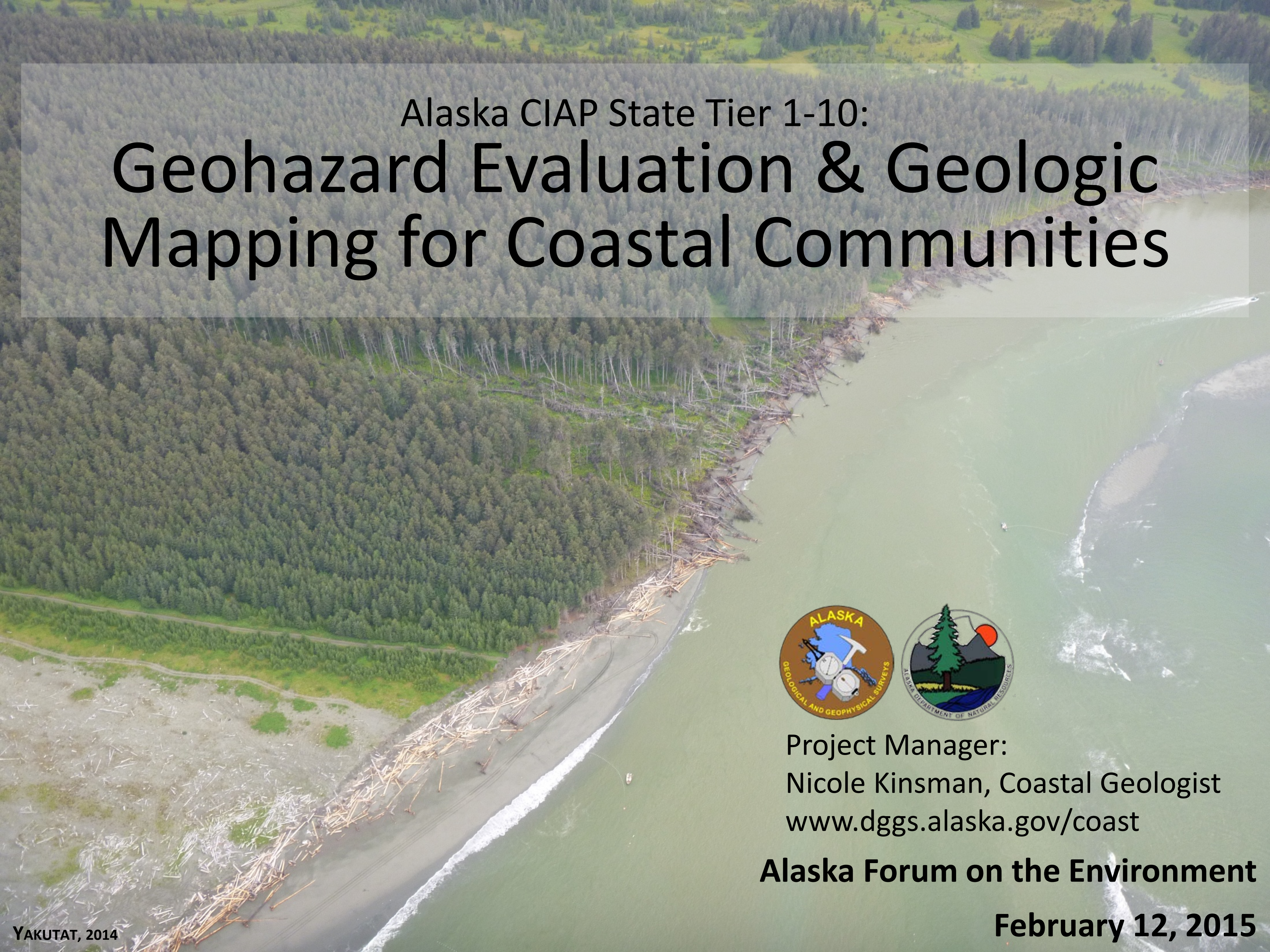
Alaska CIAP State Tier 1-10:

Geohazard Evaluation & Geologic Mapping for Coastal Communities


YAKUTAT, 2014

Project Manager:
Nicole Kinsman, Coastal Geologist
www.dggs.alaska.gov/coast

Alaska Forum on the Environment

February 12, 2015

Coastal Hazards Program at DGGS

Division of Geological & Geophysical Surveys

- Program launched in 2011, initial funding from Coastal Impact Assistance Program
- Available to field coastal questions from stakeholders (~10-20 weekly requests)
- Program objectives:
  - Increase quality/quantity of coastal baseline data
  - Provide shoreline change and coastal inundation tools
  - Encourage/develop coastal management resources for an Alaskan audience

What are

COASTAL GEOHAZARDS IN ALASKA?

GOLOVIN, NOVEMBER 2011 (T. ANUNGAZUK)

WHAT ARE COASTAL GEOHAZARDS IN ALASKA?

Beach Erosion/Accretion, Slope Failure, Coastal Flooding, Tsunami, Ivu, Sea Level Change, Salt Spray…

Erosion
Kivalina, AK *(Kinsman 2010)*

Storm Surge
Shaktoolik, AK July 2011 *(Kinsman 2011)*

Ivu (Ice Push)
Nome, AK - May 2004 *(Tom Busch 2004)*

Tsunami Damage
Kodiak, AK – March 1964 *(noaa.gov)*

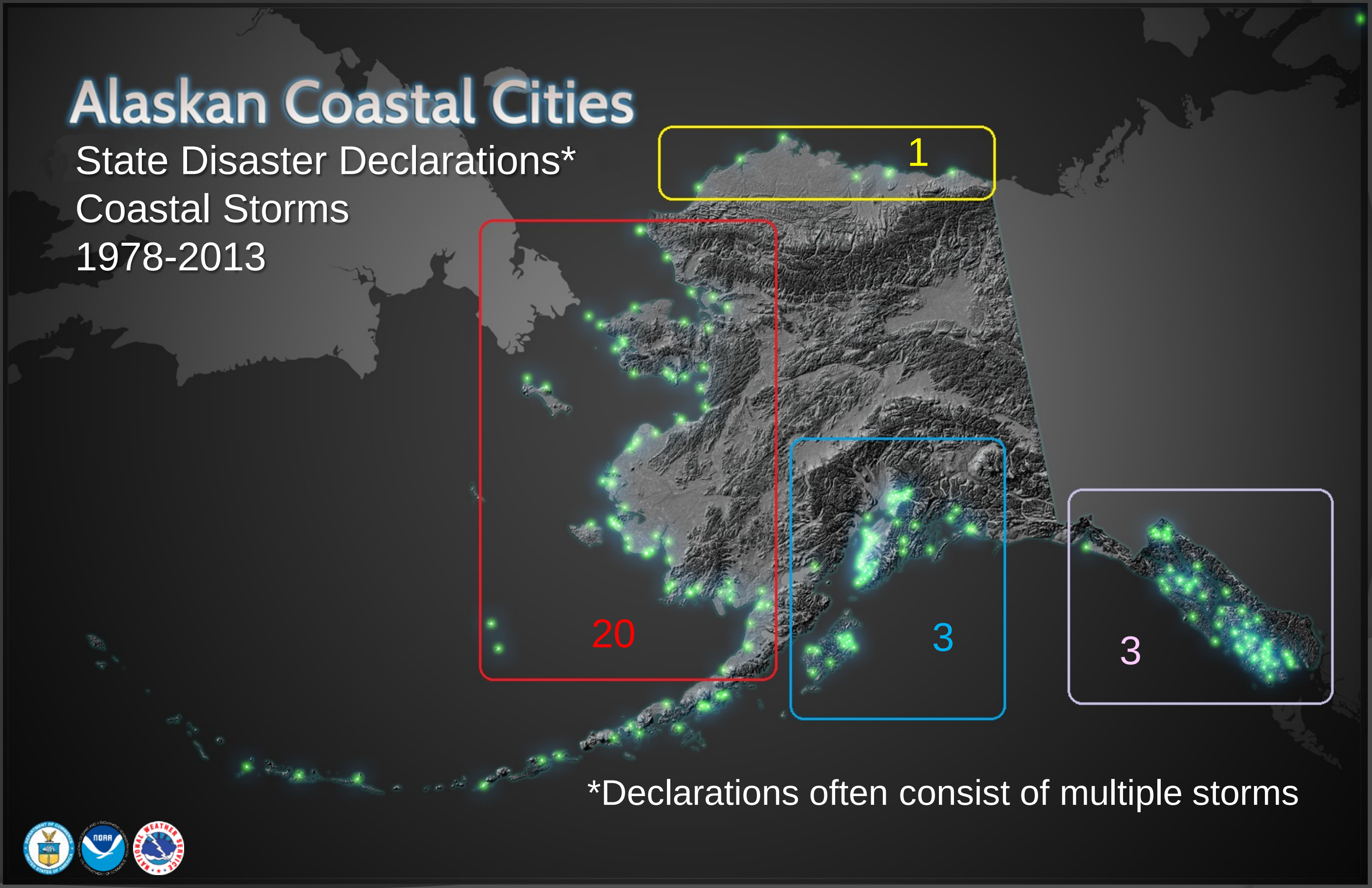
Coastal processes have highly variable:

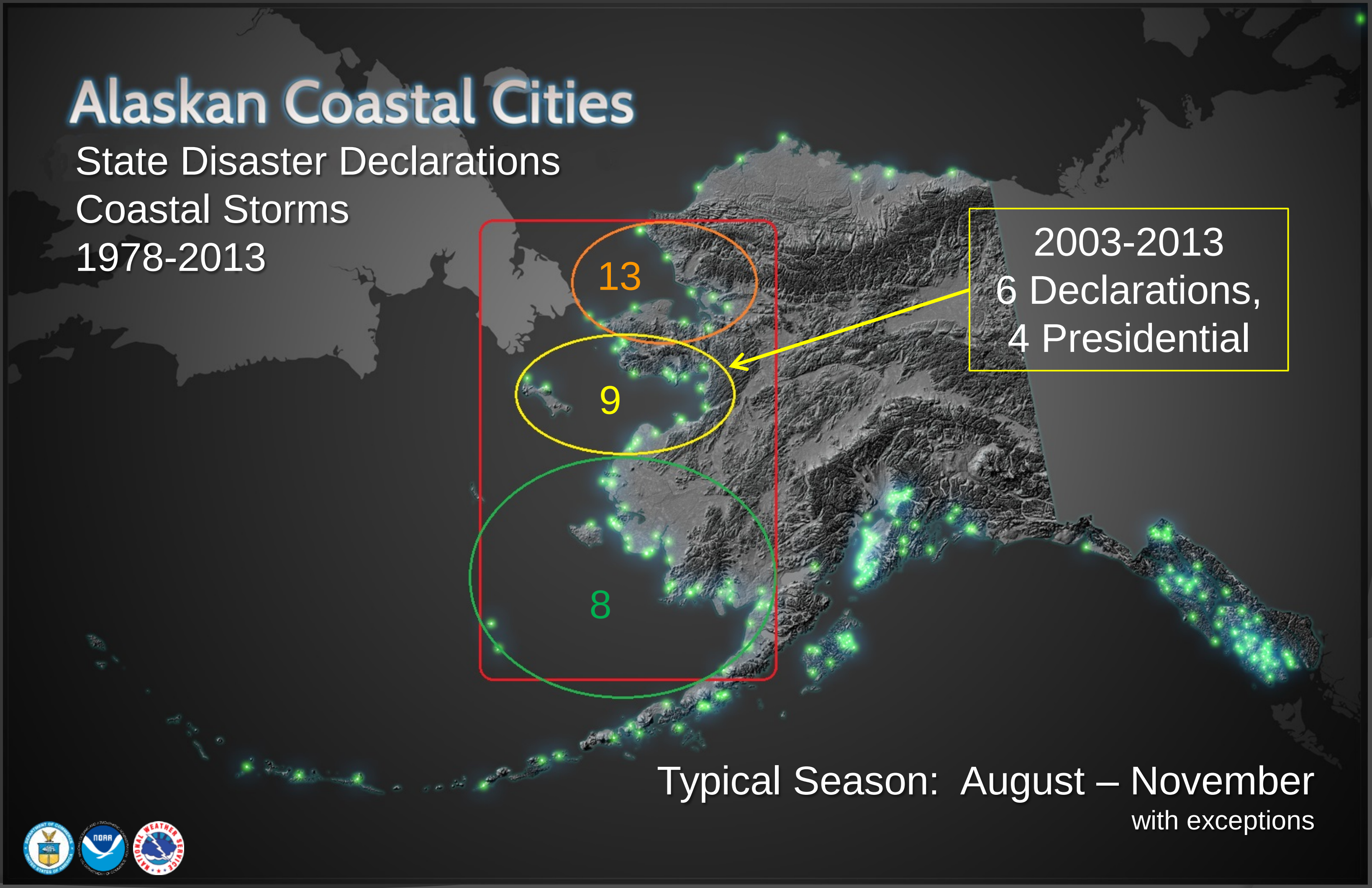
- Intensities
- Frequencies
- Spatial Extents

Processes may be <u>catastrophic</u> or <u>gradual</u>

<u>catastrophic</u>
- Storm Surge
- Tsunami

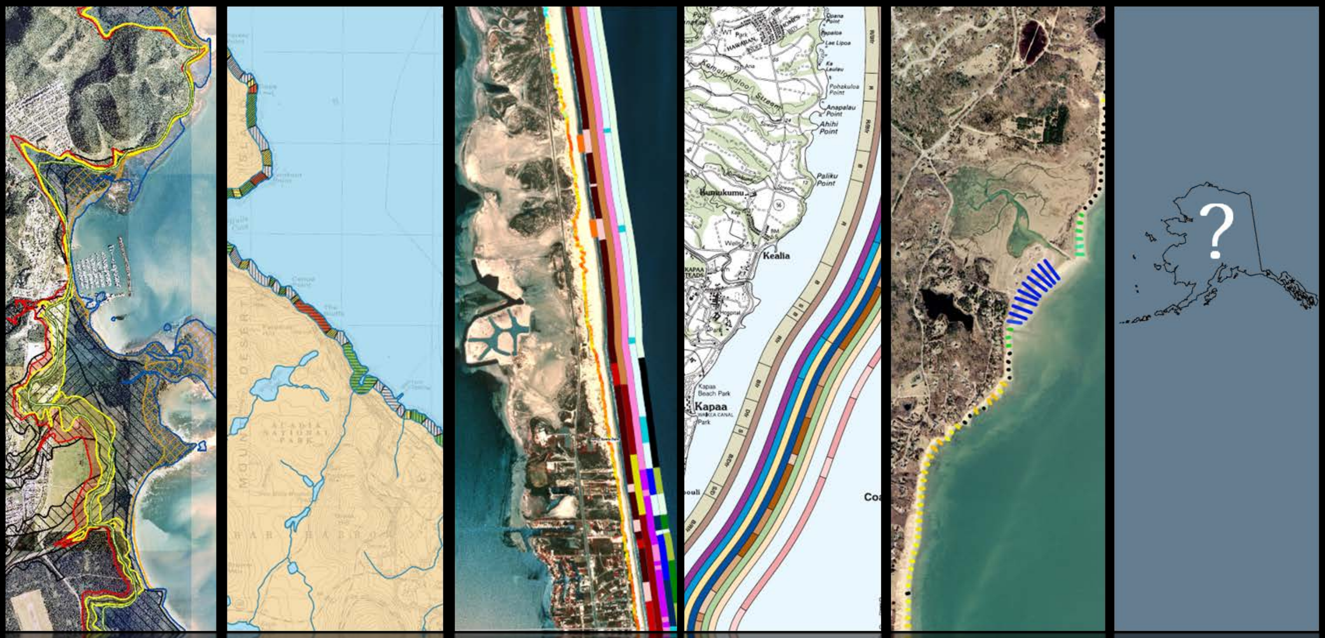
<u>gradual</u>
- Permafrost melt
- Gravel mining
- ATV use on dunes


Alaskan Coastal Cities
State Disaster Declarations*
Coastal Storms
1978-2013
1
20
3
3
*Declarations often consist of multiple storms


Alaskan Coastal Cities
State Disaster Declarations
Coastal Storms
1978-2013
13
9
8
2003-2013
6 Declarations,
4 Presidential
Typical Season: August – November
with exceptions

Why

ARE THERE NOT BETTER COASTAL MAP PRODUCTS IN ALASKA?



COASTAL VULNERABILITY MAPPING – ALASKA CHALLENGES

Shaktoolik, AK *(Kinsman 2011)*

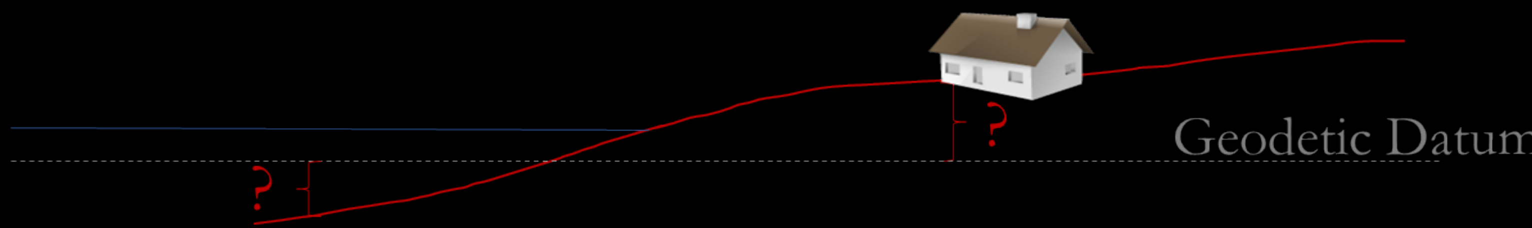
vs.

San Diego, CA
(www.oceanlight.com)

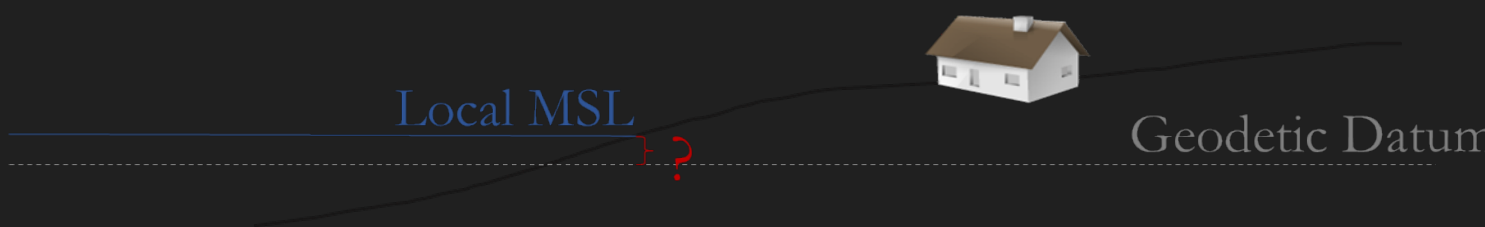
- Existing methodologies designed for densely populated coastlines
- Unique hazards & different emphasis
- Longest coastline in the United States - very diverse coastal environments
- Extremely limited baseline data
  - Water levels, historic event record, aerial imagery, topography & bathymetry
- Coastal economics are fundamentally different

DATA GAPS!

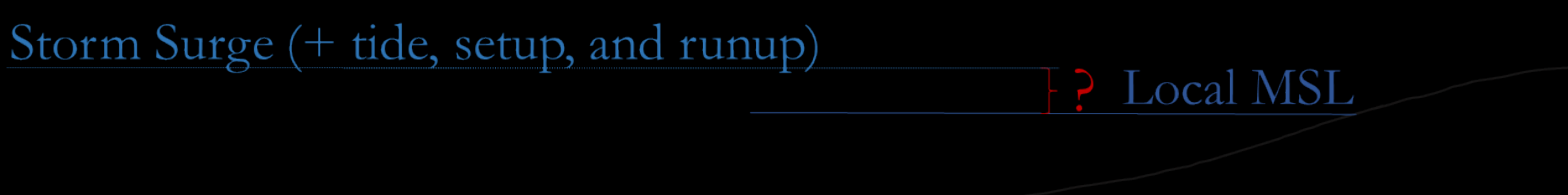
1. *Elevation Models* → *How high is the land and how deep is the water?*



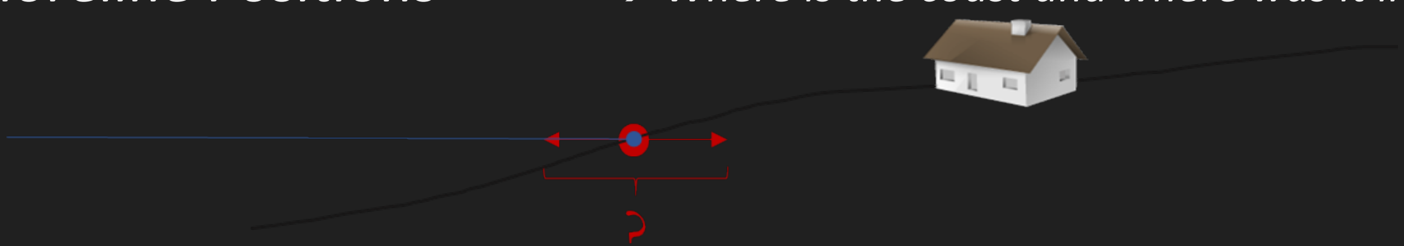
2. *Tide Gauges* → *Where is the water relative to land?*



3. *Storm Surge* → *How do ocean and waves behave in a storm?*

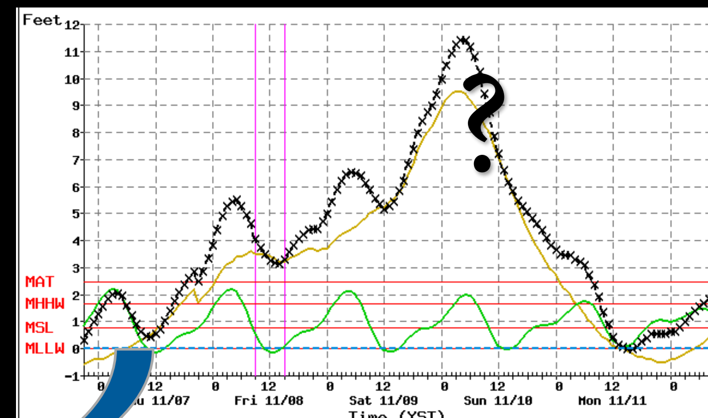


4. *Shoreline Positions* → *Where is the coast and where was it in the past?*



Qualitative → Quantitative Observations

SHAKTOOLIK, NOVEMBER 2011



Baseline Data is the Foundation for Evaluating Change

PORT HEIDEN, 2006 (SHOREZONE)

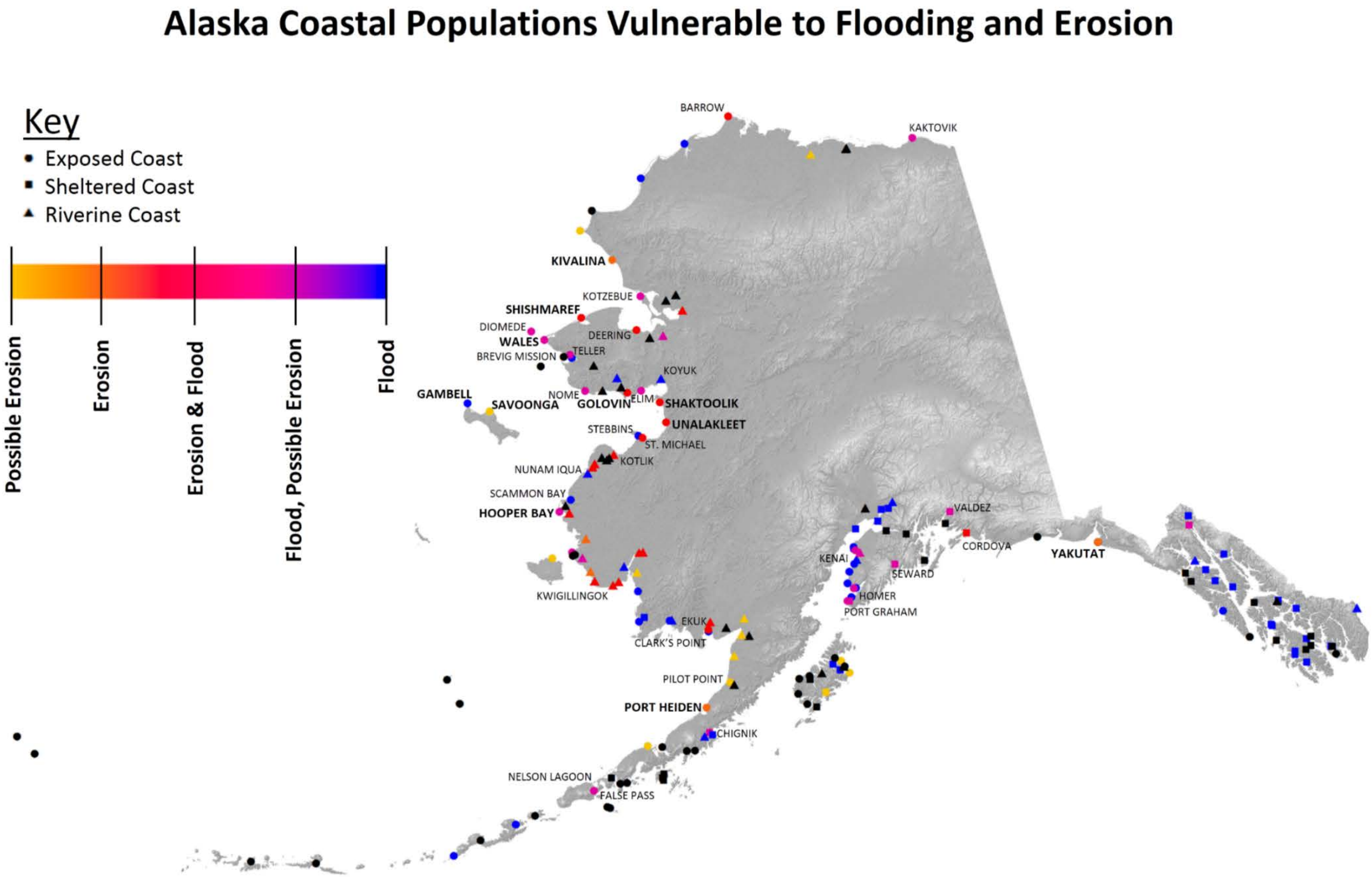
PORT HEIDEN, 2013

~~Rapid Erosion is occurring~~

38.2 ft/year of Erosion

DGGS is

COLLECTING BASELINE DATA


Alaska Coastal Populations Vulnerable to Flooding and Erosion
Key
Exposed Coast
Sheltered Coast
Riverine Coast
Possible Erosion
Erosion
Erosion & Flood
Flood, Possible Erosion
Flood
BARROW
KAKTOVIK
KIVALINA
KOTZEBUE
SHISHMAREF
DIOMEDE
WALES
DEERING
TELLER
BREVIG MISSION
KOYUK
GAMBELL
SAVOONGA
NOME
GOLOVIN
ELIM
SHAKTOOLIK
UNALAKLEET
STEBBINS
ST. MICHAEL
NUNAM IQUA
KOTLIK
SCAMMON BAY
HOOPER BAY
KWIGILLINGOK
EKUK
CLARK'S POINT
PILOT POINT
PORT HEIDEN
CHIGNIK
NELSON LAGOON
FALSE PASS
KENAI
HOMER
PORT GRAHAM
SEWARD
VALDEZ
CORDOVA
YAKUTAT

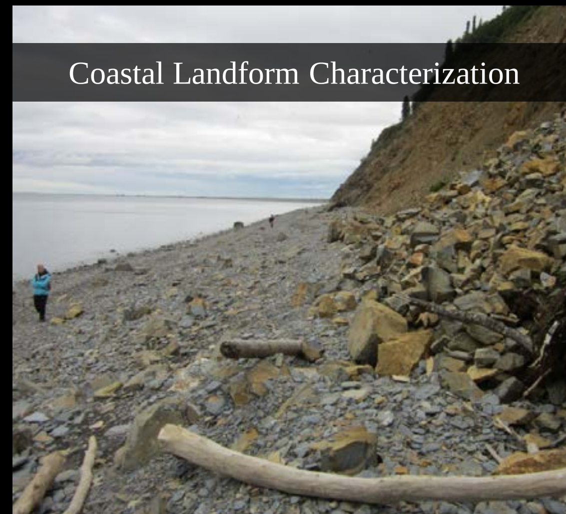
BASELINE DATA COLLECTION

What has shaped the coast?

What is shaping the coast now?

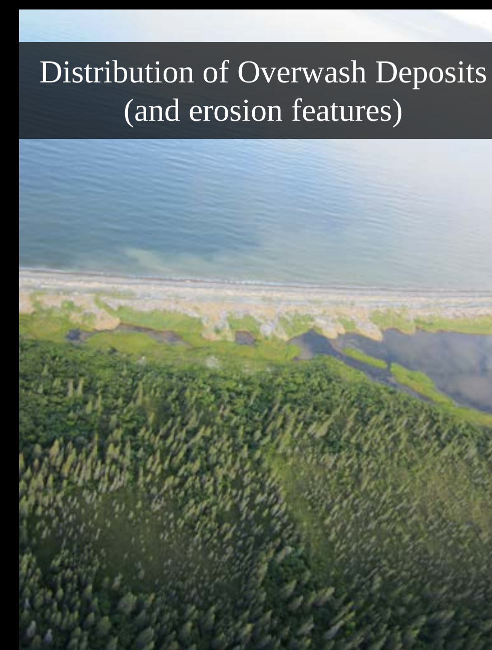
Benefits of documenting coastal processes in detail:

- Map areas of vulnerability
- Establish baselines to monitor changes in event timing, frequency and magnitude
- Design effective mitigation strategies
- Understand how modifications will influence the coastal environment
- Improve mathematical models that predict hazard impacts
- Provide forecasters with known values to test accuracy



Coastal Landform Characterization

Inlet Bathymetry and Dynamics

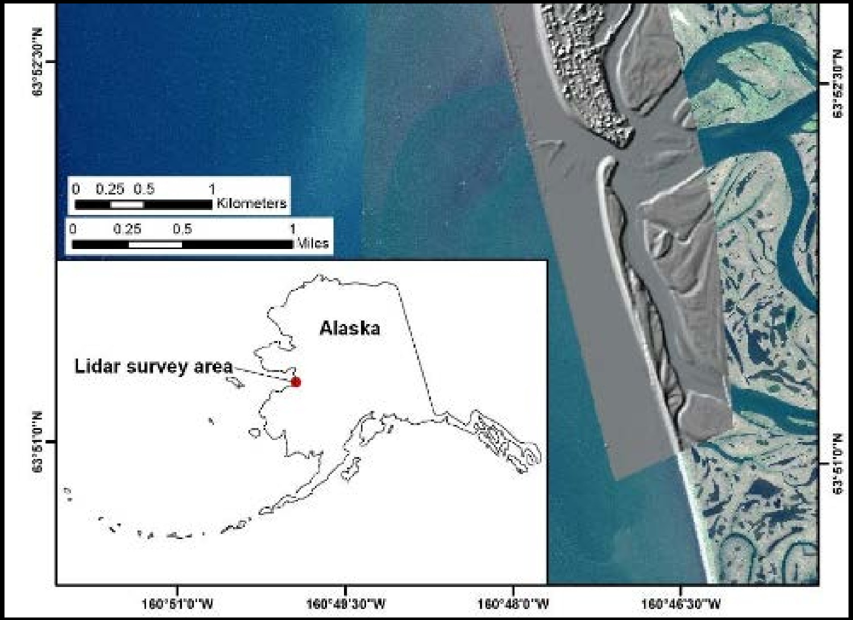


Distribution of Overwash Deposits (and erosion features)

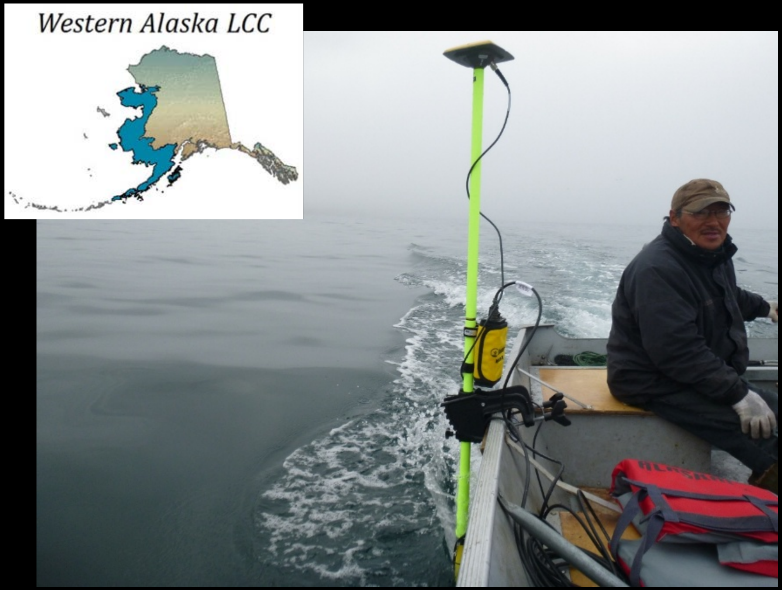
Sediment Sources and Grain size

EXAMPLE: New Aerial Imagery and Elevation Models

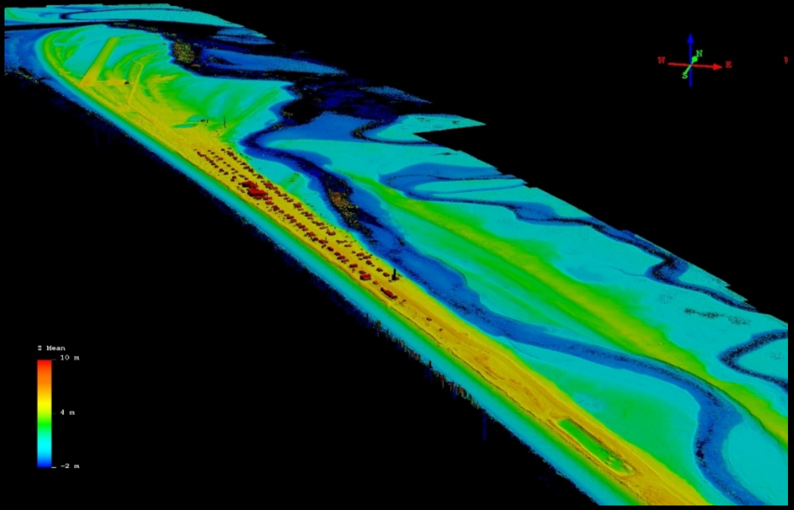
- Coastal imagery:
  - Oblique and orthoimages
  - Historical and contemporary
- Elevation data:
  - Topography
  - Nearshore bathymetry
  - Ground control
  - Tidal datums



Archive lidar release, Unalakleet (2005) – [DGGS Raw Data File 2014-2]()

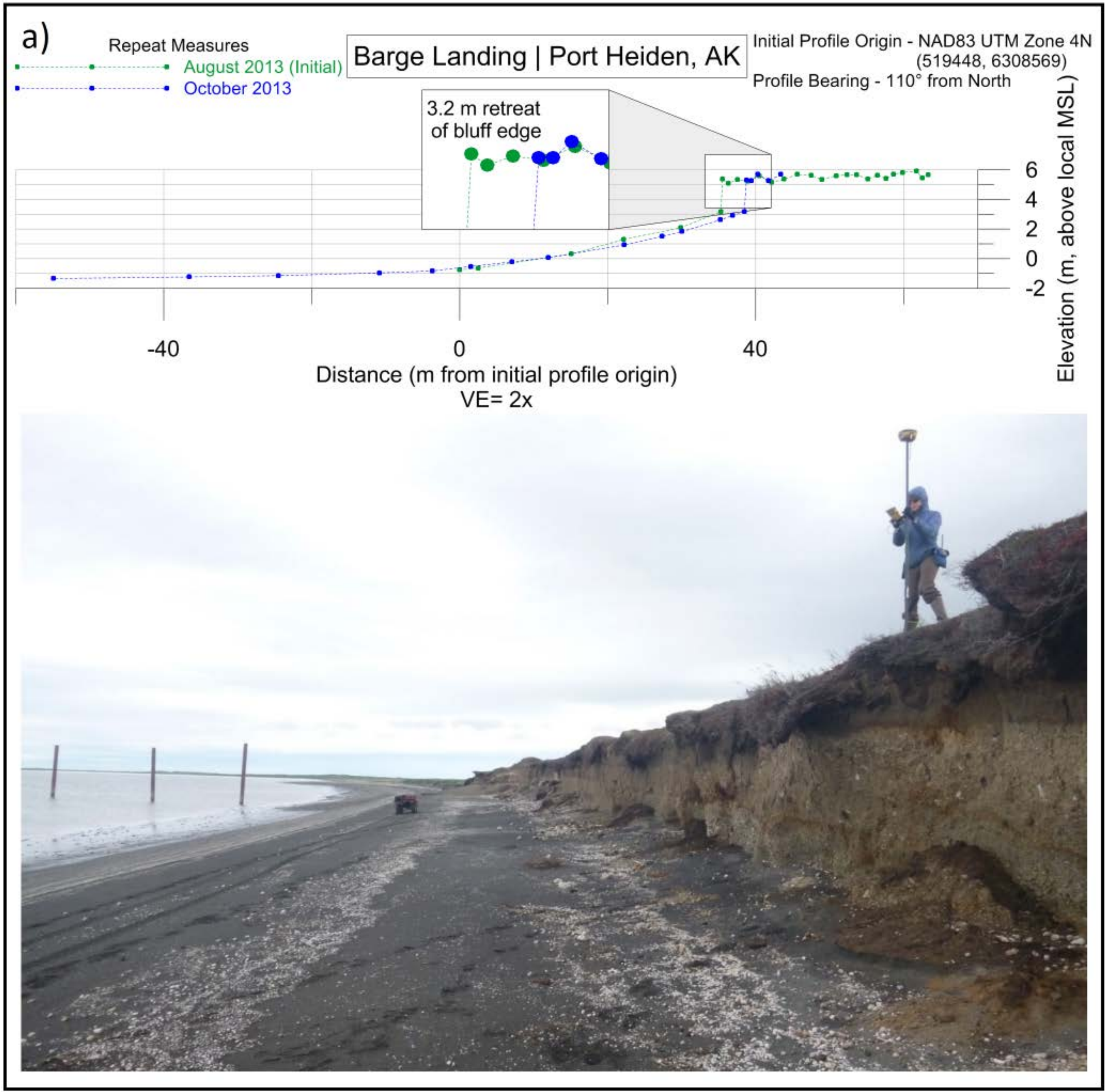


Portable sonar work with Dylan Iya, Savoonga (2013)



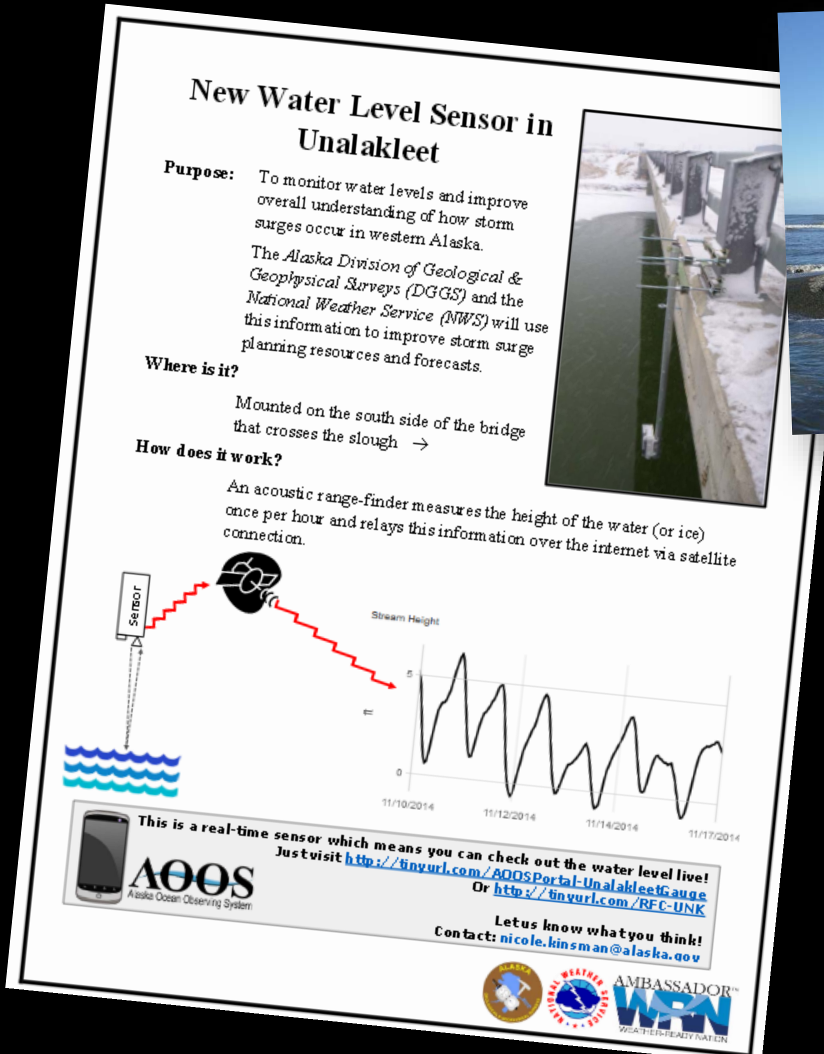
Photogrammetric DEM, Shaktoolik, Alaska (2014) – in [DGGS Misc. Publication 154]()

EXAMPLE: Coastal Profiles (Snapshots of Beach Elevation)



EXAMPLE: Mapping Shoreline Positions

EXAMPLE: Water Level Measurements



New Water Level Sensor in Unalakleet

Purpose: To monitor water levels and improve overall understanding of how storm surges occur in western Alaska.

The *Alaska Division of Geological & Geophysical Surveys (DGGS)* and the *National Weather Service (NWS)* will use this information to improve storm surge planning resources and forecasts.

Where is it?

Mounted on the south side of the bridge that crosses the slough →

How does it work?

An acoustic range-finder measures the height of the water (or ice) once per hour and relays this information over the internet via satellite connection.

This is a real-time sensor which means you can check out the water level live!
Just visit http://tinyurl.com/AOOSPortal-UnalakleetGauge
Or http://tinyurl.com/RFC-UNK

AOOS Alaska Ocean Observing System

Let us know what you think!
Contact: nicole.kinsman@alaska.gov

AMBASSADOR WRN WEATHER-READY NATION

New continuous water level stations:
Tununak and Unalakleet (2014)
– NWS and [AOOS Real-Time Sensor Map]

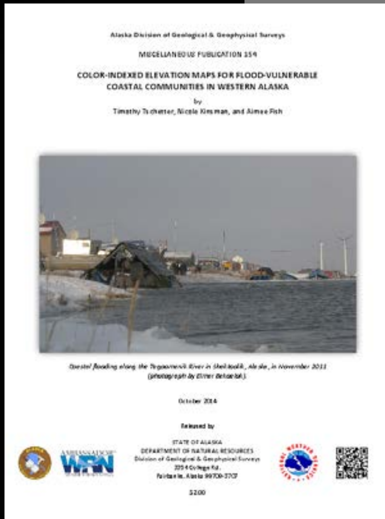
Measured limit of wave run-up – [DGGS Report of Investigations 2012-2]

NATIONAL WEATHER SERVICE

AOOS Alaska Ocean Observing System

New &
Upcoming

COASTAL MAPS AND RESOURCES


Alaska Division of Geological & Geophysical Surveys

MISCELLANEOUS PUBLICATION 154

COLOR-INDEXED ELEVATION MAPS FOR FLOOD-VULNERABLE COASTAL COMMUNITIES IN WESTERN ALASKA

by

Timothy Tschetter, Nicole Kinsman, and Aimee Fish

Coastal flooding along the Tagoomenik River in Shaktoolik, Alaska, in November 2011 (photograph by Elmer Bekoalok).

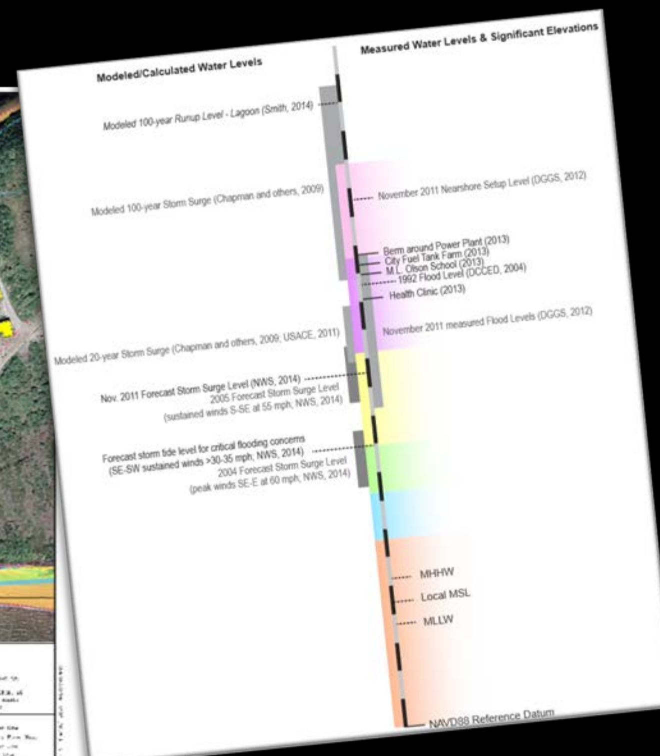
October 2014

Released by

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
Division of Geological & Geophysical Surveys
3354 College Rd.
Fairbanks, Alaska 99709-3707

$2.00

- Resource to improve 2-way communication about flood impacts
- Pilot project in 5 locations: UNK, SKK, GLV, SHH and KVL
- A stopgap tool on the way to flood maps



State of Alaska | myAlaska | My Government | Resident | Business in Alaska | Visiting Alaska | State Employees

Alaska Coastal Profile Tool (ACPT)

Alaska Division of Geological & Geophysical Surveys

State of Alaska > Natural Resources > Geological & Geophysical Surveys > Maps > ACPT

This interactive tool enables access to beach elevation profile measurements collected throughout Alaska since the 1960s. Users can explore profile measurements collected by DGGS and others as time-series plots and location-based images of the shoreface environment. The map has been designed to accommodate datasets collected with differing techniques, including differential leveling, survey-grade GPS or extraction from lidar-derived digital elevation models.

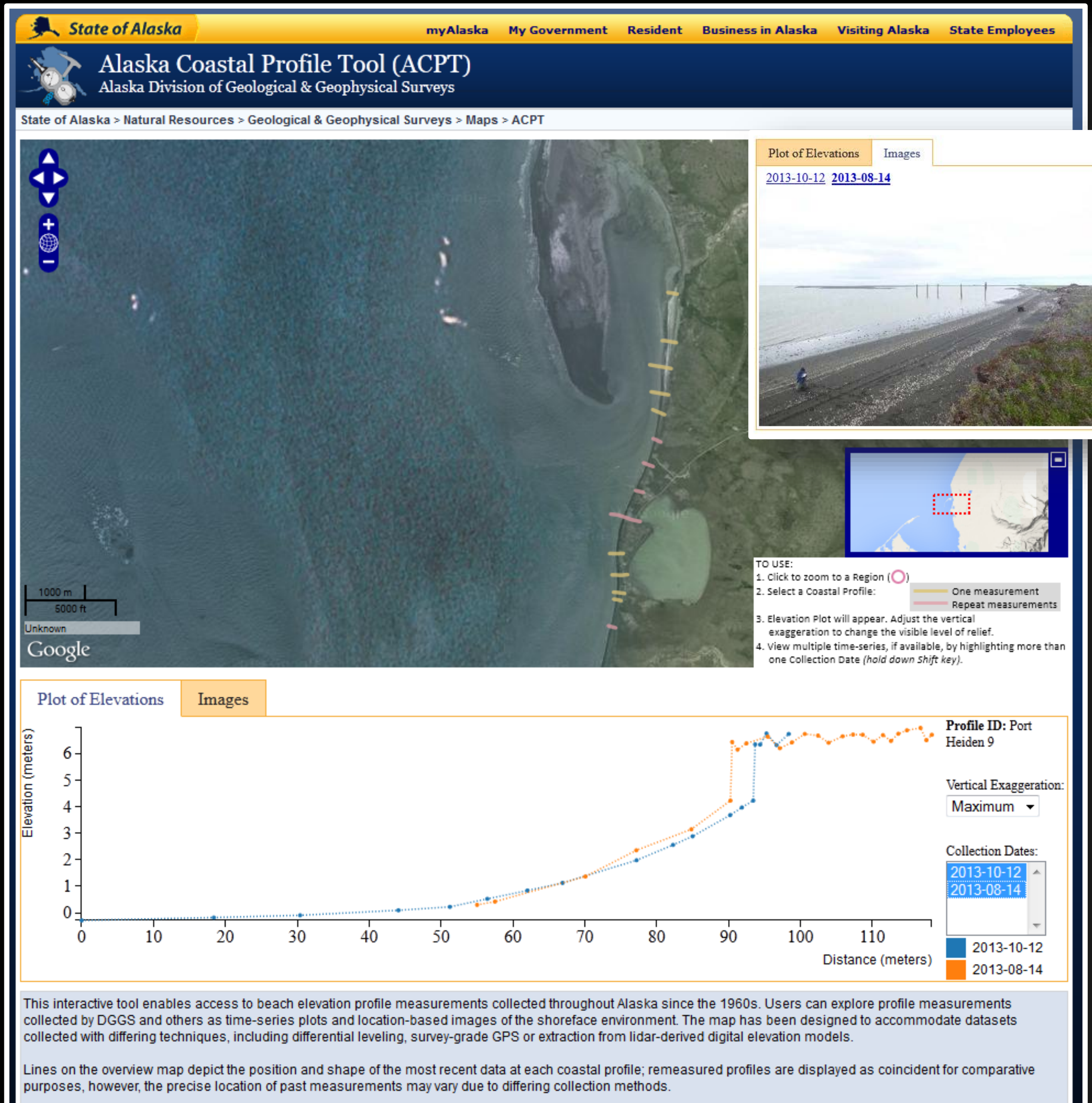
Lines on the overview map depict the position and shape of the most recent data at each coastal profile; remeasured profiles are displayed as coincident for comparative purposes, however, the precise location of past measurements may vary due to differing collection methods.

Source data for this application is available for download. For complete citation information, contributor and funding acknowledgements and metadata, please see http://www.dggs.alaska.gov/pubs/id/27359

Alaska Coastal Profile Tool: maps.dggs.alaska.gov/acpt/

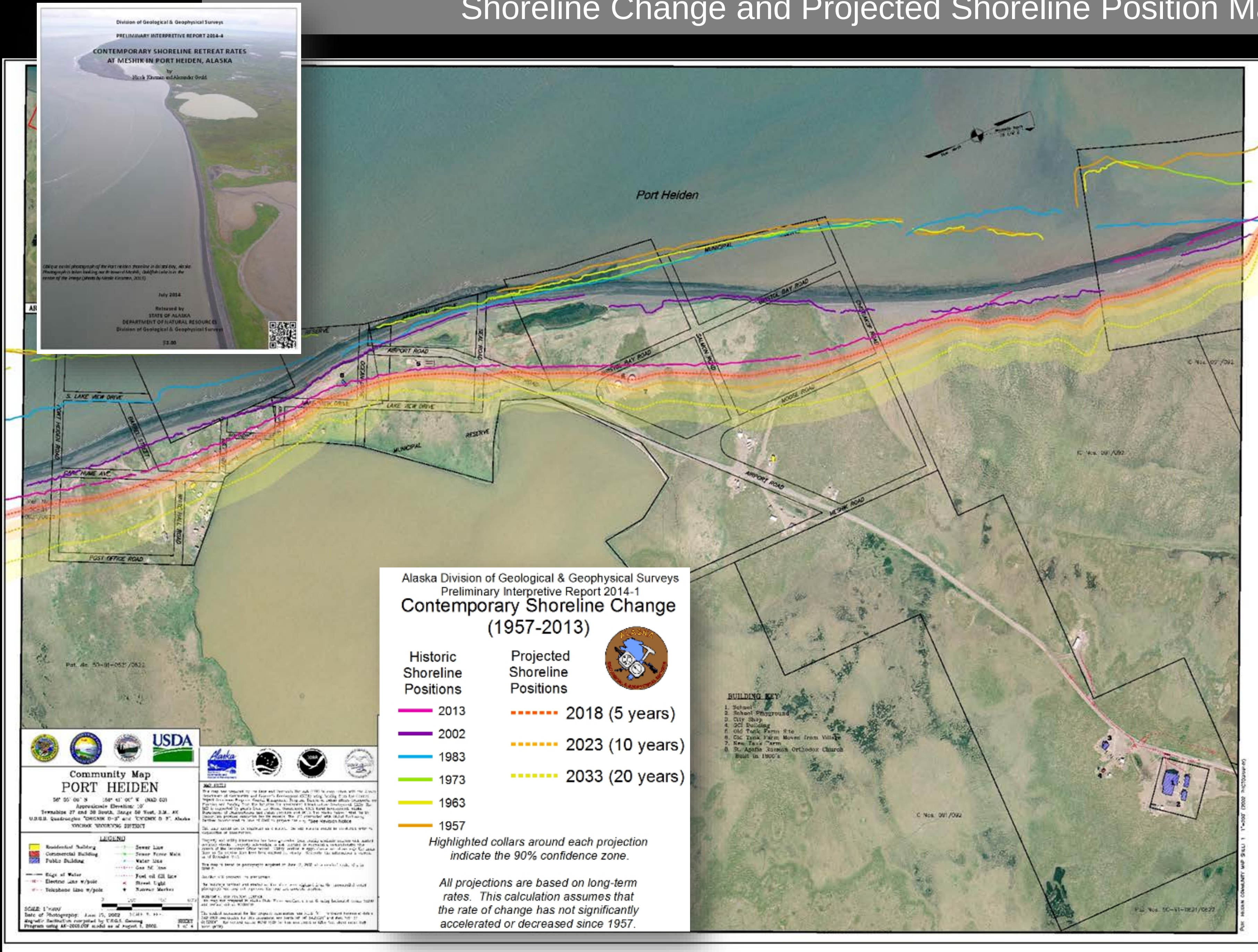
AOOS Alaska Ocean Observing System

Interactive Mapping Tool for Coastal Elevation Profiles

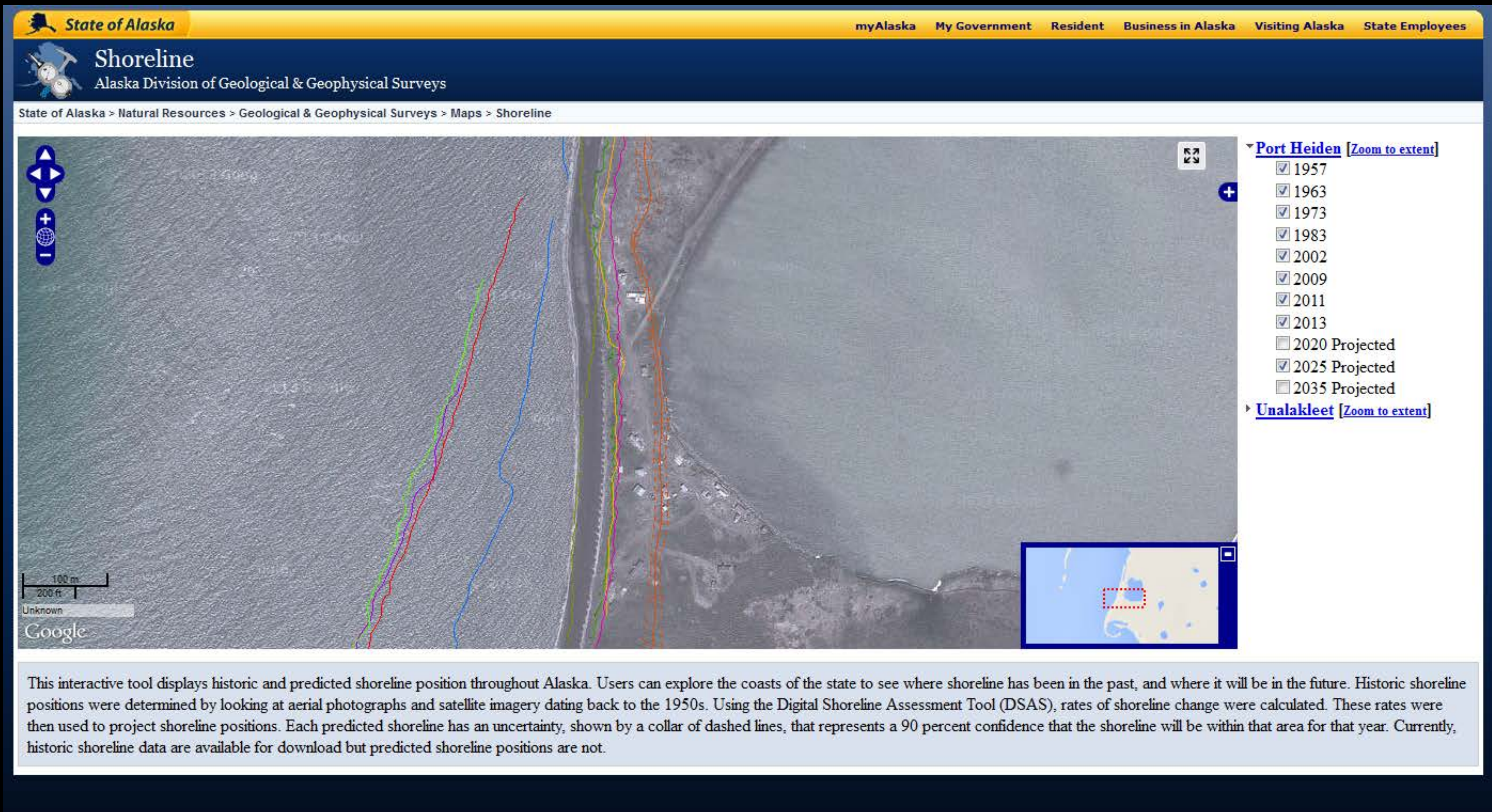


- DGGS Digital Data Series 7
- New datasets each month
- Raw data download
- Non-DGGS contributions welcome

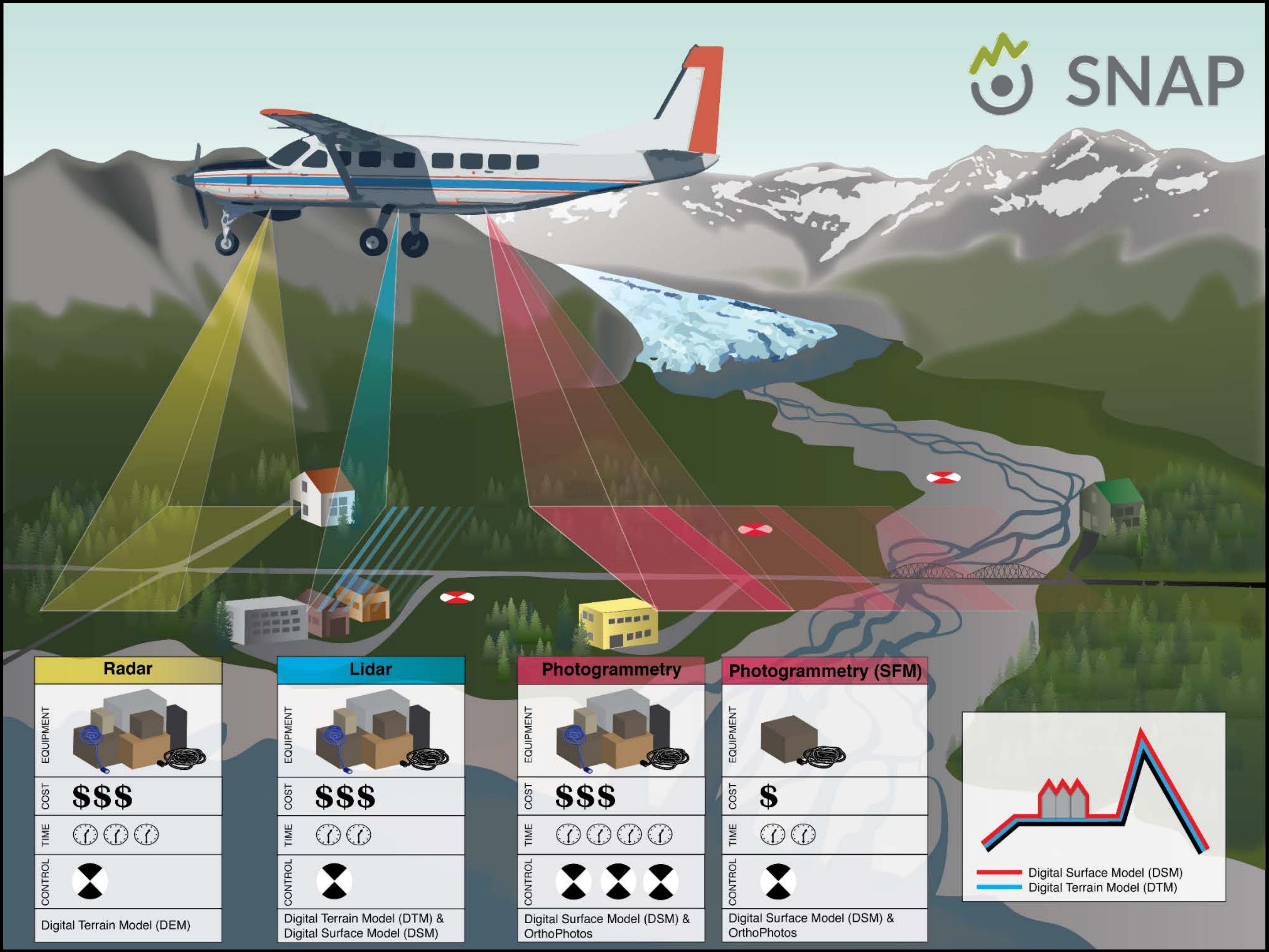
Shoreline Change and Projected Shoreline Position Maps



UPCOMING: Interactive Mapping Tool for Shoreline Change



UPCOMING: New Aerial Imagery and Elevation Models



UPCOMING: New Aerial Imagery and Elevation Models

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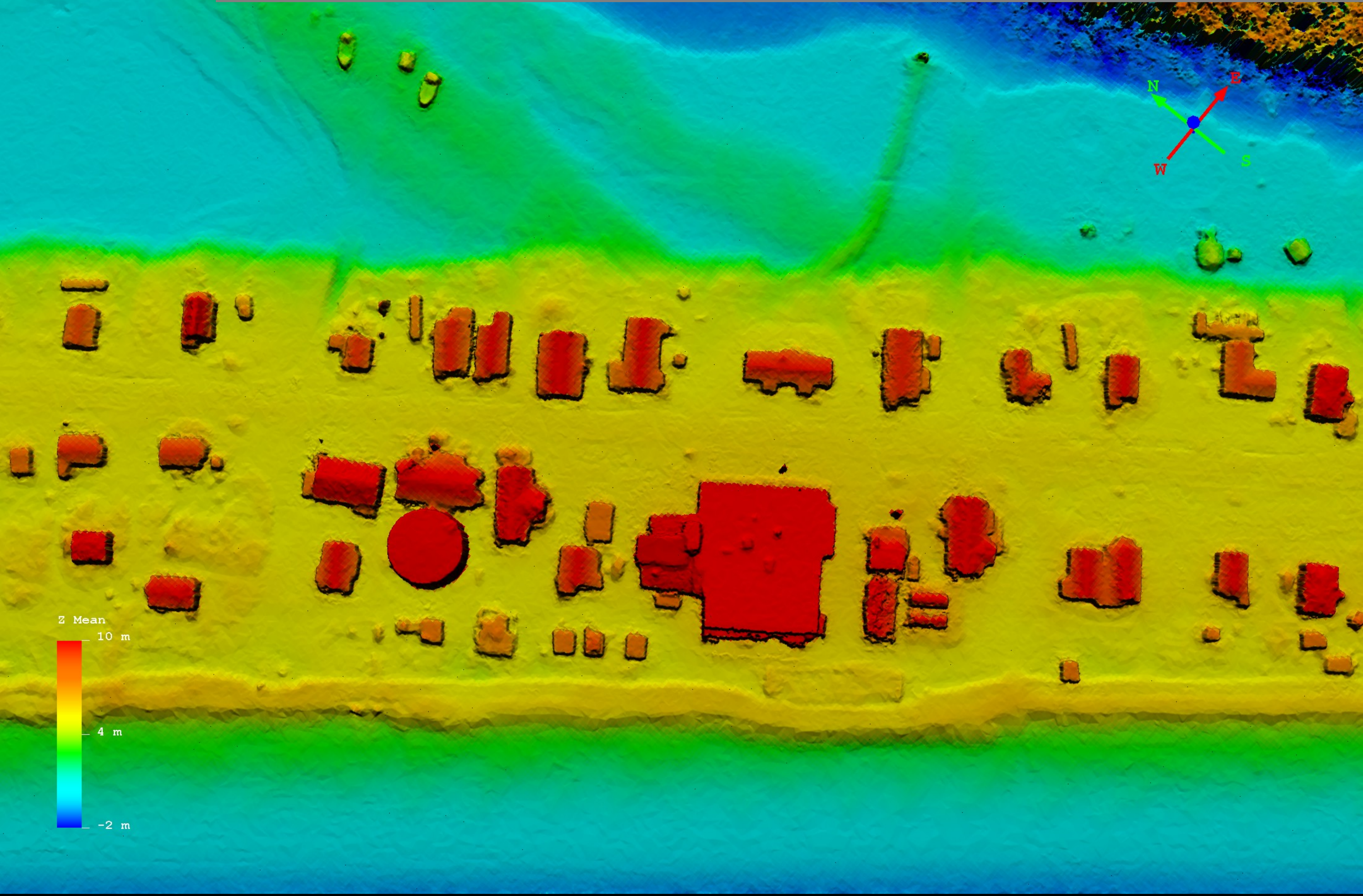
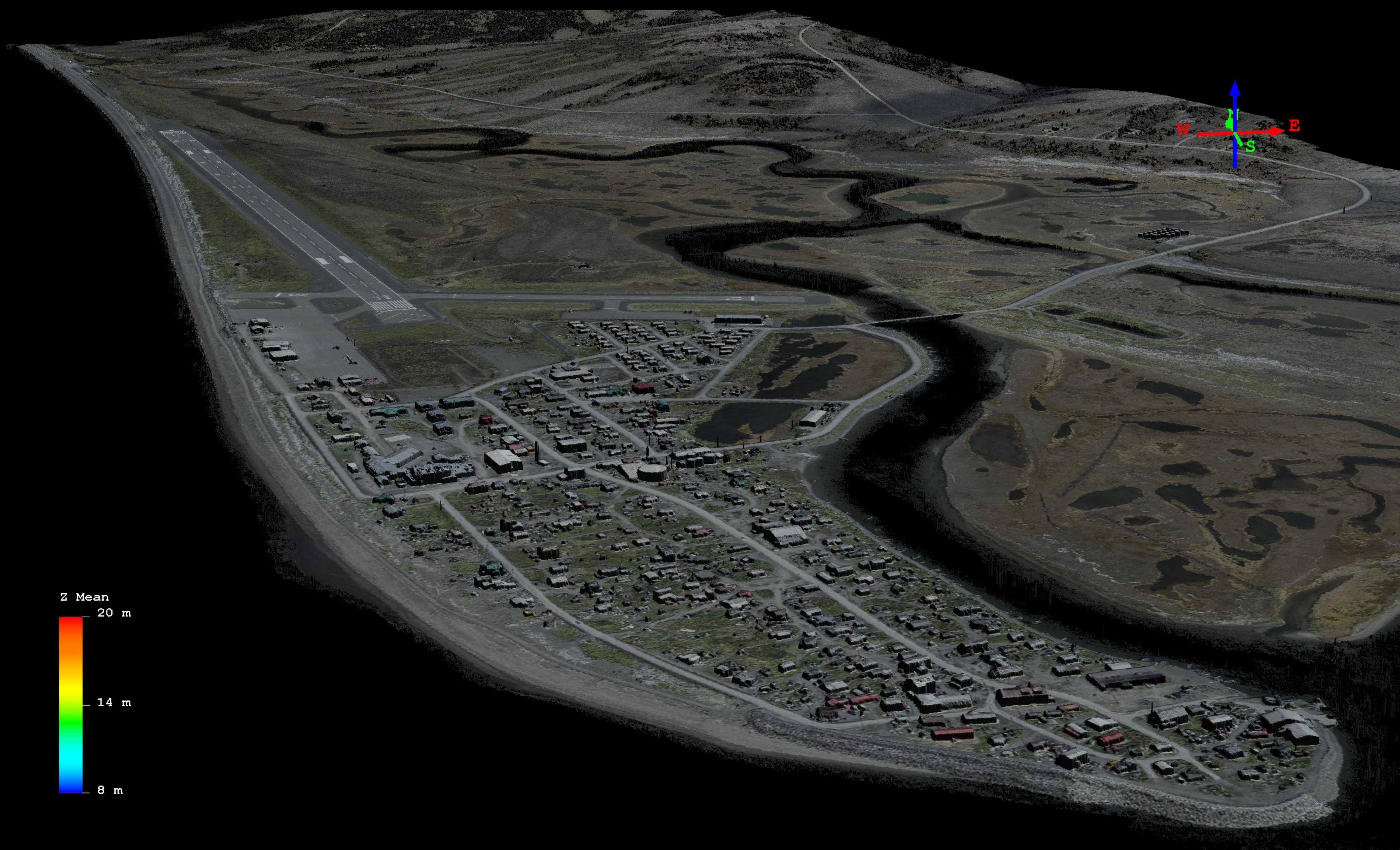
FAIRBANKS FODAR

UPCOMING: New Aerial Imagery and Elevation Models

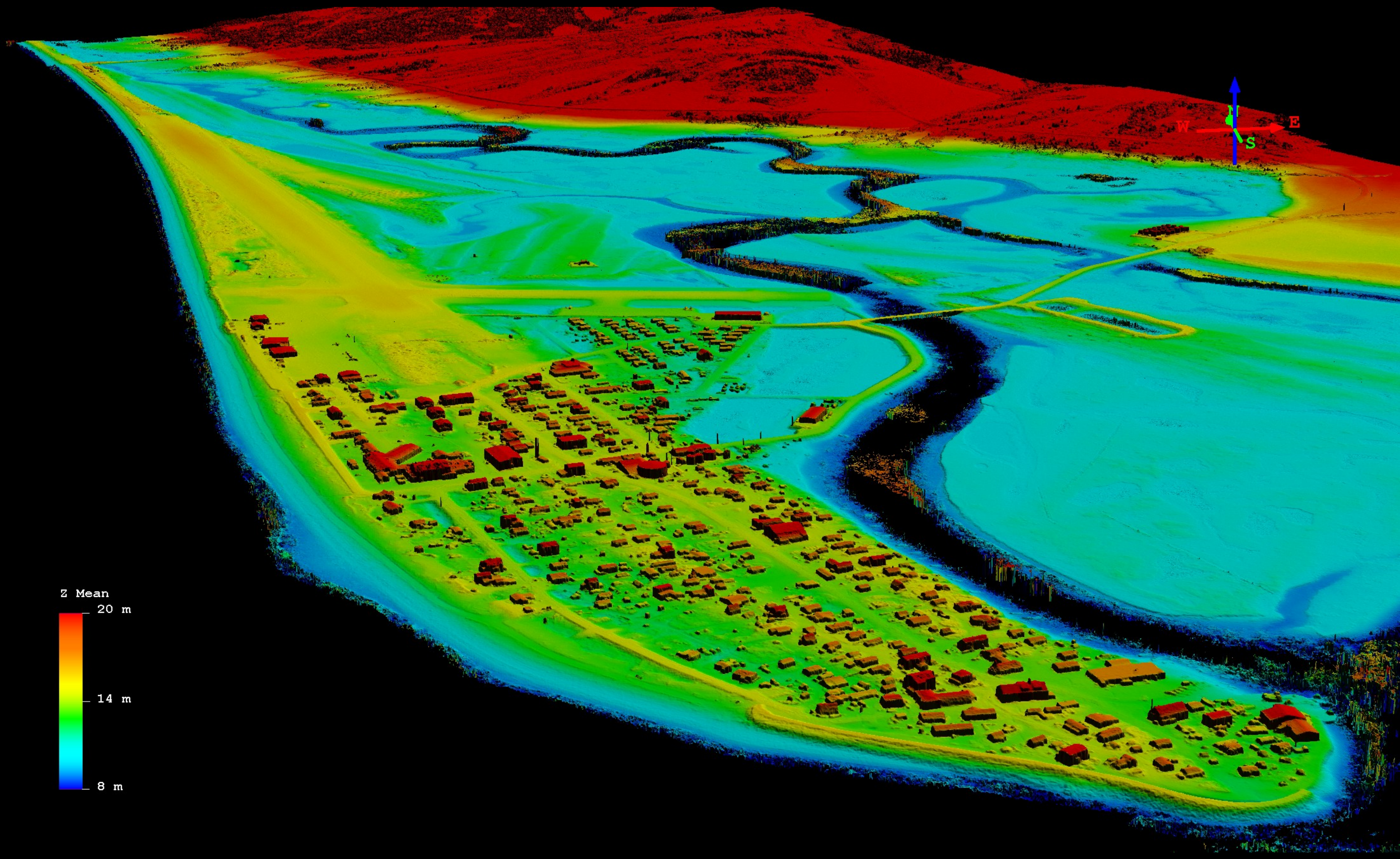


UPCOMING: New Aerial Imagery and Elevation Models



FAIRBANKS
FODAR

UPCOMING: New Aerial Imagery and Elevation Models

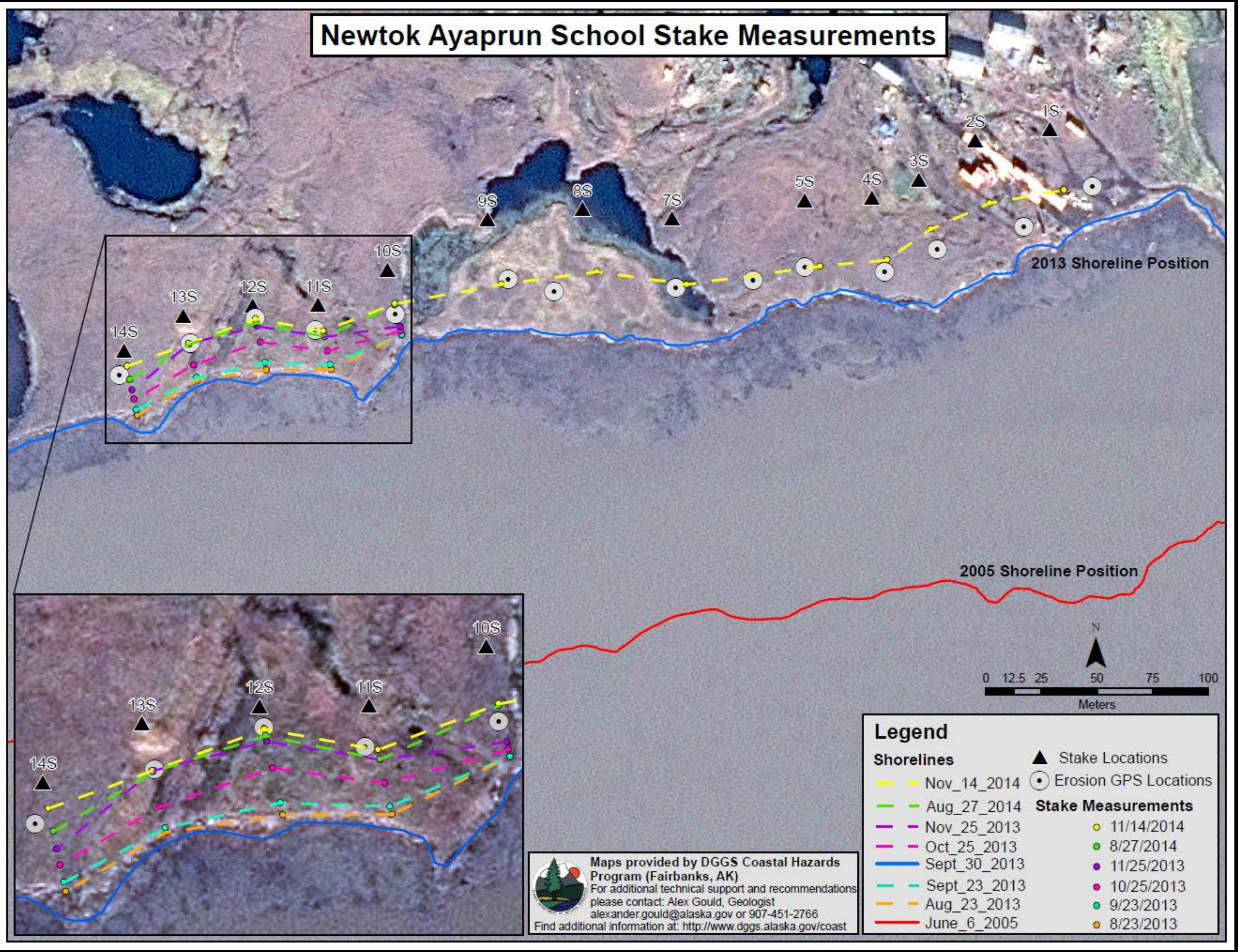


FAIRBANKS FODAR

RESIDENT INVOLVEMENT

Increase Local Observation Capabilities

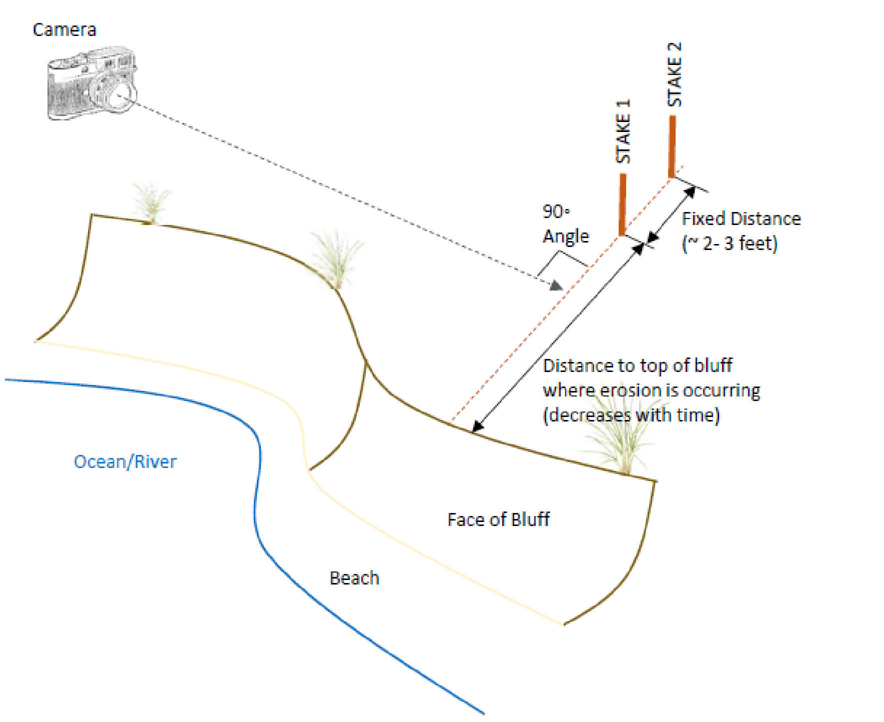
High School students collecting coastal elevation data on Cannon Beach in Yakutat, Alaska (2014)



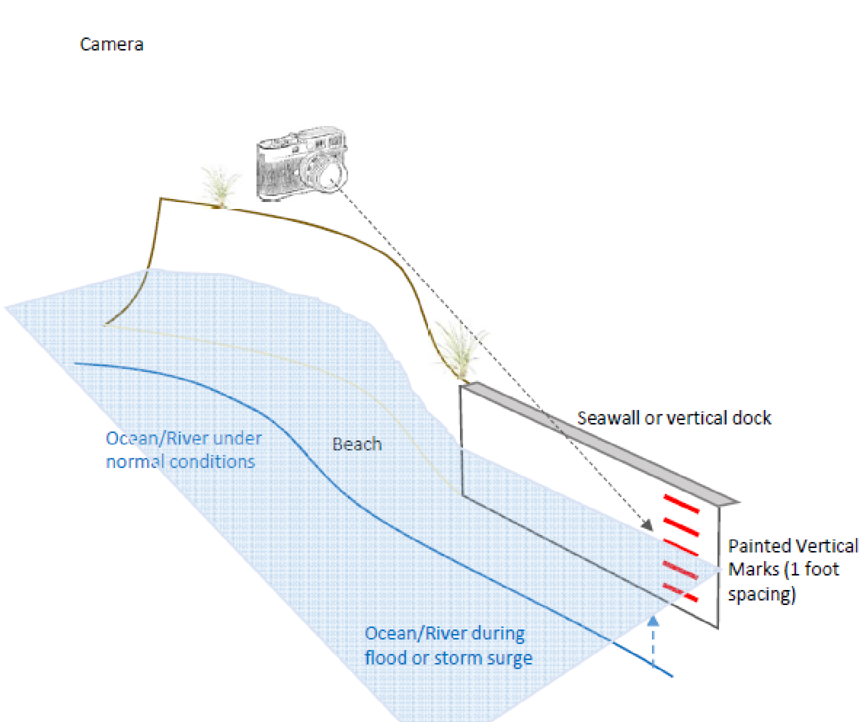
Newtok Ayaprun School Stake Measurements
1S
2S
3S
4S
5S
7S
8S
9S
10S
11S
12S
13S
14S
2013 Shoreline Position
2005 Shoreline Position
N
0 12.5 25 50 75 100
Meters
Legend
Shorelines
Nov_14_2014
Aug_27_2014
Nov_25_2013
Oct_25_2013
Sept_30_2013
Sept_23_2013
Aug_23_2013
June_6_2005
Stake Locations
Erosion GPS Locations
Stake Measurements
11/14/2014
8/27/2014
11/25/2013
10/25/2013
9/23/2013
8/23/2013
Maps provided by DGGS Coastal Hazards Program (Fairbanks, AK)
For additional technical support and recommendations please contact: Alex Gould, Geologist
alexander.gould@alaska.gov or 907-451-2766
Find additional information at: http://www.dggs.alaska.gov/coast

Increase Local Observation Capabilities

Stake Erosion Monitoring in Combination with Time-Lapse Camera*

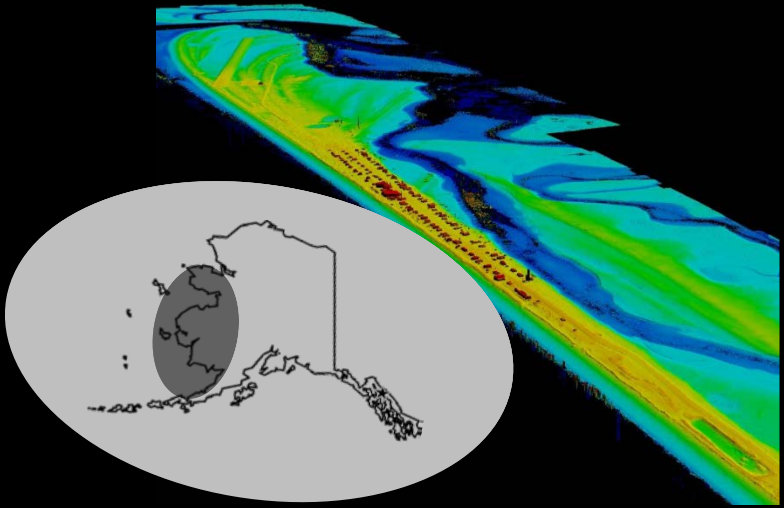


Water Level Monitoring with Time-Lapse Camera*



Baseline measurements (2-3 places on Y-K Delta, post-storm) intern?

New western Alaska aerial image & elevation collection



Expand water level monitoring network

Build a toolbox of resources and support local monitoring efforts