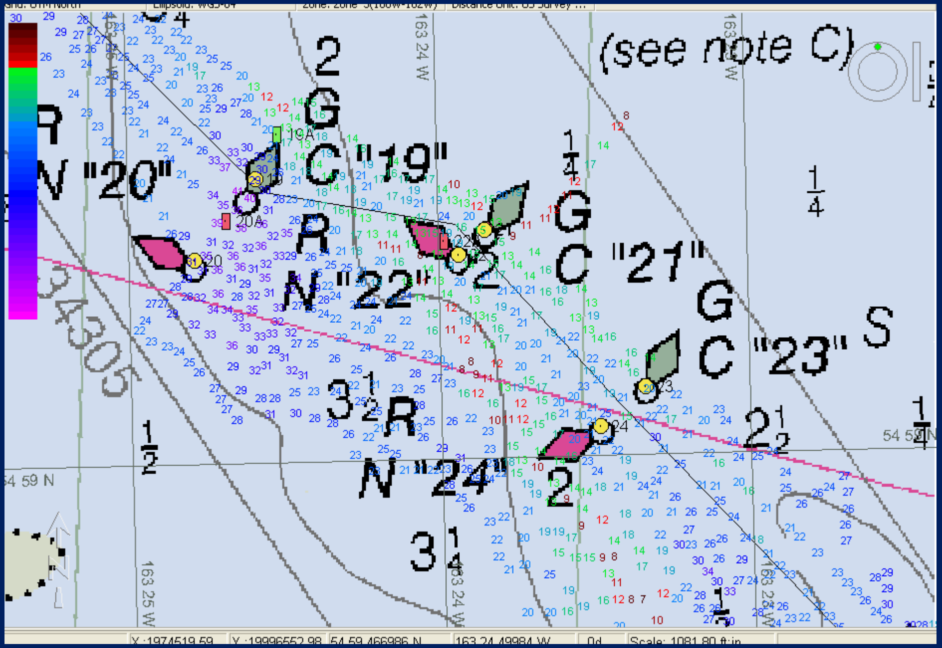


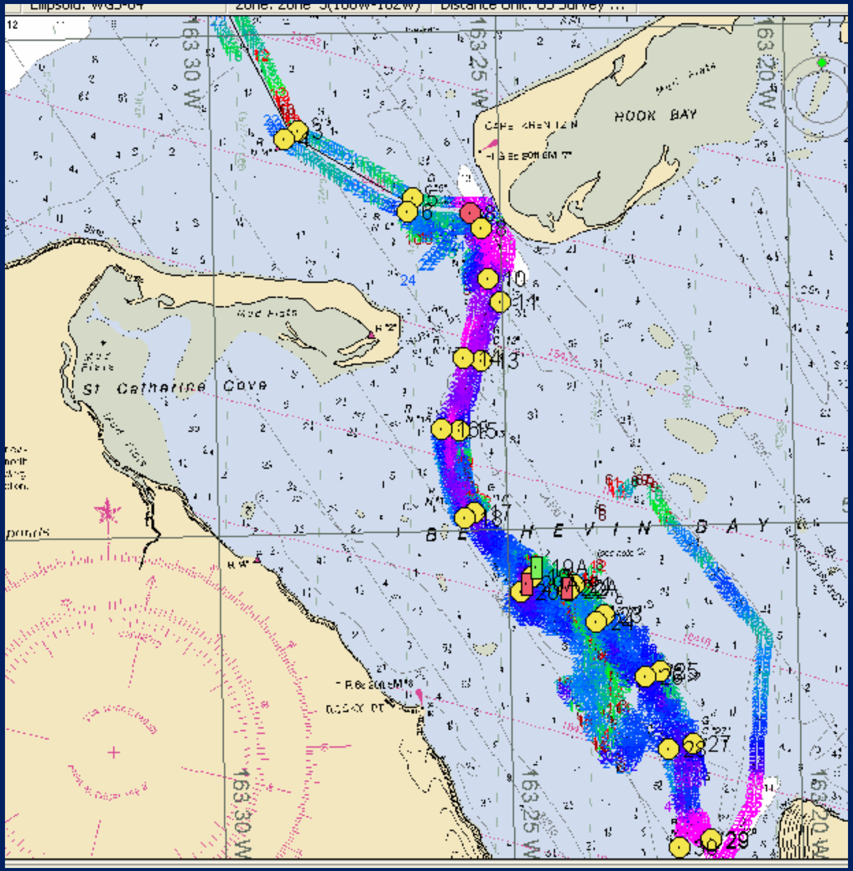
Shallow Water Aids to Navigation Ops

- •USCG Maintains seasonal buoys in shallow draft waterways:
  - •Local areas surveyed by boat using HYPAC.
  - • Data files exported to cutter navigation suite to prevent grounding.

Shallow Water Aids to Navigation Ops

- Example from False Pass & Bechevin Bay:
    - Composite representation from ~2 days of boat surveys.
    - Data is used to reposition buoys depending on shoaling.





- 3 buoys relocated to mark deepest water, about 165 yards wide.

Questions?

Seventeenth Coast Guard District

Standing the watch on the last frontier yesterday, today and tomorrow

COASTAL RESILIENCE AND ADAPTATION WORKSHOPS

Identified needs linked with mapping

Karen Murphy
Western Alaska LCC & USFWS

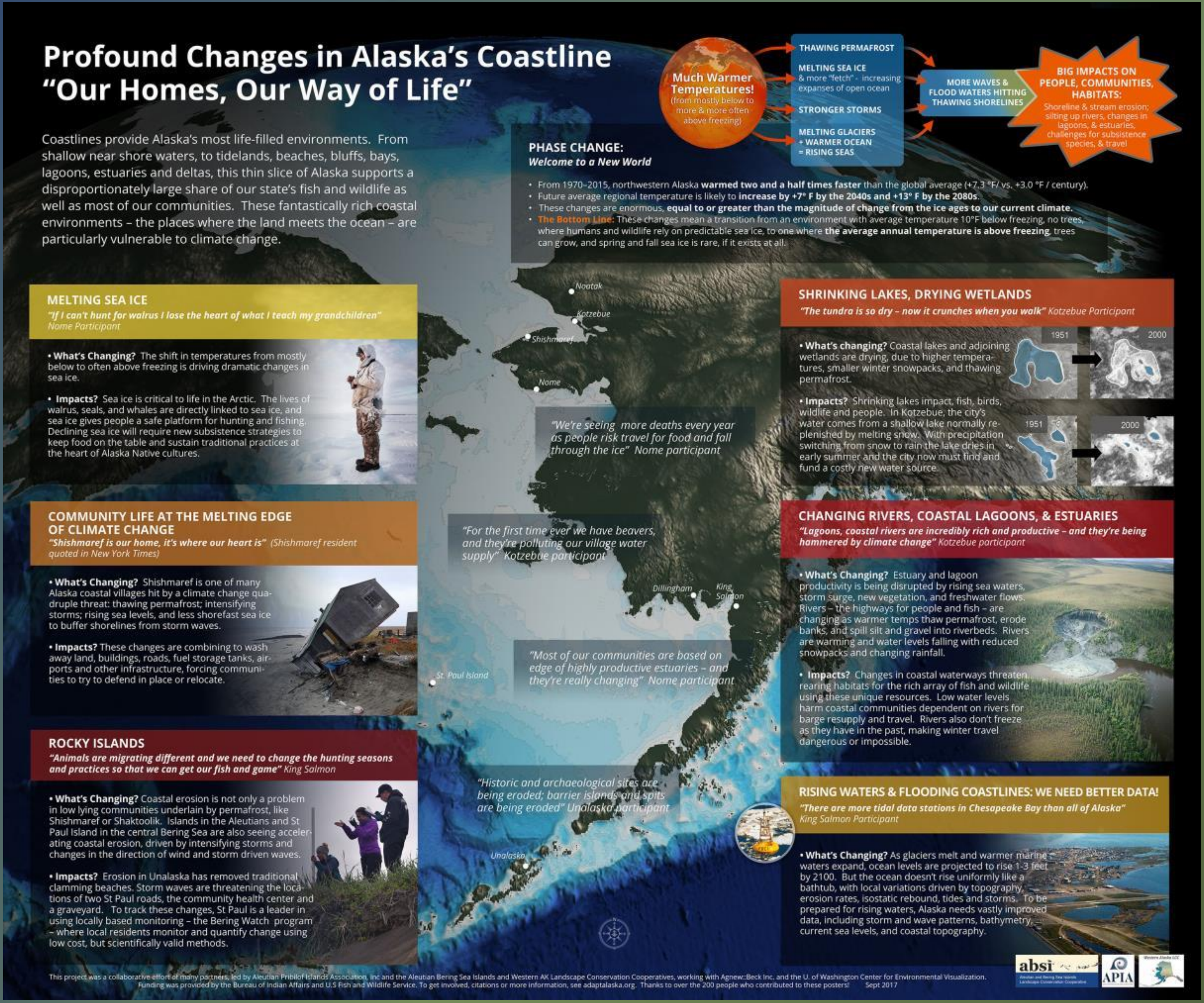
On behalf of the primary organizing and funding partners:

2016 Coastal Resilience & Adaptation Workshops

- Four western Alaska regions
  - Northwest Arctic
  - Bering Straits
  - Bristol Bay
  - Aleutians/lower AK Peninsula
- Southeast AK

- Over 300 participants
- Product highlights
  - Posters
  - Reference document of ‘tools’
  - Database of science, management and policy needs

Jointly assess relevant issues



Connections to ‘mapping’

- Ocean to Land Connections
  - Nearshore bathymetry, high resolution topography, tidal benchmarks/water levels
- Biological/ecological baseline information
- Projections of potential changes of distribution/abundance for species/ecological communities
- Ice (nearshore, thickness, patterns)
- ShoreZone
- Scalable and locally refined

"Land is not only part of our soul; it's what literally feeds us: berries, caribou, fish. We must maintain the environment so we have those things. Our goal is to still be here. We eat the berries, the caribou, the moose, the fish – being able to conserve those resources, maintain clean water for fish habitat – that's what we talk about is that we are still here. That's our goal."
(King Salmon workshop)

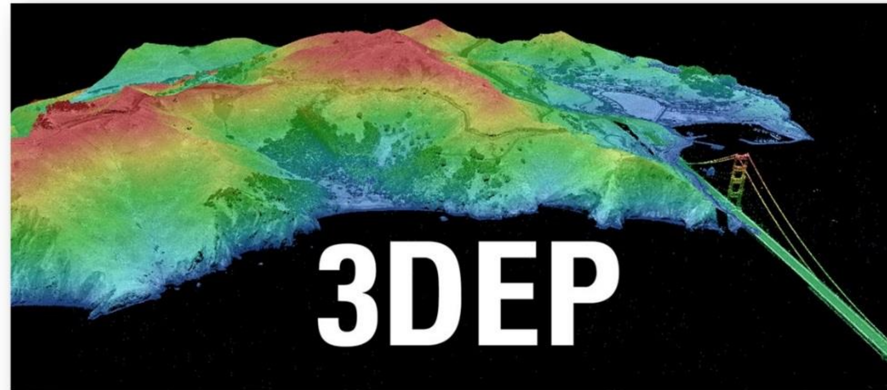
Questions?

Contact information:

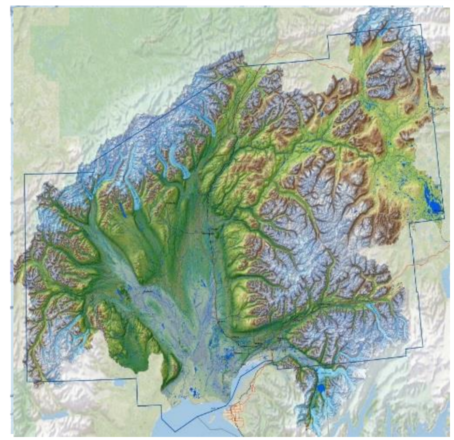
Karen Murphy
karen_a_murphy@fws.gov
907-786-3501

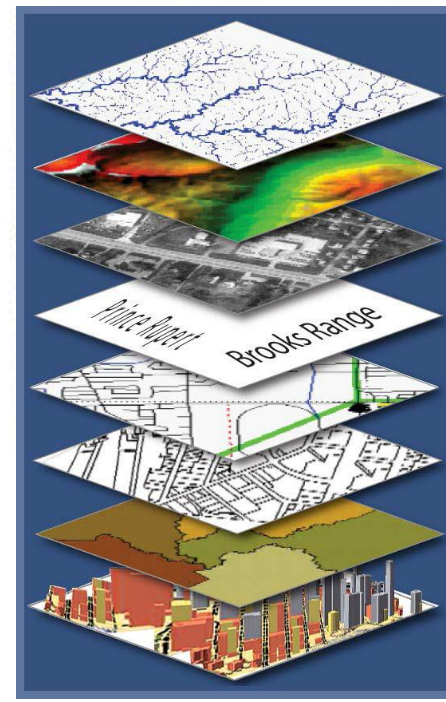
Information about Landscape Conservation Cooperatives in Alaska/NW Canada:
http://www.northernlatitudes.org/

Information from the workshops
http://adaptalaska.org/



US Geological Survey Partnerships for Elevation Data





National Geospatial Program

USGS
science for a changing world

The National Map
Your Source for Topographic Information

Brian Wright
National Map Liaison – Alaska
February 9, 2018

+ National Map Liaison Roles

- Engage partners to produce consistent and accurate data and services
- Network to create and maintain long-term partnerships
- Leverage funding across organizations cost savings and
- Reduce redundancy
- Assist with the availability of common base data to a broad range of users and applications
- Representation of Alaska Mapping needs via Alaska Mapping Executive Council (AMEC) and Alaska Geospatial Council (AGC)

Alaska Mapping Initiative - goal is to acquire and enhance foundational digital map layers such as elevation and hydrography used to produce new US Topo maps for Alaska.

+ 3D Elevation Program

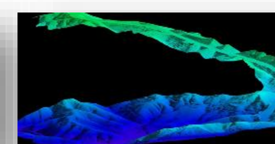
- Proceeds the National Elevation Dataset – NED
- Leverage collaboration among Federal, states, local, and tribal partners to systematically complete national 3D data coverage in 8 years
- Address the mission-critical requirements of 34 Federal agencies, 50 states, and a sampling of local governments, tribes, private and not-for profit organizations documented in the **National Enhanced Elevation Assessment (NEEA)**
- *Leverage the capability of private industry mapping firms and create jobs*
- Refresh national elevation data holdings with new lidar and IfSAR (Alaska) elevation data products and services **Alaska Mapping Initiative (AMI)**


Natural Resource Conservation


Infrastructure Management


Flood Risk Mitigation


Precision Farming


Land Navigation and Safety


Geologic Resources and Hazards Mitigation

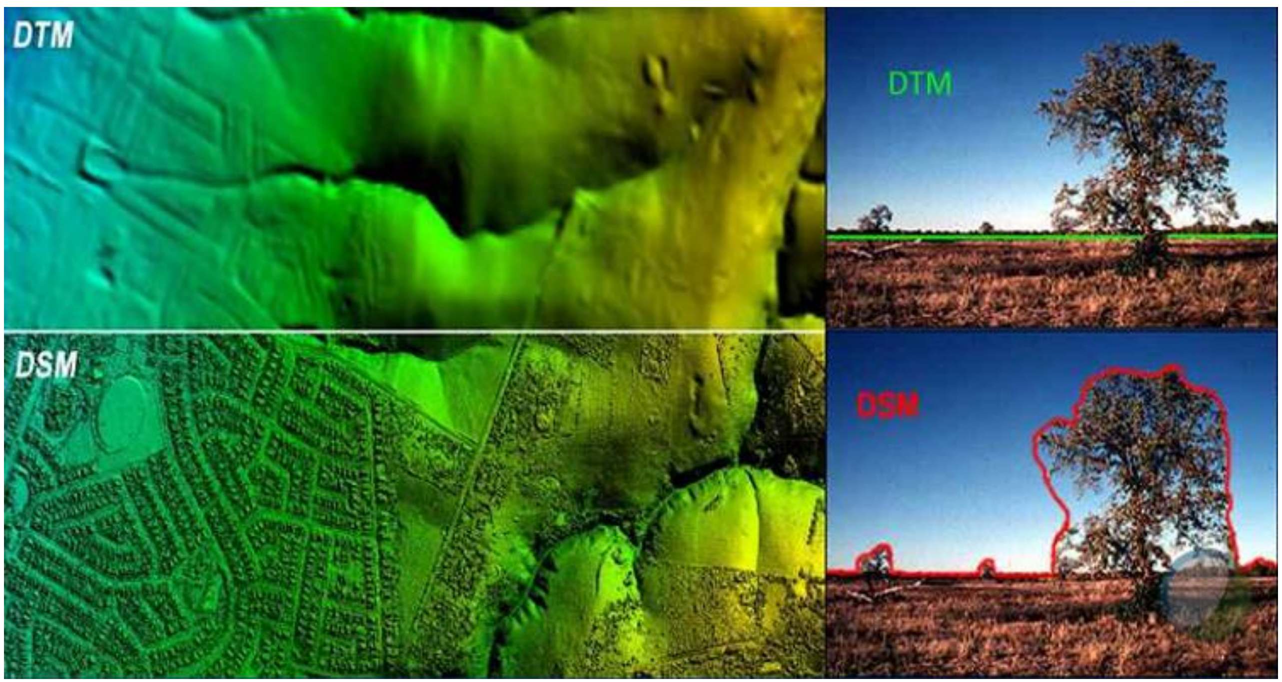
USGS science for a changing world

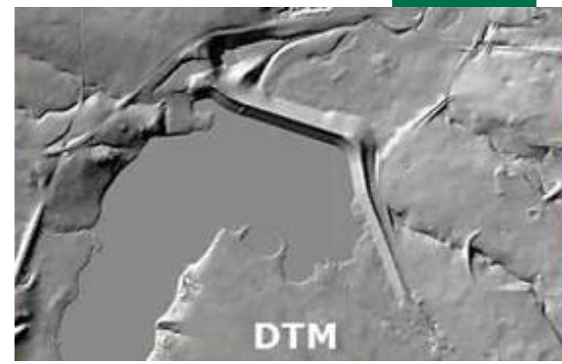
The National Map Your Source for Topographic Information

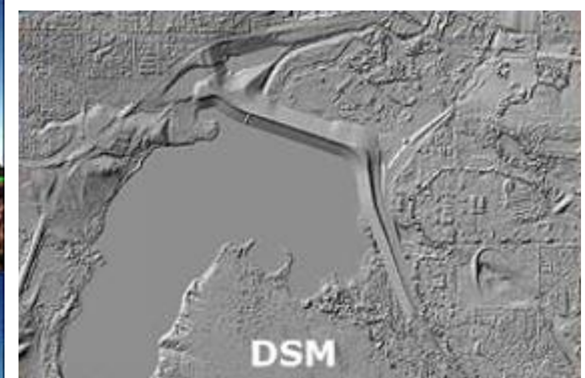
+ Interferometric Synthetic Aperture Radar

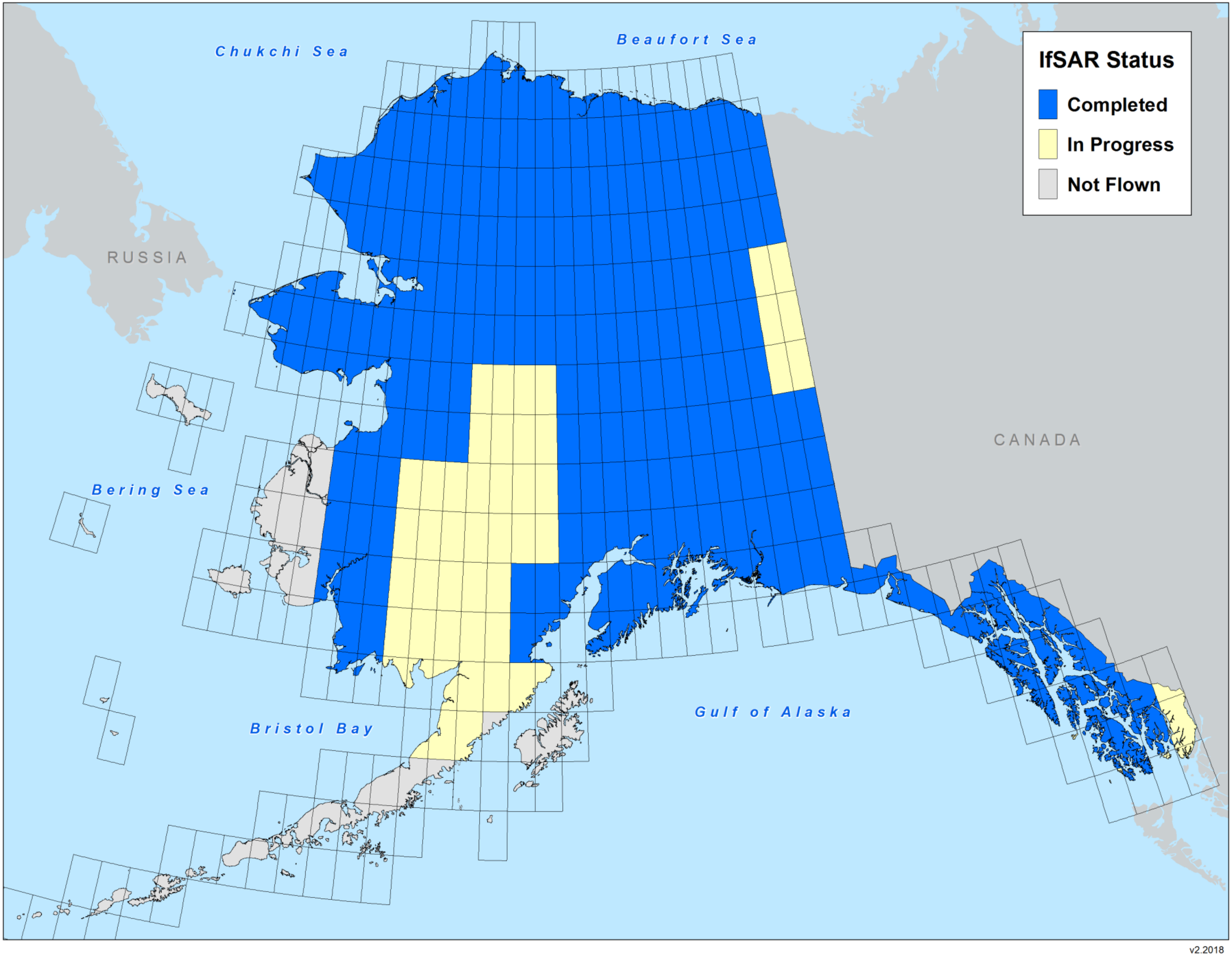
The 5-meter elevation data replaces decades old 60 meter elevation data.

IfSAR uses two radar images taken at the same time but from two different places in space.







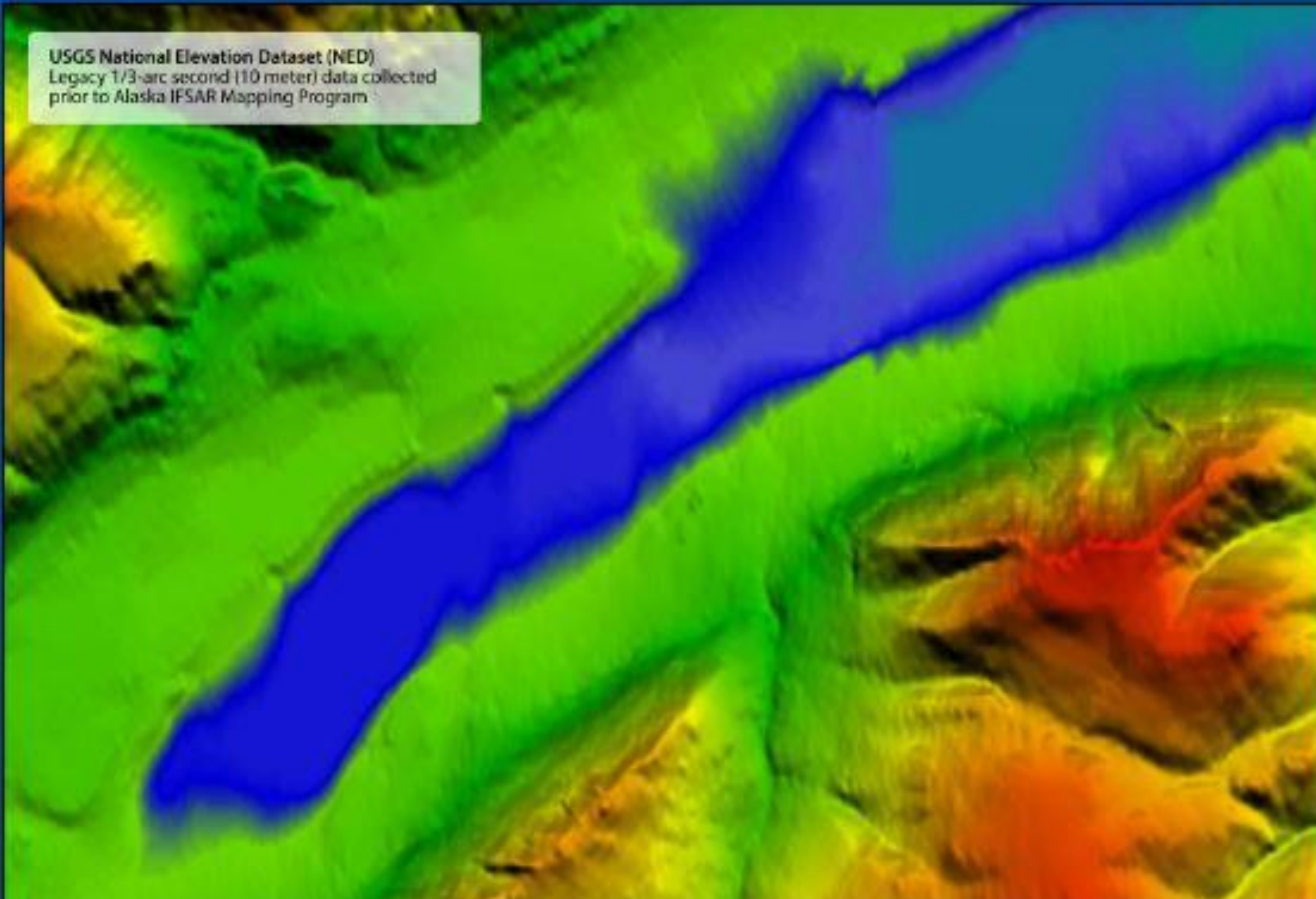

IfSAR Status
Completed
In Progress
Not Flown
Chukchi Sea
Beaufort Sea
RUSSIA
CANADA
Bering Sea
Bristol Bay
Gulf of Alaska
v2.2018

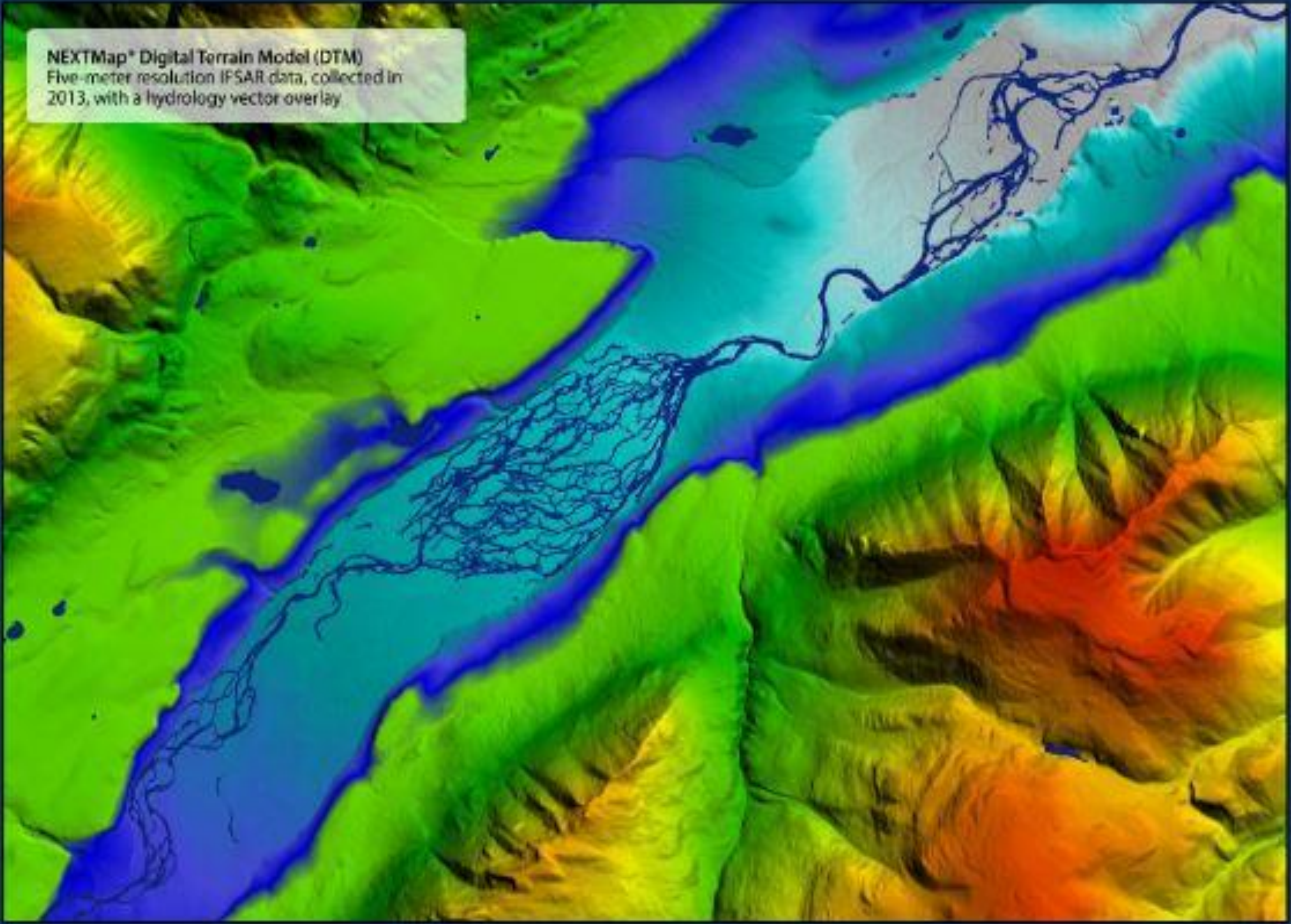
+ Partner Contribution Summary

Partner	2017 Contribution	2010-2017 Contributions
BLM	$50,000	$3,267,355
USFWS	$0	$950,000
NGA	$0	$2,399,895
NPS	$975,000	$3,050,348
NRCS	$700,000	$3,703,472
USFS	$150,000	$1,786,842
USGS	$7,212,088	$27,074,156
Alaska	$0	$13,340,591
Total	$9,087,088	$55,572,659

USGS science for a changing world
The National Map Your Source for Topographic Information

Killick River, Gates of the Arctic National Park and Preserve, North Slope Borough




NEXTMap® Digital Terrain Model (DTM)
Five-meter resolution IFSAR data, collected in 2013, with a hydrology vector overlay

+ BAA in Nutshell

- Think lidar
- Competitive process
- Federal funding to acquire lidar at QL2 level – minimum
- Proposal covers cost for above base deliverables and QL1
- Need to identify why IfSAR does not meet your needs
- Have matching funding
- Begin planning process one-year in advance to identify partnerships
- Contractors can work with partners to develop projects
- Geiger Mode and Single Photon lidar

2015 - Anchorage Municipality	765 sq/mi	QL2
2016 - Yukon and Kuskokwim Delta	1700 sq/mi	QL2
2017 - Prince of Wales Island	1600 sq/mi	QL1
2017 - Fairbanks North Star Borough	2500 sq/mi	QL/QL2

+ # BAA Eligible Applicants

Individuals

Small businesses

For profit organizations other than small businesses

Nonprofits having a 501(c) (3) status with the IRS, other than institutions of higher education

City or township governments

Special district governments

County governments - Boroughs (Anchorage and Fairbanks)

State governments (AK DNR, Division of Geological and Geophysical Surveys)

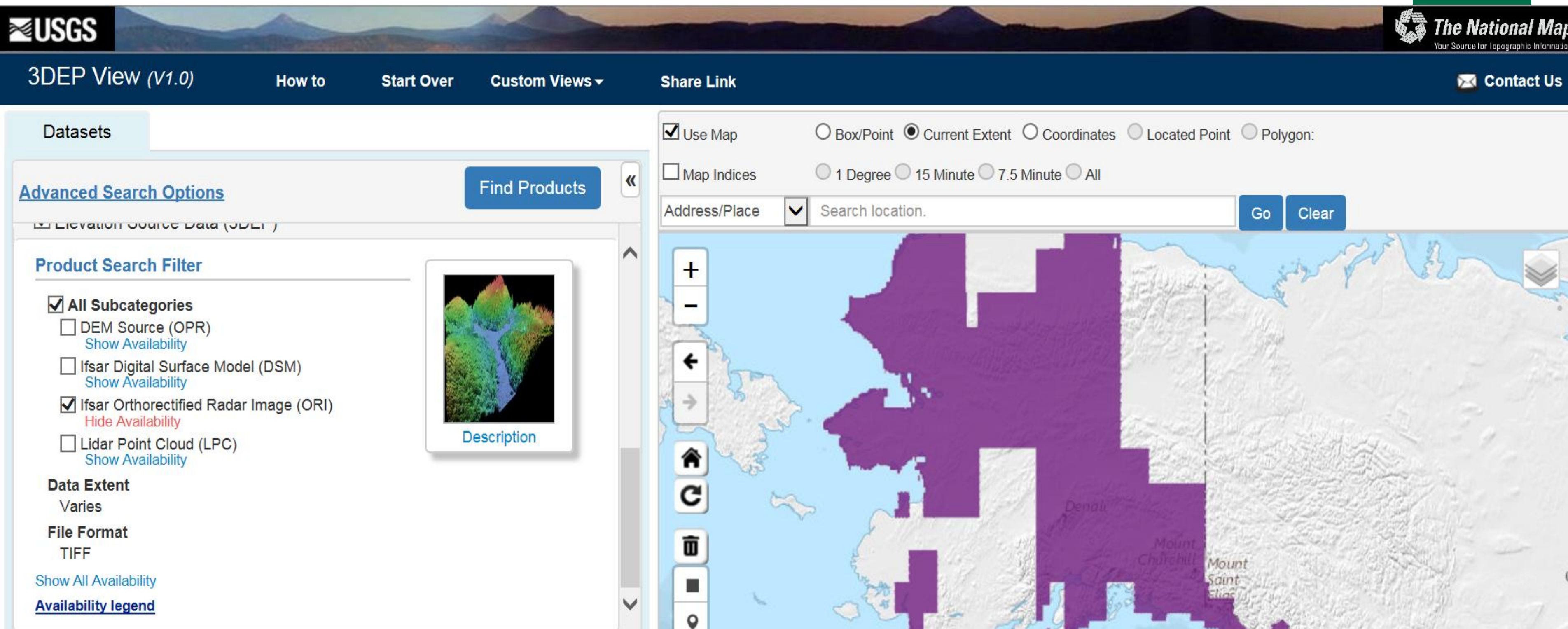
Native American tribal governments (Federally recognized)

Native American tribal organizations (other than federally recognized tribal governments)

Federal agencies

The Nature Conservancy, Anchorage Municipality, Fairbanks North Star Borough, Sealaska, NRCS, US Forest Service, Golden Valley Electric Association, NOAA, Alaska Department of Natural Resources.

+ # The National Map



How to Find and Download Products

Users can find products in the following steps. (Tutorial Videos)

A. Find Products

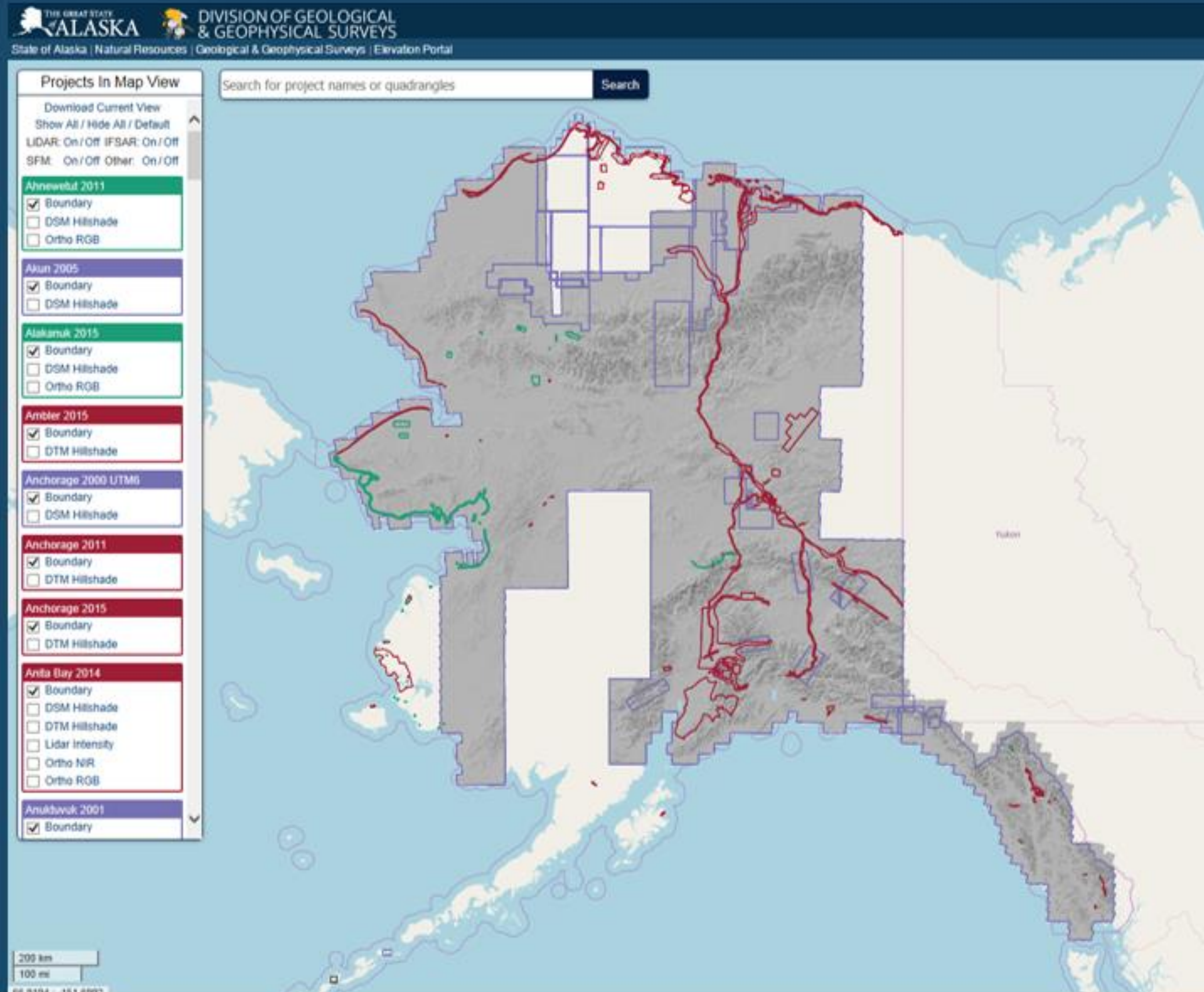
B. Review Products

C. Use Cart (Optional)

USGS science for a changing world The National Map Your Source for Topographic Information

Alaska Elevation Distribution & Archive

- 371# IfSAR, lidar, and SfM data products available.
- Covering a total of 540,137 square miles.
- All available for download via an easy to use map interface.



Map interface:
http://elevation.alaska.gov

For more information:
Ken Woods
907-388-0999
ken.woods@alaska.gov

REST endpoint for hillshade service used in application:
http://elevation.alaska.gov/arcgis/rest/services/apps/elevation_app_prod/MapServ

+ Geospatial Products and Services Contract

- Architecture and Engineering (A&E) Indefinite Delivery/Indefinite Quantity (IDIQ) Contract
- $750 Million delegated procurement authority for 5 years
- Perform professional mapping services
- Over 18 years old – on version 3
- Competitive qualification based selection (QBS) process for contractors
- Remote sensing and GIS services impervious surface mapping
- Elevation Lidar acquisition and processing; topographic and bathymetric
    - Charge a 5% assessment rate
        - Used to cover staff time to manage contracts and projects

+ GPSC Project Types

- Remote sensing and GIS services
  - Impervious surface mapping
- Elevation
  - Lidar acquisition and processing
    - Topographic and bathymetric
  - IfSAR
- Hyperspectral imagery acquisition
- Orthoimagery acquisition and processing
- Alaska Example: AK DOT UAV Proof of Concept
  - Looking at Airport Obstruction Survey for 1-2 rural artic airstrips/airports

What is GPSC?

- 10 contracts
  - Each has a base year plus four option years
  - Valid from 2016 – 2022, if all option years are executed

Large Business Firms

- Dewberry
- Fugro Earthdata
- Merrick-Surdex JV
- Quantum Spatial
- Sanborn
- Woolpert

Small Business Firms

- Aerial Services
- Atlantic
- Digital Aerial Solutions
- Precision Aerial Reconnaissance

Subcontractors in AK

- JOA Surveys
- Kodiak Mapping
- e-Terra
- And others….

+ Resources

3D Elevation Program (3DEP) FY17/18Broad Agency Announcement (BAA) Information Sharing Site https://cms.geoplatform.gov/elevation/3DEP

FY18 BAA Reference Materials Page
http://nationalmap.gov/3DEP/BAAReferenceMaterials.html

NOAA sponsored Seasketch site: U.S. Federal Mapping Coordination, *A Demonstration Site for Federal Mapping Data Acquisition*

http://fedmap.seasketch.org

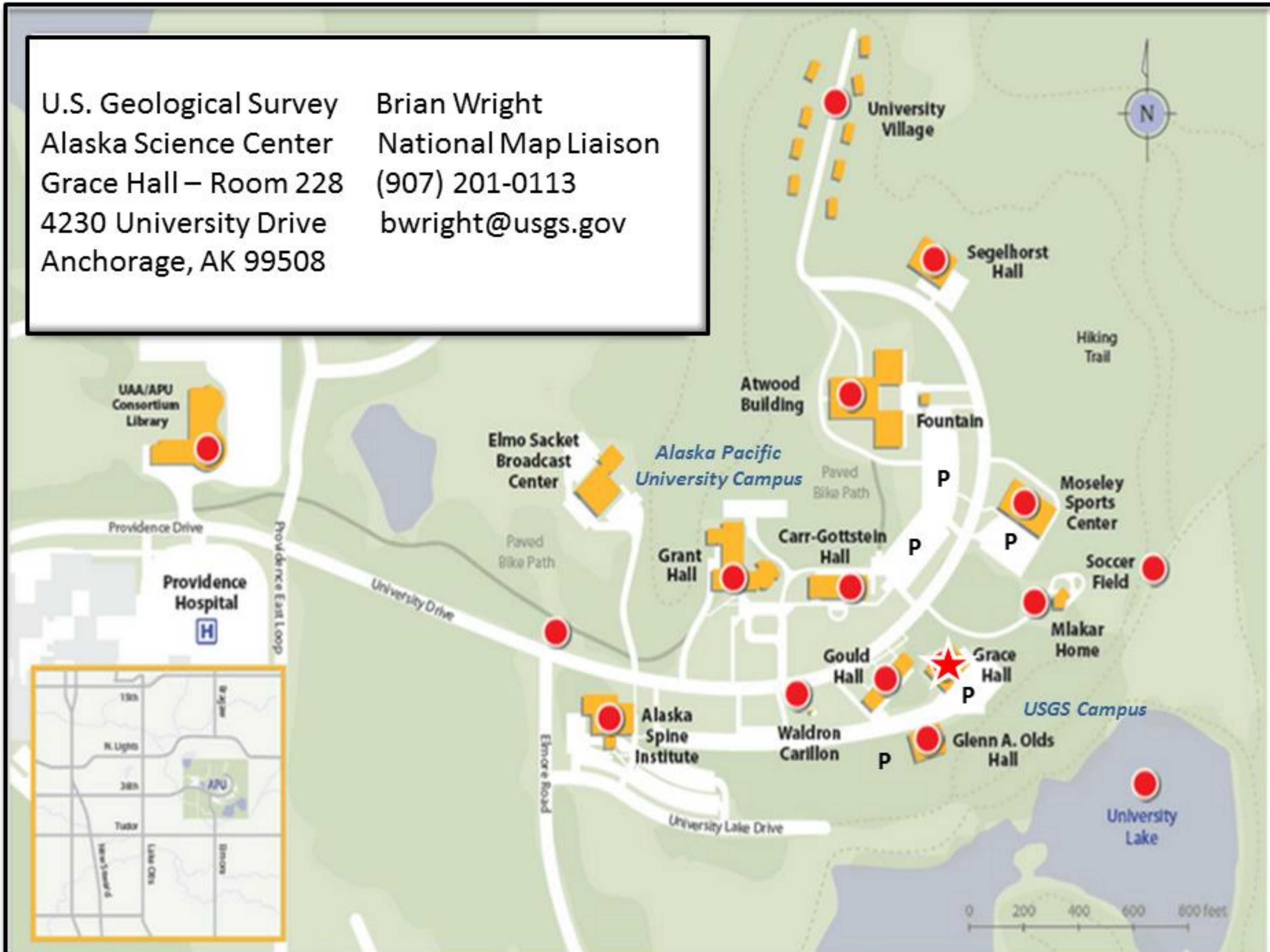
The 3D Elevation Program Initiative – A call for Action
http://pubs.usgs.gov/circ/1399/

USGS NGP Lidar Base Specification V1.2
http://pubs.usgs.gov/tm/11b4/pdf/tm11-B4.pdf

Where can you find me?

U.S. Geological Survey
Alaska Science Center
Grace Hall – Room 228
4230 University Drive
Anchorage, AK 99508

Brian Wright
National Map Liaison
(907) 201-0113
bwright@usgs.gov



Coastal Geospatial Services Contract

Alaska Coastal Mapping Summit

February 9th, 2018

Dave Stein

Geographer, Contracting Officer's Representative

Coastal Geospatial Services Contract III

- Brooks Act, Architecture and Engineering, Federal Acquisition Regulation Part 36 – Indefinite Delivery, Indefinite Quantity
- As of August 2016, five prime contractors (Dewberry, Fugro, Quantum Spatial, Tetra Tech, and Woolpert) with more than 75 subcontractors
- Awarded August 2016, ends August 2021
- $49 million ceiling (shared among the primes)
- Contract III follows successful implementation of two previous Coastal Geospatial Services Contract Awards: 2006 to 2011 and 2011 to 2016

History

Contract I
2006 - 2011

Contract II
2011 - 2016

Contract III
2016 - 2021

Task Orders: 128
Total Dollars: $23M
Contractors:
- Dewberry
- Fugro
- Photo Science
- Sanborn

Task Orders: 156
Total Dollars: $47M
Contractors:
- Dewberry
- Fugro
- Photo Science
- Woolpert

Task Orders: 20
Total Dollars: ~$3M
Contractors:
- Dewberry
- Fugro
- Photo Science
- Tetra Tech
- Woolpert

Contract Services

- **Data Acquisition:** Collection of Lidar, imagery, and bathymetry using a variety of platforms and sensors.
- **GIS Services:** Spatial data development, data management, application development, cartographic product development, and GIS consultation in support of coastal management applications.
- **Thematic Mapping:** Using source data to delineate and derive data products. Creating thematic classes for land cover, environmental sensitivity, benthic habitat, and hazards vulnerability mapping.

Contract Services

- **Quality Assurance and Quality Control:** Third-party review of data deliverables.
- **Technical Support:** Could include scanning of historical imagery, curriculum development, website development, expert consultation, white paper development, and specialized software development

coast.noaa.gov/idiq/geospatial.html

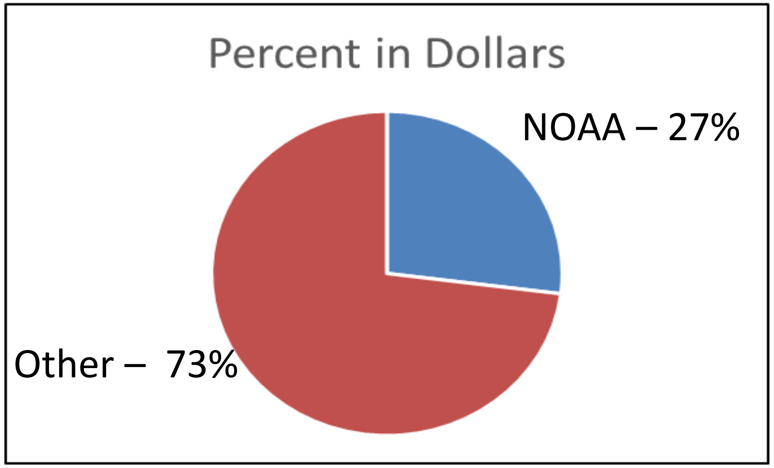
Active Partnerships

Federal:

- Bureau of Ocean Energy Management
- Environmental Protection Agency
- Housing and Urban Development
- National Park Service
- National Oceanic and Atmospheric Administration
- United States Geological Survey

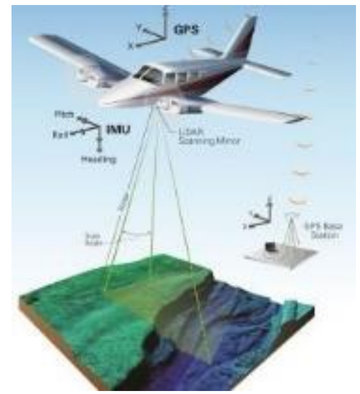
States: California, Connecticut, Georgia, Massachusetts, and New York

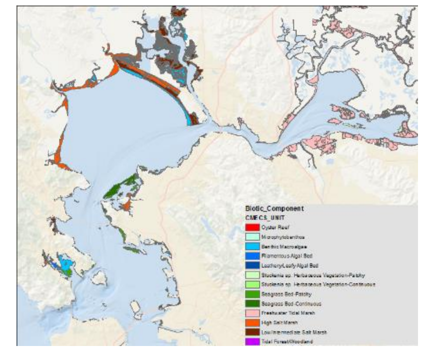
Others: Multiple Georgia counties and regional commissions, County of Hawaii

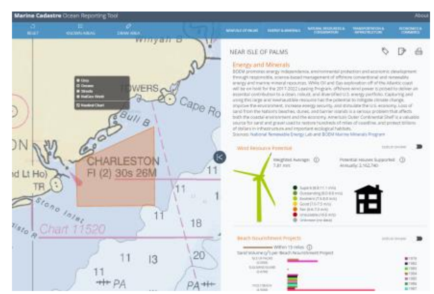


Project Examples FY17-18

- Coastal Imagery – GA Coastal Resources Commission
- Imagery for Seagrass Mapping – State of New York
- Imagery for Seagrass Mapping – State of Massachusetts
- Wild rice Mapping in Lake Superior using Hyperspectral Imagery – EPA/NOAA
- Lidar for Big Island, Hawaii – USGS/NOAA
- Lidar for GA Watersheds – GA DNR
- Benthic Habitat Mapping Lake Michigan – NOAA/EPA/NPS
- Marine Minerals GIS – BOEM
- AIS – Vessel Traffic – BOEM/NOAA/USCG
- Data Development to support Ocean Reporting for Aquaculture - NOAA/BOEM







How Can You Use the Coastal Geospatial Services Contract?

- Meet the requirements
  - Coastal
  - Address a Coastal management issue
  - Available capacity
- Enter into Memorandum of Understanding

Memorandum Process

Phase I – Establish (Two to Three Months)

** All financial transactions outside of NOAA require a Memorandum of Understanding

- Requesting agency contacts our office to start the process
- OCM sends a template
- Requesting agency fills in MOU template and returns
- Department of Commerce attorneys review, approve, and clear
- Requesting agency approves and signs
- If there's funding involved, an invoice is sent to requesting agency by NOAA Finance
- Upon receipt of funds, contracting can begin!

Contract Benefits

1. Competition is already done
2. Streamlined process
3. Access to industry leaders with proven capabilities
4. Contract management provided at small percentage of total cost (2%)
5. NOAA Office for Coastal Management technical expertise provided at no cost

Questions?

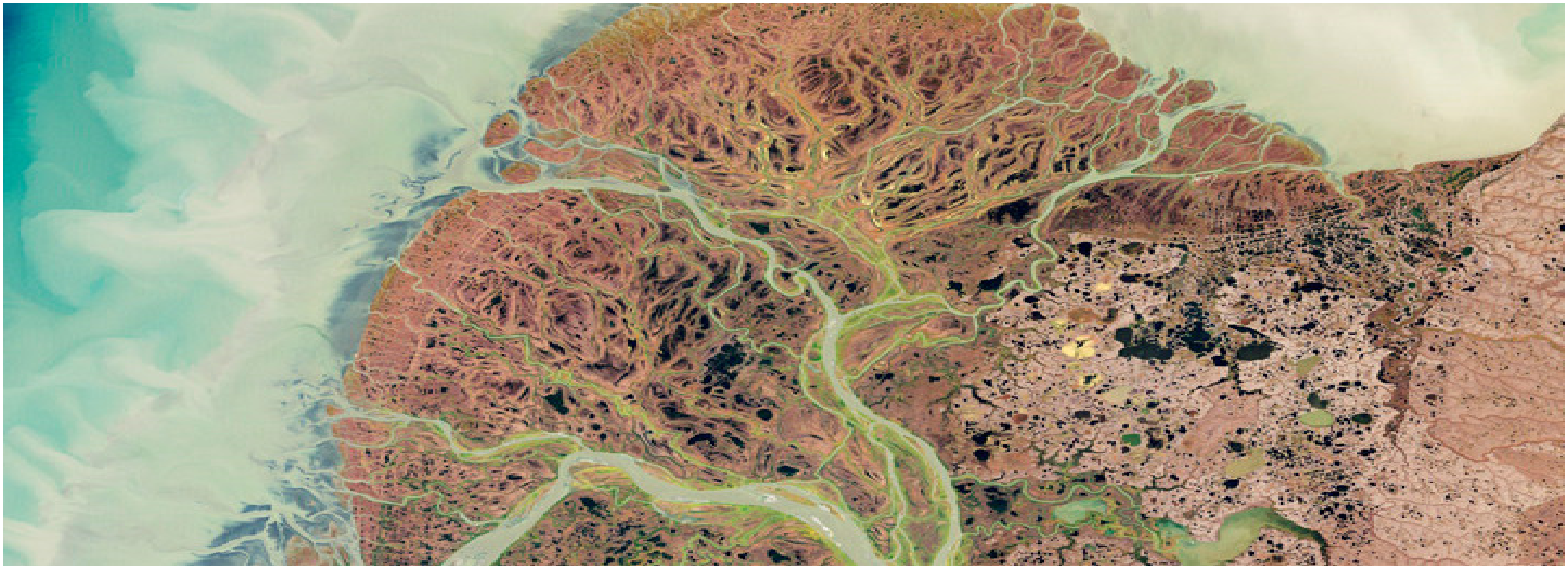
Dave.Stein@noaa.gov

(843) 740-1310

coast.noaa.gov/idiq/geospatial.html

Credit: Mark Sullivan, NOAA

Lidar Data Collection in the Yukon-Kuskokwim Delta, Alaska



WOOLPERT

ARCHITECTURE | ENGINEERING | GEOSPATIAL

John Gerhard, CP

Vice President

Program Director

Woolpert

Yukon-Kuskokwim Delta Lidar

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

FEDERAL EMERGENCY MANAGEMENT AGENCY
PACE AC BELLO MERITA

Western Alaska LCC

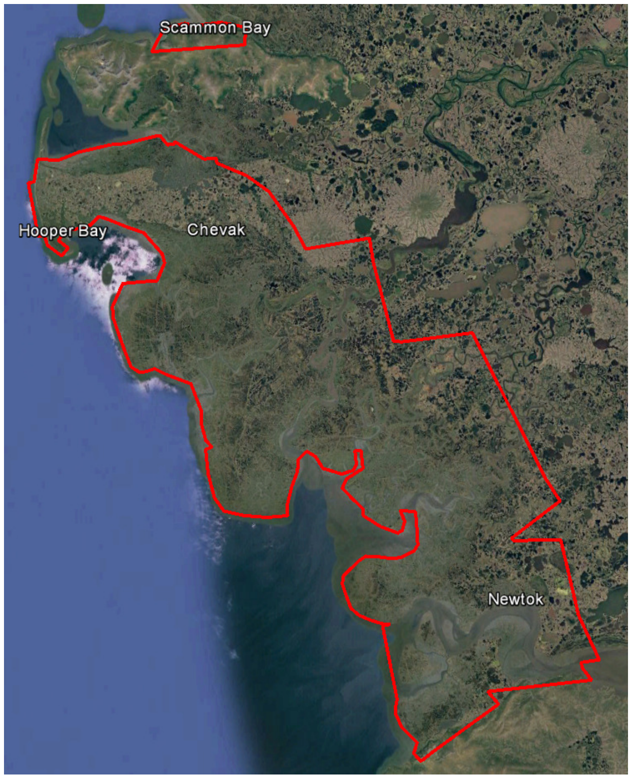
ALASKA DEPARTMENT OF NATURAL RESOURCES

NRCS
Natural Resources Conservation Service

AOOS
Alaska Ocean Observing System

USGS

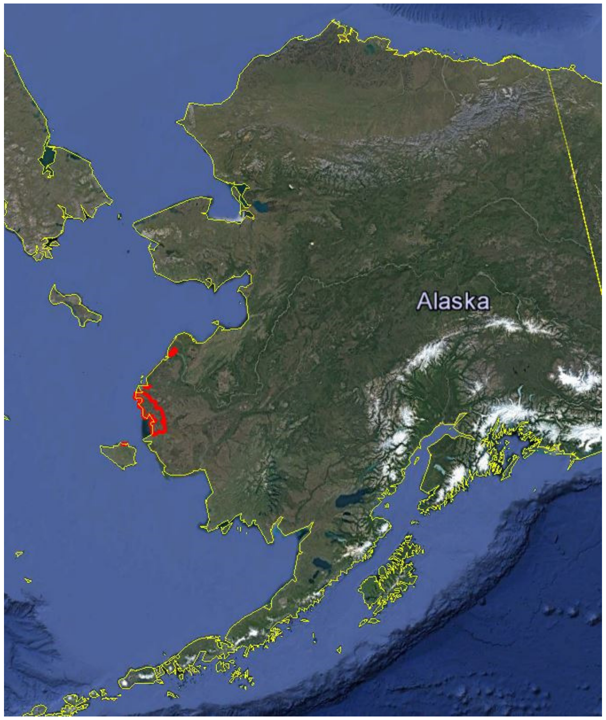
Yukon-Kuskokwim Delta Lidar



Yukon-Kuskokwim Delta Lidar

Data Collection by Kodiak Mapping

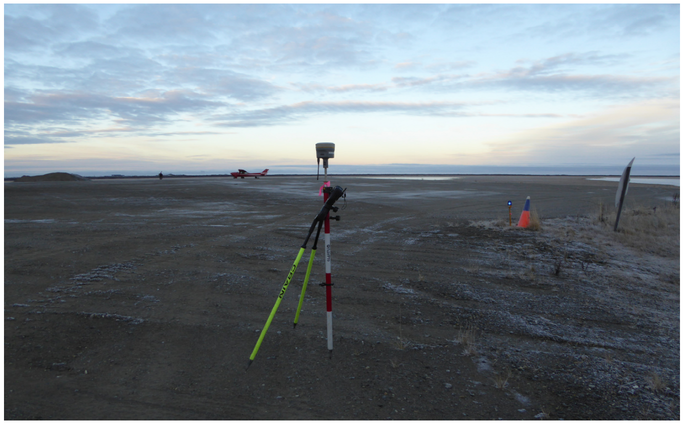
- August 30, 2016 – October 16, 2016
- C-182 Katmai Aircraft
- Riegl LMS-Q780
- RCD30 Digital Camera



Yukon-Kuskokwim Delta Lidar

Survey Effort

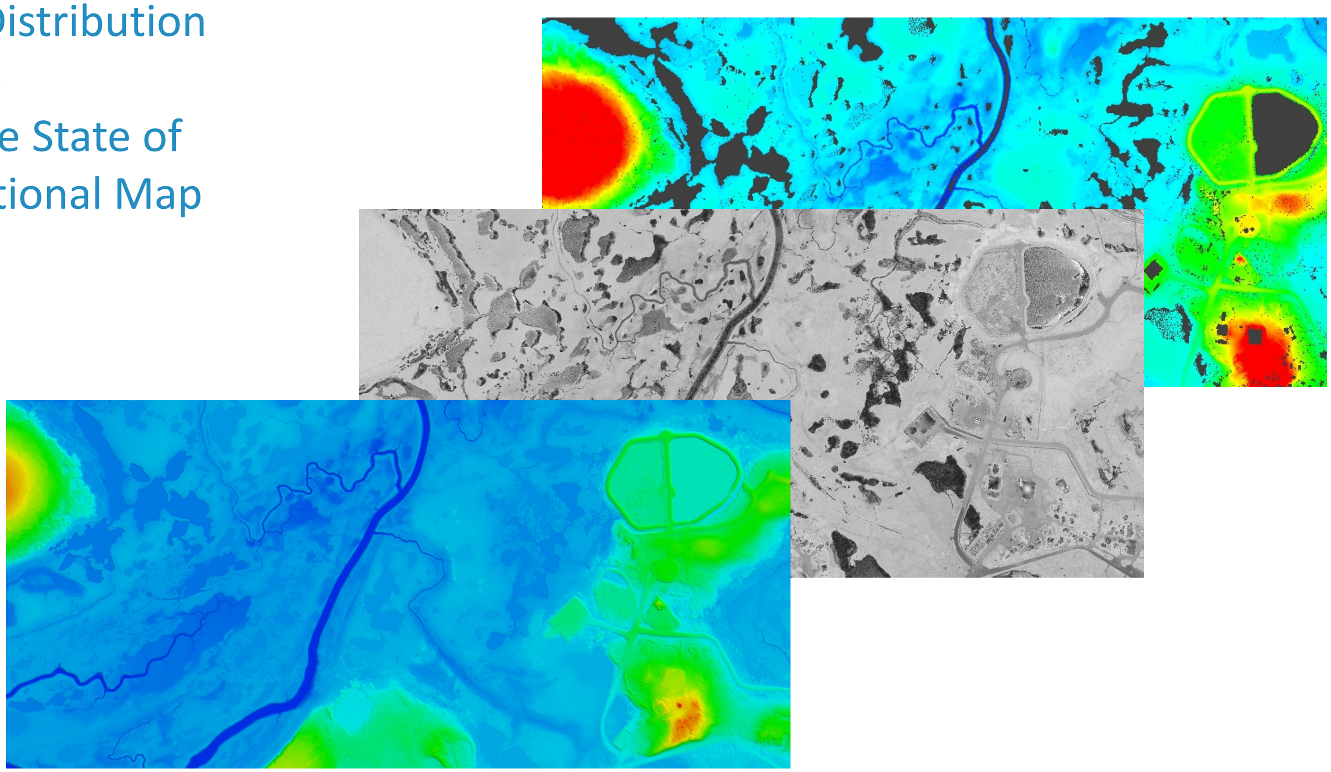
- November 2, 2016 – November 6, 2016
- Kodiak Mapping
- Control and checkpoints
- Accessibility difficulties
- Community outreach



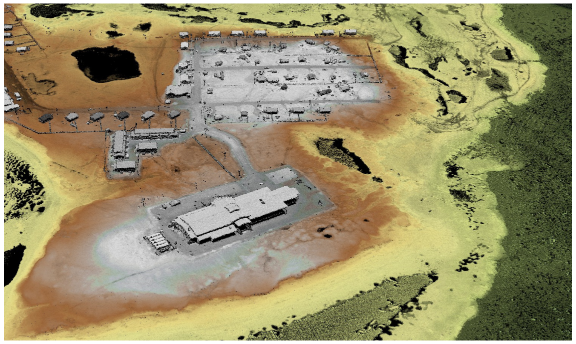
Yukon-Kuskokwim Delta Lidar

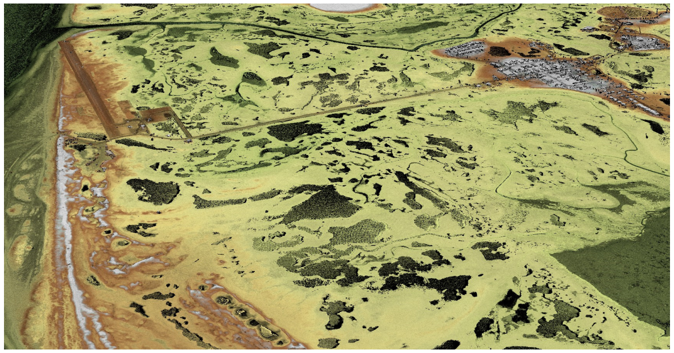
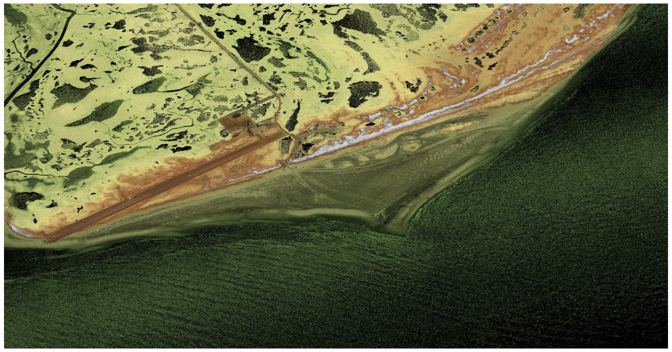
Data Deliverables and Distribution

- USGS 3DEP Products
- Available through the State of Alaska and USGS National Map Viewer



Yukon-Kuskokwim Delta Lidar

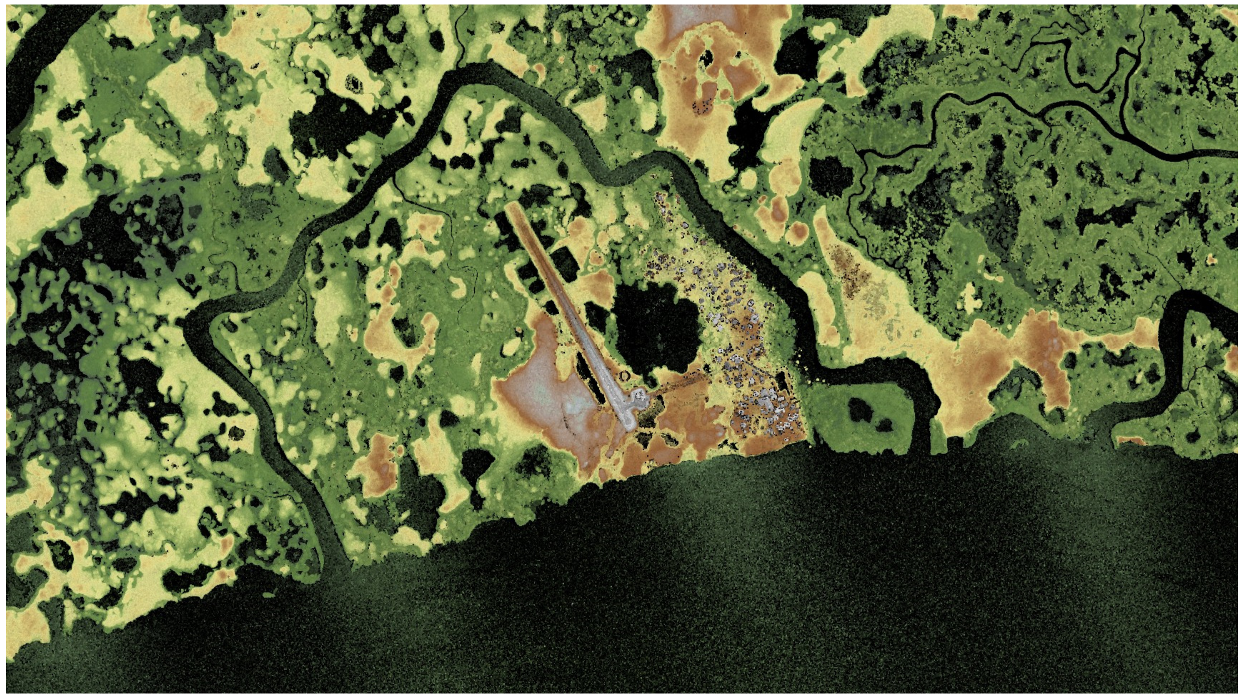



Hooper Bay, AK

Yukon-Kuskokwim Delta Lidar

2007

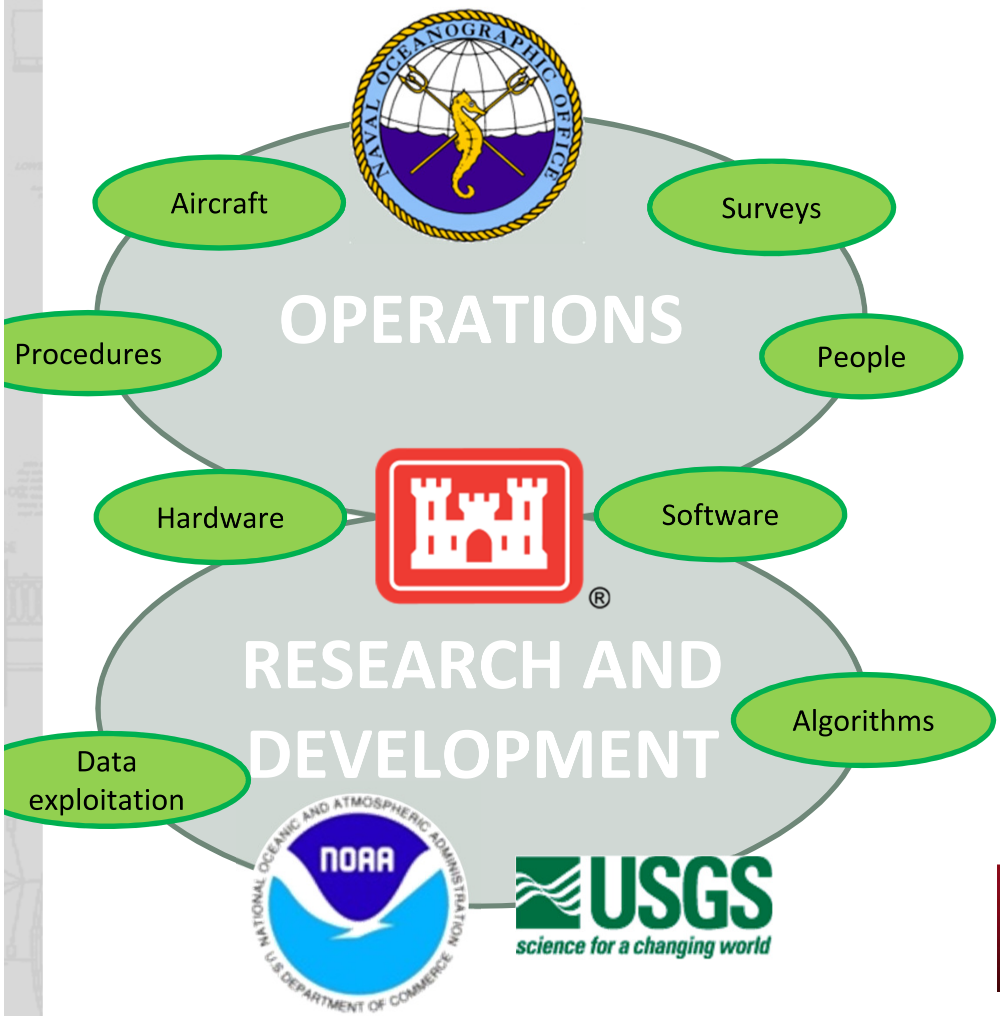


2016

Yukon-Kuskokwim Delta Lidar

- Storm surge and inundation research
- Emergency response planning
- Wildlife conservation
- Community planning
- Relocation planning
- Source of improved elevation data

JOINT AIRBORNE LIDAR BATHYMETRY TECHNICAL CENTER OF EXPERTISE



@Stennis International Airport
Kiln, MS

WOOLPERT
DESIGN | GEOSPATIAL | INFRASTRUCTURE

OPTIMAL GEO

TELEDYNE OPTECH
Everywhereyoulook

itres

UNIVERSITY of NEW HAMPSHIRE

GEOMATICS DATA SOLUTIONS

CBI

Kenn Borek Air Ltd.
Anytime, Anywhere ... Worldwide

Virginia Tech

UNIVERSITY OF NOTRE DAME

TEXAS A&M UNIVERSITY

WMR
Woolpert | Magnolia River Joint Venture

Bowhead

ONR
Office of Naval Research

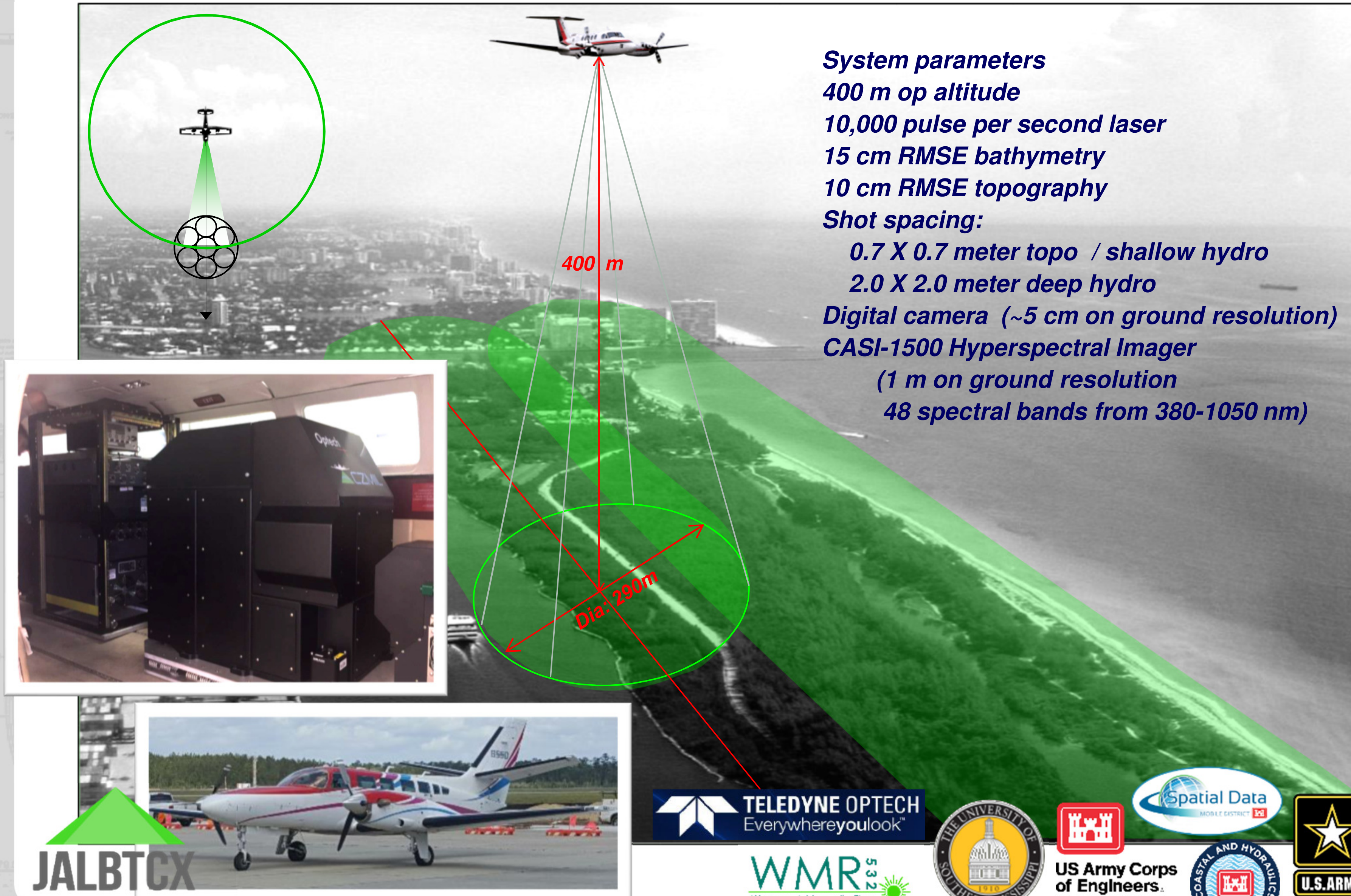
US Army Corps of Engineers

Spatial Data

U.S.ARMY

JALBTCX

CZMIL Coastal Zone Mapping and Imaging Lidar



System parameters
400 m op altitude
10,000 pulse per second laser
15 cm RMSE bathymetry
10 cm RMSE topography
Shot spacing:
- ***0.7 X 0.7 meter topo / shallow hydro***
- ***2.0 X 2.0 meter deep hydro***

Digital camera (~5 cm on ground resolution)
CASI-1500 Hyperspectral Imager
(1 m on ground resolution
48 spectral bands from 380-1050 nm)

JALBTCX

TELEDYNE OPTECH Everywhereyoulook™

WMR 532 Woolpert | Magnolia River Joint Venture

The University of Southern Mississippi 1910

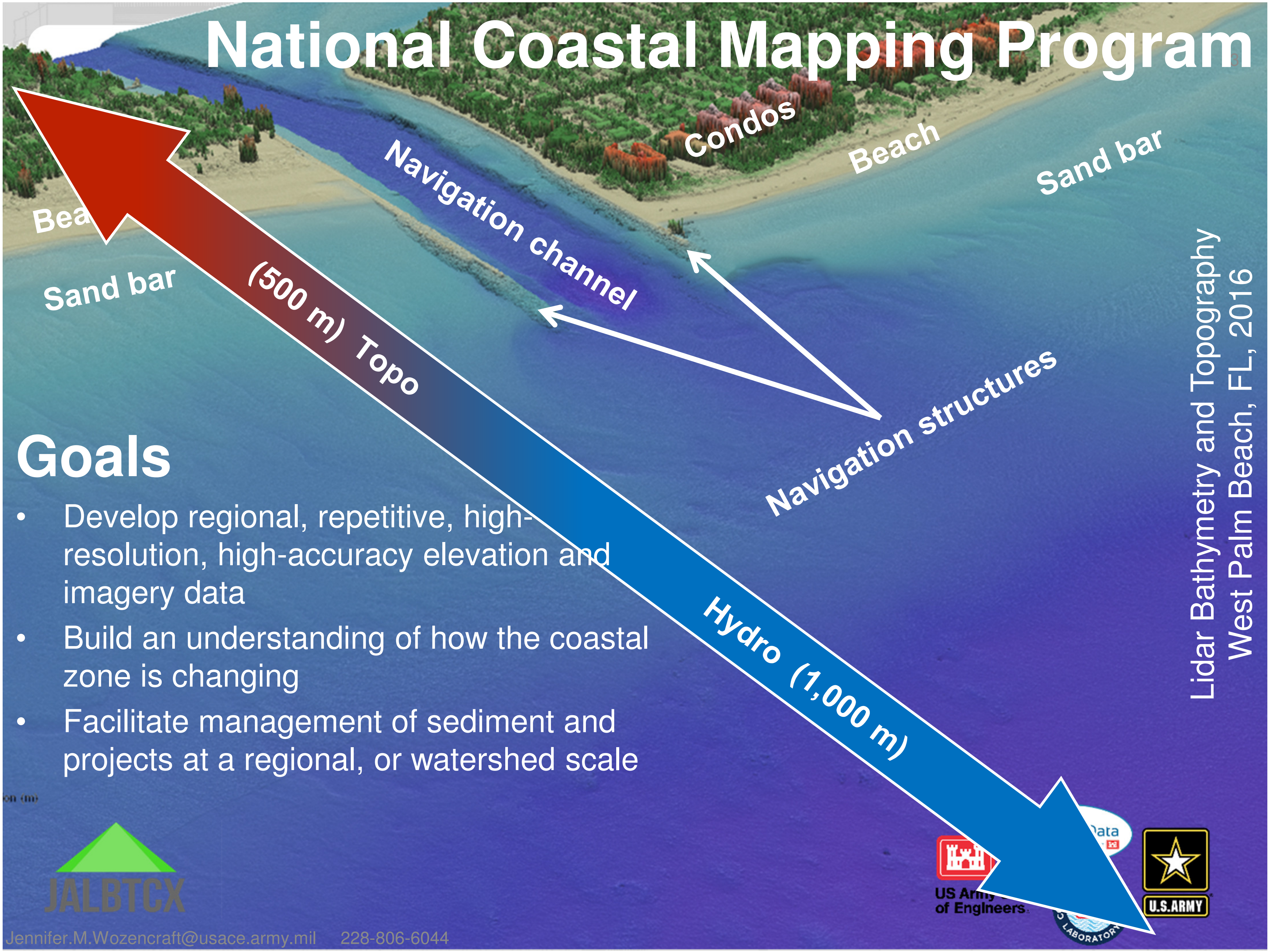
US Army Corps of Engineers

Spatial Data

Coastal and Hydraulics Laboratory

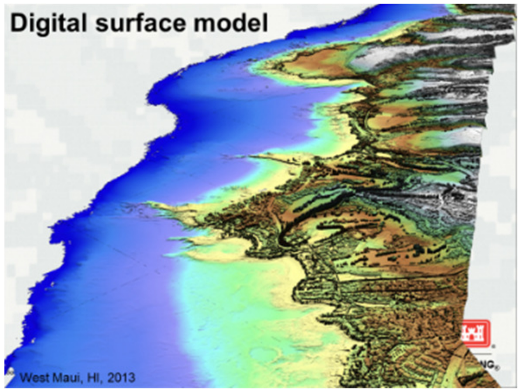
U.S. ARMY

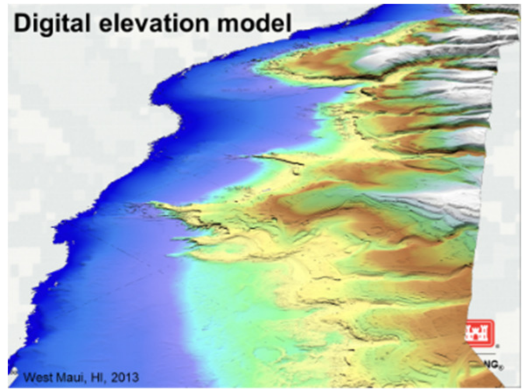
Jennifer.M.Wozencraft@usace.army.mil 228-806-6044


National Coastal Mapping Program
Bea
Sand bar
Navigation channel
Condos
Beach
Sand bar
(500 m) Topo
Navigation structures
Hydro (1,000 m)
Lidar Bathymetry and Topography
West Palm Beach, FL, 2016
Goals
• Develop regional, repetitive, high-resolution, high-accuracy elevation and imagery data
• Build an understanding of how the coastal zone is changing
• Facilitate management of sediment and projects at a regional, or watershed scale
JALBTCX
of Engineers
U.S.ARMY
Jennifer.M.Wozencraft@usace.army.mil 228-806-6044

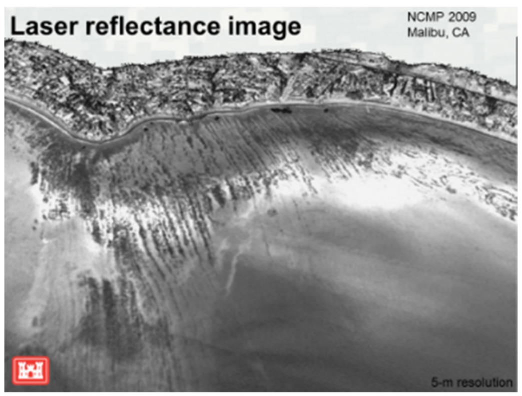
JALBTCX PRODUCTS FOR COASTAL ENGINEERS

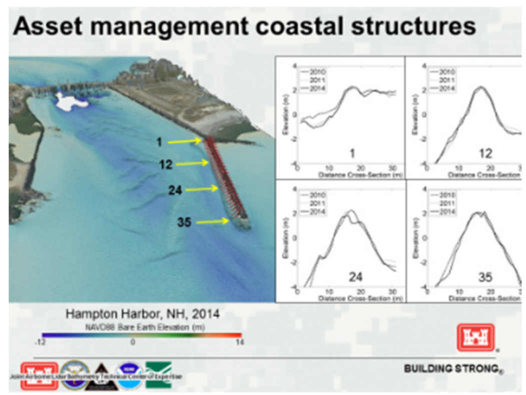
Basic lidar and imagery products





Advanced lidar products*





Fusion products*

Leveraging ERDC CHL and EL R&D

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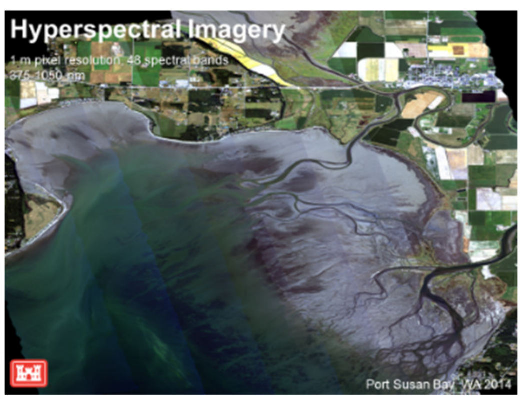
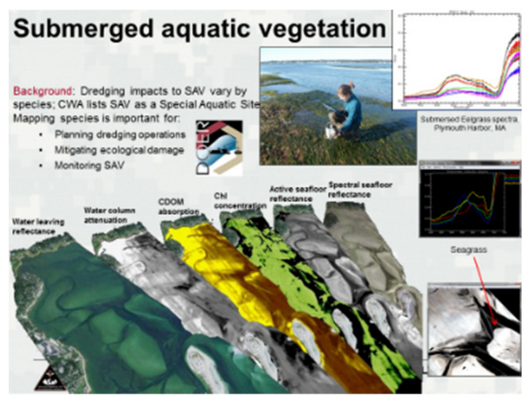
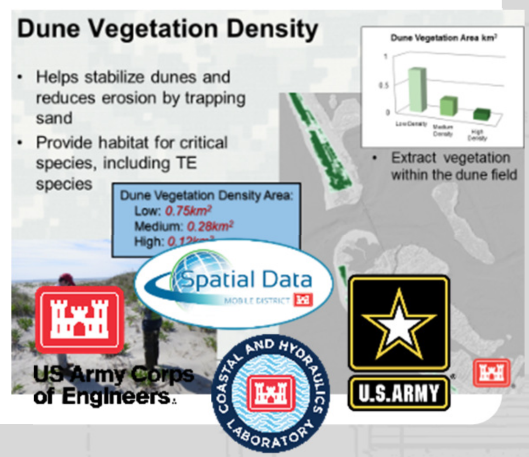
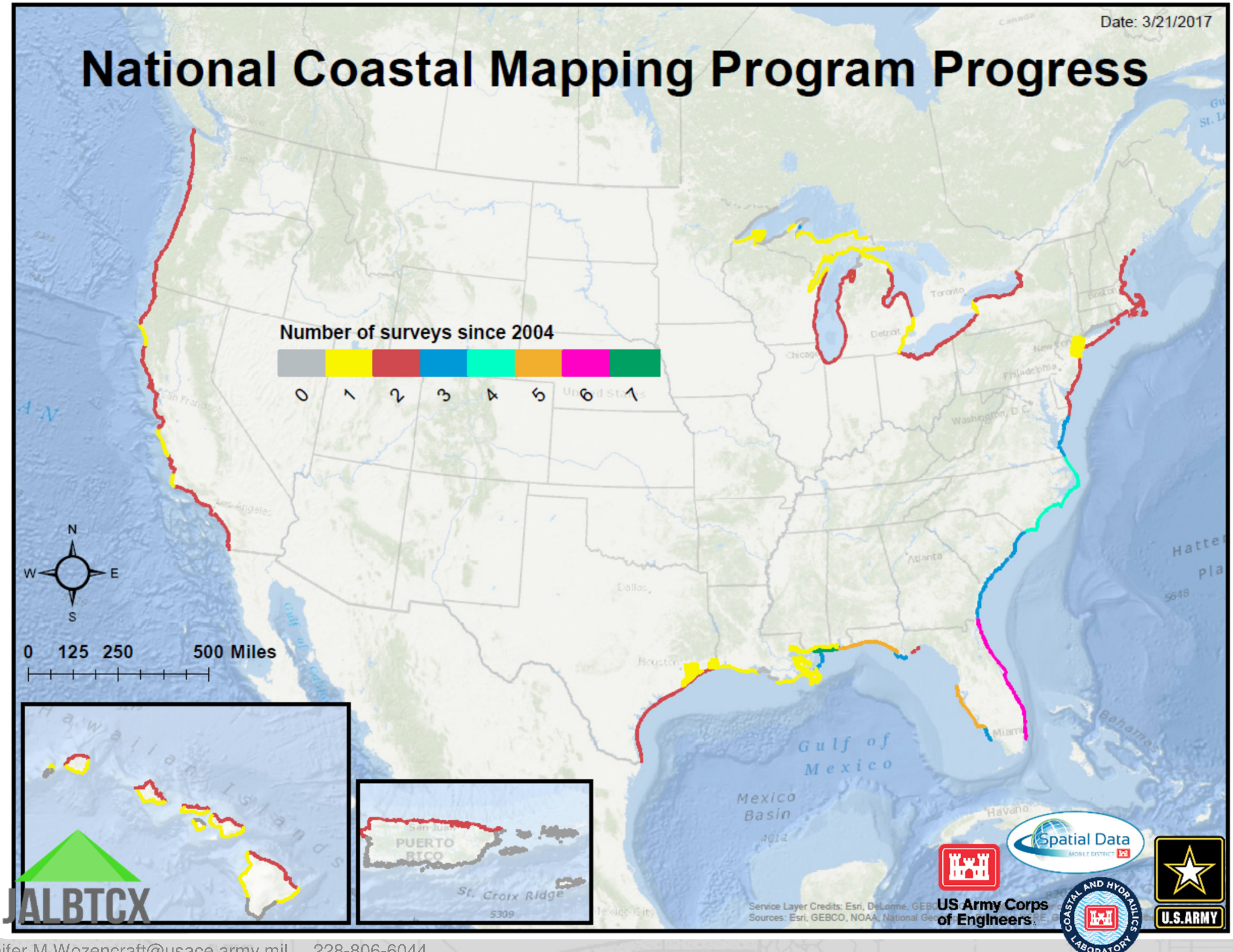






Jennifer.M.Wozencraft@usace.army.mil 228-806-6044

National Coastal Mapping Program Progress



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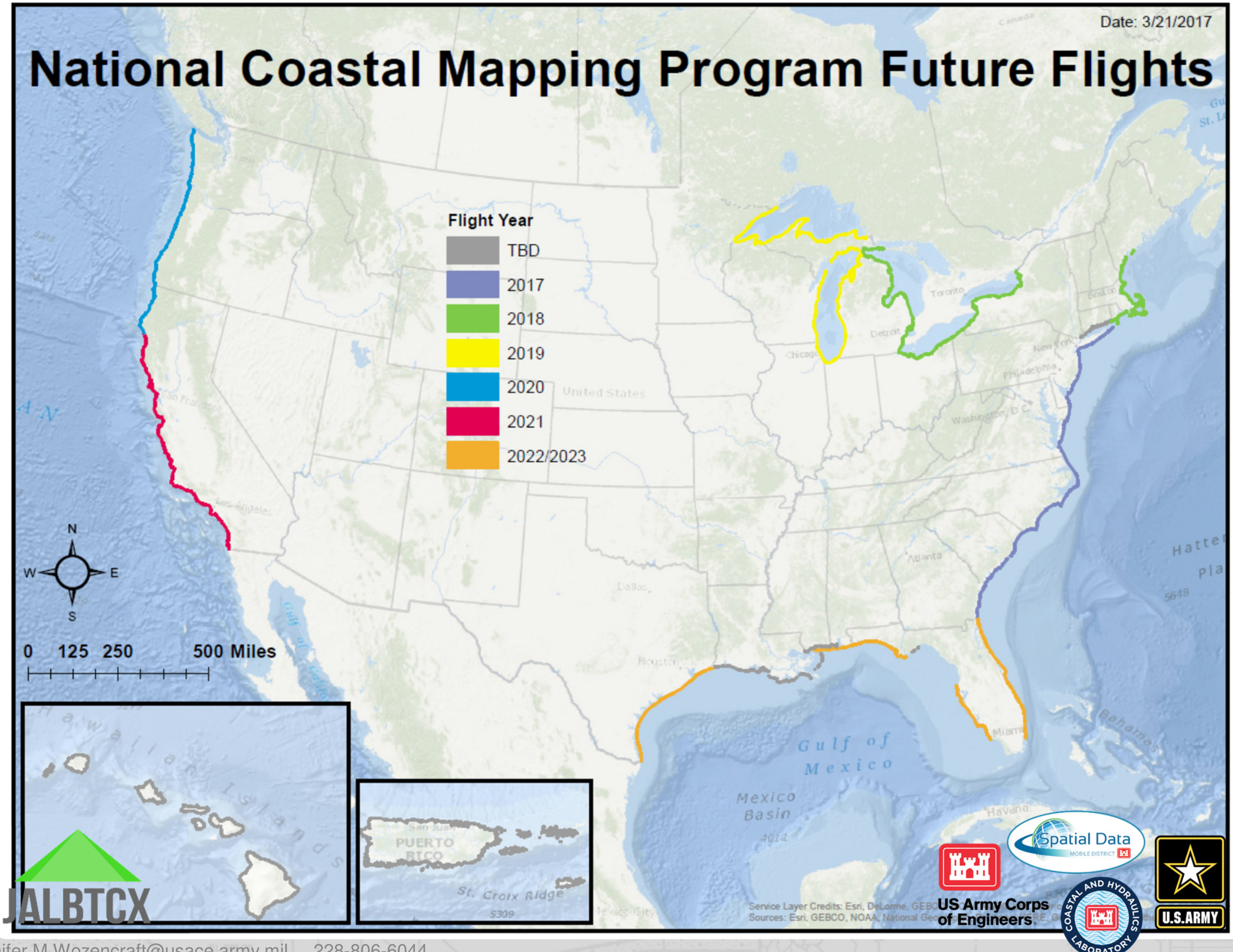


Jennifer.M.Wozencraft@usace.army.mil 228-806-6044

- Long endurance aircraft, ~11 hours.
- Transits annually through AK at the completion of the NAVO mission.
- Very experienced operating in remote and challenging locations.

JALBTCX

US Army Corps of Engineers.

Jennifer.M.Wozencraft@usace.army.mil 228-806-6044

MULTI-MISSION SURVEY AIRCRAFT

- Enhanced global reach
- Carry survey equipment & aircraft parts
- Multi-mission capable with space, power, and additional bottom ports for additional sensors as needed

BT-67 Specifications (with options)

Range	2,140 nm
Max Cruise	215 kts
Standard Cruise	205 kts
Fuel Capacity	1,542 gal
Endurance	~11 hrs
Max take-off wt.	28,750 lbs
Survey Altitude	1200 ft
Survey Speed	140 knots

Approved for public release: Distribution unlimited

JALBTCX

US Army Corps of Engineers.

Spatial Data MOBILE DISTRICT

COASTAL AND HYDRAULICS LABORATORY

U.S.ARMY

Jennifer.M.Wozencraft@usace.army.mil 228-806-6044

COASTAL ZONE MAPPING & IMAGING

LIDAR (CZMIL) SYSTEM

The right tool for safe and efficient shallow-water hydrographic and near-shore topographic data collection in support of Navy requirements

Hydro/Topo Lidar

Hyperspectral

RGB Imagery

- 10,000 Hz Pulse Rate Laser for Hydro / Topo
- 25 Megapixel Digital camera (~20 cm pixel)
- CASI-1500 Hyperspectral Imager
  - 1500 pixels
  - 380 – 1050 nm wavelength
  - 288 possible bands

Shot spacing:
  - 0.7 X 0.7 meter topo / shallow hydro
  - 2.0 X 2.0 meter deep hydro

Approved for public release: Distribution unlimited

JALBTCX

US Army Corps of Engineers

Spatial Data

U.S. ARMY

Jennifer.M.Wozencraft@usace.army.mil 228-806-6044

Shoreline Verification with Unmanned Aerial Systems

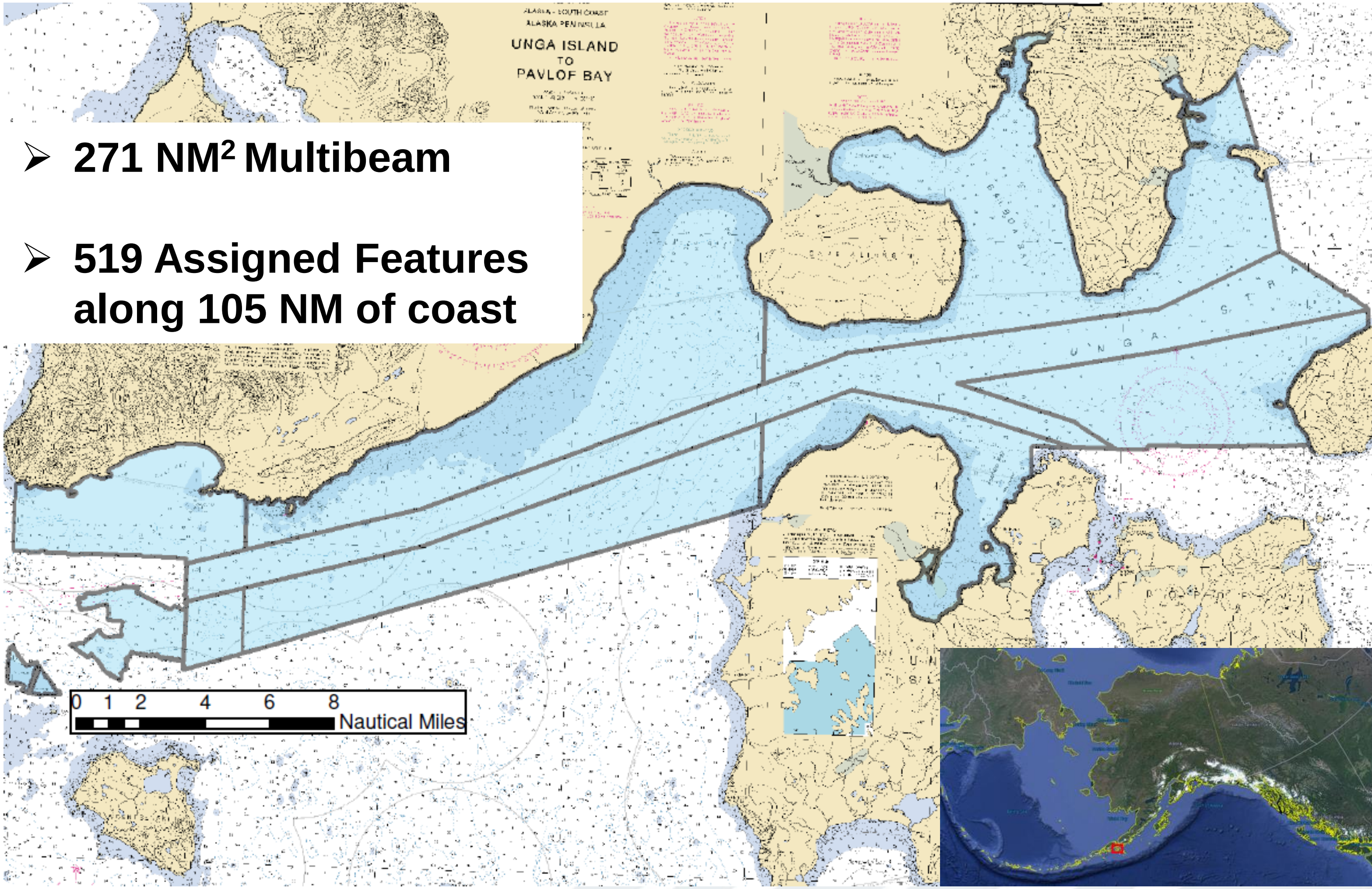
Tim Smith, TerraSond Limited

Alaska Coastal Mapping Summit

February, 2018

TERRASOND

Pavlof Islands and Vicinity Project Area

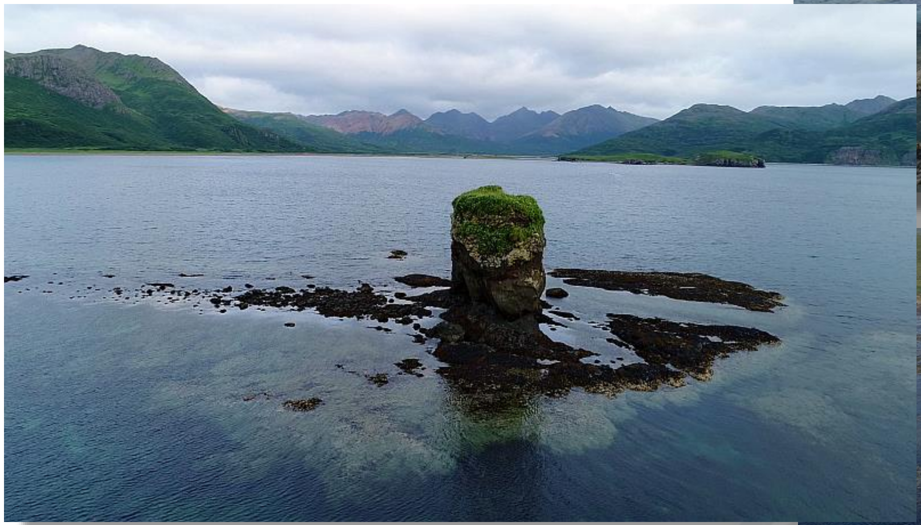


- **271 NM^2 Multibeam**
- **519 Assigned Features along 105 NM of coast**

TERRASOND

Common Shoreline Features

- Rocks & Islets
- Ledges & Reefs
- Foul Areas & Kelp



Photos from this project via UAS

TERRASOND

Vessel-based Investigation Methodology

Investigation via Skiff:

- Navigate to assigned features
- Ranges and bearings
- Visually estimate heights

TERRASOND

Vessel-based Investigation Methodology

Some problems with skiff-based approach:

- Can't approach features
- Low-confidence measurements
- What is NOT seen?
- Low efficiency
- Safety concerns

TERRASOND

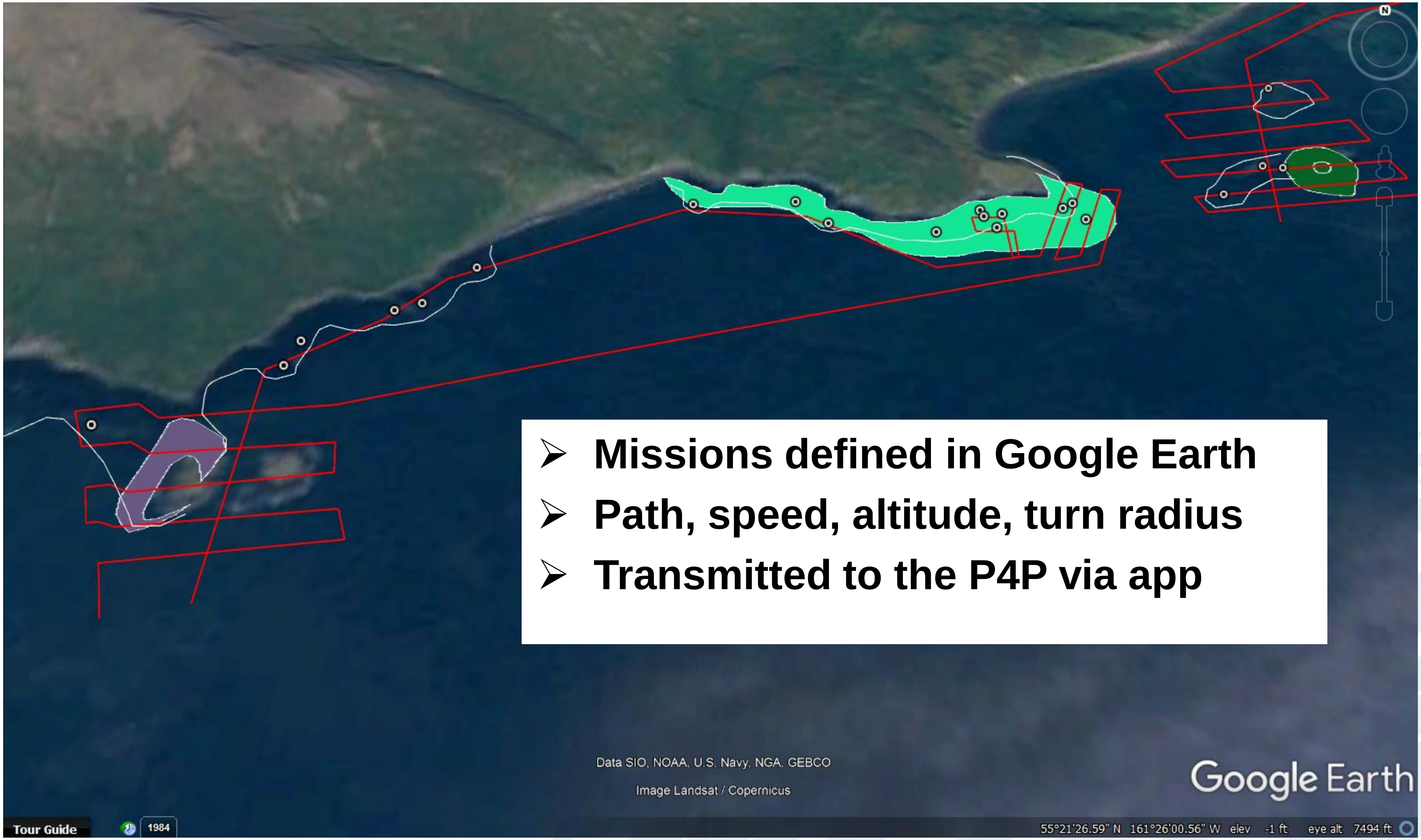
UAS (Drone) Equipment

DJI Phantom 4 Professional (P4P):

- 3 lbs
- GNSS positioning
- ~ 20 minute flight time (real-world)
- Camera – 20 megapixel, gimbal stabilized
- Affordable, simple

TERRASOND

Mission Planning

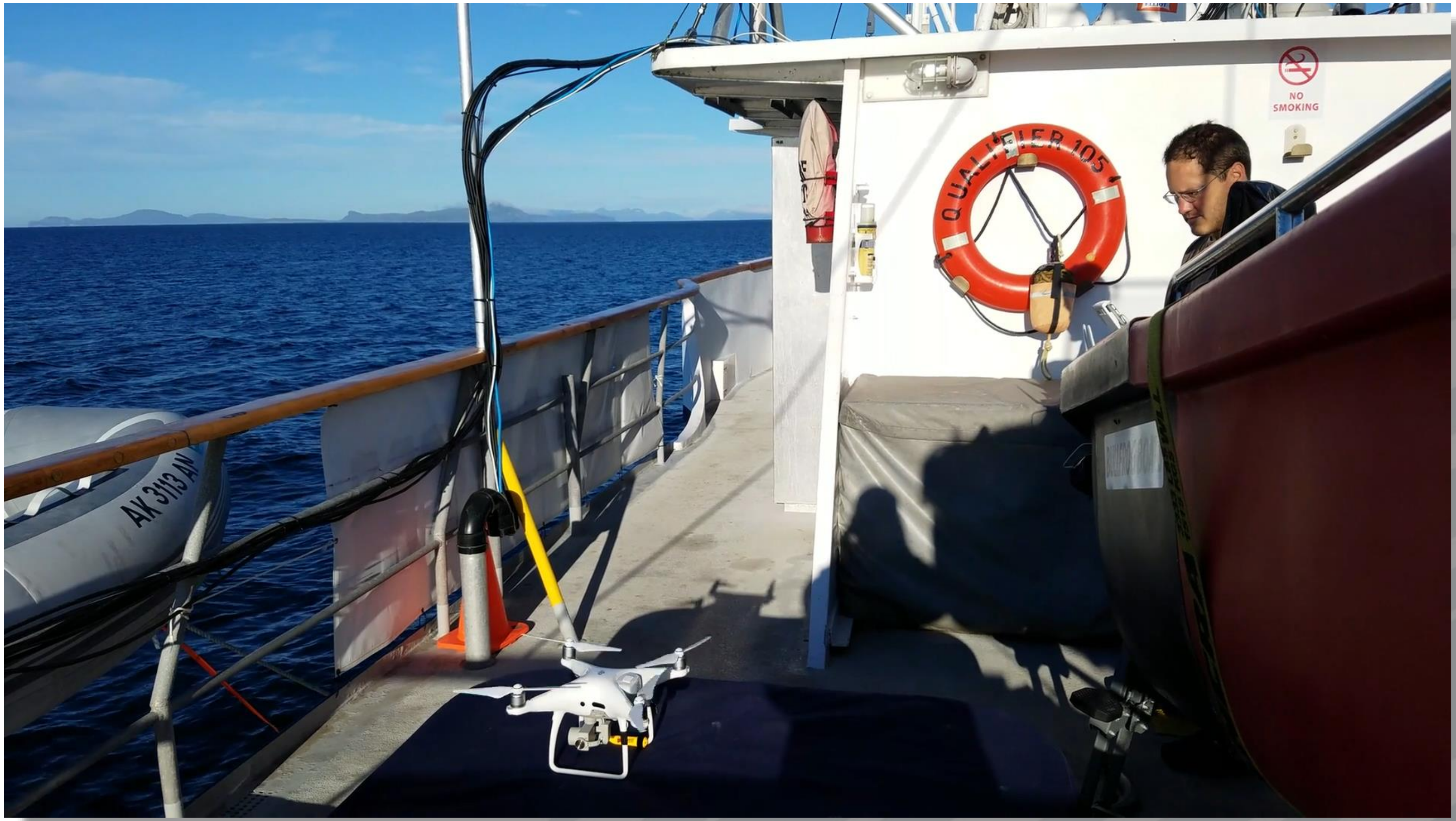


- Missions defined in Google Earth
- Path, speed, altitude, turn radius
- Transmitted to the P4P via app

TERRASOND

Launch

- **Manually-controlled launch**
- **After clear of vessel, initiate pre-planned mission**



Automatic Photo-taking

- 2-second photo interval
- 45 km/hr normal flight speed
- 120 m (~ 400’) altitude
- At least 3 photos per object
- Average 375 photos per mission

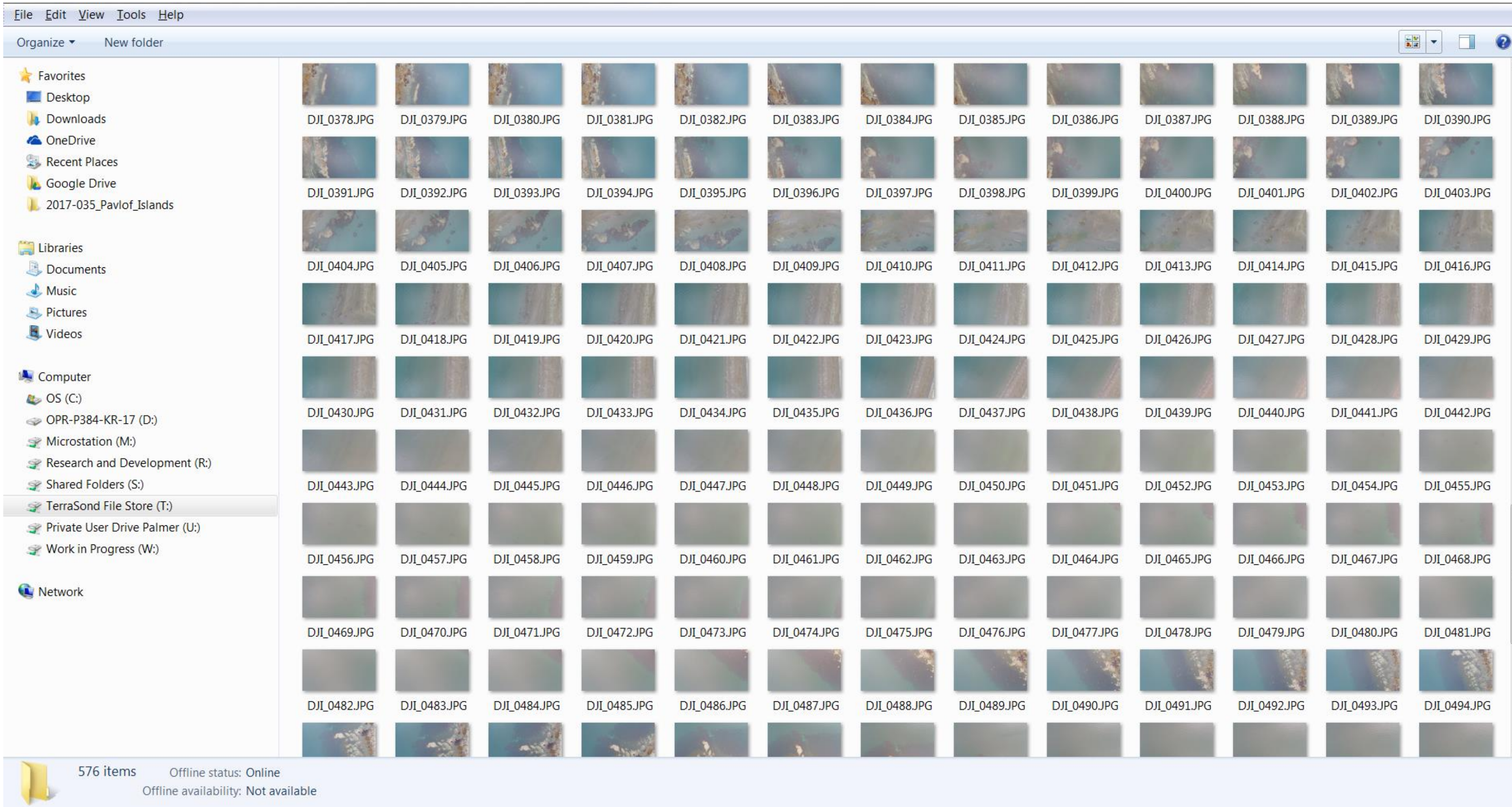
Recovery

- Manually-controlled recovery

TERRASOND

Processing

Examining hundreds of photos individually not an option…

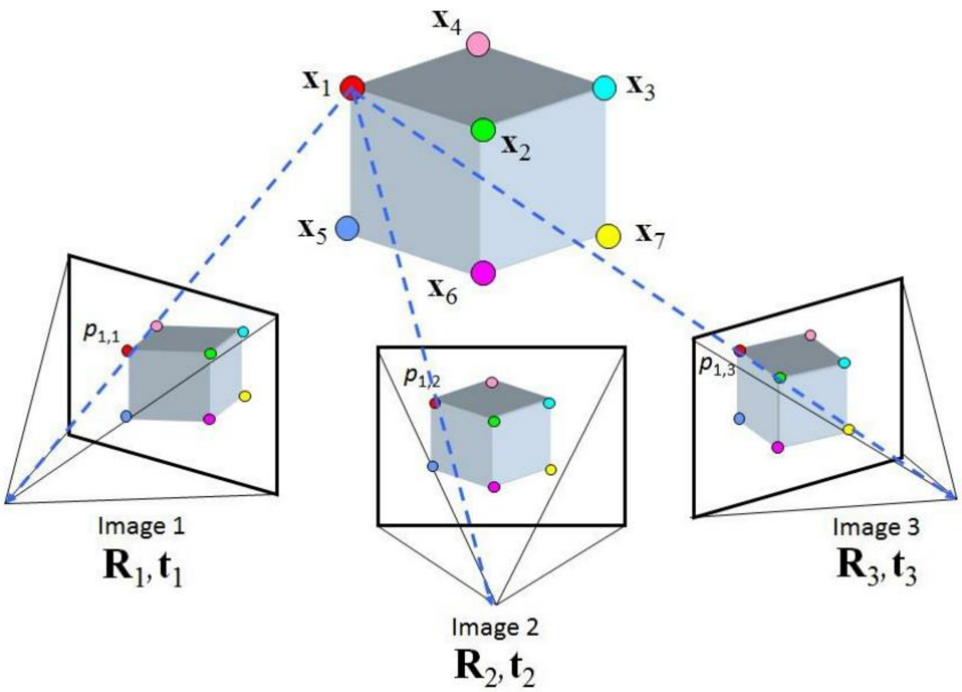


TERRASOND

Processing

- **Agisoft PhotoScan Professional**
- **Ortho-rectified photomosaics AND 3D-point clouds via SfM**

"Structure from motion (SfM) is a photogrammetric range imaging technique for estimating three-dimensional structures from two-dimensional image sequences" - Wikipedia



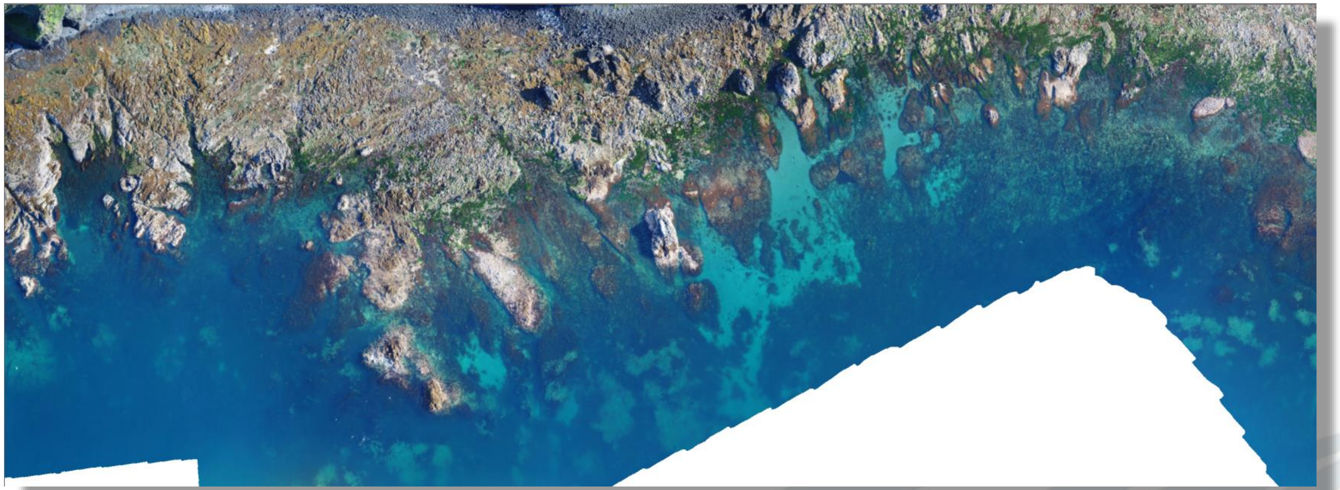
Important elements:

- Minimum 3 photos per object
- Common tie points
- Photo position (geotag) for absolute positioning
- Perspective (nadir to oblique)

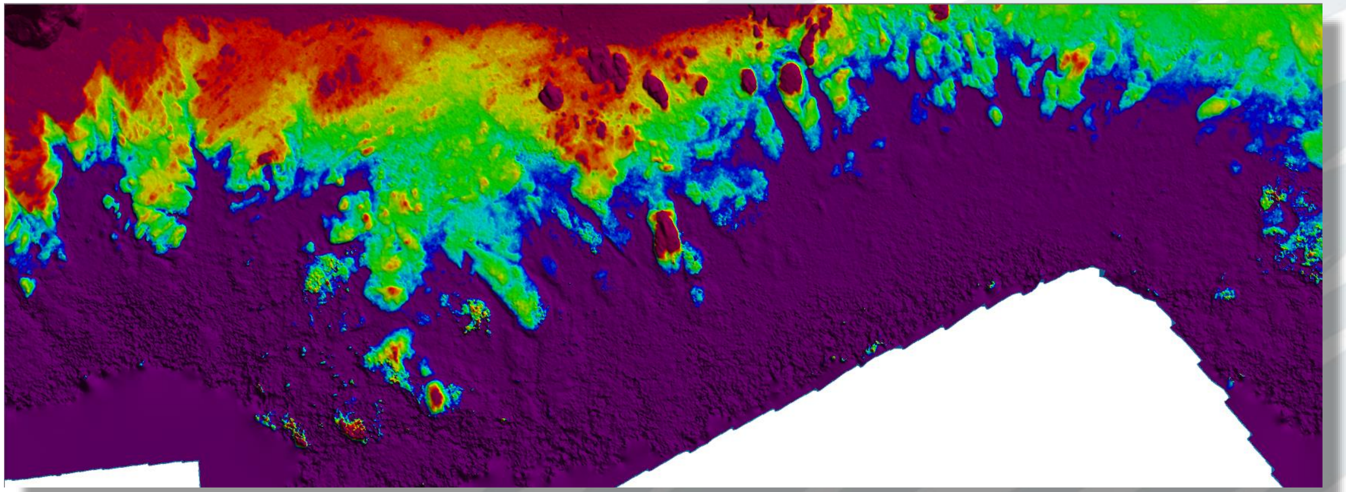
TERRASOND

Processing Products

Ortho



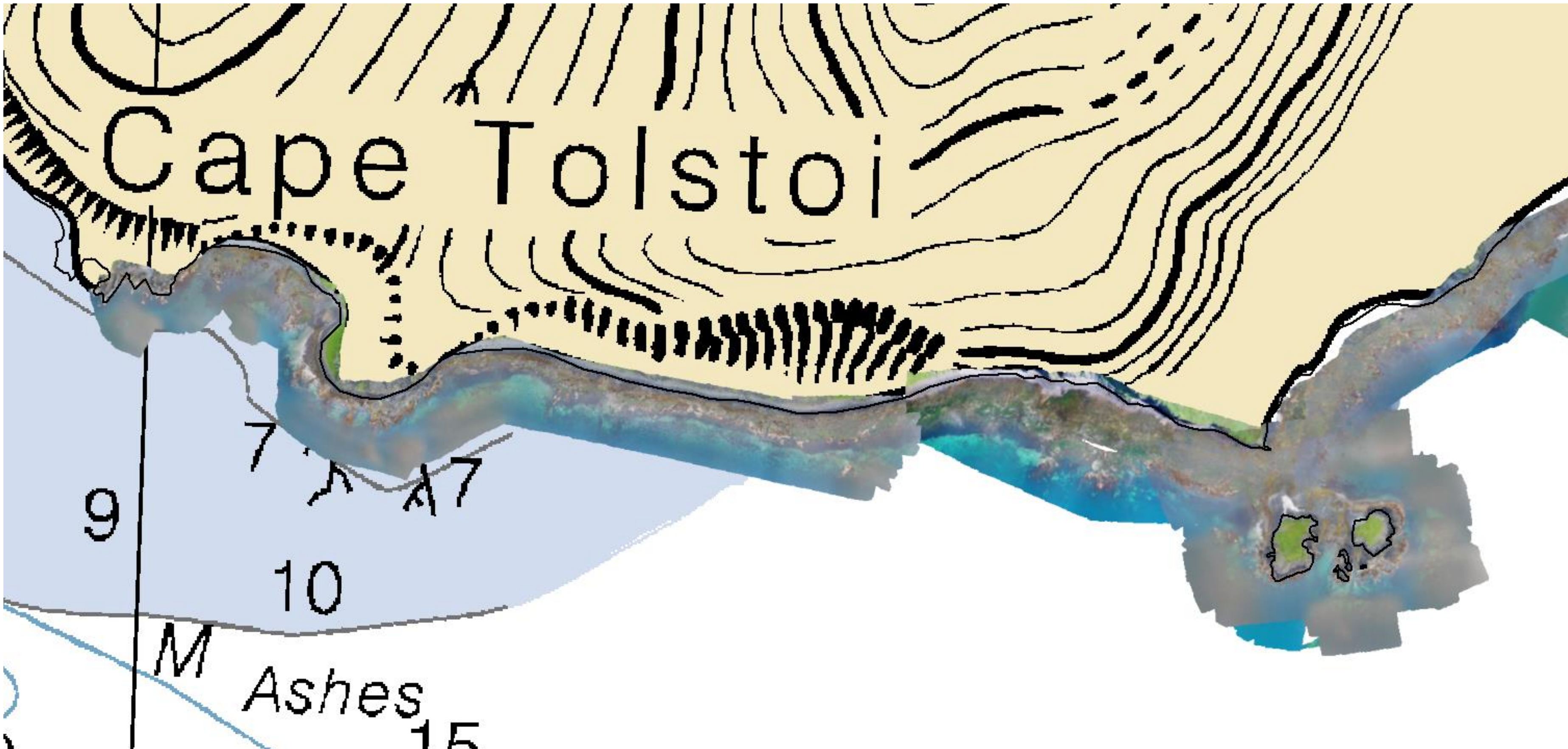
DEM



Purple = 0 m MLLW and deeper

TERRASOND

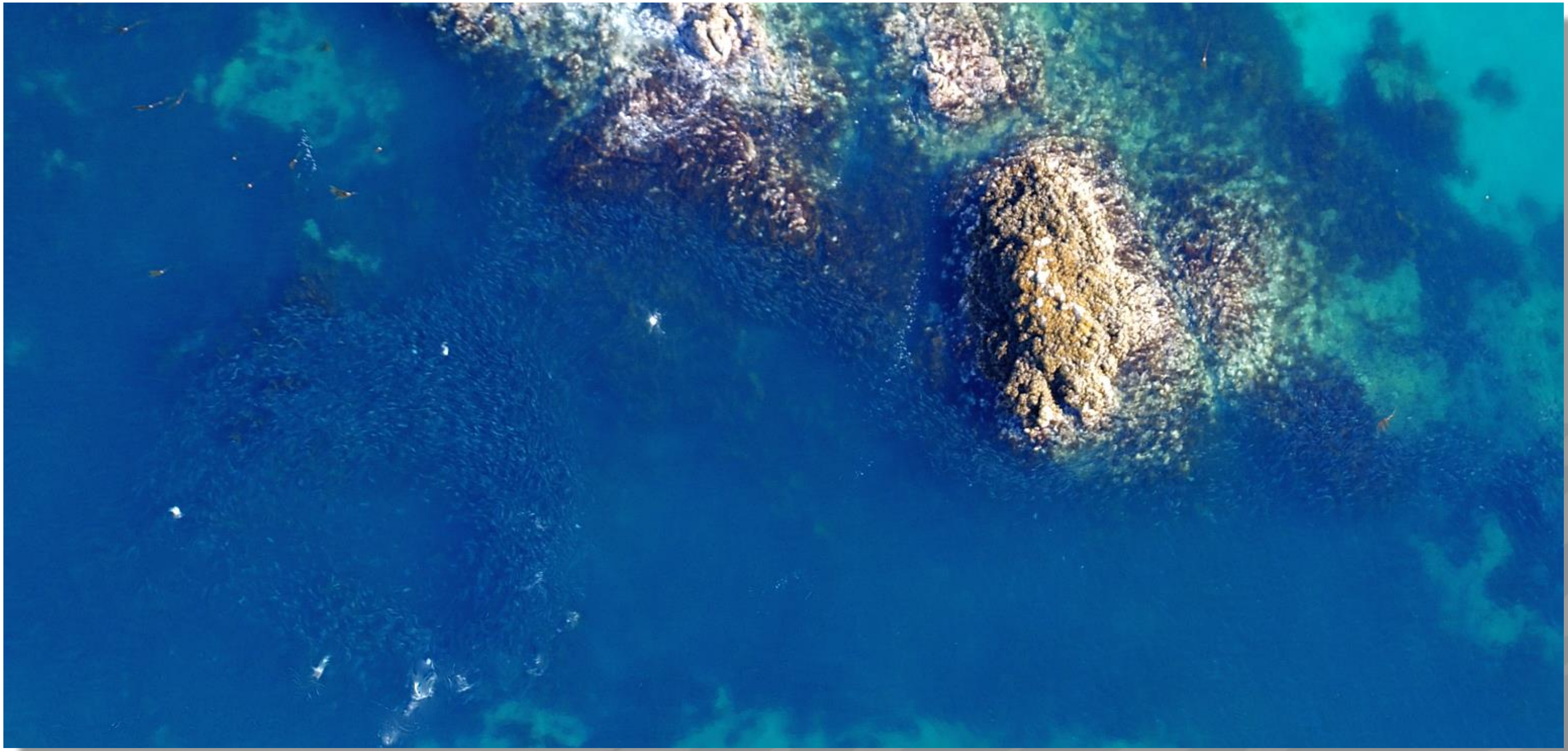
Ortho-photomosaics



TERRASOND

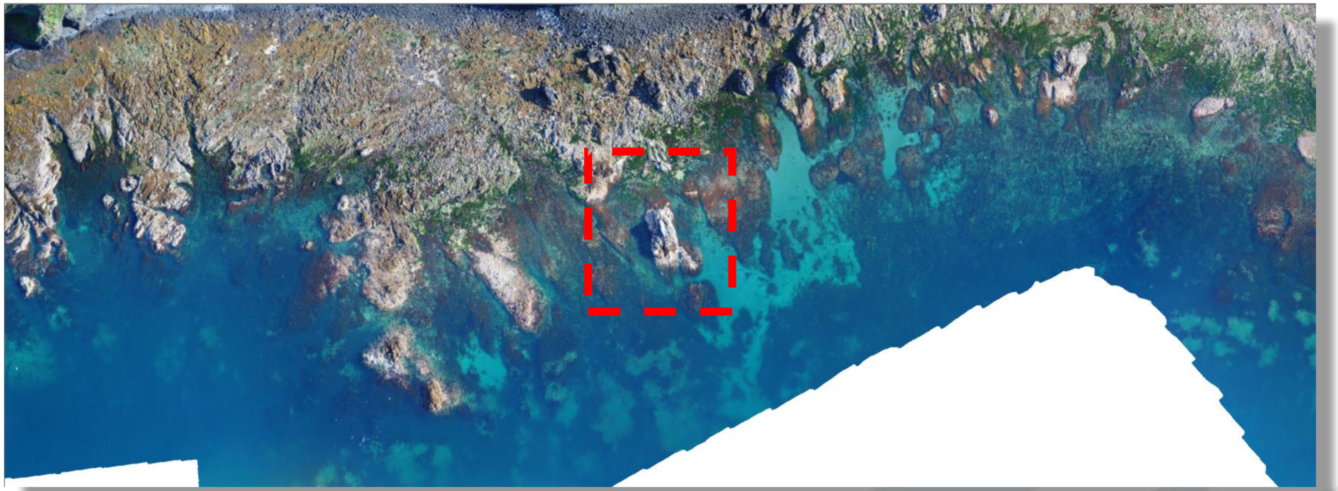
Ortho-photomosaics

Ortho-photomosaics

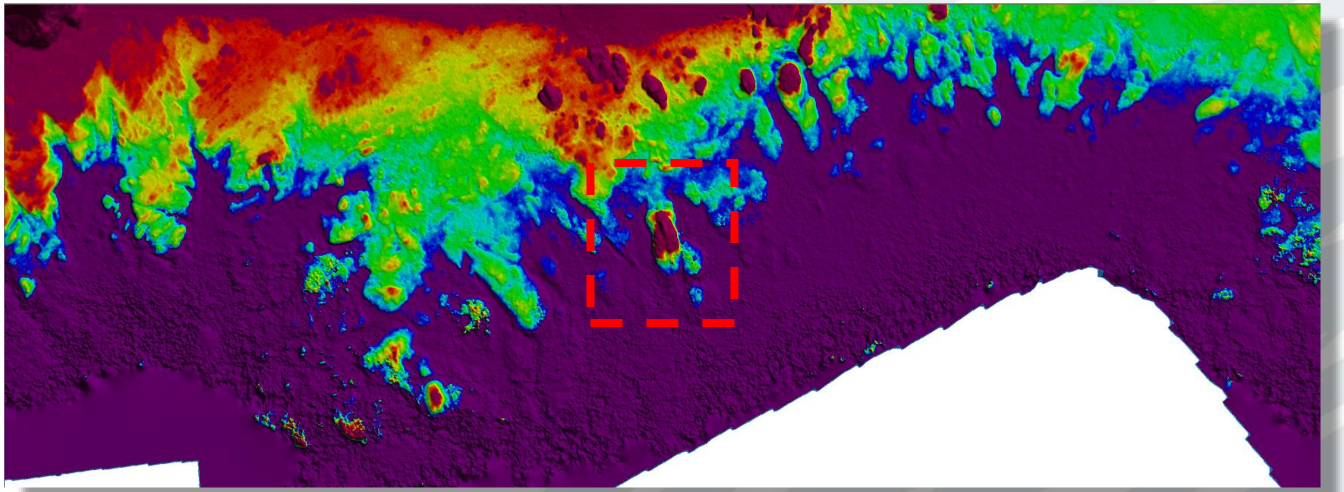


SfM Derived DEMs

Ortho



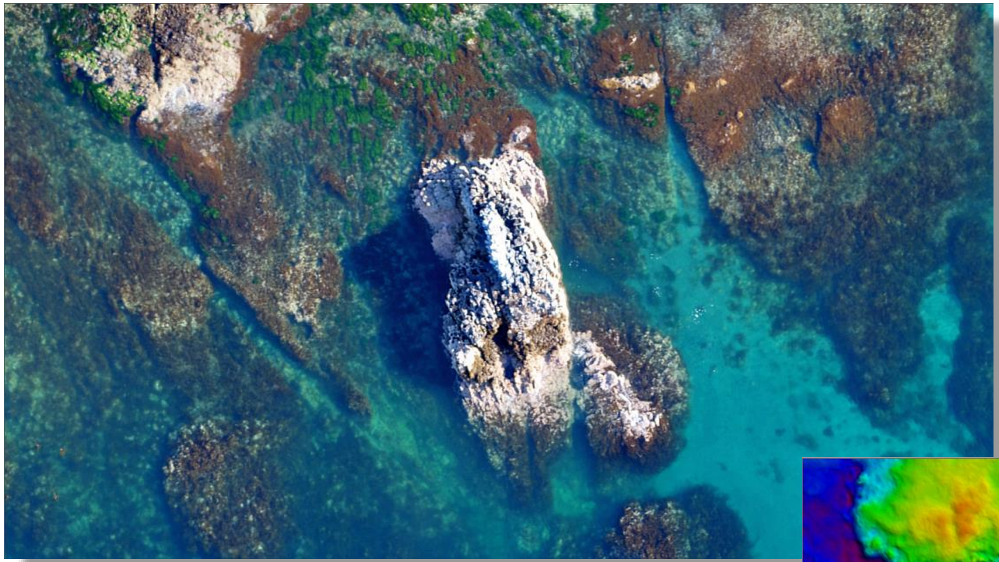
DEM

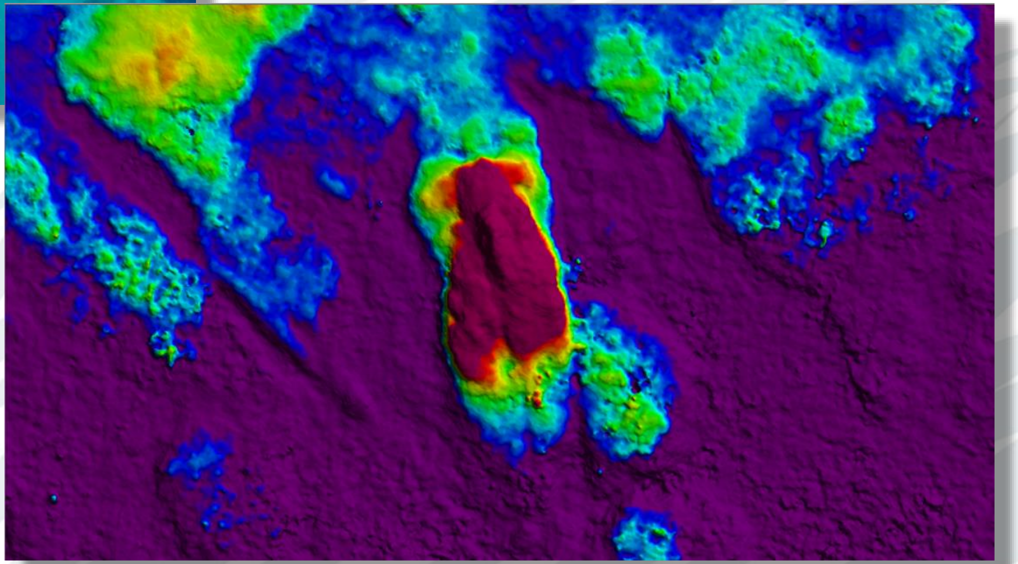


Purple = 0 m MLLW and deeper

TERRASOND

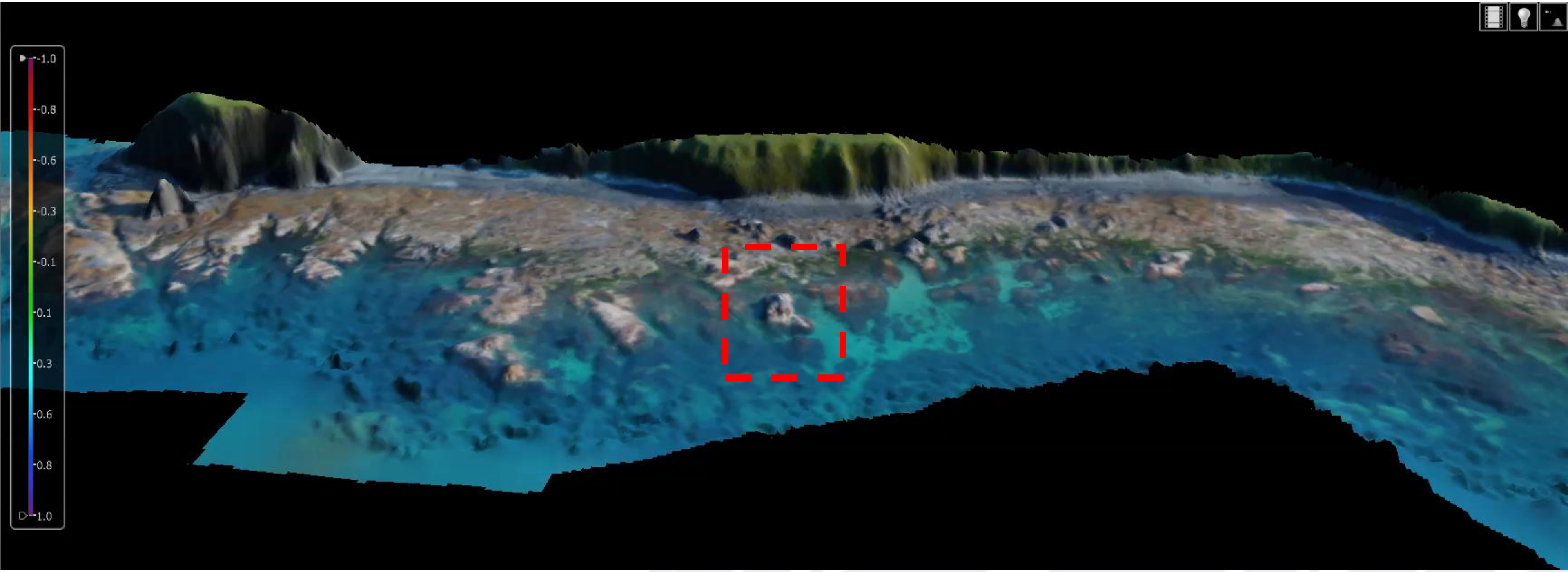
SfM Derived DEMs





Purple = 0 m MLLW and deeper

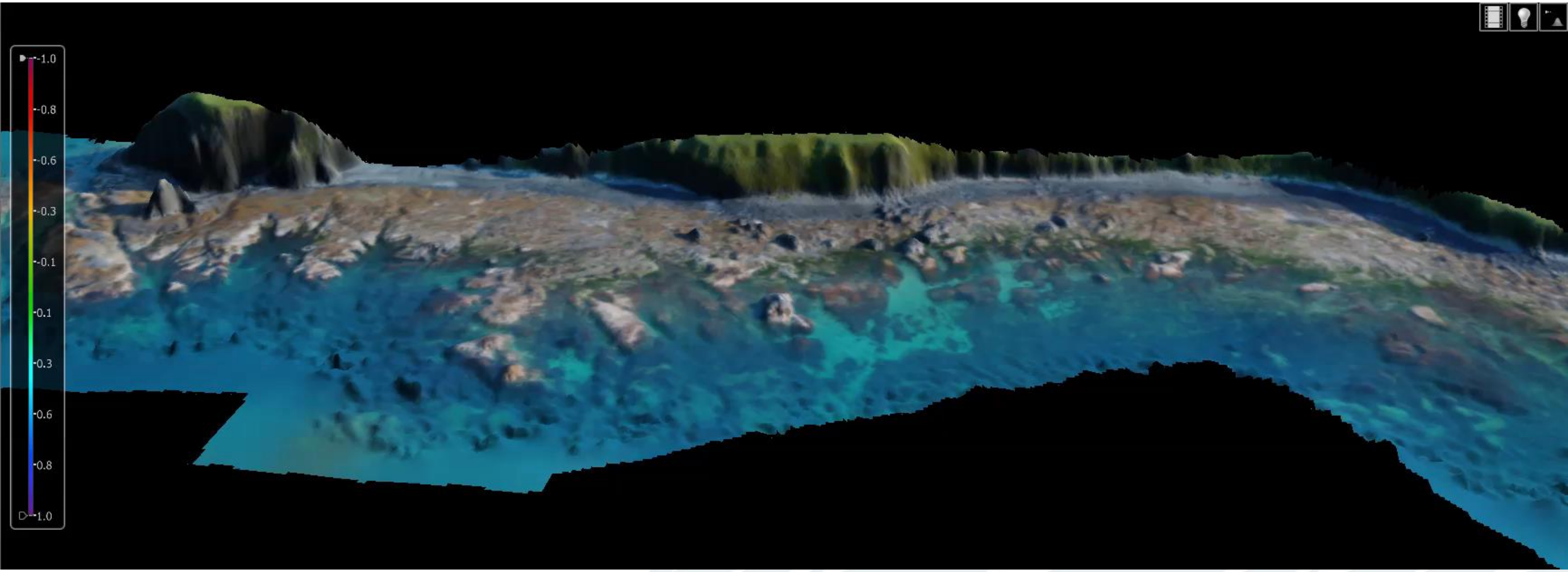
Ortho-DEM Drape (in CARIS HIPS)



Purple = 0 m MLLW and deeper

TERRASOND

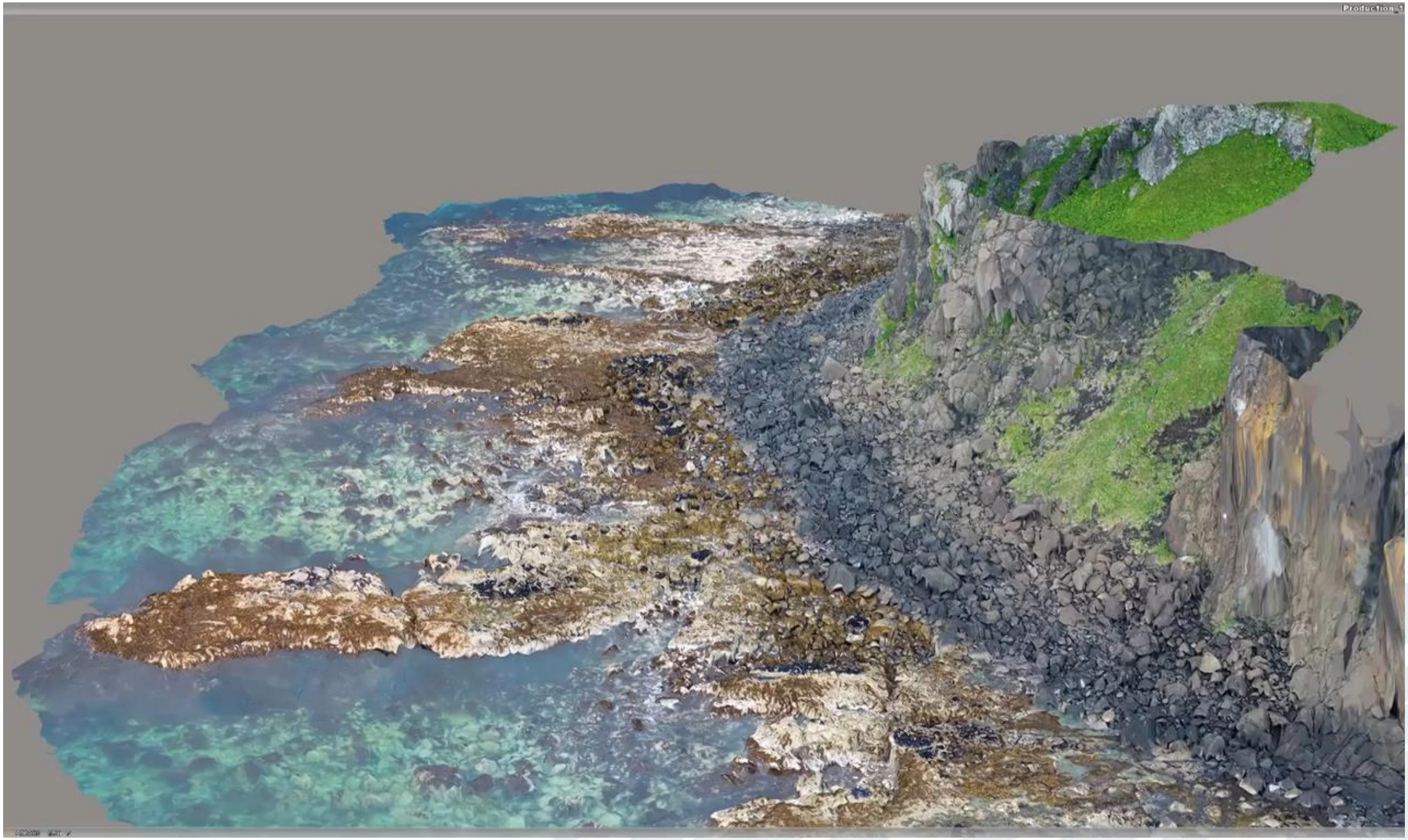
Ortho-DEM Drape (in CARIS HIPS)



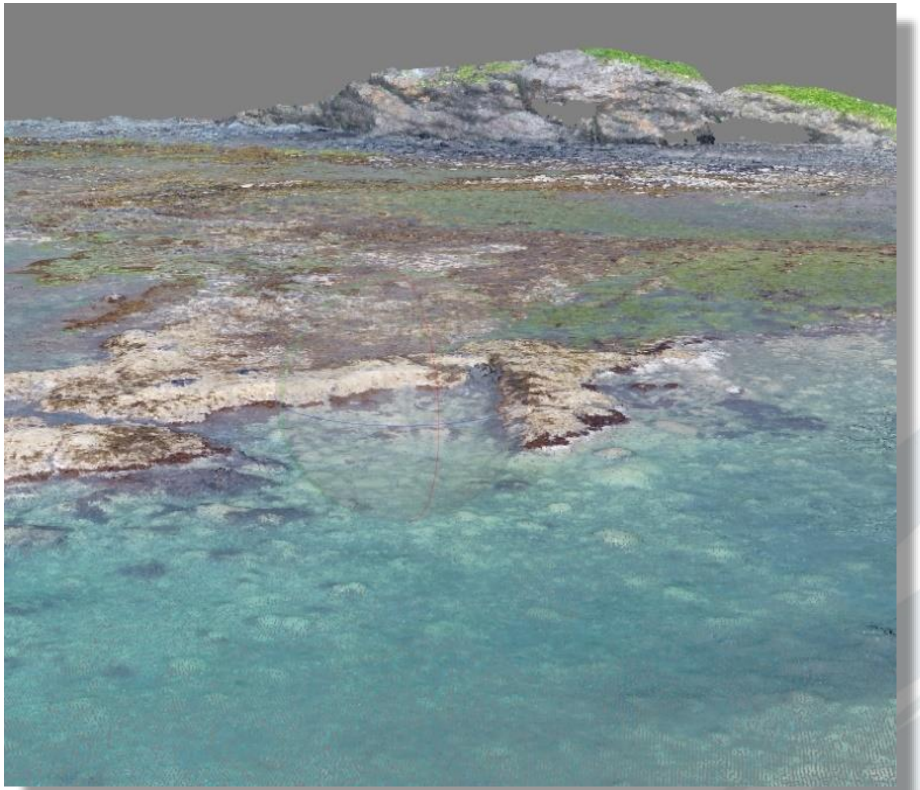
Purple = 0 m MLLW and deeper

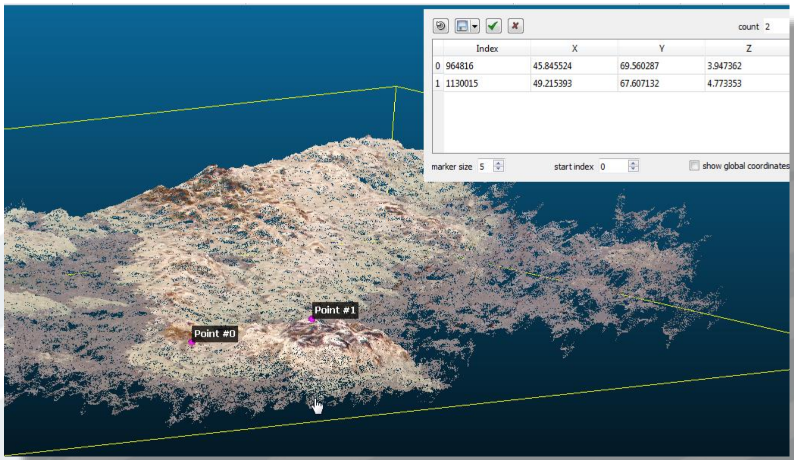
TERRASOND

Ortho-DEM Drape



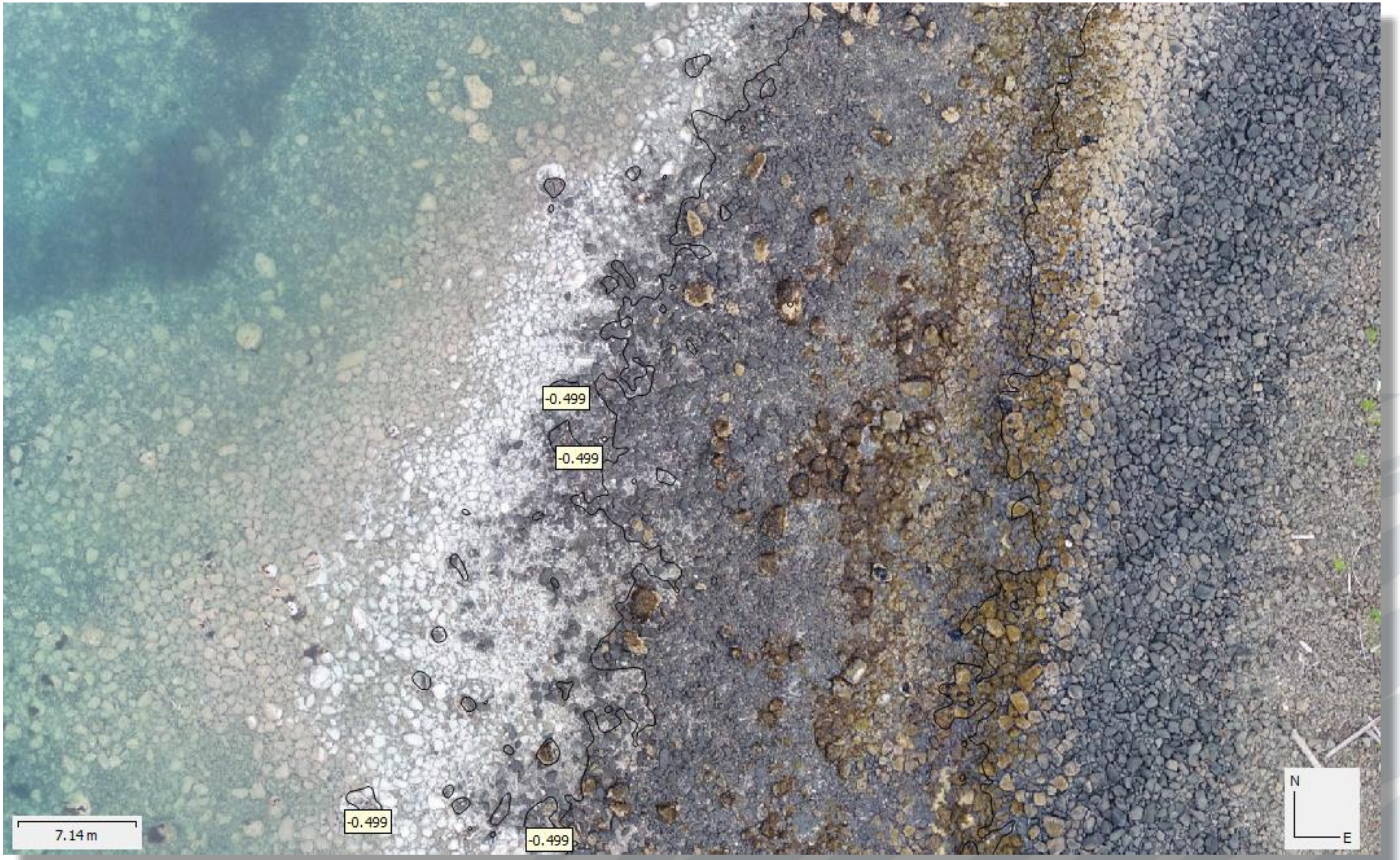
Point Cloud Adjustment to MLLW





TERRASOND

Point Cloud Adjustment to MLLW



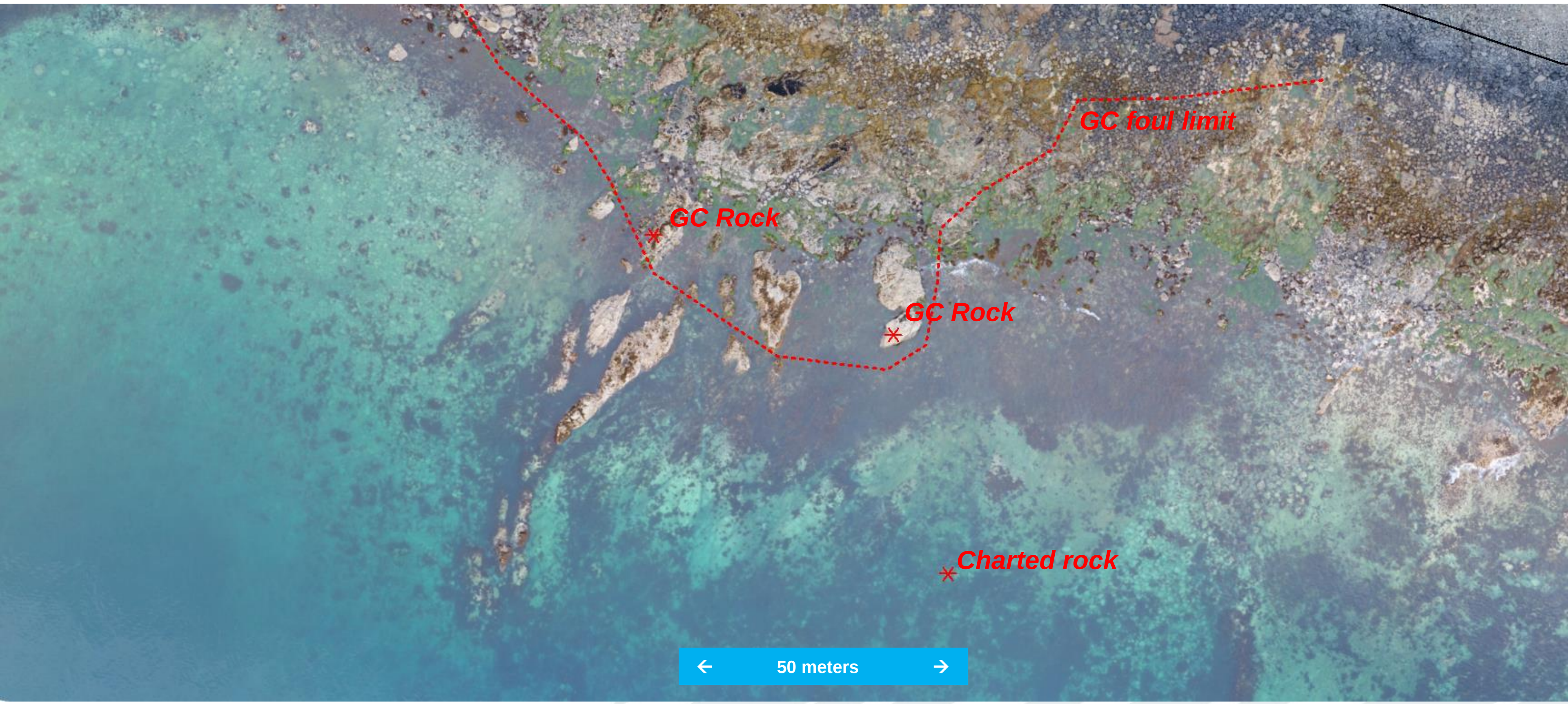
TERRASOND

Using the Data / S57 Encoding

Verification of Assigned Features

- SfM products overlaid with assigned features
- Features verified and deconflicted

Assigned features



TERRASOND

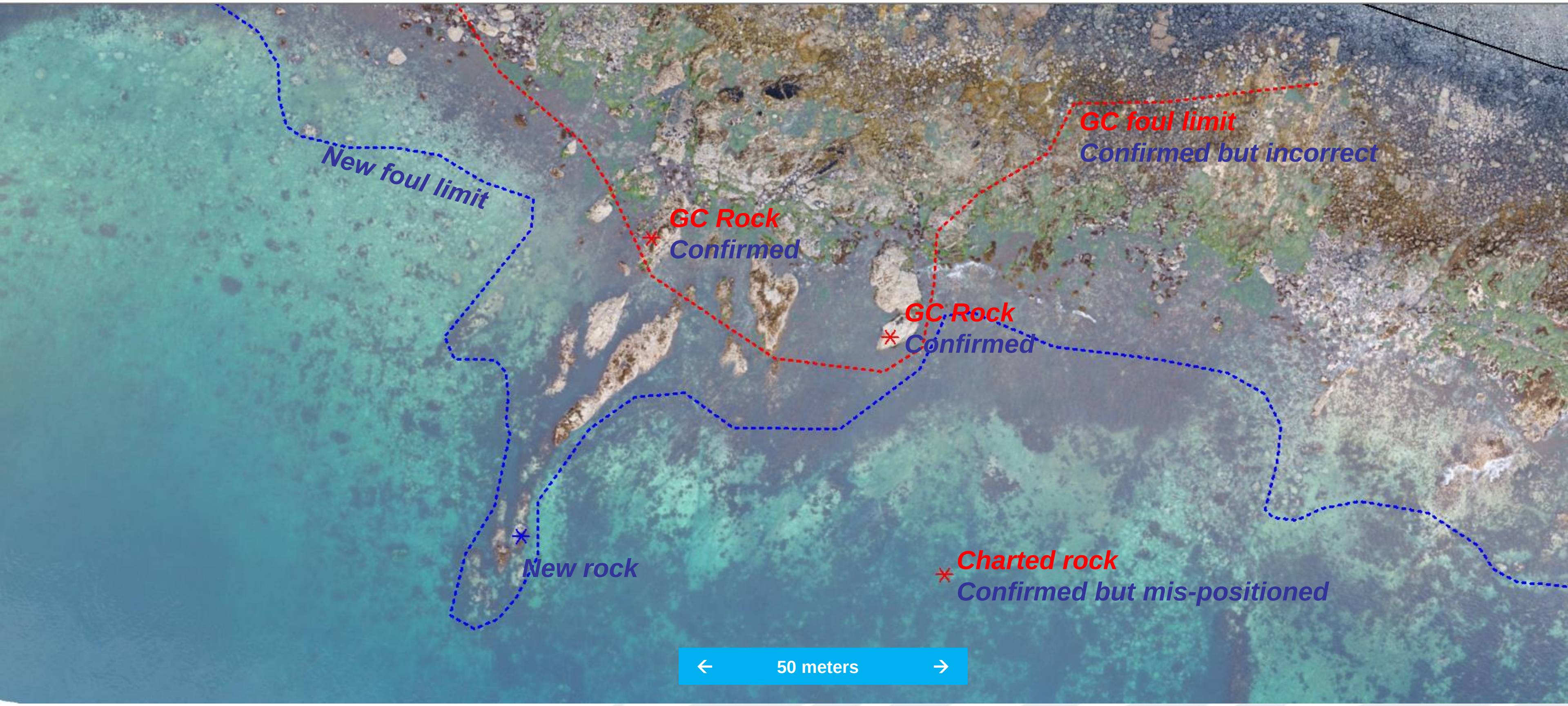
Using the Data / S57 Encoding

Verification of Assigned Features

- SfM products overlaid with assigned features
- Features verified and deconflicted

Assigned features

Verification results



TERRASOND

Using the Data / S57 Encoding

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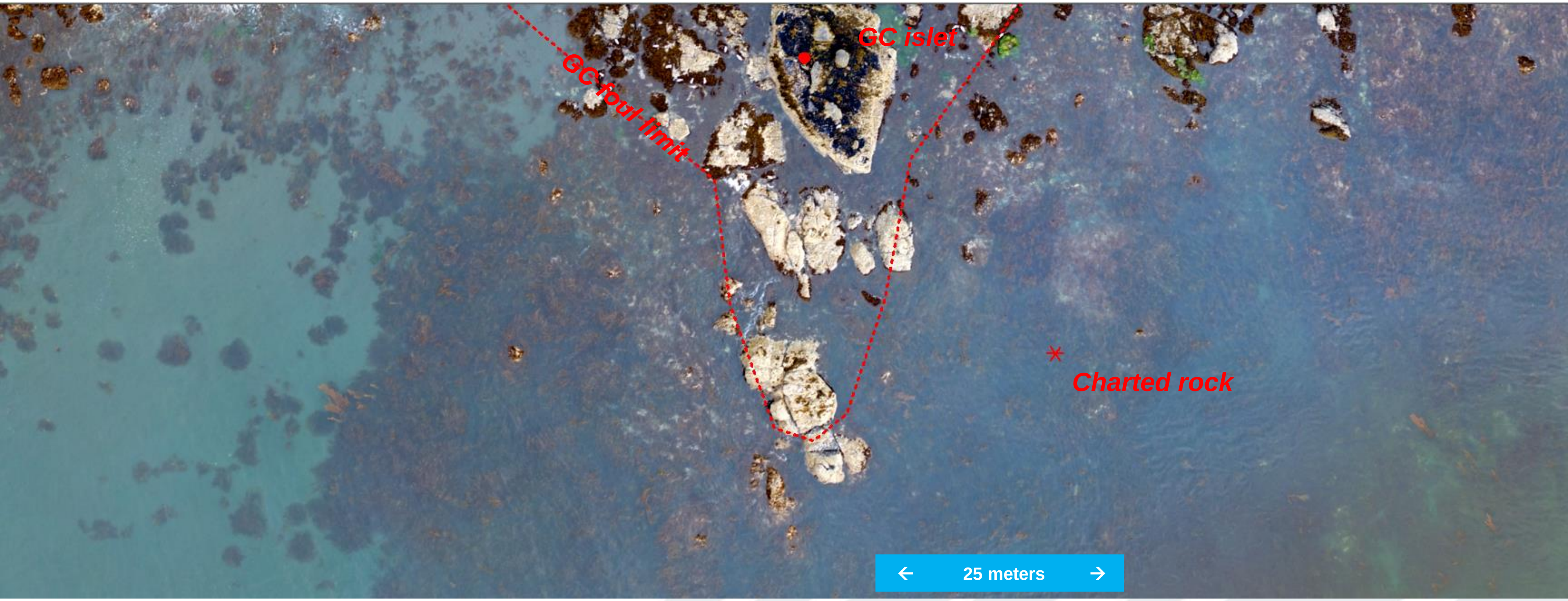
Assigned features



TERRASOND

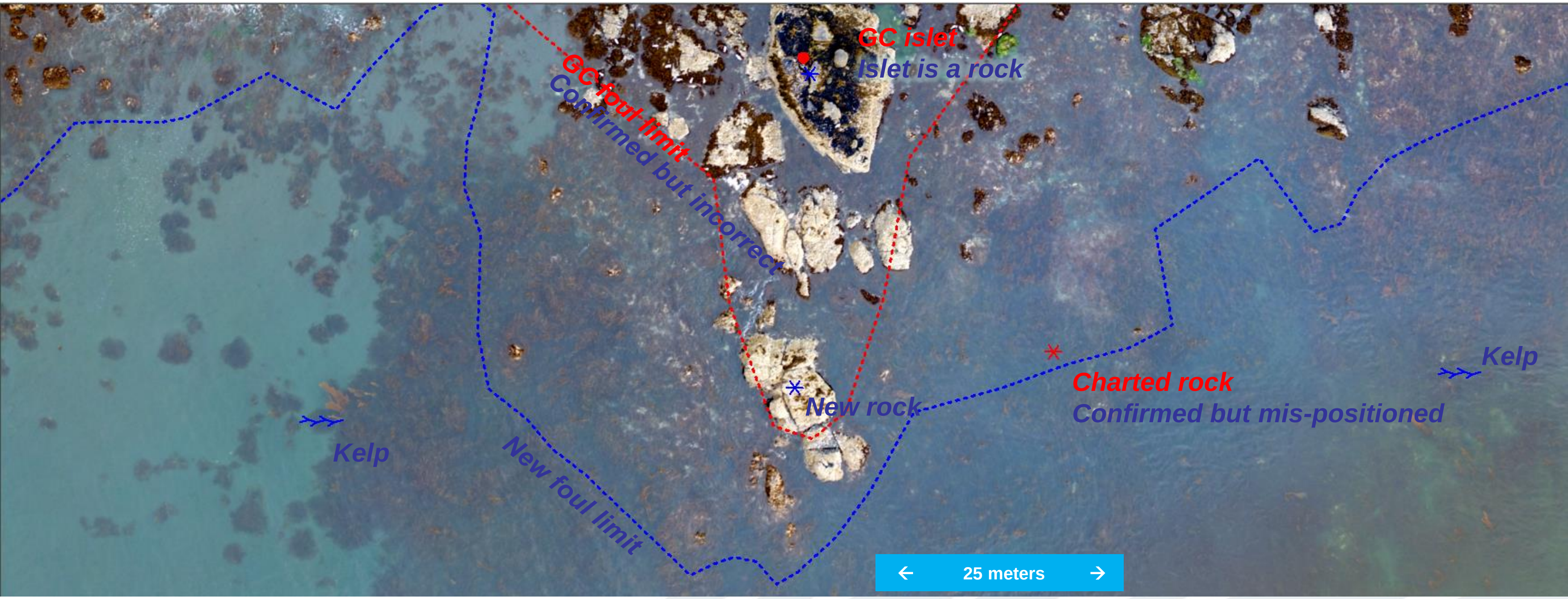
Using the Data / S57 Encoding

Verification of Assigned Features

- SfM products overlaid with assigned features
- Features verified and deconflicted

Assigned features

Verification results



TERRASOND

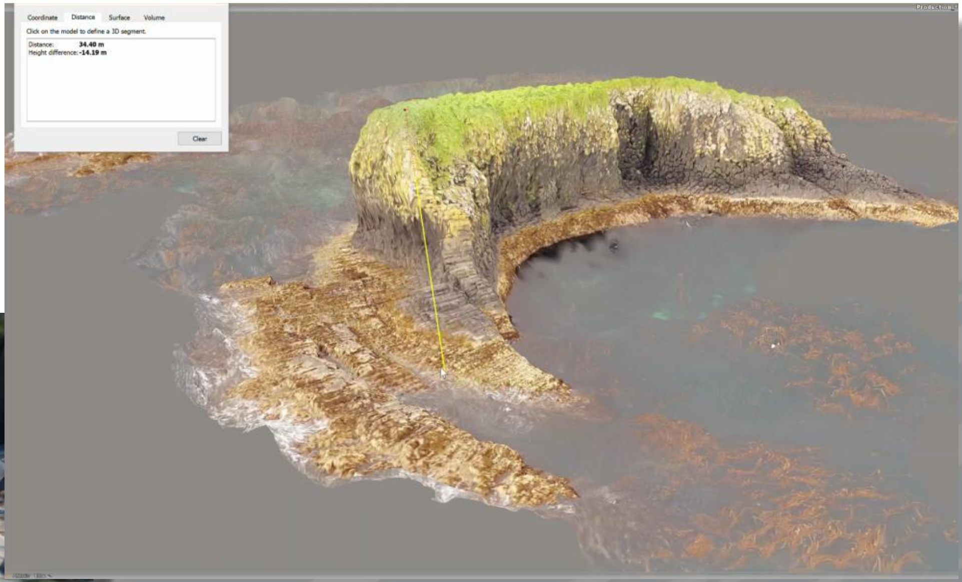
Results

Compared to traditional, vessel-based investigation:

PROS:

Quantitative – not estimated / interpolated

✓ **Quality**



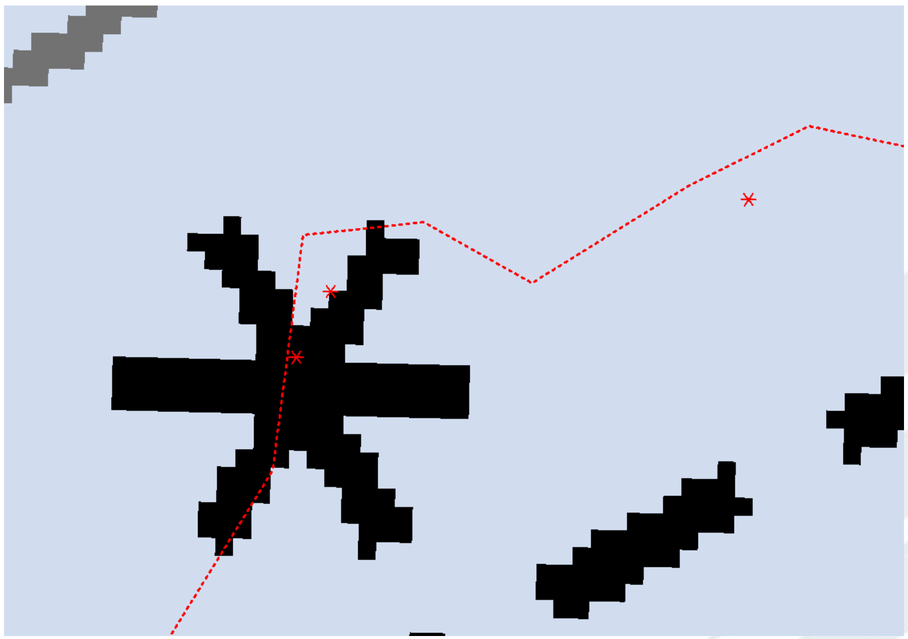
TERRASOND

Results

Compared to traditional, vessel-based investigation:

PROS:

Comprehensive – wholistic view of the shoreline area



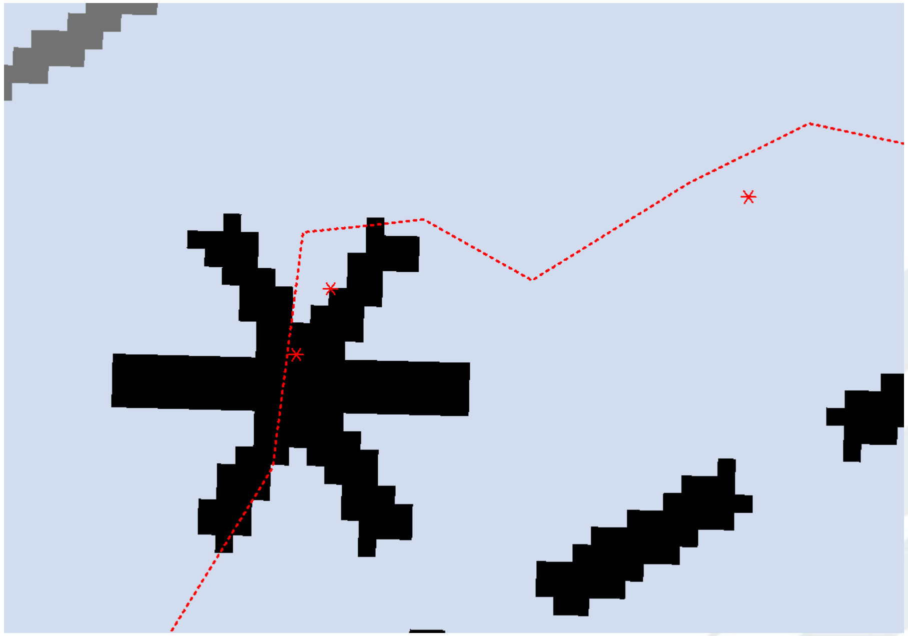
TERRASOND

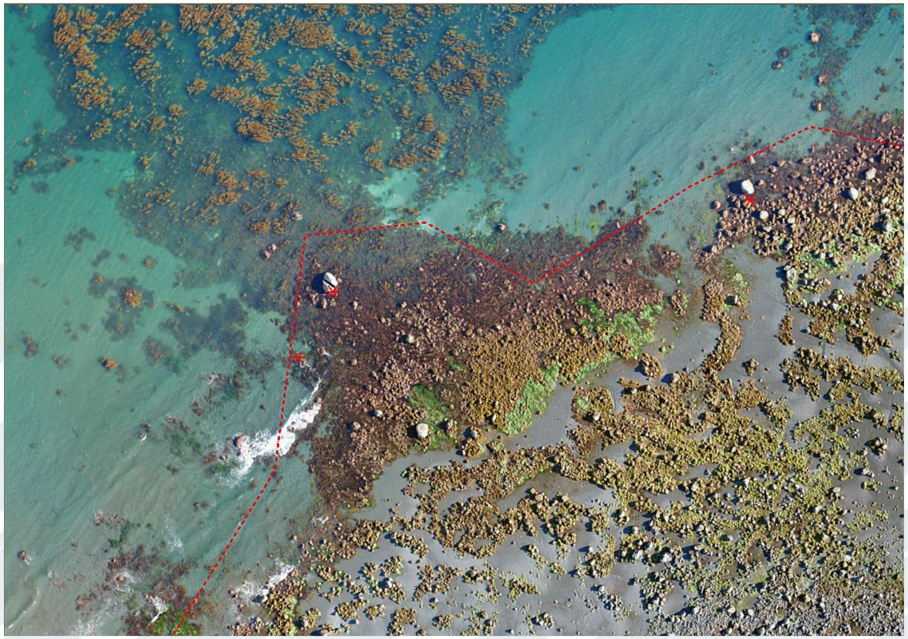
Results

Compared to traditional, vessel-based investigation:

PROS:

Comprehensive – wholistic view of the shoreline area





Results

Compared to traditional, vessel-based investigation:

PROS:

- ✓ Quality
- ✓ **Efficiency**

- About 2 NM per 15-20 minute flight
- No skiff deployment
- Reposition larger vessel between flights
- Two drones airborne at once

TERRASOND

Results

Compared to traditional, vessel-based investigation:

PROS:

✓ Quality
✓ Efficiency
✓ **Simplicity**

- Simple, off-the-shelf
- Fits in a small case
- Easy to learn

TERRASOND

Results

Compared to traditional, vessel-based investigation:

PROS:

- ✓ Quality
- ✓ Efficiency
- ✓ Simplicity
- ✓ **SAFETY**

**STAY ON THE BIG BOAT,
DRINK COFFEE,
INVESTIGATE SHORELINE!**

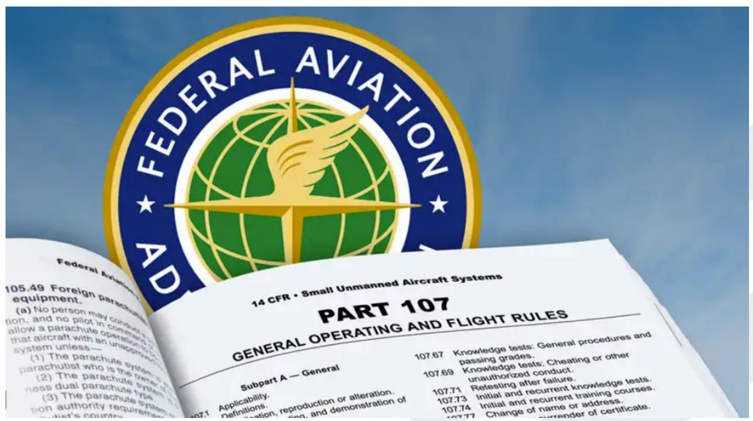
TERRASOND

Results

Compared to traditional, vessel-based investigation:

PROS:

- ✓ Quality
- ✓ Efficiency
- ✓ Simplicity
- ✓ SAFETY



CONS:

- ✓ **FAA Licensure**

TERRASOND

Results

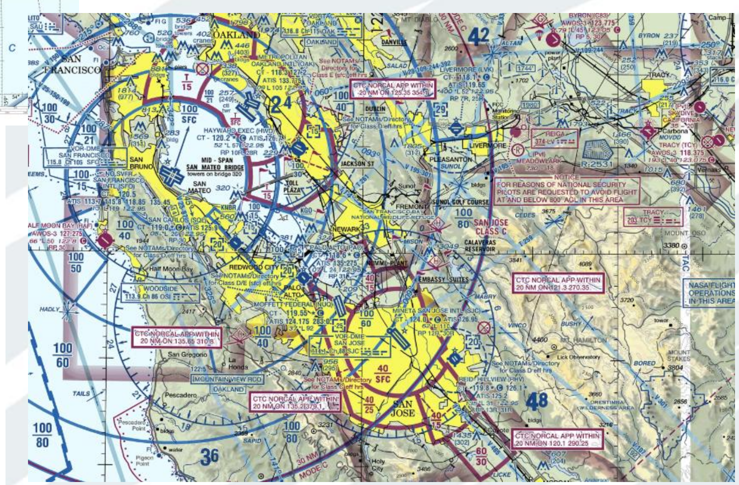
Compared to traditional, vessel-based investigation:

PROS:

- ✓ Quality
- ✓ Efficiency
- ✓ Simplicity
- ✓ SAFETY

CONS:

- ✓ FAA Licensure
- ✓ **FAA Regulations**



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Results

Compared to traditional, vessel-based investigation:

PROS:

- ✓ Quality
- ✓ Efficiency
- ✓ Simplicity
- ✓ SAFETY

- Probably MORE wind-capable
- But, precipitation & visibility are concerns

CONS:

- ✓ FAA Licensure
- ✓ FAA Regulations
- ✓ **Different Wx Windows**

TERRASOND

Results

Compared to traditional, vessel-based investigation:

PROS:

- ✓ Quality
- ✓ Efficiency
- ✓ Simplicity
- ✓ SAFETY

CONS:

- ✓ FAA Licensure
- ✓ FAA Regulations
- ✓ Different Wx Windows
- ✓ **Training & Procedures**

TERRASOND

Results

Compared to traditional, vessel-based investigation:

PROS:

- ✓ Quality
- ✓ Efficiency
- ✓ Simplicity
- ✓ SAFETY

CONS:

- ✓ FAA Licensure
- ✓ FAA Regulations
- ✓ Different Wx Windows
- ✓ Training & Procedures
- ✓ **More Data**

- ~ 200 GB raw
- ~ 1 TB processed (larger than the CARIS dataset)

TERRASOND

Summary / Looking Forward

- ➢ Took over 25,000 photos
- ➢ 200 km of coastline
- ➢ 700 features

- ➢ Will continue to use!
- ➢ Shoreline, scouting, documentation
- ➢ New technology

Other Possibilities:

- ➢ Full shoreline verification (with ground control)
- ➢ Bathymetry from SfM…

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Questions?

3D rendering from SfM of Unga Point ATON

TERRASOND

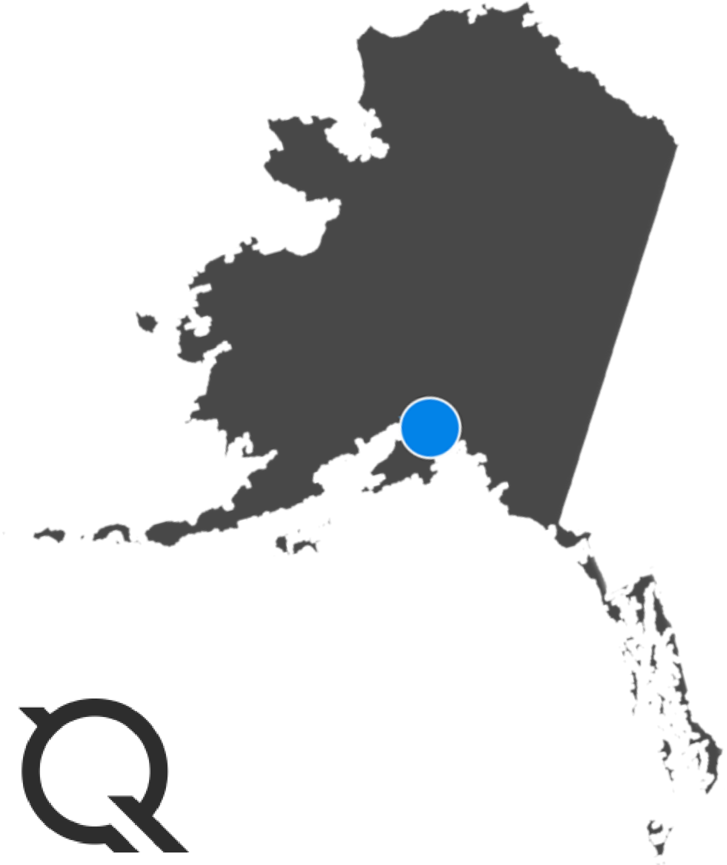
Topo-Bathymetric LiDAR – Flash Talk

Alaska Coastal Mapping Summit

Russell Faux
faux@quantumspatial.com
Friday, Feb 9, 2018

Who We Are

Mission: Deliver actionable intelligence & geospatial analytics to those who want to map, model and manage their world.

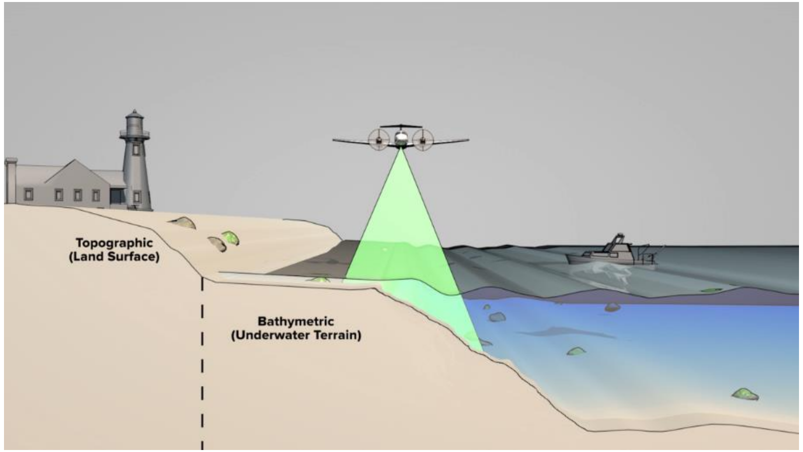


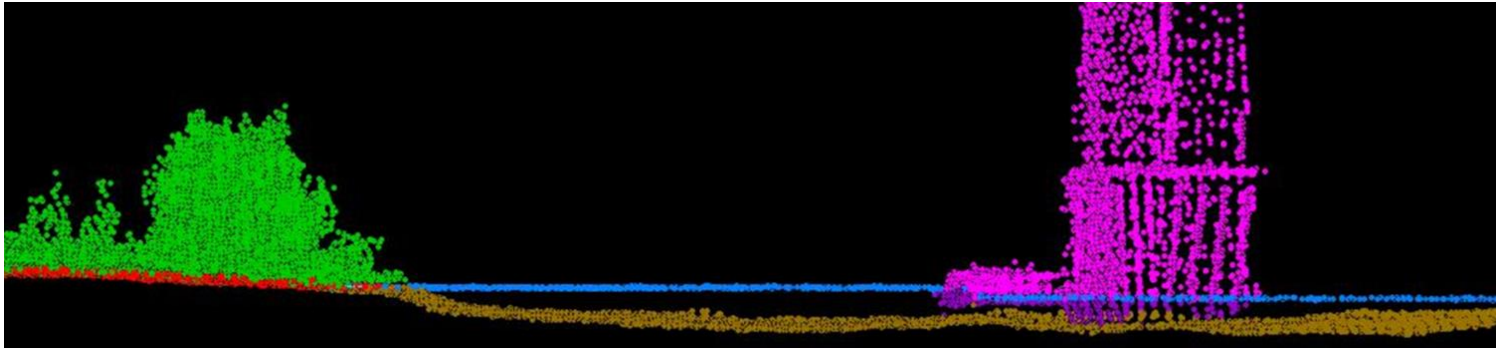
Topo-bathymetric LiDAR

Extending the Survey Under Water

Green wavelength LiDAR

Captures both near shore terrain and shallow water environments

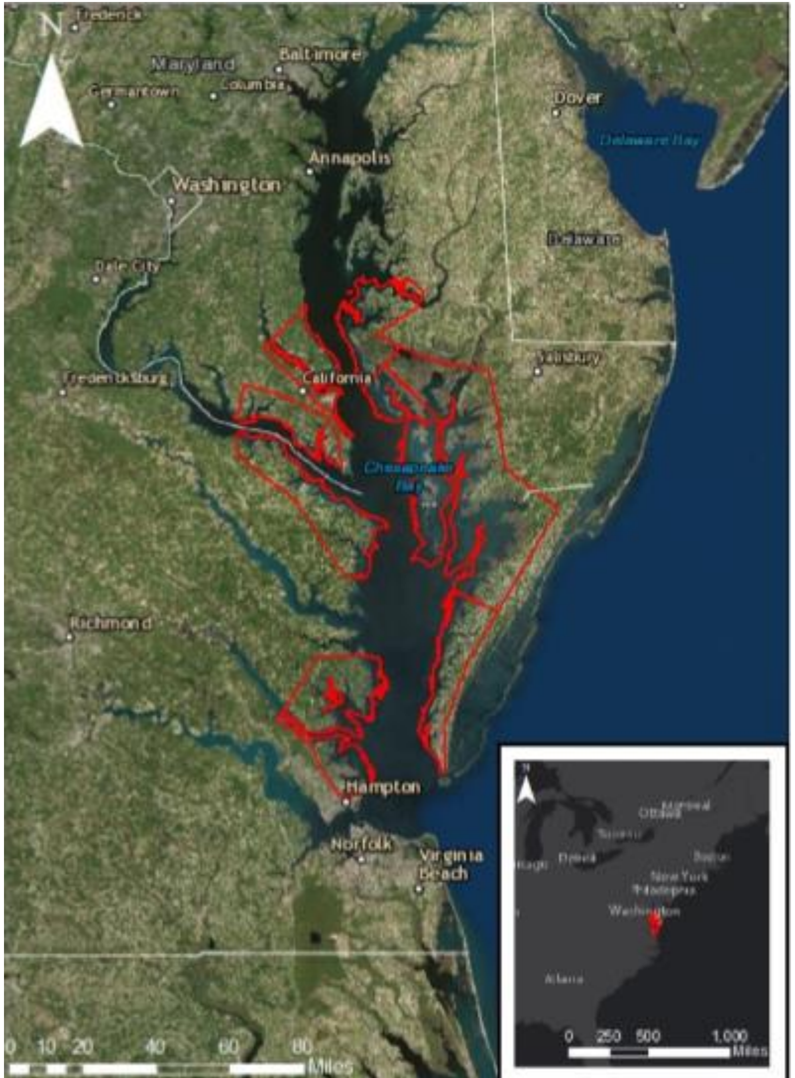




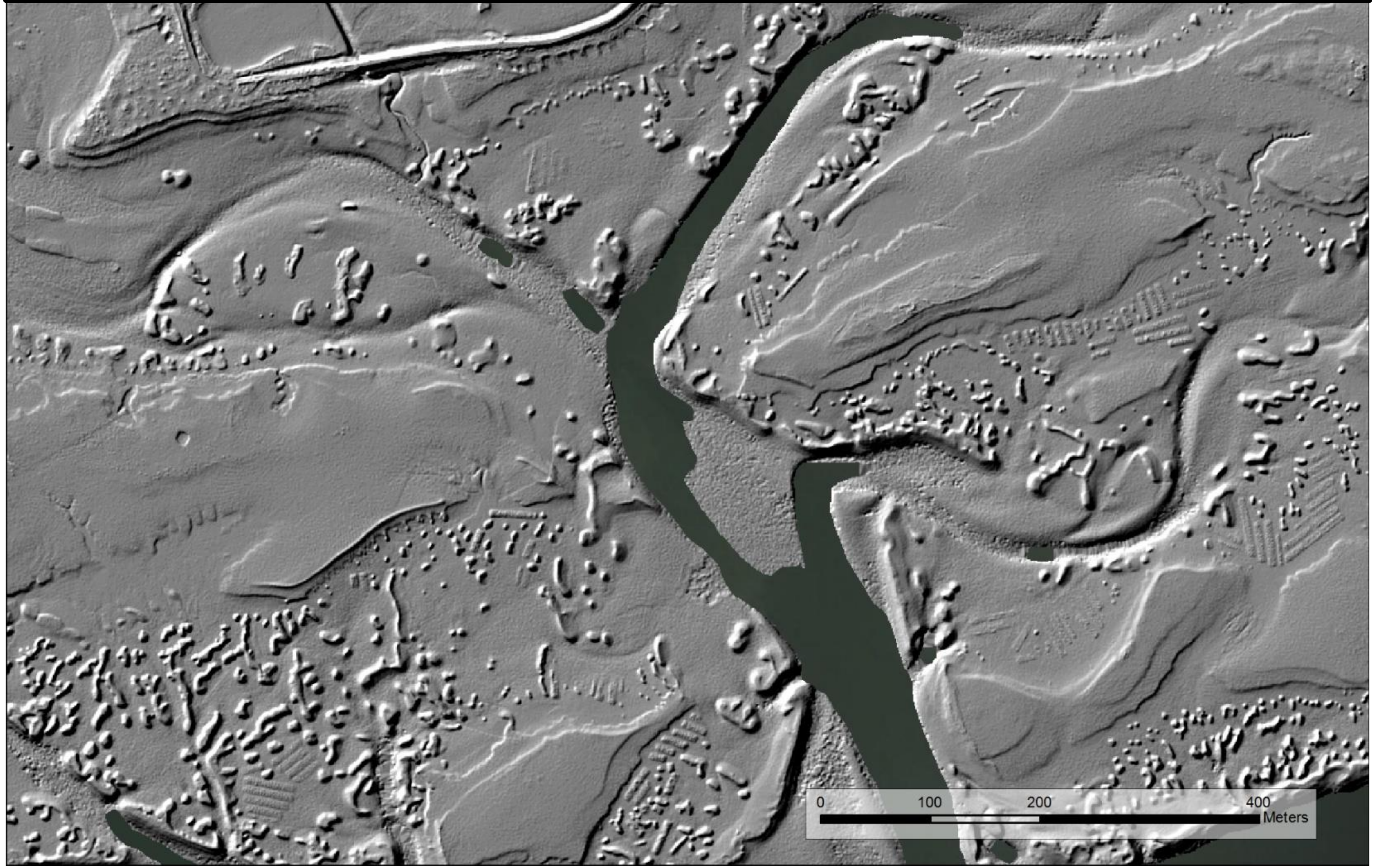
- High Pulse Rate (up to 550 kHz)
- Full waveform w/ every pulse
- Online waveform digitizing
- 1.5 Secchi Depth “depth rating”
- Selectable beam divergence
- Short pulse length

Coastal Mapping with Topo-bathymetric LiDAR

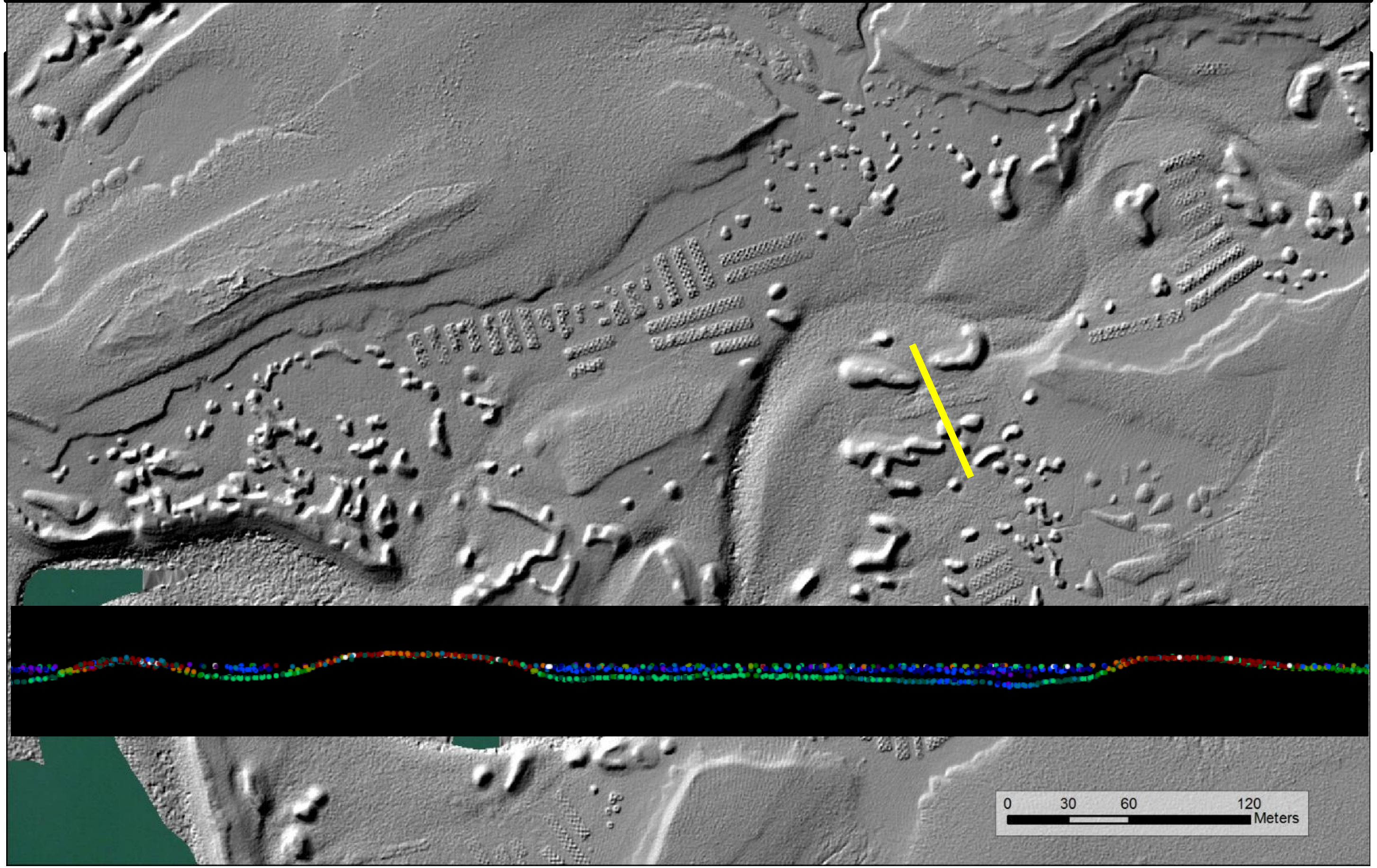
- Chesapeake Bay, MD - 450 sq. miles
  (NOAA 2018 – Phase I)
- Willamette River, OR – 170 sq. miles
  (JABLTCX 2017)
- Kootenai River, ID – 34 sq. miles
  (USGS CONED, 2017)
- Coastal South Carolina – 800 sq. miles
  (NOAA 2016/2017)
- Hurricane Sandy – 2,773 sq. miles
  (NOAA 2013/2014)



Back bay marshes and mudflats behind Kiawah Island, SC : **2016 NOAA NGS topobathy lidar**

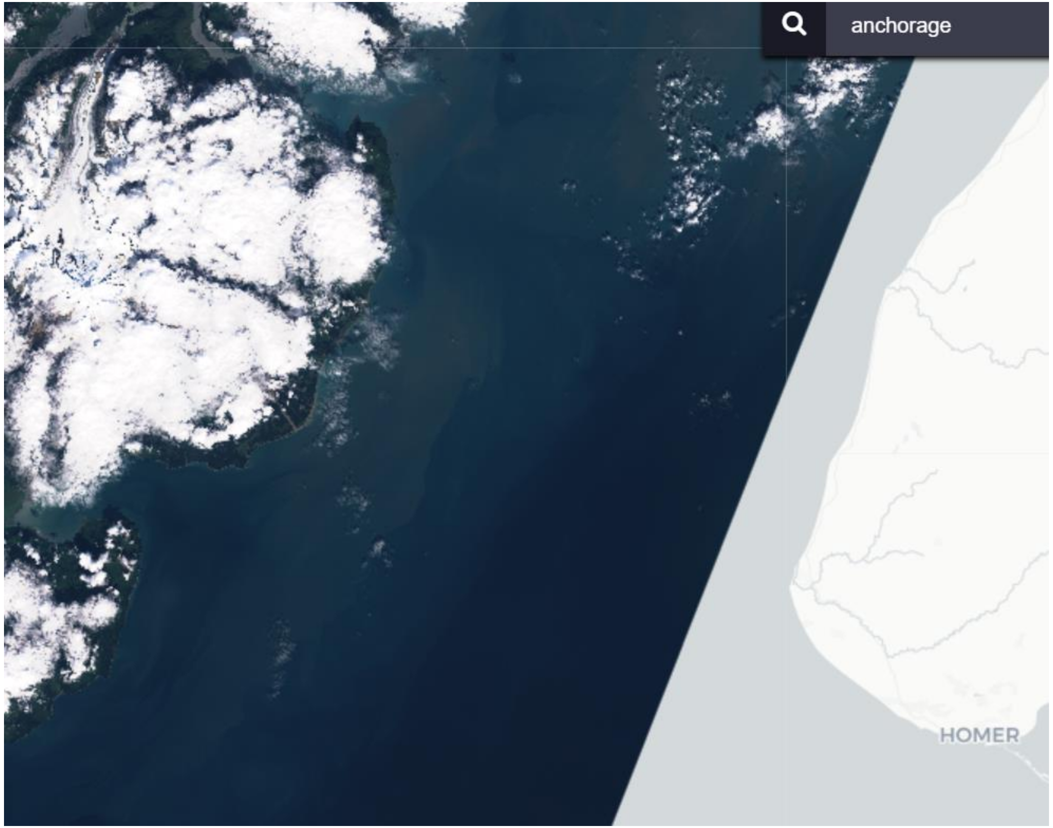


Back bay marshes and mudflats behind Kiawah Island, SC : **2016 NOAA NGS topobathy lidar**



Alaska Considerations

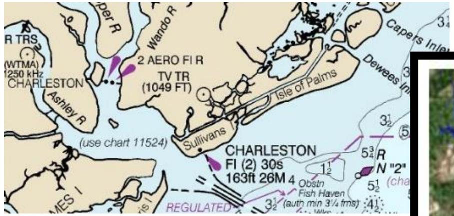
- 33,904 miles of diverse shoreline
- Short data collection season
- Variable water clarity conditions
- Fewer monitoring resources – including satellite data
- Remote locations and bad weather



How it helps

Safety of Navigation &

Foundation for sound decision making



Safety of Navigation

Up-to-date Nautical Charts

Contributing Partners

NOAA NGS, NOAA OCS

Sea Level Rise Viewer

View potential impacts of sea level rise along the coast

Contributing Partners

NOAA OCM

Riverine Flood Inundation Maps

View riverine flood forecasts in a visual format

Contributing Partners

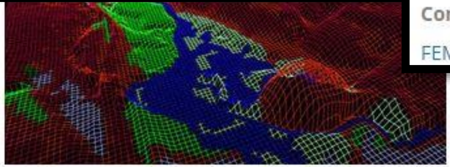
FEMA, NOAA NWS, NOAA OCM, USACE, USGS

Digital Shoreline Analysis System

Computes the rate of shoreline change using multiple historical shoreline positions

Contributing Partners

USGS

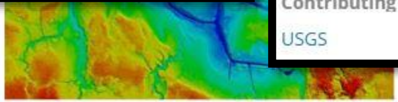


Sea Level Affecting Marshes Model

Simulates potential impacts on wetlands and shorelines from long-term sea level rise

Contributing Partners

EPA, Warren Pinnacle Consulting



VDatum

Vertically transforms geospatial data between a variety of tidal, orthometric, and ellipsoidal datums

Contributing Partners

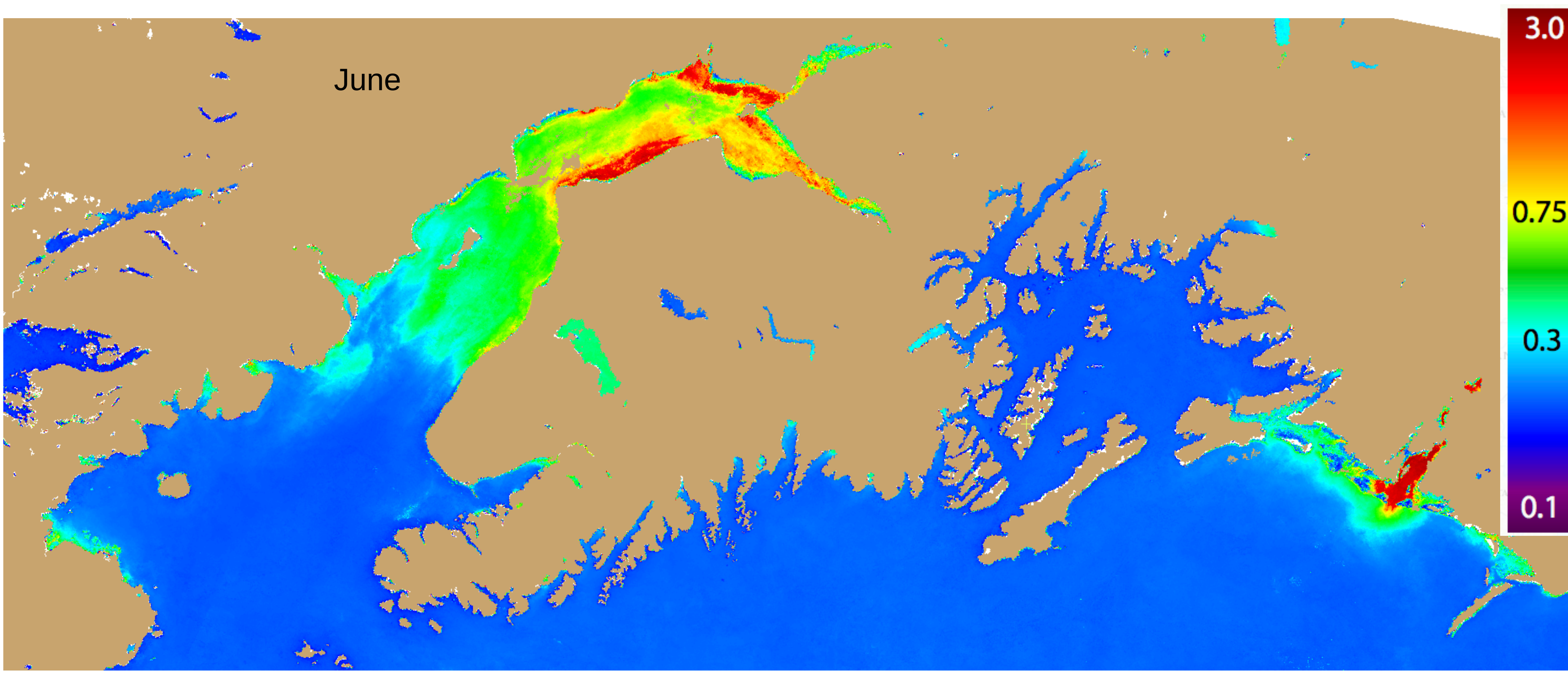
NOAA CO-OPS, NOAA NGS, NOAA OCS

Thank You

faux@quantumspatial.com

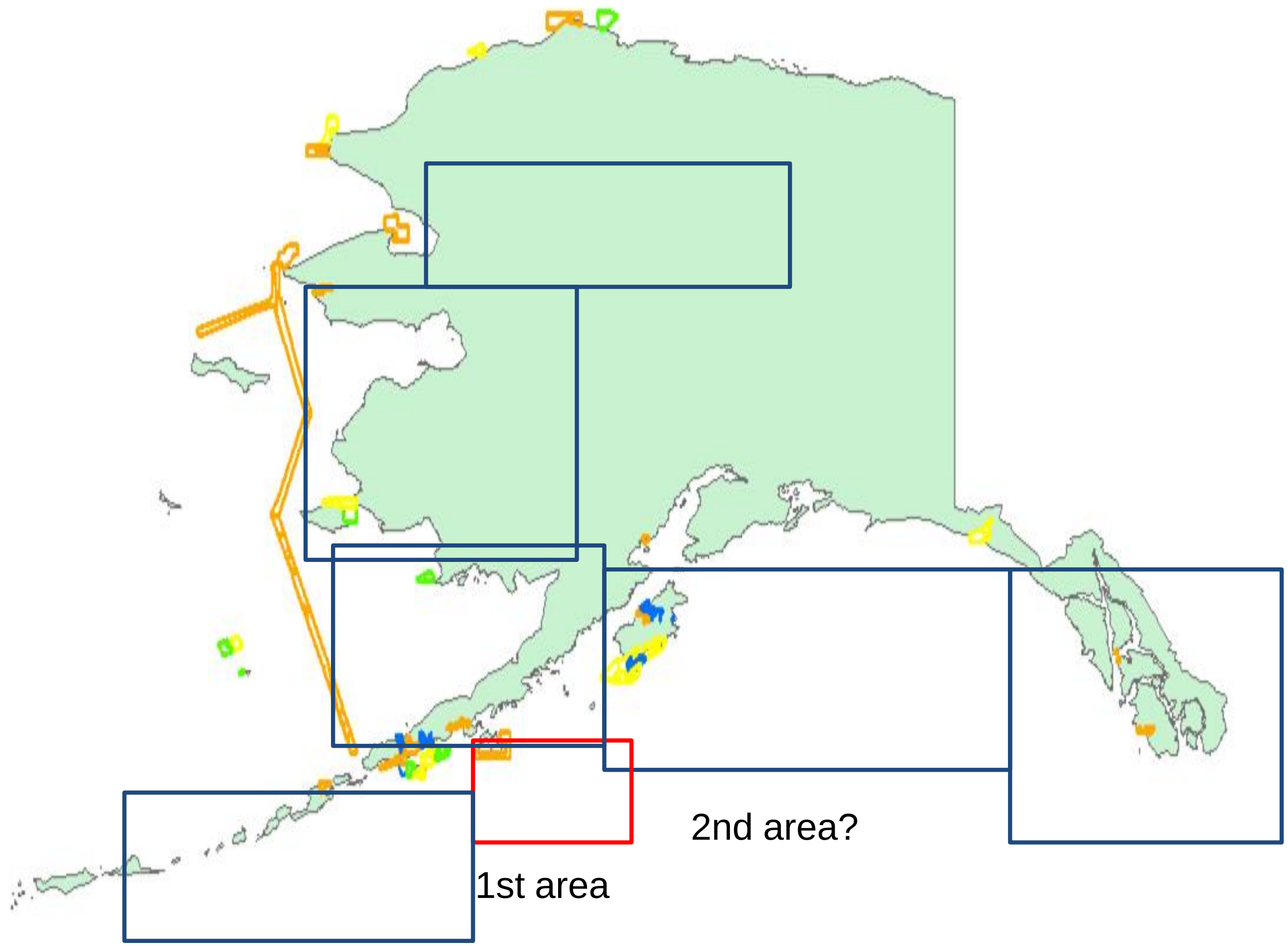
Coastal Water Clarity in Alaska

Rick Stumpf, NOAA National Ocean Service
Natl Centers for Coastal Ocean Science, Maryland

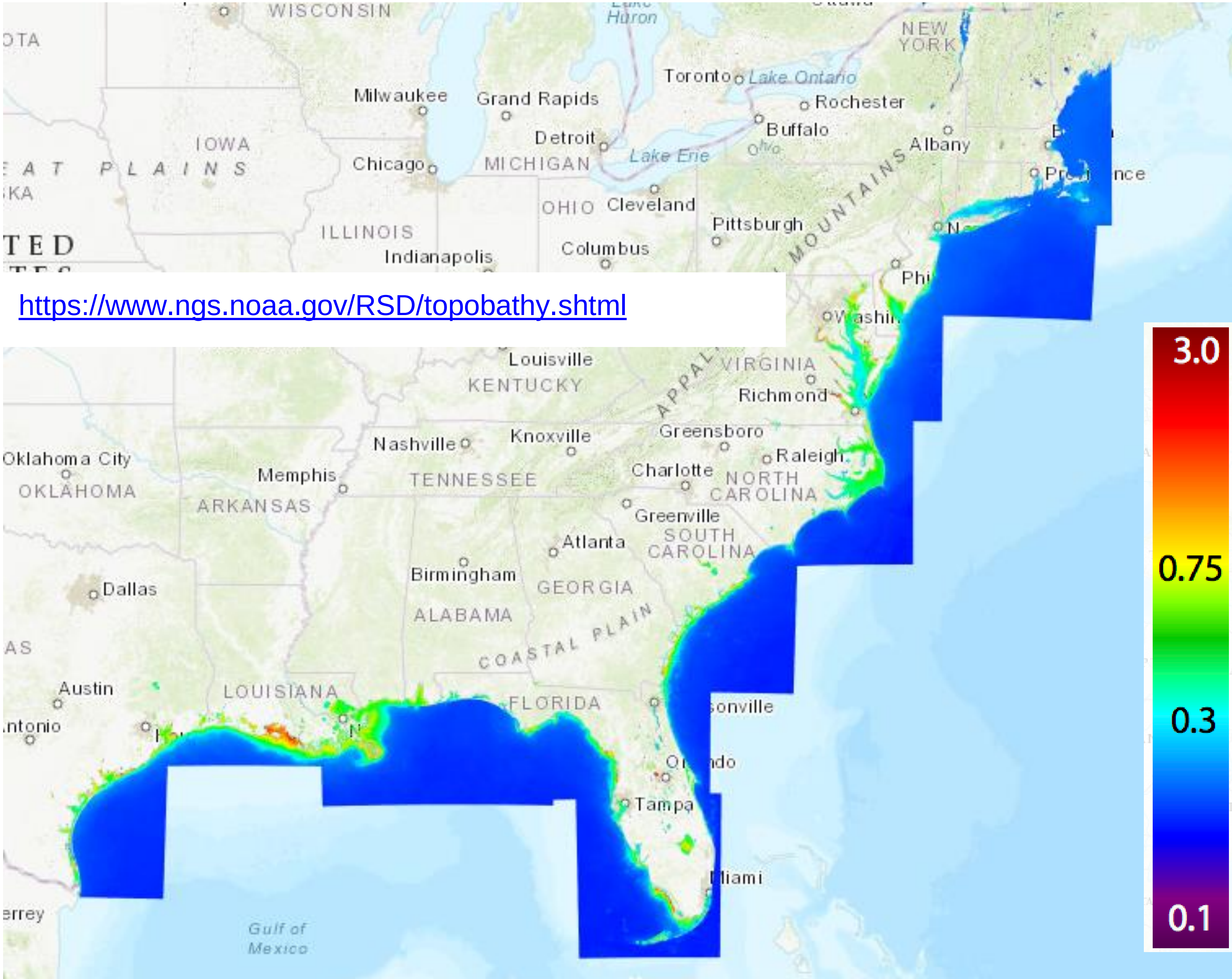


What are NGS/OCS's needs?

- Barrow
- Point Hope
- Etolin Strait
- Pribilof
- Aleutians
- Kodiak

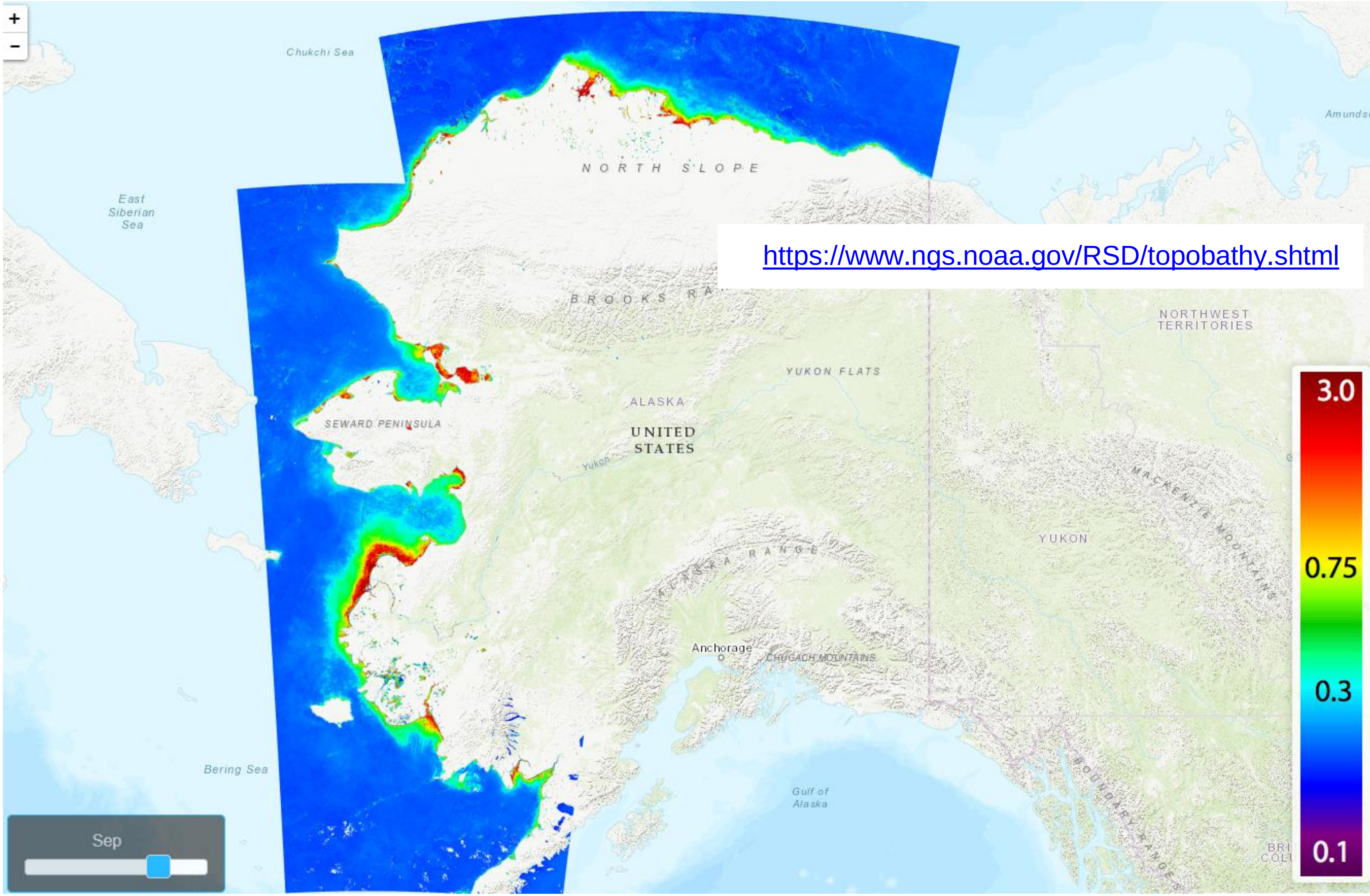


Light Attenuation Climatology for US

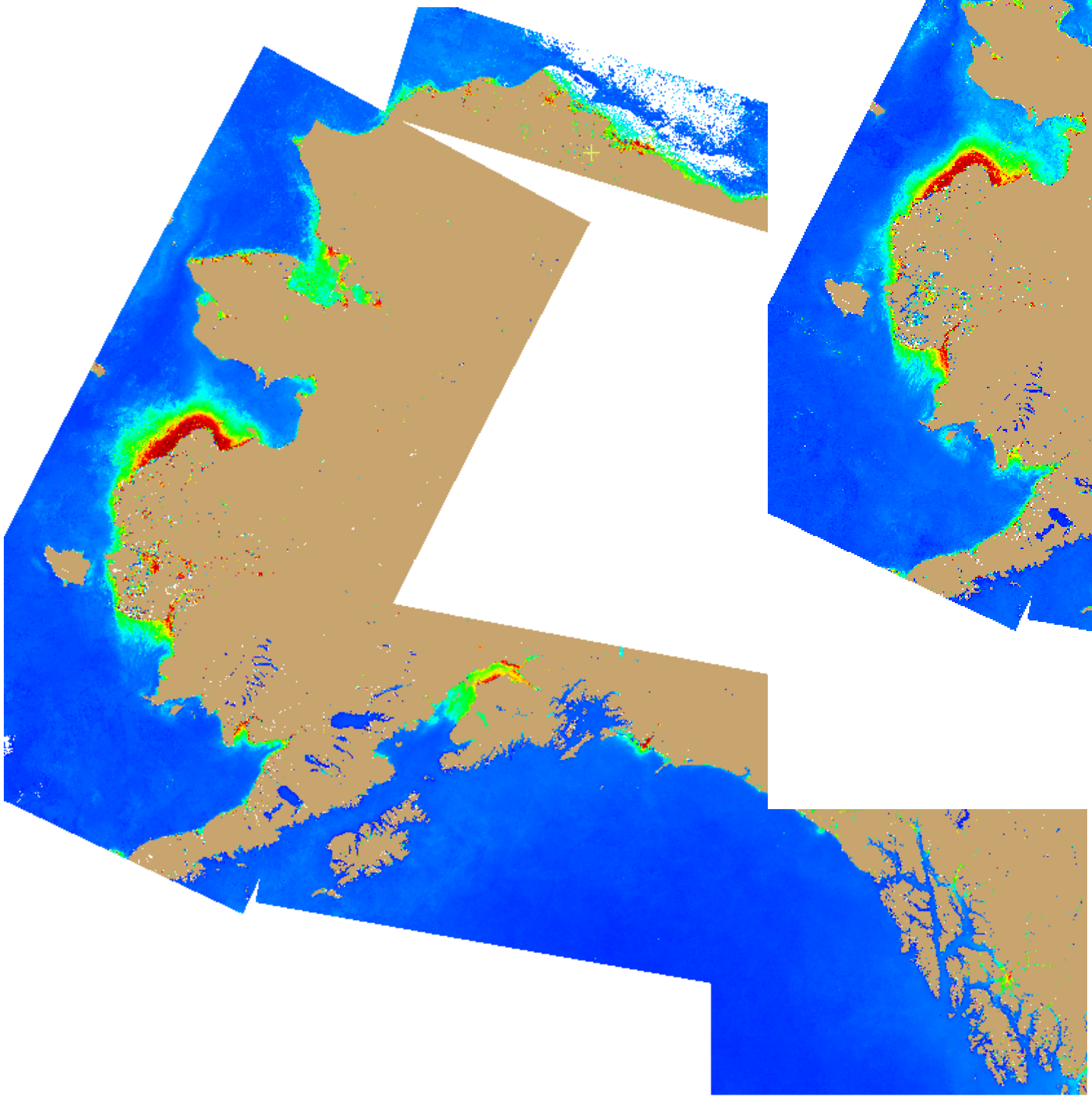


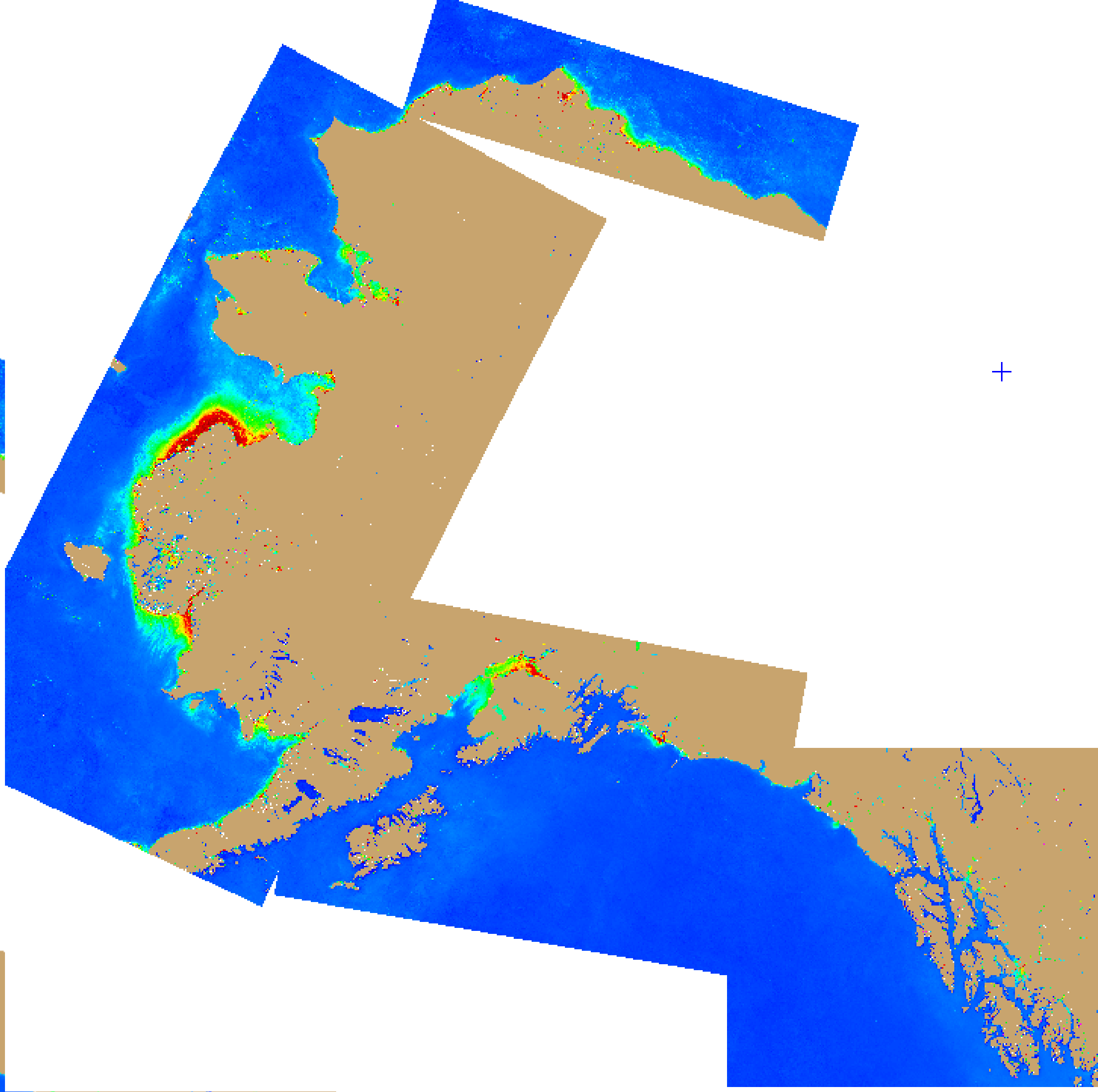
https://www.ngs.noaa.gov/RSD/topobathy.shtml

Climatology for U.S. and Alaska

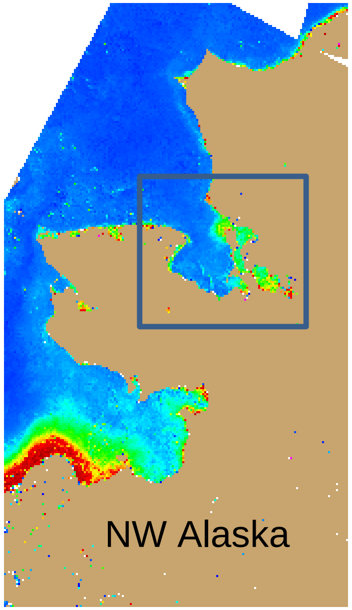


Alaska Kd climatology

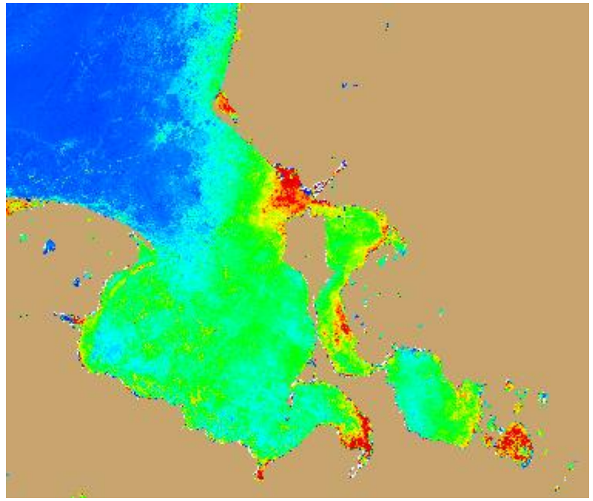




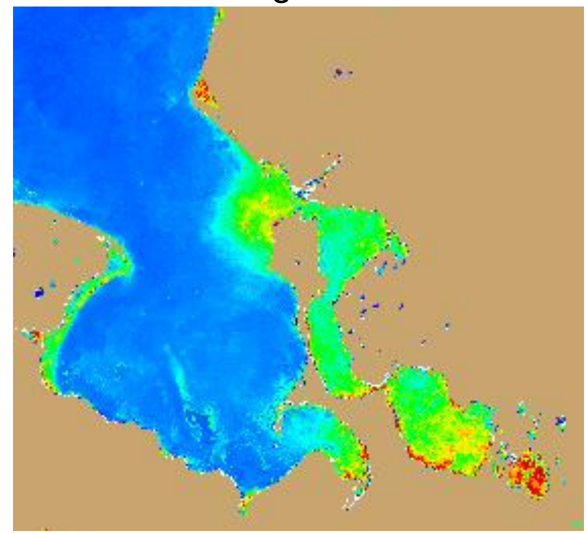
Changes over season, multi-year climatology



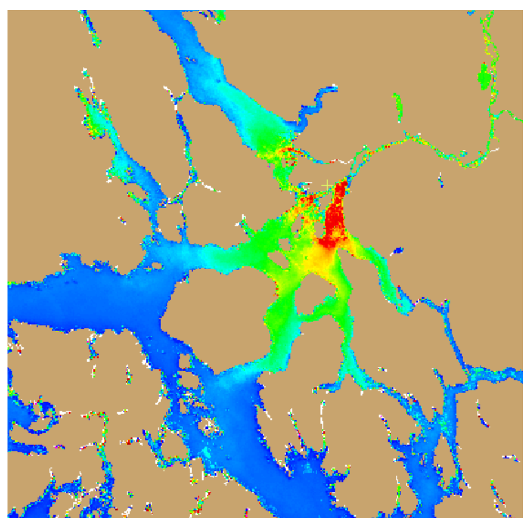
Kotzebue Bay June



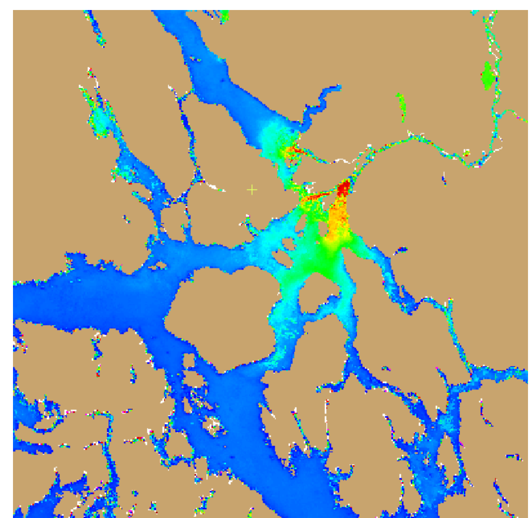
August



Wrangell June



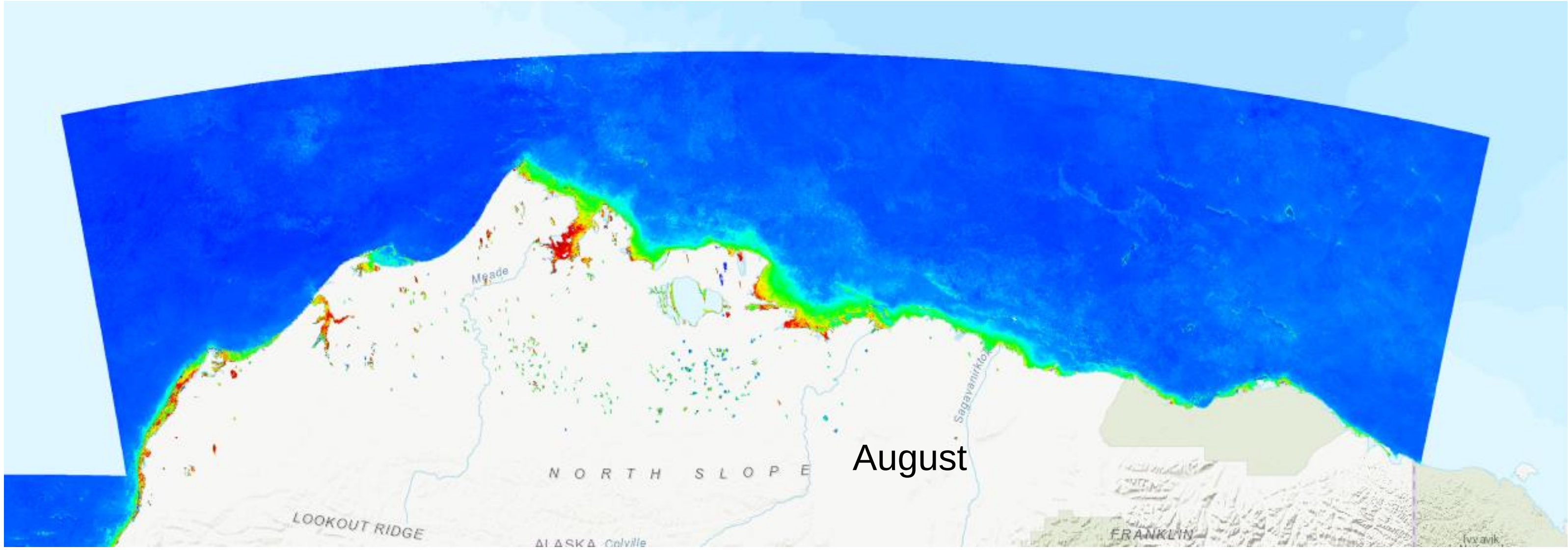
August



What are the products?

- Georeferenced products
  - 300m resolution
  - UTM projection
  - light attenuation (estimate of water turbidity)
  - Grand means/medians for each month
    - Also each year (although clouds/ice can be a problem)

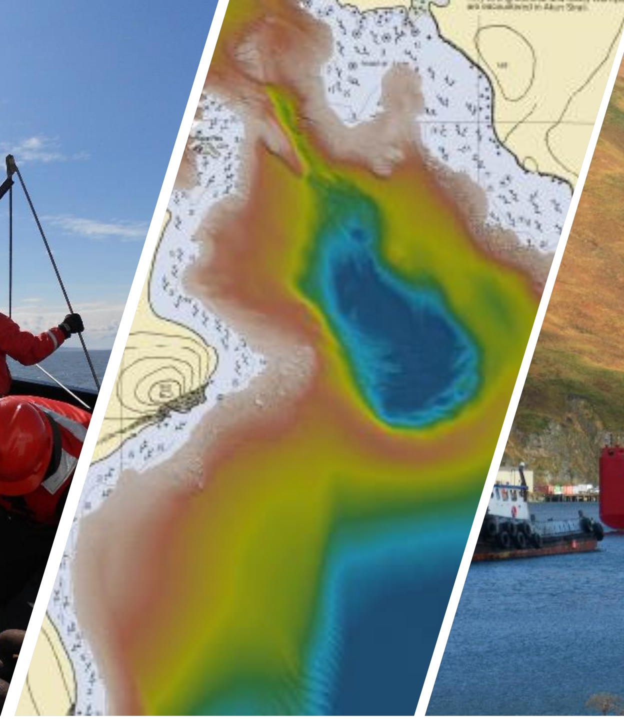
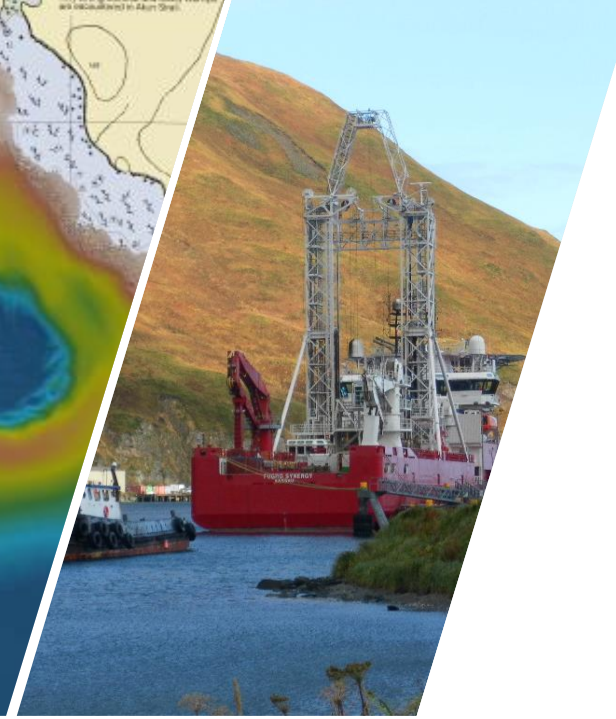
https://www.ngs.noaa.gov/RSD/topobathy.shtml



Technology Integration for Coastal Mapping Success

2018 Alaska Coastal Mapping Summit

We are Fugro

We collect data on topography, soil composition and environmental conditions, both on and offshore. We organize the acquired data and add value through processing, interpretation and visualization.


33,904 miles of shoreline

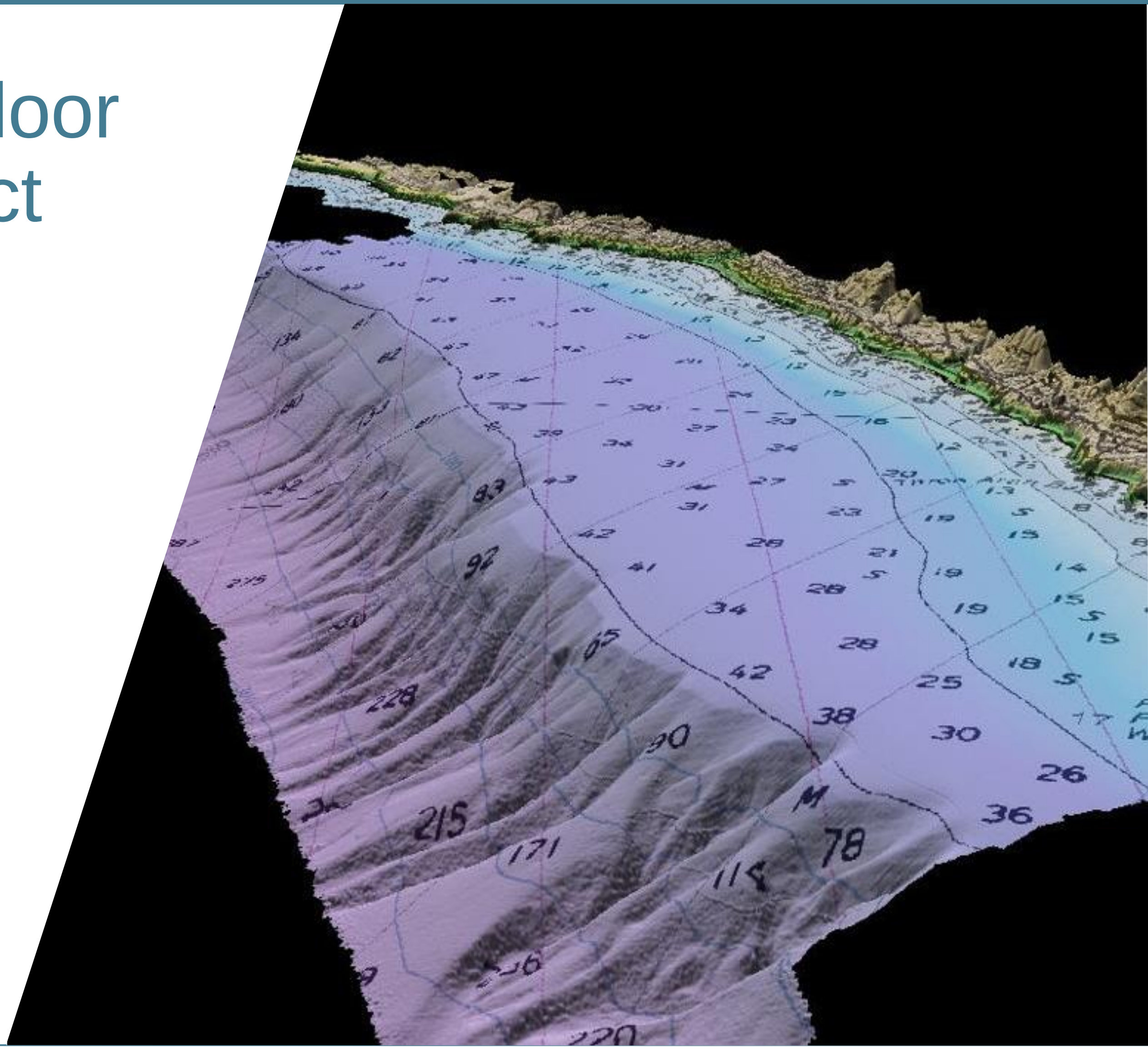
Coastal mapping requires multiple types of data:

- Nearshore
- Shoreline
- Coastal elevation

It’s been done elsewhere

California Seafloor Mapping Project

- Multi-year effort made possible through a partnership model
- Dedicated to producing high-resolution geologic and habitat base maps for all CA waters while also updating nautical charts
- Benefitted multiple stakeholder groups



Largely uncharted territory

- Extreme weather
- Remote locations
- Short field season
- Limited tide/base stations

Integrated technologies offer time, cost, and safety benefits

- **Vessel:** multibeam echosounder (MBES)
- **Aircraft:** airborne lidar bathymetry (ALB)
- **Satellite:** satellite-derived bathymetry (SDB)

Multibeam echosounder (MBES)

Overview

Data resolution is dependent on the distance from the sensor to the seafloor. Coverage is typically 3-5 times the water depth. Works in turbid water.

Applications

- Nautical charting
- Infrastructure planning and inspections
- Dredging and volume computations
- Habitat classification
- Rate of change tracking

Experience

- Recently collected more than 1 million km² of high resolution bathymetry data per year in shallow and deep waters globally
- Extensive AK experience for public- and private-sector clients; NOAA charting projects dating back to 1999
- First company to deliver high-resolution seabed imagery from MBES backscatter for NOAA

Airborne lidar bathymetry (ALB)

Overview

Depending on water clarity, seabed type, and weather conditions, ALB maps in water depths of up to 70 meters.

Applications

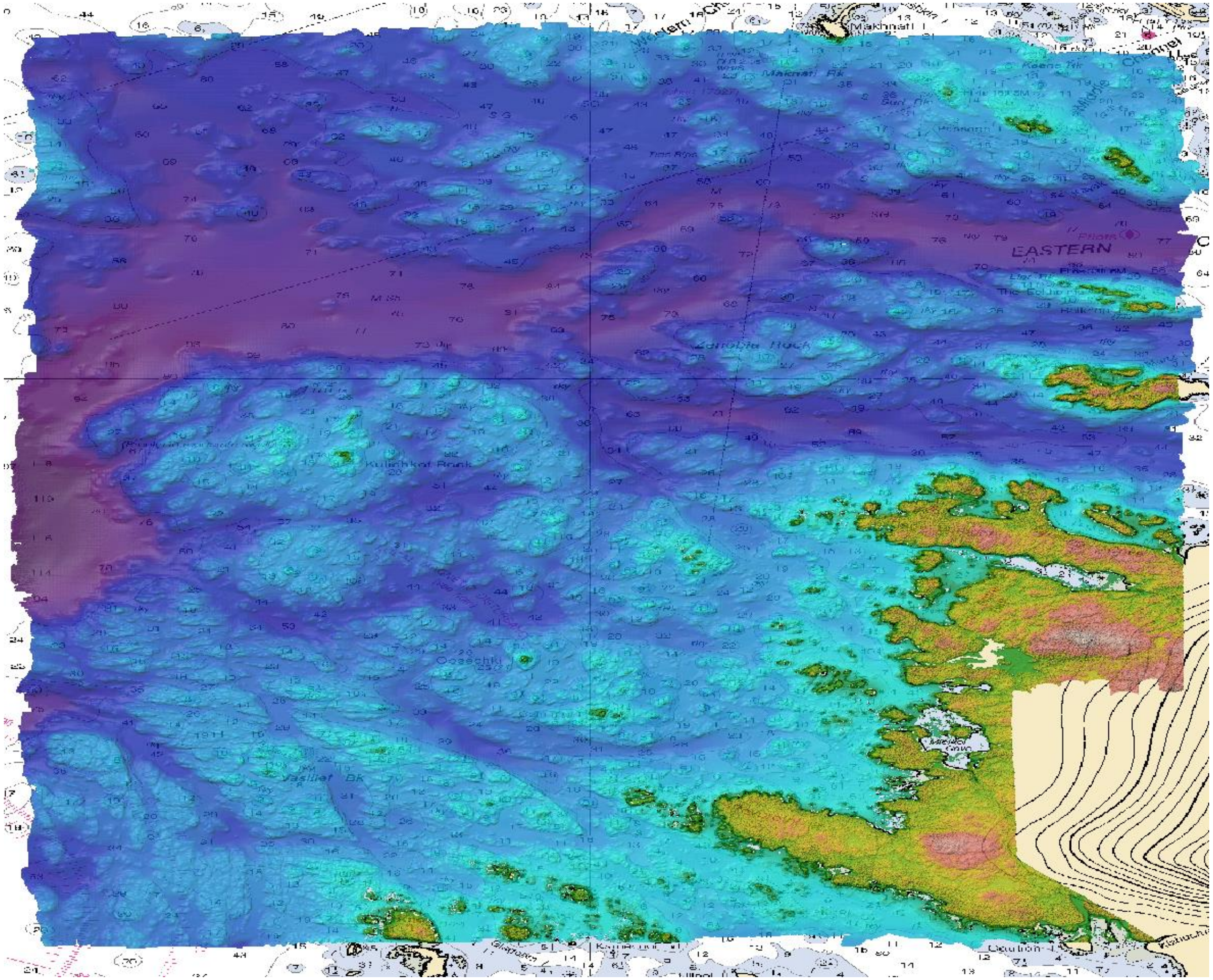
- Nautical charting
- Coastal zone management
- LOS/EEZ mapping
- Infrastructure planning and inspections
- Habitat mapping
- Rate of change tracking

Experience

- 25 years experience; 500+ ALB projects worldwide
- Multiple ALB projects in Alaska for NOAA
- First company to deliver ALB services to USACE, NOAA, and NAVO
- First company to use ALB for charting in the US
- First company to deliver ALB reflectance imagery
- First company to integrate ALB with MBES and topo lidar

Example: Combined topo lidar, ALB, and MBES

Sitka, Alaska
2004



Satellite derived bathymetry (SDB)

Overview

In optimal conditions, our SDB capabilities offer a vertical accuracy of 10-15% water depth, in depths up to 35 meters. Offers fast delivery of large, homogenous datasets.

Applications

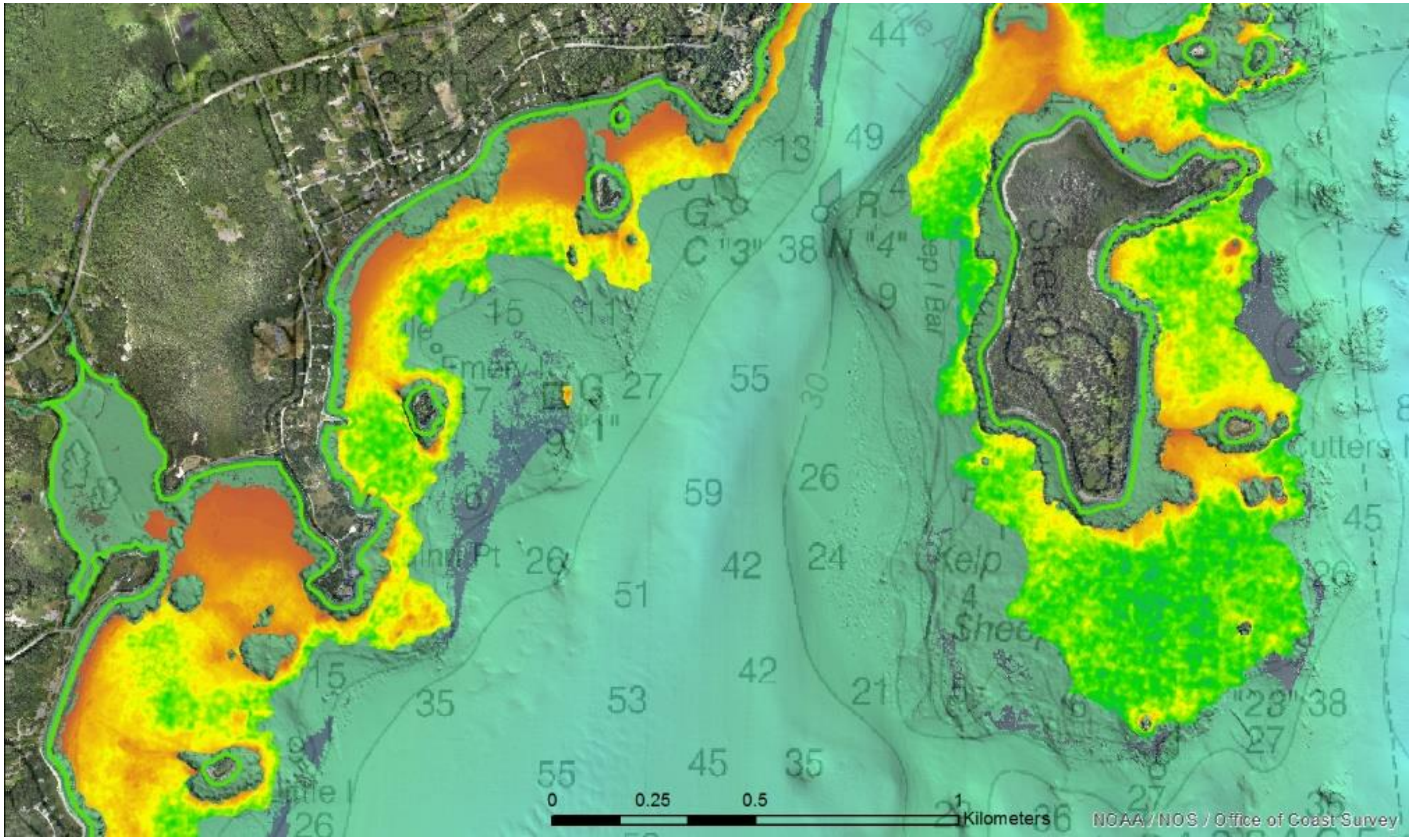
- Coastal zone mapping
- Reconnaissance for high-resolution surveys
- Environmental assessments
- Environmental impact statements
- Seabed classification
- Change detection (erosion/accretion)

Experience

- 2015 teaming agreement with EOMAP, the leading global service provider of satellite-derived aquatic information in maritime and inland waters

Example: Combined SDB, ALB, and MBES

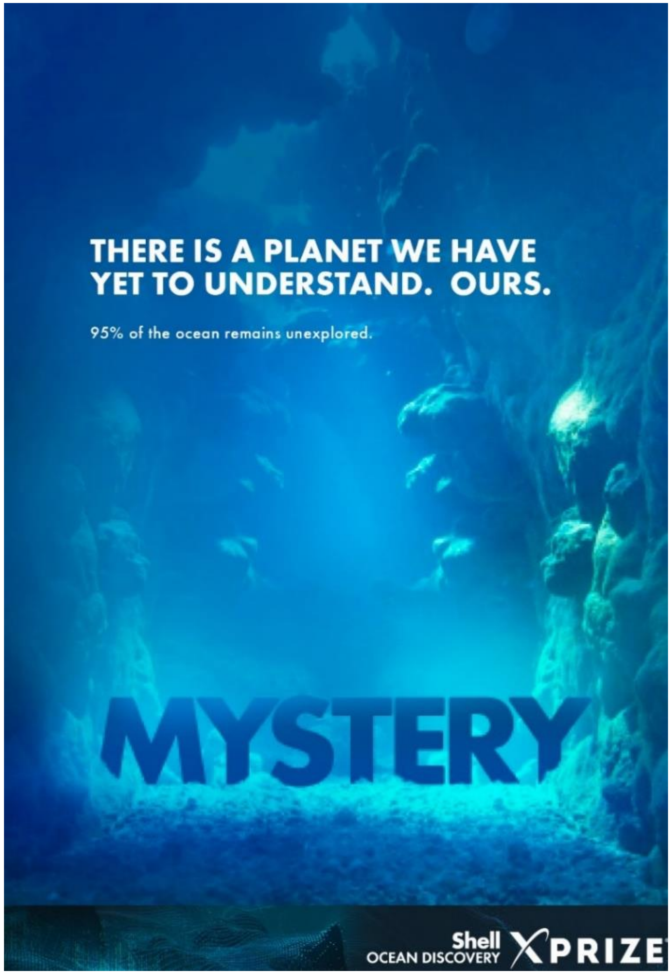
Penobscot Bay, Maine



What's next: faster, better, cheaper

Seabed 2030

Shell Ocean Discovery XPRIZE



FUGRO

5761 Silverado Way, Suite O
Anchorage, AK 99518
907 561 3478 / akprojects@fugro.com
www.fugro.com
Rada Khadjinova, Alaska General Manager

Satellite Imagery for Coastal Mapping

2018 IWG-OCM Alaska Coastal Mapping Summit
Lighting Talk
February 9, 2018

Drew Hopwood
GeoNorth Information Systems (GNIS)

Why Use Satellite Imagery for Coastal Mapping?

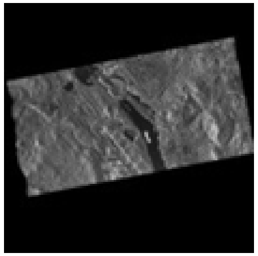
- Easy access remote locations
- Regular monitoring and repeat collections
- Year round data collection
- Weather independent
- Broad area collections
- Rapid response (emergencies, storms, etc.)

Synthetic Aperture Radar (SAR)

- Multiple acquisition modes (resolution and coverage)
- All-weather, day/night data acquisition
- Predictable collection scheduling
  - Increased revisits in high latitudes
- Precise & accurate geolocation and measurement
  - TerraSAR-X up to 1m @ CE90

TerraSAR-X Collection Modes

Staring SpotLight

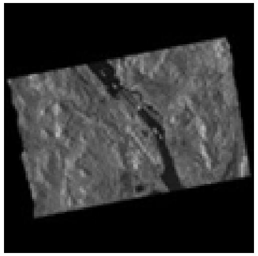


Up to 25cm resolution

Scene size depending on incidence angle, for example ~ 4km (width) x 3.7km (length) at 60°

Identification of objects

High Resolution SpotLight

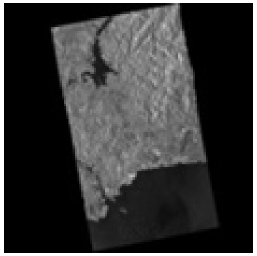


Up to 1m resolution

Scene size 5 to 10km (width) x 5km (length)

Recognition of objects (airplanes, hangars, vessels)

StripMap

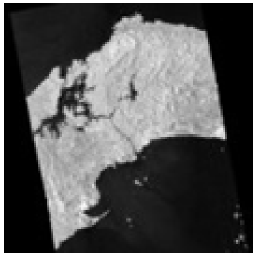


Up to 3m resolution

Scene size 30km (width) x 50km (length*)

Detection & classification and monitoring of vessels and infrastructure
Large scale mapping

ScanSAR

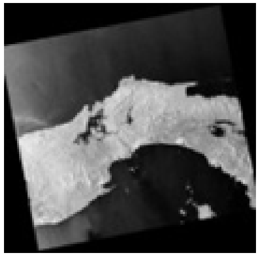


Up to 18.5m resolution

Scene size 100km (width) x 150km (length*)

Detailed maritime monitoring & detection
Small scale mapping

Wide ScanSAR



Up to 40m resolution

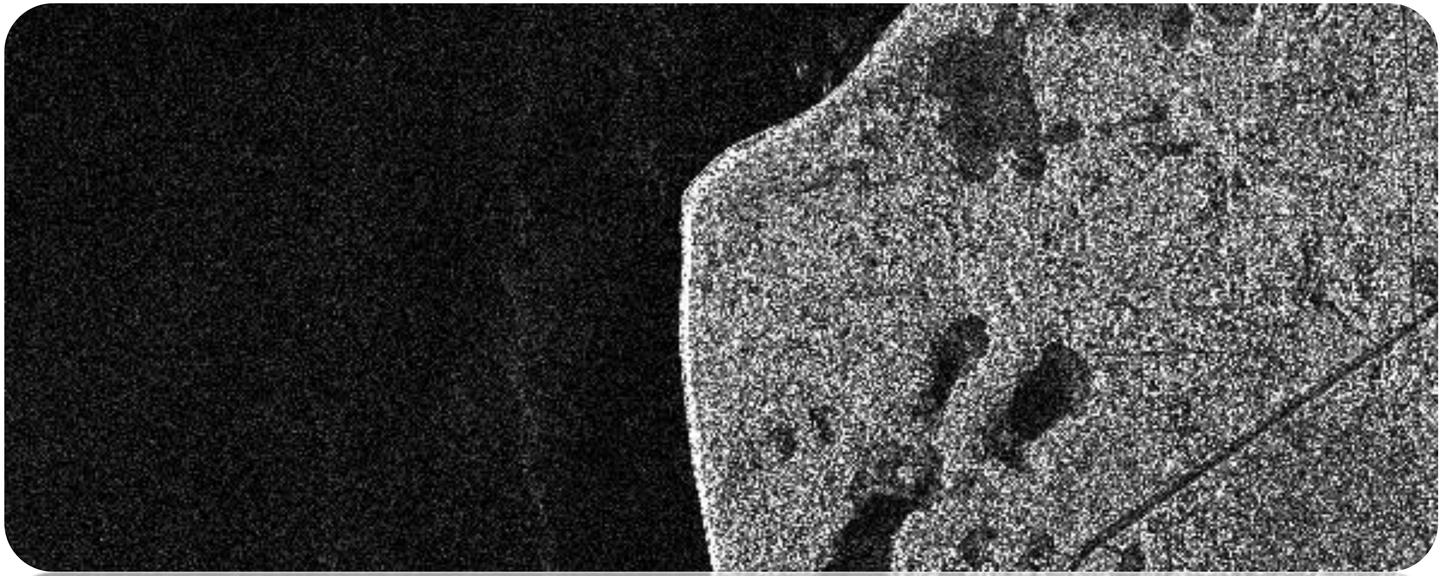
Scene size up to 270km (width) x 200km (length**)

Large area maritime monitoring of ship traffic, oil spills, sea ice

*StripMap and ScanSAR: acquisition length extendable to 1,650 km
**Wide ScanSAR: acquisition length extendable to 1,500 km

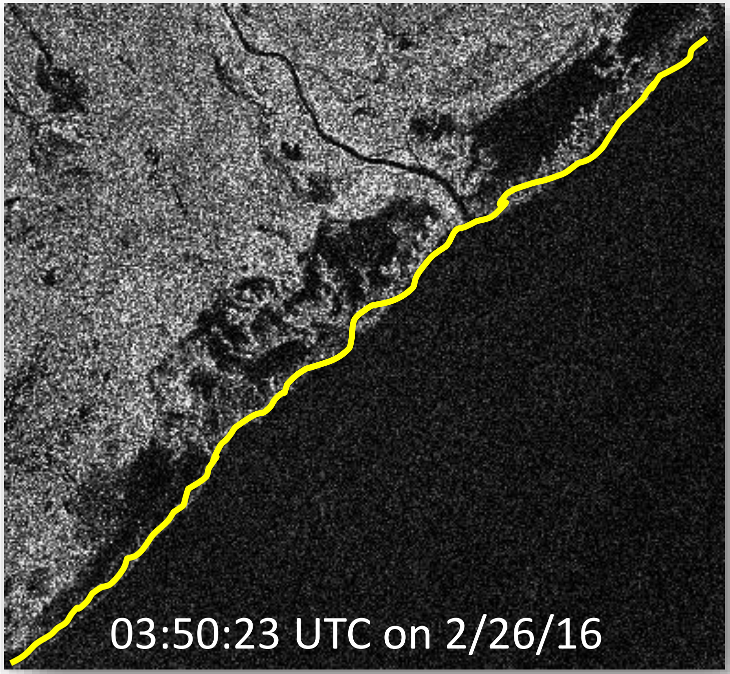
Using SAR for Coastal Mapping

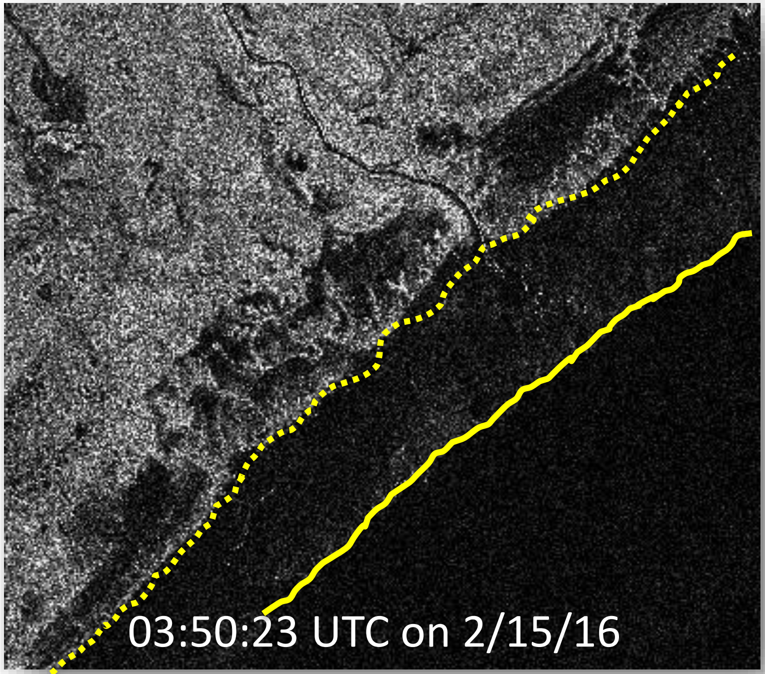
- Land/Water boundary identifiable
  - Automation is possible
- Precise & accurate geolocation and measurement
  - TerraSAR-X up to 1m (w/o GCPs)
- All season monitoring, emergency/event response



Using SAR for Coastal Mapping

- Weather independence allows collection scheduling
  - Enabling tide coordinated collections
  - Aiding field work coordination
  - Guaranteed collections to meet project timelines

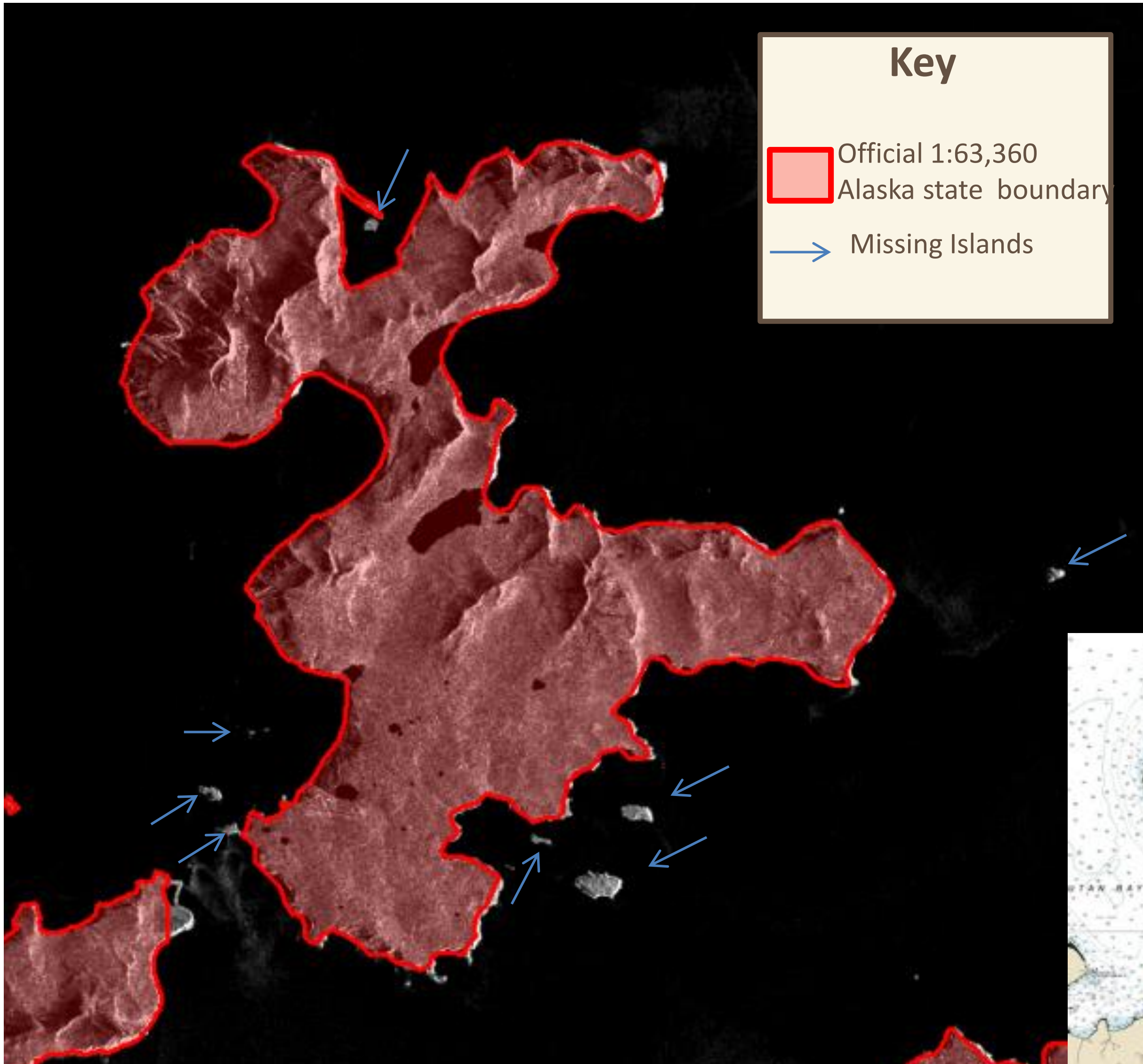




* Shoreline was traced in PPT to illustrate tidal impact on shoreline

Coastline Example

GeoNorth Information Systems



Akun Island

Several islands are missing from the 1:63k state boundary file

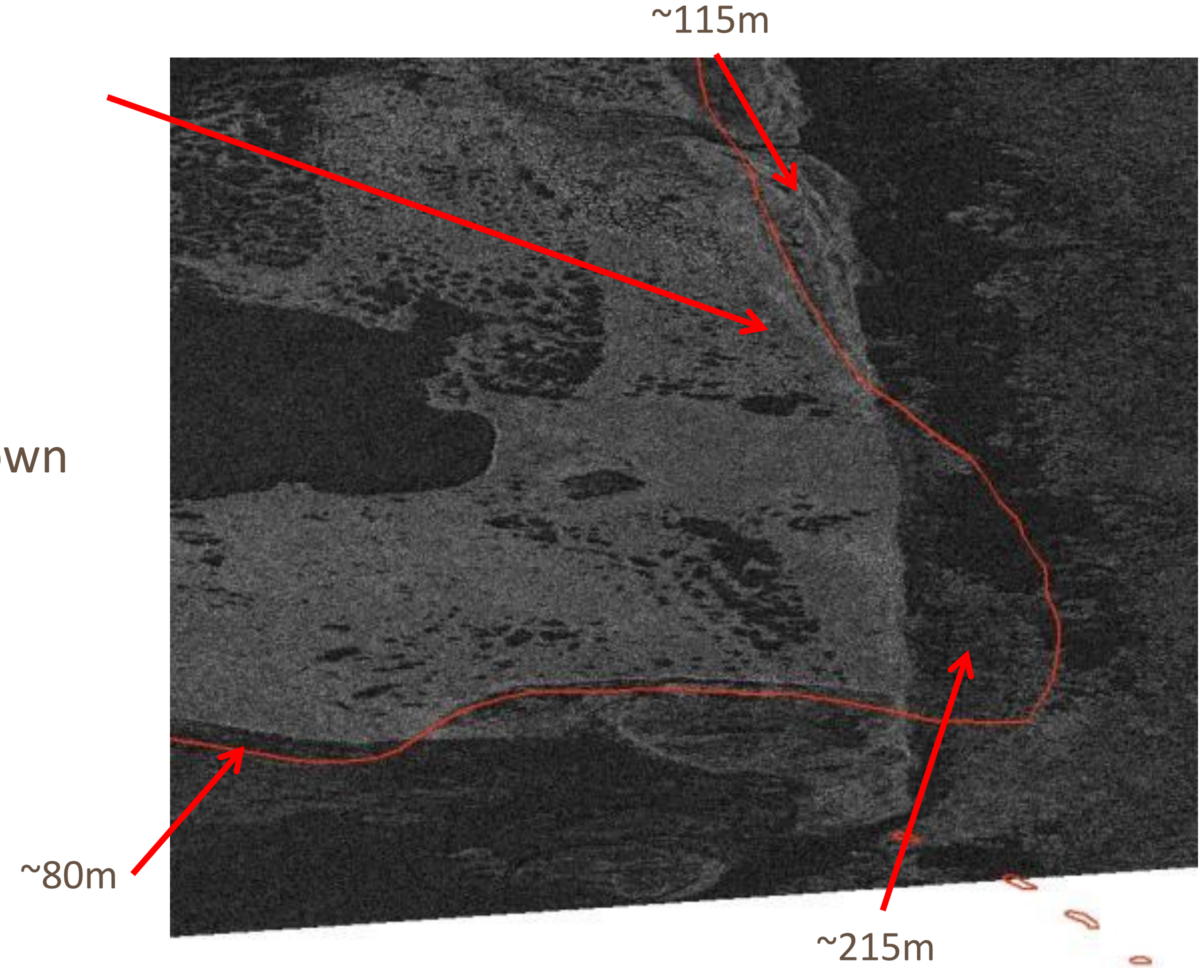
EO Advantages for Coastal Mapping

- Land/Water boundary identifiable using NIR band
- Collection of Stereo imagery
- Sub-surface capability for near shore bathymetric mapping
  - Subject to multiple environmental factors
- Source for land classification

North Slope Coastline

ENC Coastline – Chart US5AK9LM
- Scale – 1:48,767
- Edition 1.0
- Published – February 2012

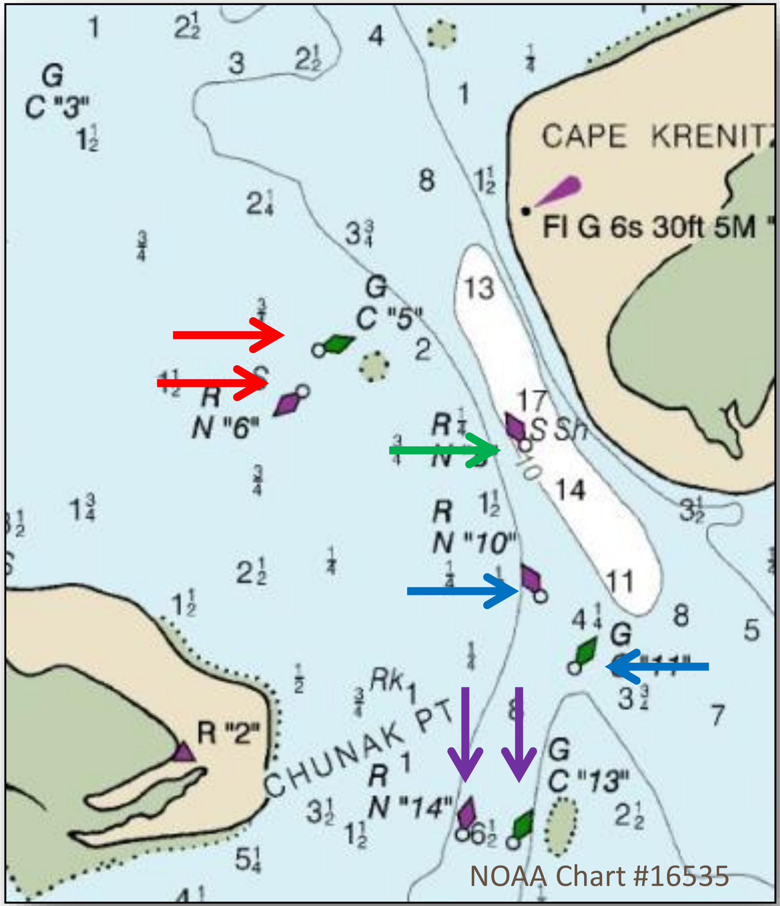
Landsat – Date Unknown
SDMI SPOT 5 – Date Unknown
Pleiades – July 2013
TerraSAR-X – June 2014
- High Resolution Mode
- VV Polarization



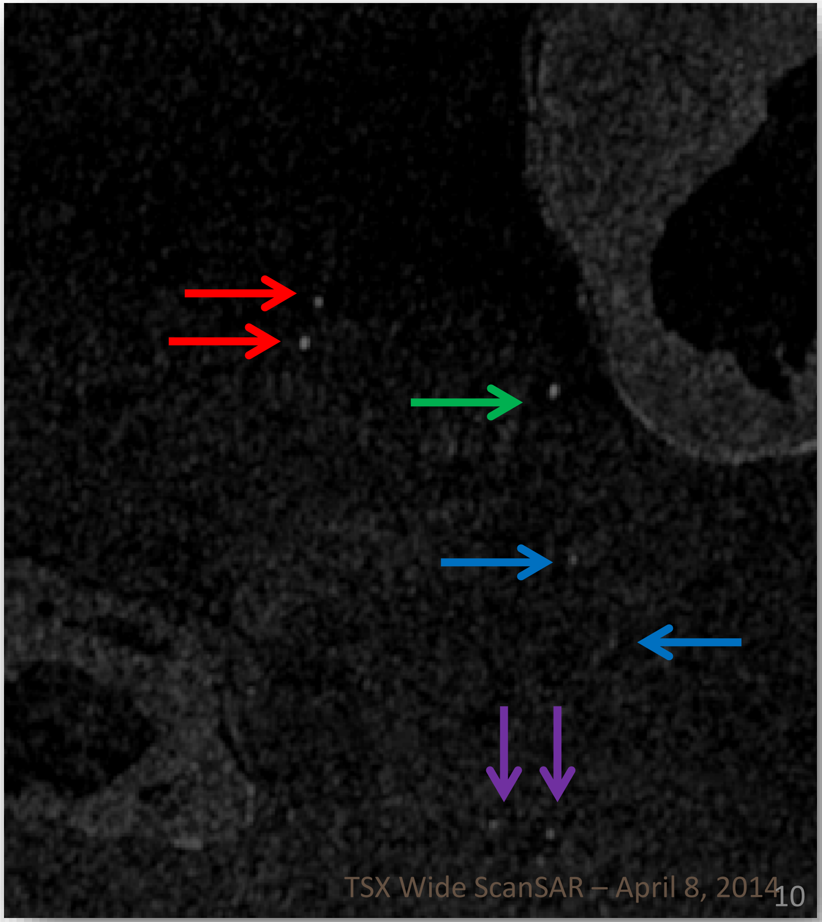
Using SAR for Monitoring Aids to Navigation

Bechevin Bay, Alaska

Locations known within 1 meters



NOAA Chart #16535



TSX Wide ScanSAR – April 8, 2014

Access to GNIS Services

- GNIS prime contract with Army Geospatial Center (AGC) – Imagery Office (IO)
  - Available to any USACE user
  - Includes both SAR & EO products, value-added products, DEMs, etc…
  - Responsive data collection, processing and delivery

Other Government-Wide Acquisition Contracts (GWACs)

- GSA Schedule 70: Schedule# GS-35F-0119Y
  - Term: December 20, 2011- December 19, 2021
- NASA SEWP: Schedule # NNG15SC03B (small) or NNG15SC27B (other than small)
  - *Term: May 1, 2015 - April 30, 2020*

About GNIS

- Founded in 1999
- Alaska Native-Owned Corporation (ANC) and SBA-certified 8(a)
  - A wholly-owned subsidiary of The Tatitlek Corporation
- Headquartered in Anchorage; Offices in Denver and Vienna, VA.
- 18 years IT and Geospatial Solutions
- Top Secret Facility Clearance
- Cleared Staff (TS/SCI, TS, Secret)
- USG Clients: AGC, HHS, NOAA, USGS

Questions?

Drew Hopwood
GeoNorth Information Systems (GNIS)

Tel: (907) 646-4529
Email: dhopwood@geonorthis.com

ShoreZone Coastal Imaging and Habitat Mapping in Alaska

ShoreZone

Sarah Cook RPBio
Coastal and Ocean Resources
sarah@coastalandoceans.com

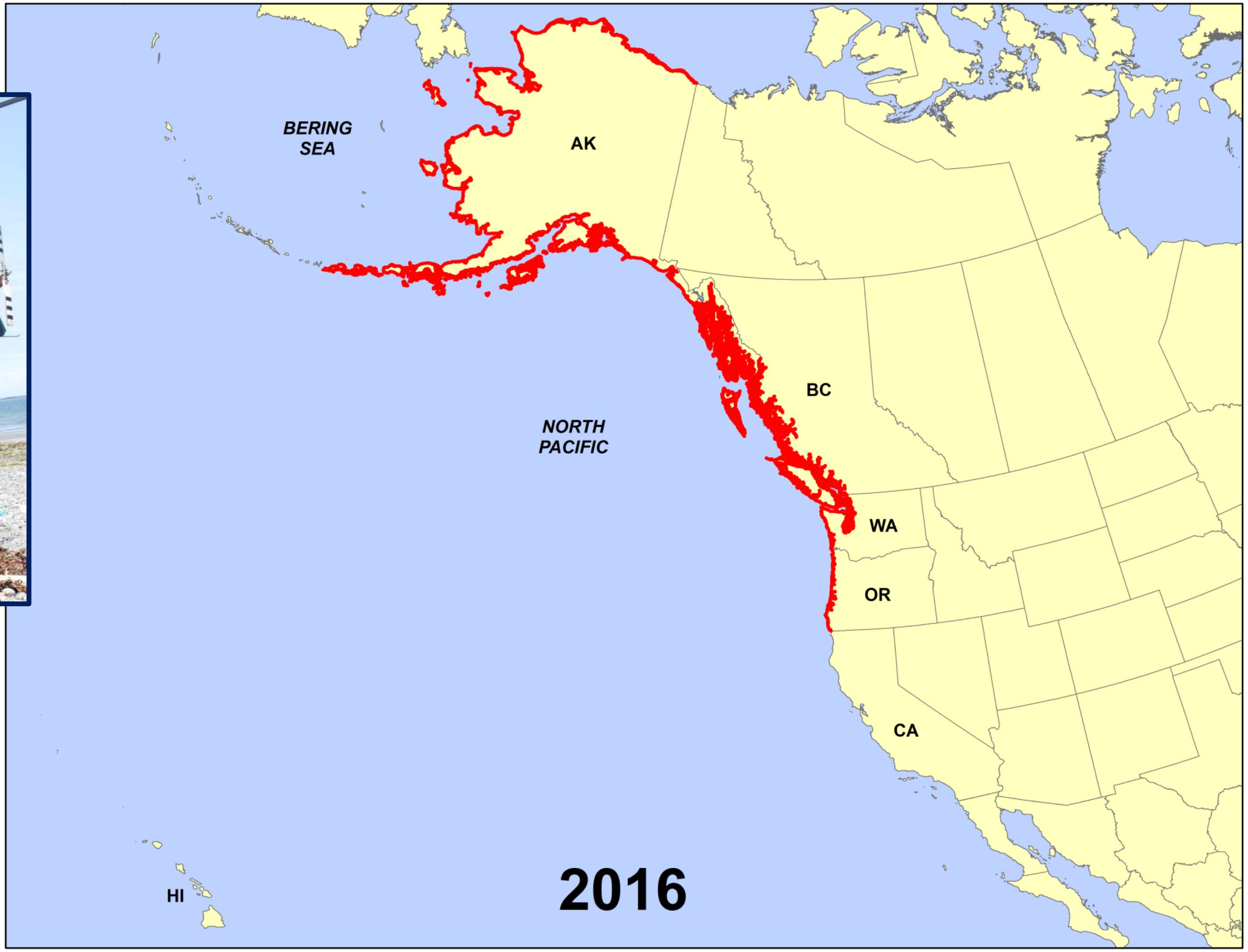
Alaska Coastal Mapping Summit, February 9th, 2018

What is ShoreZone?



A standardized coastal imaging and habitat mapping system that characterizes physical and biological attributes of the shoreline in a searchable, georeferenced database.

Where is ShoreZone?



How to Access ShoreZone

NOAA ShoreZone Website

https://alaskafisheries.noaa.gov/habitat/shorezone

TNC ShoreZone Website

https://www.ShoreZone.org

AOOS Portal

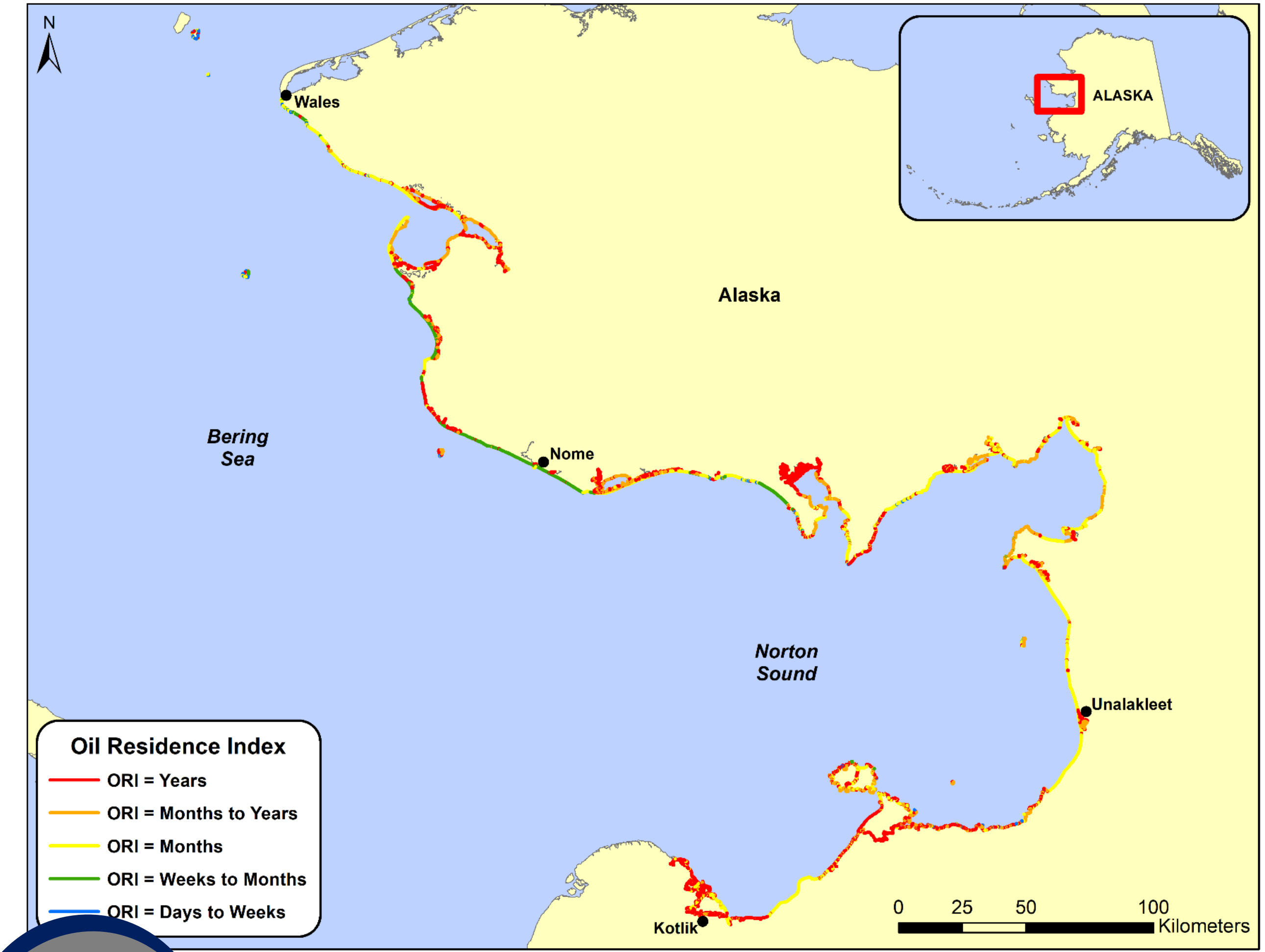
Arctic ERMA

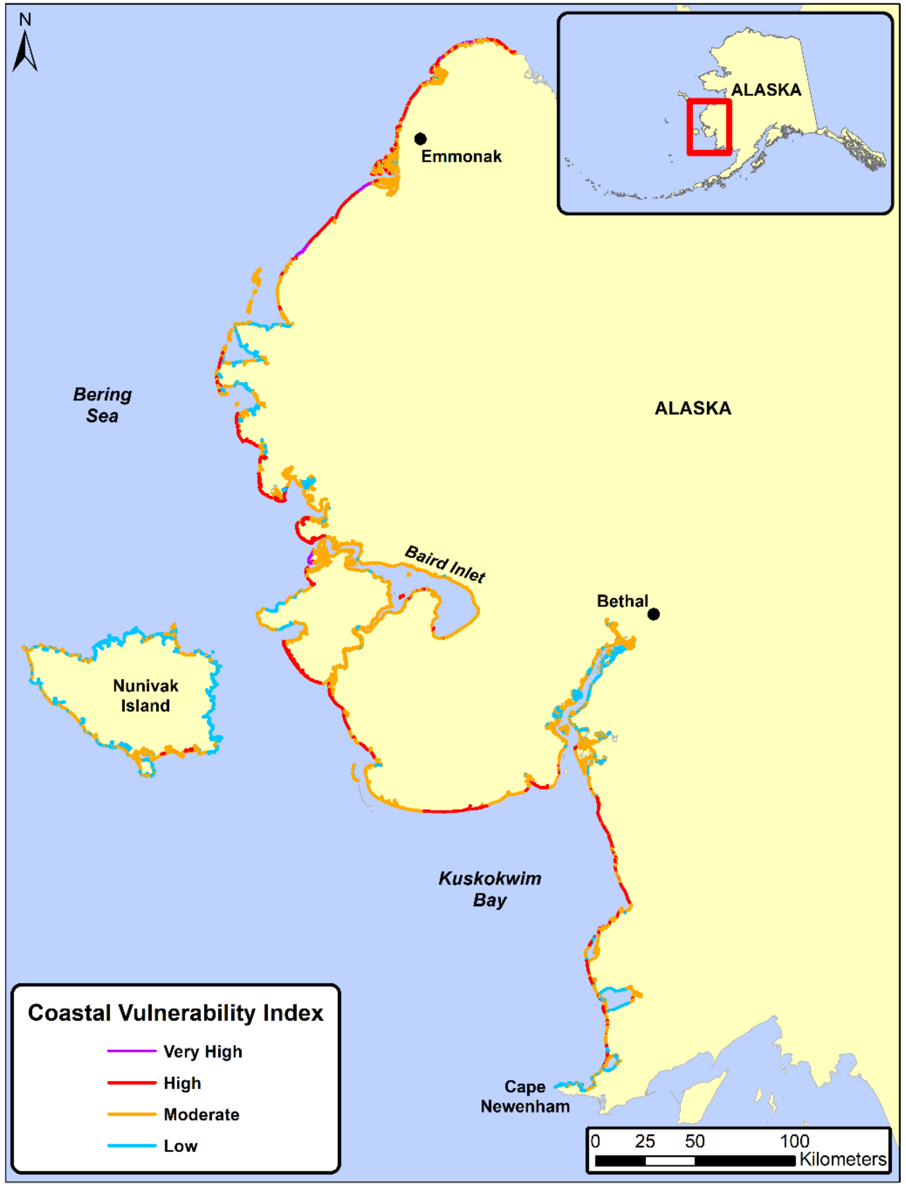
Collect Once, Use Many Times

~85% of the State of Alaska Imaged and Mapped (or Mapping in Progress)

Multiple Uses for both the Imagery and Habitat Mapping

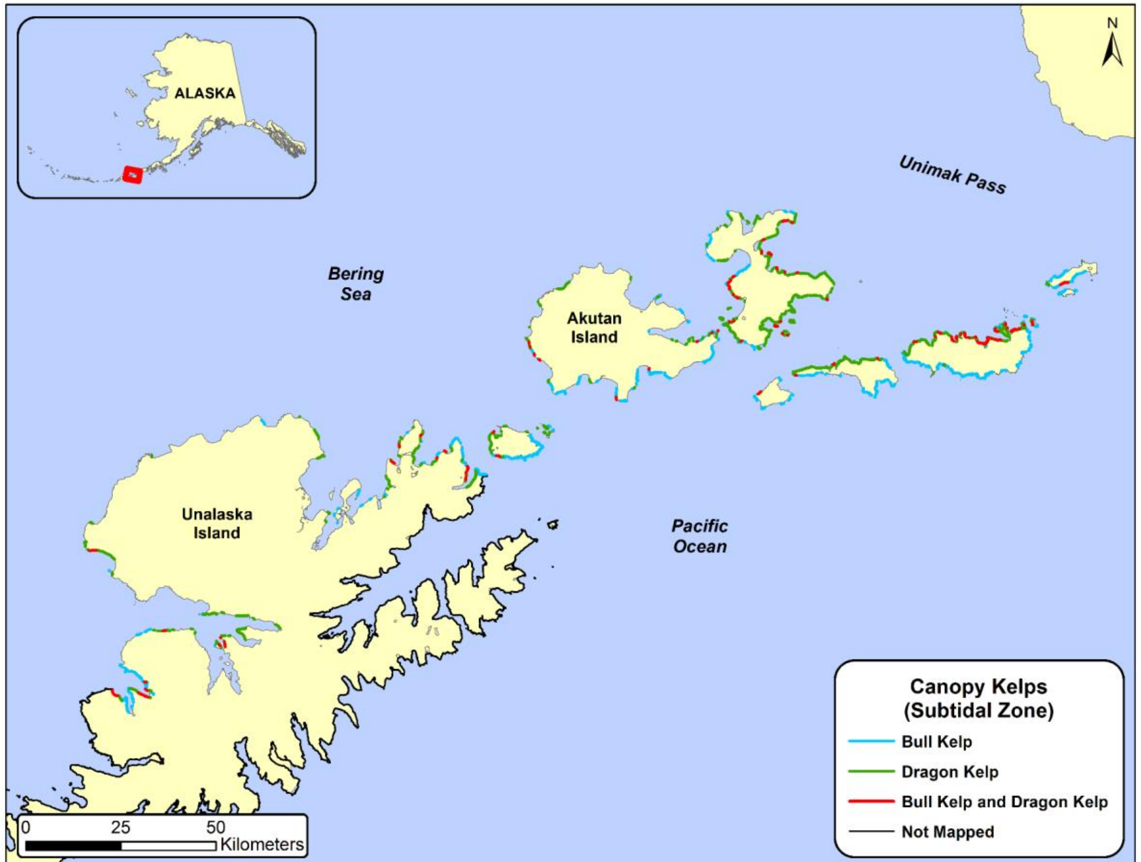
Uses for ShoreZone
Attribute Maps

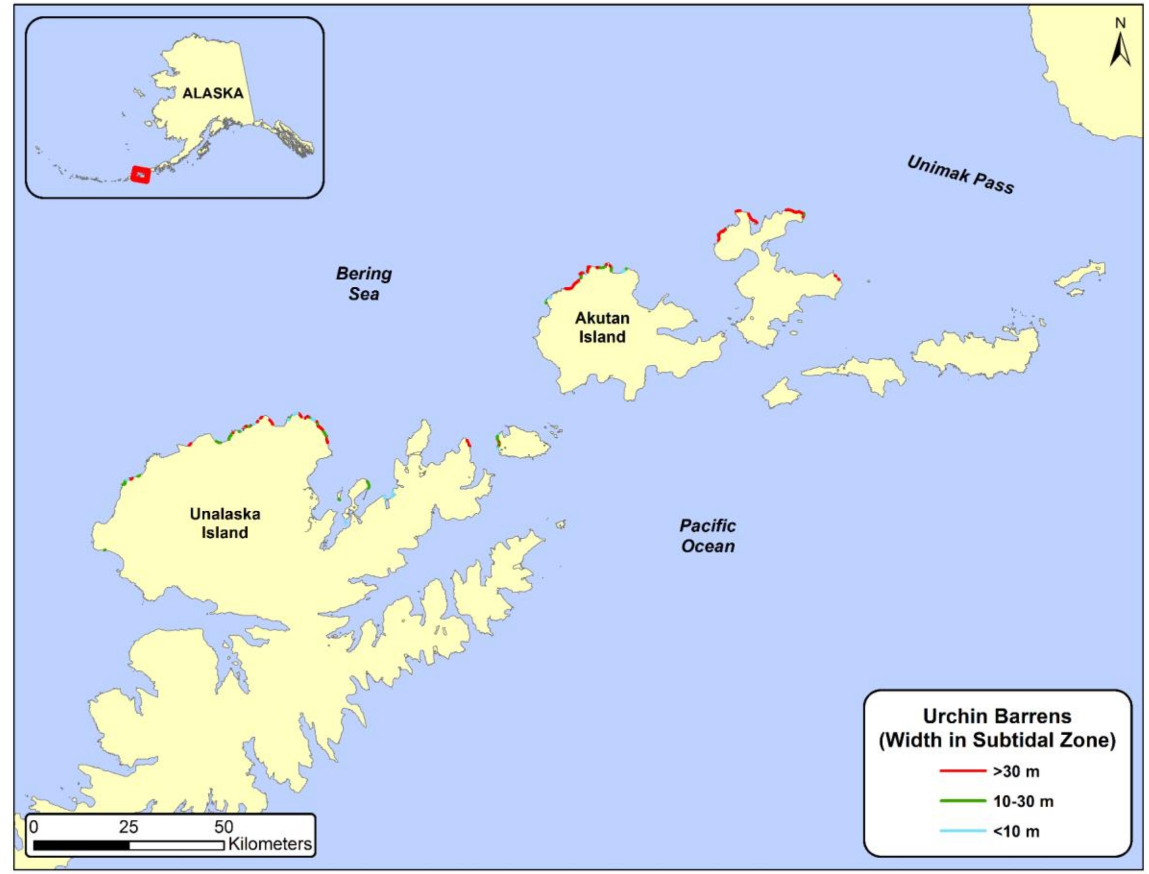




Uses for ShoreZone

Attribute Maps

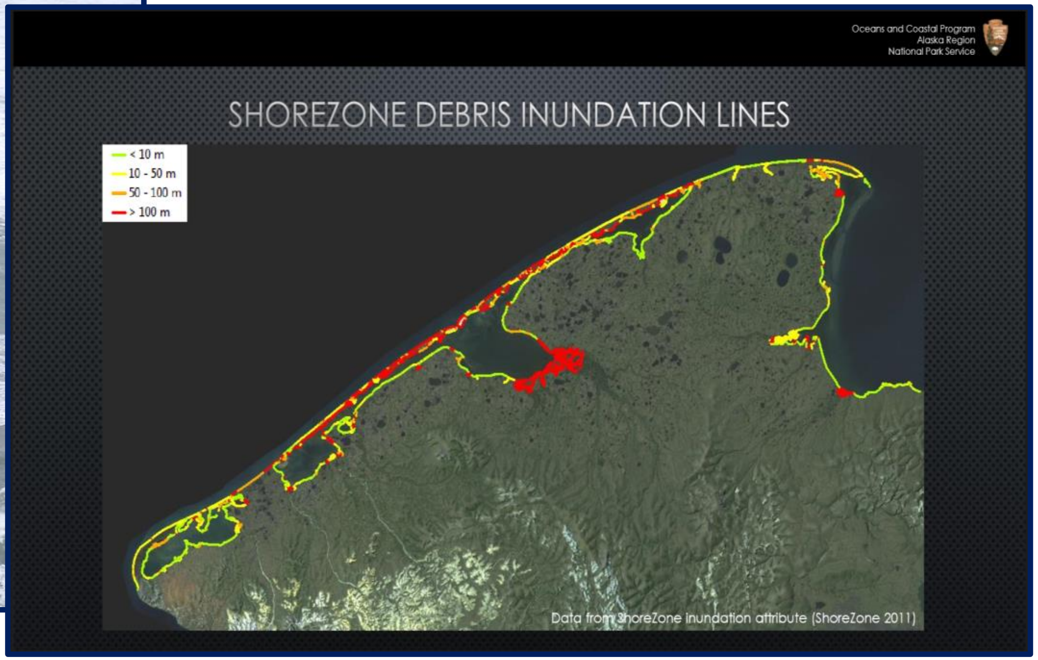




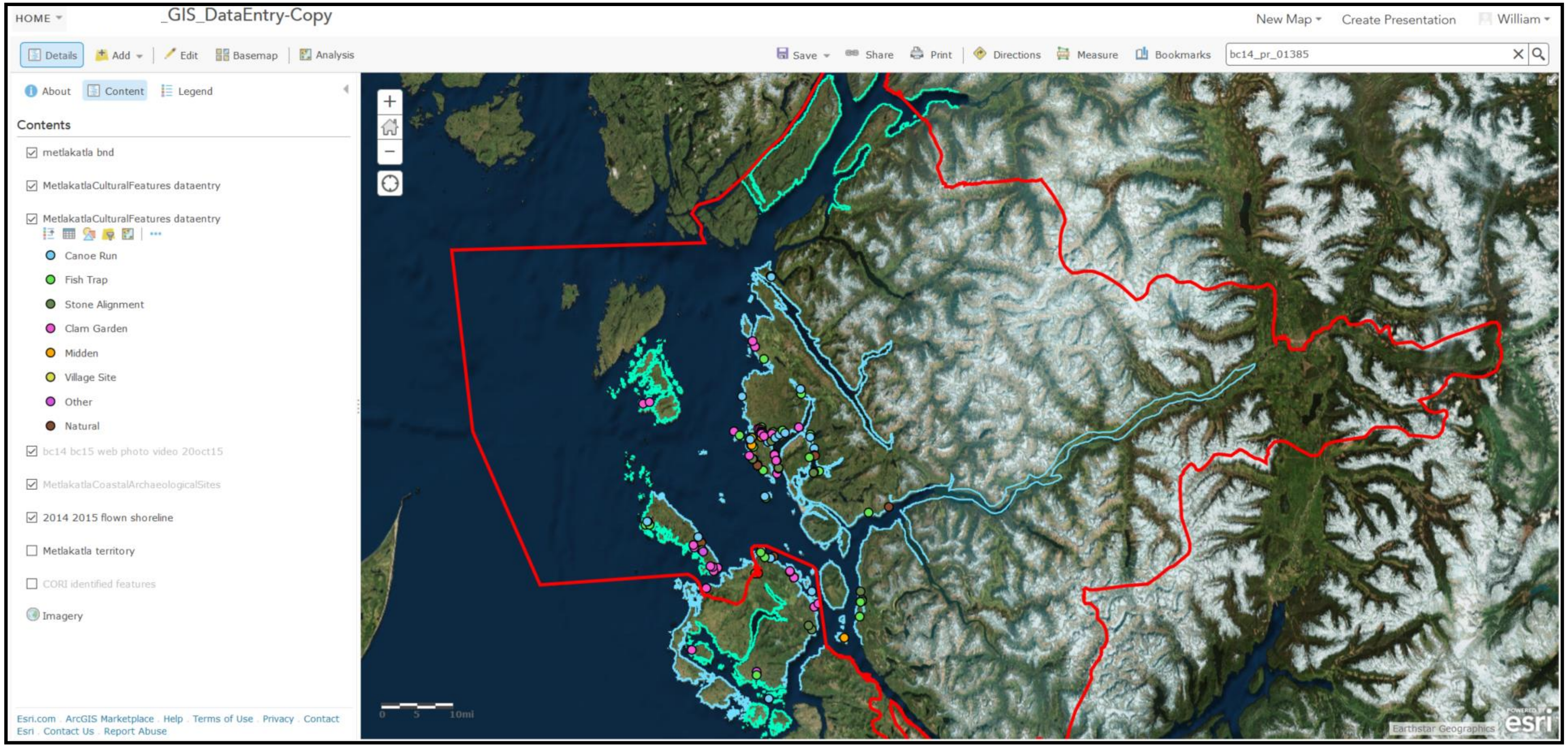
Uses for ShoreZone

Oil Spill Planning and Response

Marine Debris Mapping

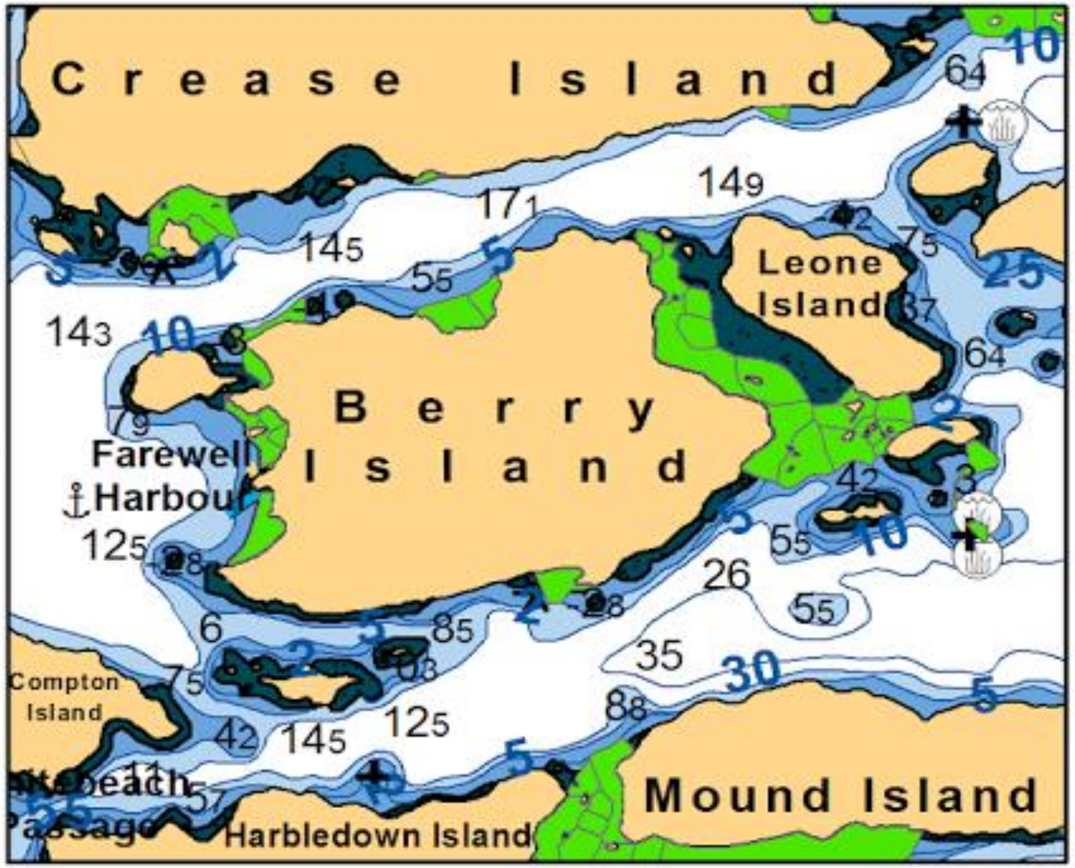


Uses for ShoreZone

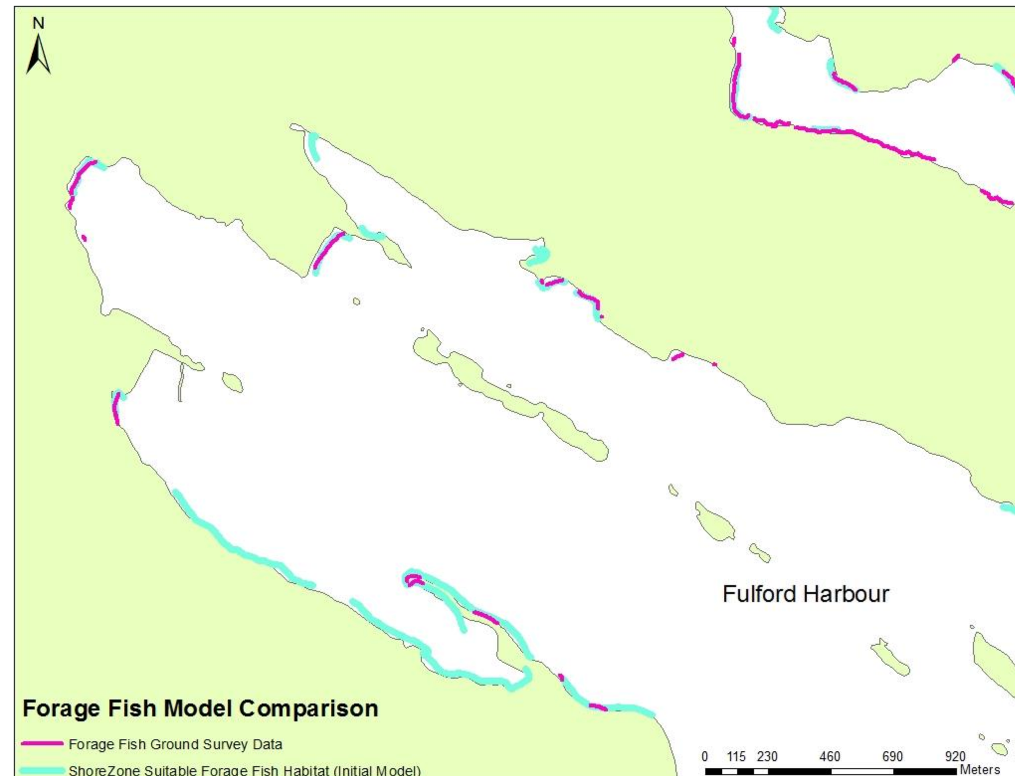


Cultural Features Mapping

Uses for ShoreZone

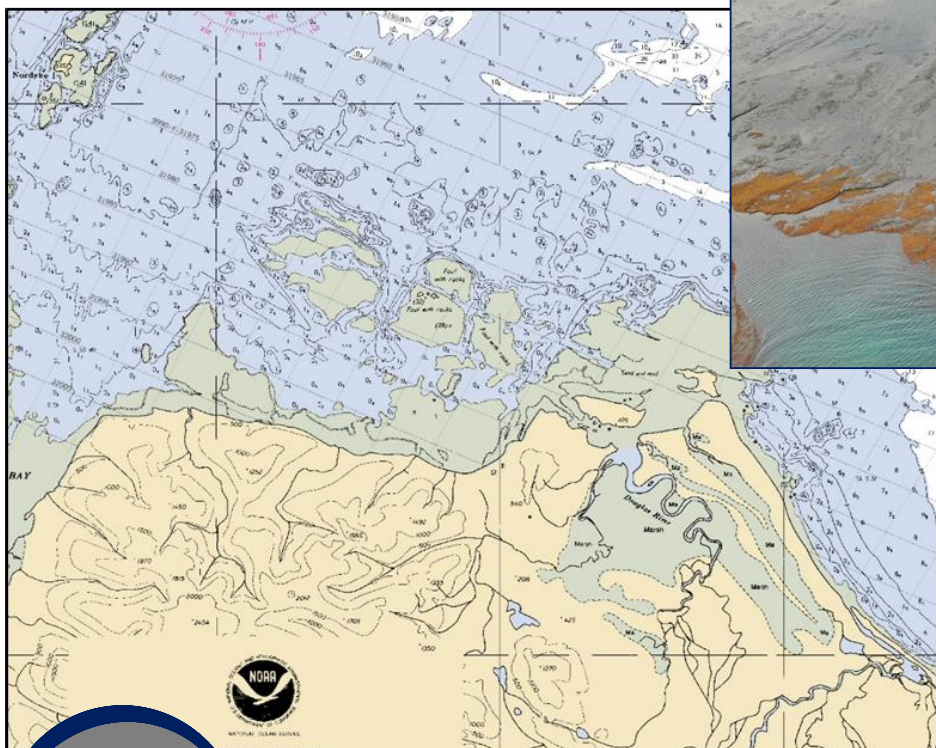


Habitat Modelling
Species Modelling



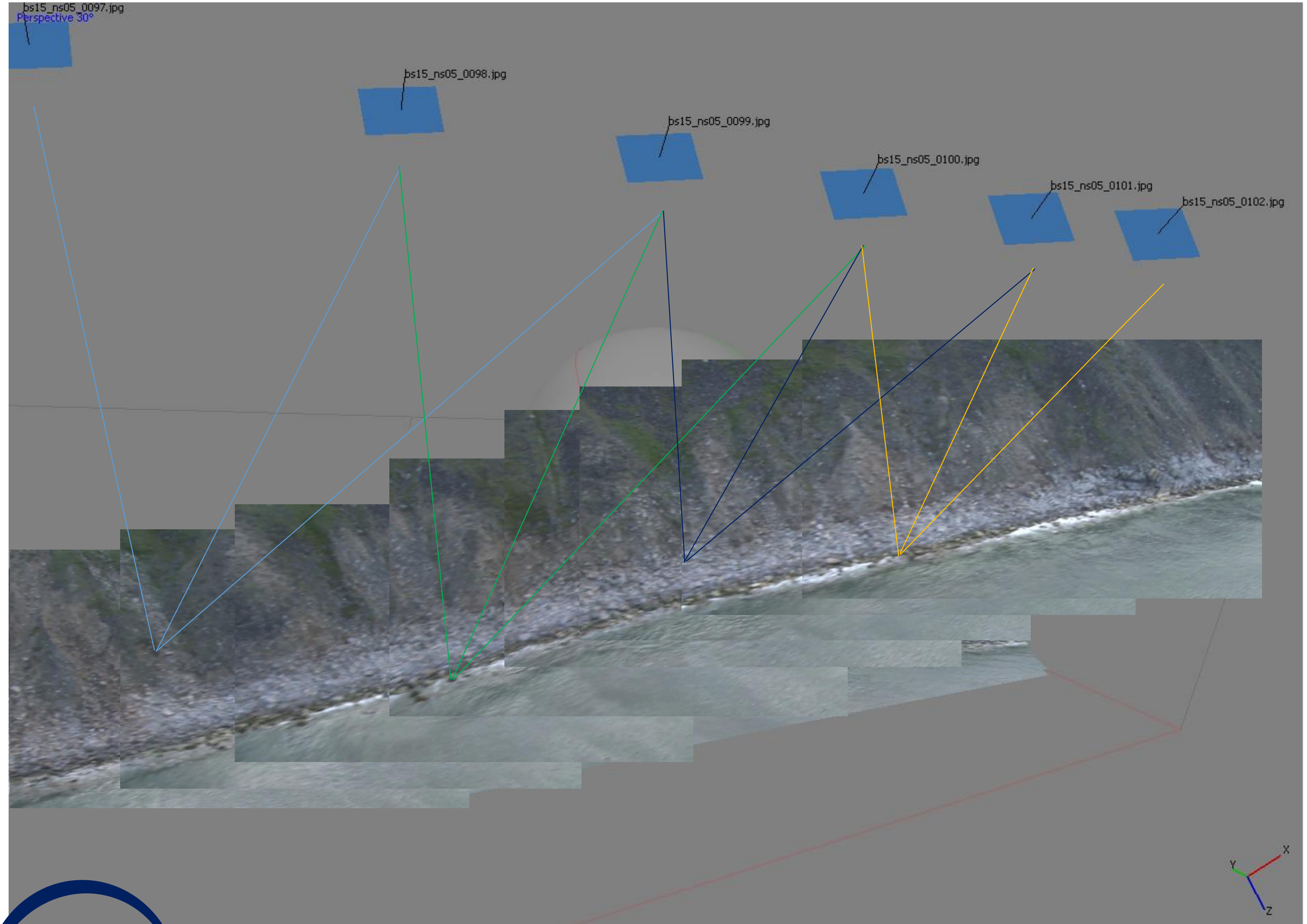
Uses for ShoreZone

Kamishak Bay, Cook Inlet



Research Study Design

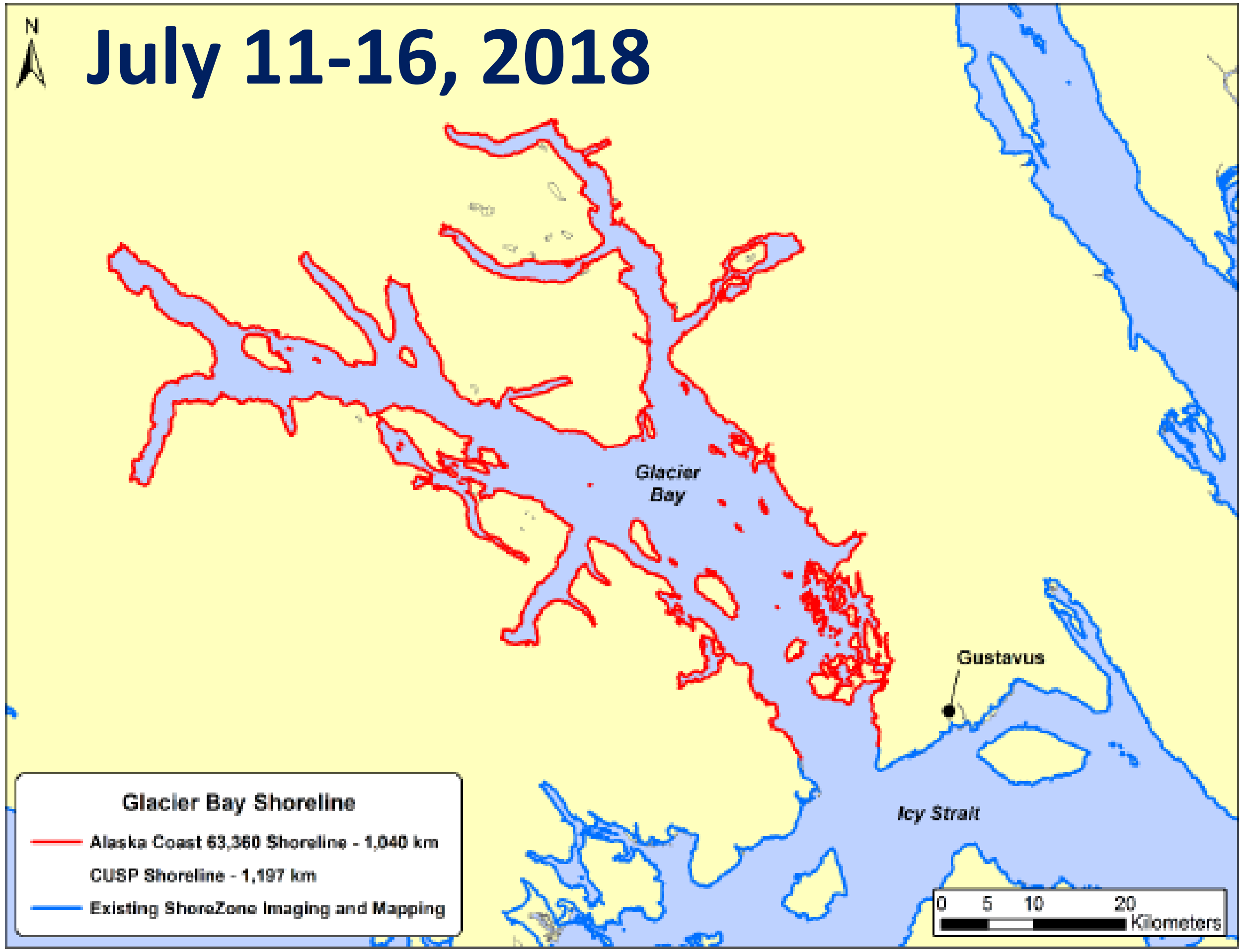
Uses for ShoreZone
Outreach and Education

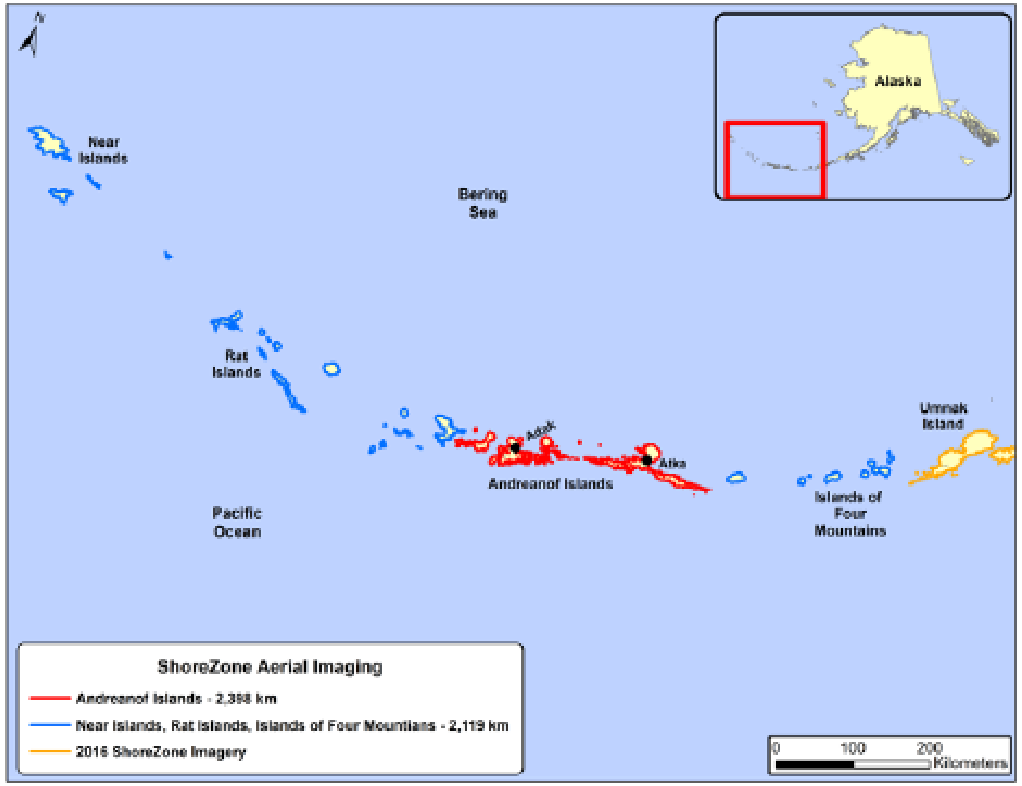


Developing ShoreZone for the Future

Structure From Motion

Future Projects in Alaska





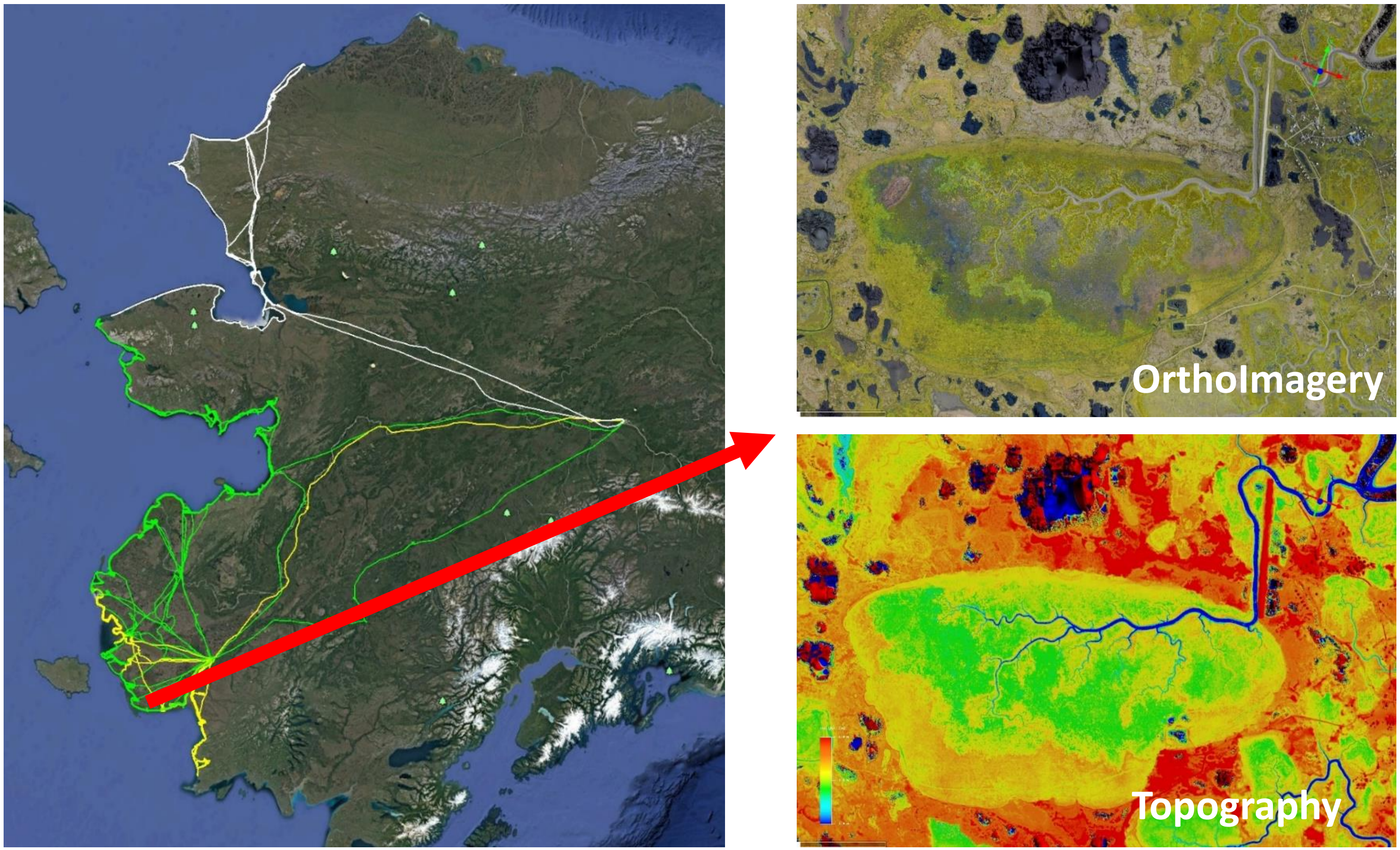
Looking for Funding

Thank-you!

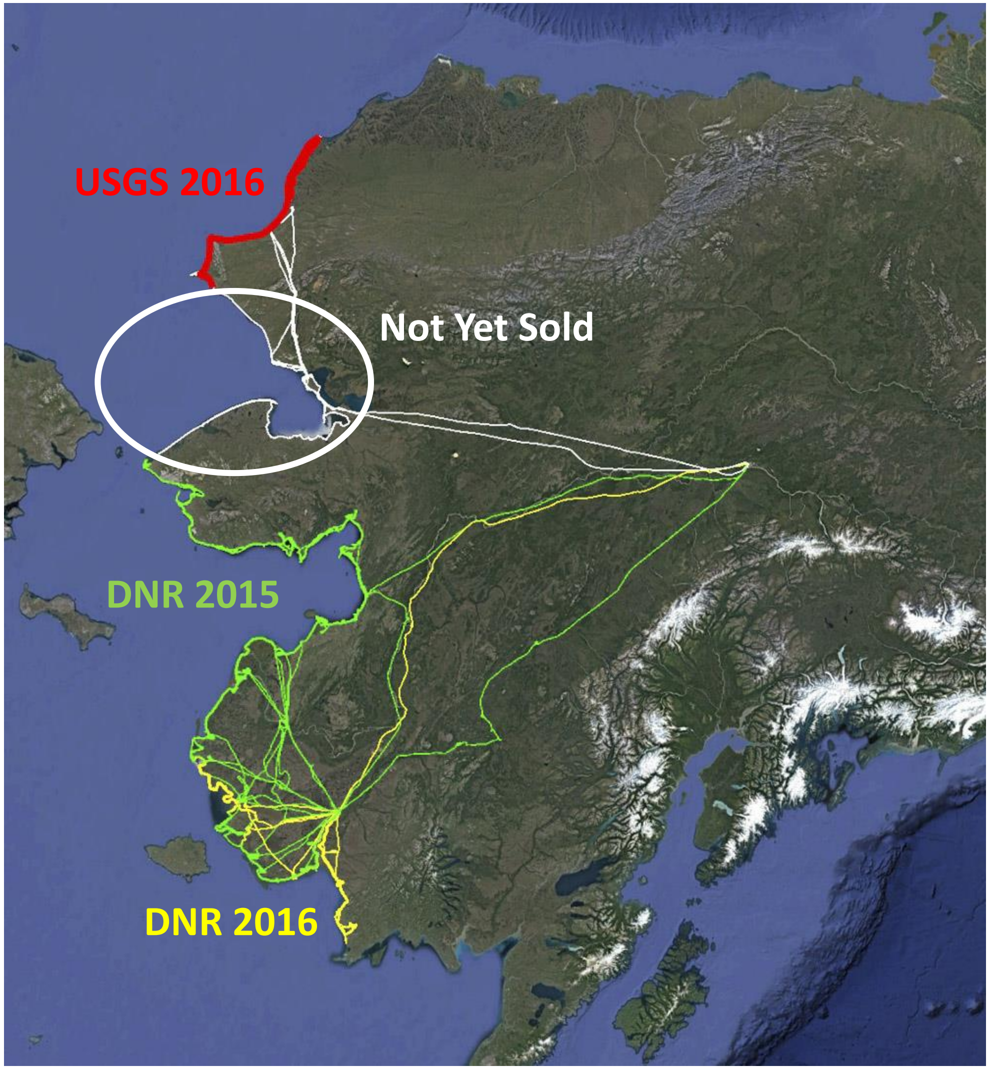
sarah@coastalandoceans.com

Two hundred billion pixels of digital coastal paradise: Mapping a mile wide swath of Alaska's west coast at 10-20 cm GSD with Fodar

Matt Nolan
www.FairbanksFodar.com



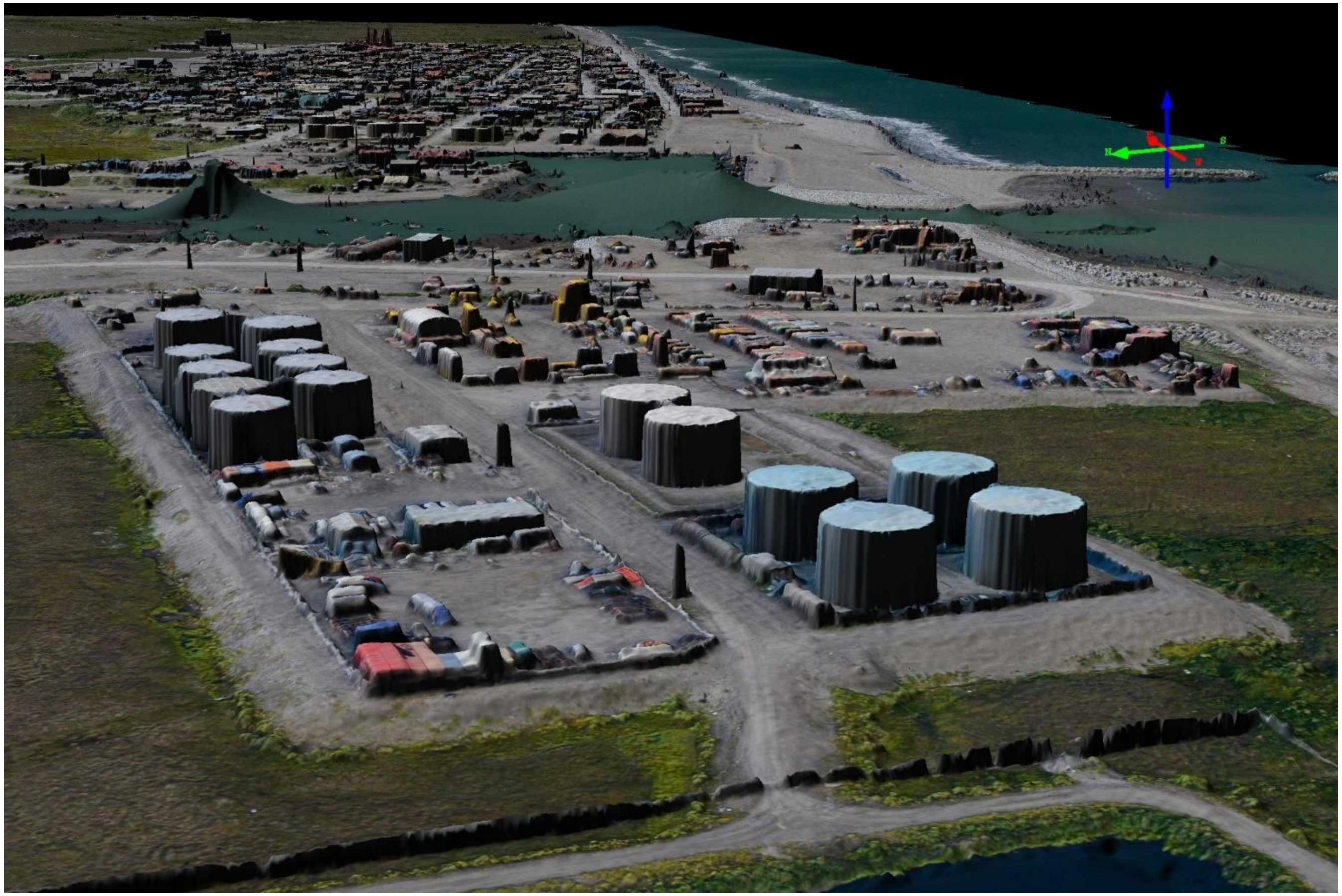
Data Coverage Overview



Fodar is a proprietary form of survey-grade SfM photogrammetry in development since 2010.

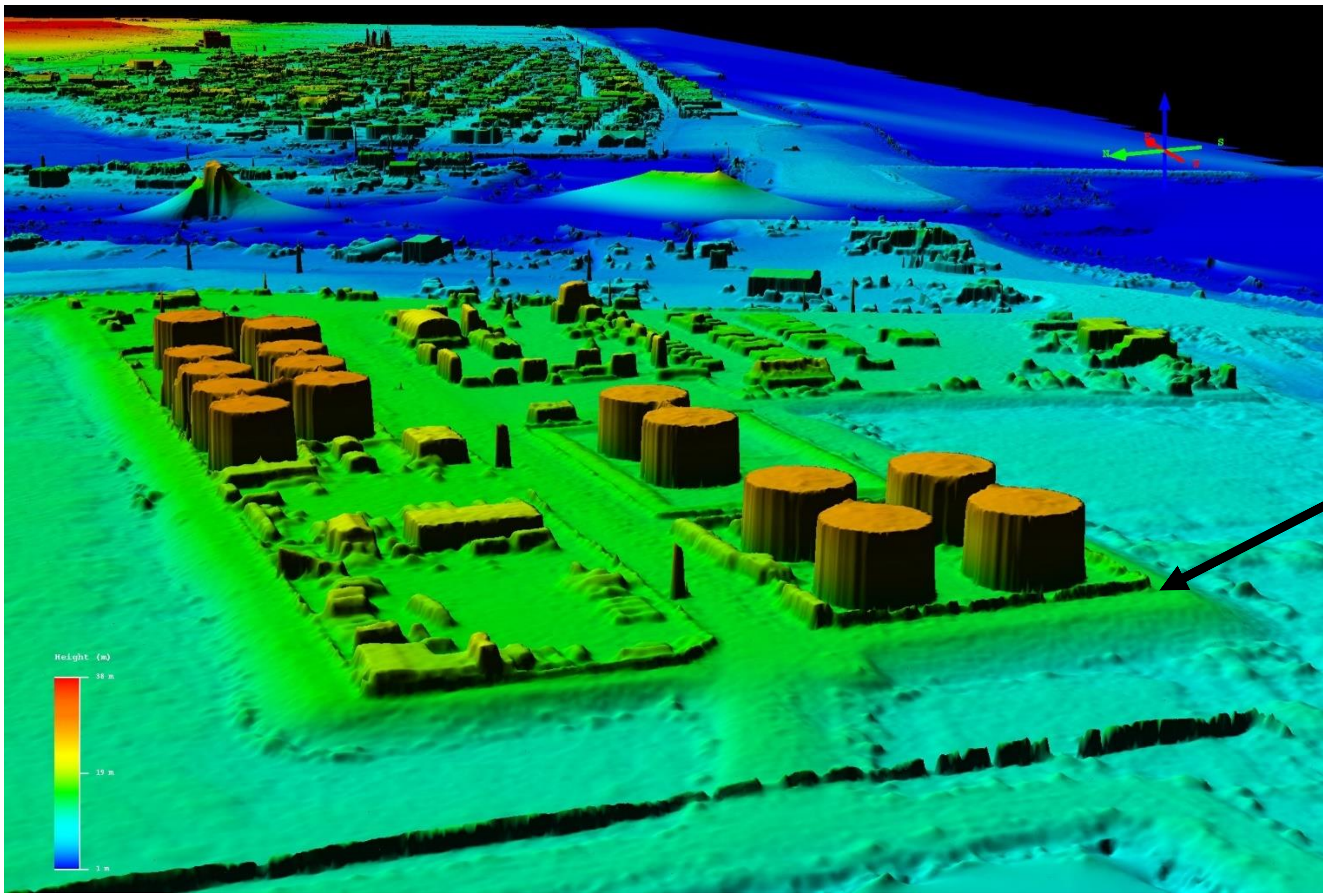
Fairbanks Fodar acquired ~2000 miles of coastline, to ~ 1 mile inland including 35 villages, at 10 - 20 cm GSD with an accuracy and precision of 10 - 20 cm @95%.

Sample Fodar Results



A primary goal for the data was to assess the vulnerability of coastal villages to storms and sea level rise and guide policy accordingly.

Sample Fodar Results



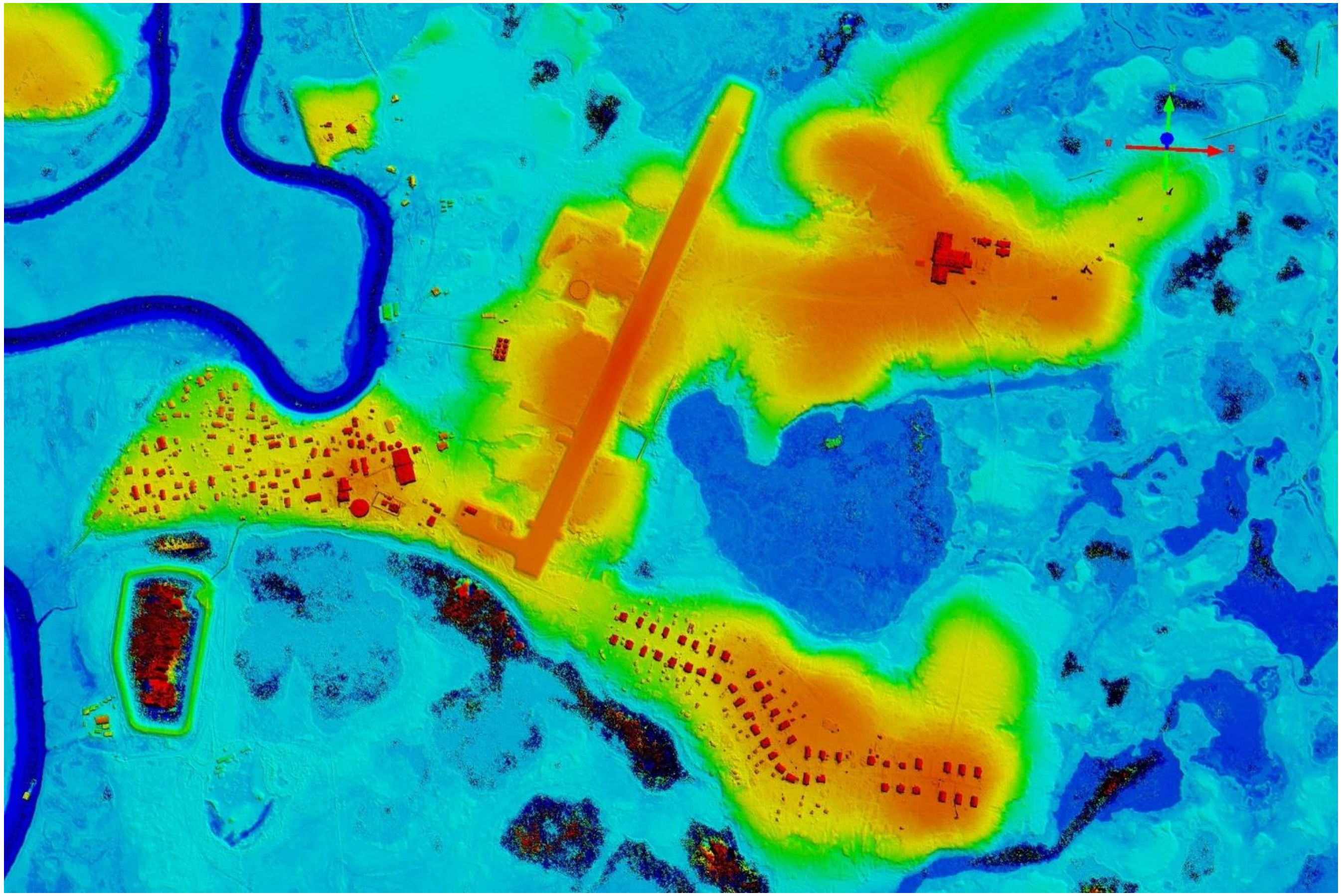
Is this embankment high enough?

These data are now being used by State and Federal stakeholders for exactly that purpose, as we've seen in this meeting.

Sample Fodar Results

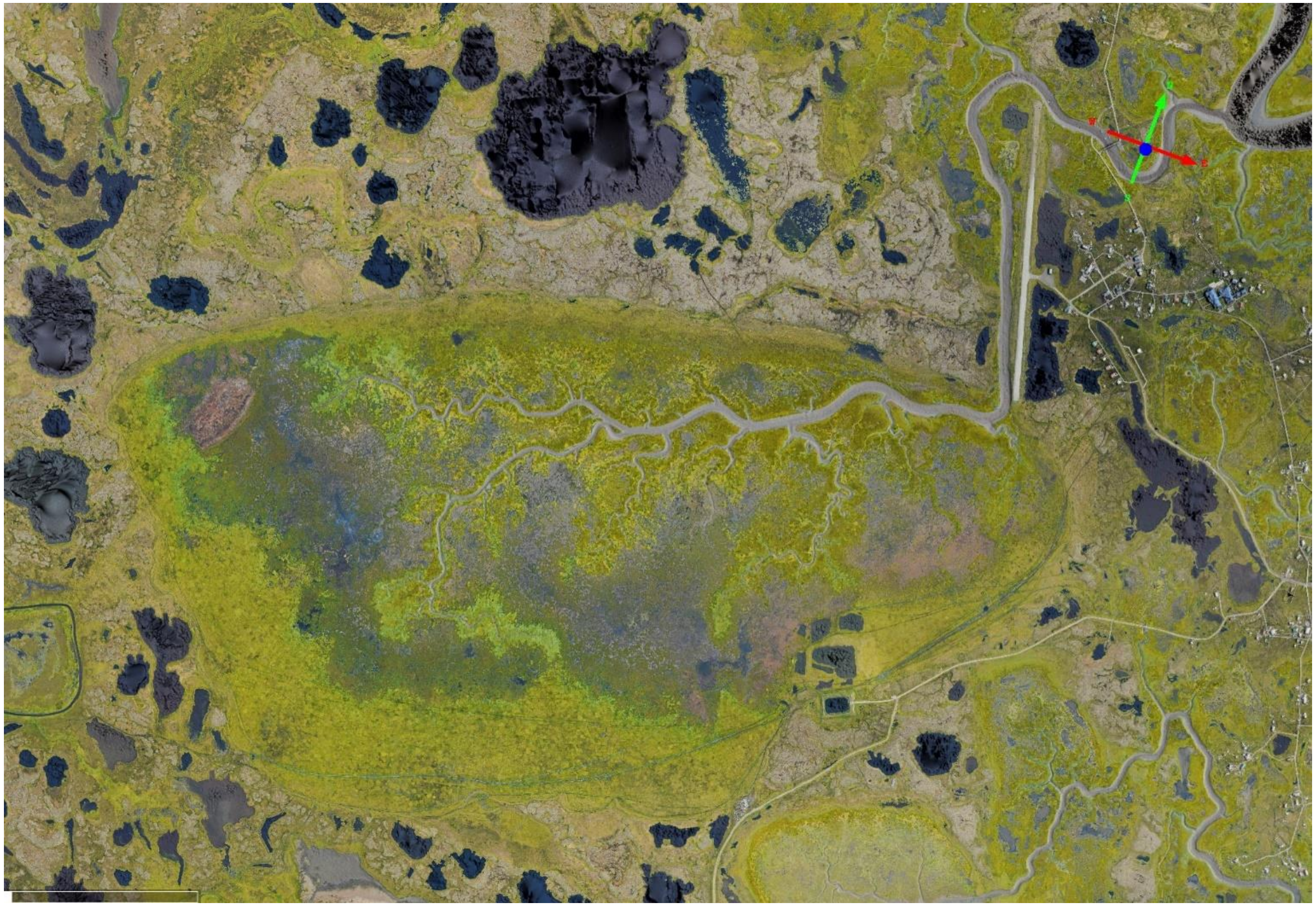
Kongiganak has a strange layout…

Sample Fodar Results



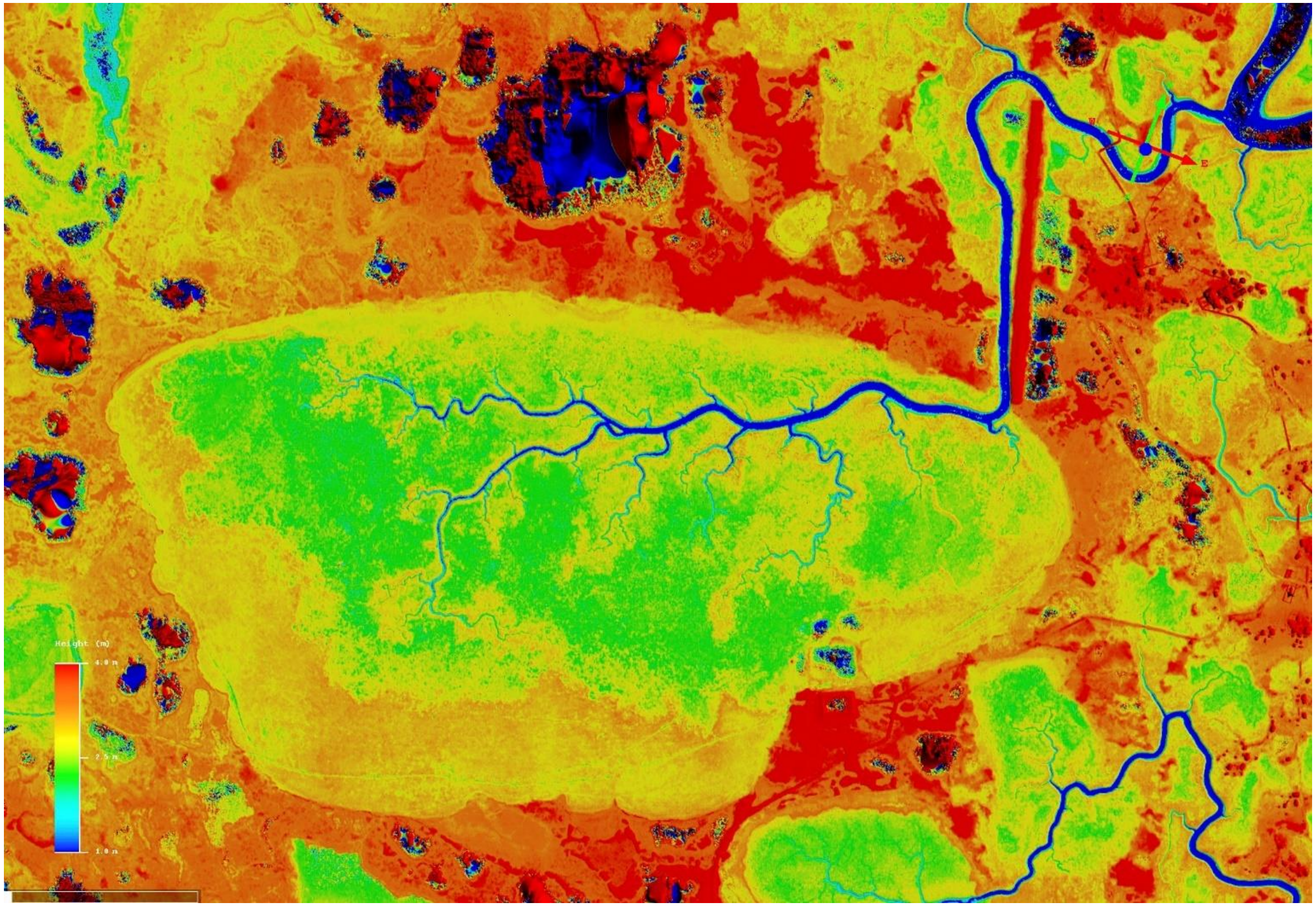
Kongiganak has a strange layout…
… until you realize its built on a island!
This is a serious problem for many villages.

Sample Fodar Results



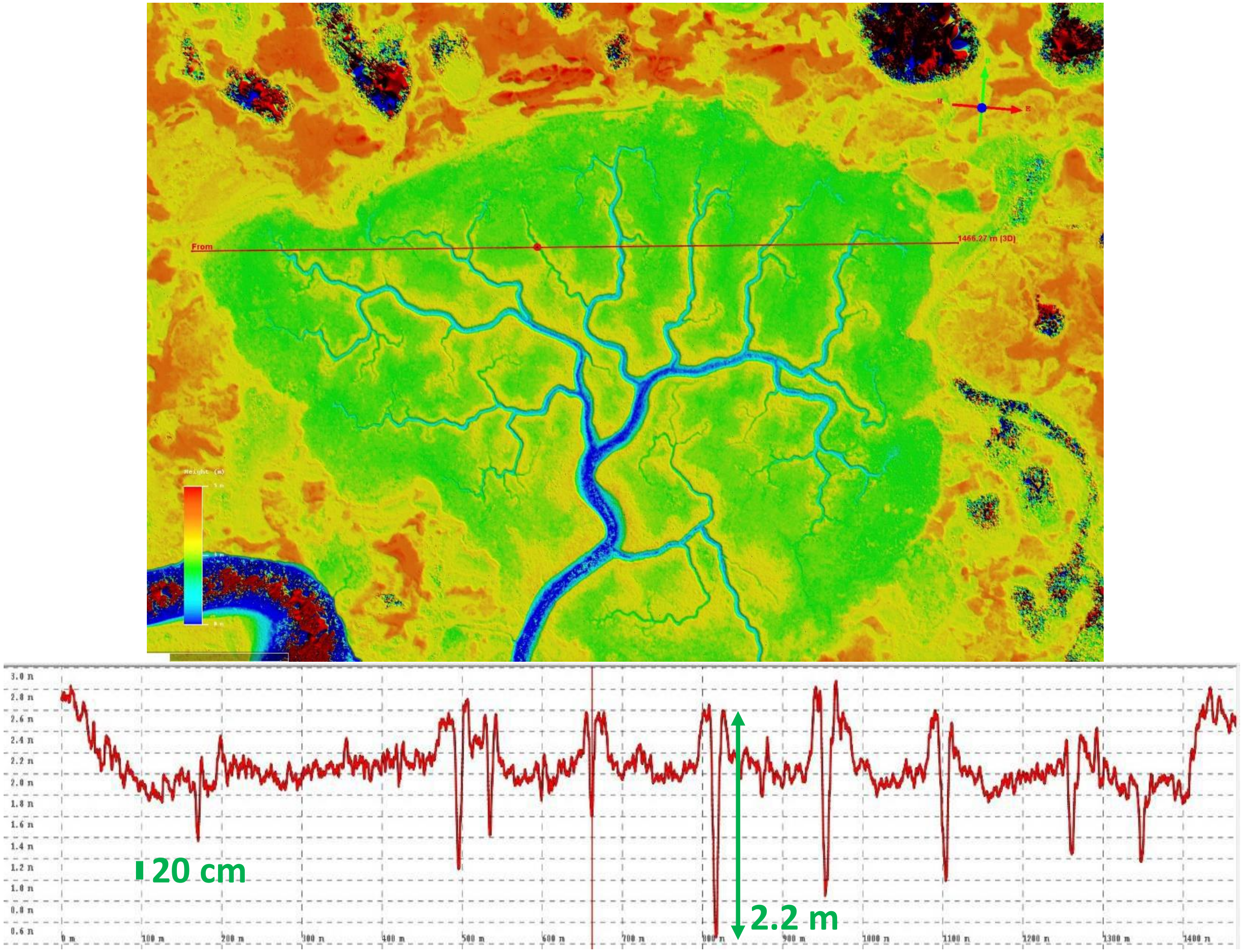
This tidally-filled lake at Kwigillingok is an excellent example of the detail derived from fodar. Note the size of the lake compared to the size of the village (upper right)

Sample Fodar Results



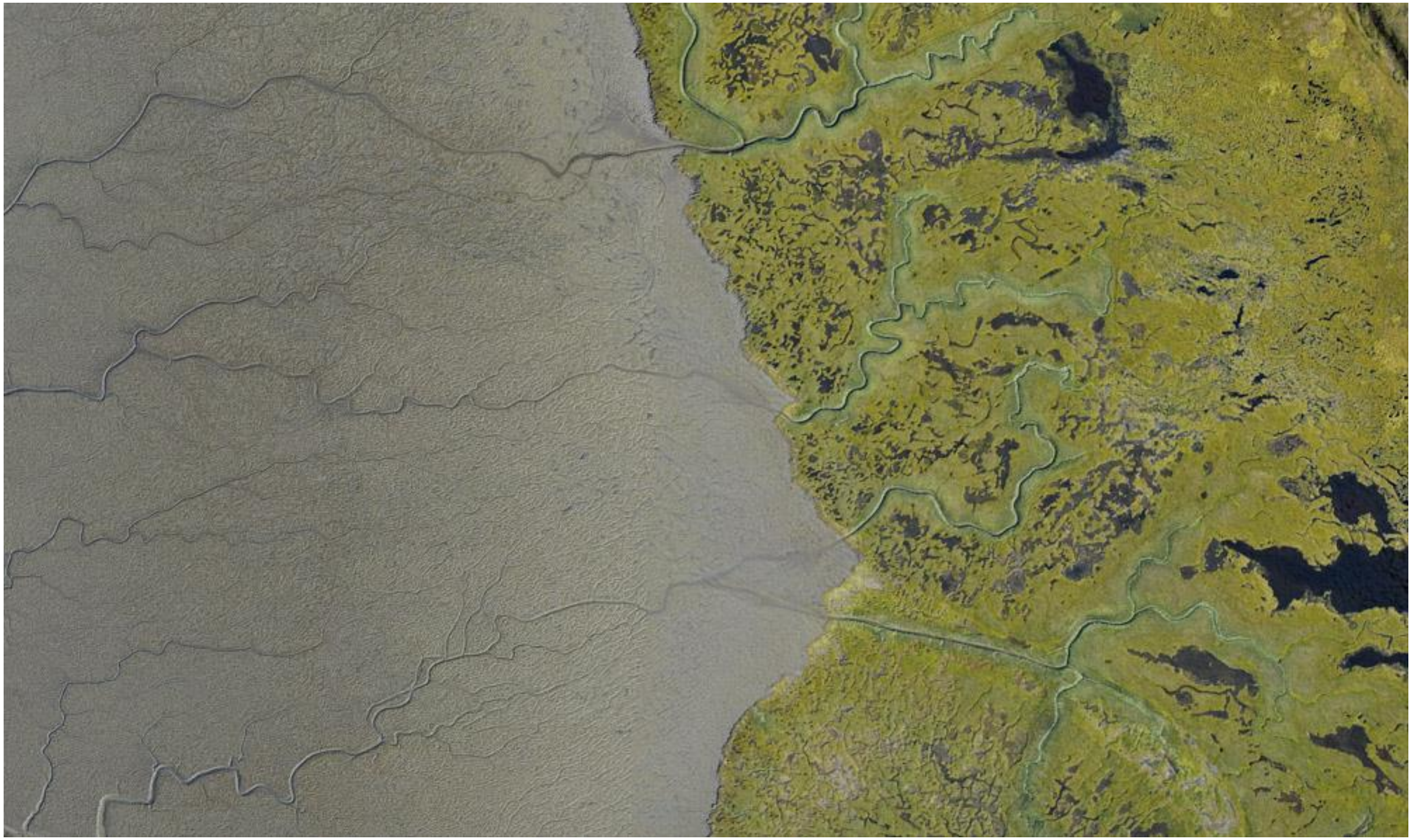
This tidally-filled lake at Kwigillingok is an excellent example of the detail derived from fodar. Note the size of the lake compared to the size of the village (upper right)

Sample Fodar Results



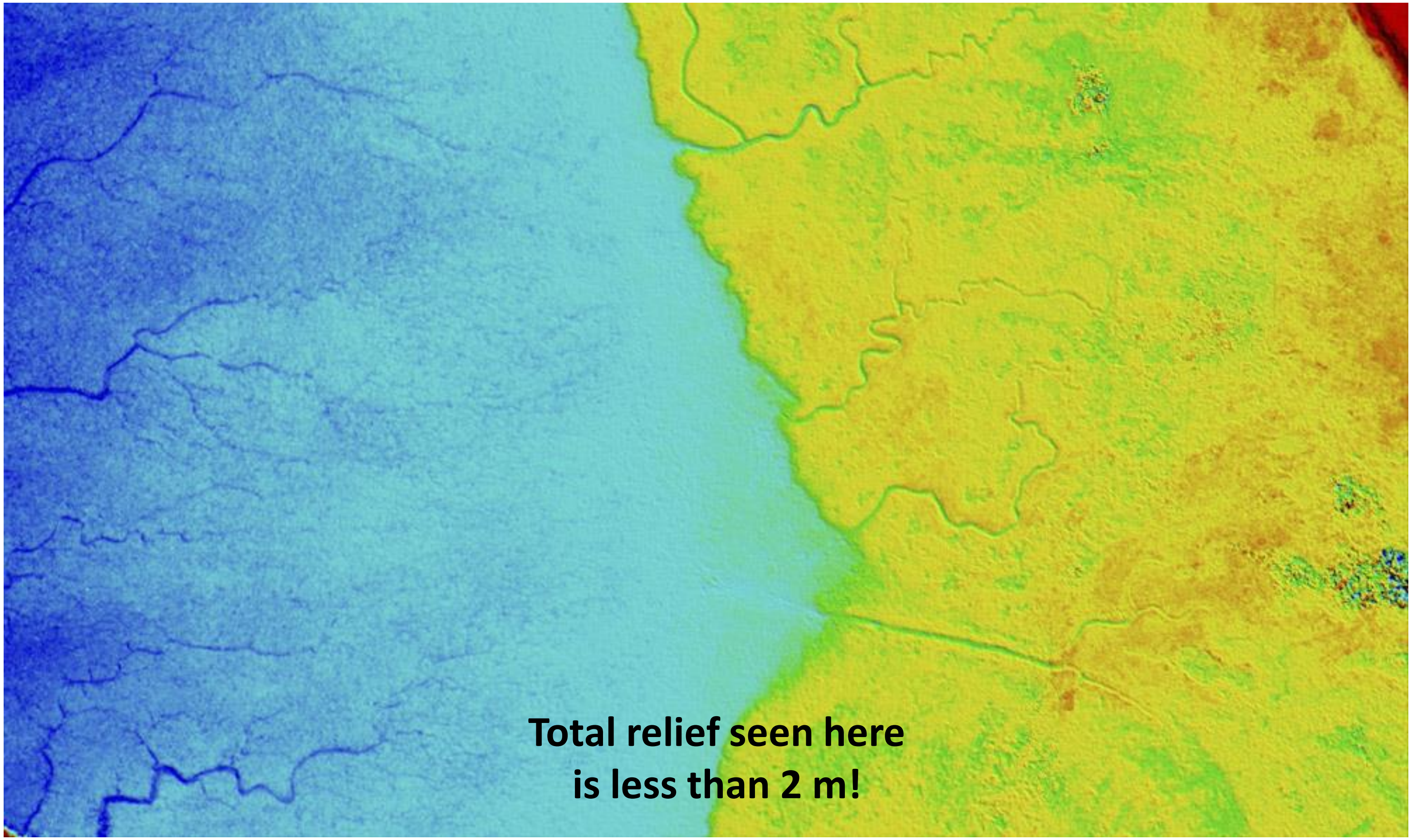
We can not only measure the depth of small stream channels, but the height of the vegetation growing along their edge.

Sample Fodar Results



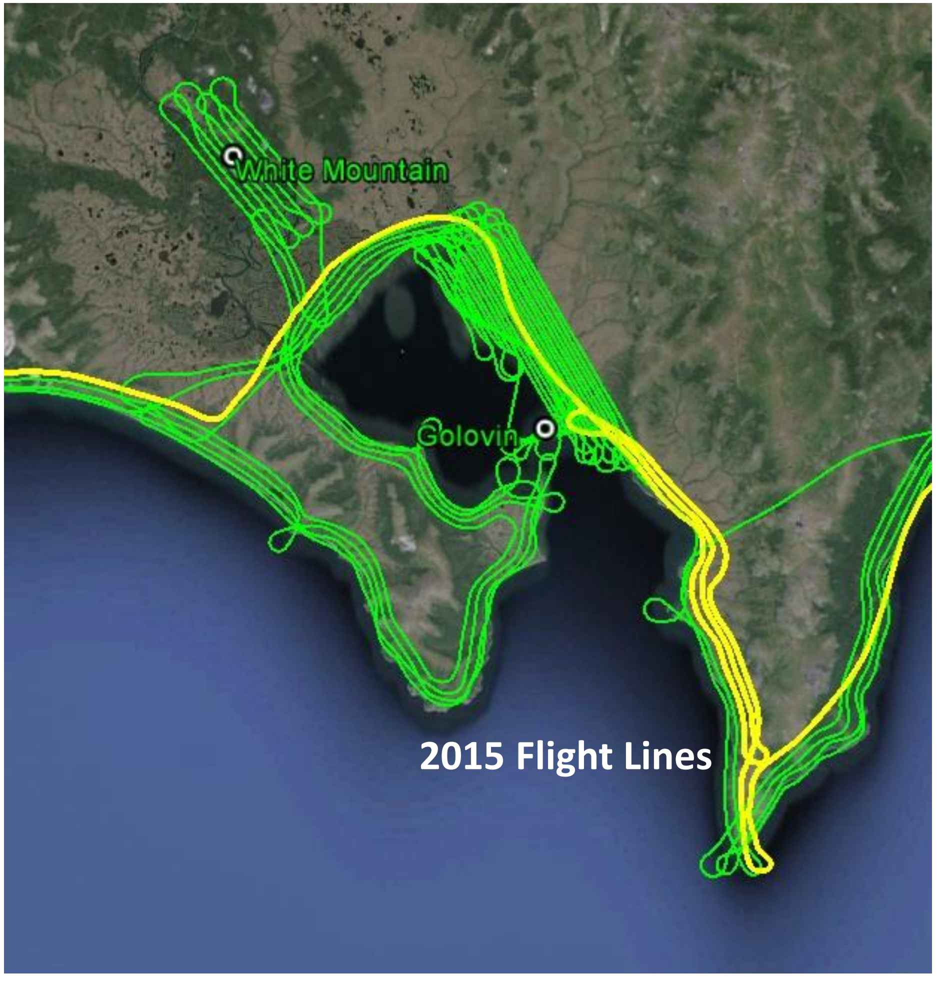
I acquired the entire coast with tide below MHW (and most of it below MLW I think). That is, acquisition dates and times were pinned to the tide predictions.

Sample Fodar Results



I love mapping mud flats.

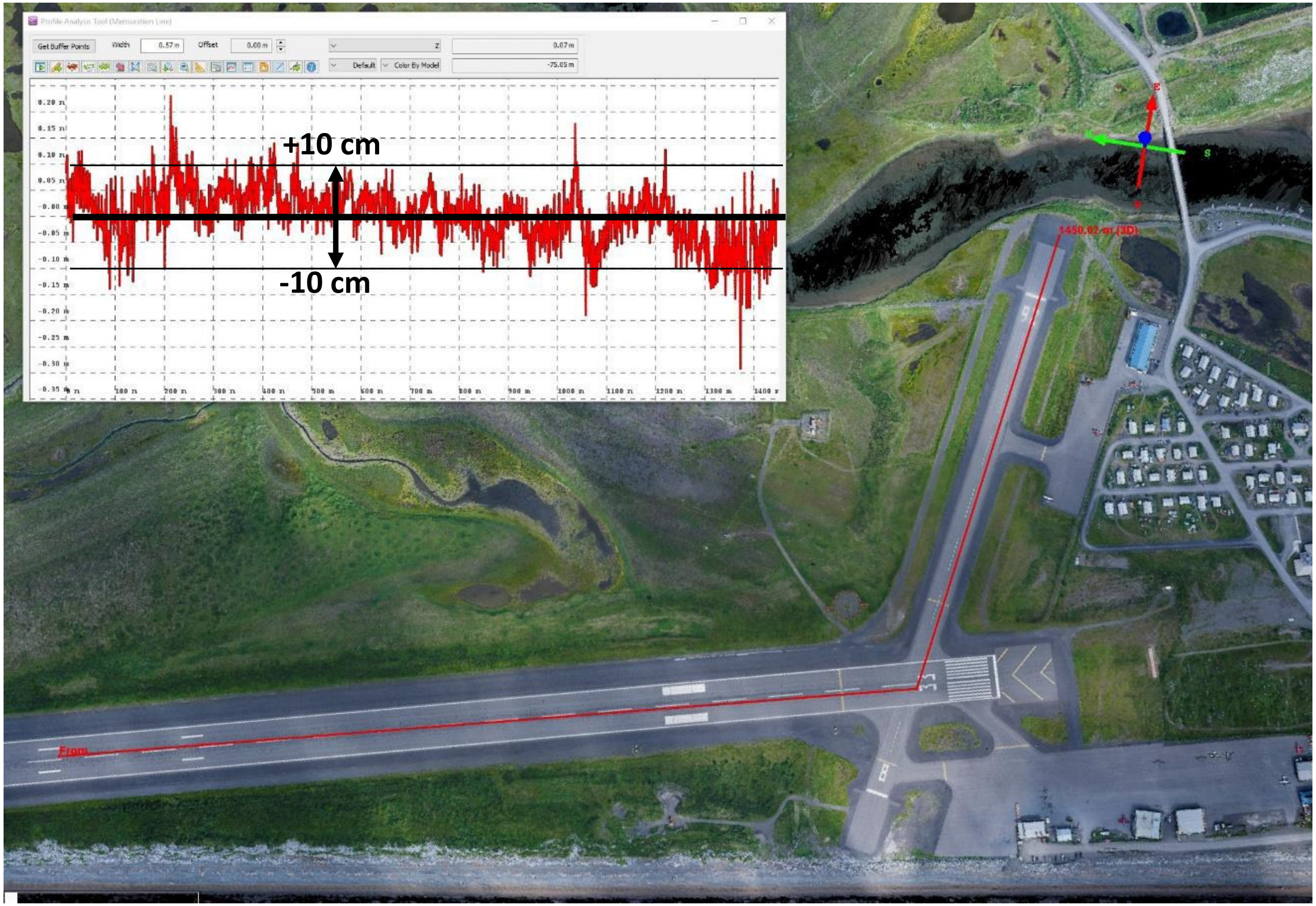
Methods



About 25,000 miles of flying, over 30 days in 3 campains.

Golovin Bay is beautiful. I'll offer deep discounts for more mapping there…

Data Validation



The best means of validating these huge raster data sets is by comparing to another. Here I assessed vertical precision by comparing fodar of Unalakleet from 2014 and 2015 and found that 95% of difference is less than 8 cm (~4 cm stdev).

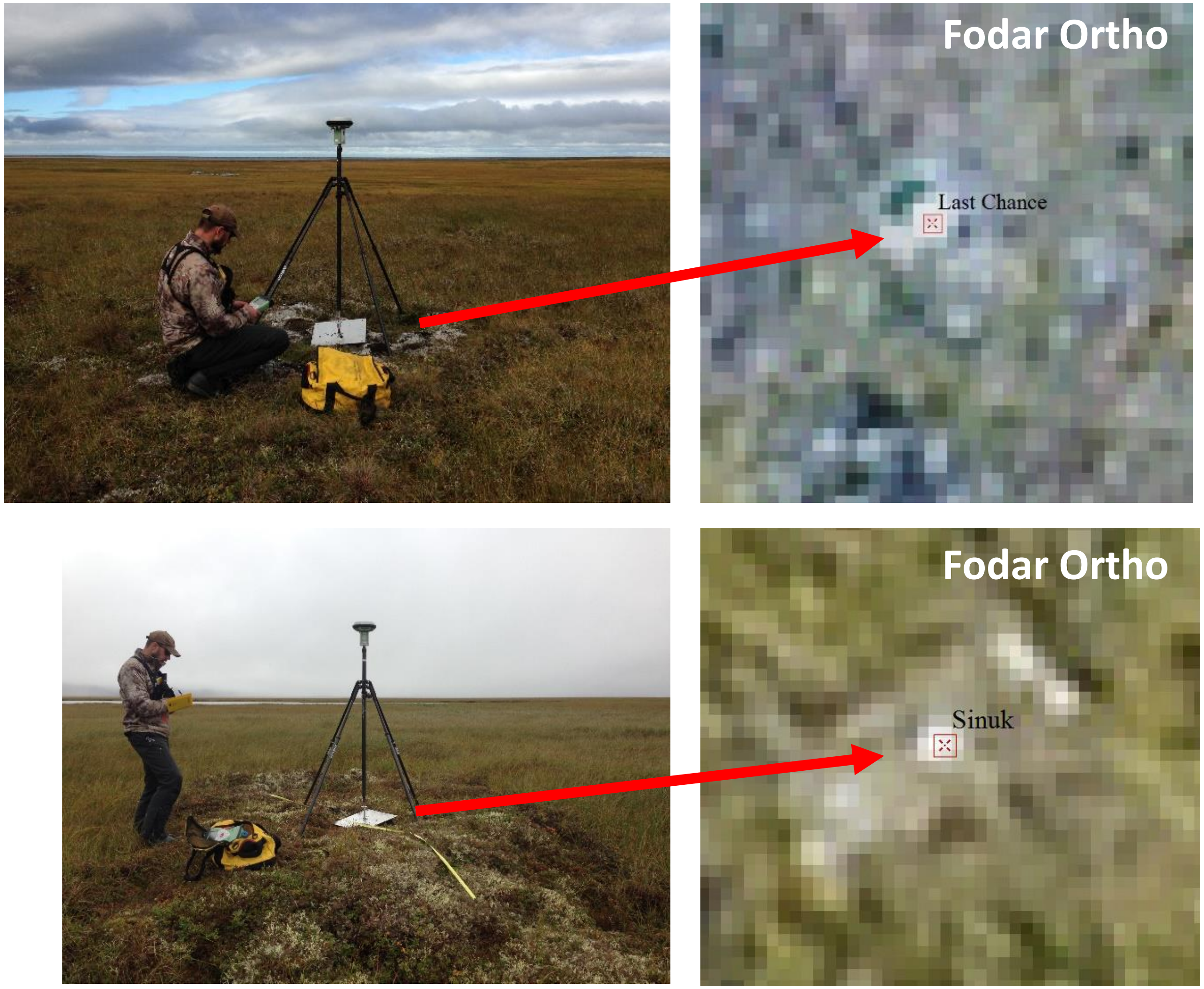
Data Validation

The best means of validating these huge raster data sets is by comparing to another. Here the compass rose at an airport makes the horizontal accuracy crystal clear.

Data Validation

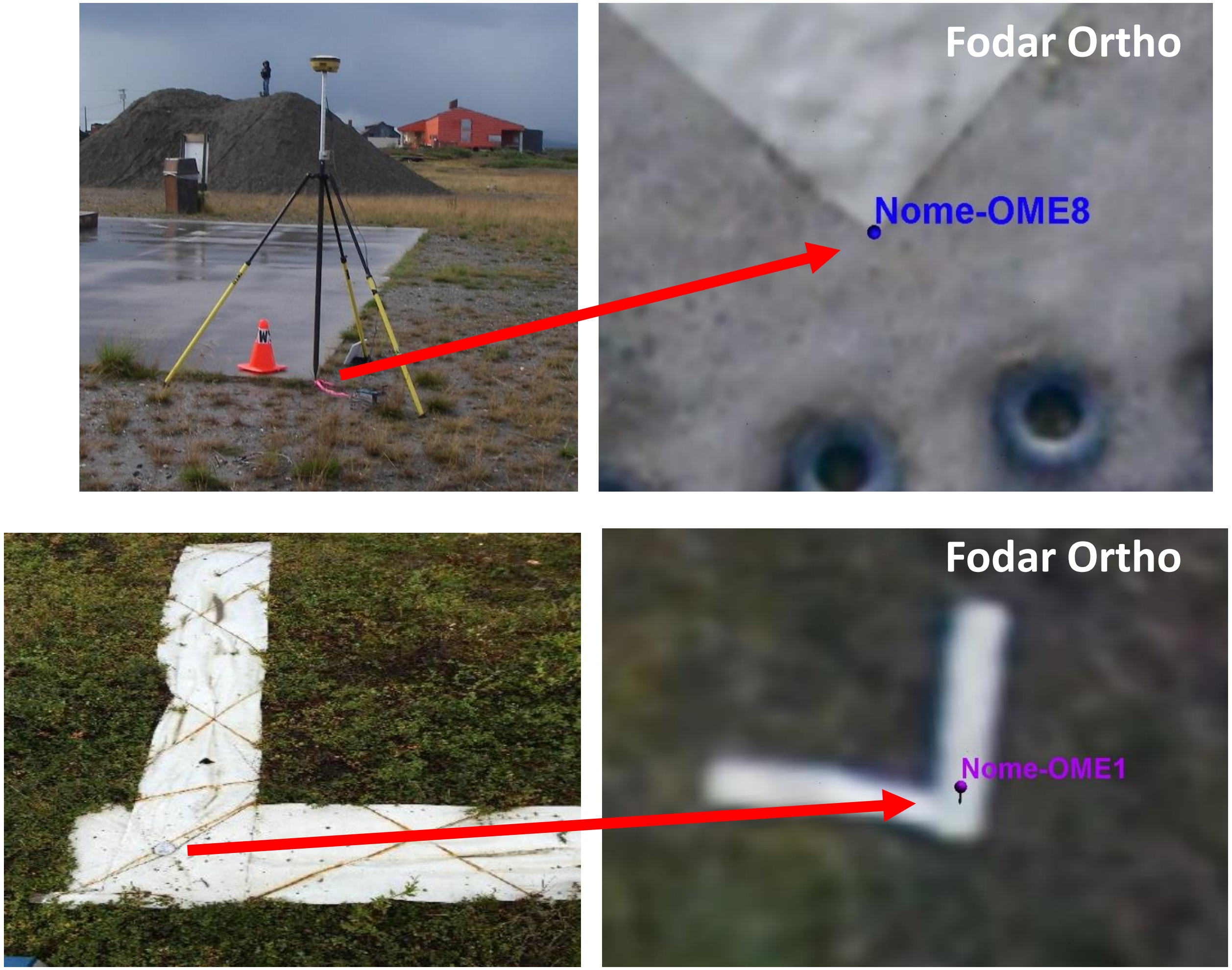
The best means of validating these huge raster data sets is by comparing to another. Here the compass rose at an airport makes the horizontal accuracy crystal clear.

Data Validation



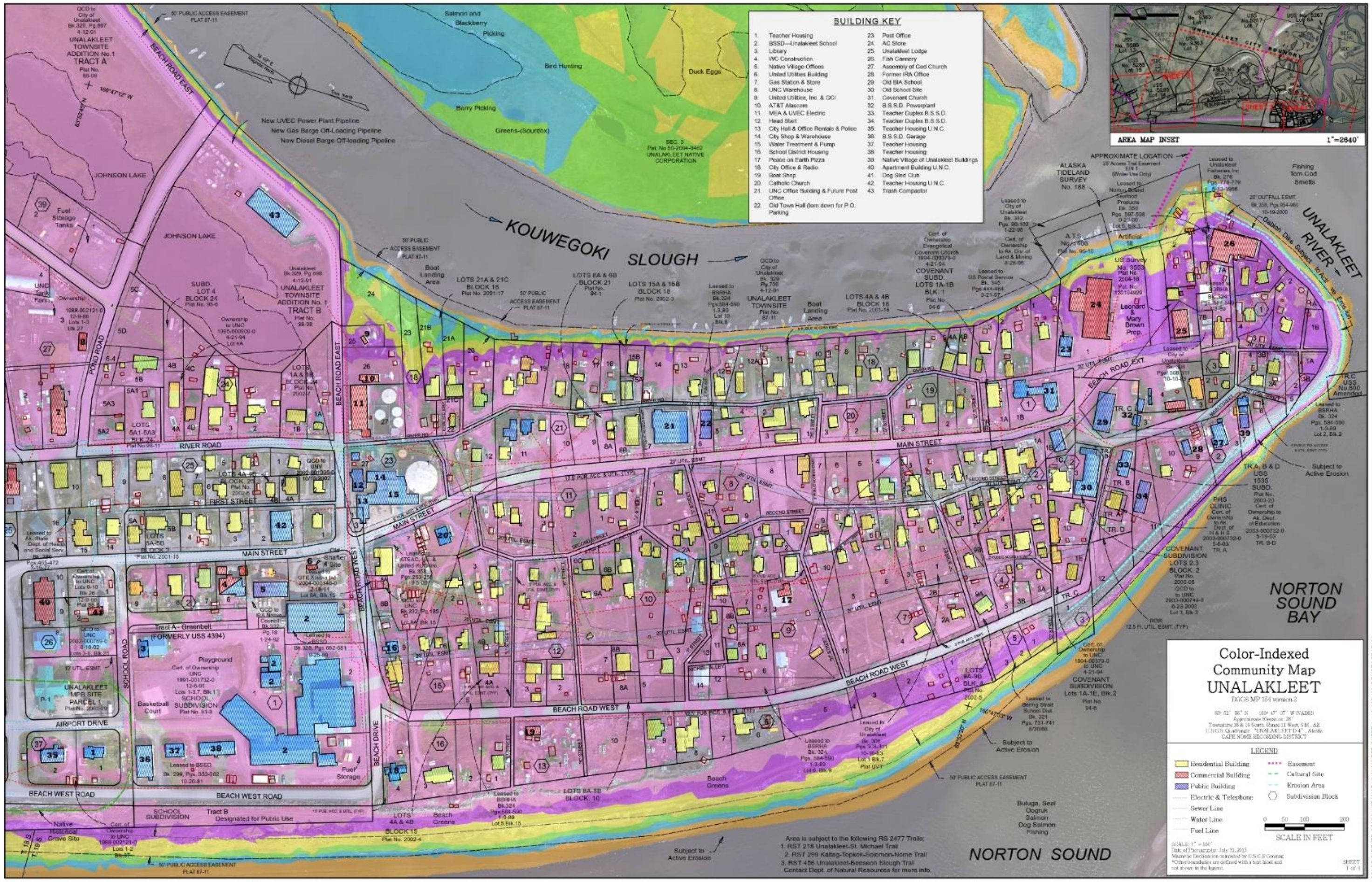
Some photo-identifiable targets are better than others; these are good ones. Regardless, comparing 120 GCPs to 120 billion pixels is an undersampling, though they are quite useful for blunder checking.

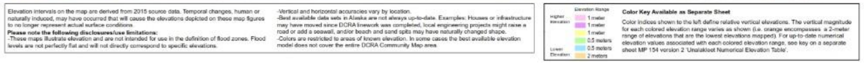
Data Validation



About 120 GCPs were collected by a professional land surveyor.
Horizontal accuracy was found to be perfect (subpixel).
Note that no ground control was used in fodar processing.

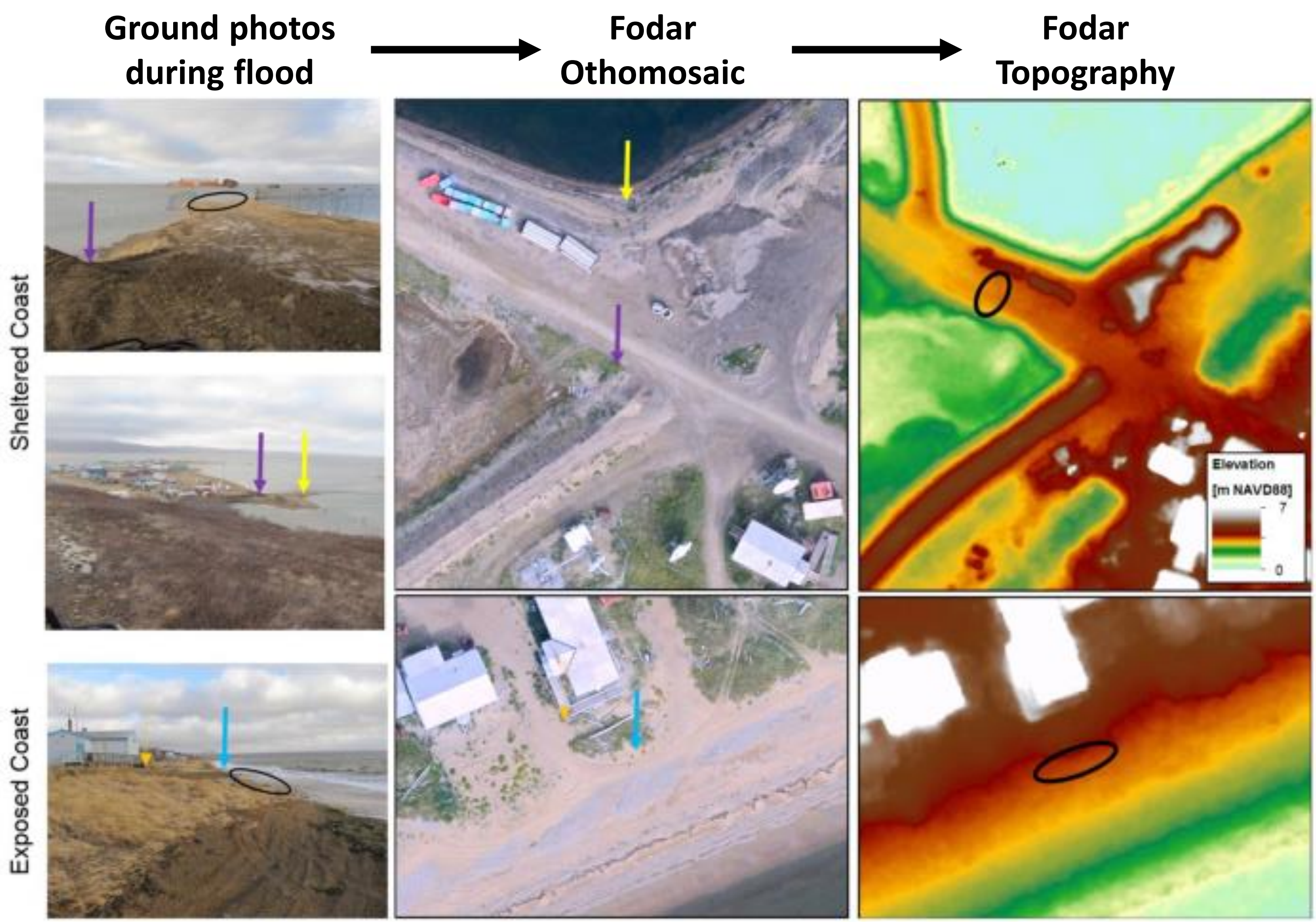
Applications: Policy Decision Facilitation





DGGS Conclusion: Fodar is suitable for creation of maps for land-use and emergency planning.

Applications: Flood Inundation Mapping



DGGS Conclusion: Fodar is suitable for determining flood inundation extents using suitable ground photographs.

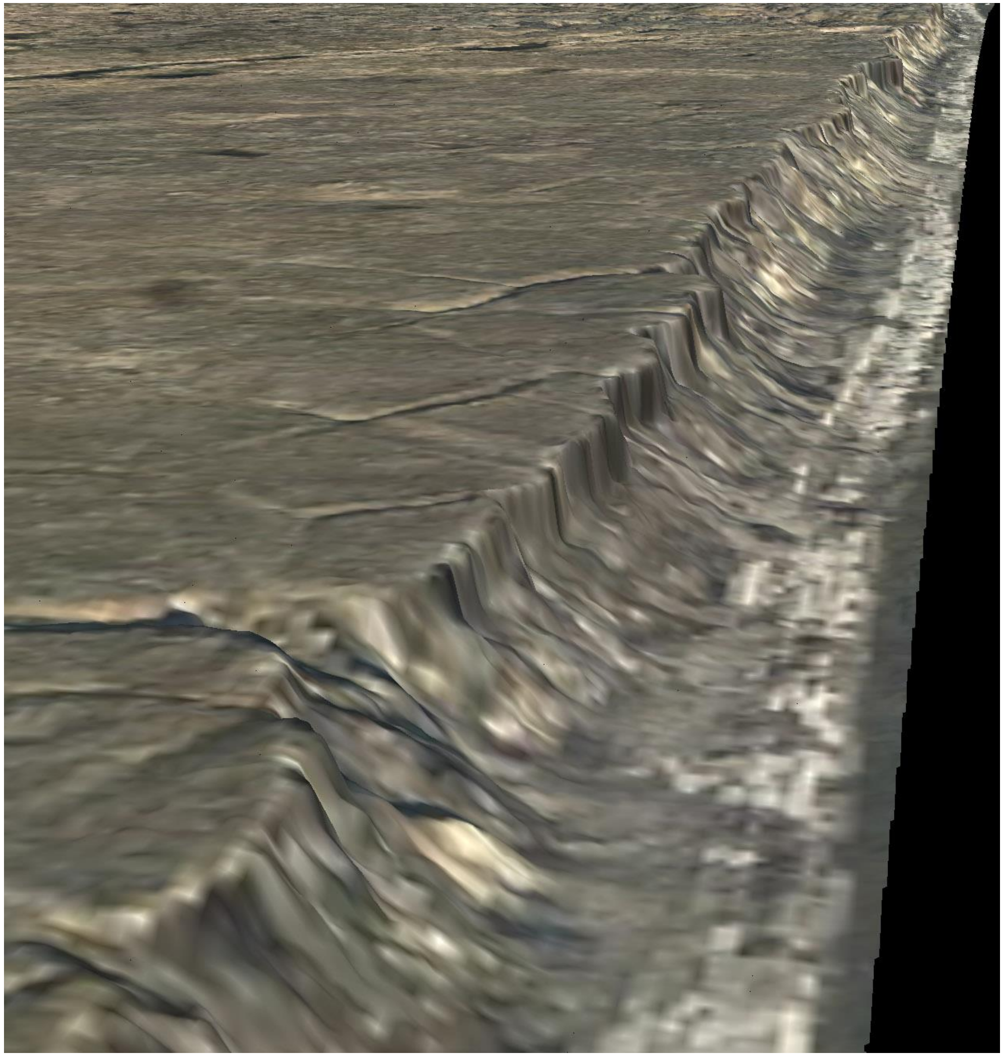
Applications: Coastline delineation

Nicole Kinsman, Ann Gibbs, and Matt Nolan, 2015.
EVALUATION OF VECTOR COASTLINE FEATURES EXTRACTED FROM 'STRUCTURE FROM MOTION'-DERIVED ELEVATION DATA.
In *The Proceedings of the Coastal Sediments 2015*.

Conclusion: Fodar is suitable for creating accurate shoreline vectors from both orthoimage and DSM.

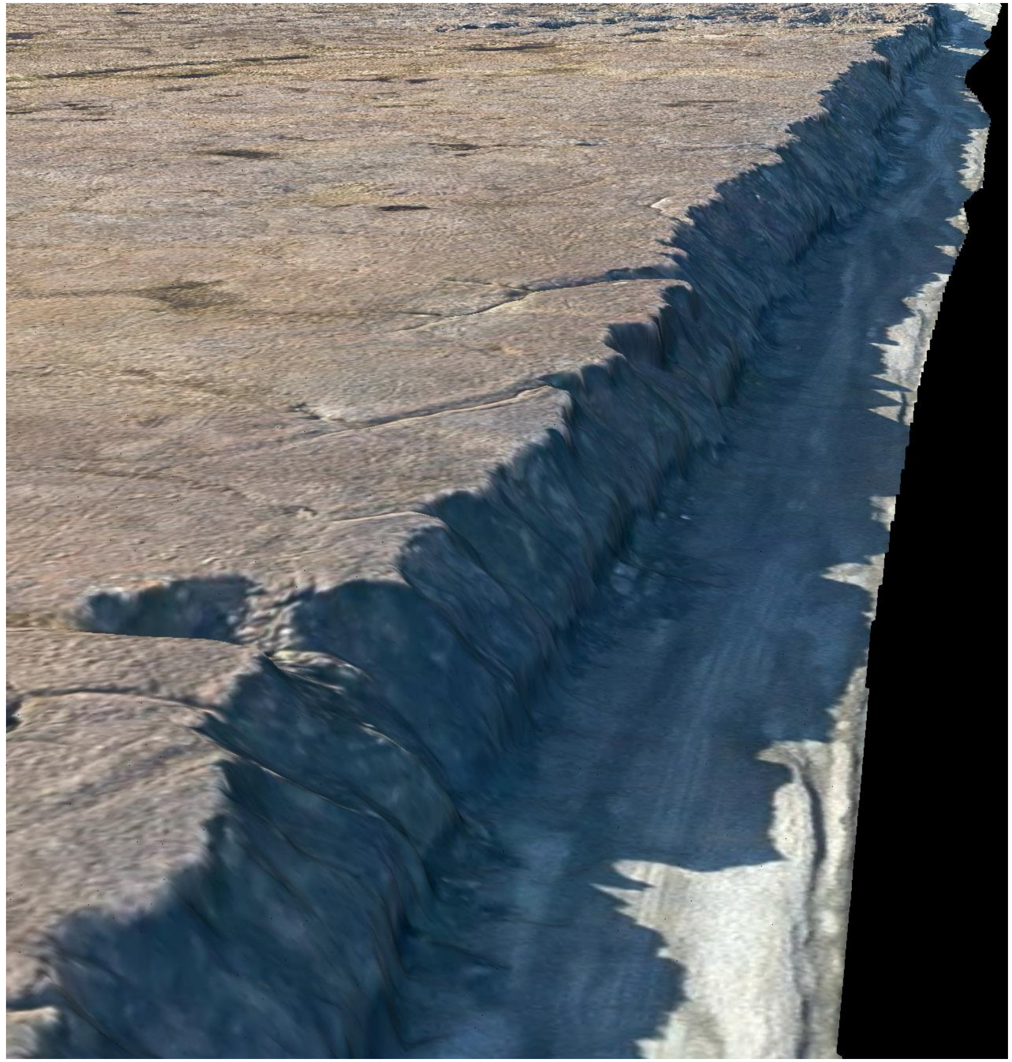
Indeed, DGGS is currently doing just that.

Applications: Coastal Erosion from Repeat Mapping



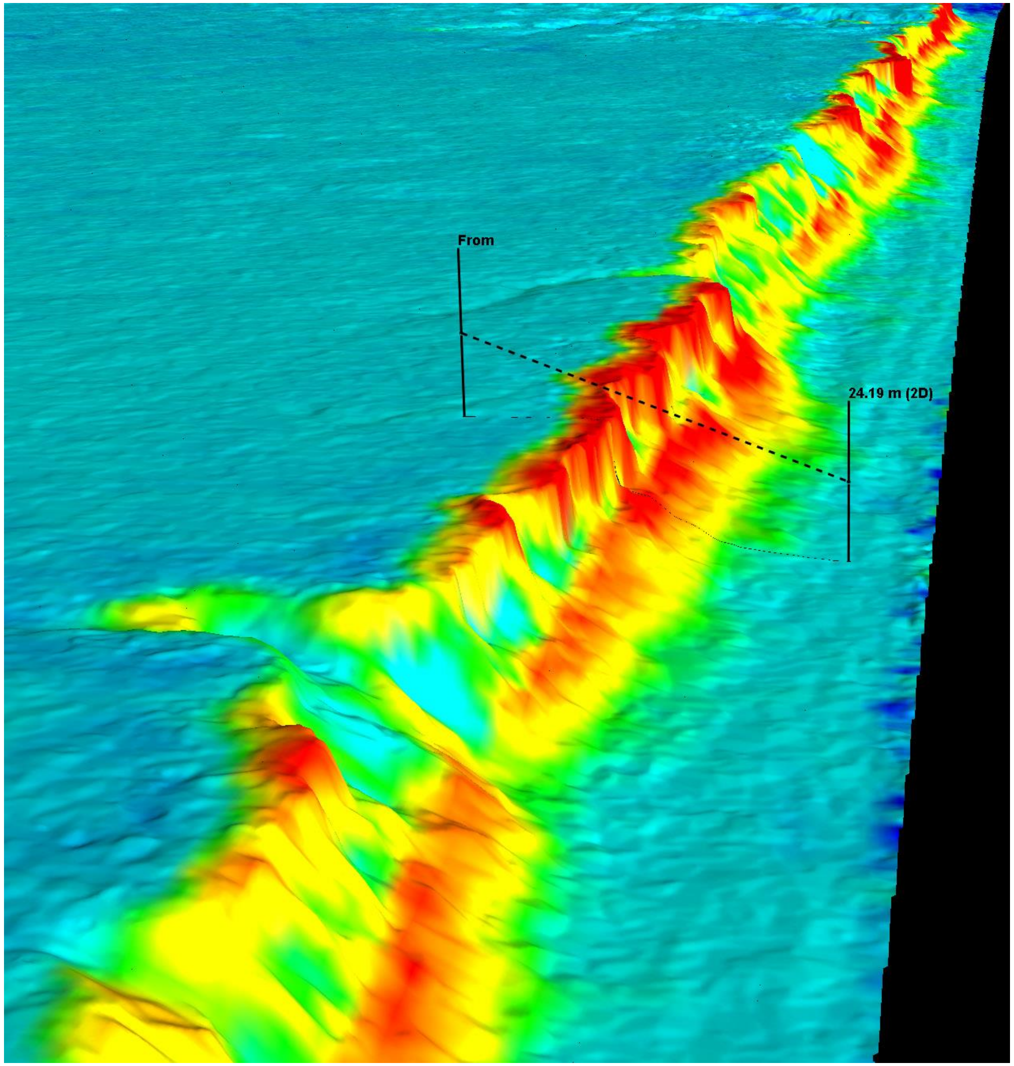
Here is some fodar data of a beach on Barter Island from July 2014.

Applications: Coastal Erosion from Repeat Mapping



Here is the same stretch of beach from September 2014, two months later.

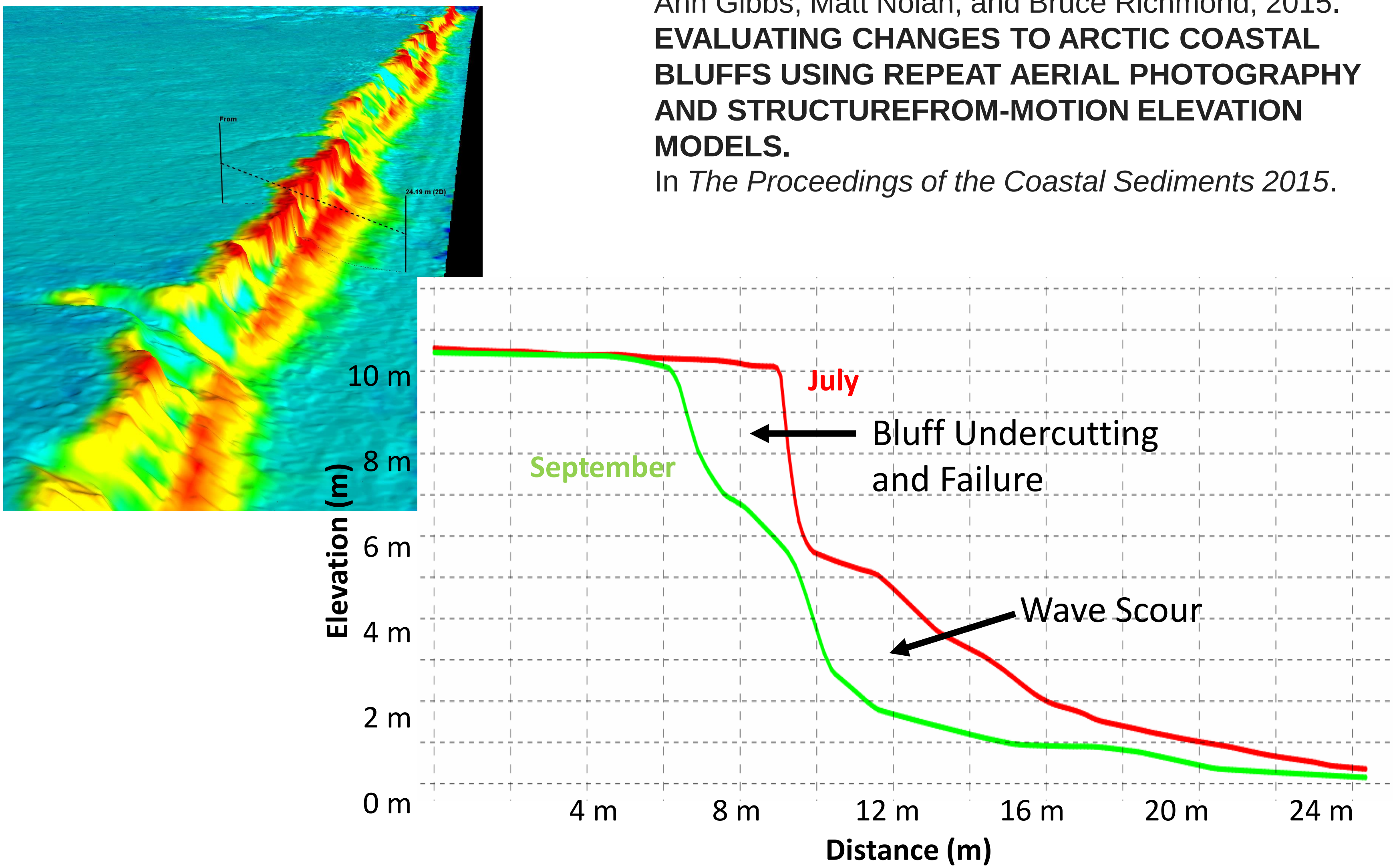
Applications: Coastal Erosion from Repeat Mapping



Here is the erosion that occurred in those two months, with reds, yellows, and greens showing loss.

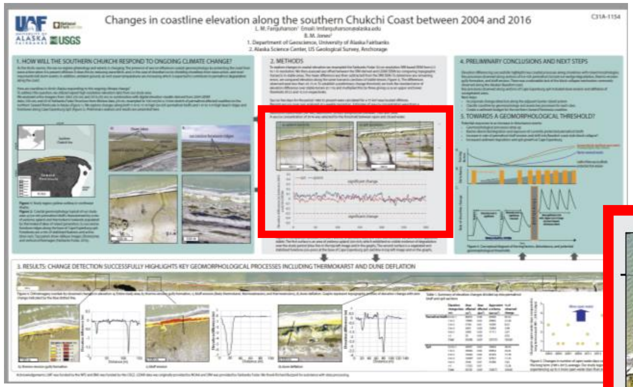
Applications: Coastal Erosion from Repeat Mapping

Ann Gibbs, Matt Nolan, and Bruce Richmond, 2015.
EVALUATING CHANGES TO ARCTIC COASTAL BLUFFS USING REPEAT AERIAL PHOTOGRAPHY AND STRUCTUREFROM-MOTION ELEVATION MODELS.
In *The Proceedings of the Coastal Sediments 2015*.



USGS Conclusion: Fodar is suitable for measuring coastal erosion at unprecedent accuracy.

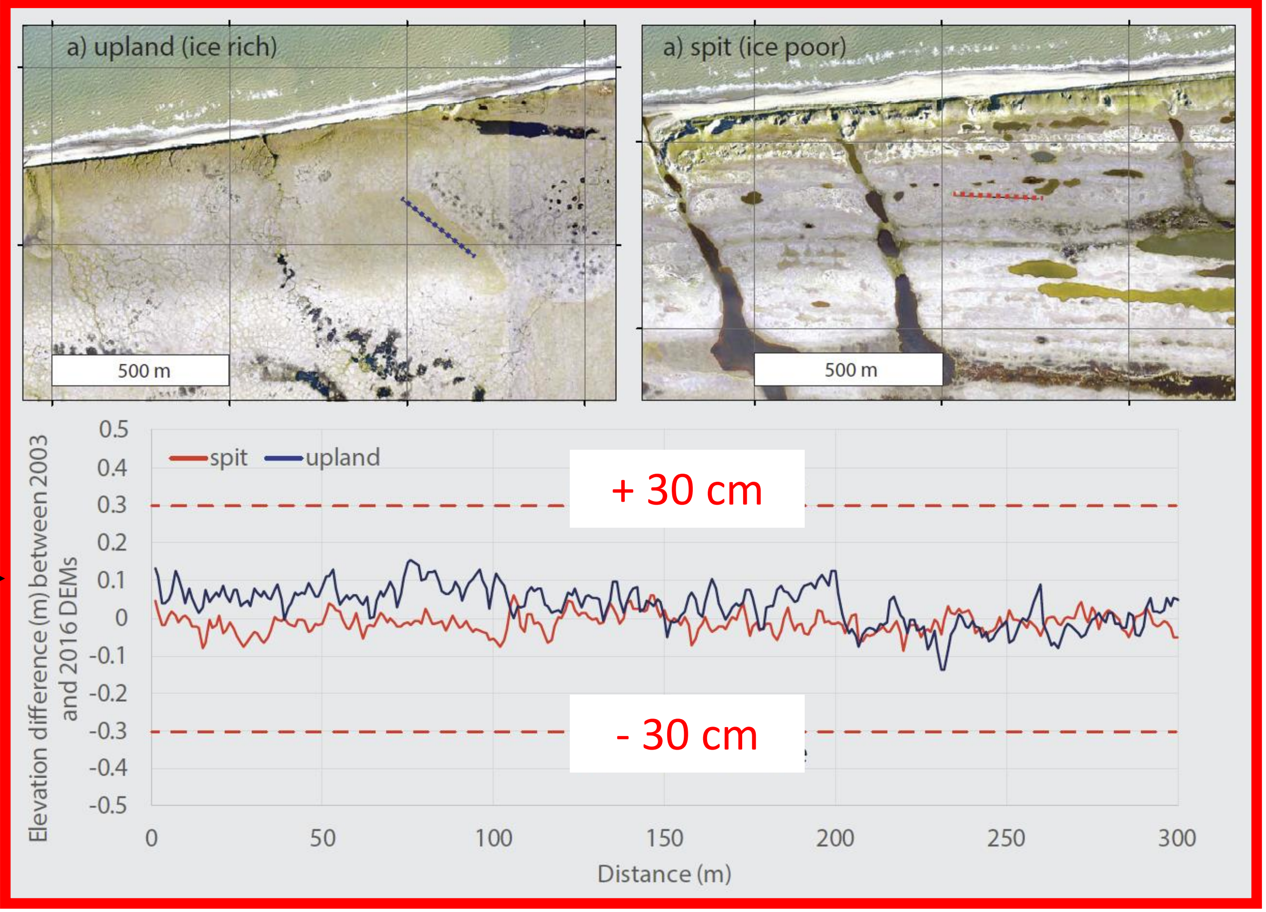
Applications: Coastal Erosion from Repeat Mapping



Louise Farquharson and Ben Jones,
Changes in coastline elevation along the southern Chukchi Coast between 2004 and 2016.
AGU Fall Meeting 2018, C31A-1154.

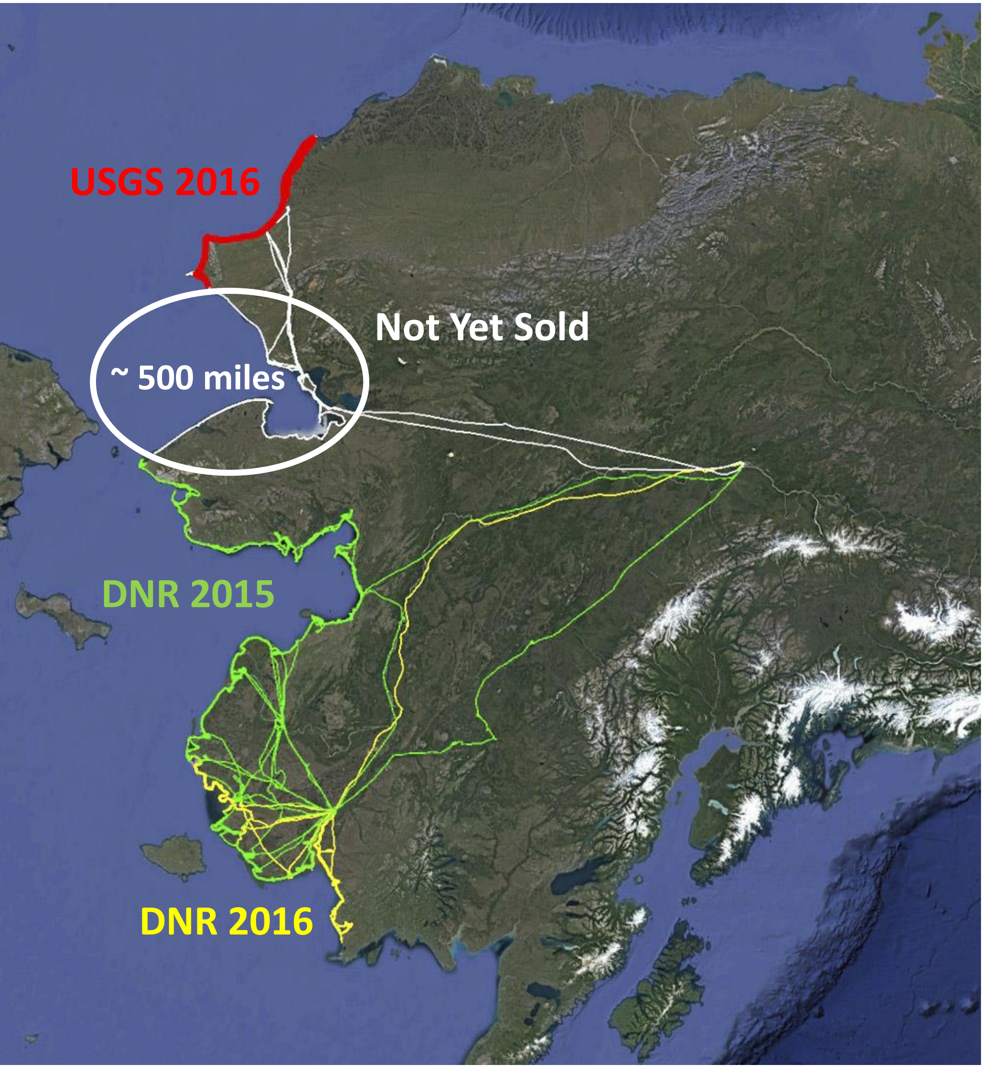
Between Shishmaref and Cape Espenberg

2004 Lidar
minus
2016 Fodar
near Shishmaref



UAF Conclusion: Fodar elevation values are within 10 cm of lidar and thus these data are suitable for coastal erosion measurements.

West Coast Overview



There has been some awesome work done with the existing data I don't want to hold up scientific and policy progress by waiting/hoping for an RFP for the missing data, but I can't release it for free either.

Total cost to date: $375,000.

Applying the DNR/USGS rates to these 500 miles, retail price should be $125,000,
and includes Shishmaref and Kivilina.
Data have the same specs as DNR/USGS,
But are only 700-1000 m wide.

I'm willing to reduce the price to $36,000 if…

… the people at this summit are excited to crowd fund this purchase and work together to figure out a mechanism.

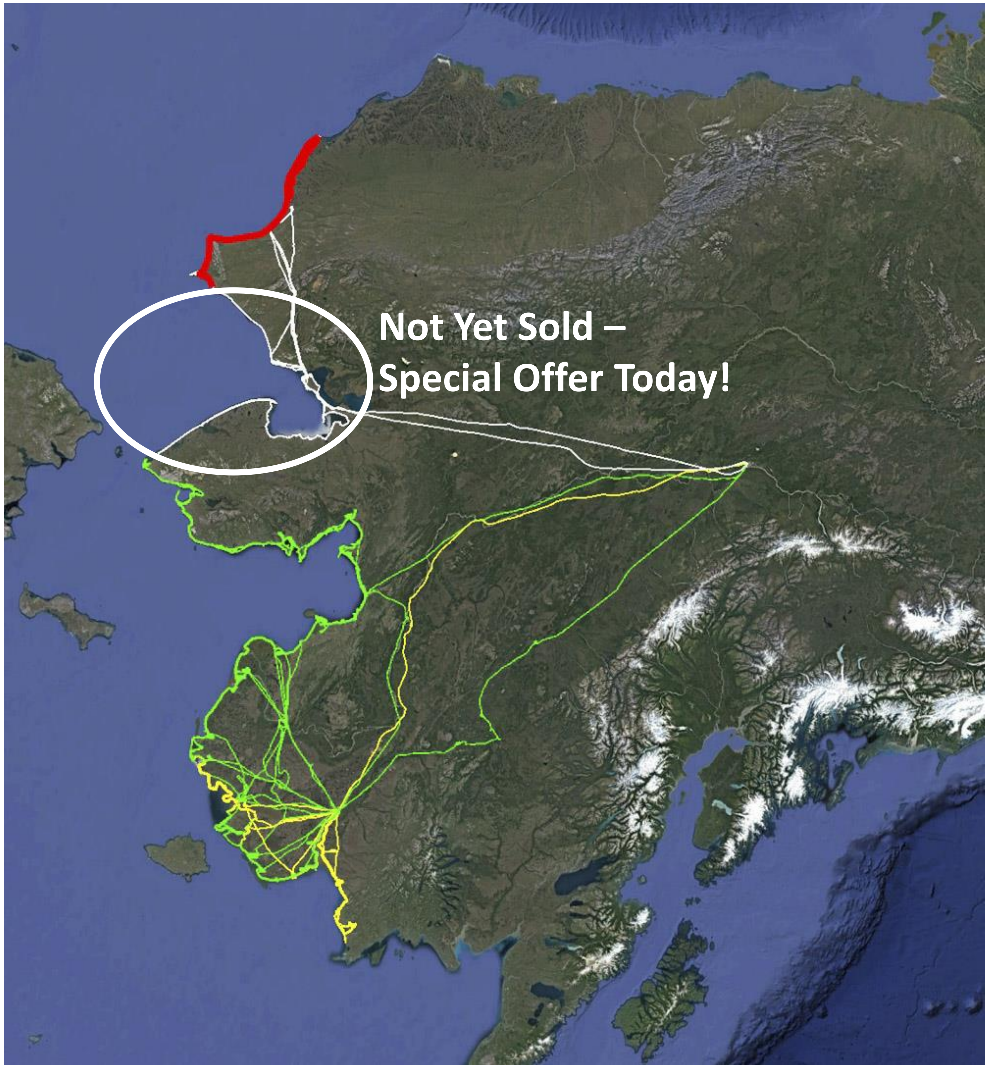
That's only $360/person attending!
Or 12 people @ $3000 each!

Take Home Messages

1) Fodar is awesome for coastal mapping and analysis. But don't just take my word for it…

2) I'm excited to map the rest of Alaska's coast!

3) COASTAL SUMMIT SPECIAL OFFER for WALES to PT HOPE Today: $36,000, but need a large expression of interest from this crowd and need to figure out the best mechanism to share costs.



Thank You!

Visit www.fairbanksfodar.com for more info!

Closing Remarks

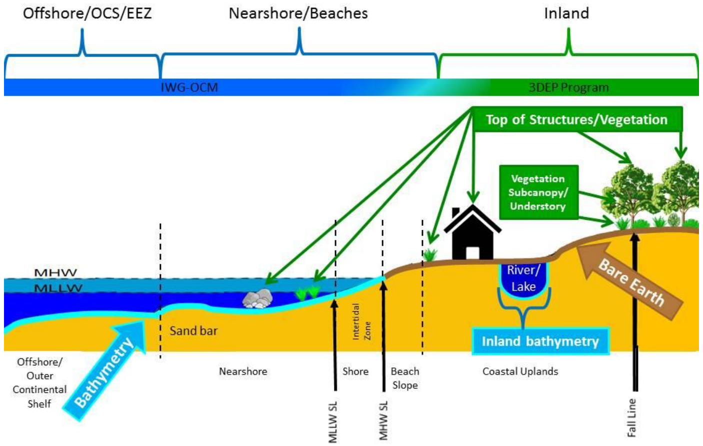
Alaska Coastal Mapping Summit

Marta Kumle, Coastal Mapping Strategist
Alaska Ocean Observing System
Alaska Department of Natural Resources

February 9, 2018

Coastal Mapping Strategy

Coastal Mapping Strategist



Strategy Document

Goal:

Create an achievable plan to map AK's Coastal Zone

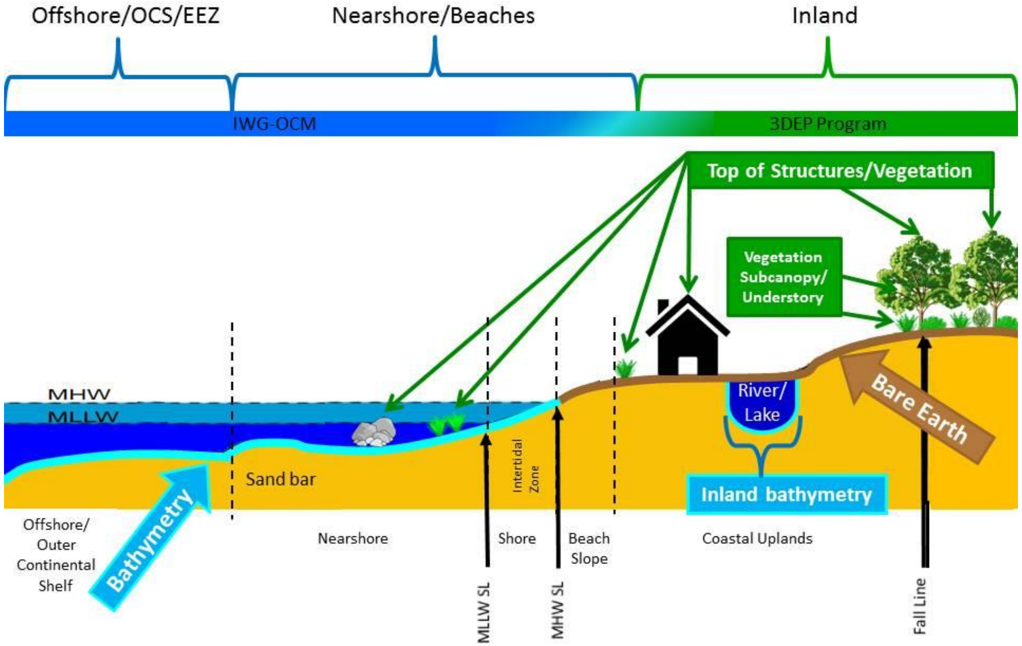
(approx. from <30 m deep to 1 km inland)

- **Long term strategy for prioritizing coastal mapping activities**
- **Selective/tiered data specifications**
- **Appropriate to physical environment**
- **Current and future area uses**
- **Technological/logistical feasibility**
- **Versionable document**

MULTIDISCIPLINARY APPROACH

Data Types:

Bathymetry
Shoreline Delineation
Nadir/Oblique Imagery/Video
IFSAR Topography
Lidar
Photogrammetry
New Technologies



MULTIPURPOSE APPROACH

Products:
flood mapping
coastal navigation
coastal hazards
coastal change
habitat mapping

Enable Classifications:
vegetation
habitat
hazard
geomorphic

Industry Applications:
infrastructure
engineering
nearshore navigation
project planning

Image courtesy of Shorezone: Tigvariak Island, Beaufort Sea, North Slope.

Specifications Matrix

- **Data Acquisition (as technology neutral as possible)**
  - **leverage new technologies**
  - **resources already in Alaska**
- **Elevation, Bathymetry, Imagery**
- **DEM, DSM, Photomosaics, Land Cover**
- **Refresh Rates**
- **Horizontal & Vertical Control**
- **Water Levels, Tidal Fluctuations**

	IHO Bathy	Lidar: Q1, Q2, Q3	Imagery
IHO Bathymetry	✓✓✓	✓	✓✕
Lidar: Q1, Q2, Q3		✓✓✓	✓
Imagery			✓✓✓

Location Specific

What specifications are needed where?

Match feasibility & capacity

Account for:

- **population/communities**
- **industry activity**
- **natural resources**
- **hunting/fishing**
- **habitat**
- **geomorphic processes**
- **storm surges & flooding**

2017 → 2030

what is feasible to accomplish?

User Groups

Alaska Geospatial Council (AGC)

Alaska Mapping Executive Committee (AMEC)

Agency Liaisons

Native Corporations

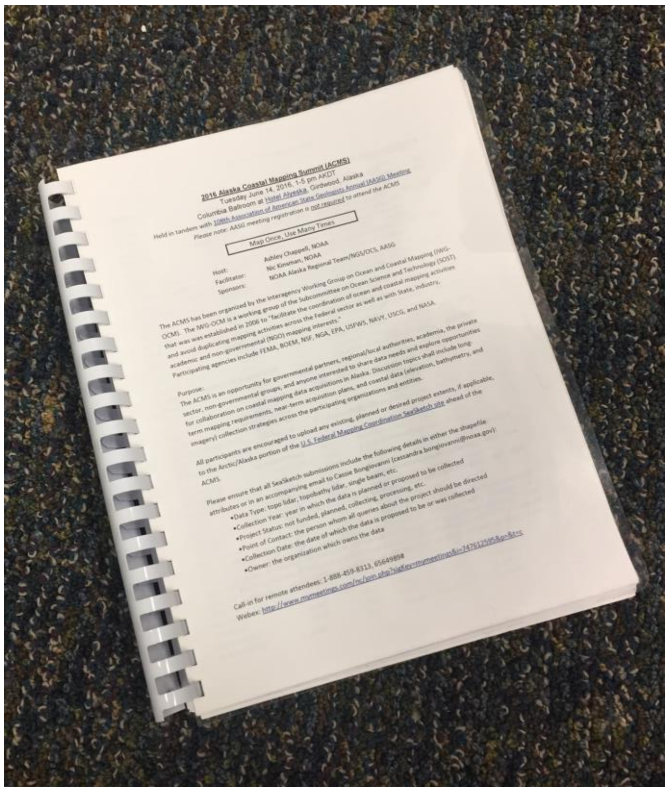
Non-Governmental Organizations

Private Sector

Academic Community

Suggestions?

NEXT STEPS



Conference Report

- executive summary
- send me feedback

Hydrographic Service Review Panel (HSRP) & Alaska Mapping Executive Committee (AMEC)

- Juneau, AK in August

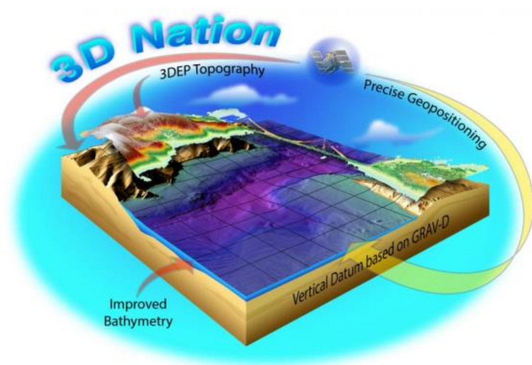
Stay Involved

Alaska Geospatial Council Technical Working Groups:

- **Elevation**
- **Imagery**
- Geoportal
- **Terrestrial Hydrography**
- Transportation
- Administrative Boundaries
- Parcels/Cadastral
- Geodetic Control
- **Wetlands**

http://agc.dnr.alaska.gov/

Email: Ann.Johnson@alaska.gov



Volunteer to be a strategic plan contributor/reviewer

Contact me:
marta.kumle@alaska.gov

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