

Observation to Resilience: Integrated Storm Impact Analysis Following Ex-Typhoon Halong

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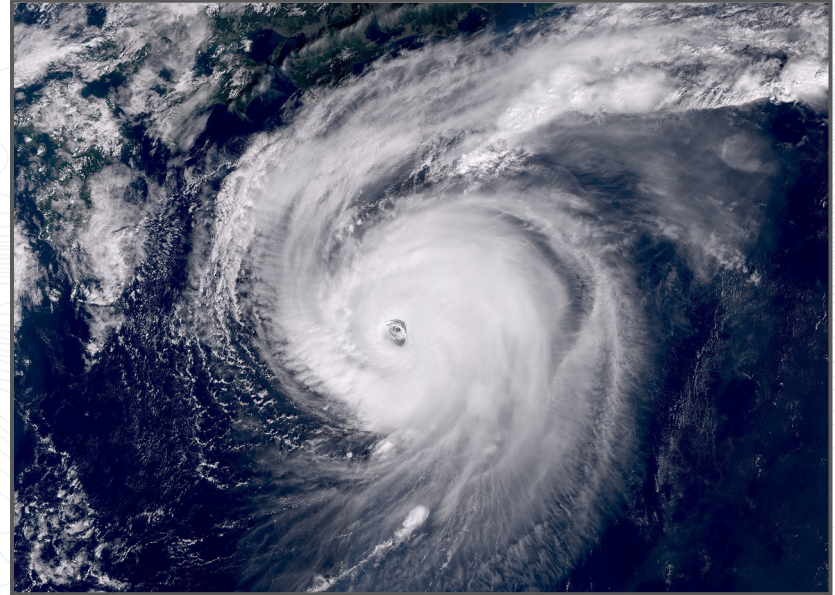
⁴Native Village of Hooper Bay



AGS
Tech Conference
April 18, 2026

Presentation Outline

- Storm Summary
- Storm Surge Flooding
 - Flood height estimates
 - Flood categories & context
 - Community-specific impacts
- Storm Surge Erosion
 - Coastal profile data
 - Storm-induced erosion
- Data for Resilience
 - Community-driven data
 - Data-viewing tools & databases

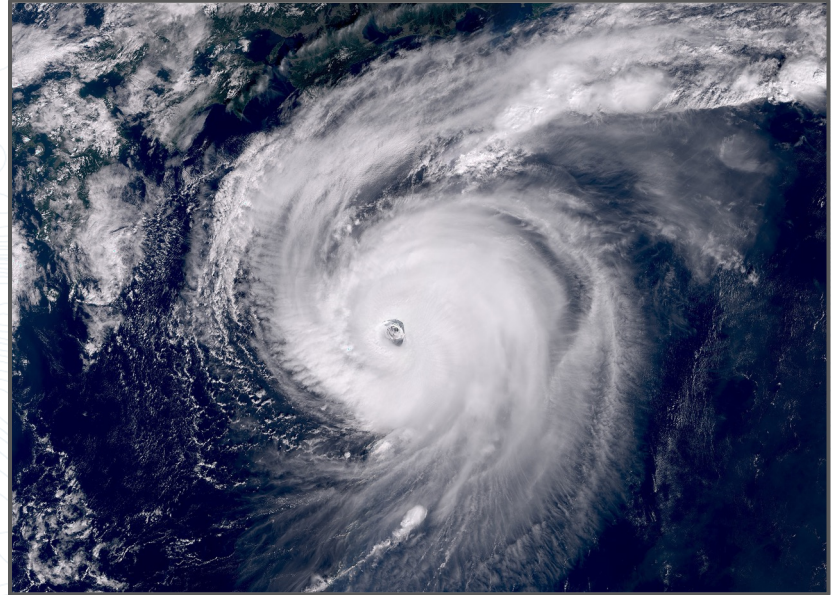


Typhoon Halong, October 8, 2025
Image from Sentinel-3 courtesy EUMETSAT

The 'Perfect' Storm

Ex-Typhoon Halong

- Unprecedented storm that caused extreme wind, flooding, & erosion in the Kuskokwim region.
- Third ex-typhoon to impact northern Bering Sea since 2022.
 - Merbok (Sept. 2022)
 - Ampil (Aug. 2024)
 - Halong (Oct. 2026)
- Rare storm track for an intense fall storm.
- Peak surge coincided with high tide.



Typhoon Halong, October 8, 2025

Image from Sentinel-3 courtesy EUMETSAT

Ex-Typhoon Halong Impacts

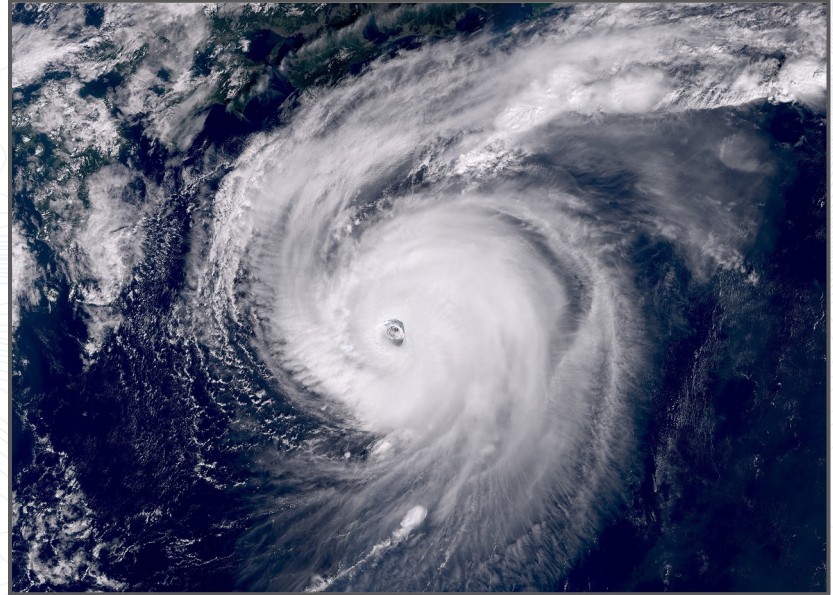
- Flood and/or high-wind damage in several dozen Western Alaska communities.
- One fatality and two never found.
- Kipnuk and Kwigillingok largely evacuated and planning relocation due to scale of damage.
- ~1500 people displaced to other communities in the region and across Alaska.
- Recovery will take a long time.



Kipnuk on October 12, 2025
Photo credit: Alaska National Guard

Presentation Outline

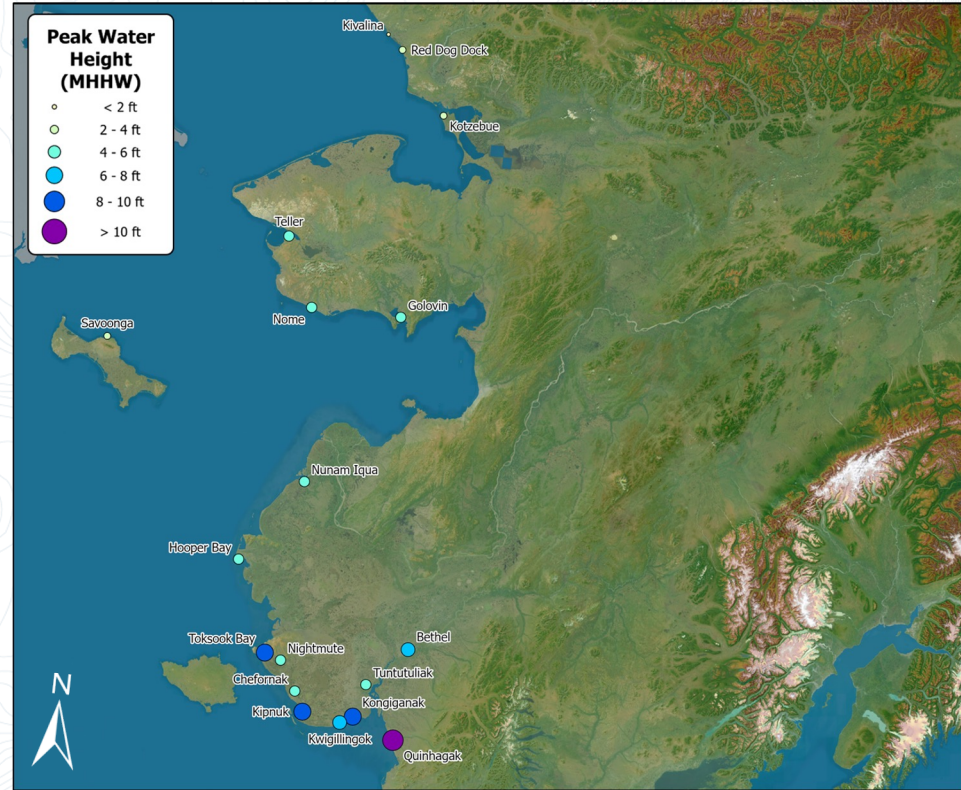
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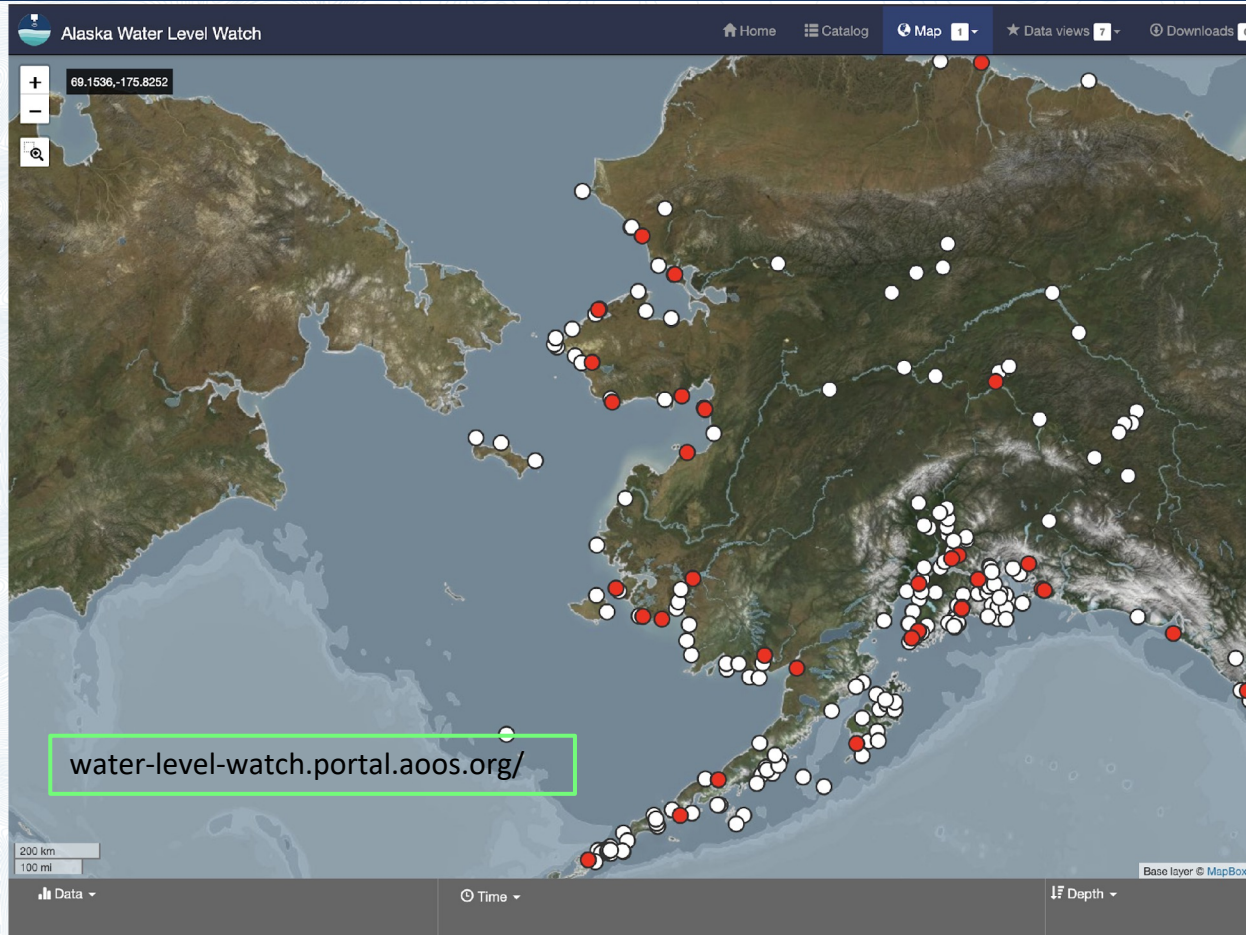
Typhoon Halong, October 8, 2025
Image from Sentinel-3 courtesy EUMETSAT

Flood Height Estimates

- Timely, high-quality water level data are extremely important for post-event damage assessment and documentation.
- Equally importantly, these data are used to develop and validate inundation models, improve risk assessments, and enhance future planning.

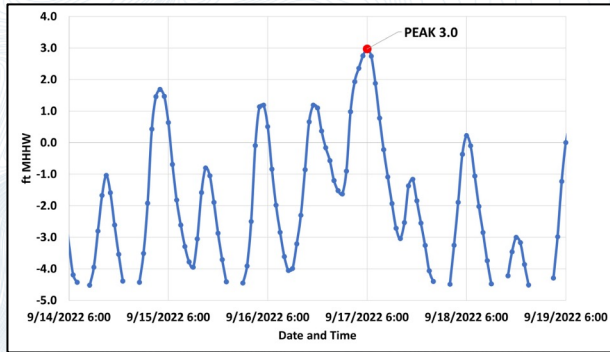


Water Level Data

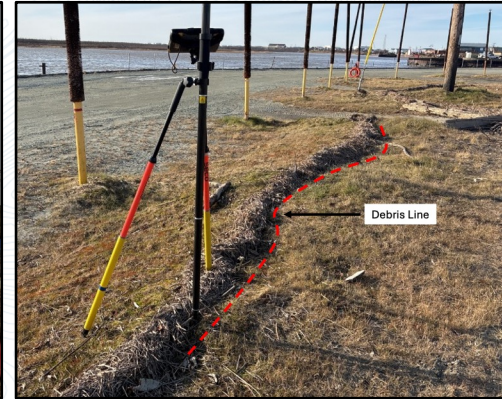


Flood Observations

Water Level Sensor Data



High-water Marks



Local Documentation



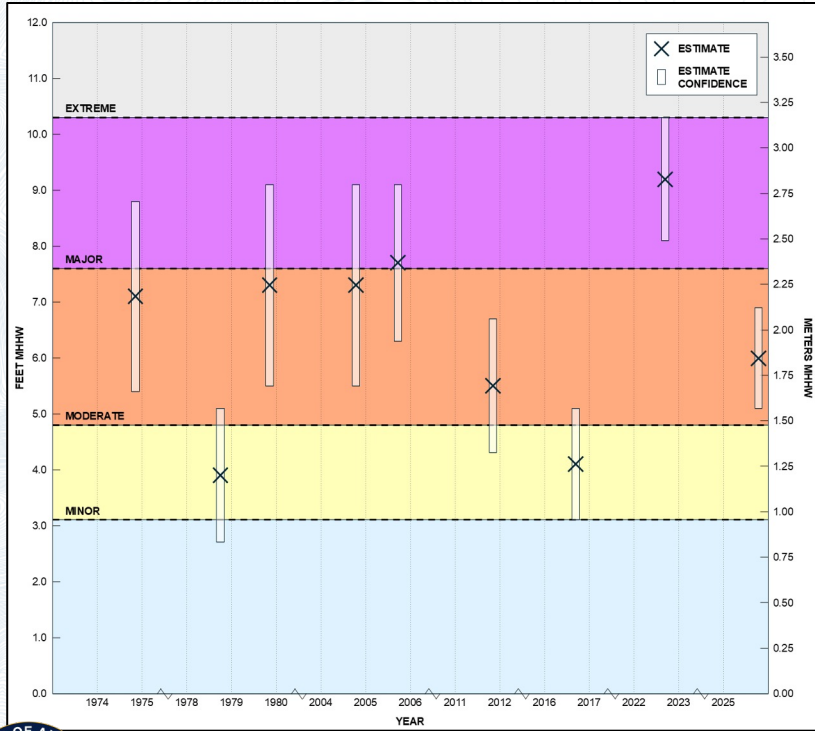
Alaska Flood Observations

Private group · 30 members



Flood Impact Assessments

Flood History for Hooper Bay

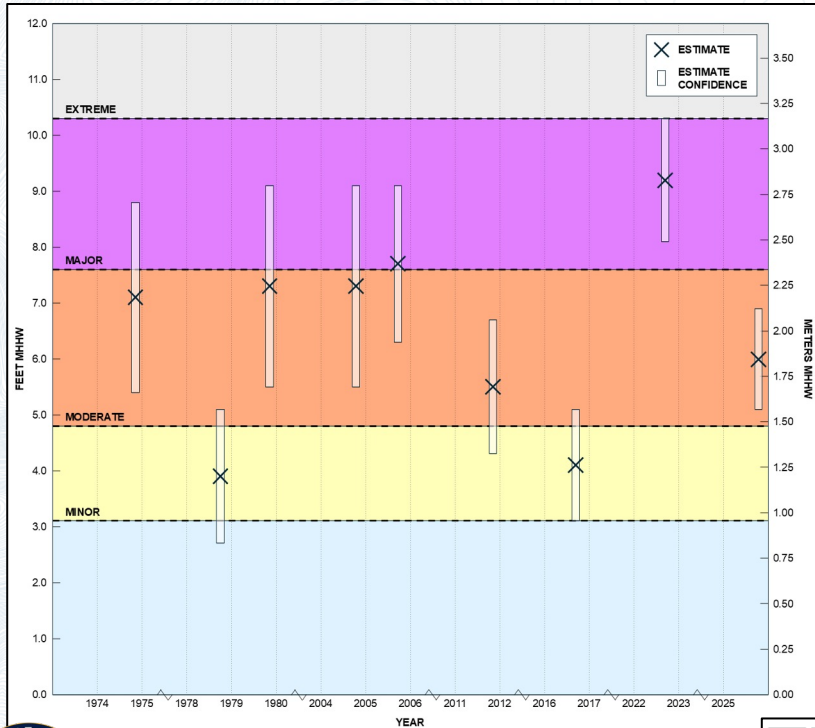


Flood categorization (minor, moderate, major) is based on impacted infrastructure.

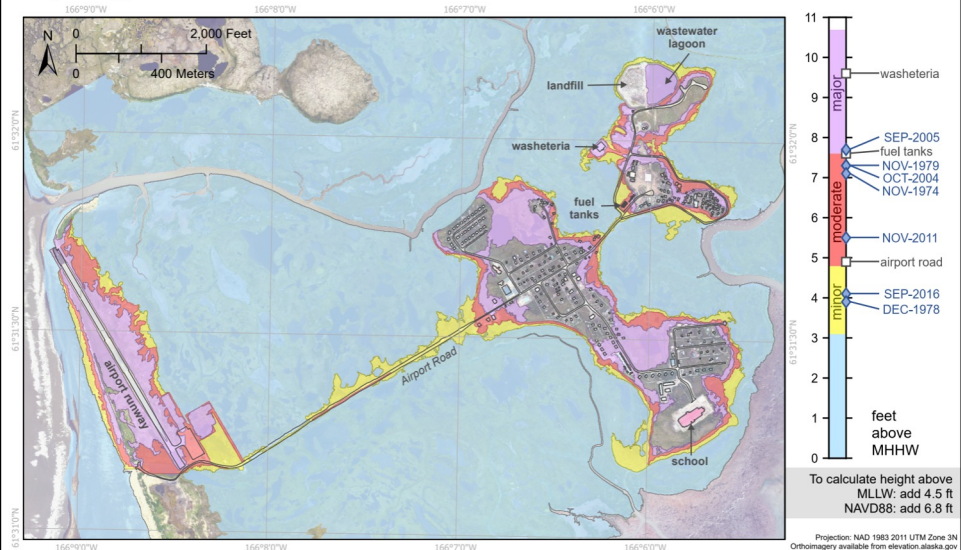


Flood Impact Assessments

Flood History for Hooper Bay



Coastal Flood Impact Map Hooper Bay, Alaska



REPORT OF INVESTIGATION 2021-1F
Buzard and others, 2021
HOOPER BAY



STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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Projection: NAD 1983 2011 UTM Zone 3N
Orthorectified available from elevation.alaska.gov
Household or infrastructure may have moved since DCRRA line work was completed.

Major Flooding is defined to have extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations are necessary.

Moderate Flooding is defined to have some inundation of structures and roads near the water. Some evacuations of people and/or transfer of property to higher elevations may be necessary.

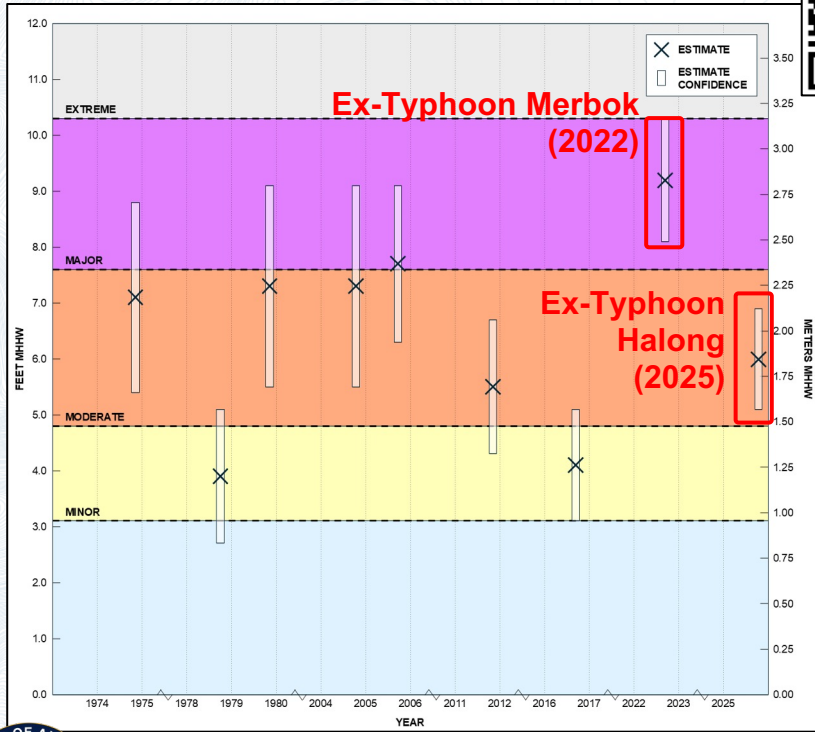
Minor Flooding is defined to have minimal or no property damage, but possibly some public threat.

This work is part of the Digital Coast Fellowship project: Bringing Alaska to the Digital Coast. The analysis was paid for by the National Oceanic and Atmospheric Administration Office for Coastal Management, and the State of Alaska.



Flood Impact Assessments

Flood History for Hooper Bay



Ex-Typhoon Halong high-water mark collection funded by NSF grant #2318375 AC³TION Project.

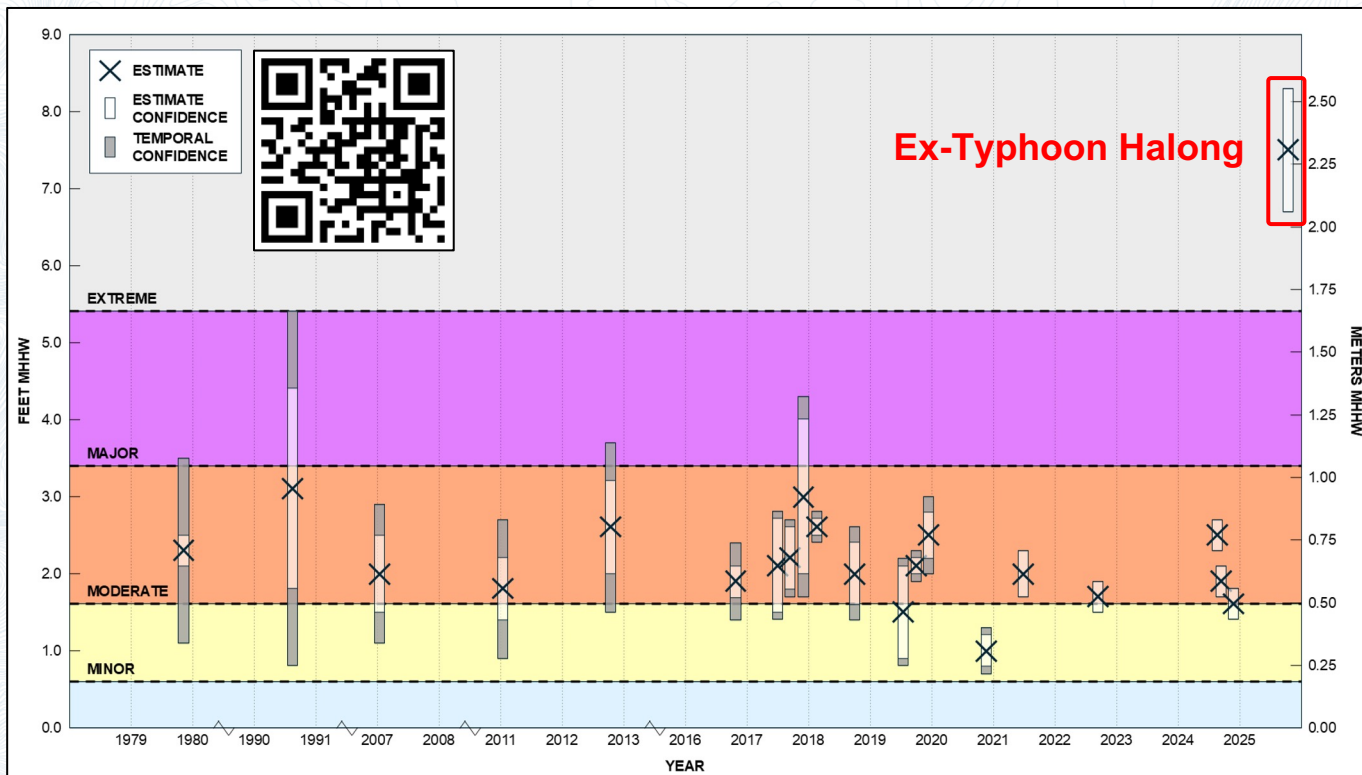


Ex-Typhoon Halong debris line

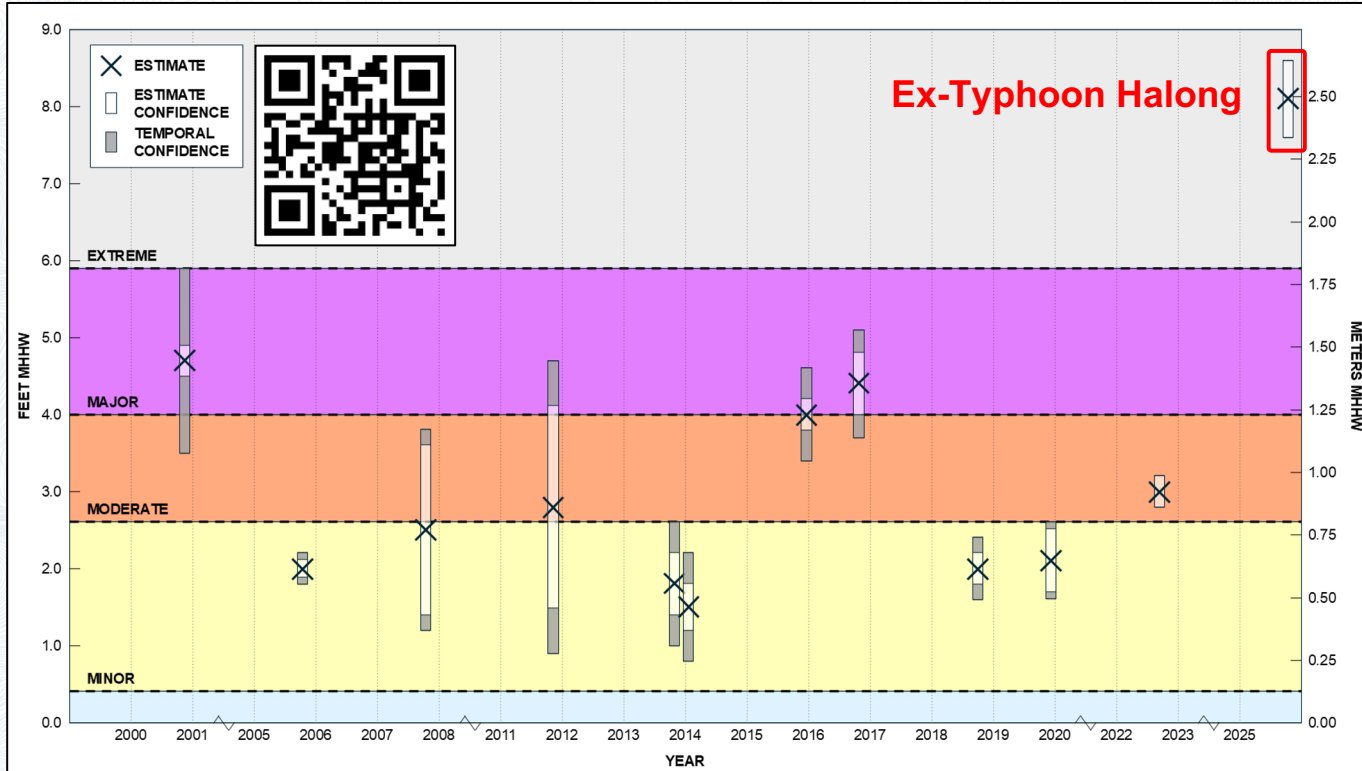
Ex-Typhoon Merbok debris line



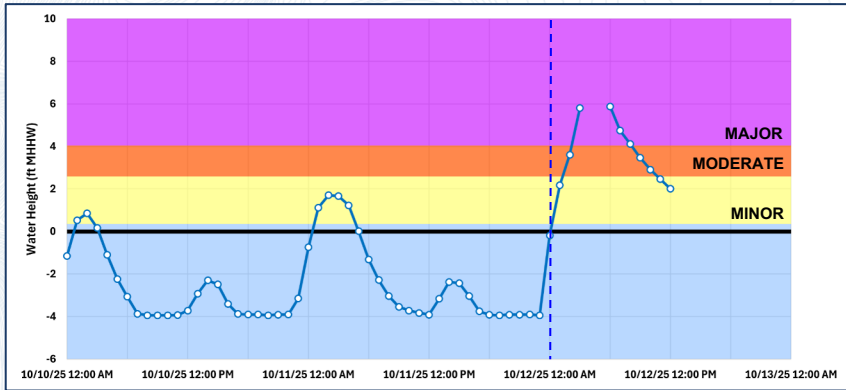
Flood History - Kwigillingok



Flood History - Kipnuk

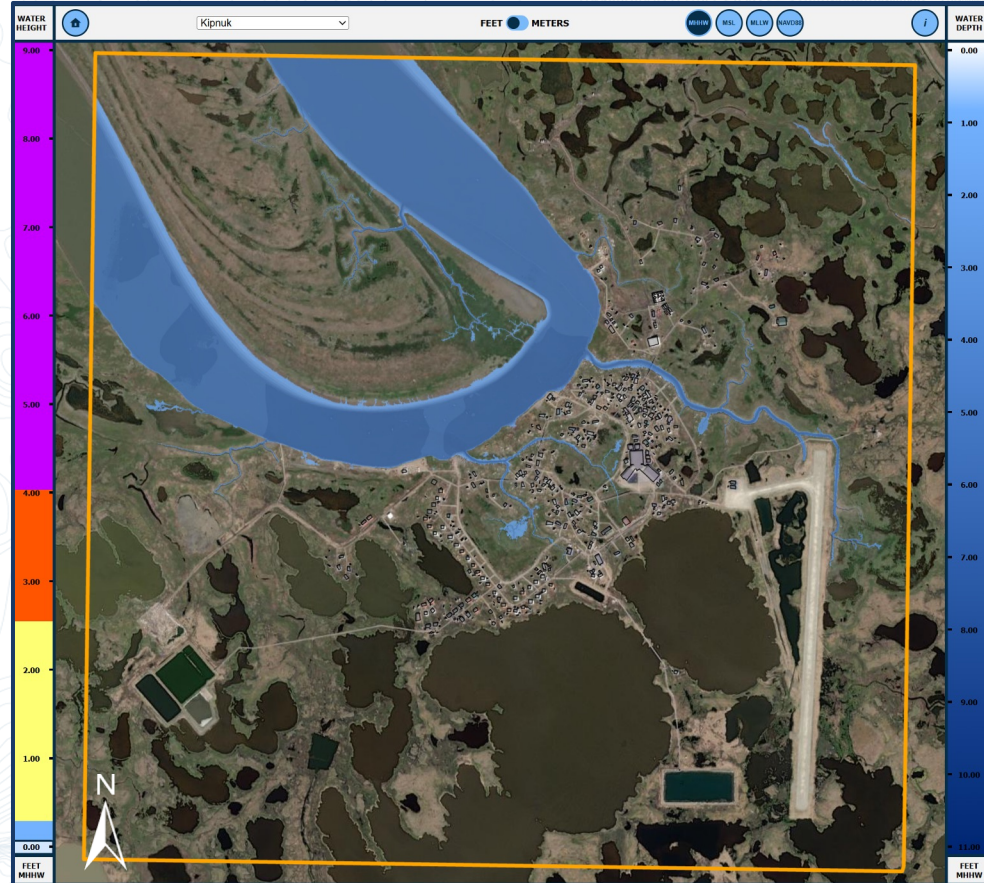


Impacts - Kipnuk

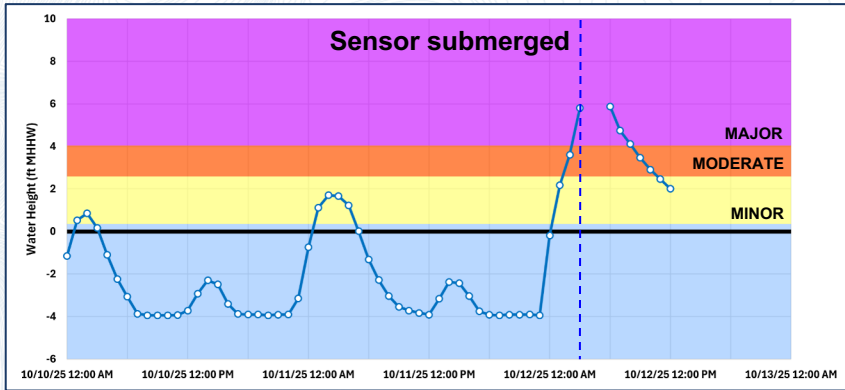


Occupied Buildings Impacted

Residential	0
Public	0
Commercial	0

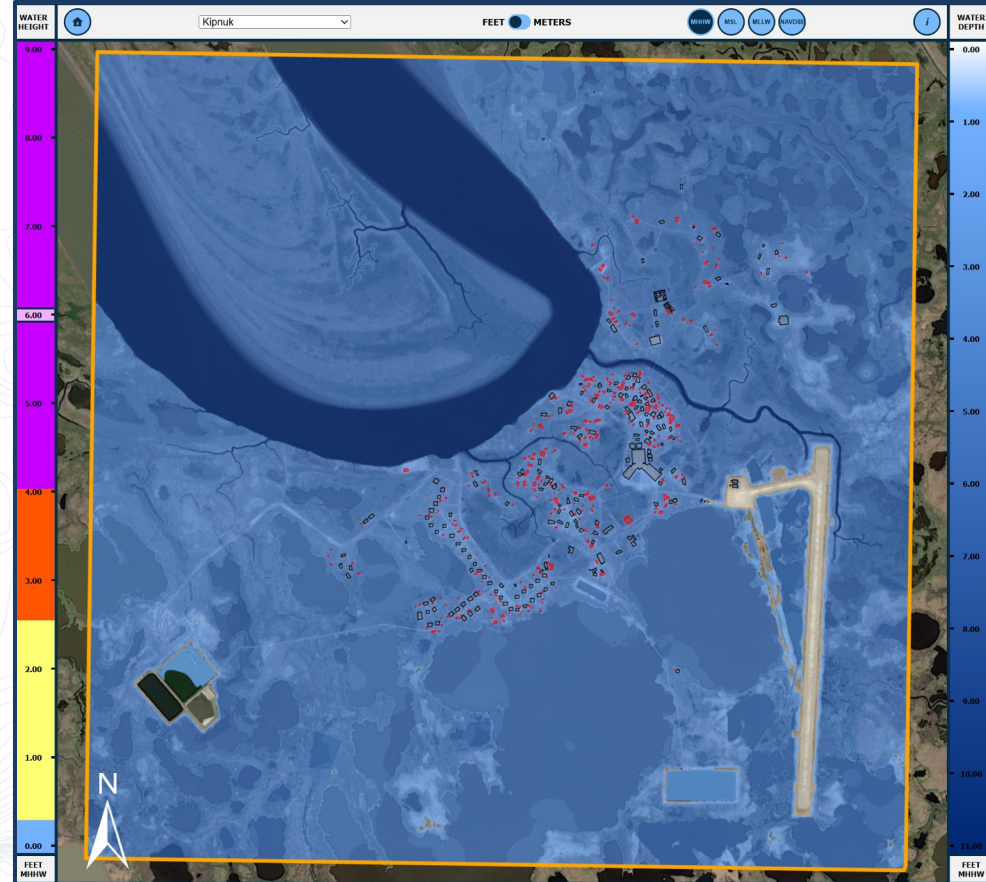


Impacts - Kipnuk

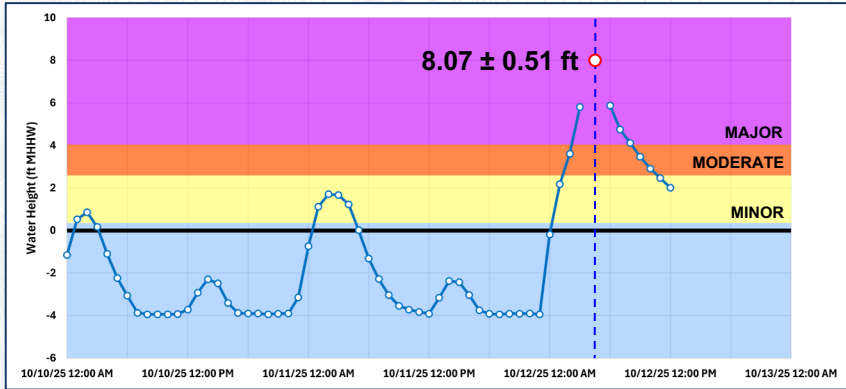


Occupied Buildings Impacted

Residential	42
Public	8
Commercial	11

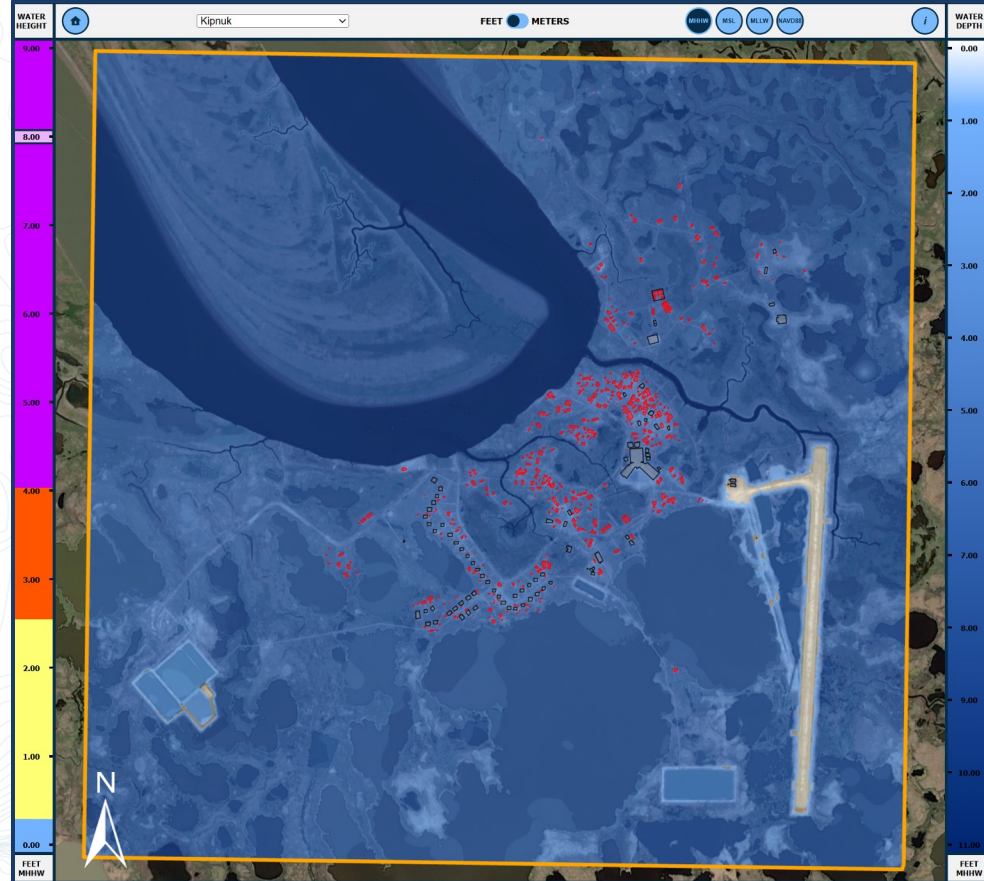


Impacts - Kipnuk



Occupied Buildings Impacted

Residential	135
Public	20
Commercial	33



Model Validation

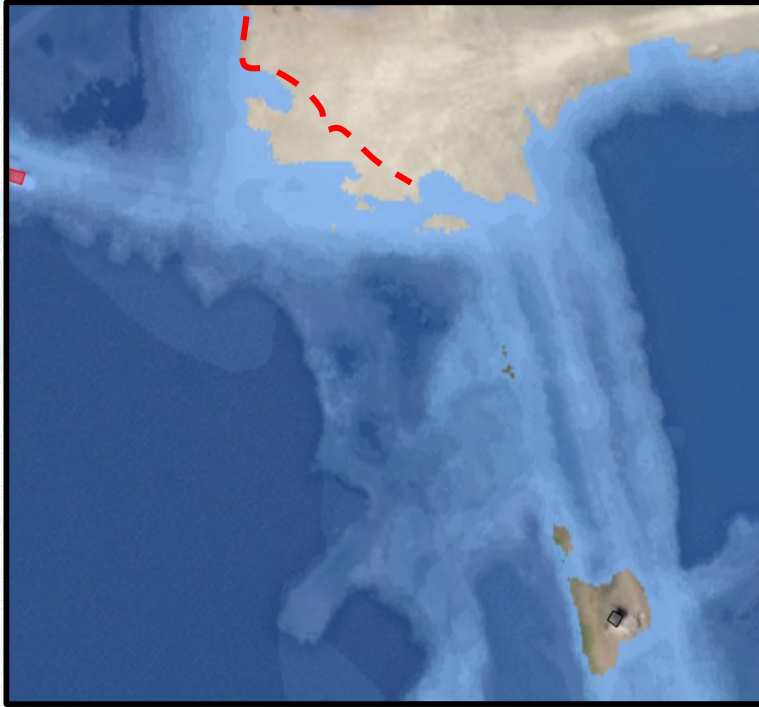


Kipnuk



Drone image taken after ex-Typhoon Halong (AKDOT)

Model Validation



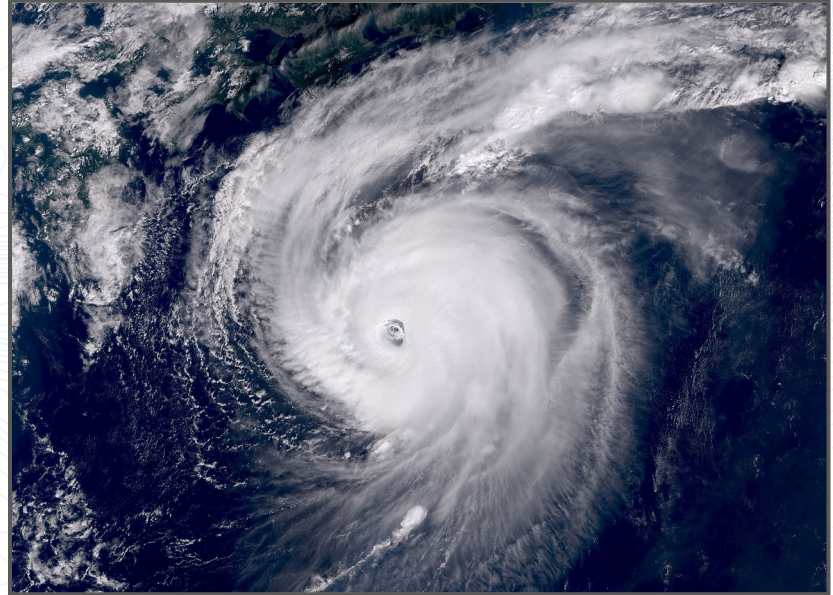
Modeled still water flood extent for 8ft MHHW



Drone image taken after ex-Typhoon Halong (AKDOT)

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Typhoon Halong, October 8, 2025
Image from Sentinel-3 courtesy EUMETSAT

Erosion Impacts



Erosion by Antone Lake on St. Paul Island, before (left) and after (right) Ex-Typhoon Merbok.

Increased wave energy during storm events can cause **erosion**.

Erosion can impact critical infrastructure, residences, roads, and subsistence infrastructure, as well as reduce land and access points for subsistence activities.

Coastal Profile Datasets

Repeat GPS datasets collected ~annually to monitor shoreline change.

Horizontal location of features in graph indicate erosion or accretion over time.

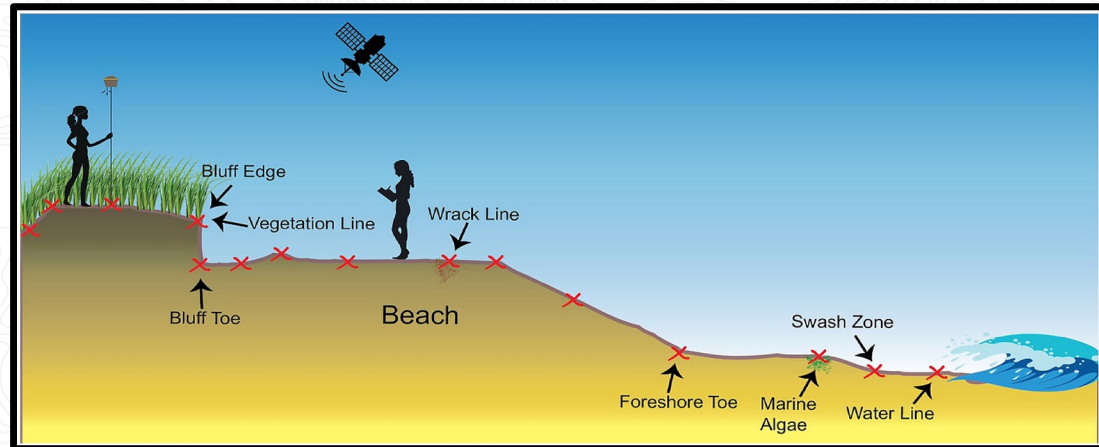
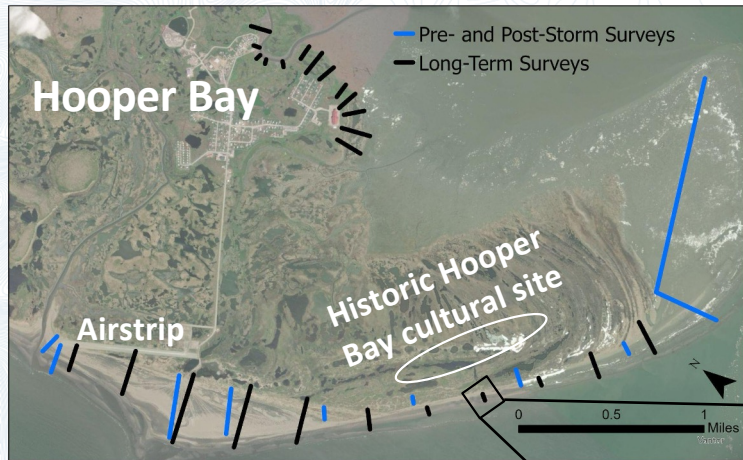
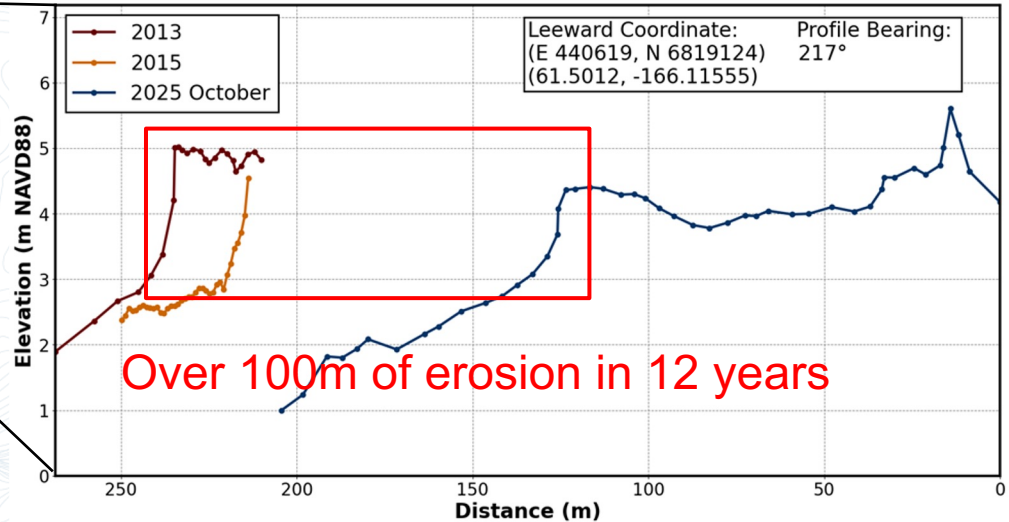


Figure from Christian et al., 2025

Erosion - Hooper Bay

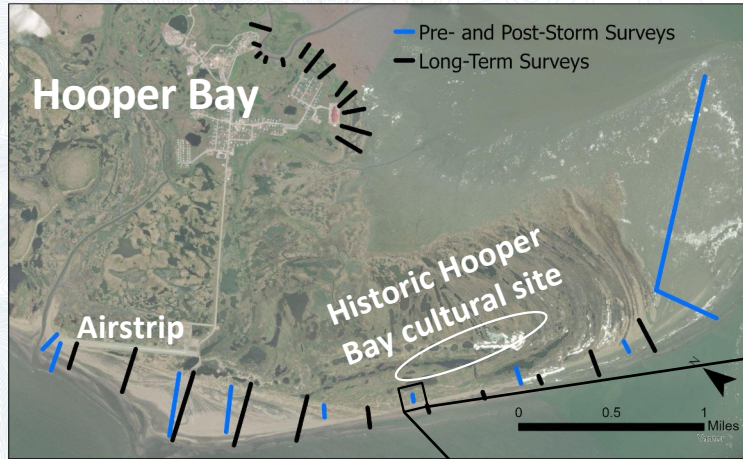


Profile 14



Shoreline feature moving to the right (away from waterline) indicates **erosion** over time.

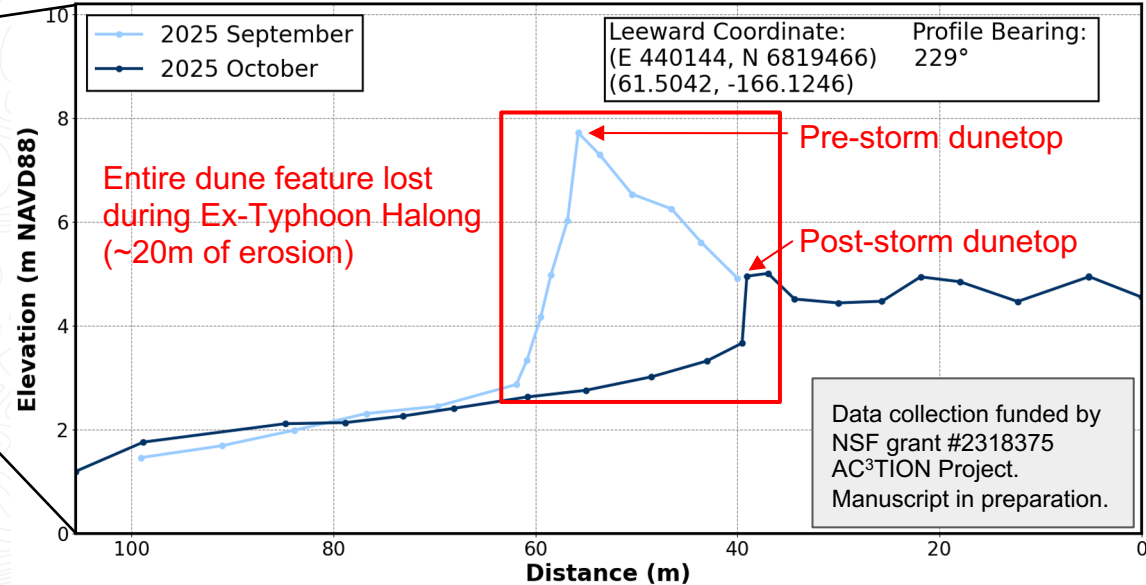
Erosion - Hooper Bay



Unique Data Collection Opportunity

Pre- (September 2025) and post- (October 2025) storm datasets quantify erosion impacts from ex-Typhoon Halong.

Profile 12



Significant erosion documented fronting **historic Hooper Bay** townsite.

Data informs mitigation planning.

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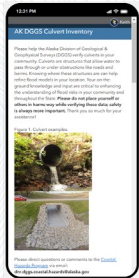


Kipnuk, October 12, 2025

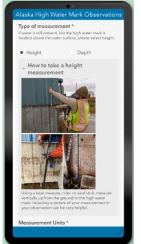
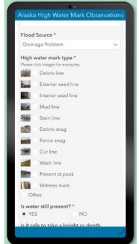
Photo Credit: Alaska National Guard

Data for Resilience

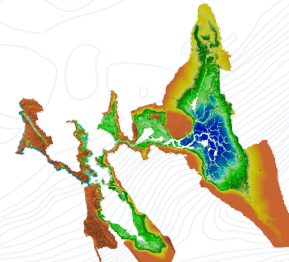
Field Surveys and Local Observations



Alaska High Water Mark Observations



Baseline Datasets



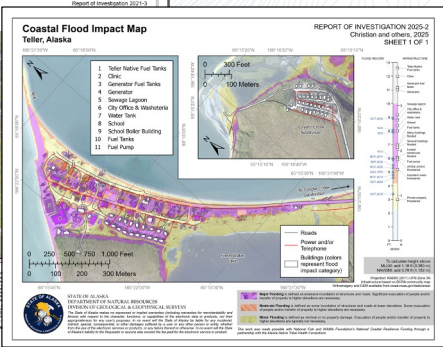
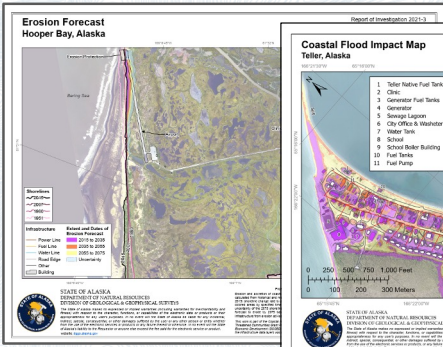
Topographic Lidar



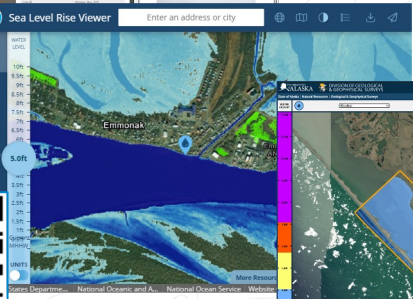
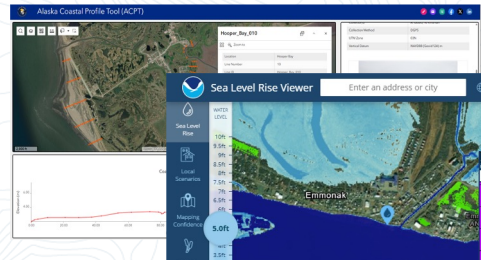
Hydrologic Models



Risk and Impact Assessments



Erosion and Flooding Tools



Questions?

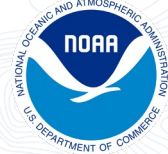
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