HSRP Recommendations to NOAA for the Implementation Plan for the Alaska Coastal Mapping Strategy

By David F. Maune, PhD, CP, PSM, PS, GS

Alaska Coastal Mapping Summit

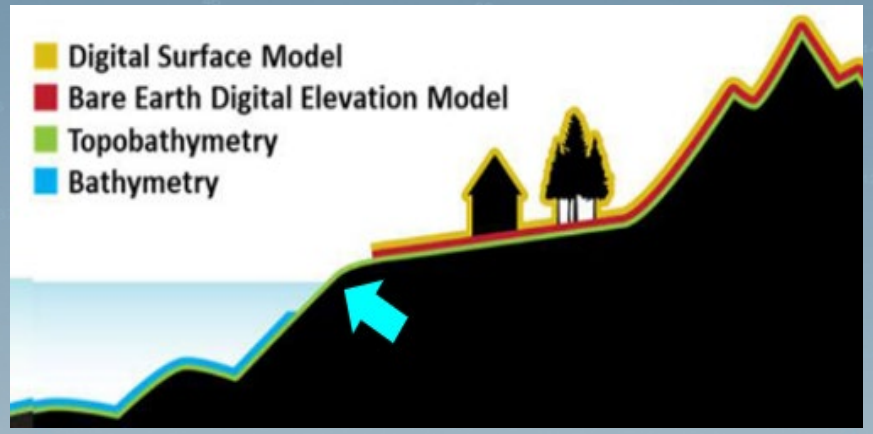
December 9, 2020

Disclosure

- I am a member of the NOAA Hydrographic Services Review Panel, a Federal Advisory Committee that reports to the NOAA Administrator.
- I am here in my personal capacity and for purposes of this presentation I do not represent NOAA or the HSRP.
- I will share information including the key HSRP recommendations and a paper the HSRP approved in September 2020, “Recommendations to NOAA for the Implementation Plan for the Alaska Coastal Mapping Strategy”.
- The presentation and the opinions I will be sharing are my personal opinions on the report and do not represent the HSRP or NOAA.
- The ACMS paper was sent to the NOAA Administrator on Oct. 26, 2020. The paper is publicly available on the HSRP recommendations web page at the following website:

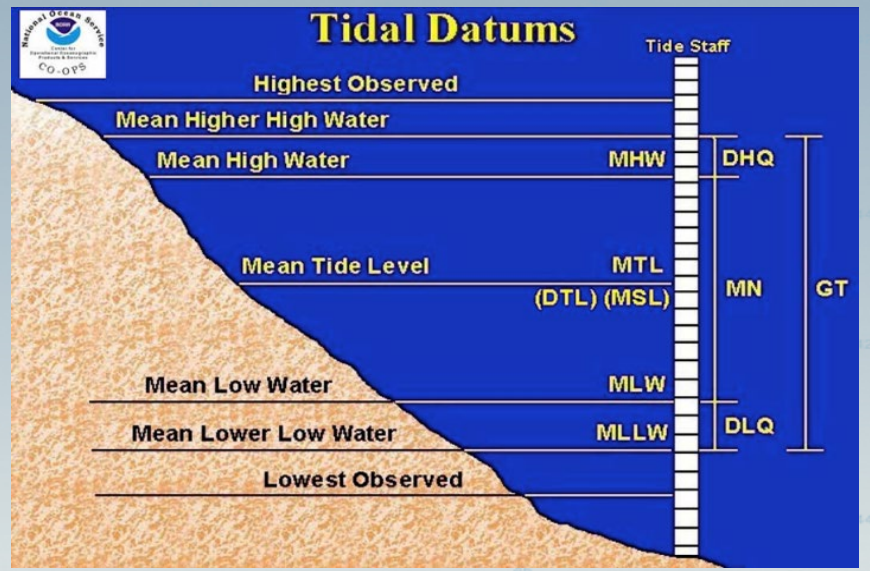
  https://www.nauticalcharts.noaa.gov/hsrp/recommendations.htm

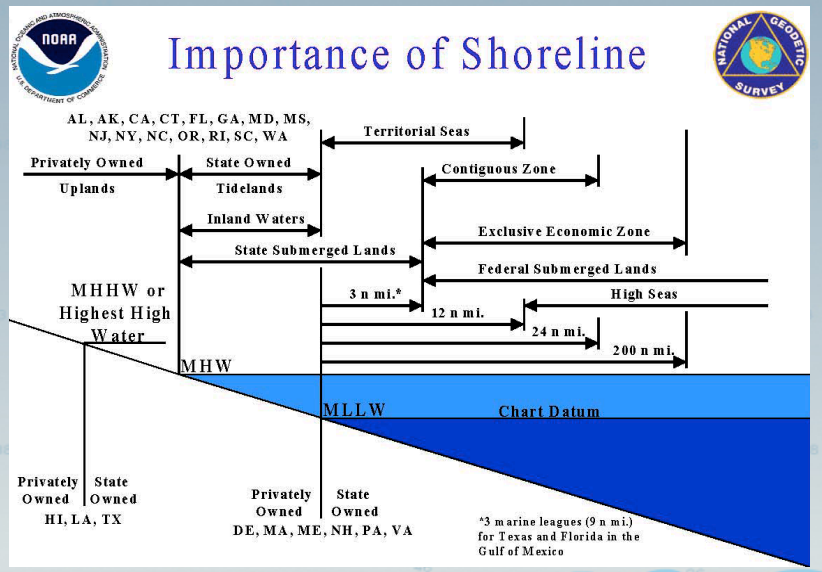
Alaska Coastal Mapping Strategy Background Information



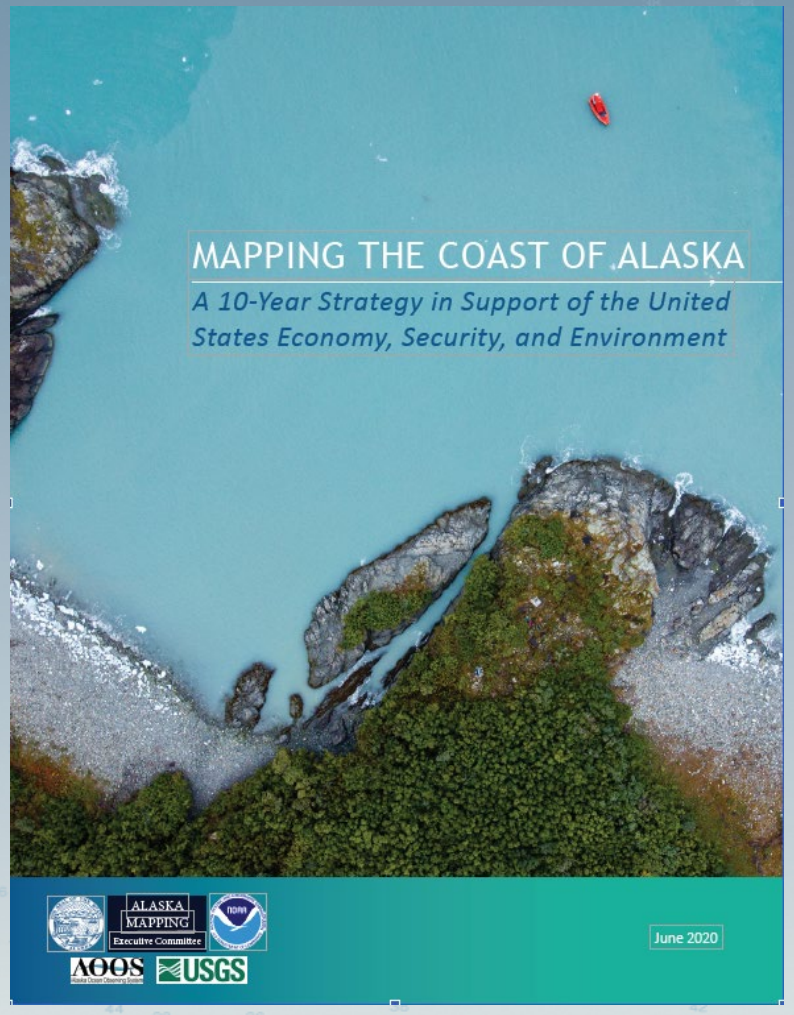
We explained the following:

1. Seamless intertidal zone
2. Importance of ellipsoid, orthometric and tidal datums and the Vertical Datum Transformation Tool (VDatum)
3. Importance of Alaska's official shoreline based on MHW



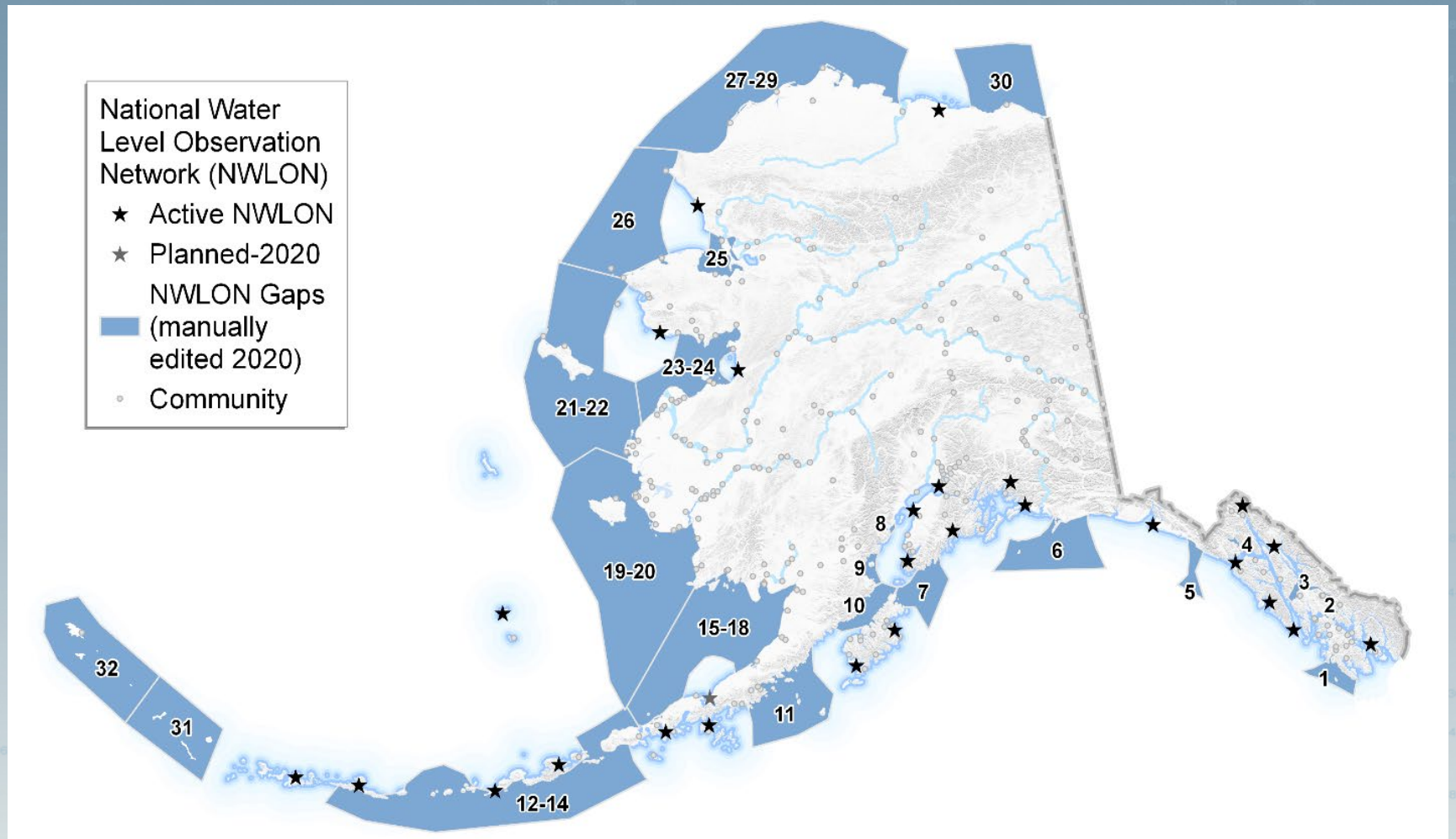


The HSRP fully supports the ACMS; our priority considerations (if practical) are:

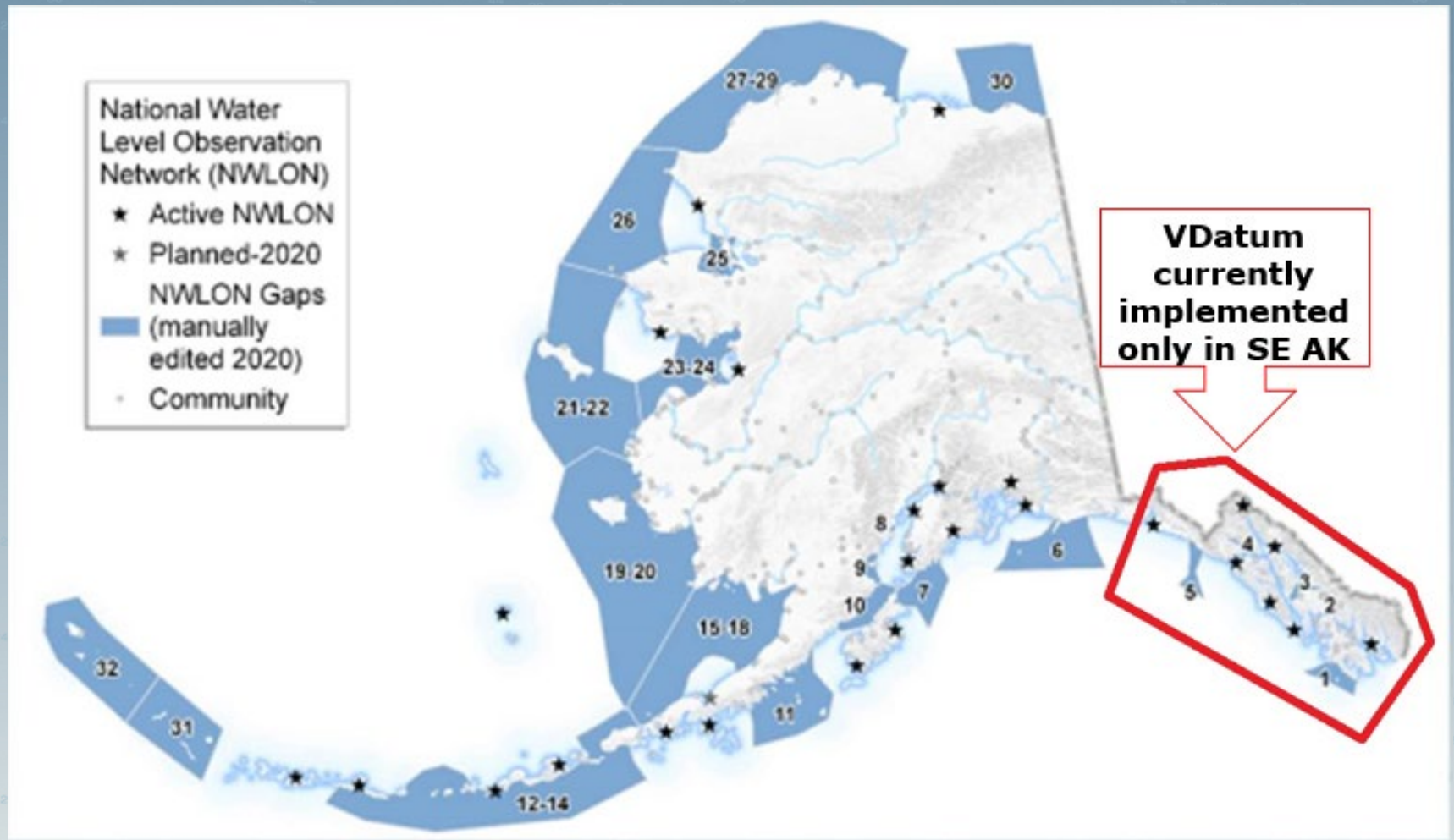


1. Establish tidal datums for VDatum tool statewide and to estimate high & low tides by priority areas
2. Update NOAA's climatology tool that predicts times and locations when waters are the clearest
3. Re-evaluate Satellite Derived Bathymetry (SDB)
4. Collect topobathy lidar and aerial imagery at low tide (±2 hours)
5. Determine data voids out to 4m depth contour
6. Collect sonar at high tide (±2 hours) out to 4m depth using Uncrewed Surface Vessels (USVs) where possible

1. The Alaska Water Level Watch is already addressing alternatives for filling NWLON gaps



We need to expand VDatum statewide so we can convert from ellipsoid to orthometric/tidal datums



VDatum needs for Alaska

Foundational data needs to be acquired before model development can be initiated:

- **Water Level Observations** (with GNSS ellipsoidal ties)
- **Geodetic GNSS Ellipsoidal Observations** on tidal benchmarks at historical Water Level Observation sites throughout the state

Model Development

- Processing, Ingestion, and Publication of Water Level and Geodetic Observations for NOAA acceptance into development
- Hydrodynamic Development and Simulations (Tidal Datums)
- Topography of the Sea Surface Development (TSS)
- Spatially Varying Uncertainty Development
- Software Integration

Iterative Version Development (Future)

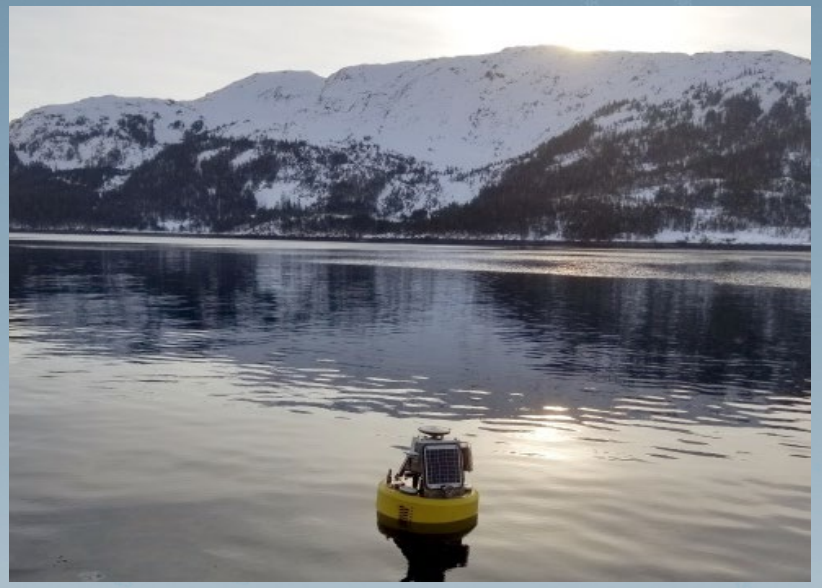
- As we learn what issues present themselves after model development and uncertainty analysis, additional data (Bathymetry, Shoreline, Foundational Water Level and Geodetic Data needs) may be needed for an iterative approach to revisions for enhanced coverage and decrease of uncertainties for user needs

AWLW is already considering lower-cost alternative sensors for tidal datums

GNSS-Reflectometry determines height of the antenna above a reflected surface

Non-vented pressure tide gauges have some advantages over vented gauges

Other alternative sensors for tidal datums

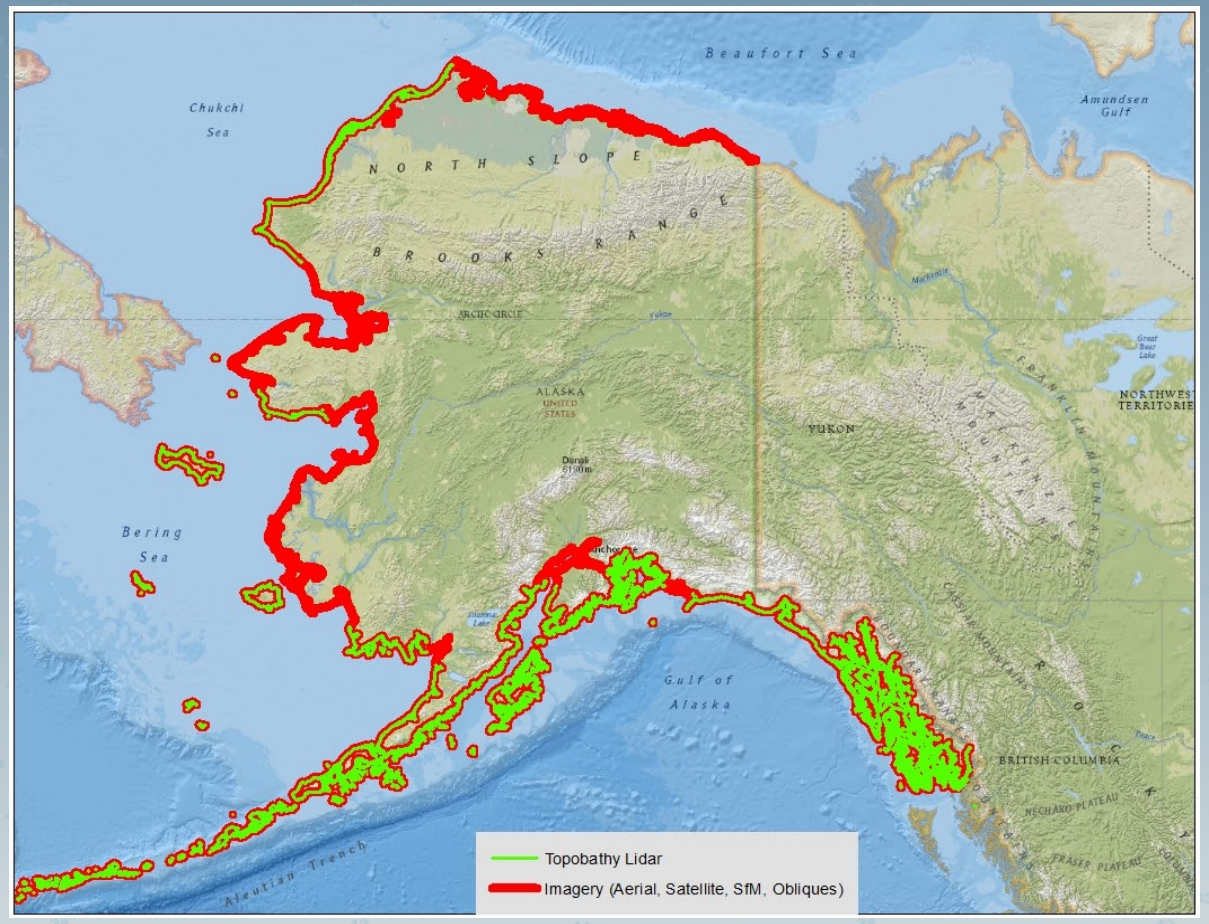


GNSS tide buoy

Hydroball buoy with GNSS and multibeam sonar

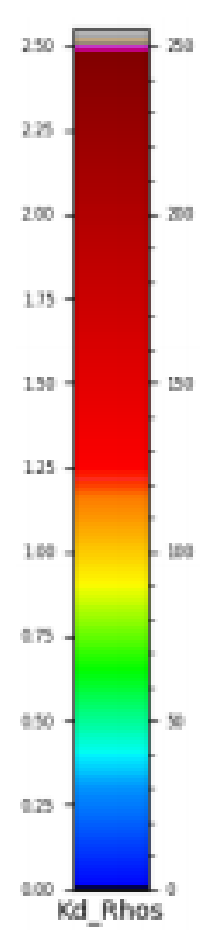
Use alternative lower cost systems for acquiring tidal data and establishing tidal datums in Alaska using the NOAA Tidal Analysis Datums Calculator that enables partners to compute tidal datums themselves using CO-OPS methodologies and their data which may not be collected to NOAA's most rigorous NWLON standards.

2. Update and use NOAA's Climatology Tool



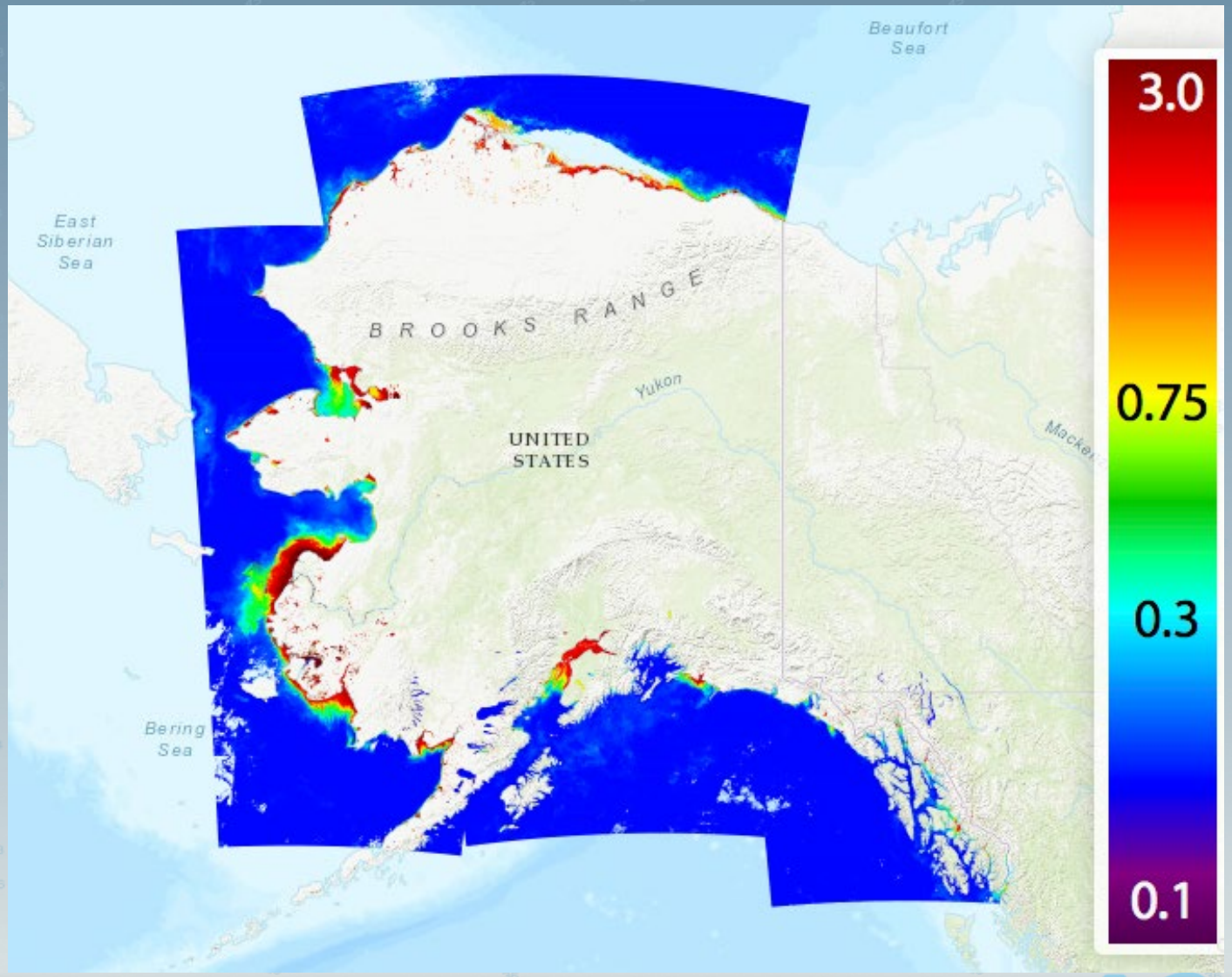
- Work with NOAA to update their climatology tool that predicts times and locations when waters are expected to be the clearest along different reaches of the AK coastline
- NGS and other ACMS partners hope to acquire topobathy lidar for areas in green, and imagery only for areas in red.

Alaska Climatology Model/Water Clarity Viewer using Sentinel-3

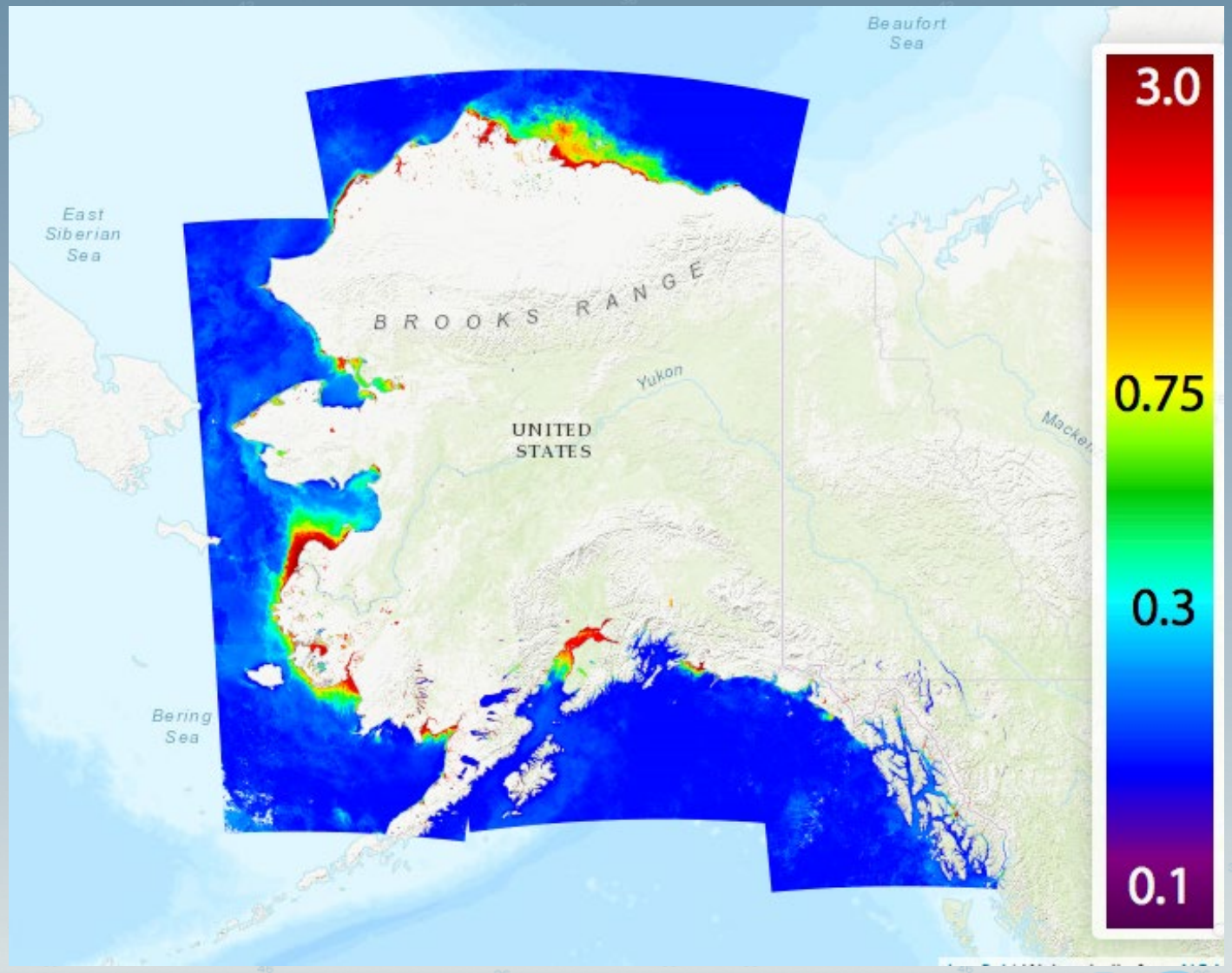


- Sentinel-3 is a multi-instrument mission to measure sea-surface topography, sea- and land-surface temperature, ocean color and land color with high-end accuracy and reliability. The mission supports ocean forecasting systems, as well as environmental and climate monitoring. Sentinel-3A was launched on 16 February 2016 and Sentinel-3B joined its twin in orbit in 2018.
- The files used to create NOAA's Alaska climatology model are monthly composites for 2019 of OLCI Sentinel-3 daily imagery at a resolution of 300 meters. Kd is a measure of how light dissipates with depth in water. Sentinel 3 has three color channels that are impacted by turbidity differently. Kd is determined by using the relative intensity information from these color channels, calibrating them and calculating a total value that approximates the amount of scattering particles in the water column.
- This is the Kd_Rhos colorbar. In general, the blue-to-cyan-to-green is going to best represent what will be 'good' conditions near shore for topobathy lidar and satellite derived bathymetry. **The Kd is an indicator of the turbidity of the water column, and is directly related to the concentration of scattering particles into the water column. So the least turbid water is going to be represented by blues**

June 2019


Beaufort Sea
East Siberian Sea
BROOKS RANGE
Yukon
UNITED STATES
Bering Sea
3.0
0.75
0.3
0.1

July 2019


Beaufort Sea
East Siberian Sea
BROOKS RANGE
Yukon
UNITED STATES
Bering Sea
3.0
0.75
0.3
0.1

August 2019


Beaufort Sea
East Siberian Sea
BROOKS RANGE
Yukon
UNITED STATES
Bering Sea
3.0
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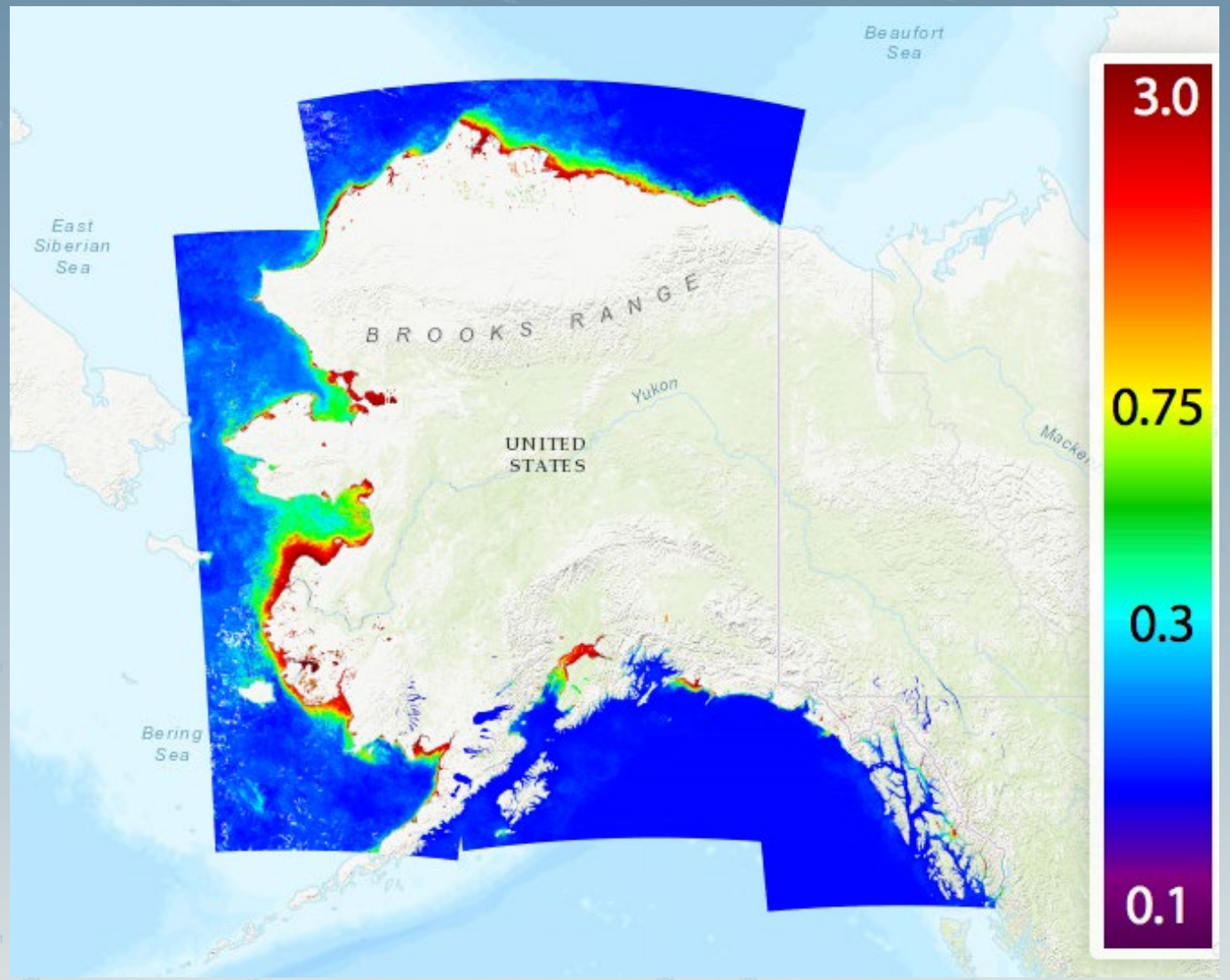
September 2019

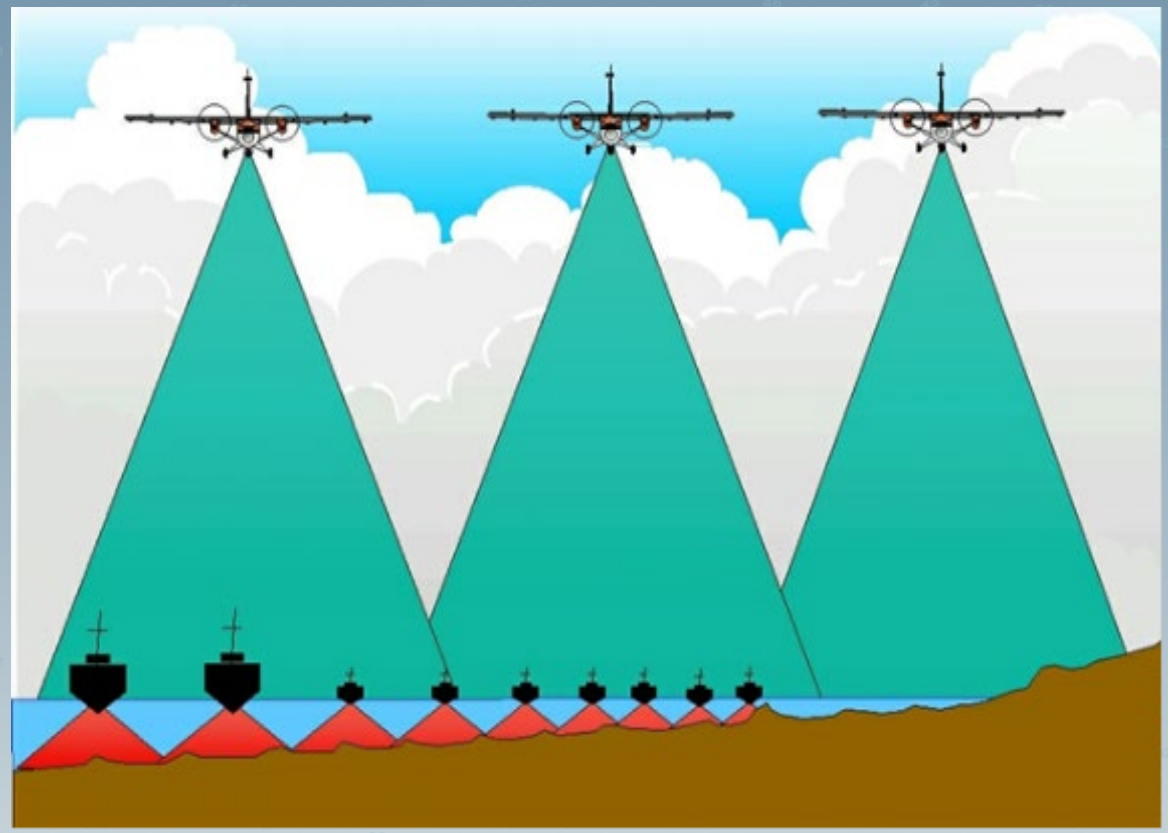


3. Re-evaluate Satellite Derived Bathymetry (SDB) Options

- We are looking for success stories in AK using selected bands of satellite imagery
- Attempts in prior years have not been successful due to limited satellite coverage, cloud cover, and turbidity
- This promises to change with increased satellite coverage by the Sentinel constellation, Maxar, Planet, and others. Currently, Sentinel-2 revisit for Alaska is 2-3 times per day.

https://sentinel.esa.int/web/sentinel/user-guides/sentinel-2-msi/revisit-coverage

Optimize times for collection of topobathy lidar (1st), then sonar (2nd)



Topobathy lidar is most cost-effective in shallow waters; sonar is most cost-effective in deeper waters and where waters are too turbid for lidar

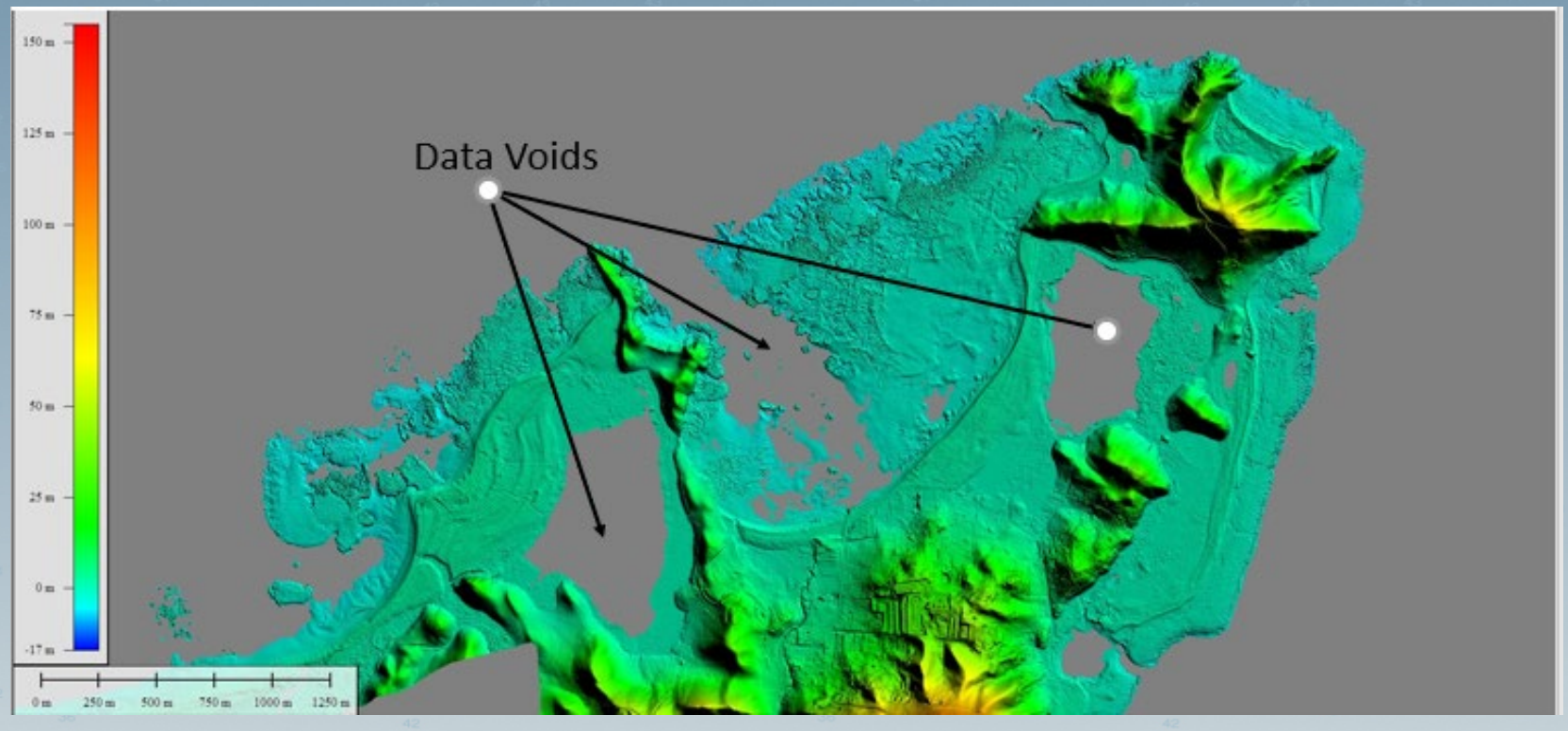
4. Collect topobathy lidar & aerial imagery at low tide (±2 hours)


2018 ALASKA COASTAL MAPPING SUMMIT SUMMARY REPORT

Haines, Alaska. A look at the intricate braiding of tidal flats, looking north at the shoreline west of McClellan Flats. The image was created from the gridded LIDAR surface colored by elevation. Quantum Spatial

Final
April 30, 2018
Prepared by Marta Kumle, Coastal Mapping Strategist
Alaska Ocean Observing System and State of Alaska Department of Natural Resources
Anchorage, Alaska

5. Determine topobathy lidar data voids out to the 4m depth contour



Where waters are too turbid for ALB, data voids must be filled in with sonar

6. Collect sonar at high tide out to 4m depth using Uncrewed Surface Vessels (USVs);

Note: 4m = Navigable Area Limit Line (NALL)

The Z-boat, with multibeam sonar, is one of may options to choose from for surveying shallow waters. They transit pre-planned acquisition patterns, but normally operate within line-of-sight of a human controller on land or on a crewed hydro survey vessel.

Saildrones, with either single- or multibeam sonar, operate autonomously, remotely monitored by Saildrone Mission Control from long distances, but they require minimum depth of 6 ft. Mapped large parts of Arctic in 2020 using zig-zag pattern.

ACMS Goal 1: Build on existing mapping partnerships to meet Alaska's mapping needs

- Objective 1.1: Establish a team for Alaska coastal mapping implementation
- Objective 1.2: Refine stakeholder mapping priorities, costs and data standards
- Objective 1.3: Cost-effectively resource the Alaska Coastal Mapping Implementation Plan
- Objective 1.4: Integration with complementary AMEC mapping priorities

While supporting other objectives, our HSRP recommendations focused on Objective 1.2, i.e., priorities, costs and standards

Where possible, prioritize needs of Alaska's coastal villages

Few villages have roads to the mainland; they are supplied by small aircraft (if they have a landing strip) or by barges guided in by sounding skiffs with consumer depth sounder or sounding poles for physical soundings of shallow water.

However, local communities can enact travel restrictions to minimize the spread of the Covid-19 virus, and AK's villages have been badly harmed in the past. It may not be possible to prioritize AK's villages if specialists can't enter.

Develop funding partnerships. Subject to availability of funds, mapping should commence immediately in areas in which there is the necessary geospatial infrastructure, i.e., CORS and tide stations needed for VDatum and accurate predictions of high and low tides.

For topobathy lidar, I'd like to see common standards between NOAA/JALBTCX e.g., swath width, tide coordination, and imagery

ACMS Goal 2: Expand coastal data collection to deliver the priority geospatial products stakeholders require

- Objective 2.1: Execute a flexible Alaska coastal mapping campaign
- Objective 2.2: Upgrade Alaska National Spatial Reference System components to support mapping data acquisition
- Objective 2.3: Produce and disseminate key datasets and products from Alaska coastal mapping data

While supporting other objectives, our HSRP recommendations focused on Objective 2.2 to include support of the Alaska Water Level Watch's Collaborative Working Group Guidance Plan to fill gaps in the NWLON network with lower-cost alternatives

ACMS Goal 3: Leverage innovation in mapping technology development

- Objective 3.1: Upgrade the Alaska climatology tool for smart application of satellite and airborne lidar bathymetry
- Objective 3.2: Monitor and test new technologies for acquisition efficiencies.

Our HSRP recommendations focused on both of these objectives.

We support the NGS build-out plan for foundation CORS; we had four additional recommendations for water level observations, plus four recommendations for expanding VDatum coverage in AK

ACMS Goal 4: Conduct strategic communications to promote widespread stakeholder engagement

- Objective 4.1: Strengthen stakeholder communications to grow participation in the Alaska coastal mapping campaign
- Objective 4.2: Use online tools and technologies to communicate plans and performance

The HSRP offered seven recommendations on how to strengthen stakeholder communications: (1) outreach and public engagement strategy, (2) ensure participation of non-government sectors, (3) demonstrate innovation, (4) AMEC transparency, (5) develop a gap analysis, (6) develop standards and protocols for consistency, (7) early stakeholder engagement

Questions Later. Thank you.