

Tidal Datums & Coastal Profiles

DGGS Coastal Hazards Program - Fairbanks, AK

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AOOS-funded DGGS Projects:

- 1) **Port Heiden Short-Term Tide Gauge Installation**
- 2) **Development of a Digital Repository for Coastal Elevation Profiles in Alaska**

CONTEXT

MOTIVATION

APPROACH

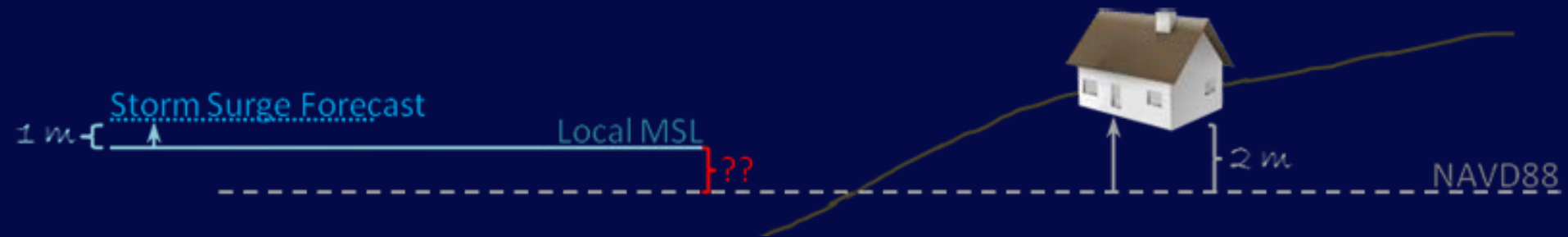
STATUS

NEW DEVELOPMENTS

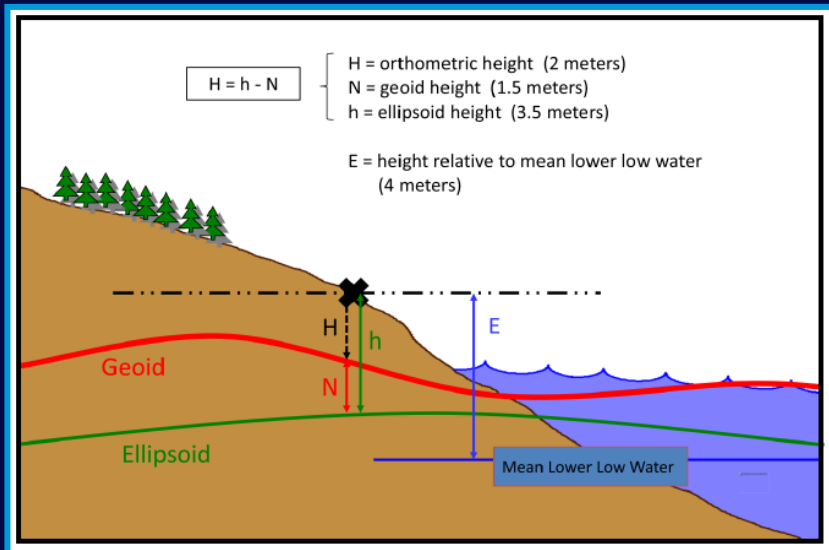
Tide Gauge Project – Context

Tidal Datums (MSL, MHHW
(standardized local sea levels)

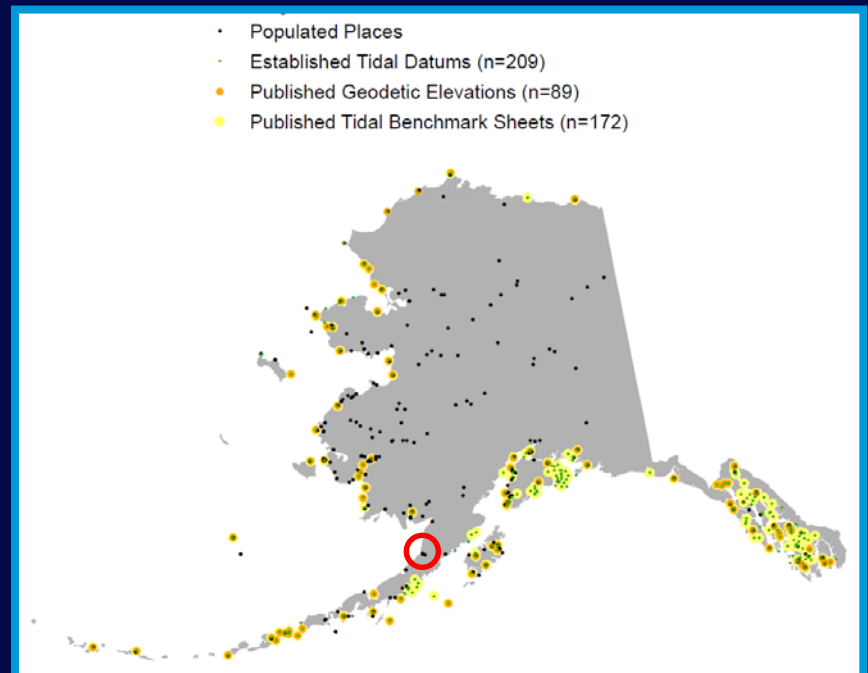
Geodetic Datum
(NAVD88 = current standard in U.S.)



Datum offset values:



Status of known values in Alaska:



Tide Gauge Project – Motivation

National Water Level Observation gap:

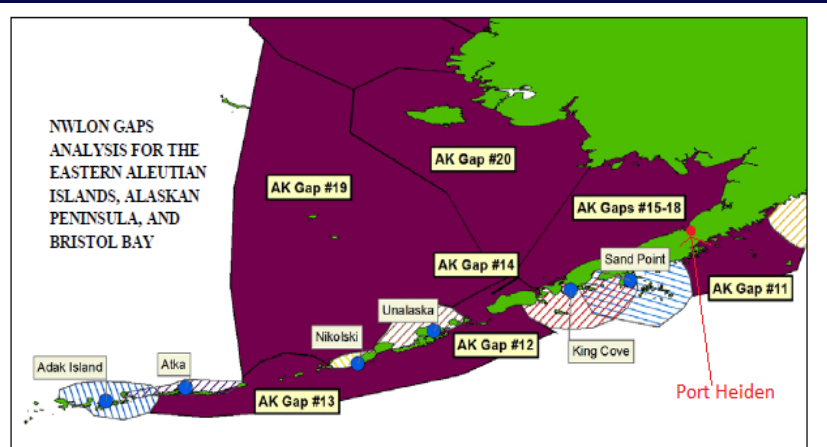


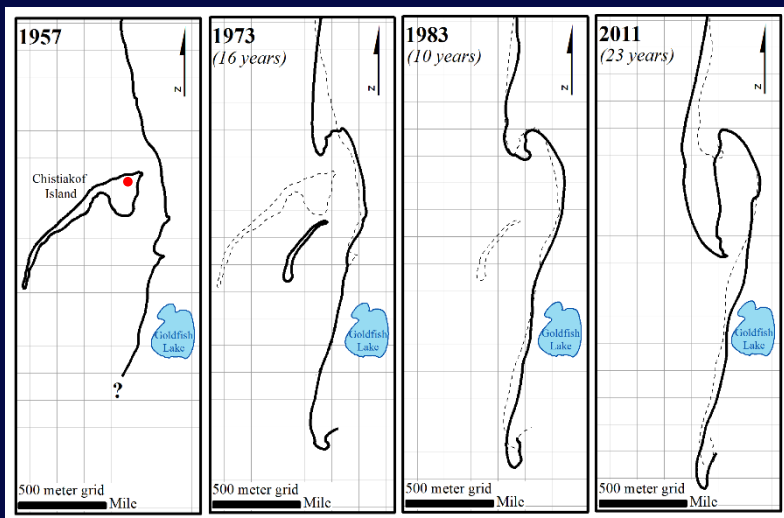
Figure 27. NWLON gaps analysis for the eastern Aleutian Islands, Bristol Bay and Alaskan Peninsula.

DGGS erosion mapping in Port Heiden:

December 2007



Old datums (1957) and no tidal benchmarks:



Tide Gauge Project – Approach

- Contracted with JOA Surveys, LLC in cooperation with UAF research intern (Kimber Tweet)
- Installation from September-October, 2013
- Live-streamed to AOOS portal
- Retrieval combined with DGGS data collection



Tide Gauge Project – Status

- Tidal benchmark positions have been formally submitted to the NGS database →
- Tide station files have been formatted to meet NOAA specifications for ingestion into CO-OPS database
- Local tidal datums delivered to DGGS for incorporation into tidal datum calculator

SURVEY DATASHEET (Version 1.0)

PID: BBDG96
 Designation: 946 4075 B
 Stamping: 4075 B 2013
 Stability: Monument will probably hold position well
 Setting: Stainless steel rod in sleeve (10FT+ or 3.048M+)
 Description: The station is a stainless steel rod driven to a depth of 19.5 m (64 ft), encased in a PVC pipe with NOS logo cover set at the south end of the old Meshuk village, 93 m (305 ft) ESE of the high water and cliff line, 72.72 m (238.6 ft) SSW of bench mark 946 4075 C, 45.46 m (149.1 ft) SW of the SW corner of a shed to the south of a red building with a fuel tank, 40.69 m (133.5 ft) SE of the NE corner of a concrete slab fuel tank foundation with no tank, and 10 cm (0.3 ft) below grade.
 Observed: 2013-09-07T23:07:00Z
 Source: OPUS - page5 1209.04



4075 B 2013, 1, 20131012

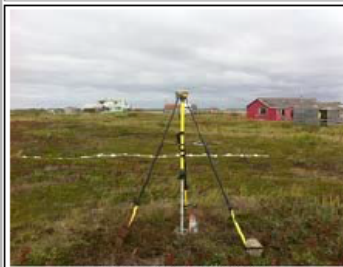
Close-up View

REF_FRAME:	EPOCH:	SOURCE:	UNITS:	SET	DETAILS
NAD_83(2011)	2010.0000	NAVD88 (Computed using GEOID12A)	m	PROFILE	
LAT: 56° 54' 31.09738" ± 0.004 m		UTM 4 SPC 5006(AK 6)			
LON: -158° 41' 0.62039" ± 0.003 m		NORTHING: 6307260.620m 323999.573m			
ELL HT: 20.812 ± 0.037 m		EASTING: 519273.409m 458364.693m			
X: -3251730.357 ± 0.018 m		CONVERGENCE: 0.26516009° -0.57264990°			
Y: -1268875.217 ± 0.010 m		POINT SCALE: 0.99960456 0.99992125			
Z: 5320369.595 ± 0.031 m		COMBINED FACTOR: 0.99960130 0.99991799			
ORTHO HT: 7.372 ± 0.063 m					

CONTRIBUTED BY

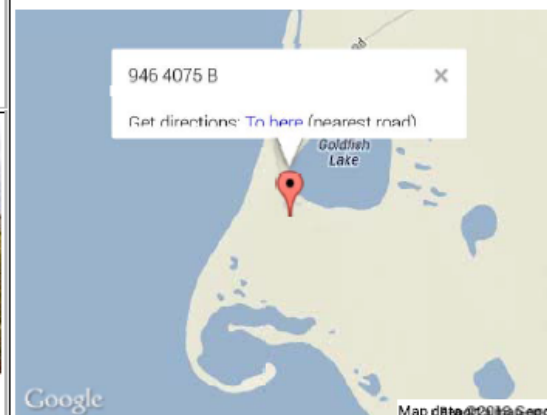
[jon roder](#)

[John Oswald and Associates, LLC](#)



4075 B 2013, 3N, 20130909

Horizon View



The numerical values for this position solution have satisfied the quality control criteria of the National Geodetic Survey. The contributor has verified that the information submitted is accurate and complete.

Tide Gauge Project – New Developments

NOAA CO-OPS 2015-2019 Strategic Plan:

Increase by 50% the number of locations in the Arctic with modern tidal datums, benchmark sheets, and tidal predictions.

Establish the baseline Arctic datum reference system through the installation of both long-term and seasonal water level gauges

Provide increased access to legacy products that no longer meet CO-OPS operational standards for web-based access but can still provide value to customers

Updating DGGS tidal datum calculator:

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Alaska Department of Natural Resources
Division of Geological & Geophysical Surveys

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Alaska Tidal Datum Portal

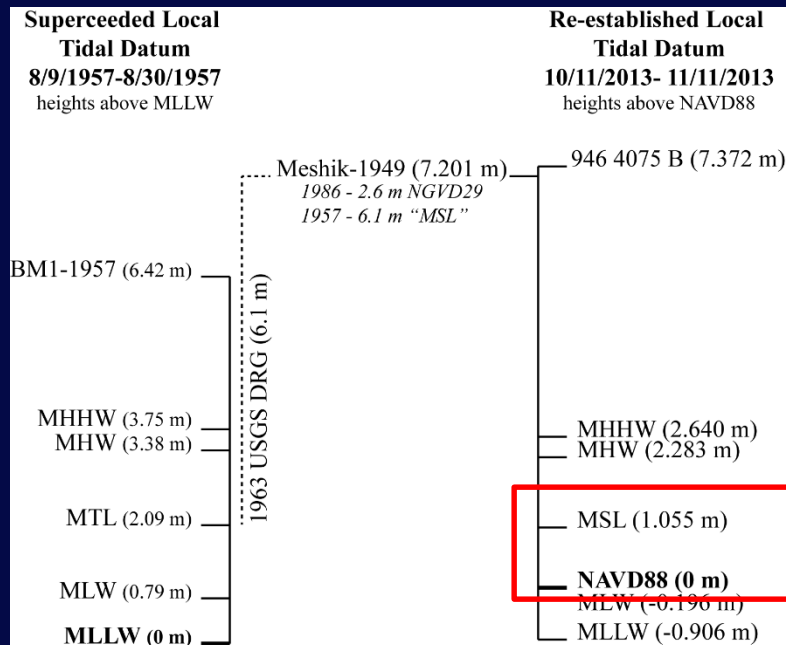
Location: Adak Island

Geodetic Elevation: 1 (meters) NAVD88(GEIOD12A), Orthometric Calculate Elevation (Tidal Datum)

Local Tidal Elevation: 1.266 (meters) MLLW Calculate Elevation (Geodetic Datum)

A summary of relevant information, including links to all of the published values included in this calculator, can be found in the [reference table document](#). The table includes all Alaska tide stations with published local datums as of January 2013, however, tidal benchmarks or NAVD88(GEIOD2012) tidal benchmark elevations are not available for all locations.

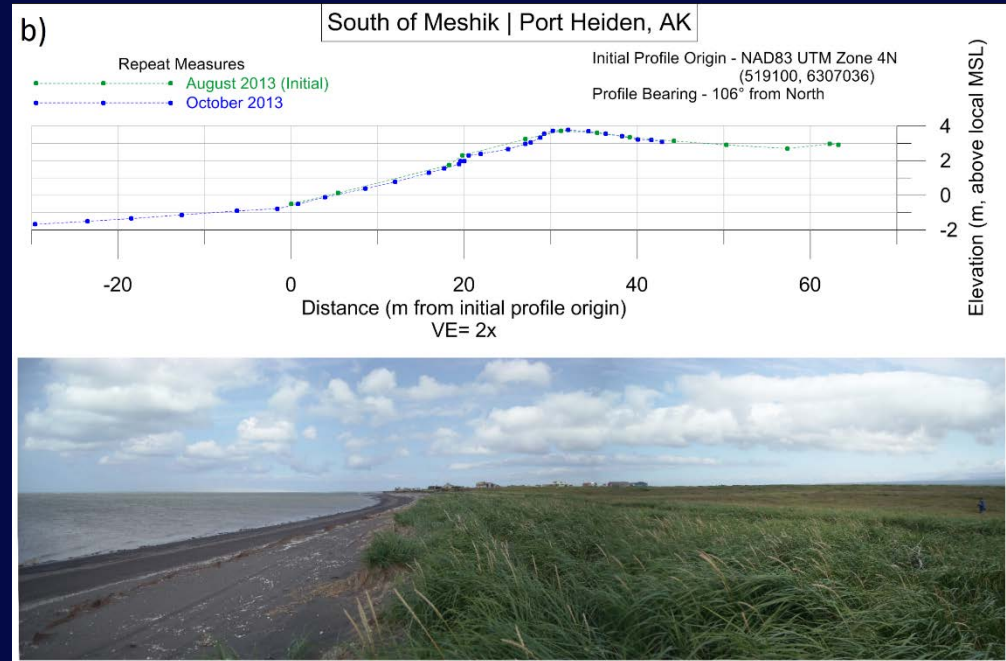
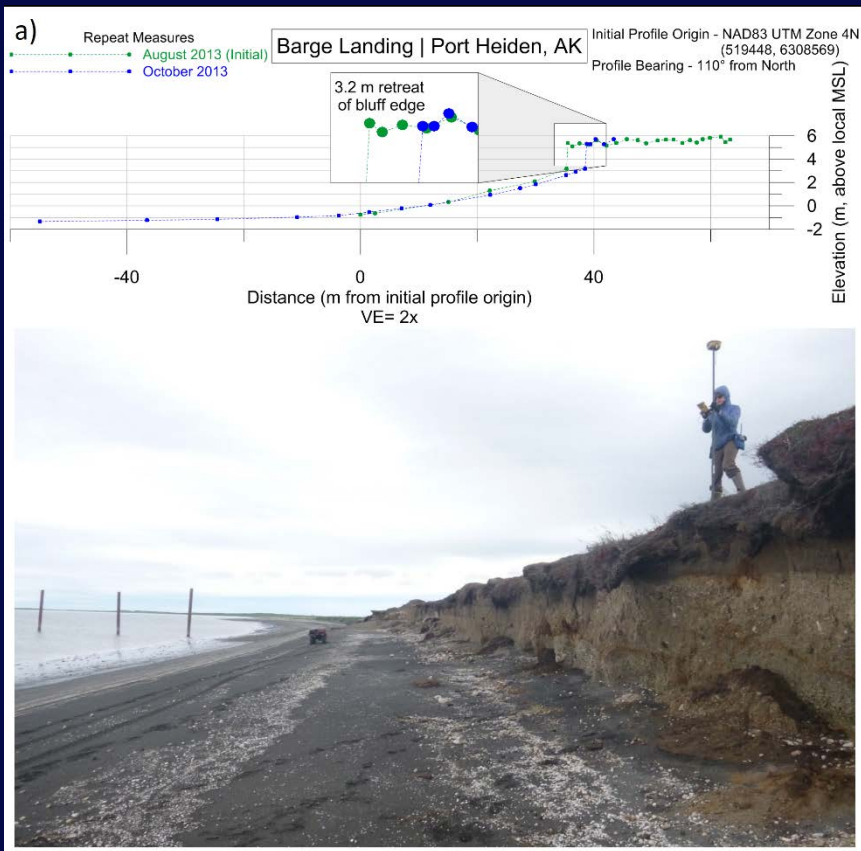
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- New DGGS report on the contemporary rate of shoreline retreat in Port Heiden
- Enough information to calculate the relative rate of sea level rise in Port Heiden (negligible)
- First measured rate of contemporary sea level rise in Bristol Bay:

~1.6 mm/yr

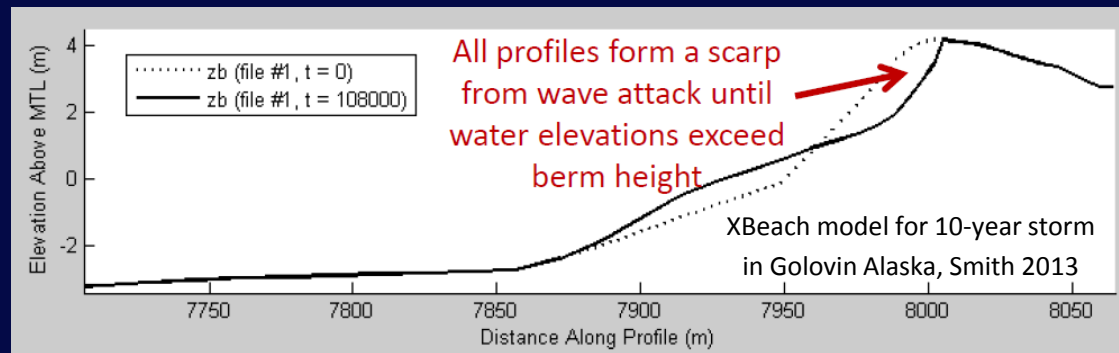
Coastal Profile Project – Context



- Seasonal and annual change detection (sediment flux, erosion)
- Measurements of process-significant elevations (bluff toe, berm crest)

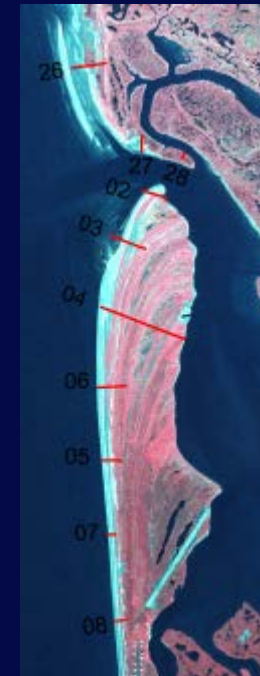
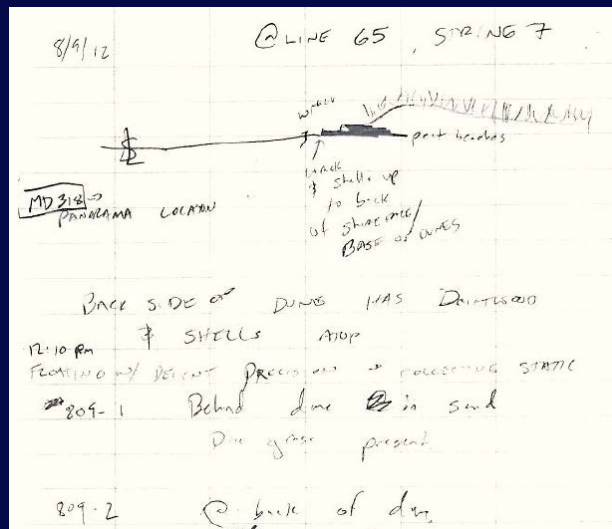
Coastal Profile Project – Motivation

Needed for advanced numerical modeling of the coastal zone



A statewide repository will:

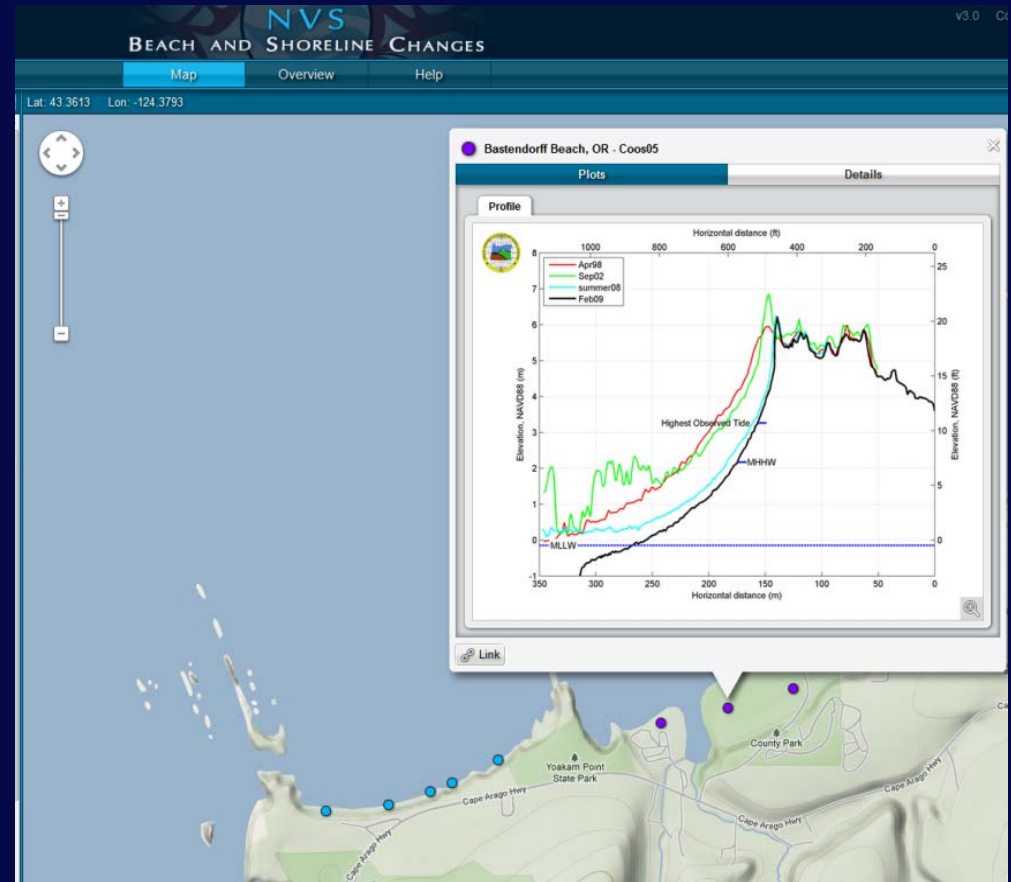
- Organize collections and databases
- Ease access to measured elevation profiles
- Encourage repeat collections in data-sparse regions



Coastal Profile Project – Approach

- Compared >15 example tools to select useful components for Alaska datasets and stakeholders

California, Florida, Hawaii, Maine, New Jersey, New York, Oregon, Washington, S. Carolina, Texas, New Zealand, Australia and the United Kingdom
- Designed a list of priority capabilities, including:
 - Interactive plotting
 - Collaborative data submission
 - Raw data download
- Isolated a subset of our profile database for the design phase

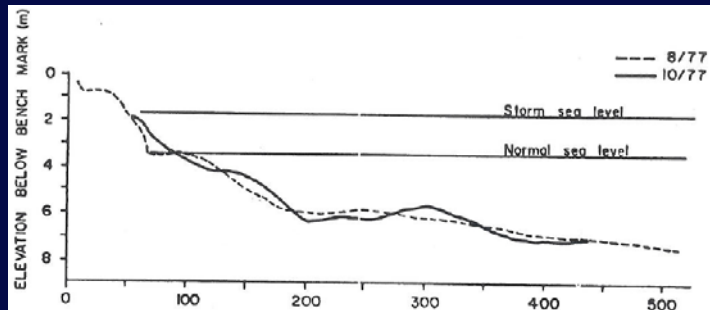


PNOOS profile site

Coastal Profile Project – Status & Developments

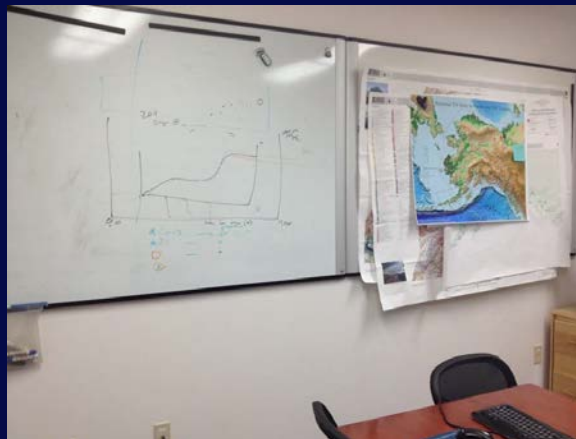
Collecting and standardizing coastal elevation profiles, discussion of lidar inclusion

DGGS, NPS, USGS, DOT, UAA



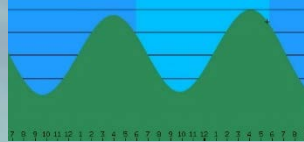
← 1977 measured elevation profile from Nome Alaska, by the late Abby Sallenger (USGS)

USGS Sallenger OME_Profile017 Monument 13-JUL-77 MSL 2.01 Notes weeping shoreface on tidal flat									
Point	Northing	Easting	Latitude	Longitude	Horiz STDV	Vert STDV	Elevation (NADV88)		
777_1	6308033.775	519369.641	56.91558	-158.681866	0.026	0.024	6.043		
777_2	6308034.131	519367.238	56.915583	-158.681906	0.027	0.026	6.127		
777_3	6308034.705	519362.109	56.915588	-158.68199	0.026	0.024	6.456		
777_4	6308035.252	519359.168	56.915593	-158.682038	0.03	0.032	6.938		
777_5	6308035.589	519357.491	56.915597	-158.682066	0.031	0.026	7.161		
777_6	6308036.208	519355.742	56.915602	-158.682094	0.024	0.021	6.63		
777_7	6308037.896	519349.054	56.915618	-158.682204	0.024	0.021	6.551		
777_8	6308038.327	519346.671	56.915622	-158.682243	0.026	0.025	6.921		
777_9	6308039.904	519339.398	56.915636	-158.682363	0.023	0.022	6.977		
777_10	6308040.724	519334.685	56.915644	-158.68244	0.026	0.024	6.476		
777_11	6308042.463	519327.184	56.91566	-158.682563	0.024	0.023	6.653		
777_12	6308043.488	519322.912	56.915669	-158.682633	0.025	0.024	6.715		
777_13	6308043.942	519320.56	56.915673	-158.682672	0.025	0.025	6.224		
777_14	6308045.482	519313.375	56.915687	-158.68279	0.025	0.025	6.026		



Initial development of profile plotting tool with DGGS staff.

Status in Summary



Leveraging exiting activities and collaborations at DGGS we were able to significantly reduce the cost of a NOAA-spec tide gauge in Alaska, which has reestablished water level datums in Bristol Bay and provided a non-satellite measurement of sea level rise in southwest Alaska.



We are in the process of trying to track down all known coastal elevation profiles in Alaska and converting them into a standardized digital format which will allow for interactive visualizations and ease of access.

Thank You!