

# Shoreline Characterization of San Clemente Island using a Regional Wave Model



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# Project Purpose & Objective

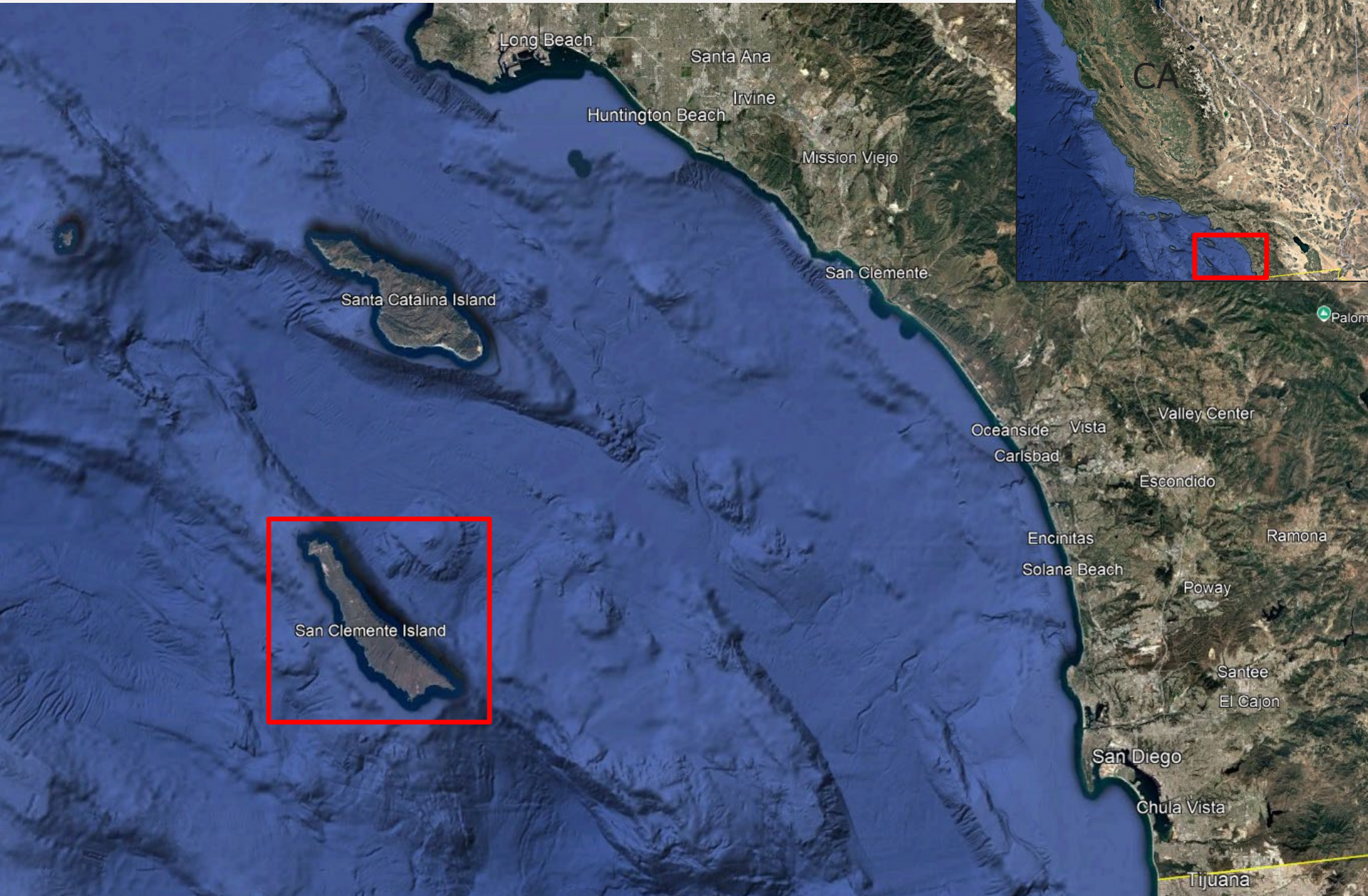
## **Objective:**

Determine the optimal waterside location to safely launch and recover vessels

- Least natural operational downtime
- Feasible with existing infrastructure and shoreline characteristics
- Assess need for breakwaters

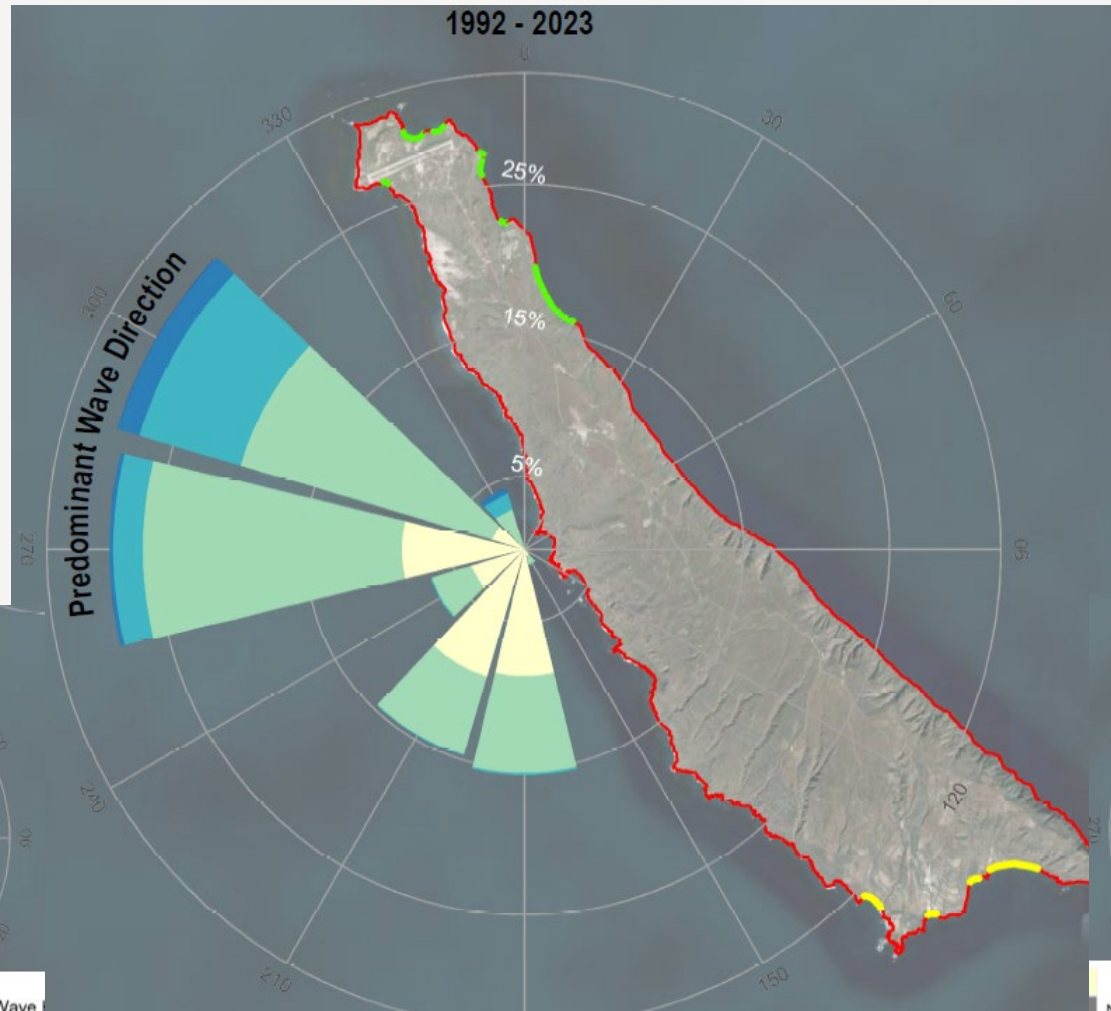


# Project Location





# Background: Wave Climate



Dec-Feb

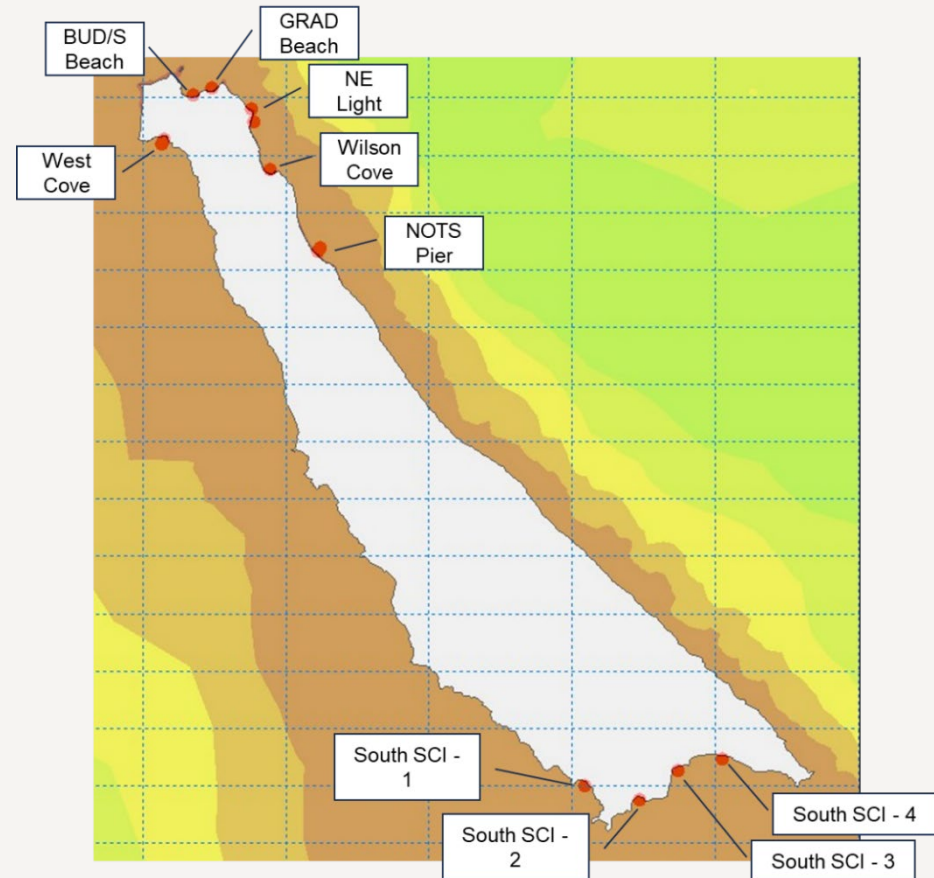
June-Aug

Wave Height (ft)



# Model Approach

- Simulate the offshore wave climate for an average year to rank the various shorelines by  $H_s$ ,  $T_p$ , and direction.
- Examine breakwater configuration at the sites of interest
- Provide estimated operational working days based on  $H_s$



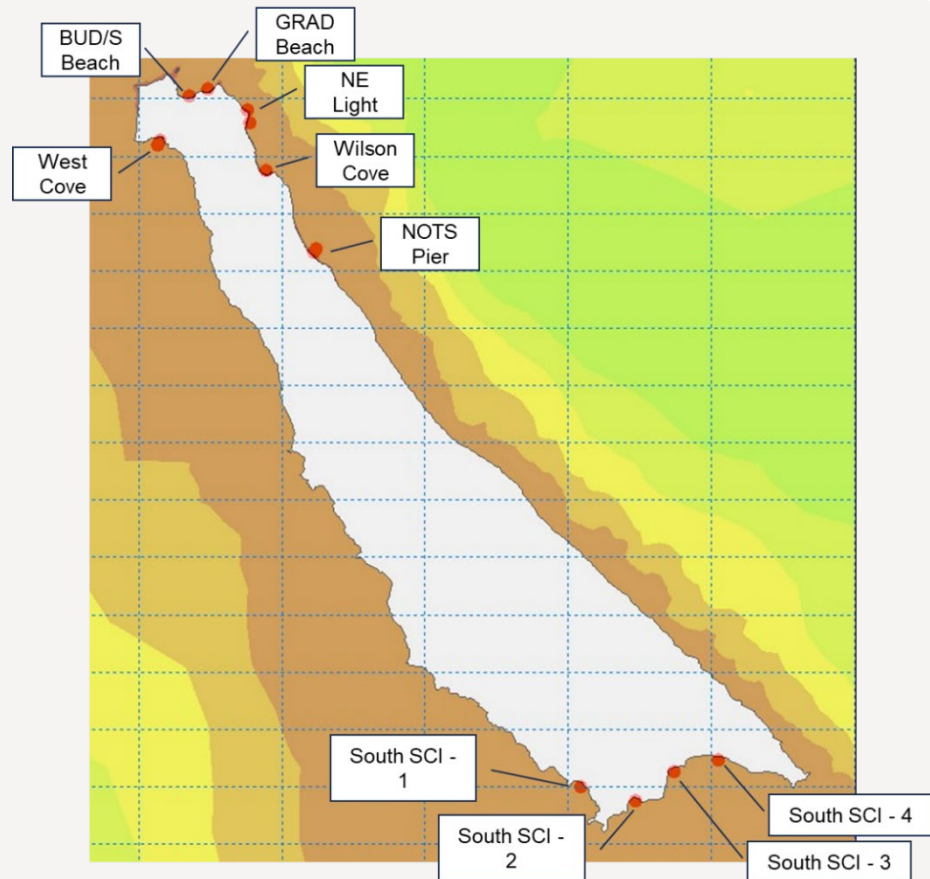
# Model Approach

## Two Models:

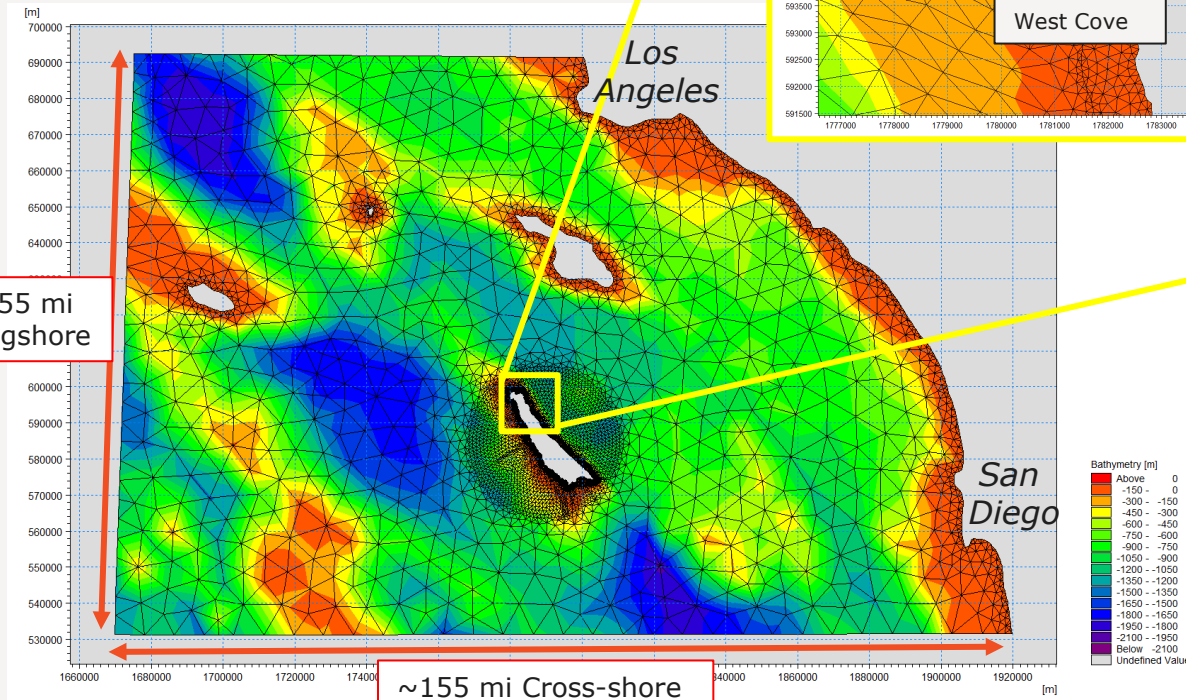
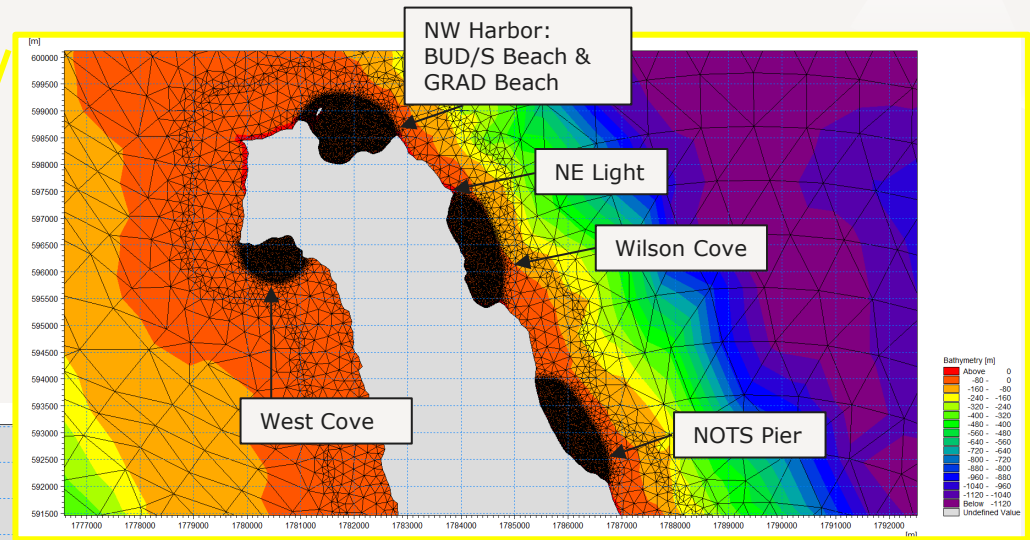
- 1) Regional Scale
- 2) Nested Localized Scale

## Results:

- Exceedance Probability & Operational Downtime
- 1-ft & 2-ft Thresholds



# Regional Model Setup





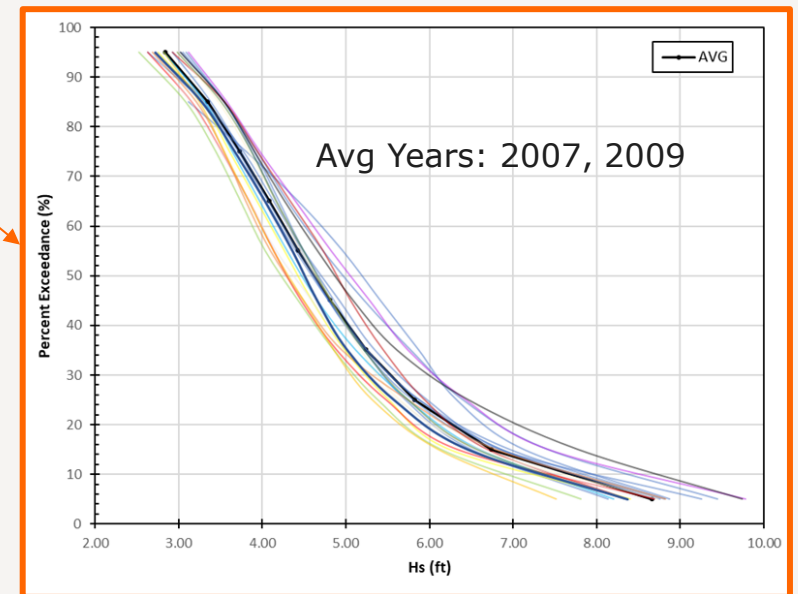
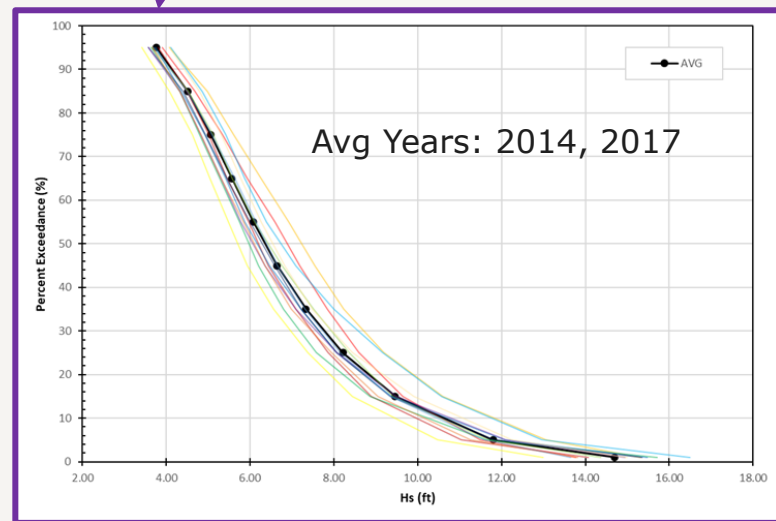
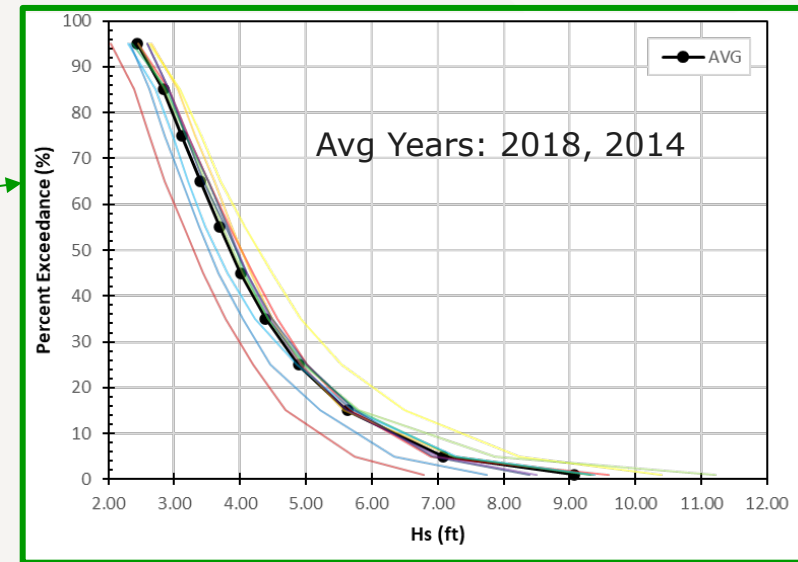
# Regional Model Setup



- Seven (7) NDBC buoys surrounding San Clemente Island
- Time/Spatially varying wave boundary conditions
- Time/Spatially varying wind fields
  - ERA5 winds (0.125x0.125 degree resolution)

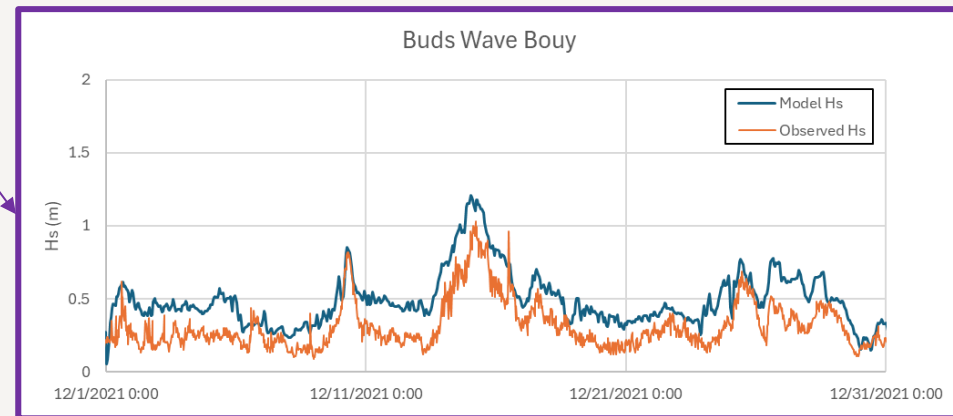
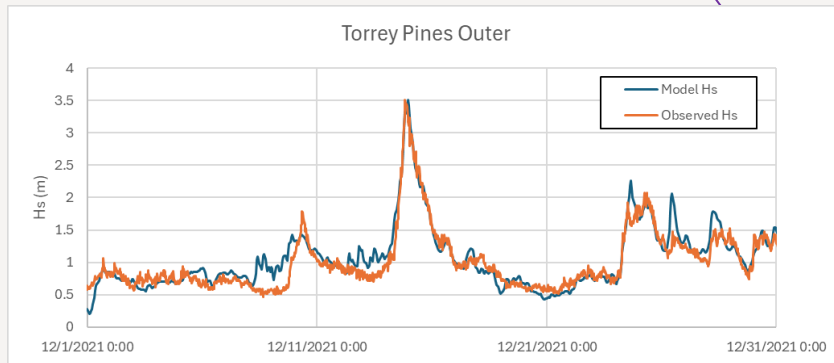
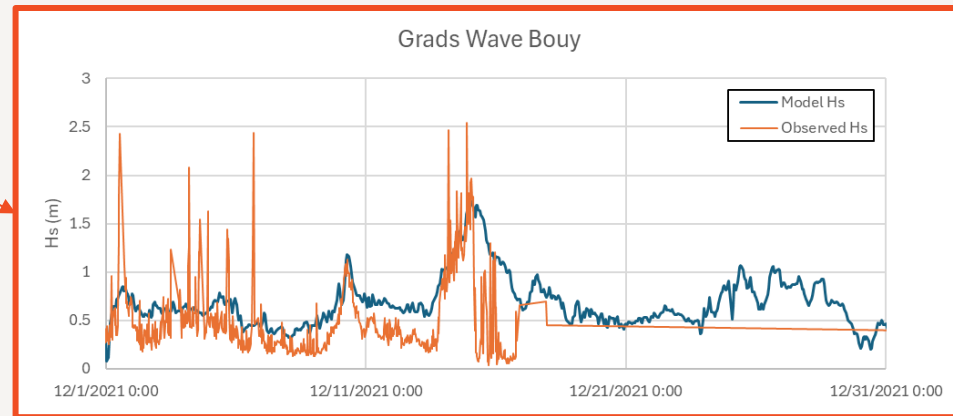
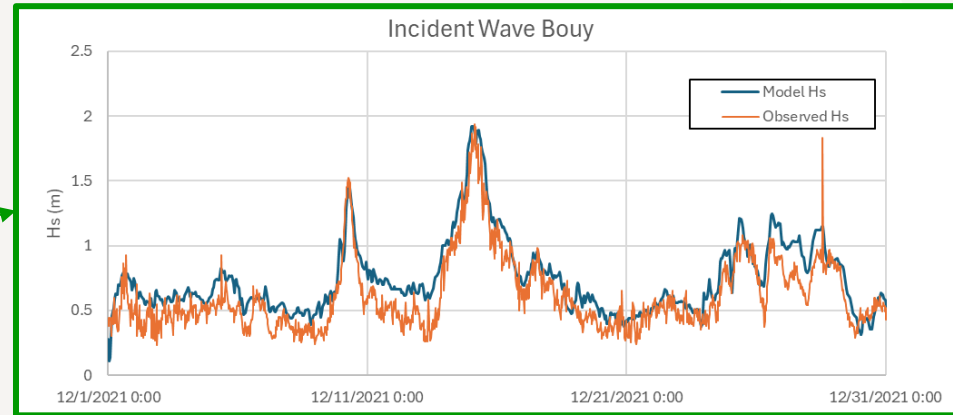
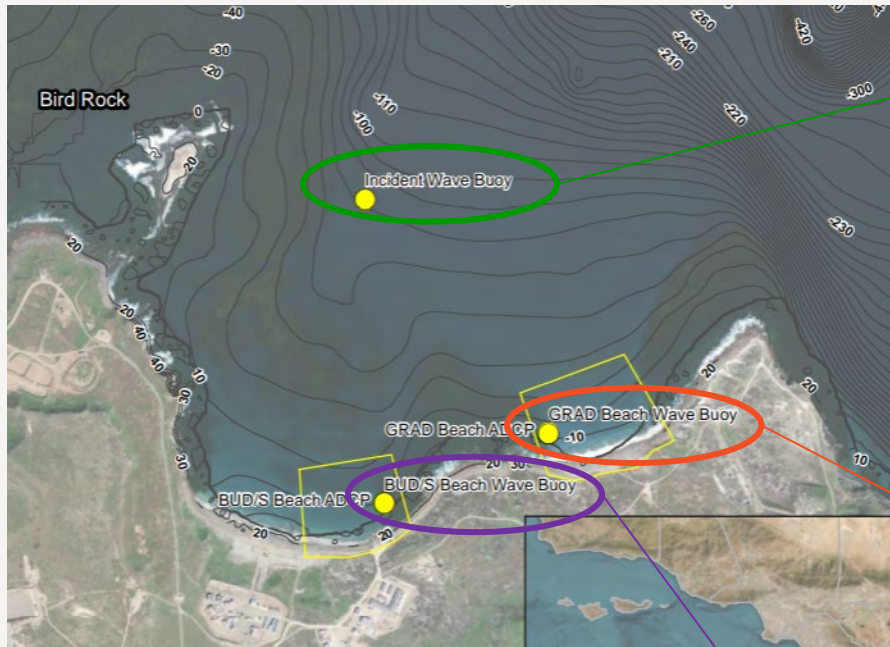


# Representative Year Selection



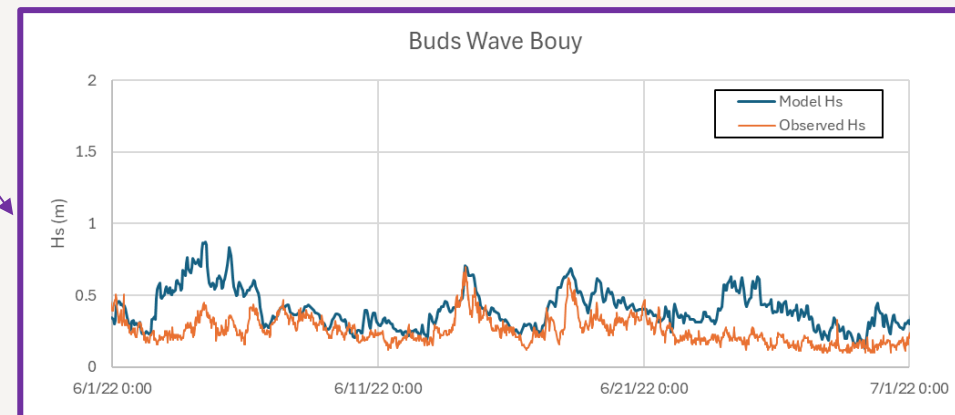
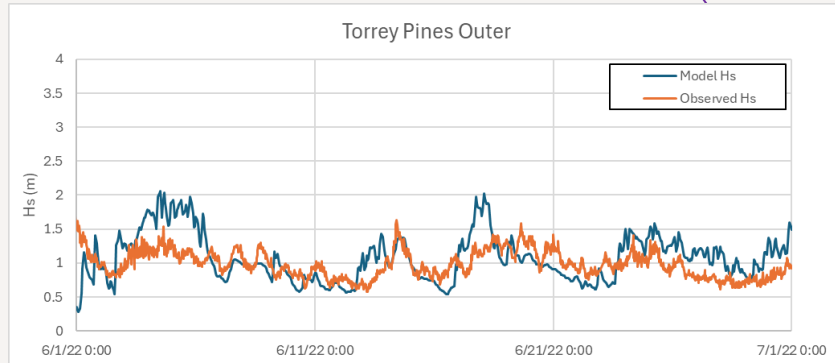
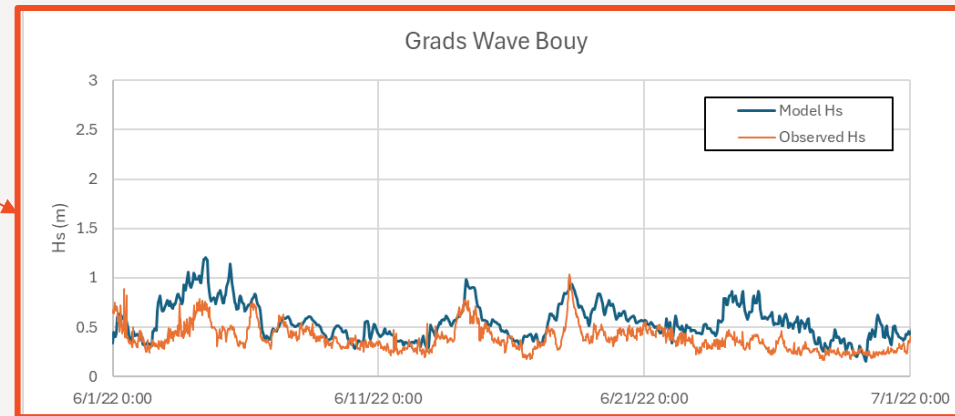
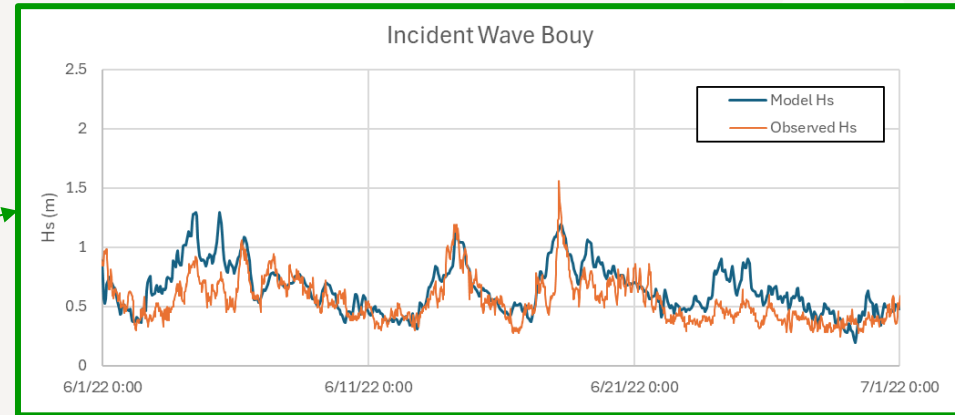
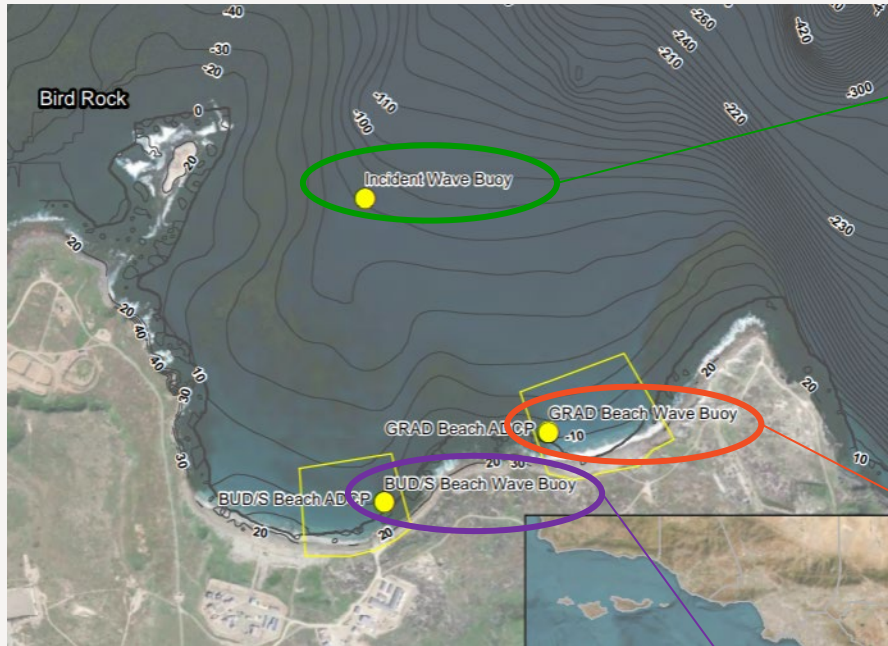
# Model Calibration – Winter

**Dec 2021**



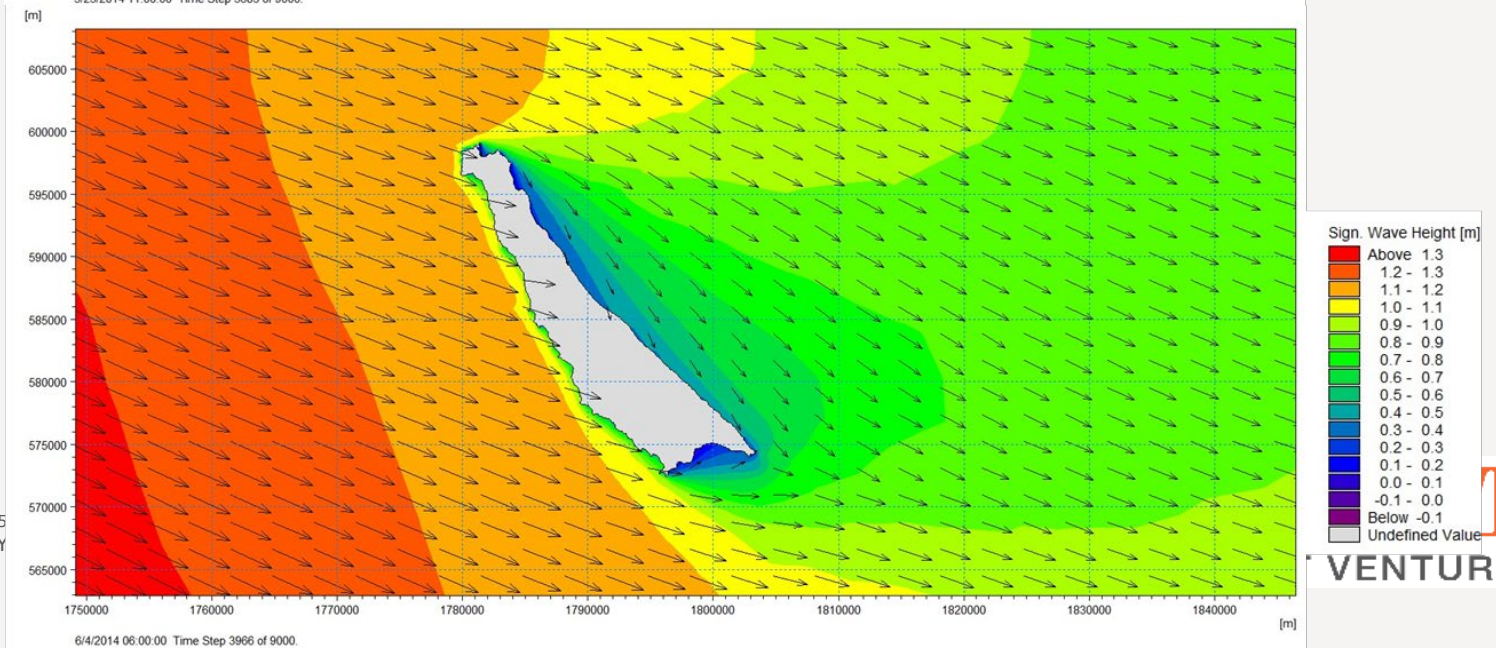
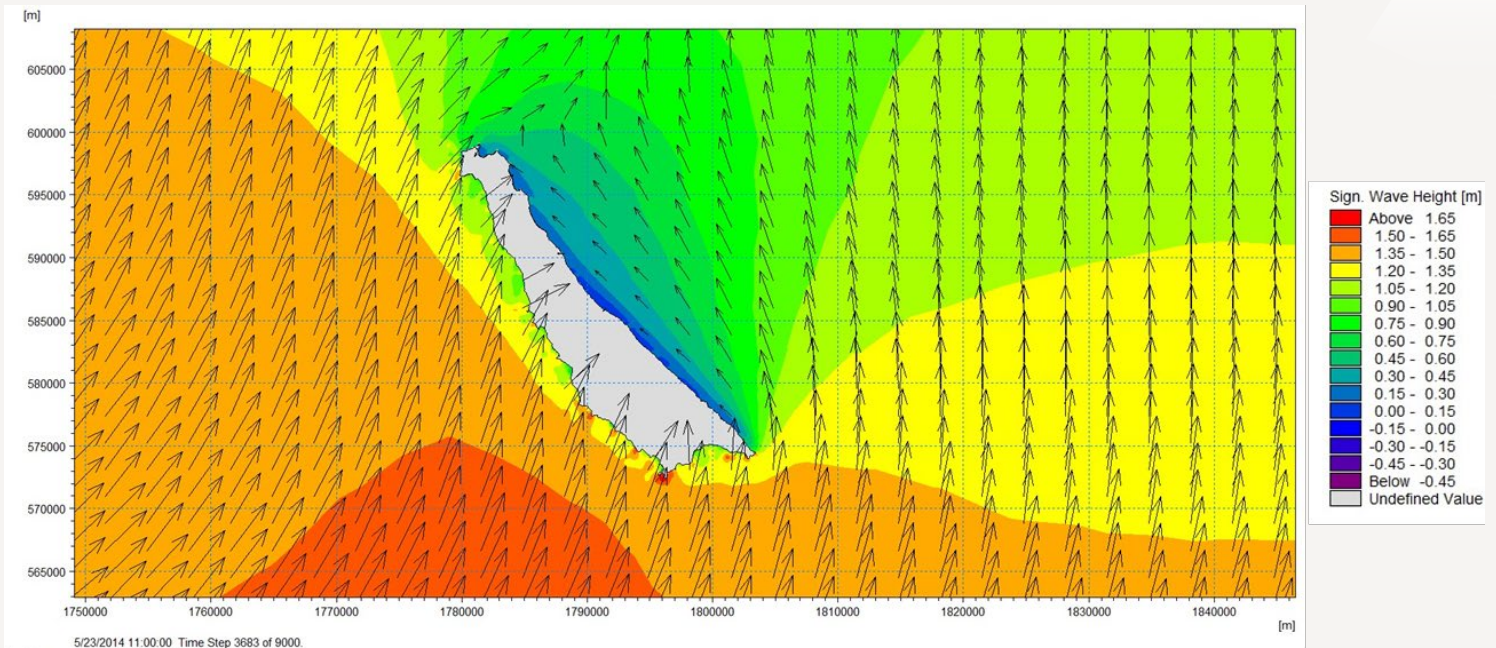
# Model Calibration – Summer

**June 2022**

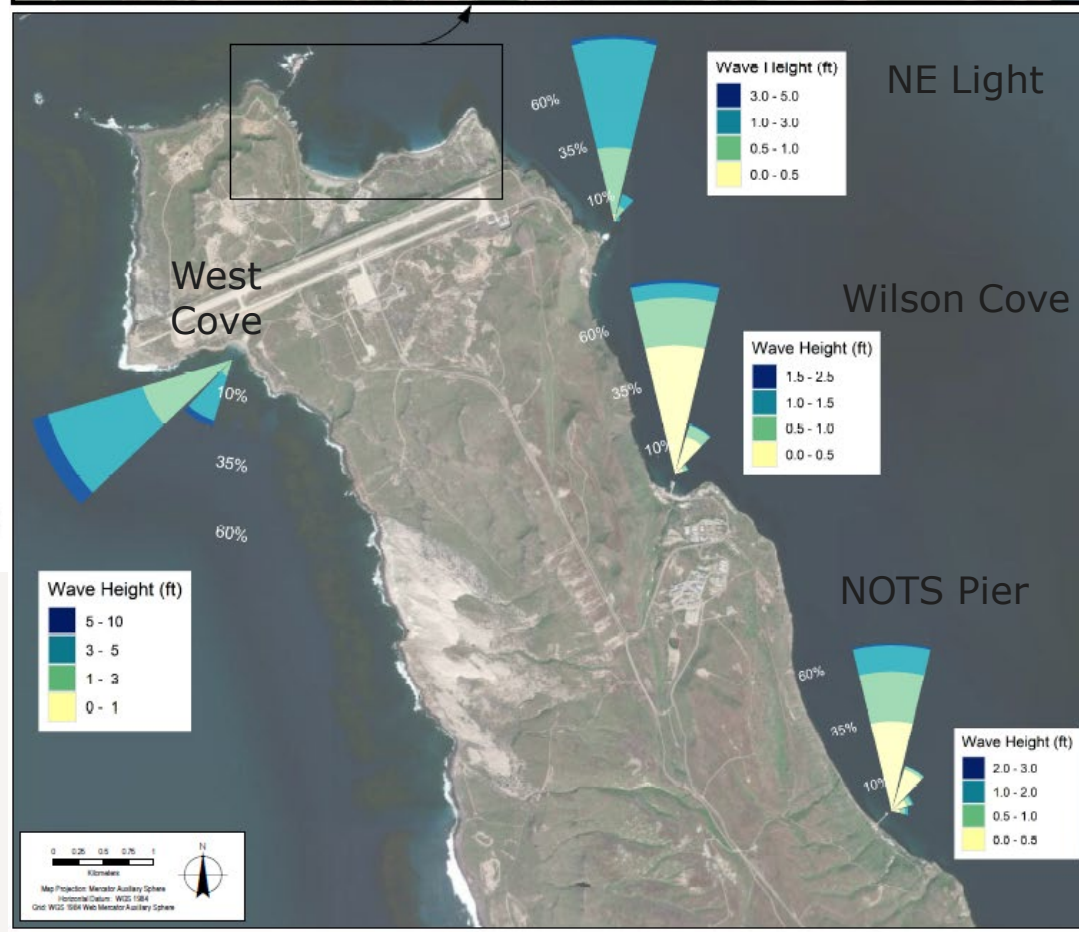
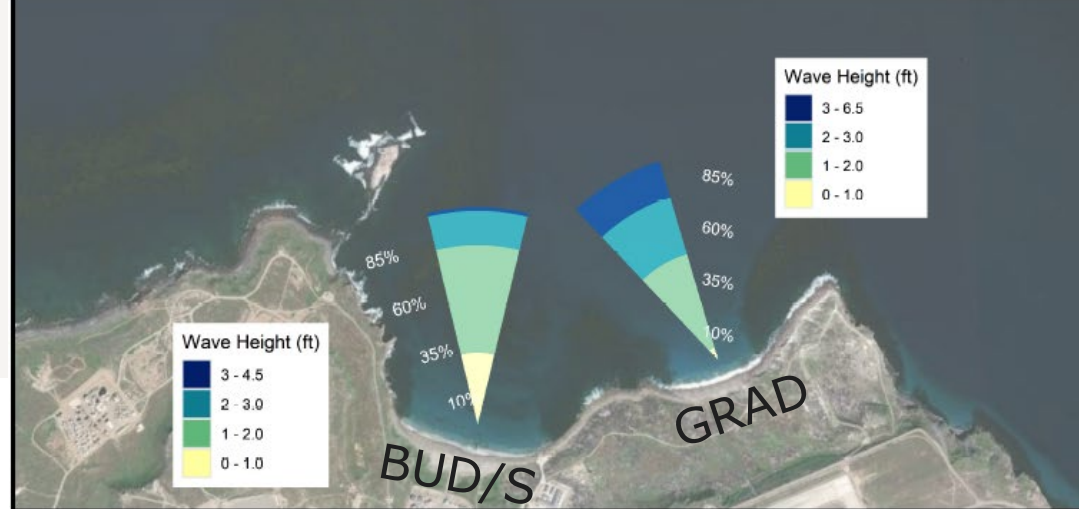
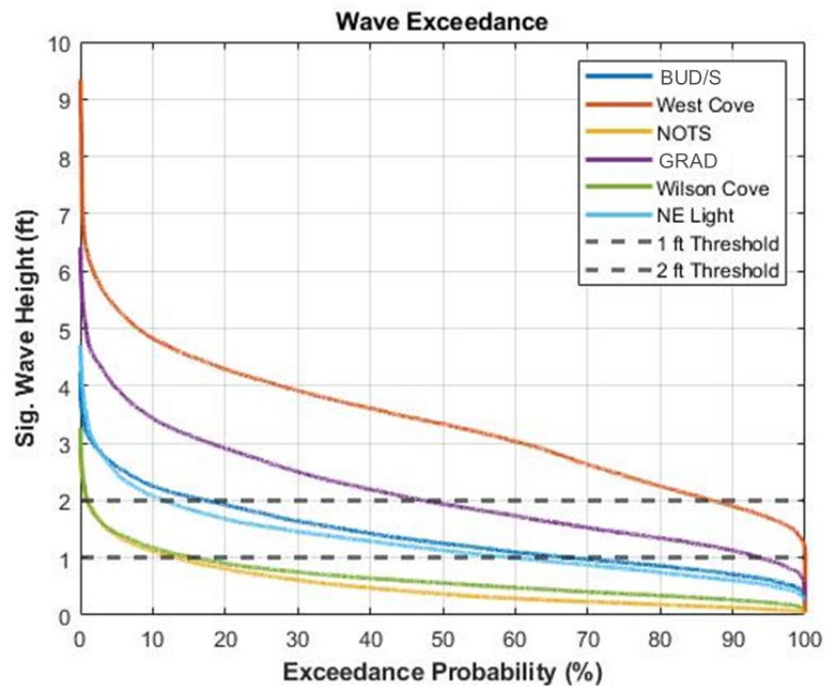




# Regional Model Results

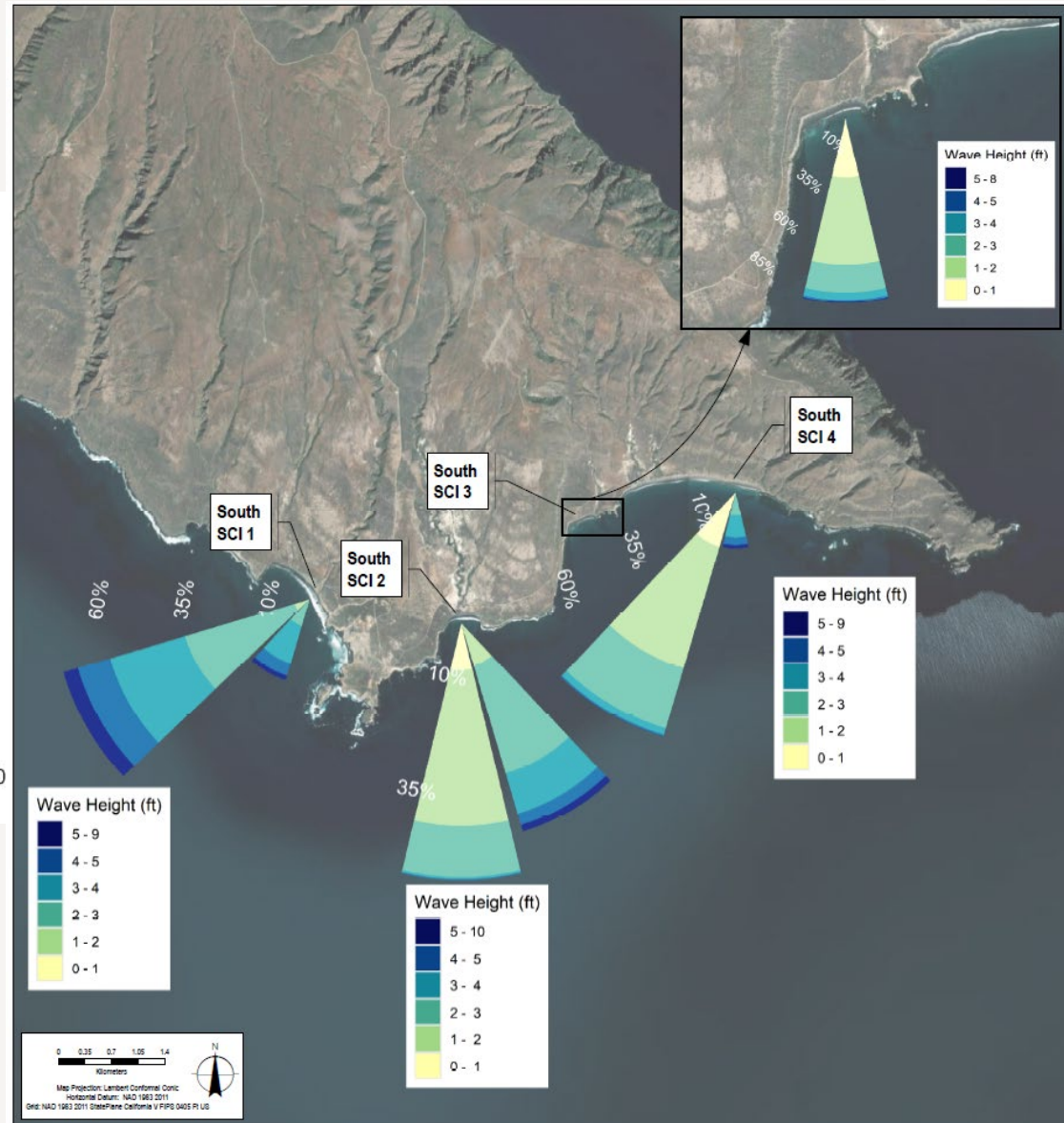
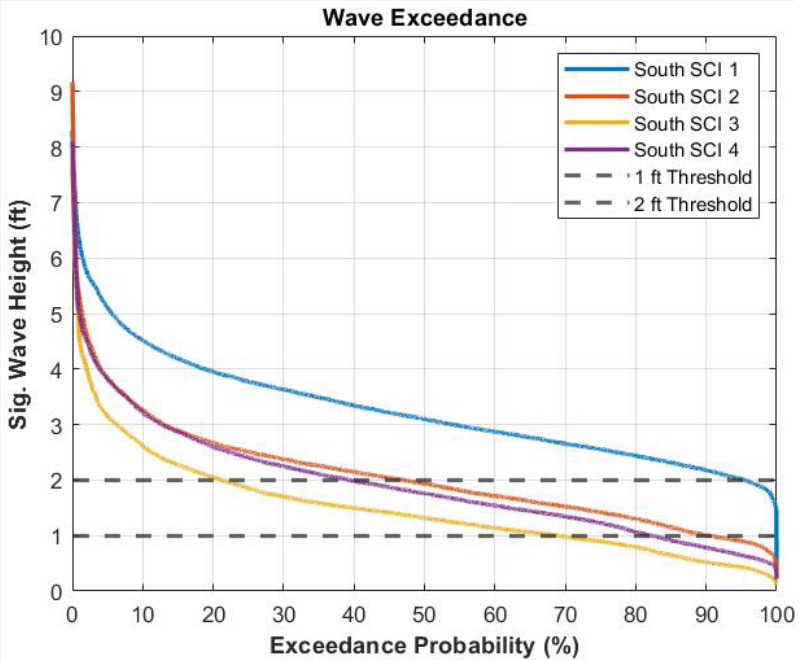


# Regional Wave Model Results





# Regional Wave Model Results





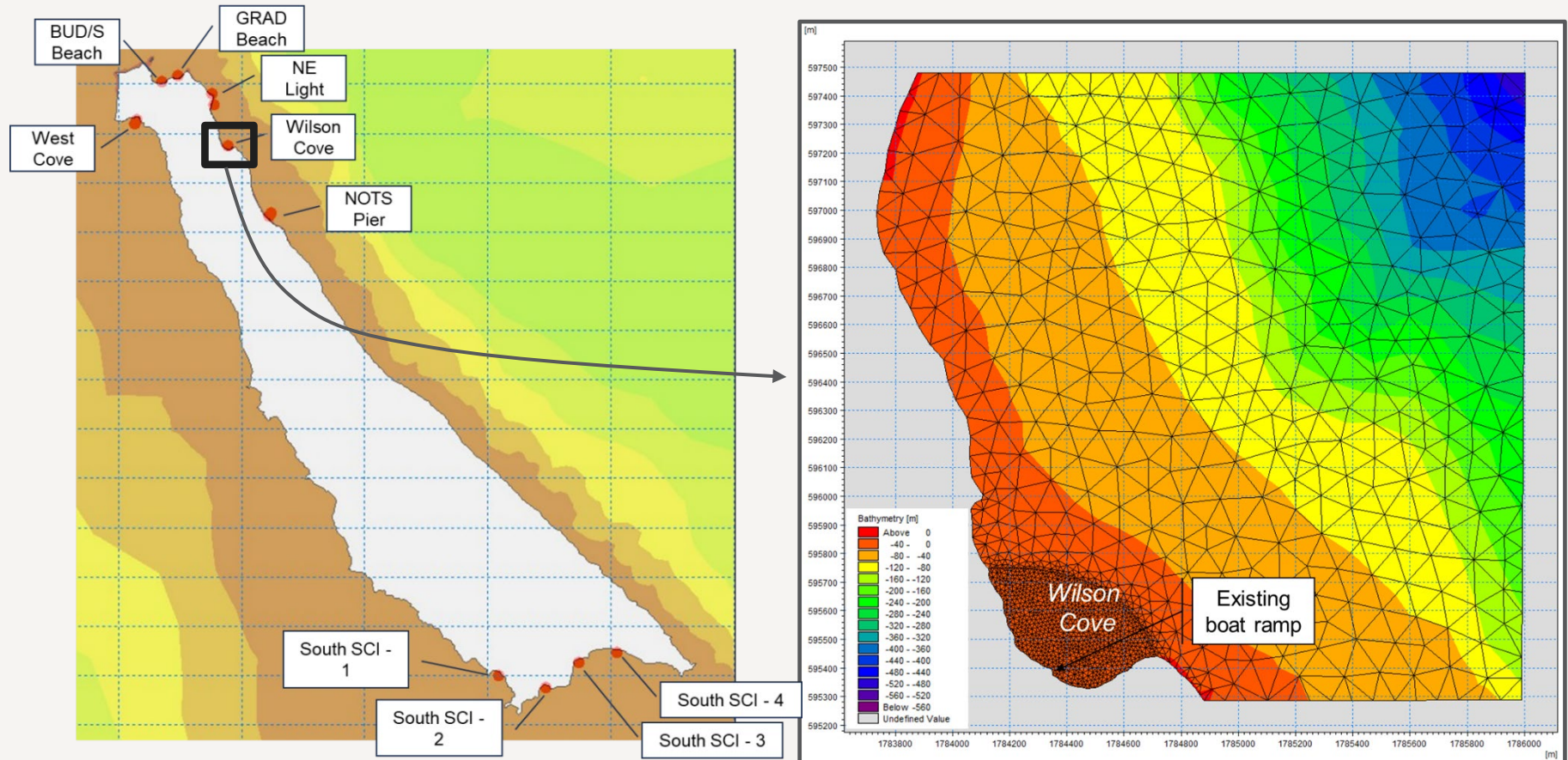
# Regional Wave Model Results

- Wilson Cove selected for nested model



Location	Exceedance probability for 1-ft threshold (%)	Exceedance probability for 2-ft threshold (%)
BUD/S Beach	68.0	20.0
GRAD Beach	93.0	50.0
<b>Wilson Cove</b>	<b>15.0</b>	<b>1.0</b>
<b>NOTS Pier</b>	<b>13.0</b>	<b>1.0</b>
West Cove	100.0	87.0
NE Light	58.9	11.2
South SCI 1	100.0	96.0
South SCI 2	90.1	45.0
South SCI 3	81.3	38.7
South SCI 4	68.6	20.8

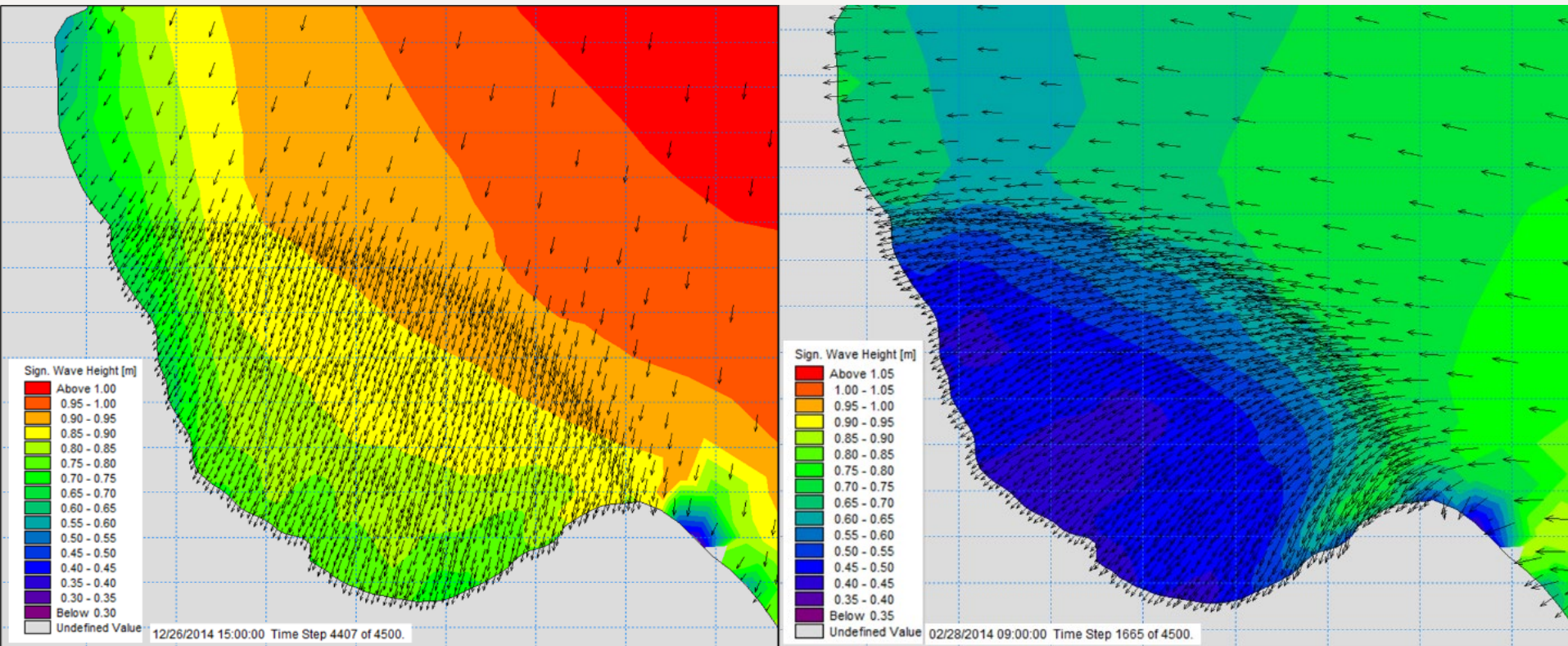
# Nested Model – Breakwater Analysis





# Nested Model – Breakwater Analysis

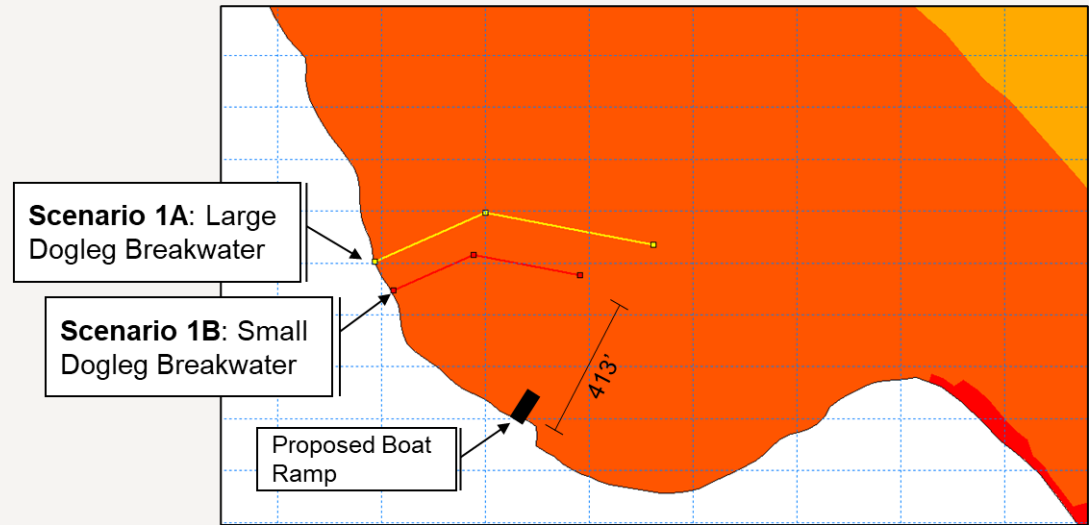
## Wilson Cove Wave Climate



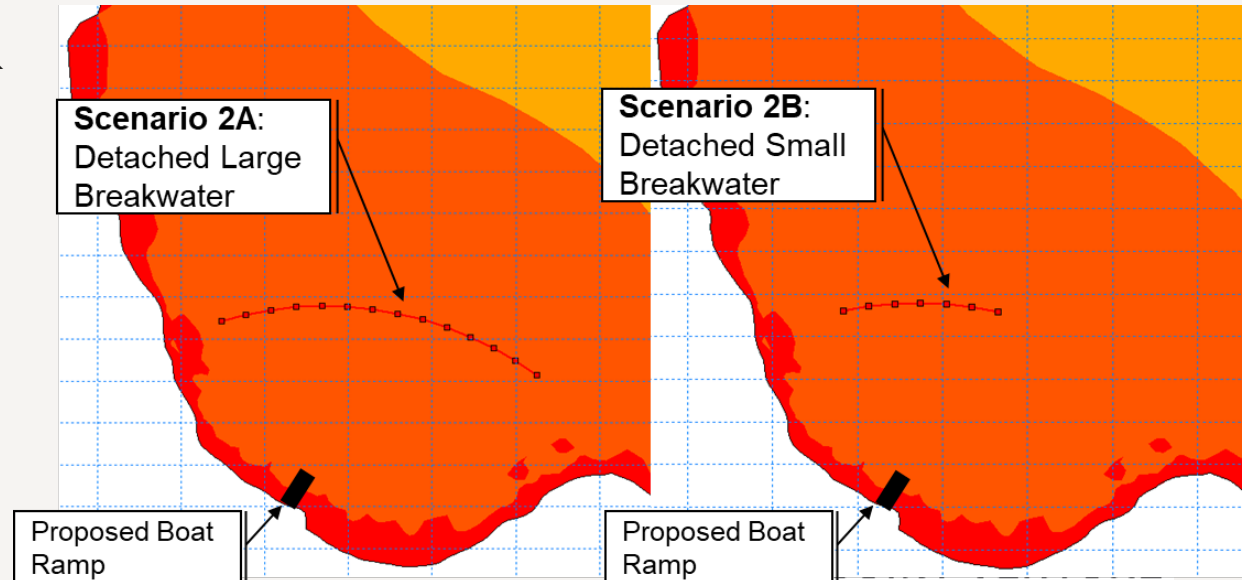


# Nested Model – Breakwater Analysis

- 4 Breakwater Scenarios
  - Large Dogleg
  - Large Detached
  - Small Dogleg
  - Small Detached

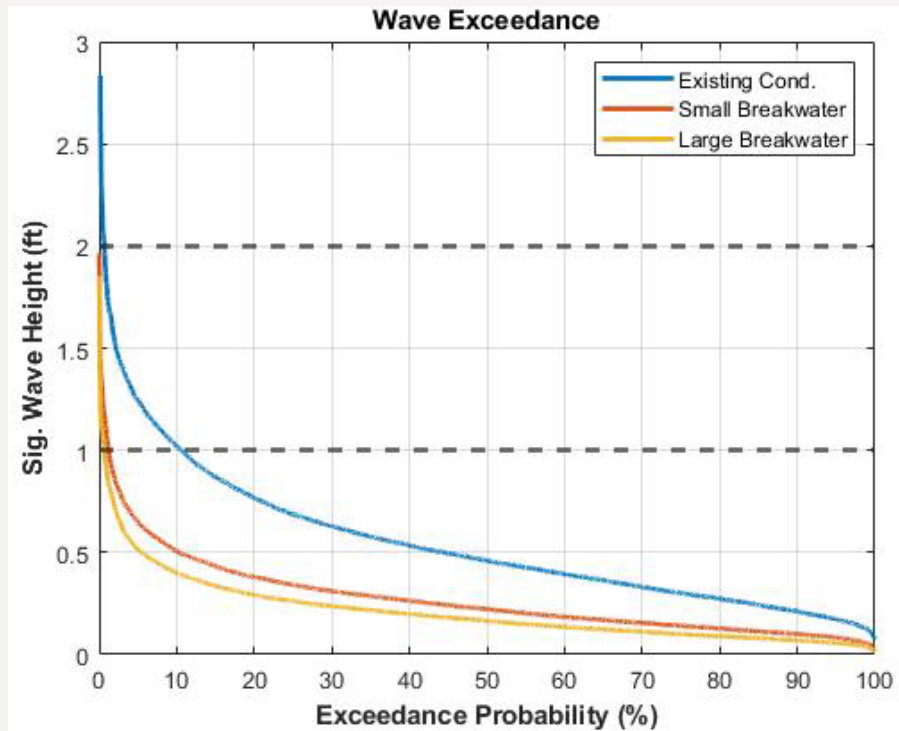


- Also modeled breakwaters at BUD/S & GRAD

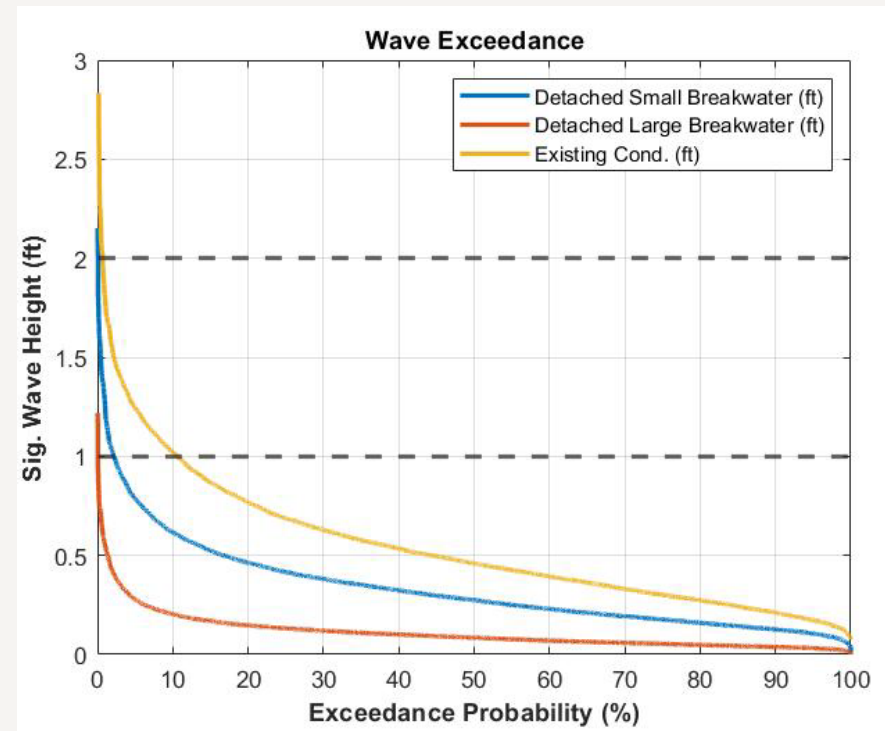


# Nested Model – Breakwater Analysis

## Dogleg Breakwater



## Detached Breakwater



# Nested Model – Breakwater Analysis

Scenario	Exceedance probability for 1 ft threshold (%)	Operational days during the year under 1 ft threshold	Exceedance probability: 2 ft threshold (%)	Operational days during the year under 2 ft threshold	Length (ft)
Large detached	0.1	364.6	0	365	1,300
Large dogleg	0.7	362.4	0	365	920
Small dogleg <sup>1</sup>	1.2	360.6	0	365	620
Small detached	2.4	356.2	0.1	364.6	600
Existing Condition	10.4	327	0.7	362.4	-



# Wave Climate Study – Conclusions & Recommendations

- Large detached breakwater is operational under both thresholds for the entire year, but is also the most expensive option
- Small and large dogleg breakwaters performed similarly
- Added length for a dogleg layout does not increase the effectiveness of the wave attenuation.
- Both of the detached breakwater scenarios are located in deeper water, thus the small dogleg breakwater is the preferred scenario to be considered for Wilson Cove.
- Wilson Cove is already sheltered from wave heights and is navigable for the entire year under the 2-ft threshold, and 327 days out of the year under the 1-ft threshold.
- **It is recommended a breakwater is not required to meet the operational criteria for the boat ramp.**

Location/scenario	Exceedance probability for 1 ft threshold (%)	Operational days during the year under 1 ft threshold	Exceedance probability for 2 ft threshold (%)	Operational days during the year under 2 ft threshold	Length (ft)
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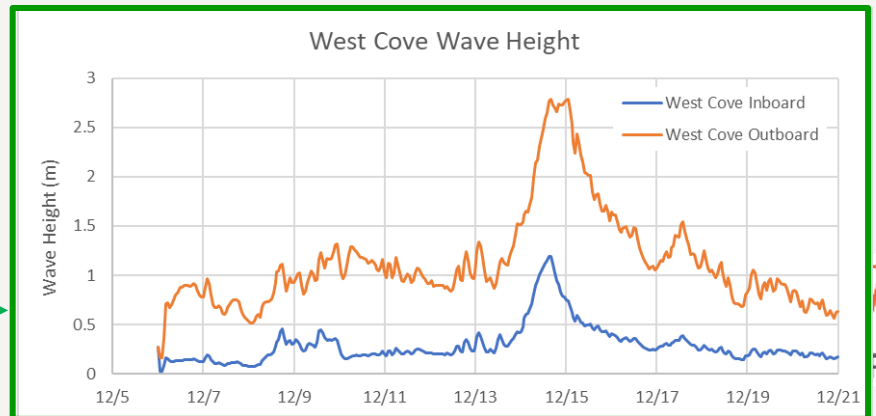
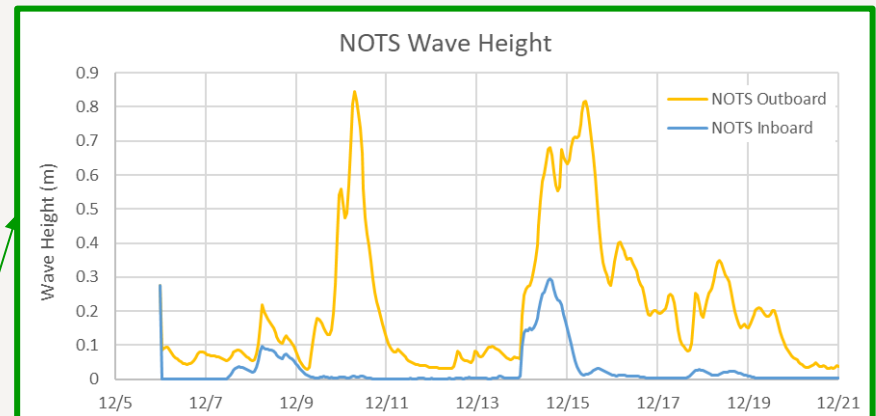
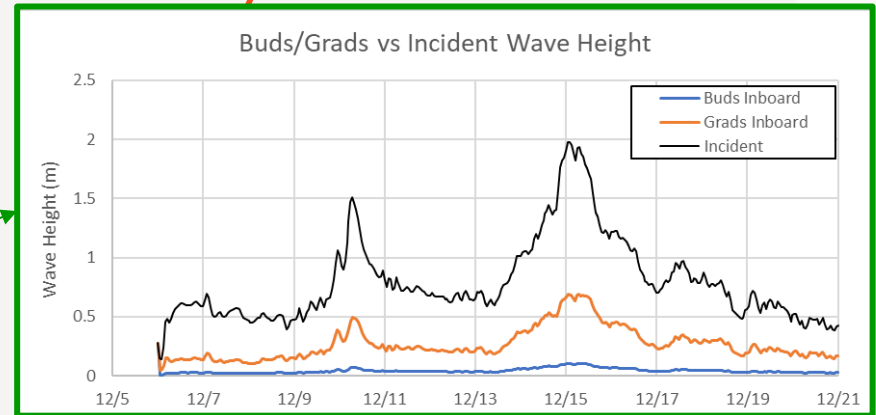
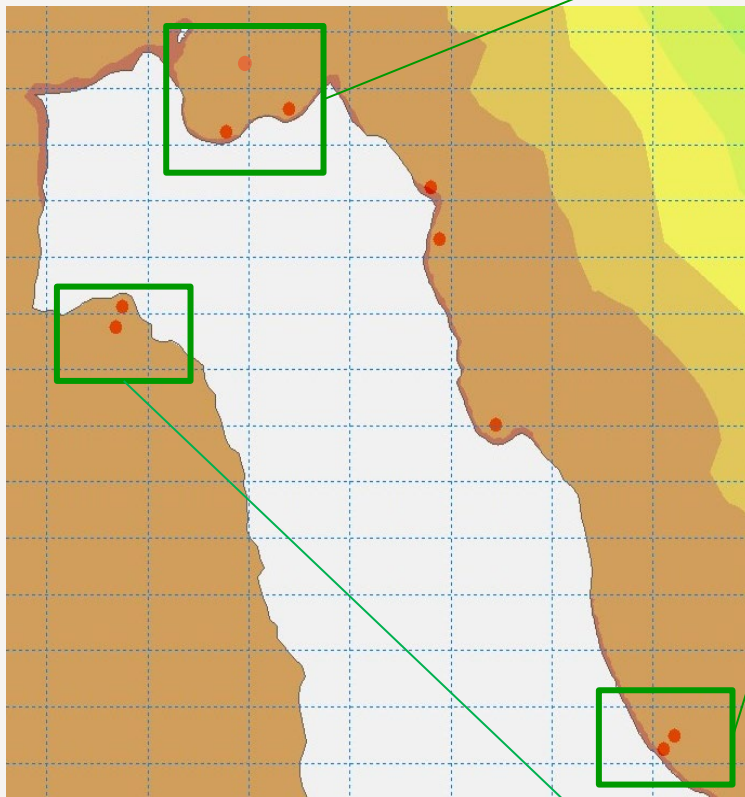
# Questions

# Extra Slides



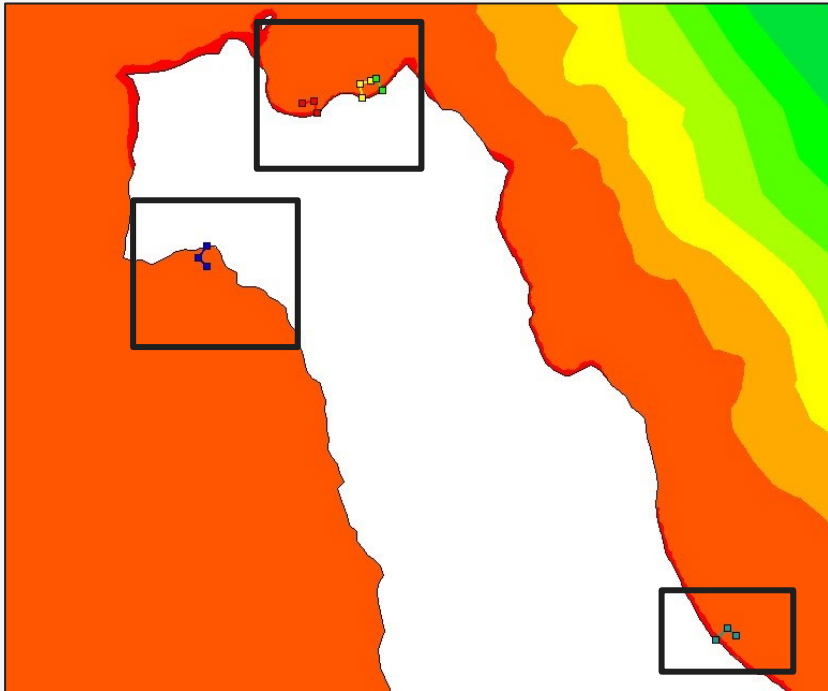
# Regional Model: Breakwater Analysis

BUD/S GRAD  
Breakwaters

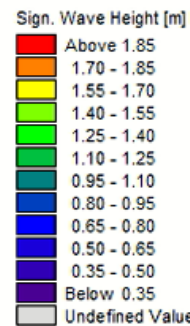
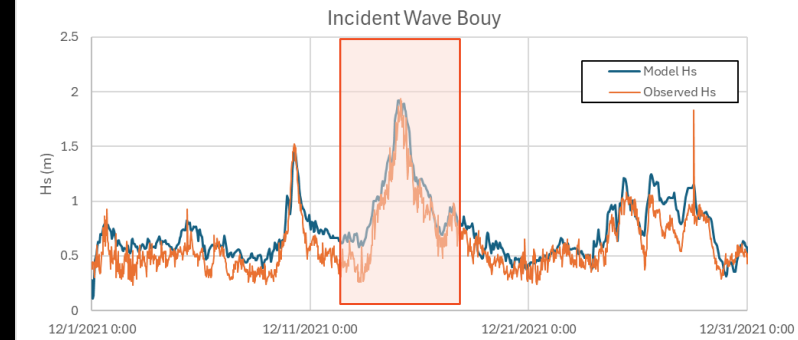


# Regional Model: Breakwater Analysis

- BUD/S Beach
- GRAD Beach
- NOTS Pier
- West Cove

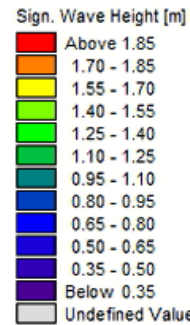
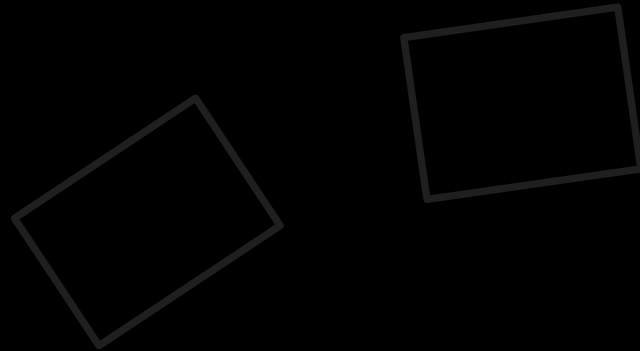
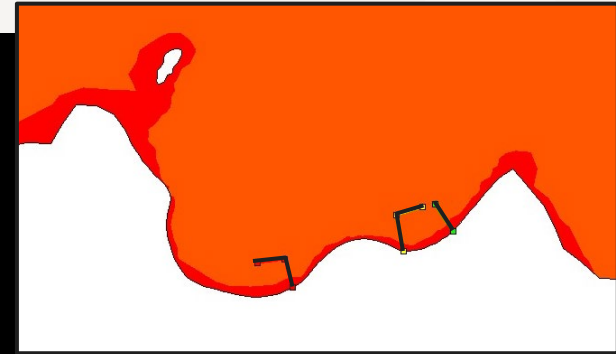


# Regional Model: Breakwater Analysis



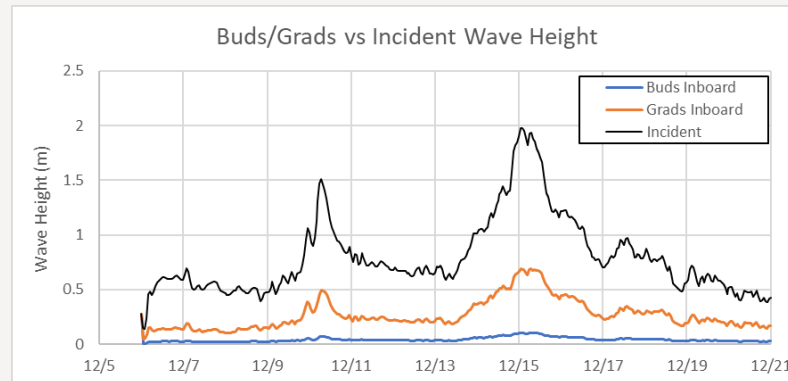


# Regional Model: Breakwater Analysis



# Regional Model: Breakwater Analysis

- Max Hs at Grads:  
0.7m / 2.3 ft



Existing

Breakwaters

