



Hooper Bay, 2013



BUILDING OUR TOOLBOX: COMMUNITY-BASED MONITORING OF COASTAL HAZARDS



LEO Webinar - April 21, 2015

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www.dggs.alaska.gov/coast

Special thanks to: Lauren Southerland, Alex Gould, John Henry Jr, Ms. Kotongan, Mike Brubaker

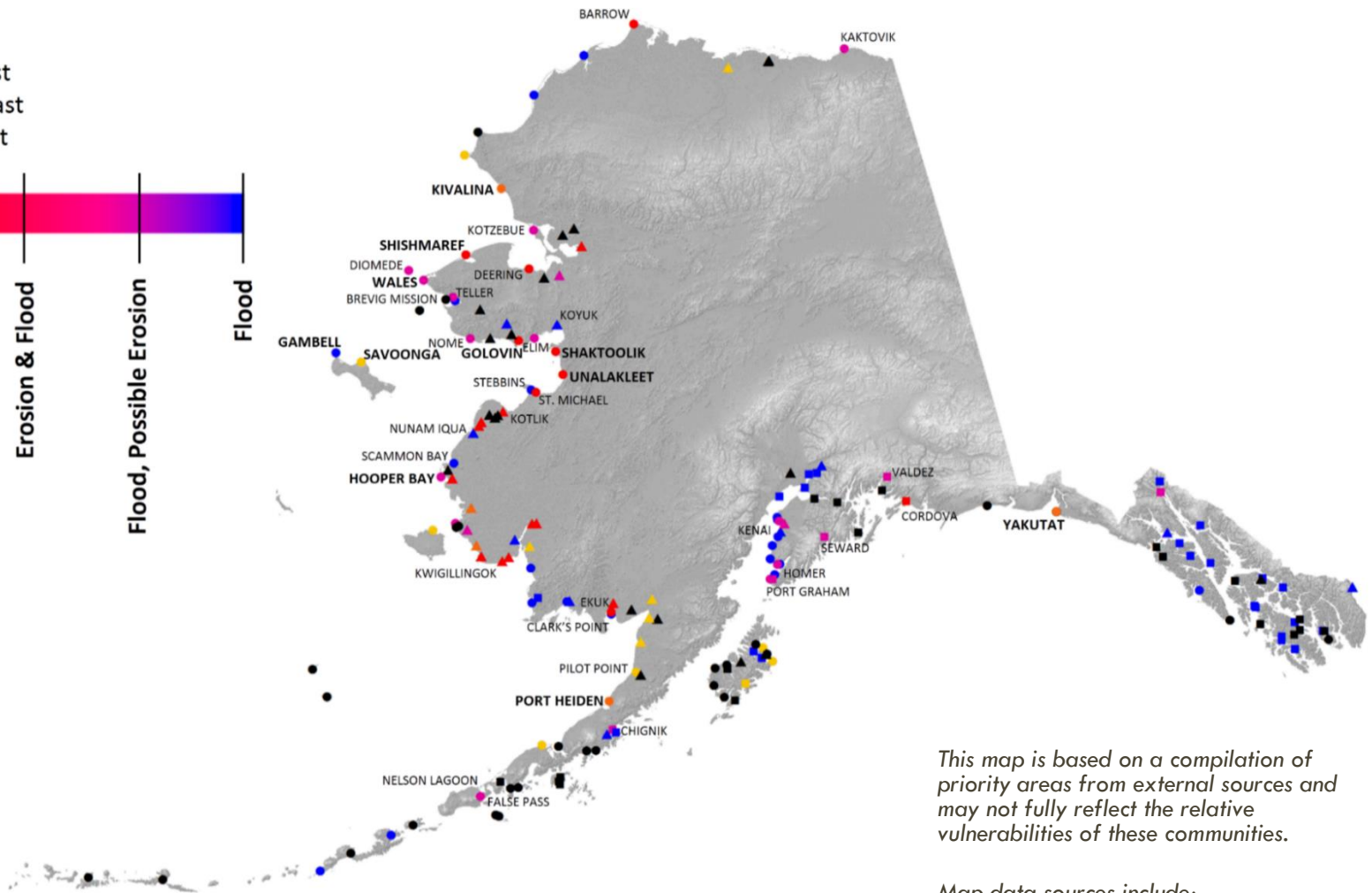
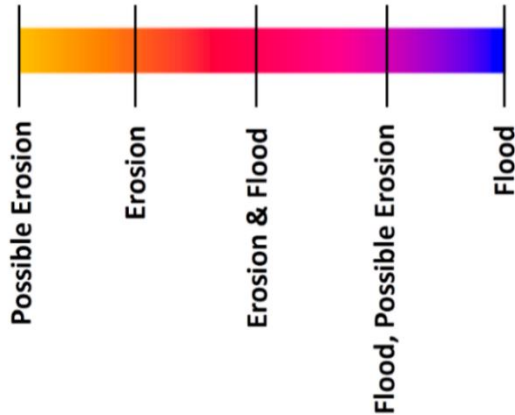
DGGS COASTAL HAZARDS PROGRAM



- Active Since 2011 (Coastal Impact Assistance Program)
- Available to field questions from residents and stakeholders
- 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

Key

- Exposed Coast
- Sheltered Coast
- ▲ Riverine Coast



This map is based on a compilation of priority areas from external sources and may not fully reflect the relative vulnerabilities of these communities.

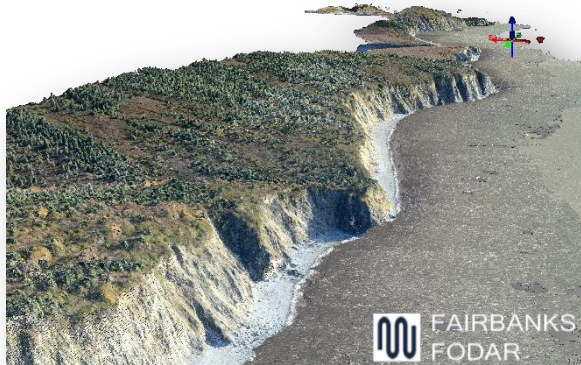
Map data sources include:

- US Army Corps of Engineers Baseline Erosion Assessment
- US Army Corps of Engineers Floodplain Database
- Government Accountability Office report on Alaska villages at-risk to flooding and erosion
- Federal and State Disaster Declarations (1978-2013)
- Recommendations to the Governor's Subcabinet on Climate Change

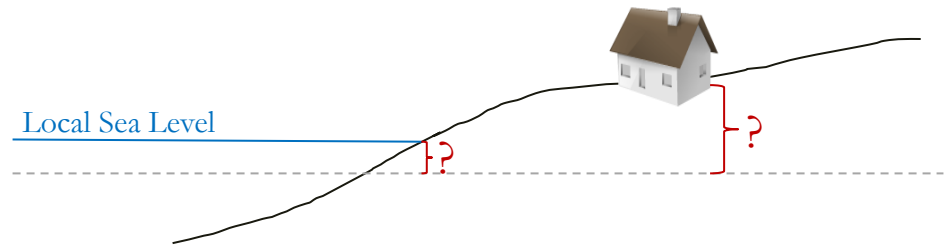
ALASKA POPULATIONS VULNERABLE TO COASTAL FLOODING AND EROSION

THE COASTAL BASICS: FLOOD AND EROSION DATA

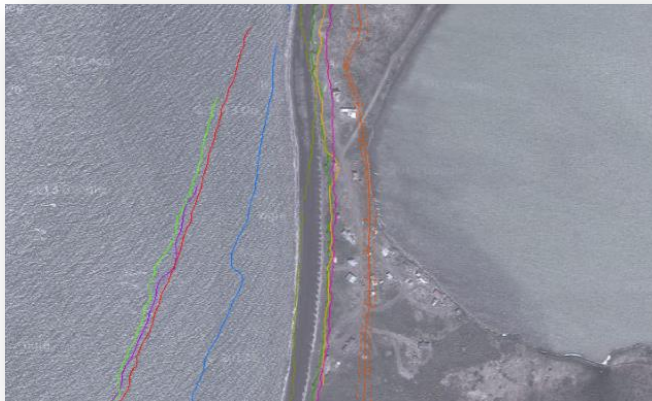
Shape of the Ground



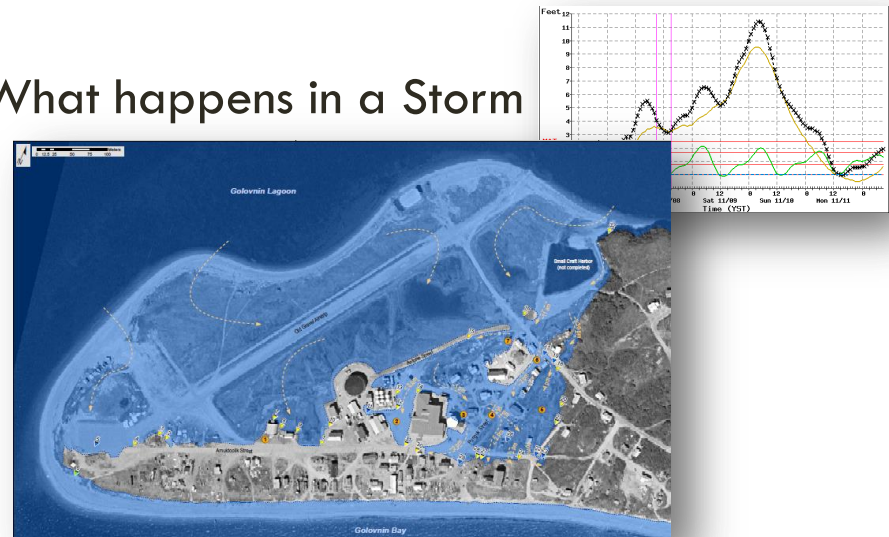
How High Things Are

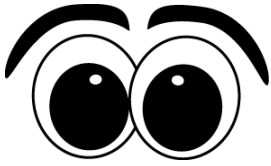


Location of the Coast



What happens in a Storm





EYEBALLS → NUMBERS

36824
105346
98705
28791



PORT HEIDEN, 2006 (SHOREZONE)



PORT HEIDEN, 2013

~~“Rapid Erosion
is occurring”~~



“38.2 ft/year
of Erosion is
occurring”

QUALITATIVE → QUANTITATIVE DATA



- Record of change that will reveal acceleration or deceleration
- Values that can be fed into models to make better predictions
- Documentation of damages to qualify for disaster mitigation funds

QUANTITATIVE OBSERVATIONS

A useful number:

- Is characteristic of the event/conditions
- Is collected by a knowledgeable observer
- Has a scientific application

Requirements:

- Time
- Conditions
- Name of collector
- Documentation
- Level of uncertainty
- A calibration or reference frame



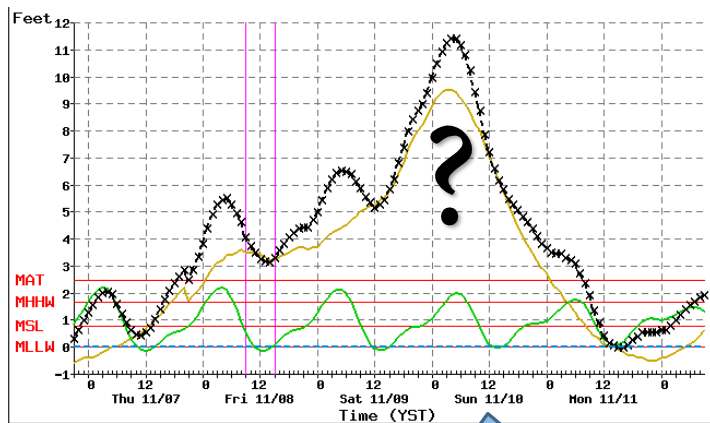
Photo by
Maggie
Halleran

Crane
platform
=
6.1 feet
above MSL

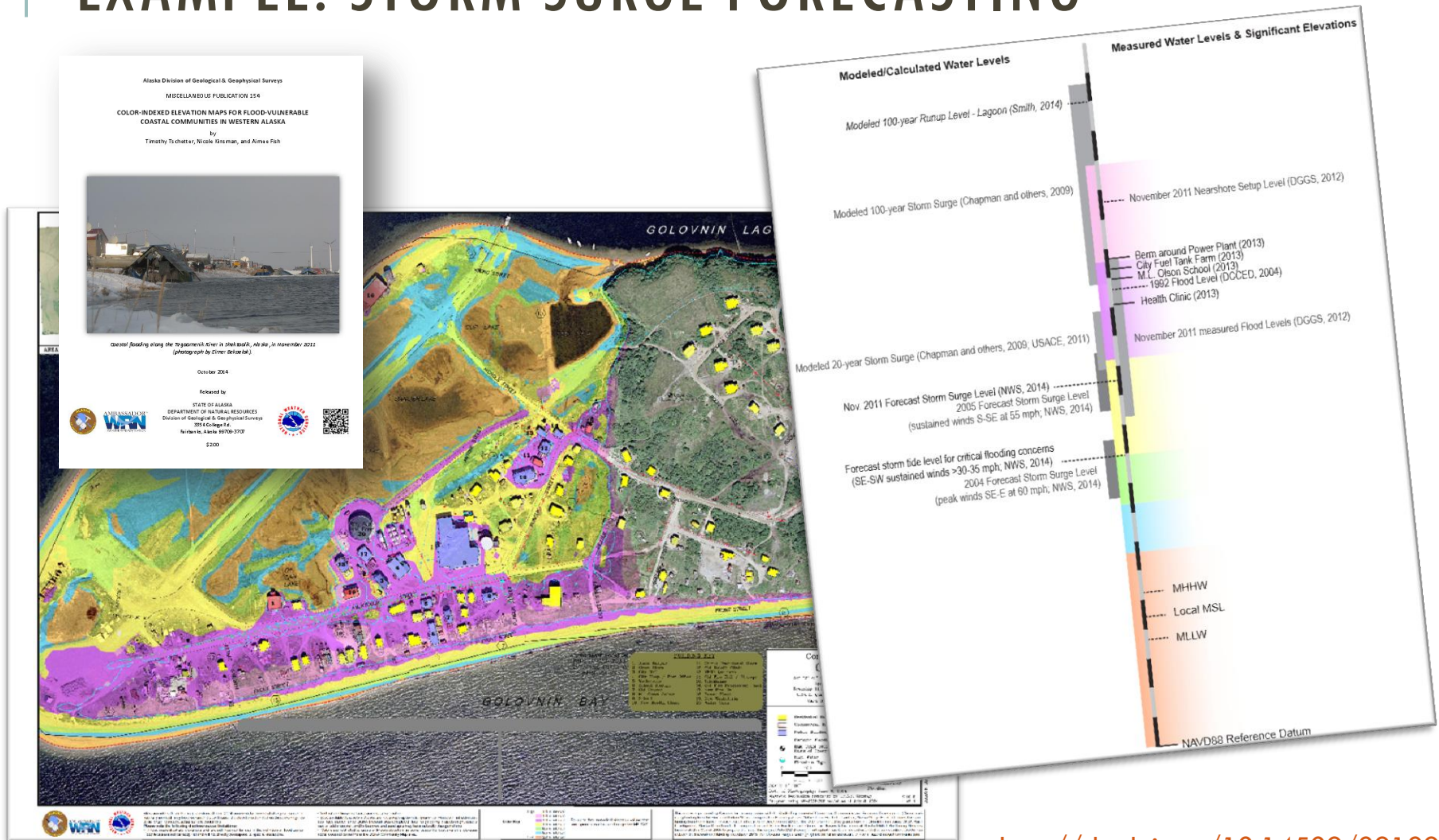
Unalakleet Dock

NUMERICAL OBSERVATIONS IMPROVE PREDICTIONS

EXAMPLE: STORM SURGE FORECASTING



NUMERICAL OBSERVATIONS IMPROVE PREDICTIONS EXAMPLE: STORM SURGE FORECASTING



CRITICAL ROLE OF RESIDENT OBSERVERS



Coastal flooding in Golovin, Alaska (Photo by Toby Anungazuk, November 2011)

- On site
- Frequent re-measurement opportunities
- Knowledge of threshold for 'significant change'
- Customized data collection



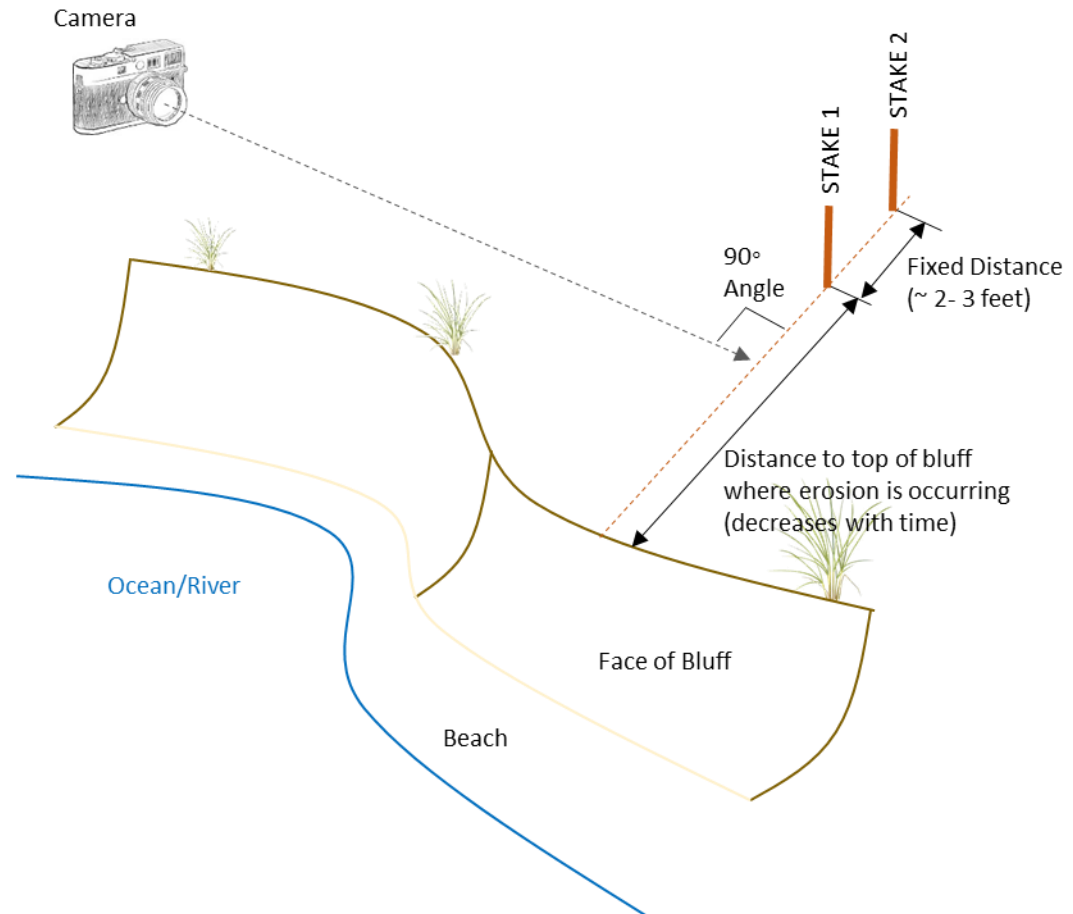
Port Heiden, 2013

RESIDENT-LED OBSERVATIONS

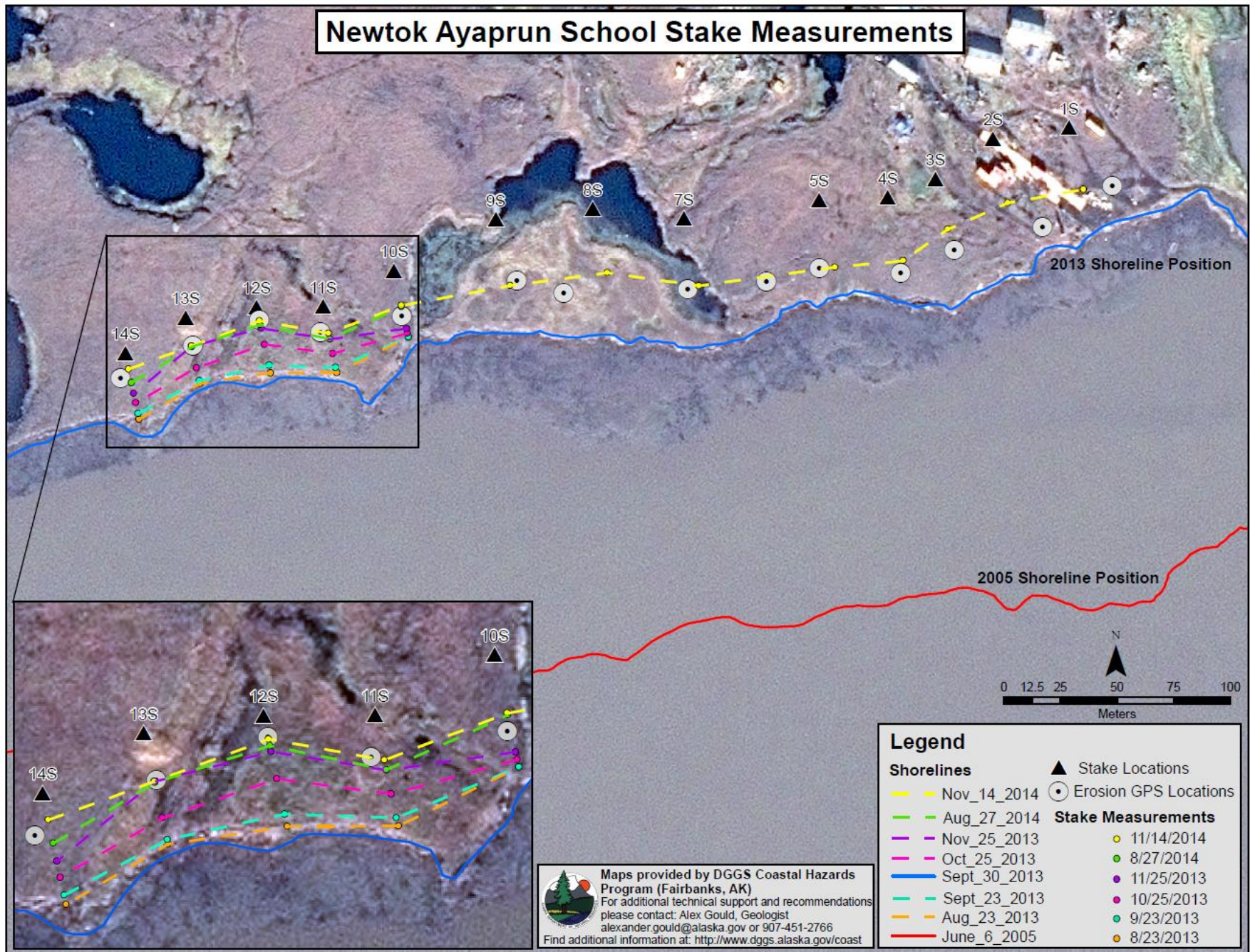
DGGS has partnered with residents in coastal AK to experiment with ways to put numbers to observations

TIME LAPSE CAMERAS: EROSION MONITORING

- Calibration requirements:
 - Stake location
 - Camera positioning
- May also be completed with a measuring tape and regular site visits
- Pursuing a pilot project with Bristol Bay Native Assn., Sea Grant, and UAF Bristol Bay Campus



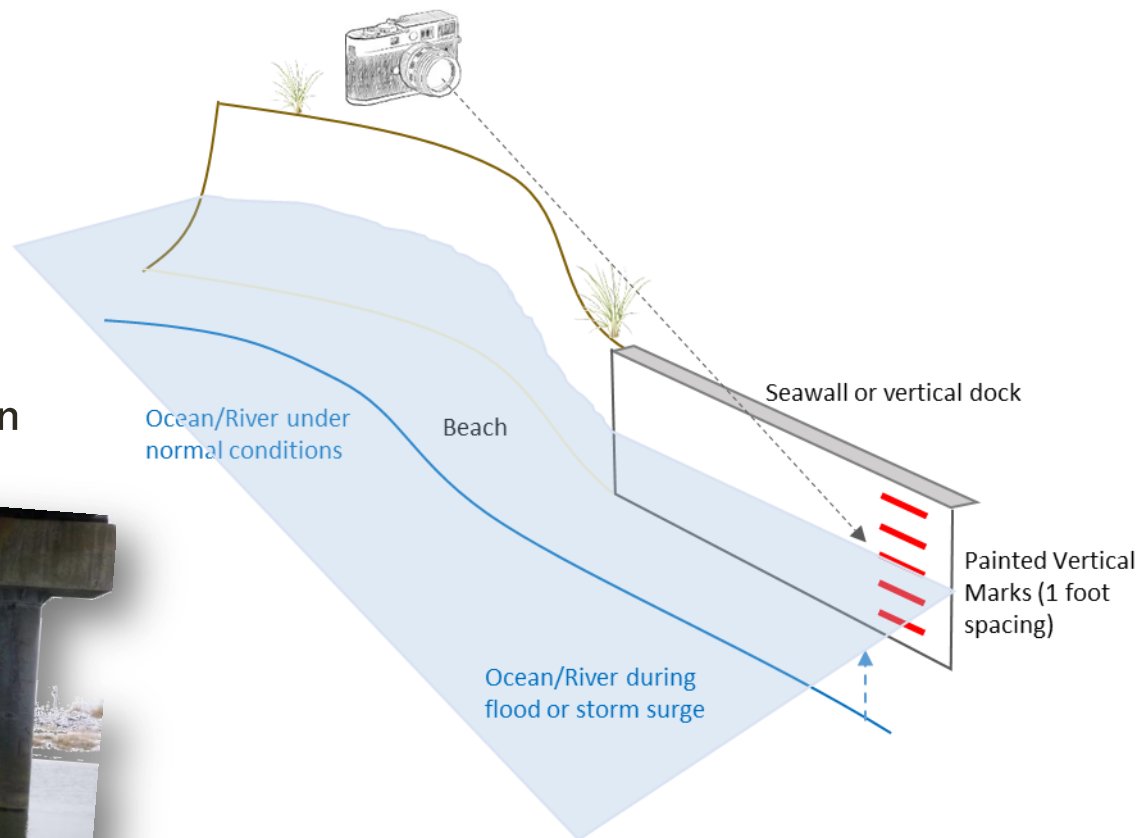
Newtok Ayaprun School Stake Measurements



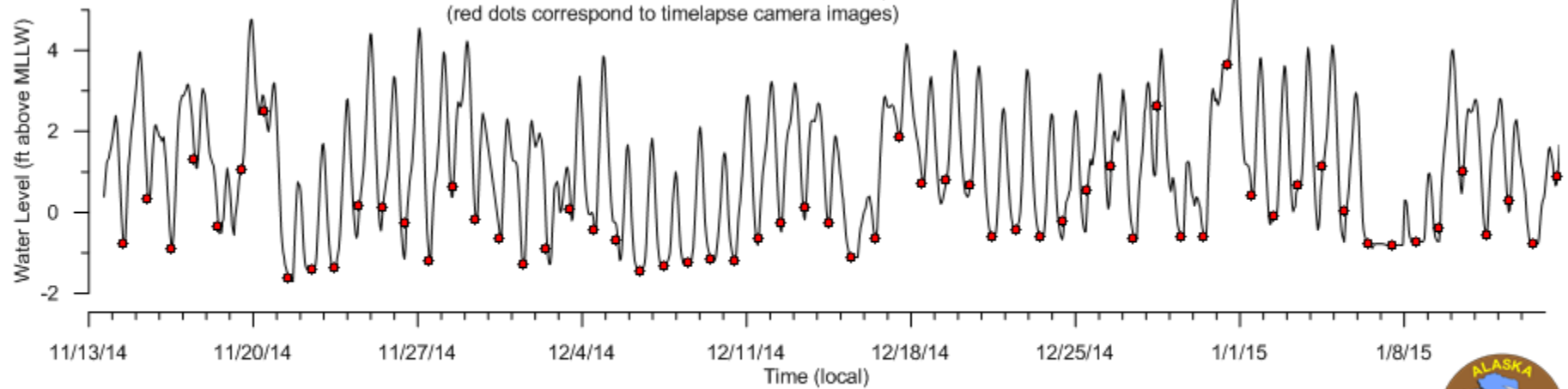
Data provided to DGGS by Alaska Division of Community and Rural Affairs

TIME LAPSE CAMERAS: WATER LEVEL MONITORING

- Calibration requirements:
 - Height of vertical marker(s)
 - Camera positioning
- May also be completed in conjunction with an instrument in the water



Water Level Record for Unalakleet, AK
(red dots correspond to timelapse camera images)



Video by Ms. Kotongan



MOBILE PHONES: CAMERA, GPS, AND COMMUNICATION

Upcoming LEO Smart phone App



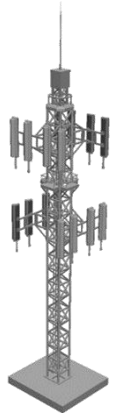
< 1 inch



~ 5-16 feet



~ 10-30 feet... and decreasing



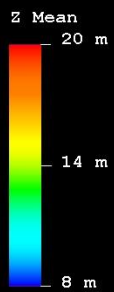
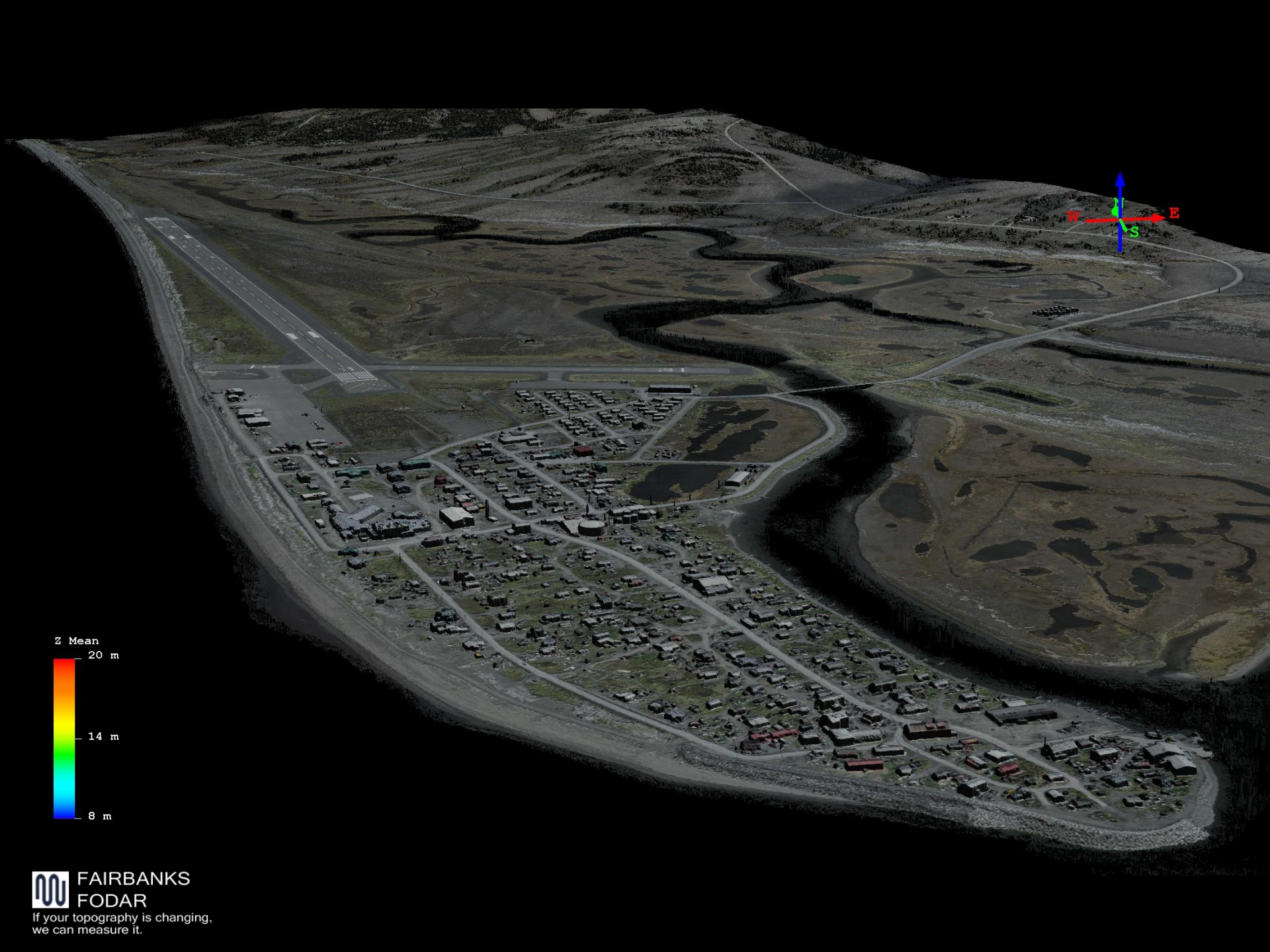
Approximate Positioning
Accuracy



UNK DATA COLLECTION EXPERIMENTS: PART 1 — ELEVATION OF A LINE

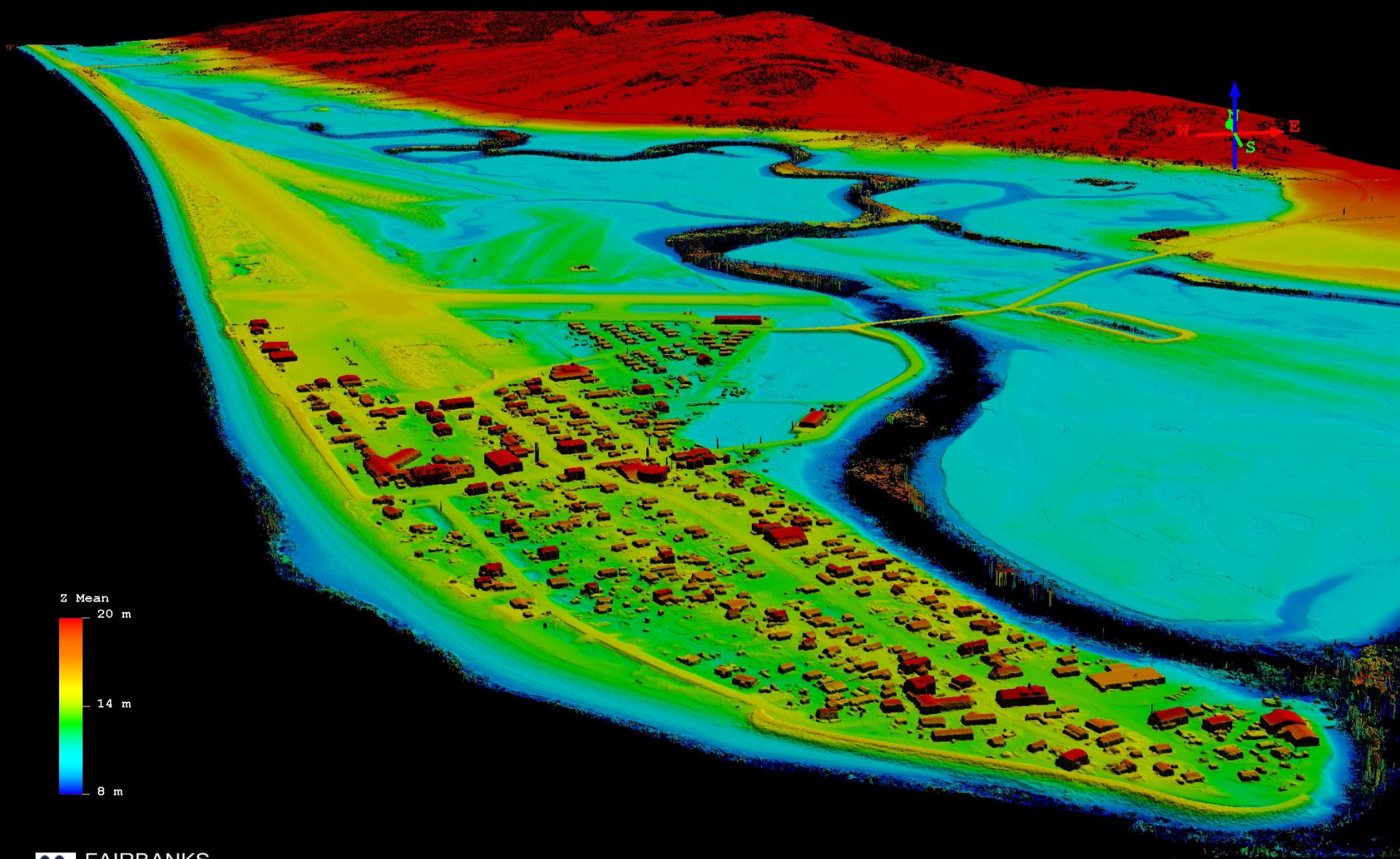
- Data need:
 - Elevation of a water level on the beach
 - Elevation of a river
 - Elevation of the peak water level after a storm surge (where the debris is)
- Assumption:
 - GPS in phone is not very good, but the error is random
 - GPS in phone is more accurate horizontally than vertically
 - The feature being measured is at a constant elevation
 - There is a very good Digital Elevation model available





FAIRBANKS
FODAR

If your topography is changing,
we can measure it.



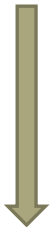
FAIRBANKS
FODAR

If your topography is changing,
we can measure it.

ELEVATION OF FEATURE FROM MODEL

Wood line on the beach is approximately 5.7 ft above Local Mean Sea Level

Standard deviation of vertical values was 3.5 inches (n = 17)



This is a good approximate measure of the water level at the beach during the most recent storm



UNK DATA COLLECTION EXPERIMENTS: PART 2 — 3-D “SNAP SHOTS”

- Data need:

Shape and size of an object/feature

For example:

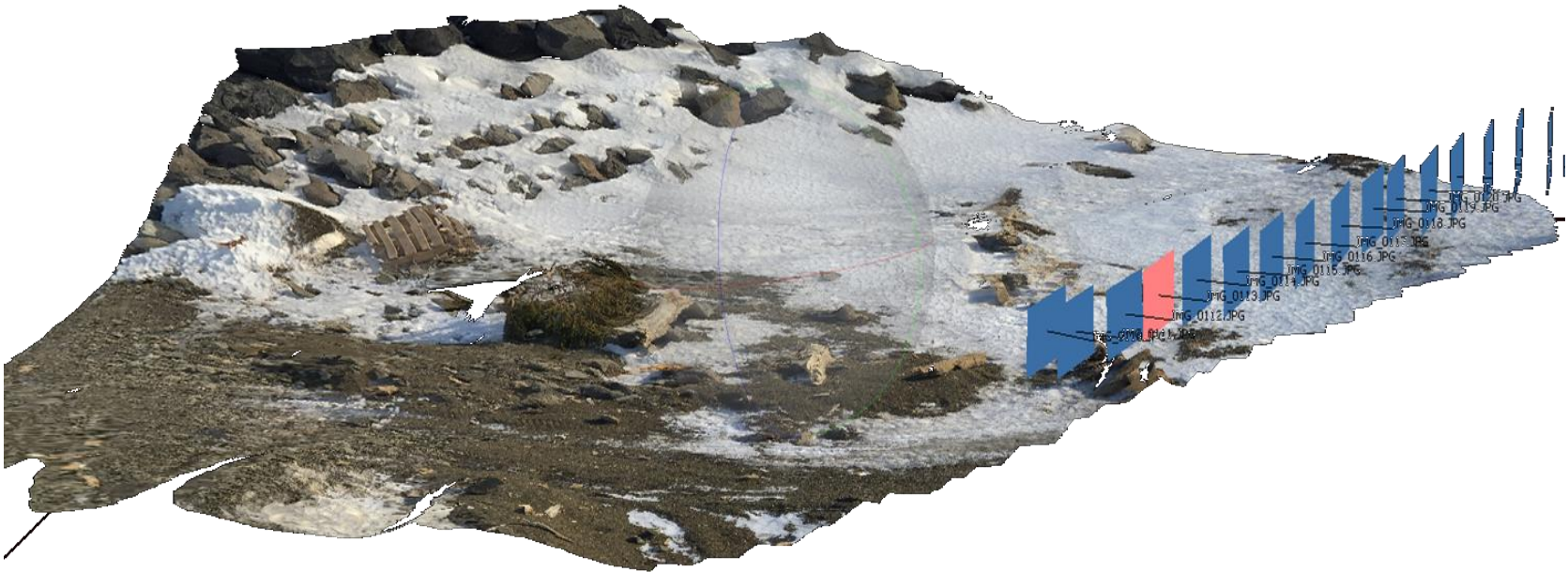
- Erosion areas or damaged revetments/seawalls
- Biological monitoring (whales, seals, plant life)
- Glacial monitoring
- Sea level trends
- Permafrost degradation

- The method:

- Lots of pictures from slightly different angles are taken of the area/object of interest
- An object with a known size (box, for example) is placed in the images for scale
- Computer software at DGGS is used to build a 3-D model that can be emailed

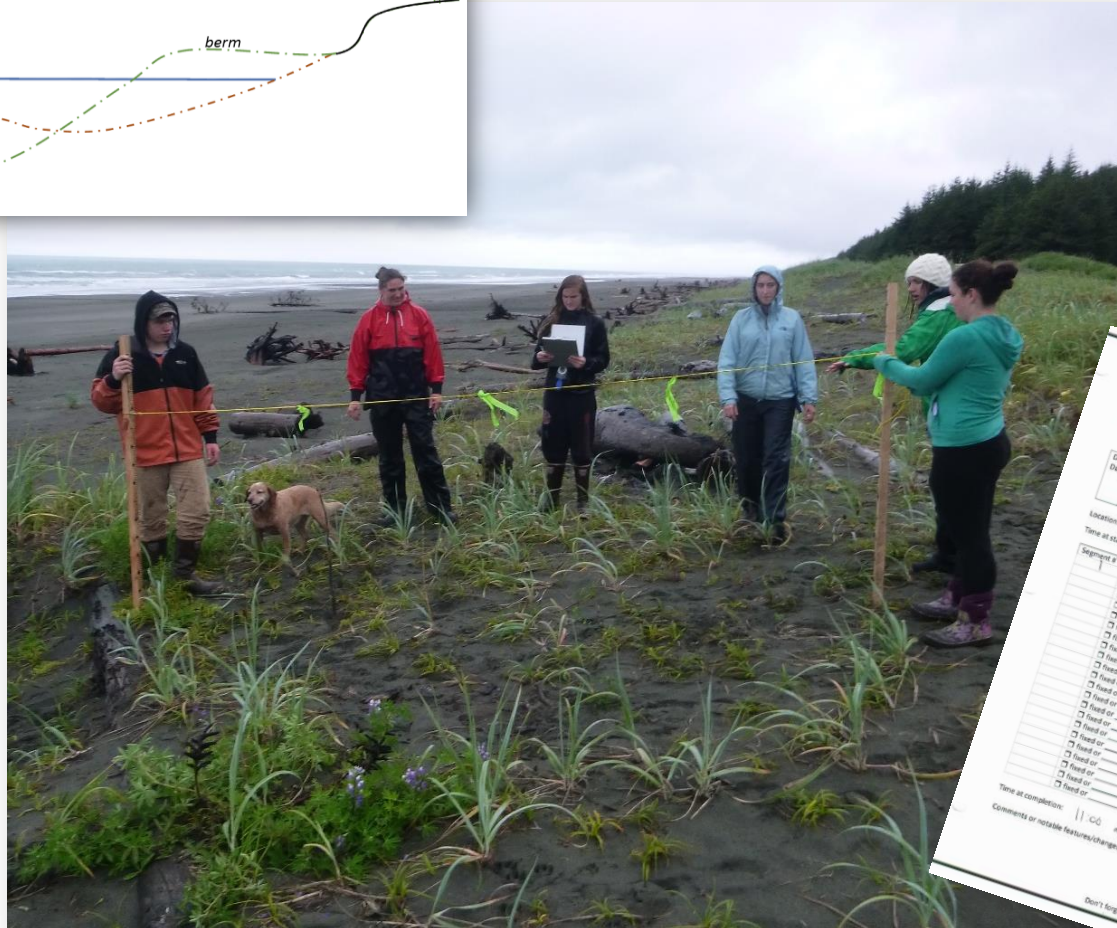
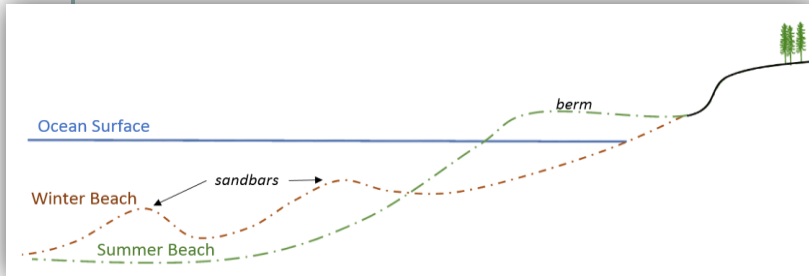


UNK DATA COLLECTION EXPERIMENTS: PART 2 — 3-D “SNAP SHOTS”



- Ongoing experiments to test best photo distance, spacing, etc.
- Lots of possible applications
- Can calculate volume change with repeat imaging

OTHER COMMUNITY-BASED MEASUREMENTS: BEACH SHAPE IN YAKUTAT



Coastal Elevation Profile - "Emery Rod" Data Sheet

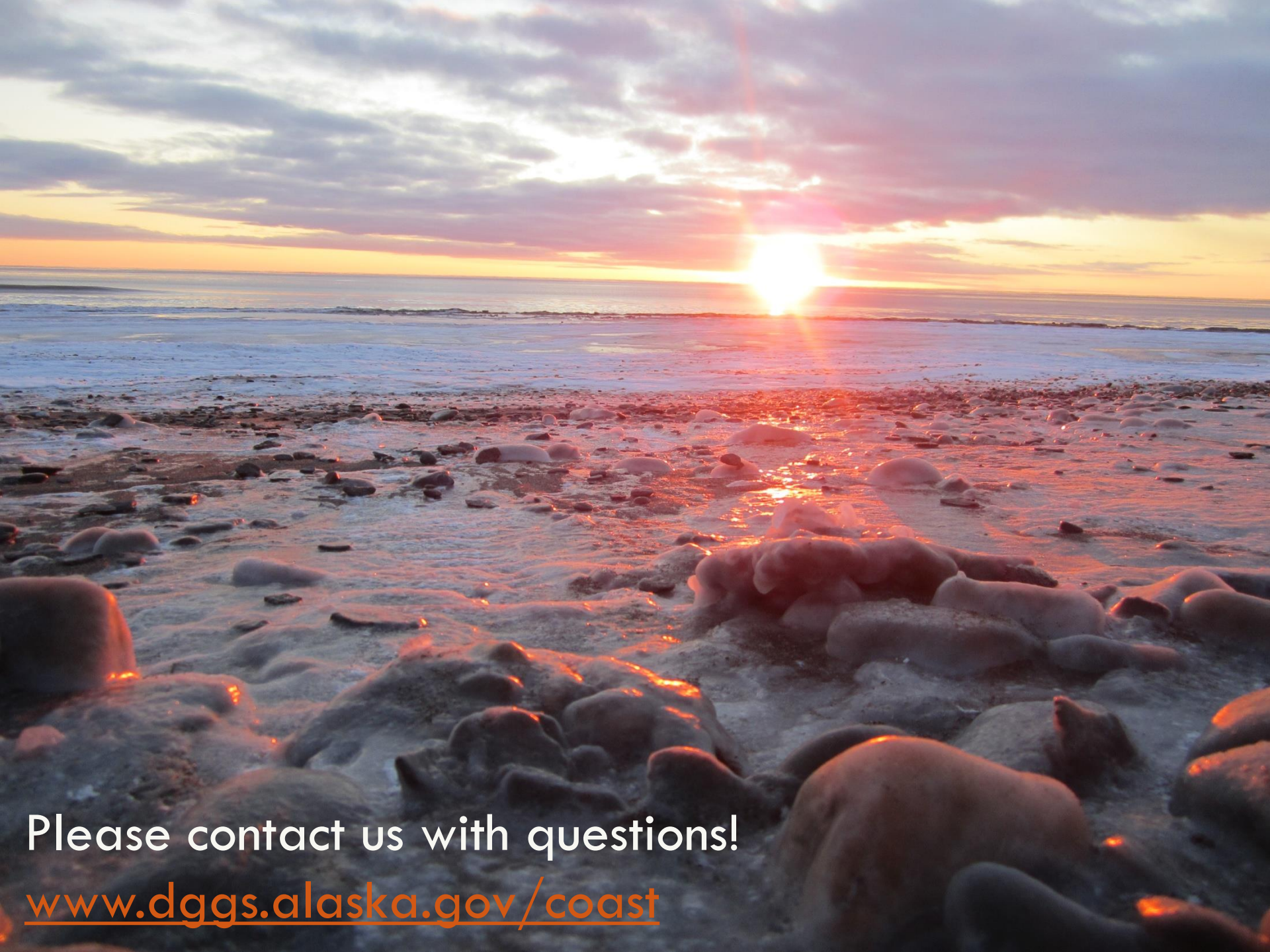
Date: 8/23/14
Data collected (date, time, tide, etc.): 11:00 AM, Low Tide, Sunny
Location: Cannon Beach, Alaska
Time at start: 10:00 AM Line number: 1
Compass bearing: 219°

Field notes (length of rope, weather, wave conditions, etc.): 15' 7" (rope), Partly cloudy, waves mostly glass

Segment #	Spacing or fixed or	Change in elevation	Sediment grain size or other notes
1	fixed or	1.00 0.10 up 0.10m	
2	fixed or	1.00 0.10 up 0.10m	
3	fixed or	1.00 0.10 up 0.10m	
4	fixed or	1.00 0.10 up 0.10m	
5	fixed or	1.00 0.10 up 0.10m	
6	fixed or	1.00 0.10 up 0.10m	
7	fixed or	1.00 0.10 up 0.10m	
8	fixed or	1.00 0.10 up 0.10m	
9	fixed or	1.00 0.10 up 0.10m	
10	fixed or	1.00 0.10 up 0.10m	
11	fixed or	1.00 0.10 up 0.10m	
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95	fixed or	1.00 0.10 up 0.10m	
96	fixed or	1.00 0.10 up 0.10m	
97	fixed or	1.00 0.10 up 0.10m	
98	fixed or	1.00 0.10 up 0.10m	
99	fixed or	1.00 0.10 up 0.10m	
100	fixed or	1.00 0.10 up 0.10m	

Time at completion: 11:00 AM
Comments or notable features/changes:
Don't forget to take a photograph!

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



Please contact us with questions!

www.dggs.alaska.gov/coast