



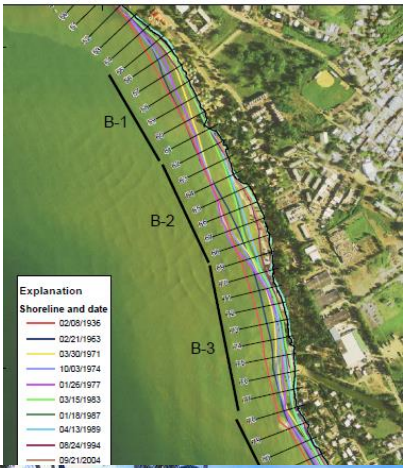
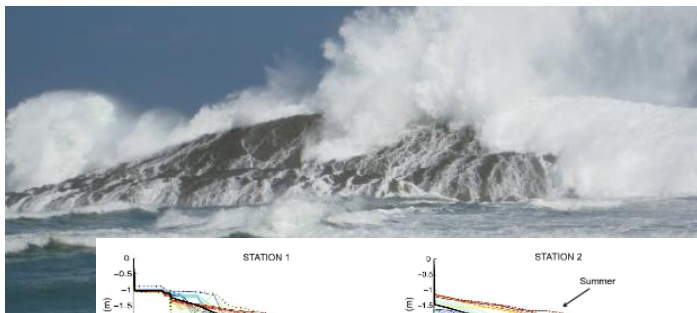
# On the potential effect of sea level rise and climate change on Puerto Rico's wave climate

Miguel Canals

Puerto Rico Climate Change Council (PRCCC) Annual Meeting  
April 7 2016



Marejadas causan estragos en Isabela.



# Lenta muerte de las playas en Puerto Rico

Más del 70% de las playas está erosionado, un problema grave que pasa inadvertido

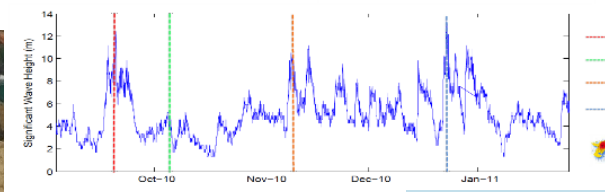
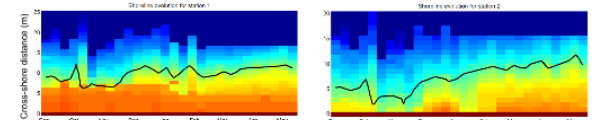
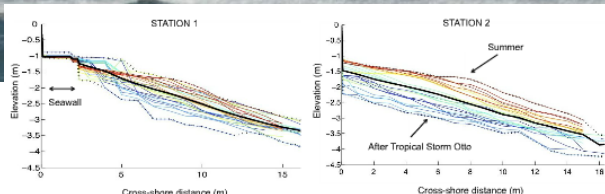


Photo from <http://www.comoestaeso.com>



## El Atlántico reclama lo que le fue quitado y más

Socava el malecón de Arecibo y sigue avanzando en una playa de Vega Baja.

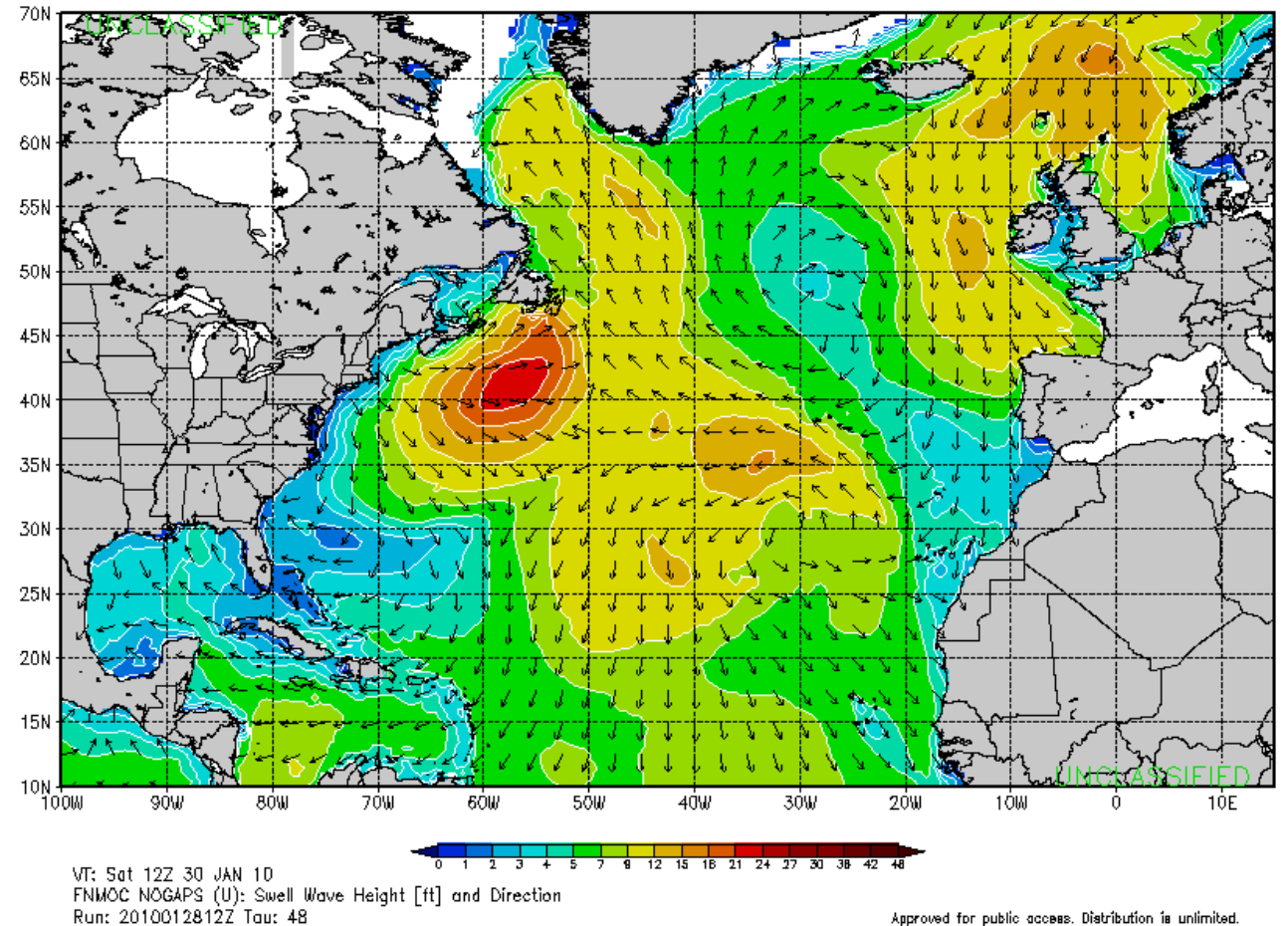
**!Rincon Sandy Beach En Peligro!!**

# Daños por las fuertes marejadas en costas de Arecibo

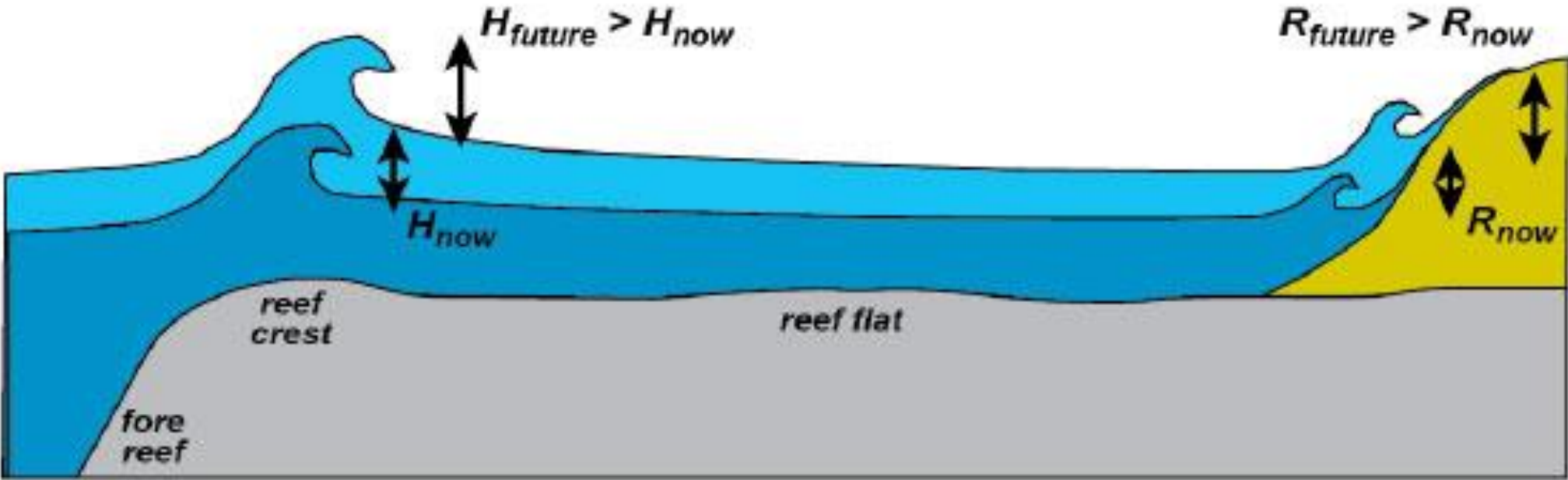






# How can Puerto Rico's wave be altered by climate change?

- Change in North Atlantic's large scale wave climate
  - Some papers indicate very slight decrease in mean  $H_s$  near PR, others slight increase in 20-yr  $H_s$
- Change in sea level leading to changes in nearshore wave climate
  - Has not been quantified for PR



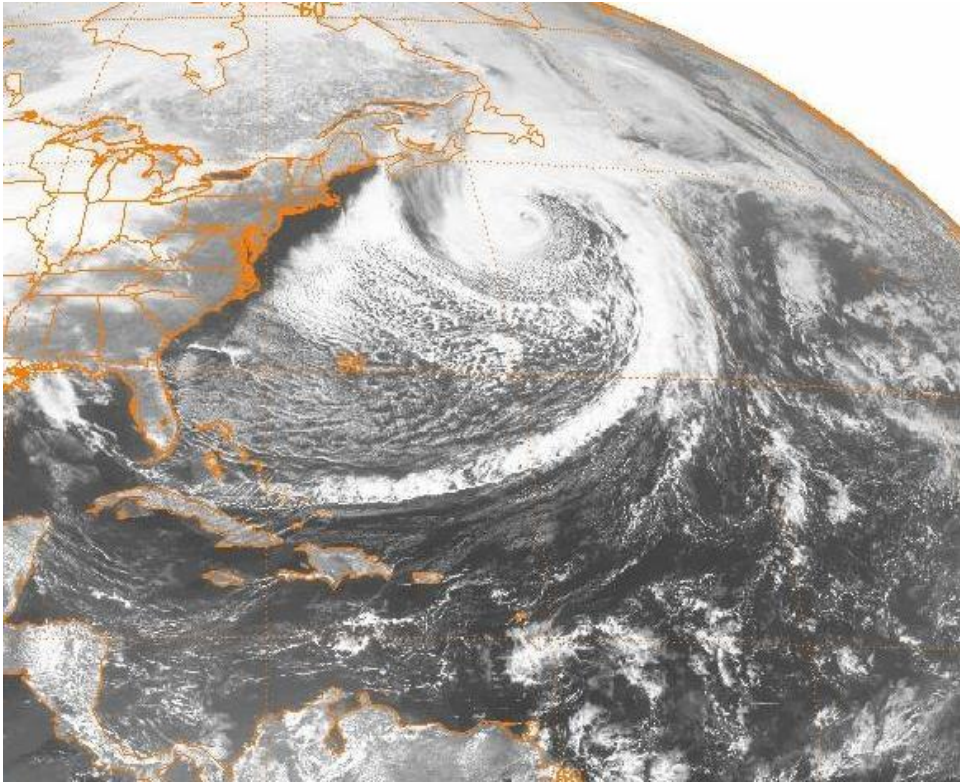
# Wave propagation under increase in MSL



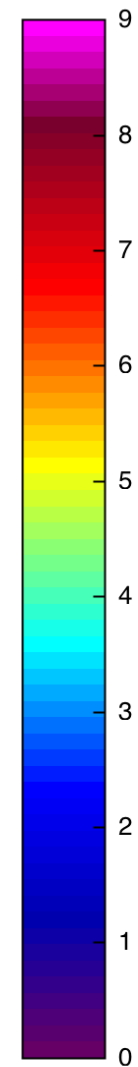
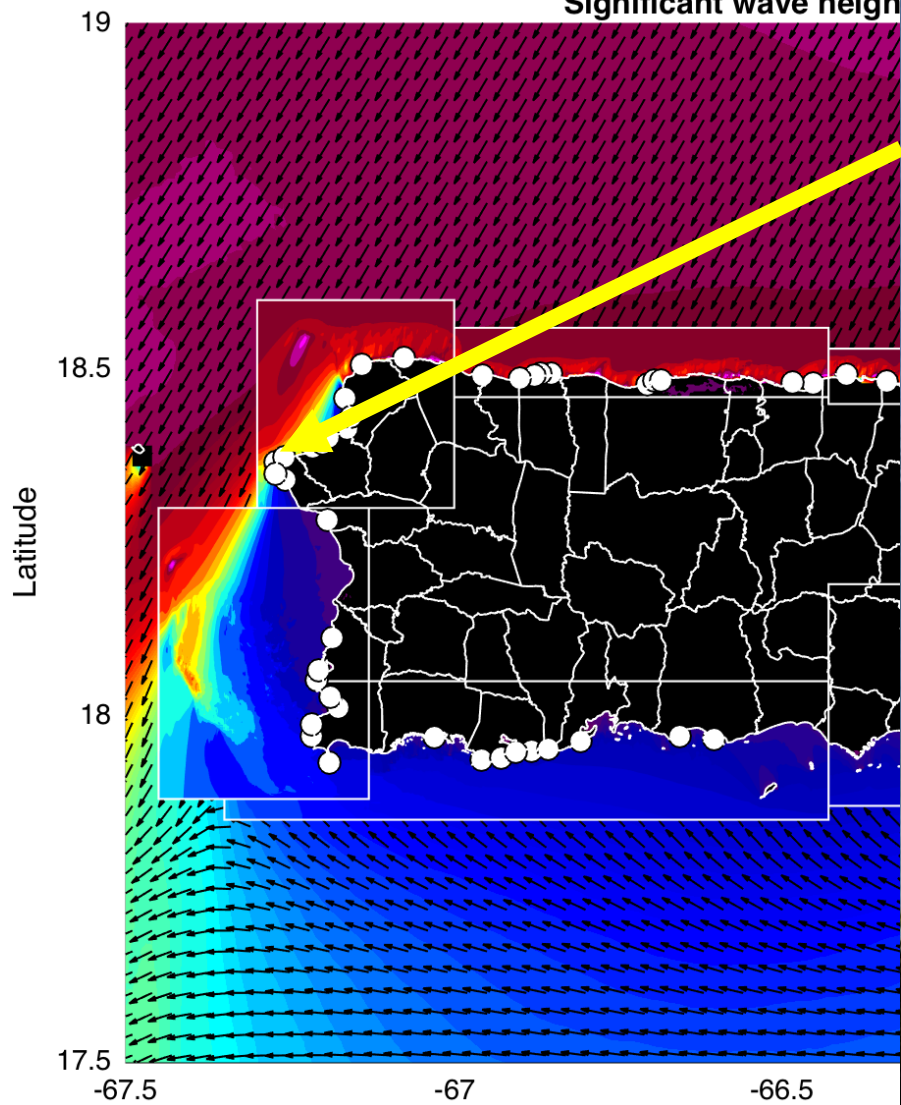
-  = Atoll islet
-  = Atoll carbonate platform
-  = Present sea level
-  = Future elevated sea level

<http://walrus.wr.usgs.gov/climate-change/atolls/background.html>

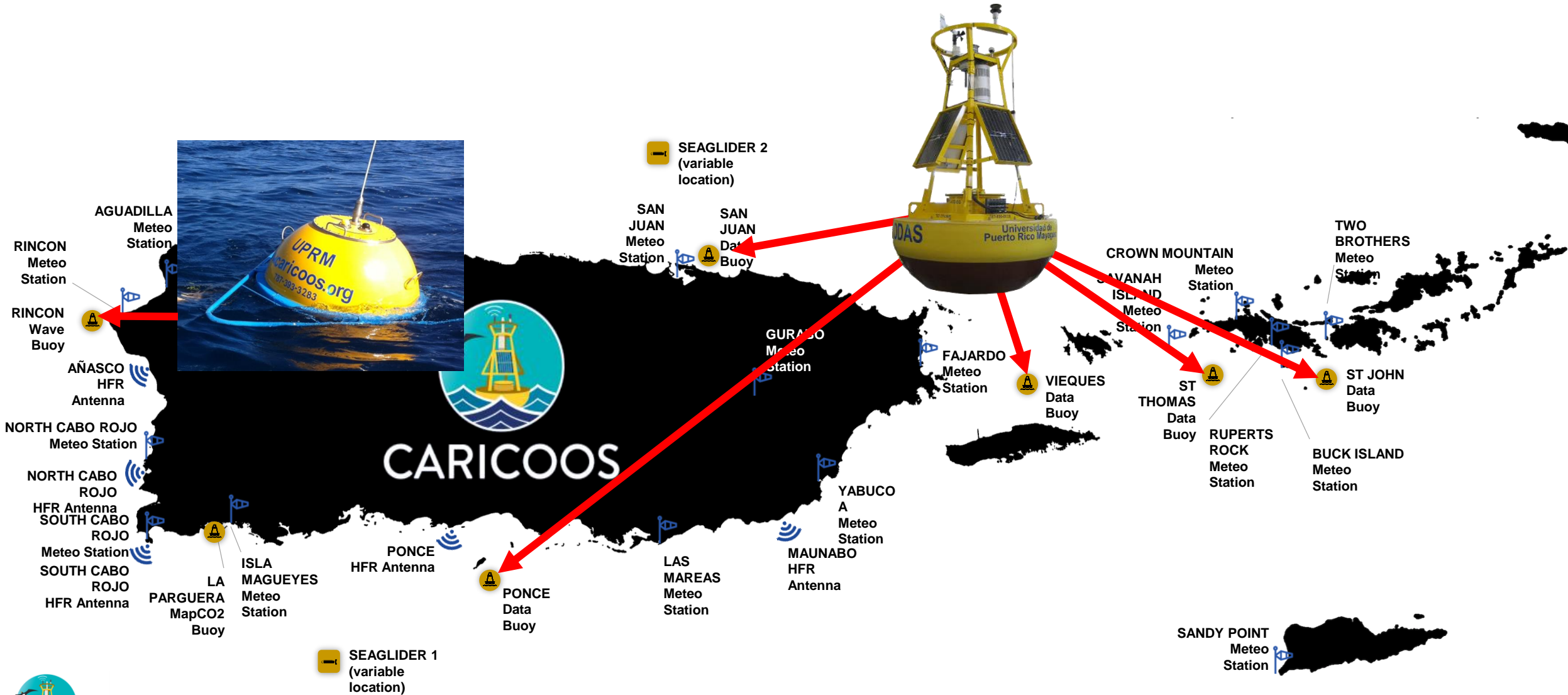
# Extreme events: March 2008 Swell



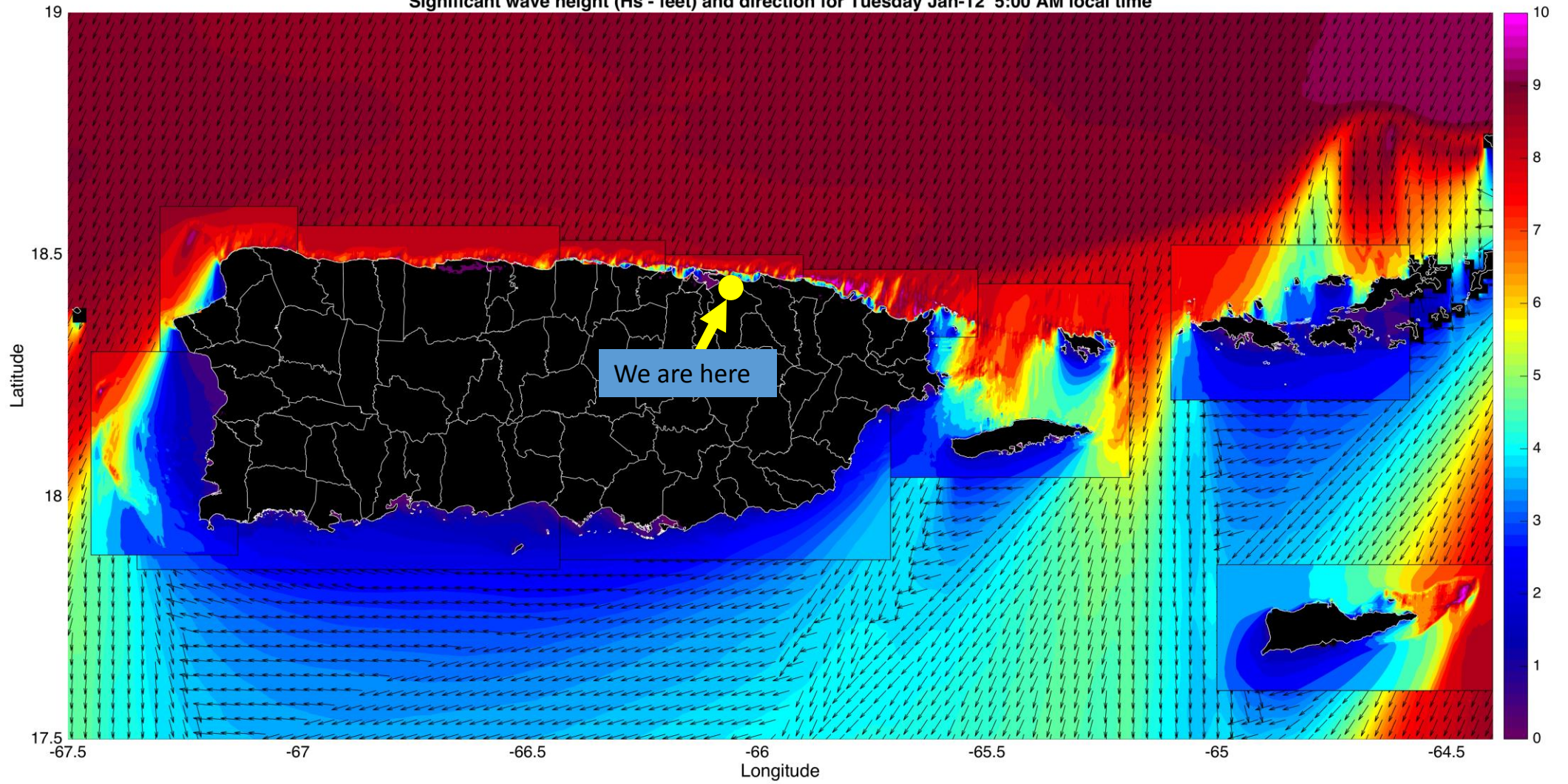
CariCOOS Nearshore V  
Significant wave height



# The Caribbean Coastal Ocean Observing System

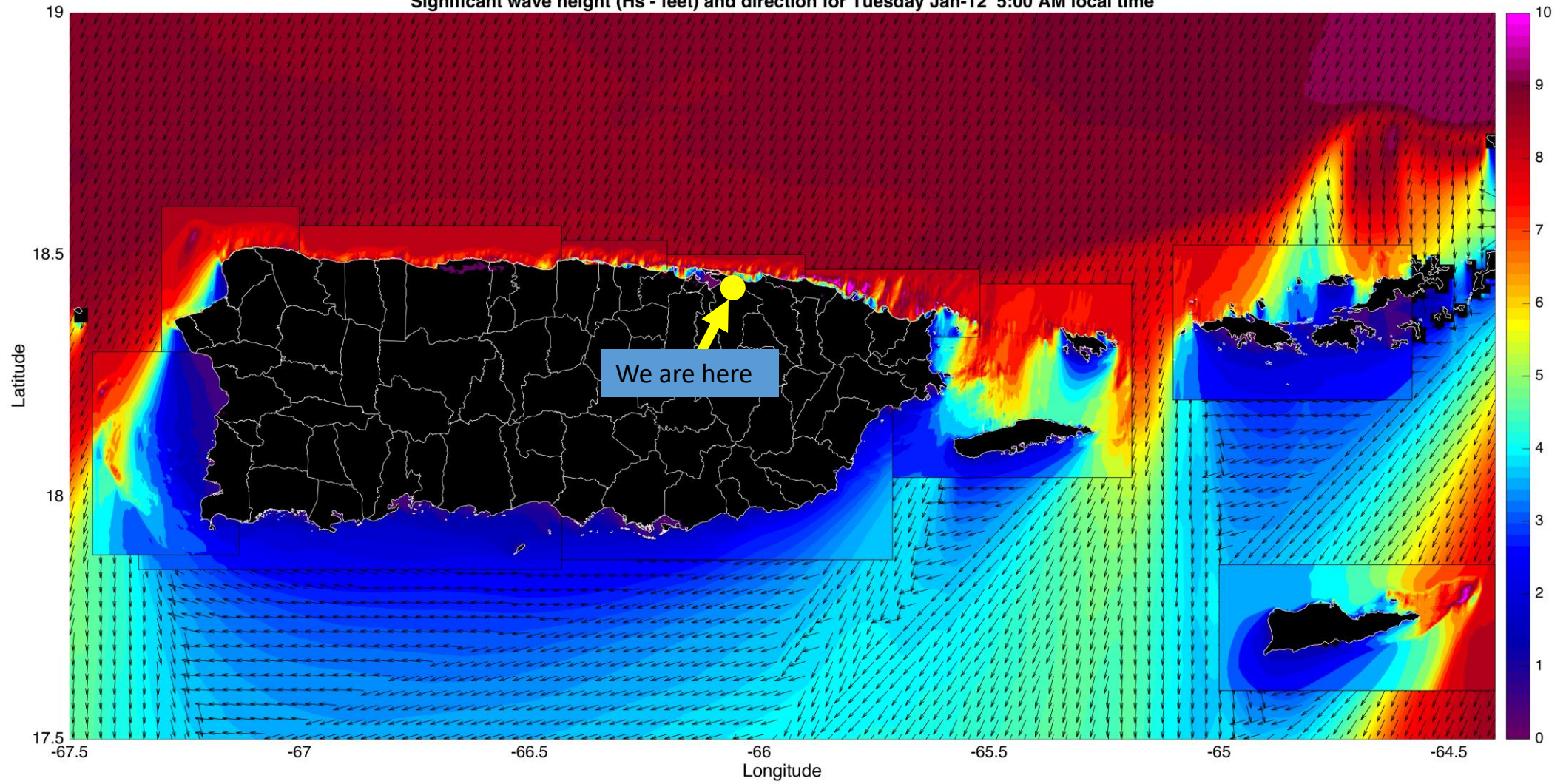


CariCOOS Nearshore Wave Model v7.0 (run: 20160111.1200 machine:swanwrf)  
Significant wave height (Hs - feet) and direction for Tuesday Jan-12 5:00 AM local time

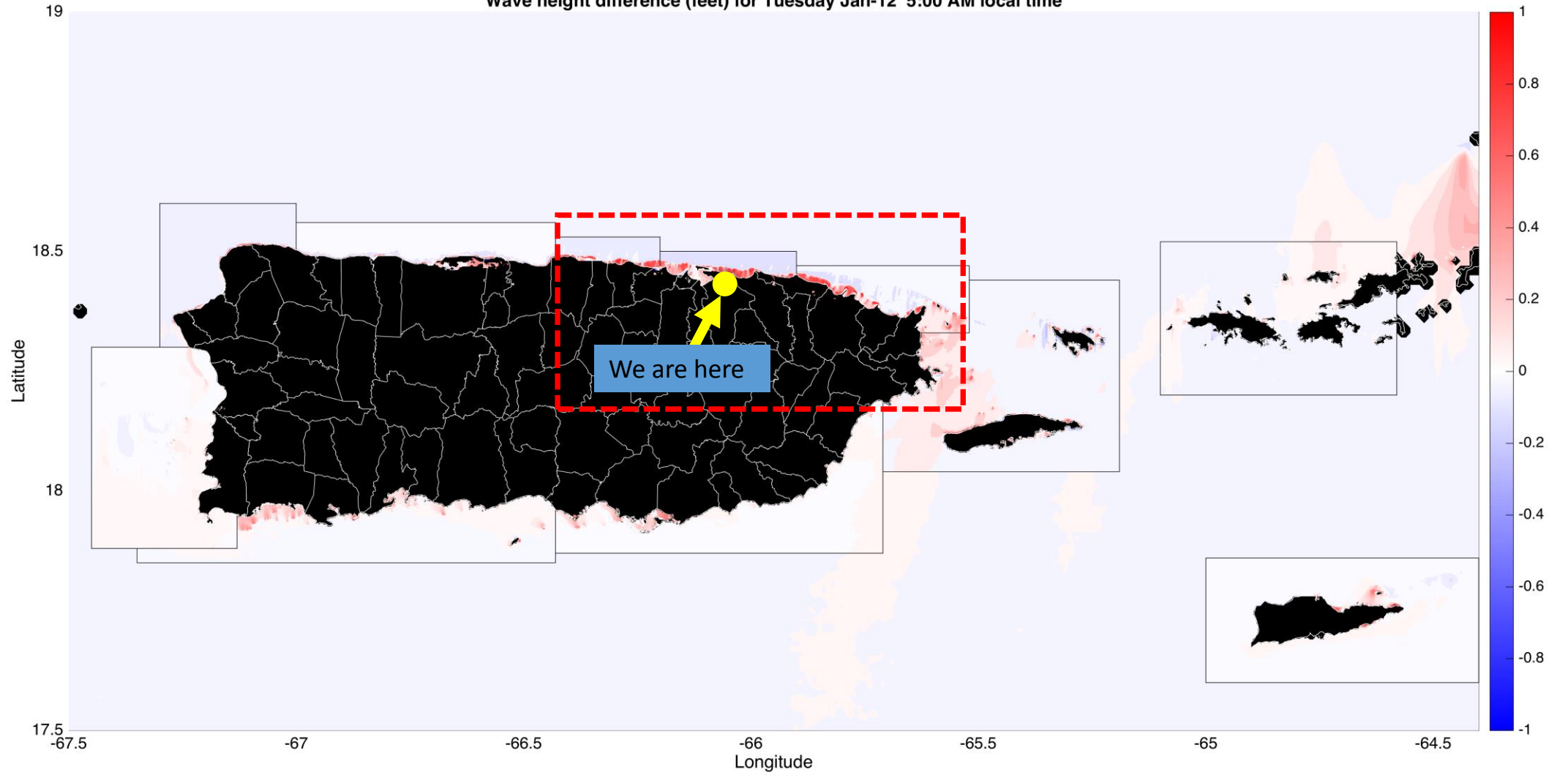




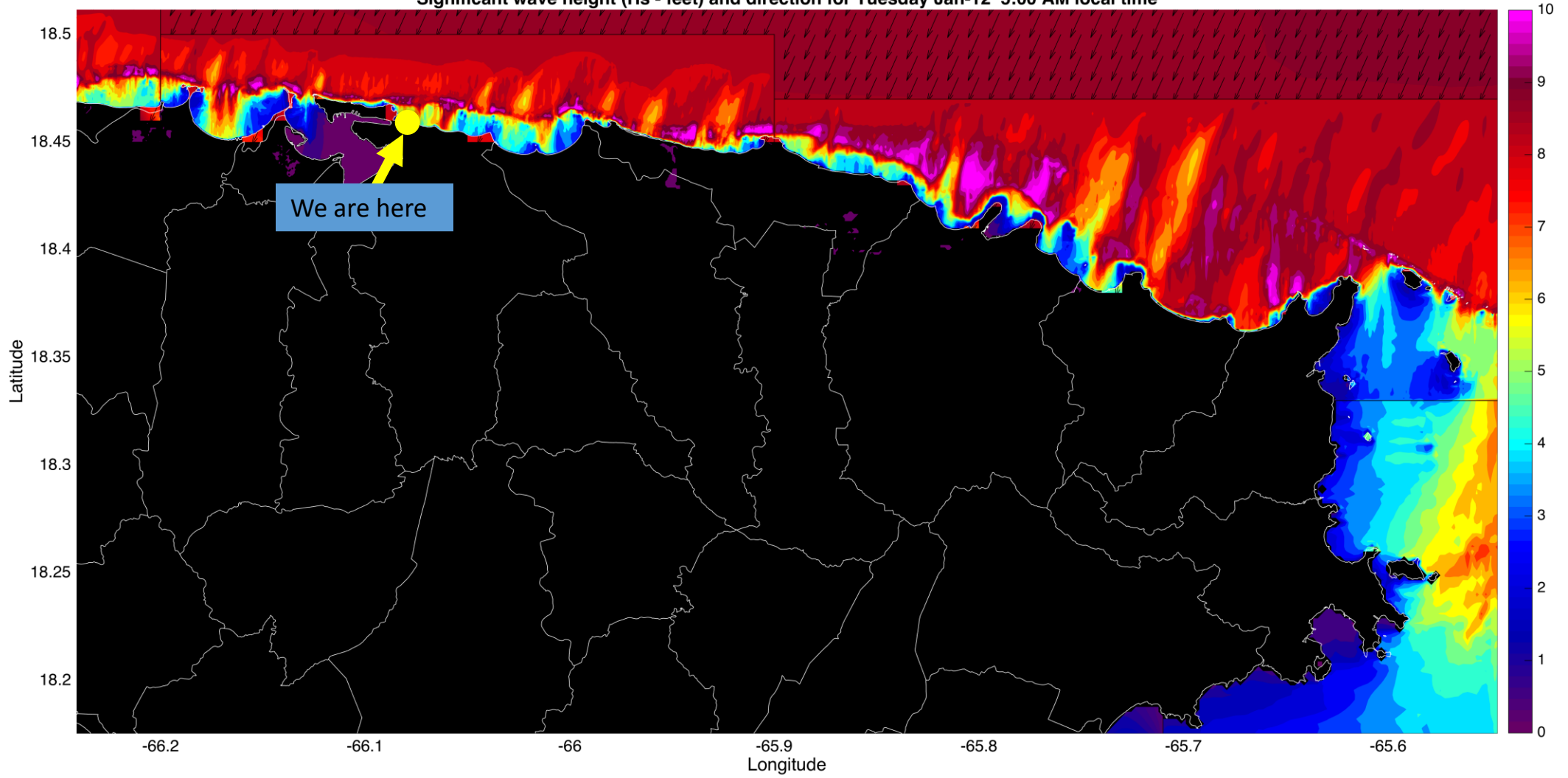
CariCOOS Nearshore Wave Model v7.0 with 0.5m SLR (run: 20160111.1200 machine:swanwrf)  
Significant wave height (Hs - feet) and direction for Tuesday Jan-12 5:00 AM local time



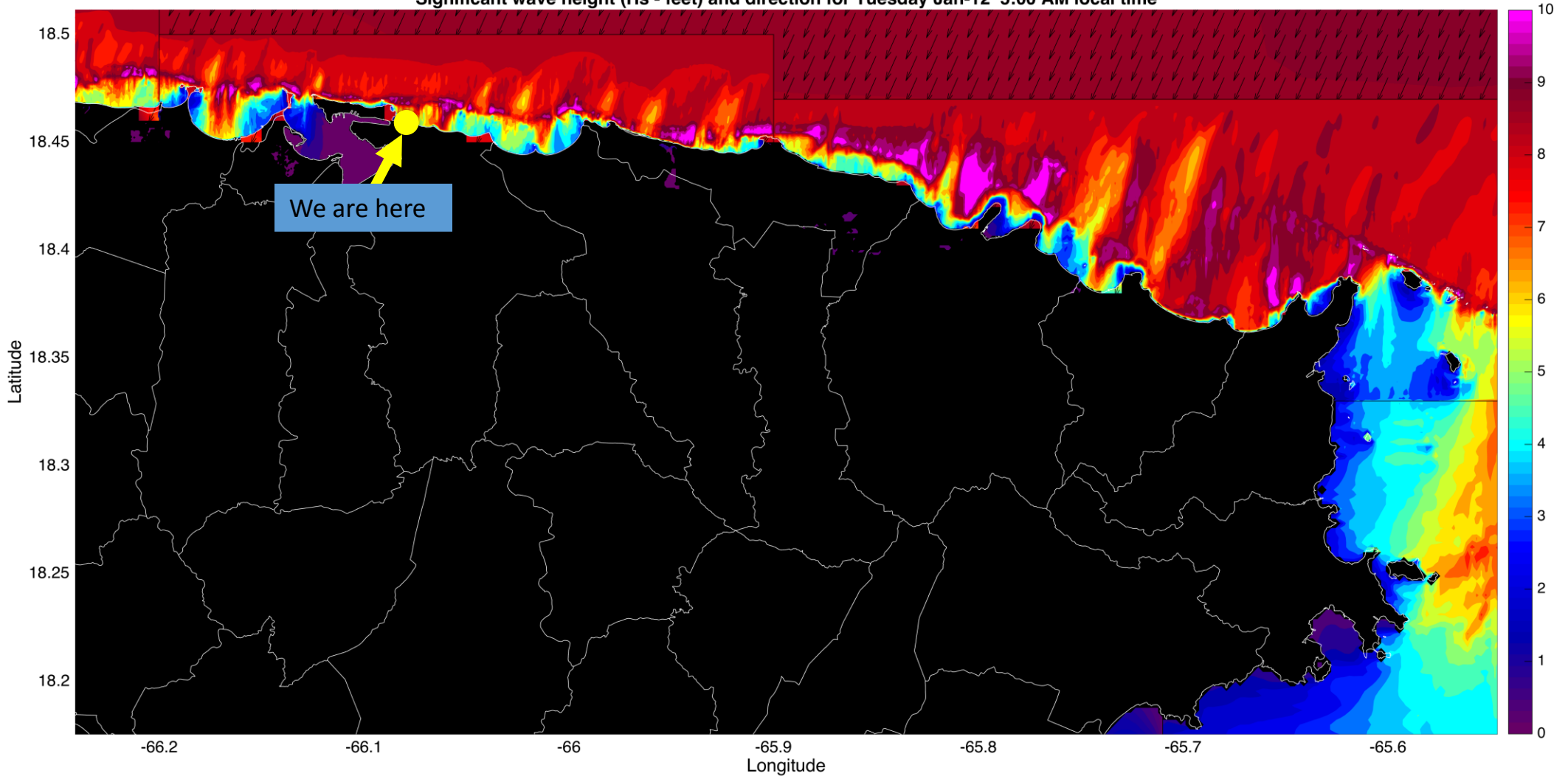
Wave height difference for 0.5m SLR scenario (run: 20160111.1200 machine:swanwrf)  
Wave height difference (feet) for Tuesday Jan-12 5:00 AM local time



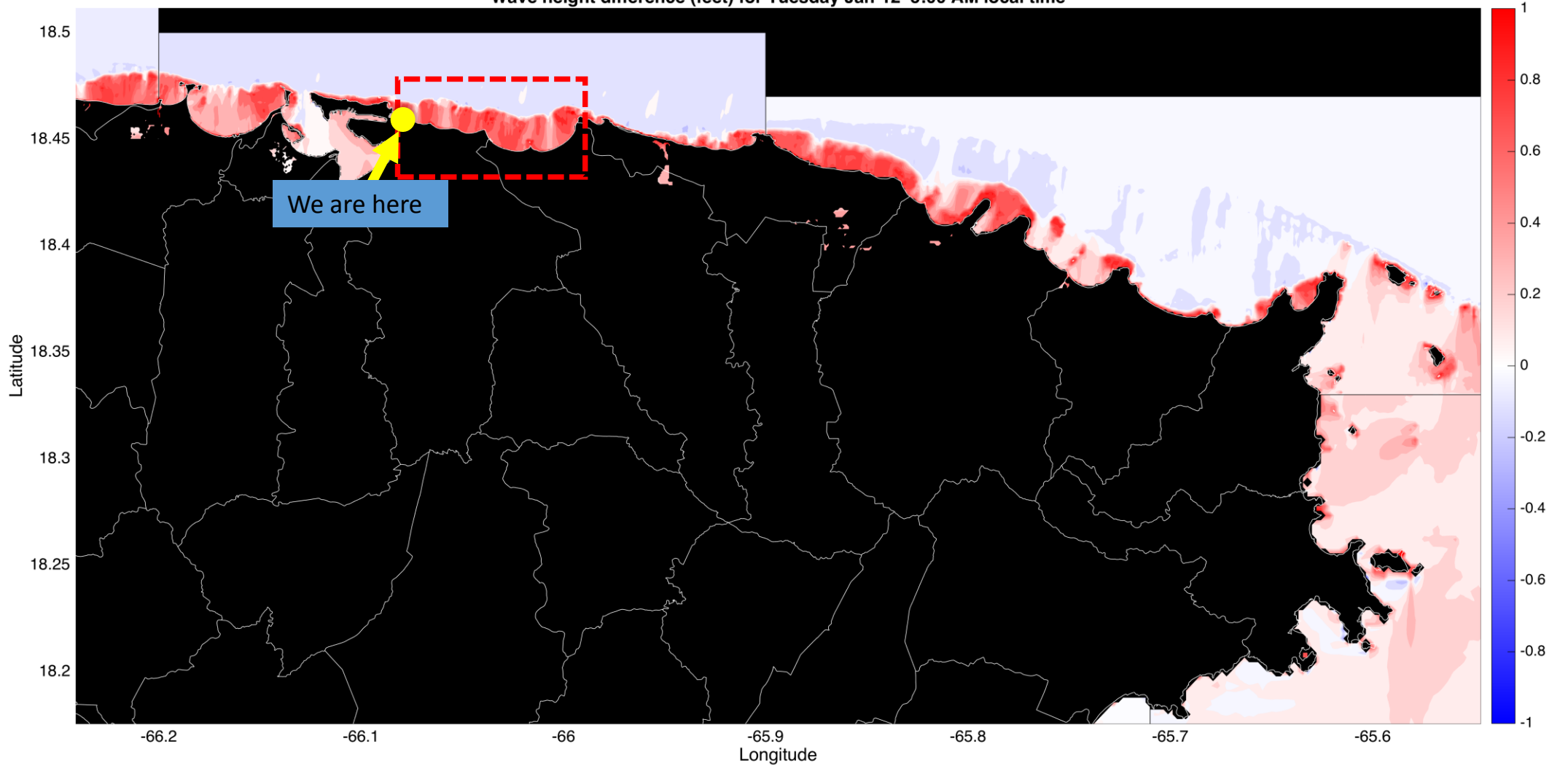
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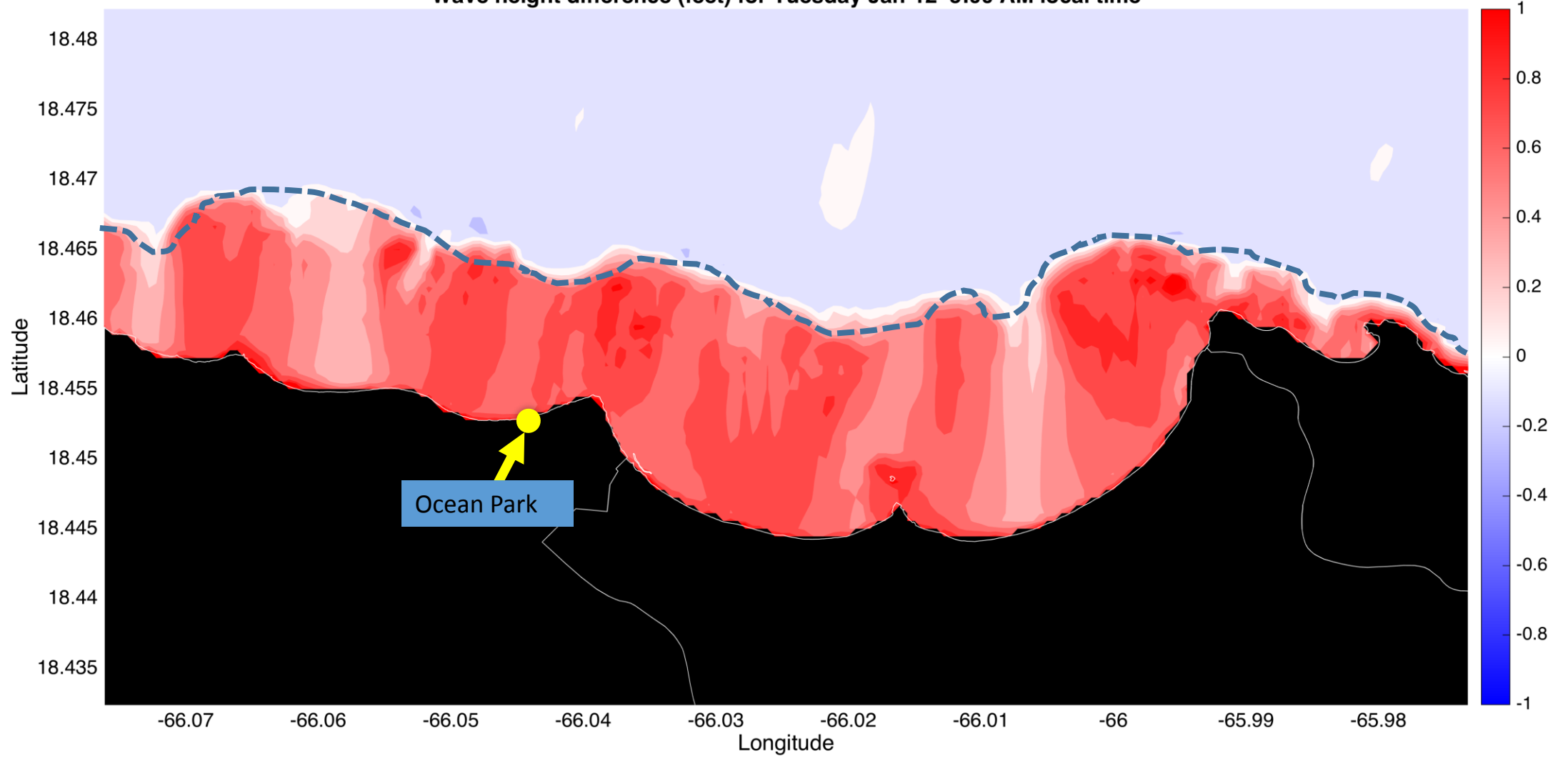
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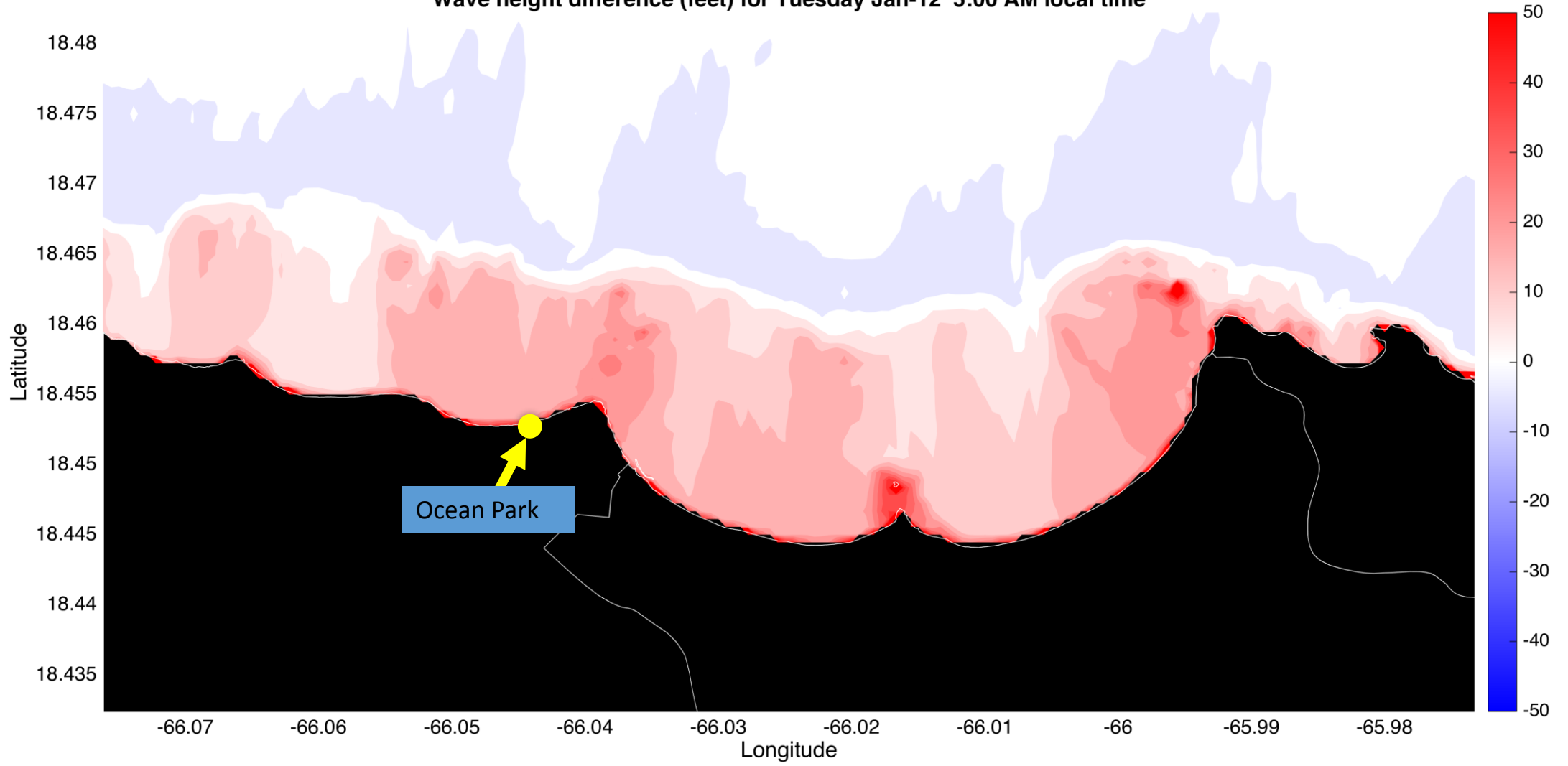
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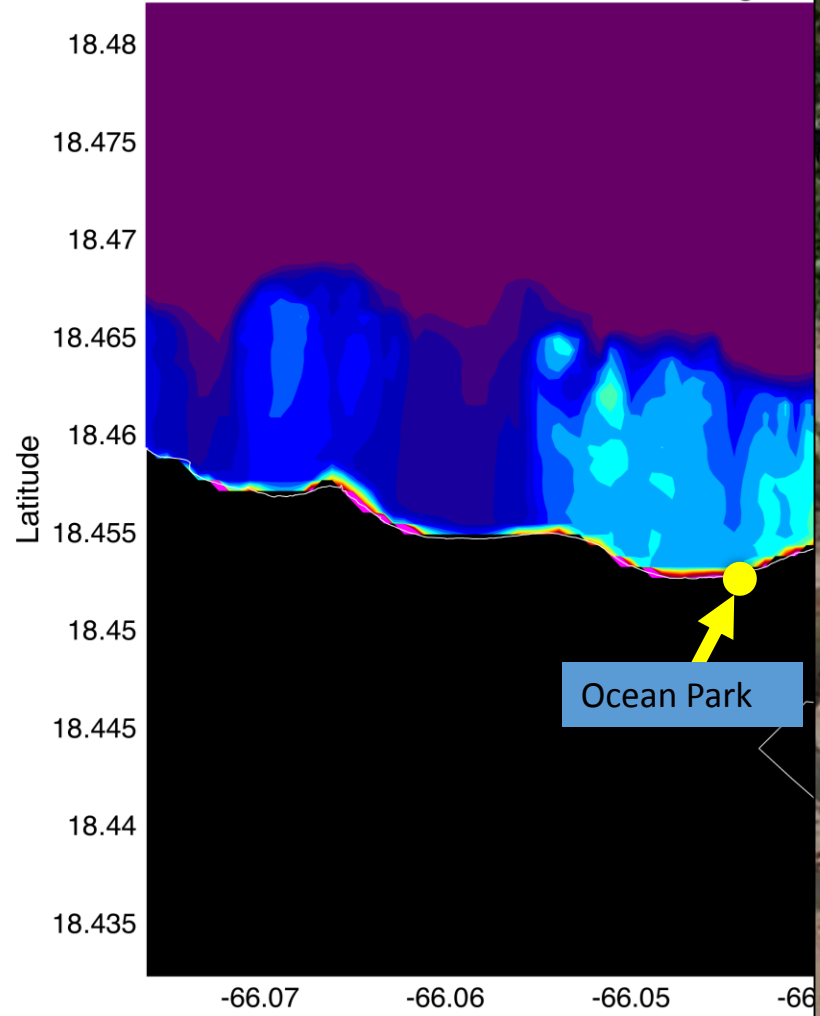
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Wave height difference for 0.5m SLR scenario (run: 20160111.1200 machine:swanwrf)  
Wave height difference (feet) for Tuesday Jan-12 5:00 AM local time



Wave power difference perce  
Wave height d



What happens to Ocean Park with 0.5 m SLR + 35% more wave power?



Pic: Maria Falcon



# SLR, wave action and coastal erosion: What can we do?...

- Pilot shoreline protection projects at most critical location
  - Offshore energy dissipation, artificial reefs
  - Beach nourishment
- Problems
  - Sounds great but.. who pays for it?
  - How do we select locations?
  - Unrealistic to armor and nourish all PR beaches with chronic erosion
- We need a science-based balanced approach which protects beach resources, public beach access and private property rights
- State of the art research should be the driving force behind management decisions.



# UPRM Center for Applied Ocean Science and Engineering: Forming the first generation of Caribbean coastal & ocean engineers



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