


Tidal Coordination for Data Acquisition

A photograph of a coastal surveying operation. In the foreground on the left, a black tripod with blue joints is set up on a muddy, rocky shore. A camera is mounted on top of the tripod. In the middle ground, a person wearing a bright green high-visibility jacket is wading in shallow, rippling water. They are holding a long, white vertical measuring pole. The background is a dark, calm body of water under a dark sky.

Alaska Coastal & Ocean Mapping Summit 2022
JOA Surveys, LLC

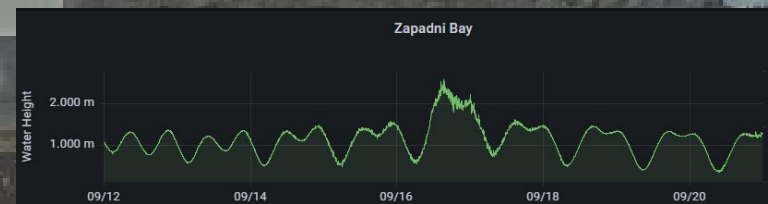
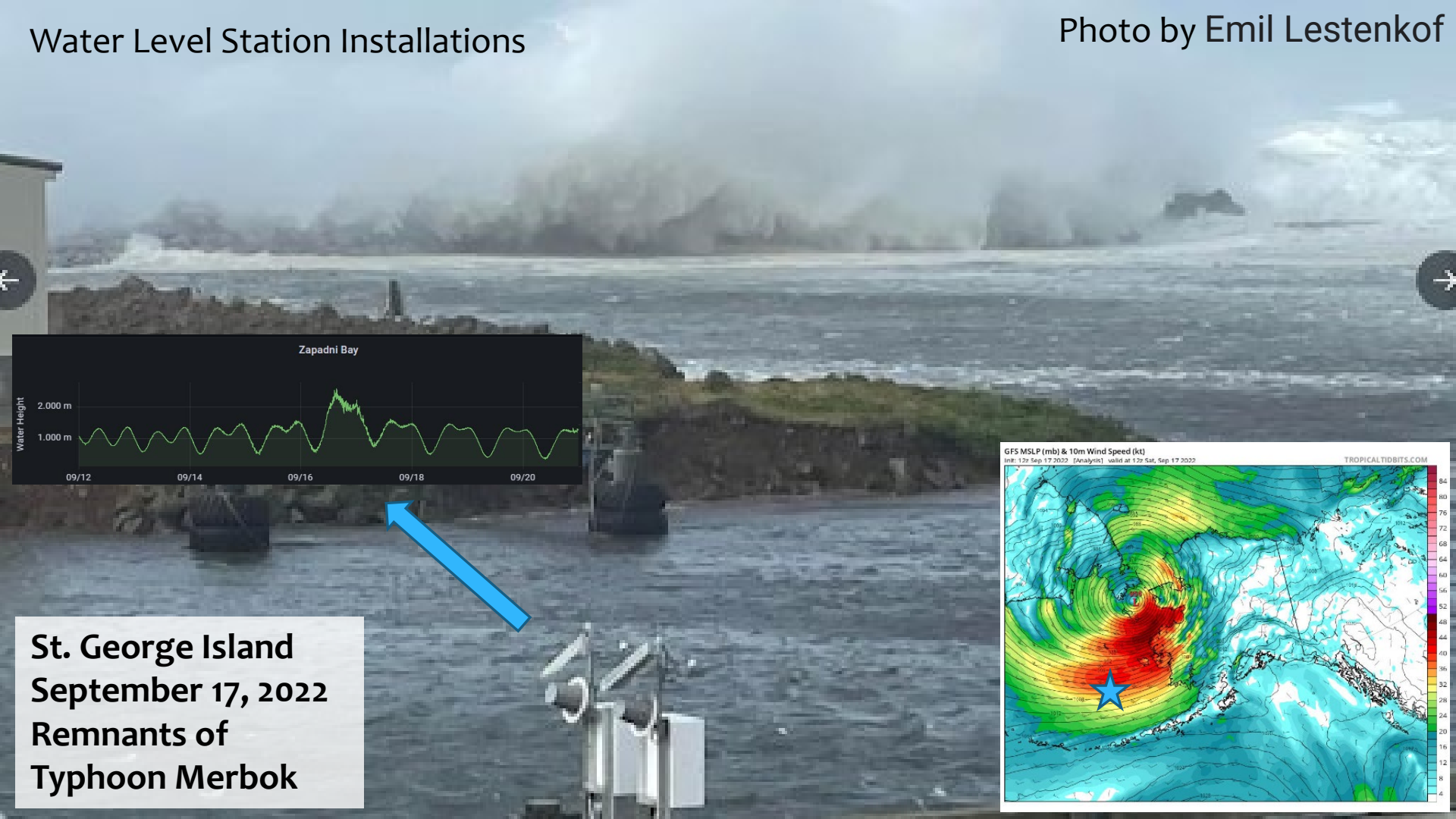
Company Overview

- * Small Business located in Anchorage AK
- * Owners (3)
- * Full Time Employees (7)
- * Part Time/Seasonal Employees
- * Land Surveyor Licensed in Alaska (3)
- * International Hydrographic Organization Cat A Hydrographer (1)
- * Geospatial Information Science Certificate (1)

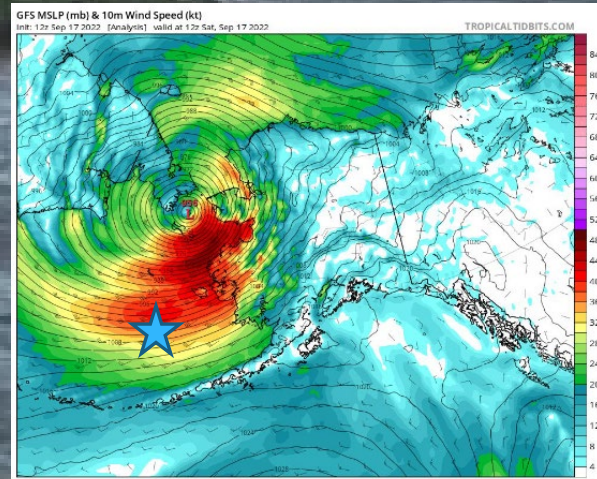


Water Level Station Installations

Photo by Emil Lestenkof



**St. George Island
September 17, 2022
Remnants of
Typhoon Merbok**

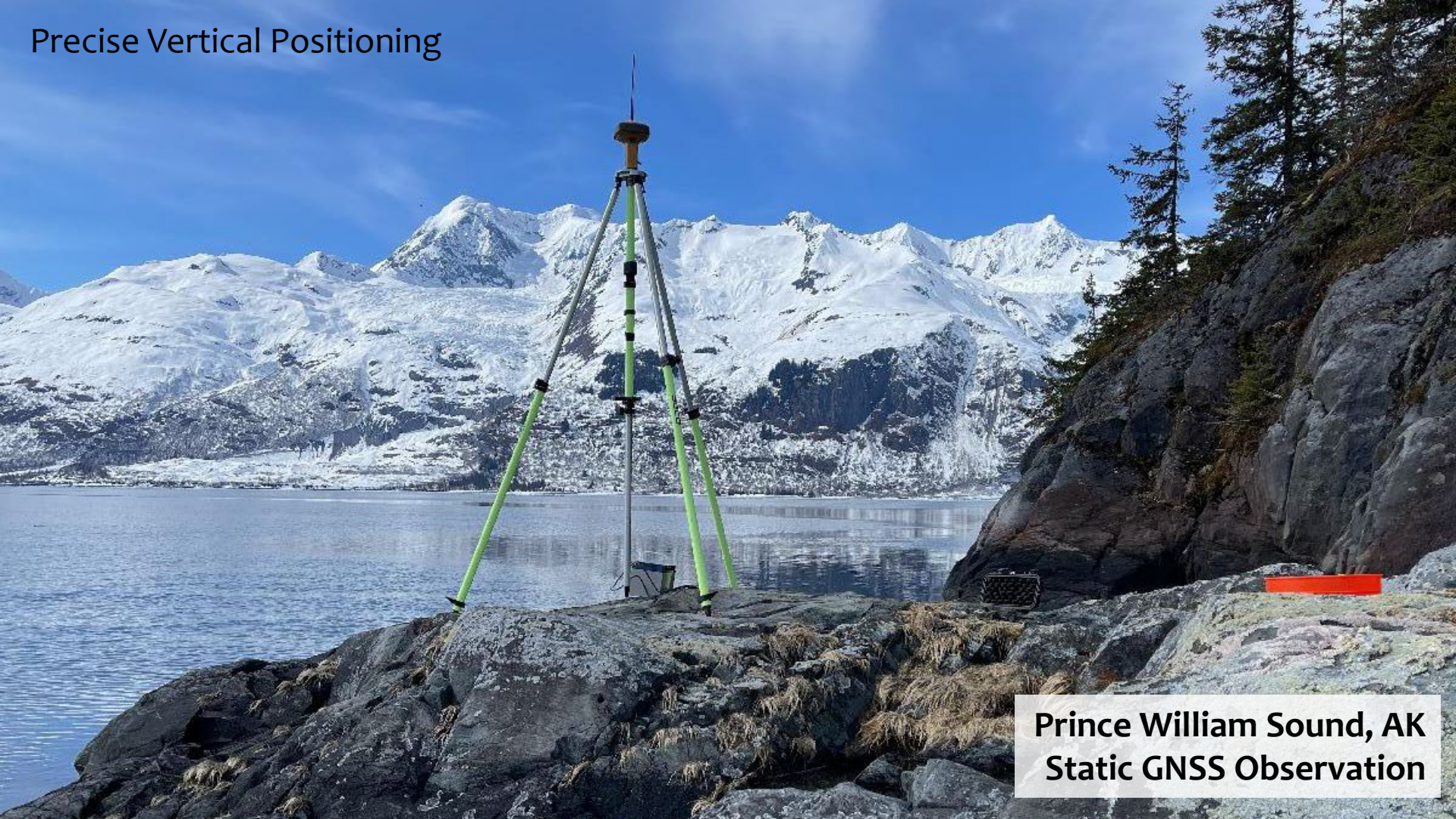


Precise Vertical Positioning



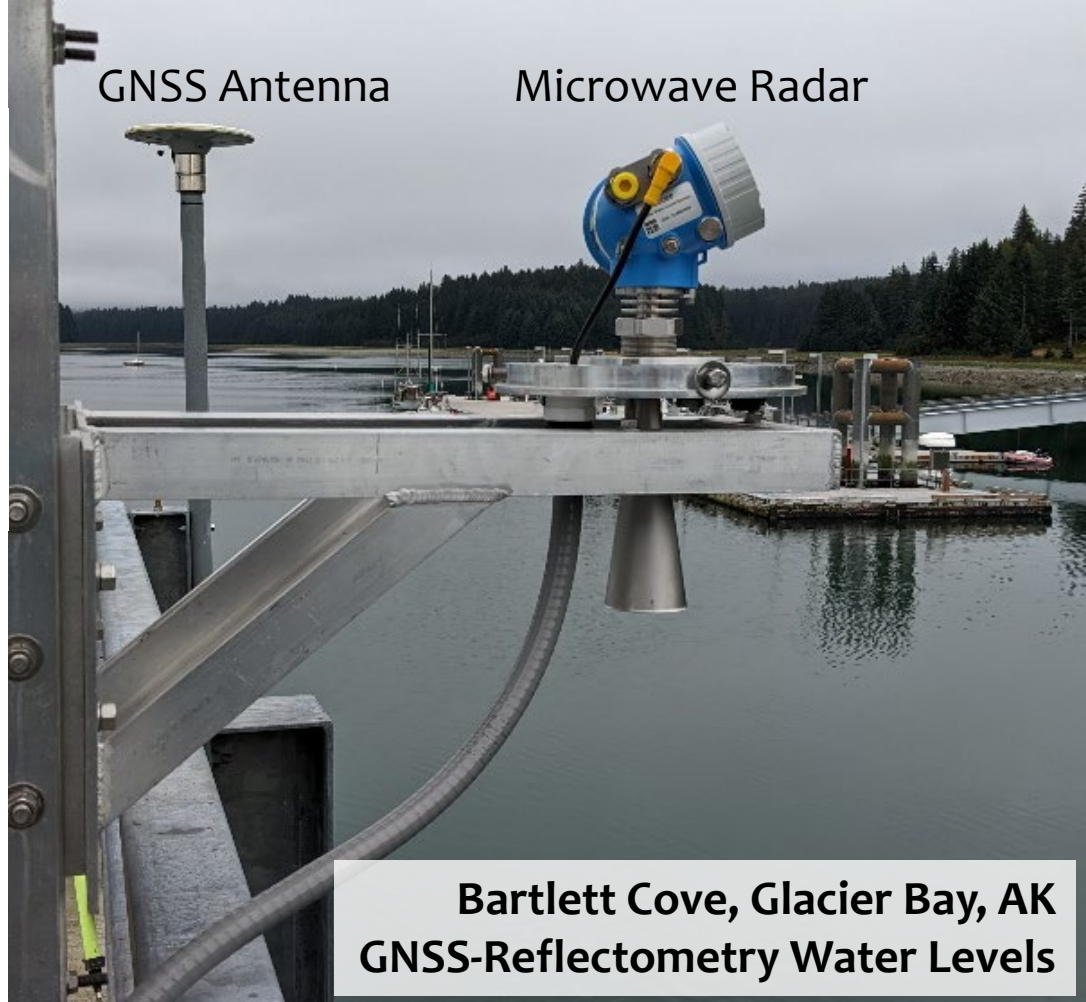
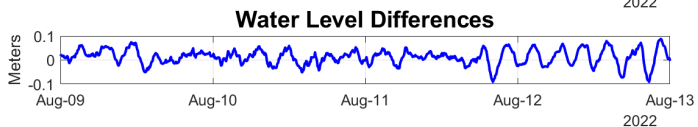
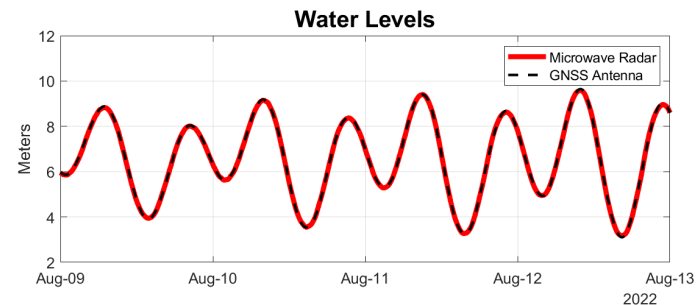
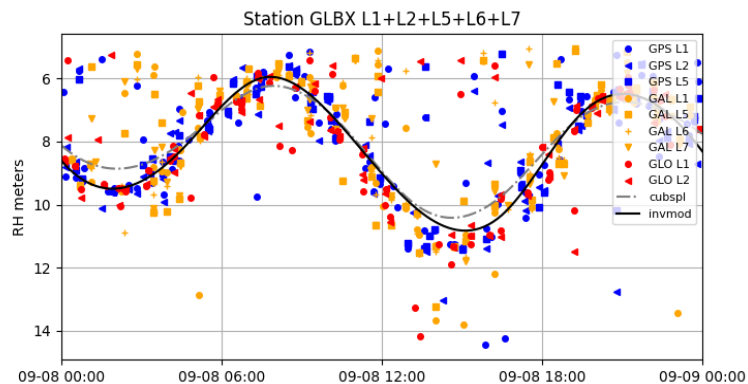
**Prince William Sound, AK
Second Order Class I
Differential Leveling**

Precise Vertical Positioning



**Prince William Sound, AK
Static GNSS Observation**

Emerging Technologies



Processed using: github.com/kristinemlarson

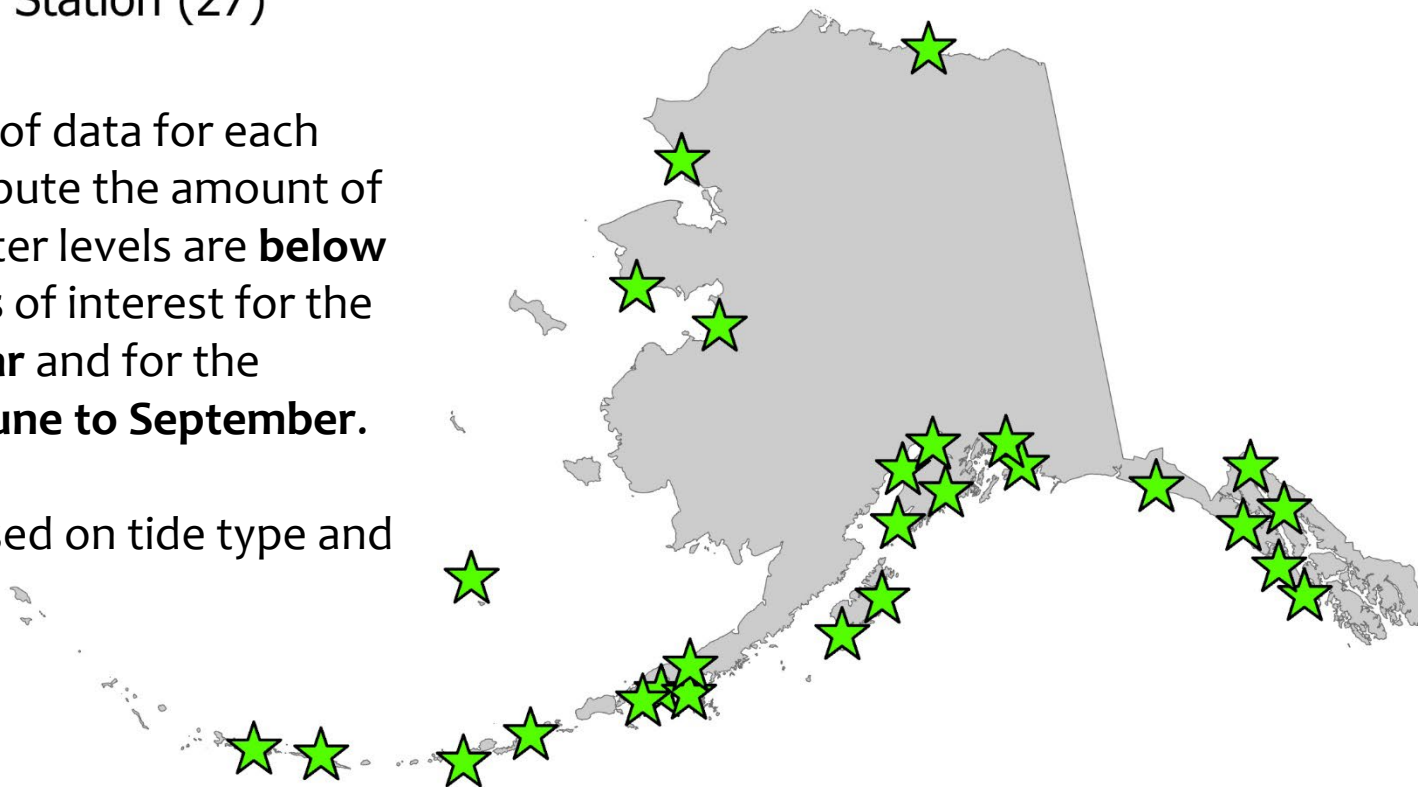


JOA Surveys, LLC
At the boundary between land and sea

★ NWLON Station (27)

Using 1 year of data for each station compute the amount of time the water levels are **below tidal datums** of interest for the **calendar year** and for the months of **June to September**.

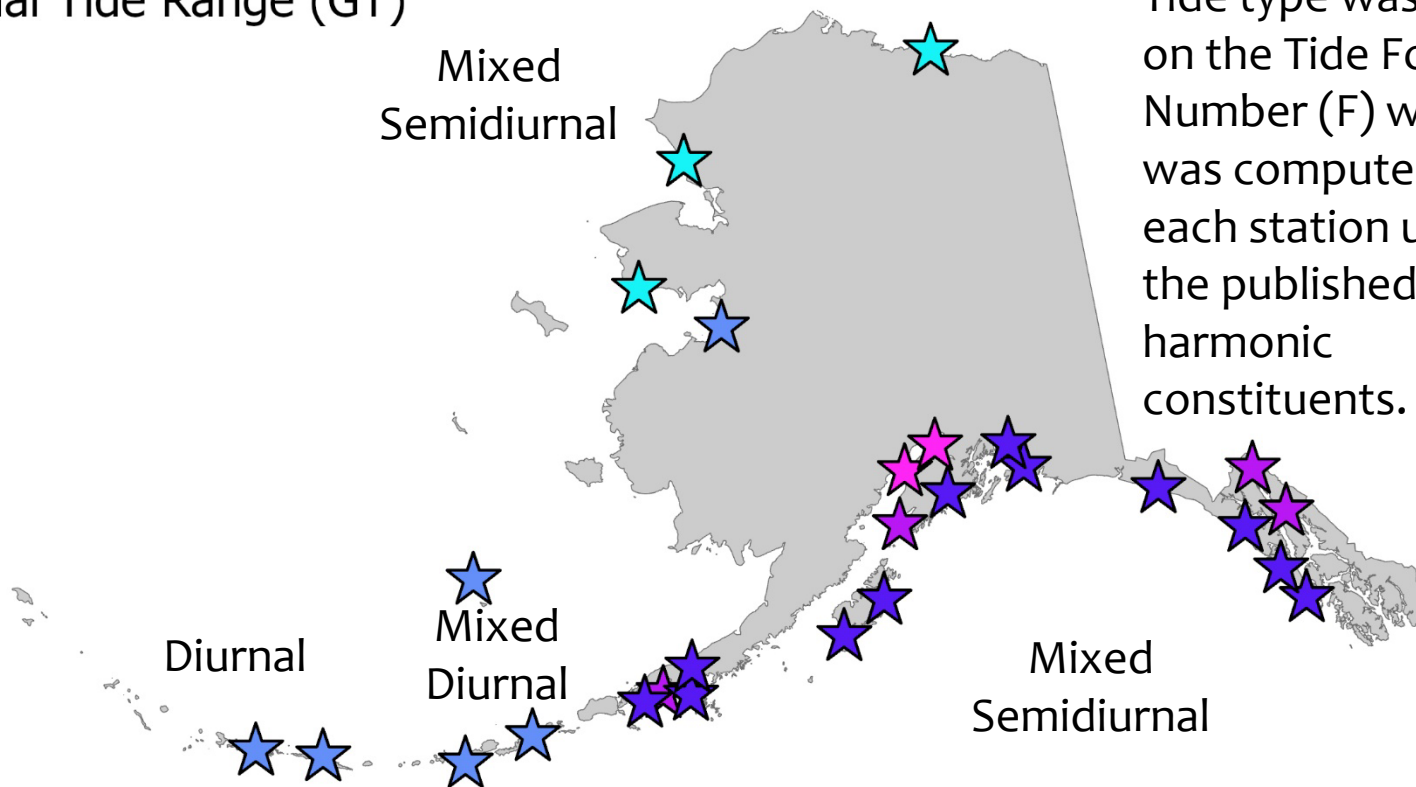
Evaluate based on tide type and region.



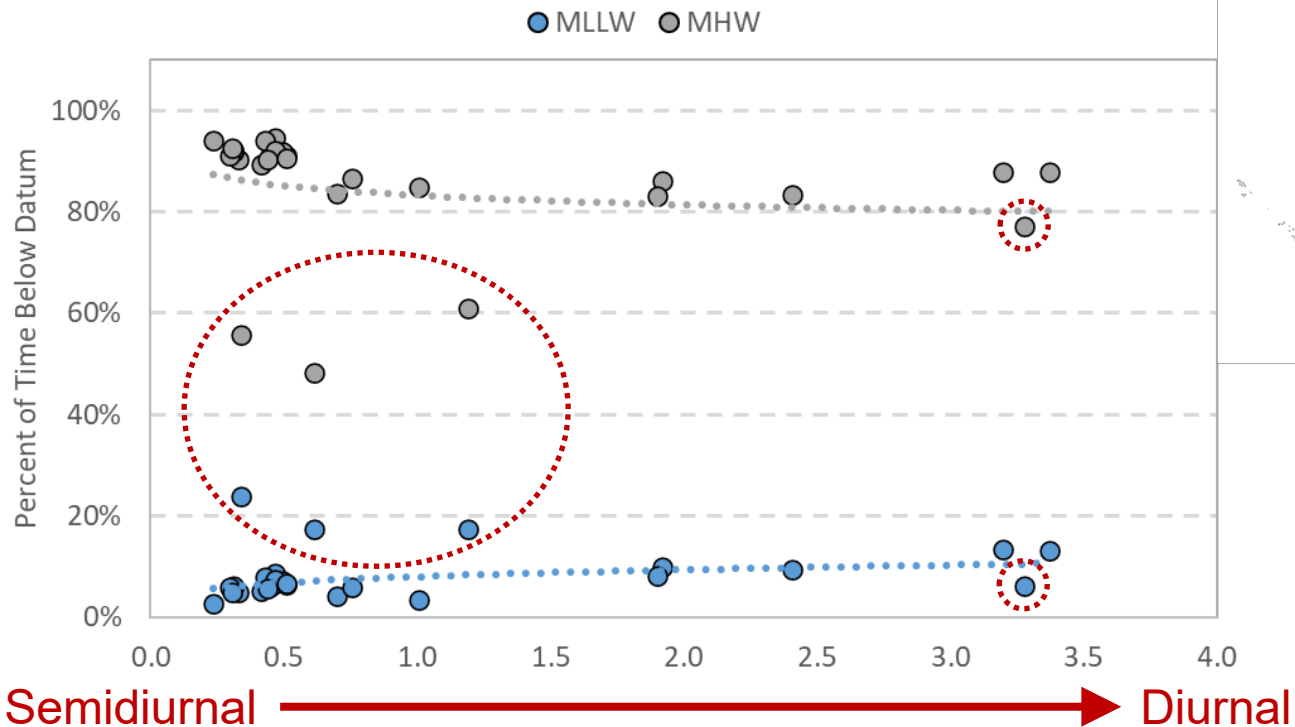
Great Diurnal Tide Range (GT)

- ★ ≤ 0.5 m
- ★ ≤ 2.0 m
- ★ ≤ 4.0 m
- ★ ≤ 6.0 m
- ★ ≤ 9.0 m

Tide type was based on the Tide Form Number (F) which was computed for each station using the published tidal harmonic constituents.



Percent of Time Below Datum as a Function of Tide Form Number (F) - Jan to Dec

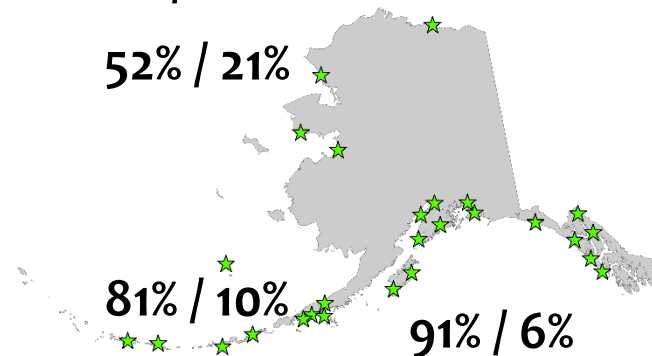


MHW / MLLW

52% / 21%

81% / 10%

91% / 6%



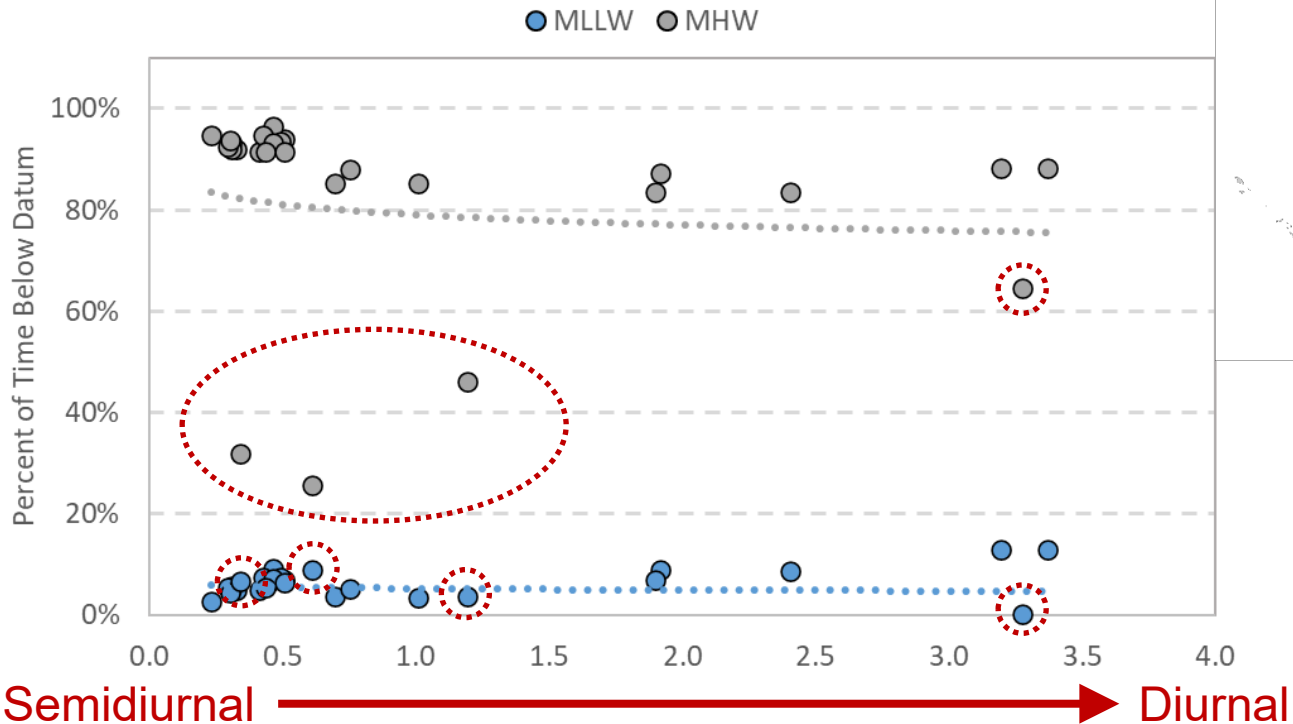
The percent of time water levels are below MLLW is slightly higher for diurnal stations than for semidiurnal stations.

That is the opposite for MHW.



JOA Surveys, LLC
At the boundary between land and sea

Percent of Time Below Datum as a Function of Tide Form Number (F) - Jun to Sep



MHW / MLLW

29% / 8%

78% / 7%

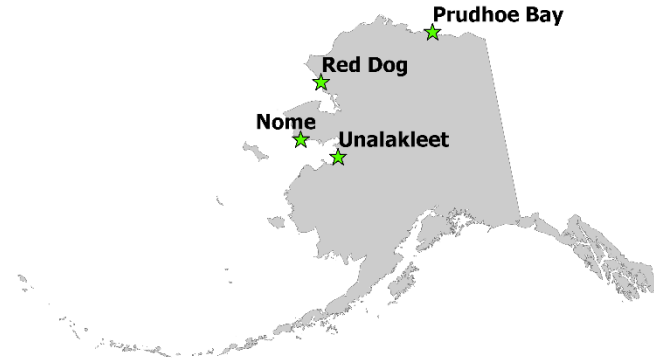
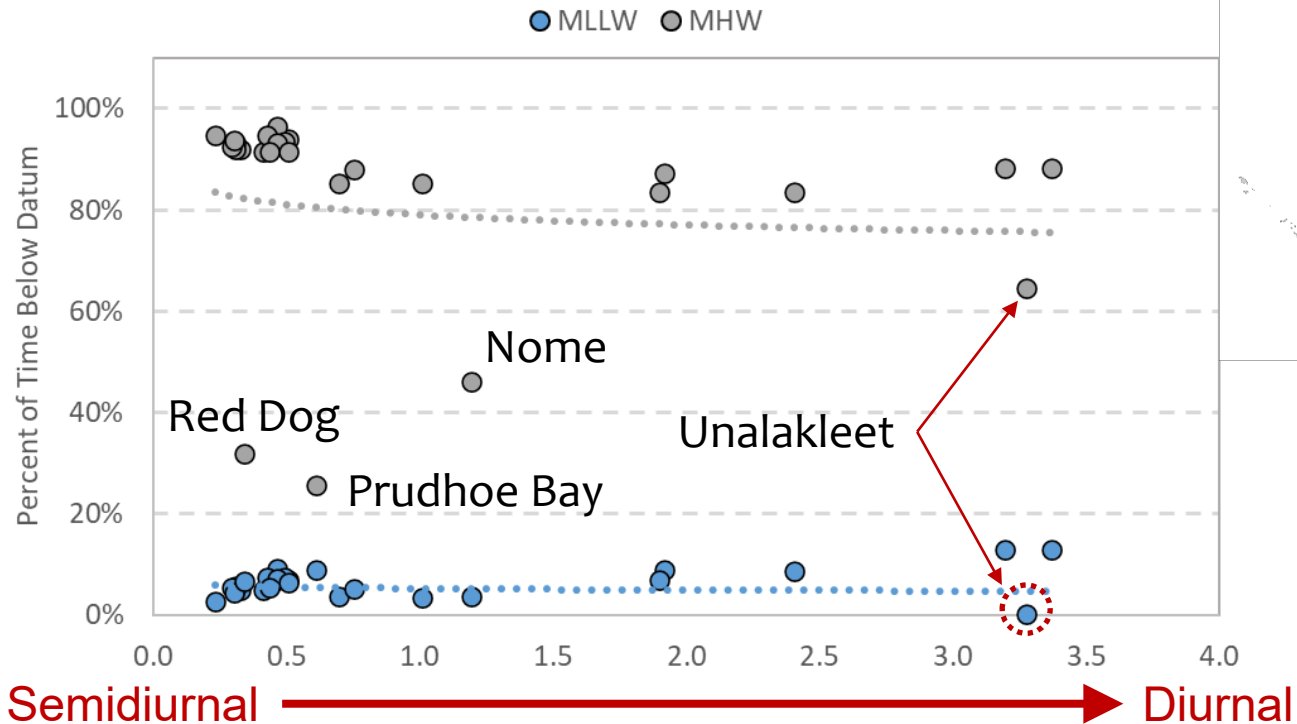
93% / 6%

Seasonality has a large affect in the Bering and Arctic.

In the Arctic the average % of time water levels are below MLLW drops from 21% for the calendar year to 8% for the months of **June to September**.



Percent of Time Below Datum as a Function of Tide Form Number (F) - Jun to Sep

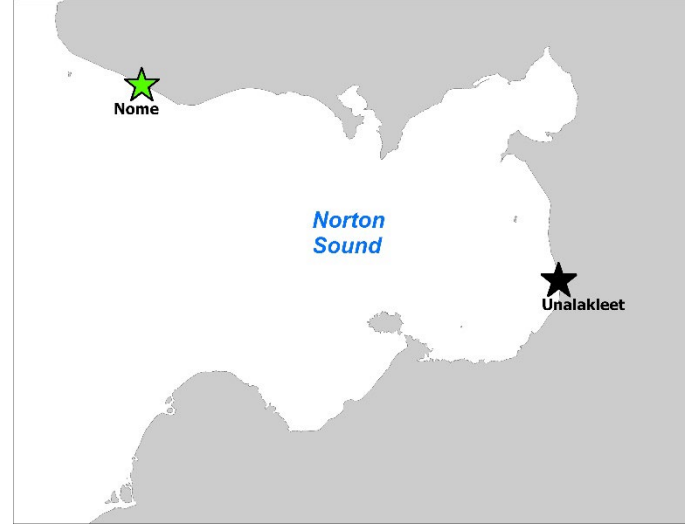
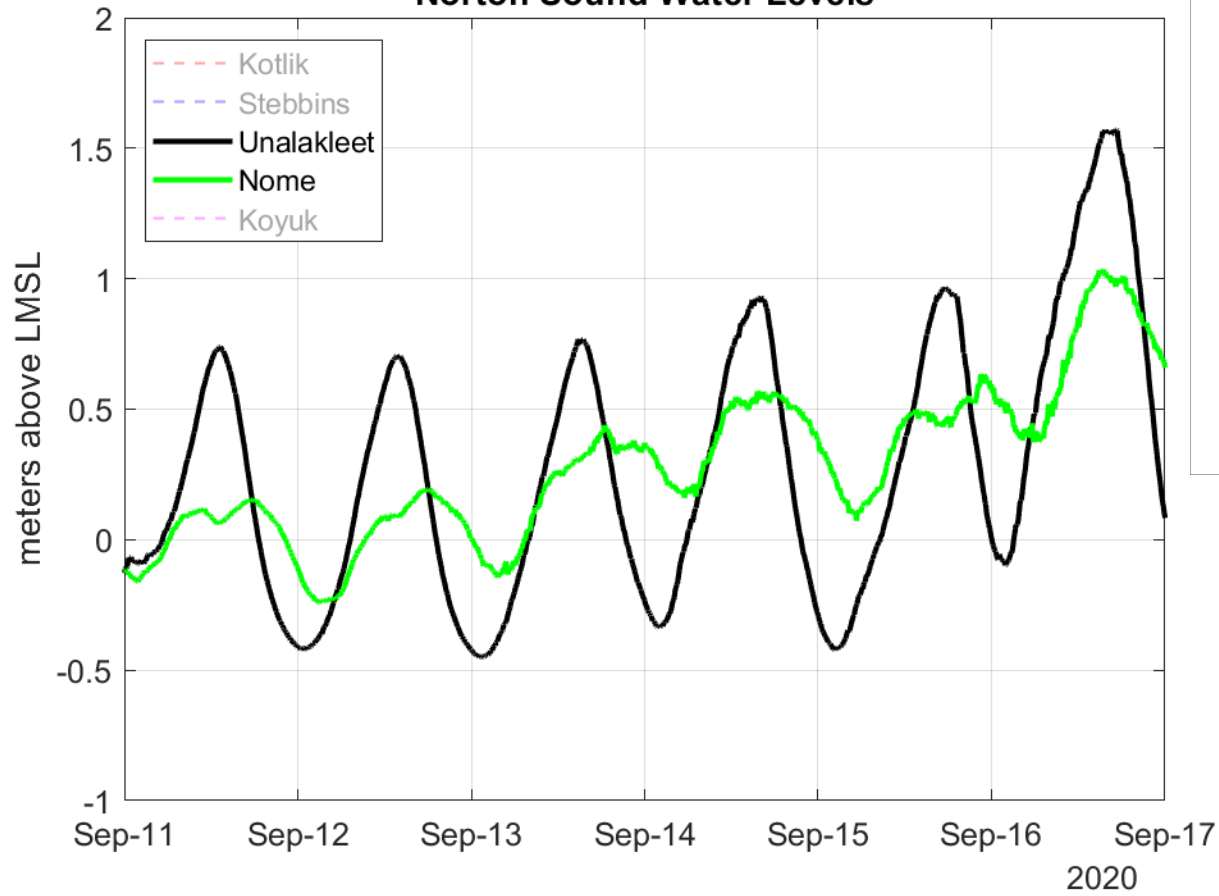


The **seasonality** affect is even **more drastic** for **MHW** where it reduces from **52%** to **29%** in the months of **June to September**.

From June to Sep of 2020 the water level at Unalakleet never dropped below MLLW!



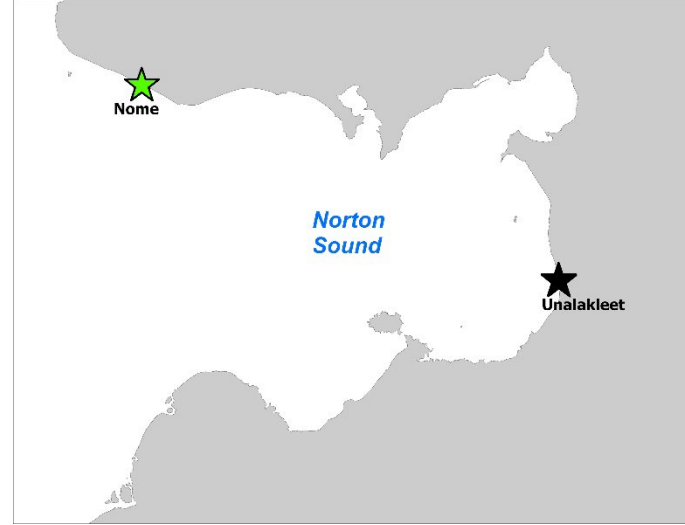
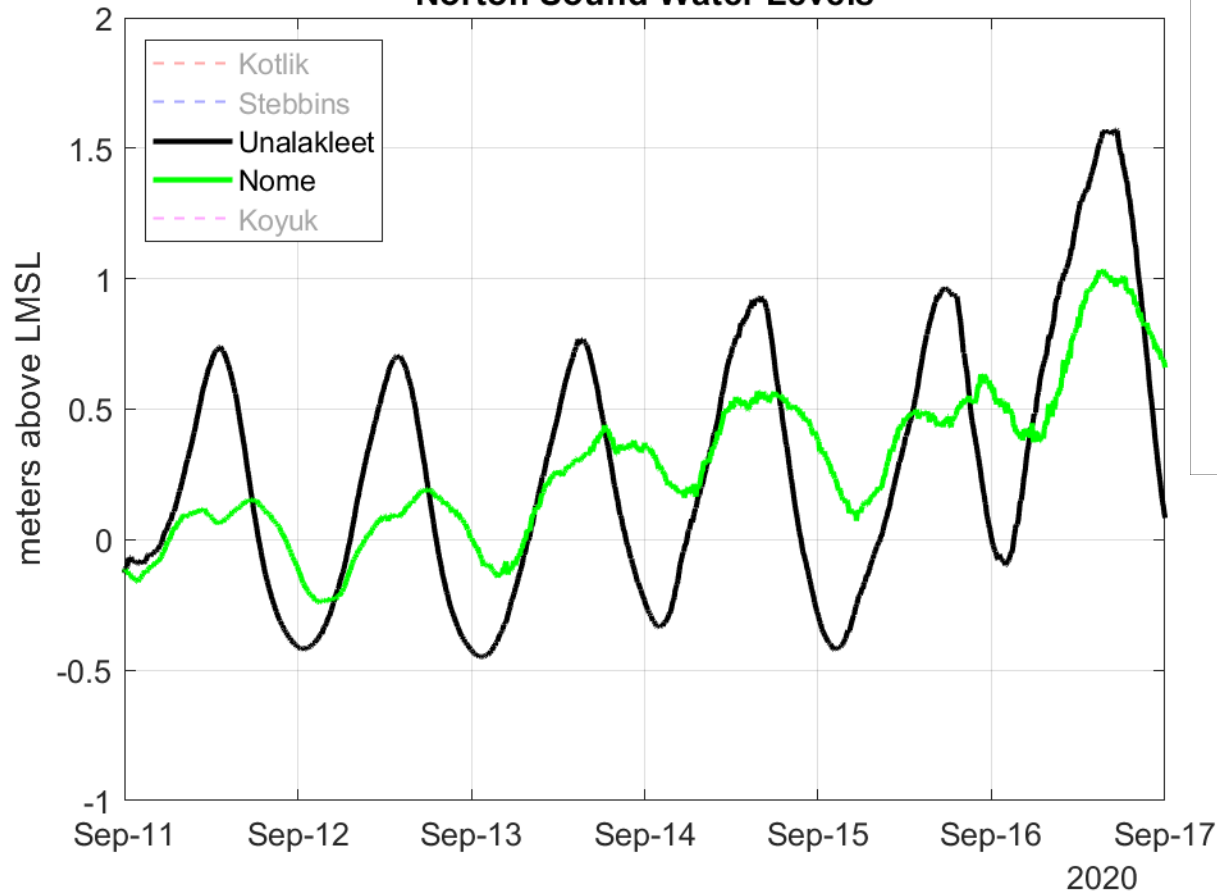
Norton Sound Water Levels



Nome and Unalakleet are National Water Level Observation Network stations with real-time water level data.



Norton Sound Water Levels

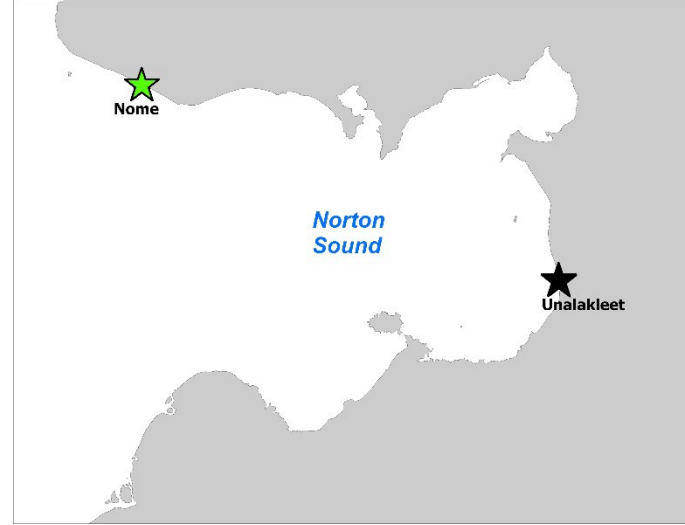
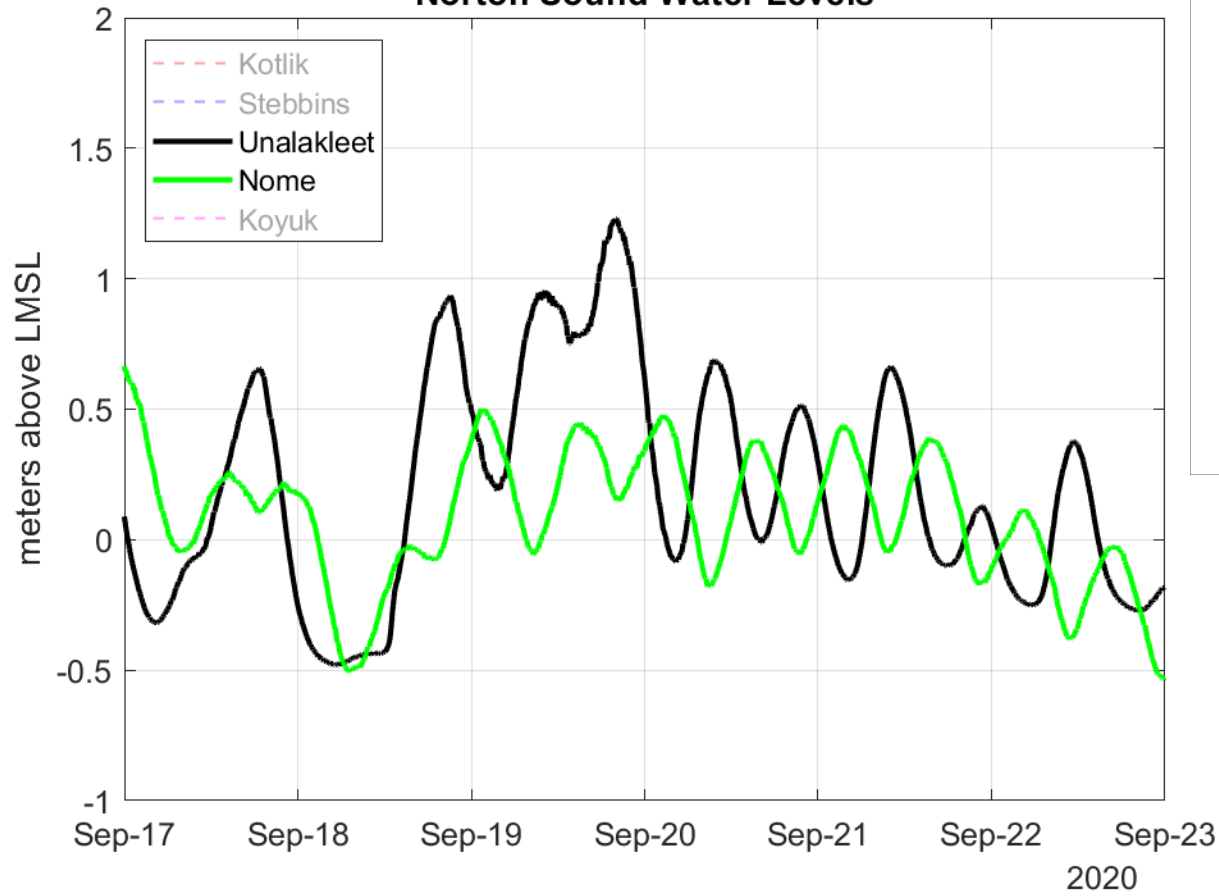


During this time period the tides are **diurnal** and **in phase**.

The tide range at Unalakleet is about twice as large as the tide range at Nome.



Norton Sound Water Levels

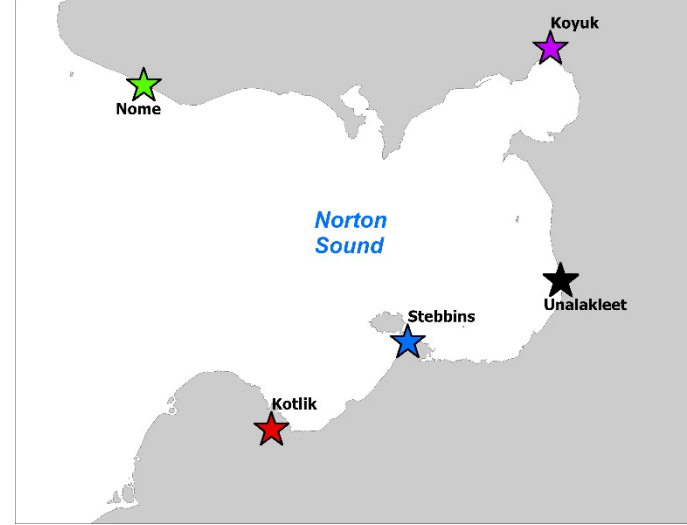
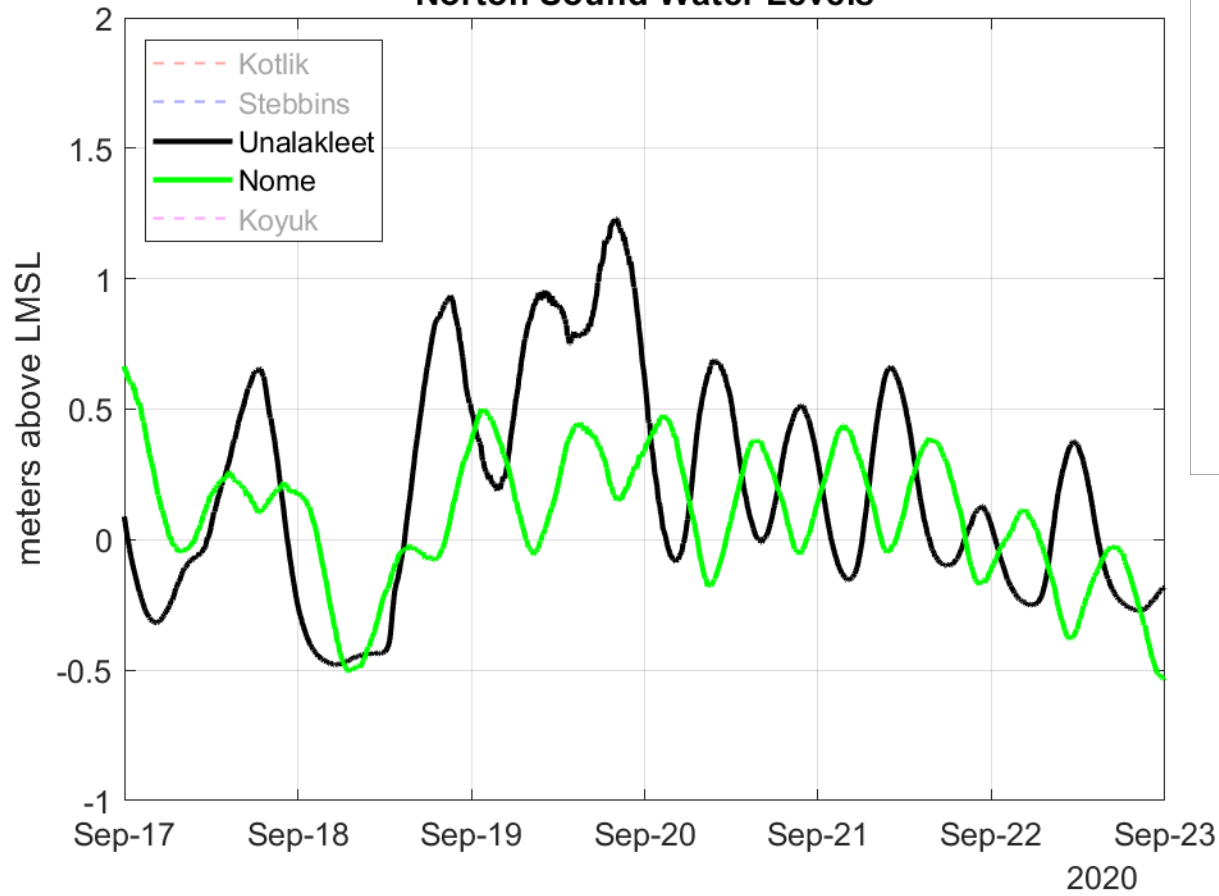


The next week they transition to **semidiurnal** and **out of phase**.

The tide range at Unalakleet is now smaller.



Norton Sound Water Levels

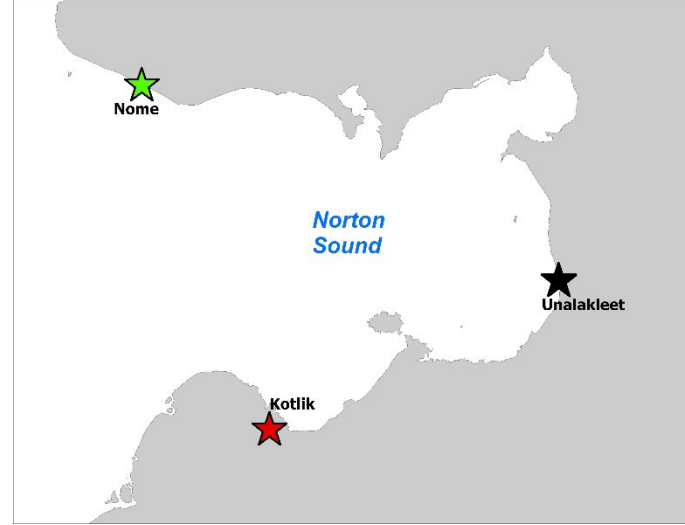
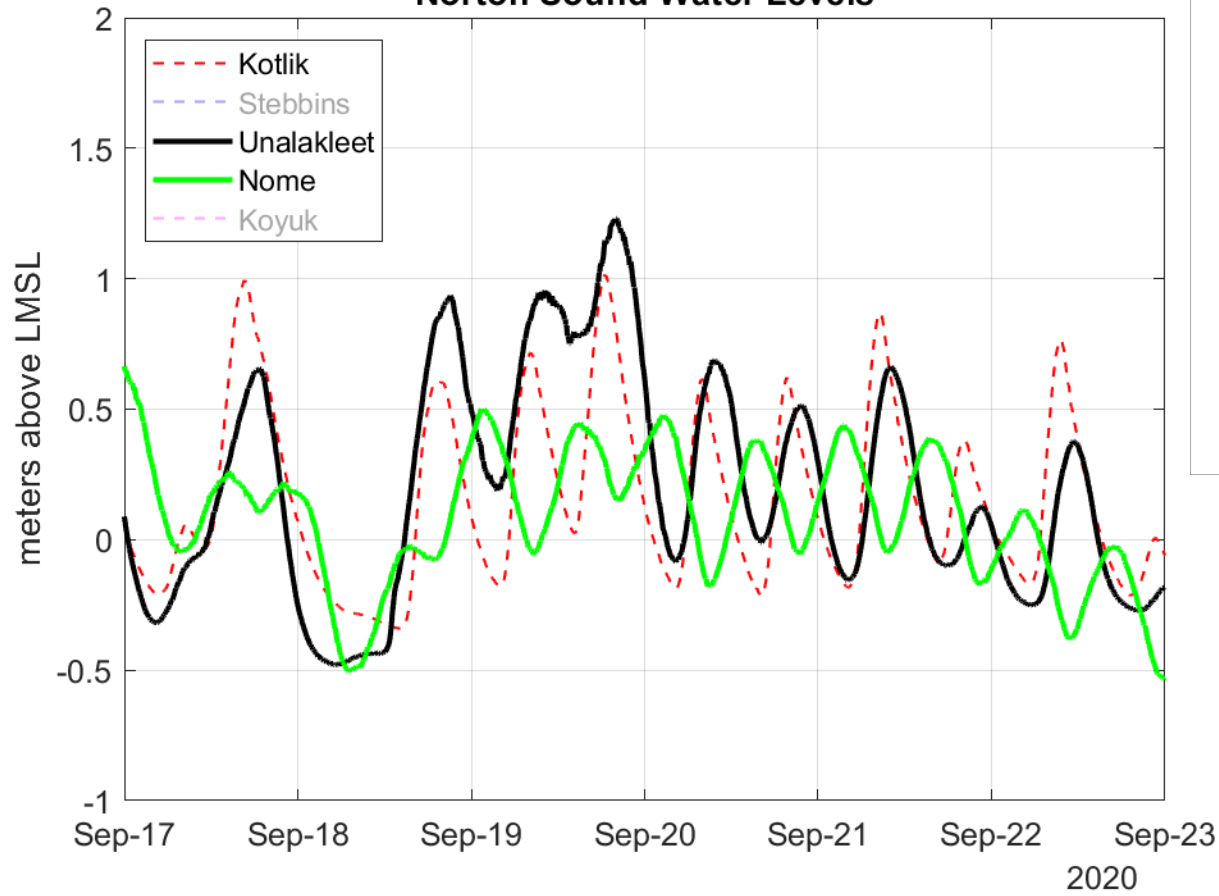


There were three temporary stations operating in Norton Sound during this time period.

Kotlik, Stebbins and Koyuk



Norton Sound Water Levels

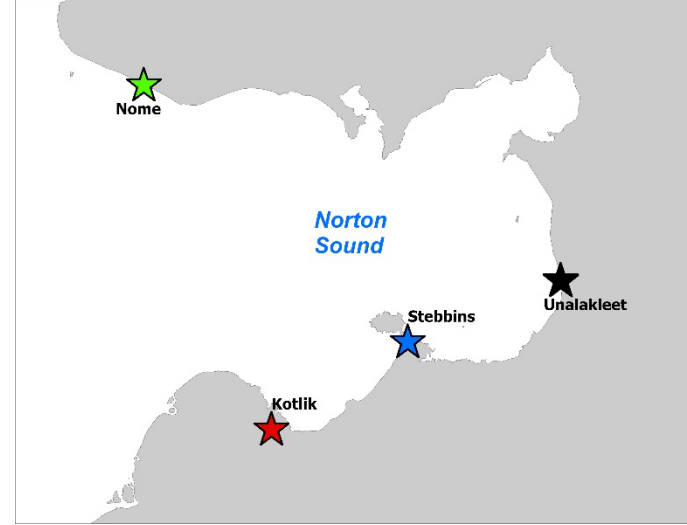
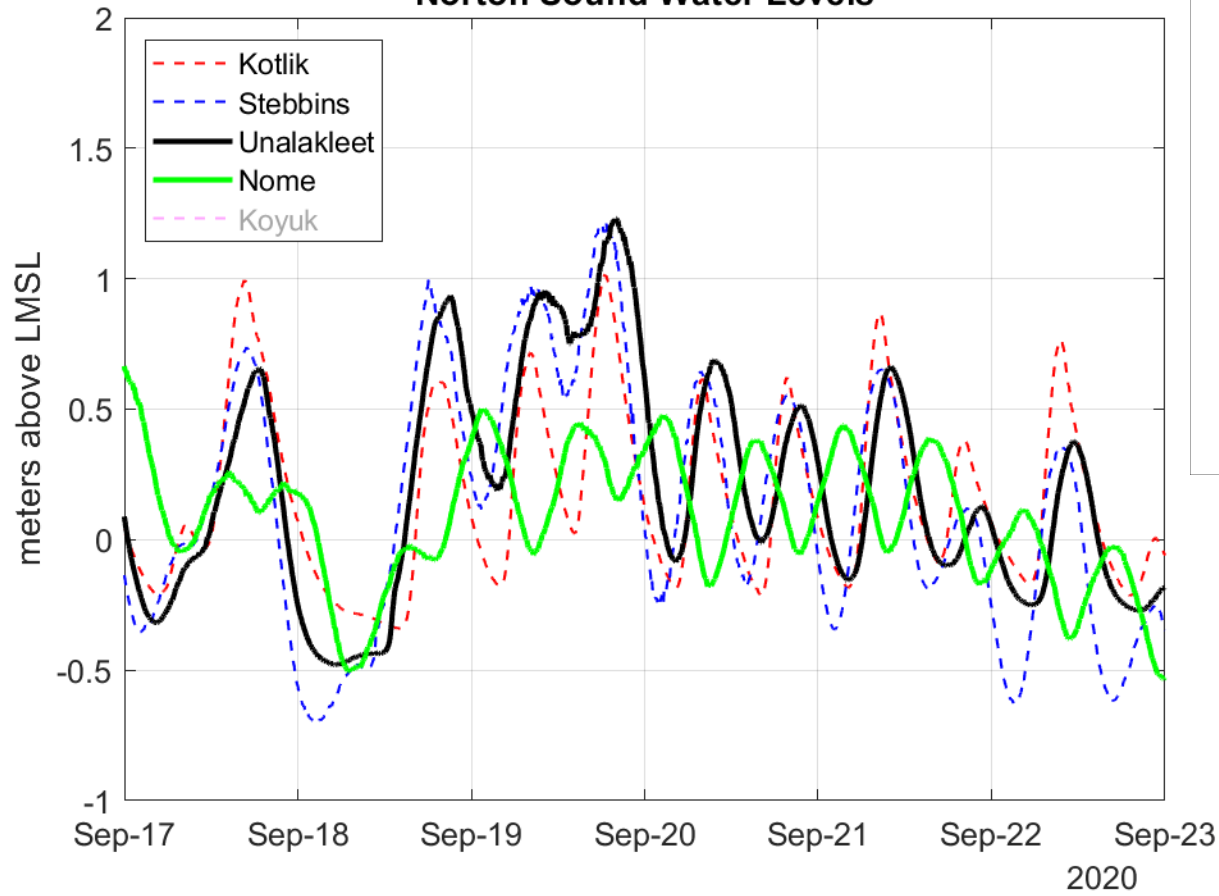


The tidal characteristics at Kotlik are similar to Unalakleet.

Kotlik is close to in phase with Unalakleet and out of phase with Nome.



Norton Sound Water Levels

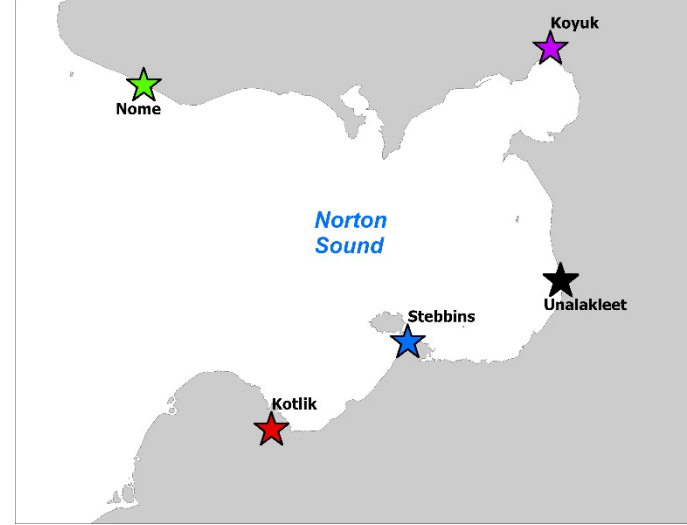
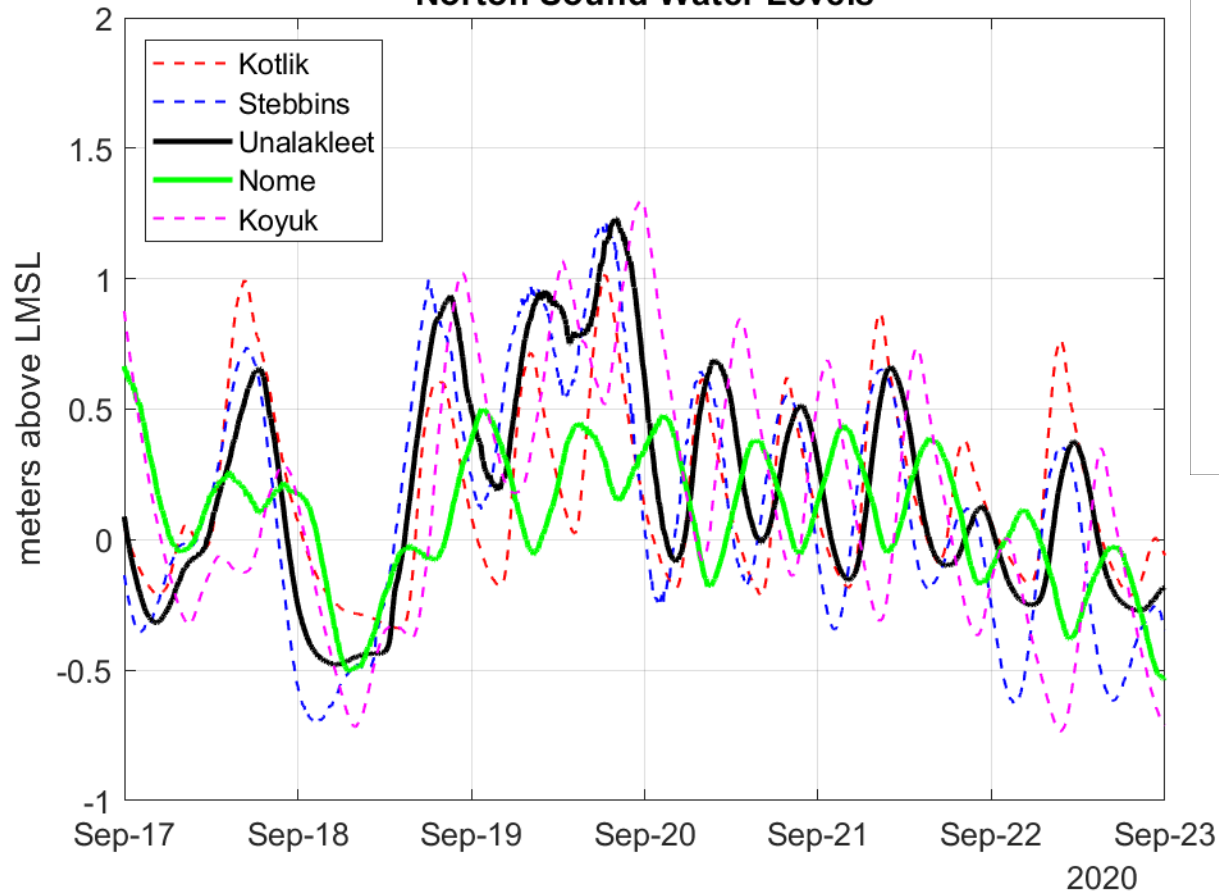


The tidal characteristics at Stebbins are similar to Unalakleet and Kotlik.

Stebbins is close to in phase with Unalakleet and Kotlik while out of phase with Nome.



Norton Sound Water Levels



The tidal characteristics at Koyuk are similar to Unalakleet, Kotlik and Stebbins.

The time of the high and low tides is between Unalakleet and Nome.



Take Aways

- * Tide coordinated mapping in Alaska is challenging, especially in the Arctic
- * There are not enough real-time water level stations in Alaska to provide a complete picture for tide coordinated coastal mapping operations
- * When considering coastal mapping project specifications consider tide type and region of the state so you can set realistic objectives



Thanks!

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