



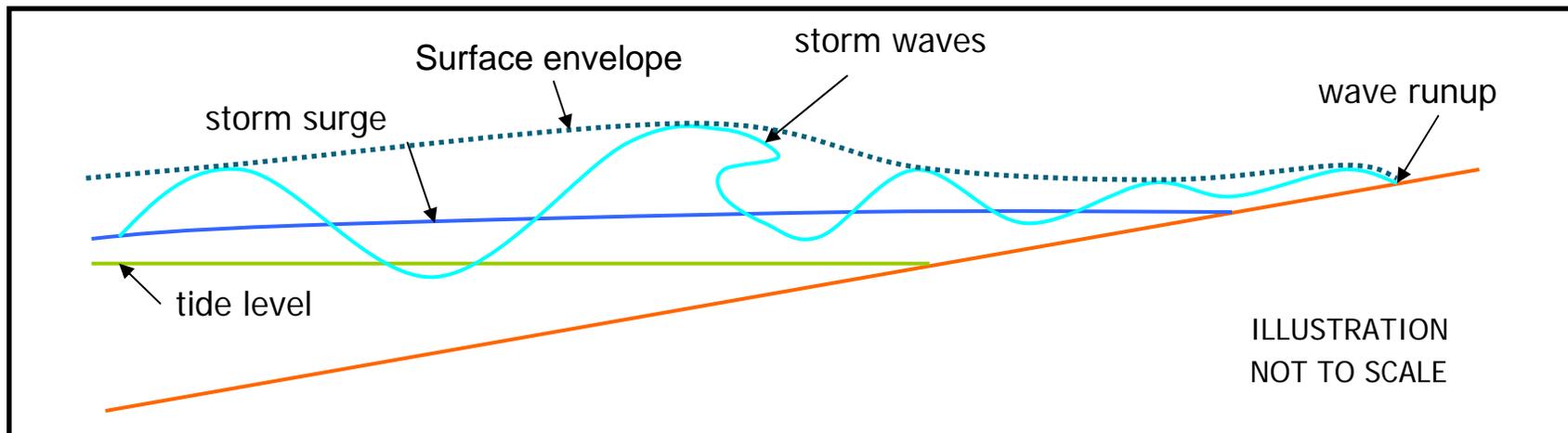
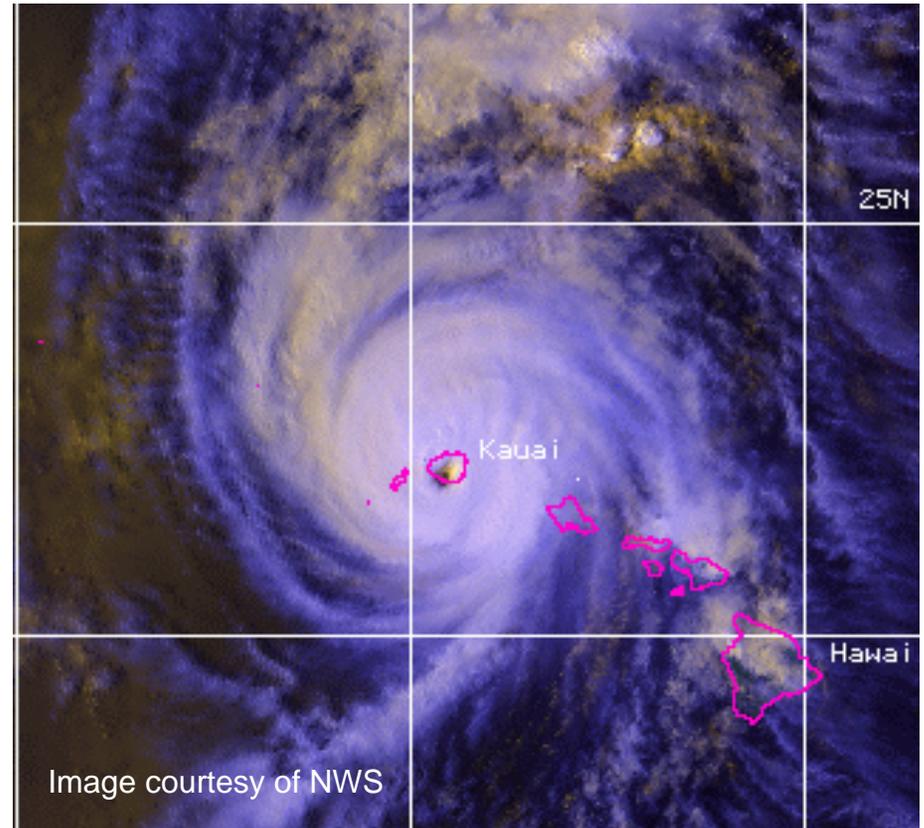
What if a Category-4 Hurricane Came Onshore at Ewa?

Kwok Fai Cheung, PhD, PE  
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University of Hawaii at Manoa

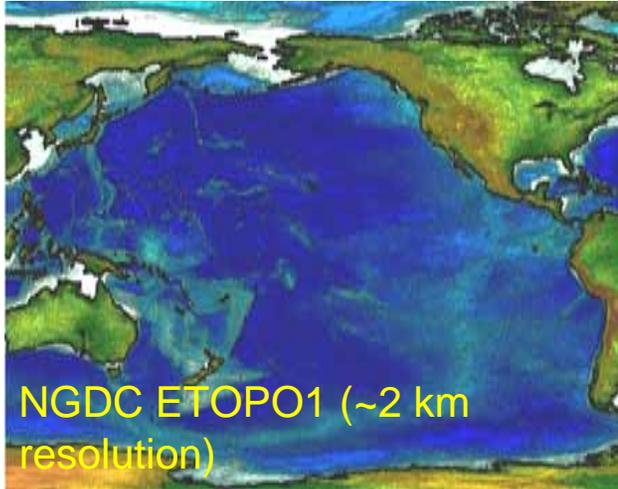
Climate Change Transportation Vulnerability Workshop  
Honolulu, Hawaii  
March 8, 2011

# Ocean Responses to Tropical Cyclones

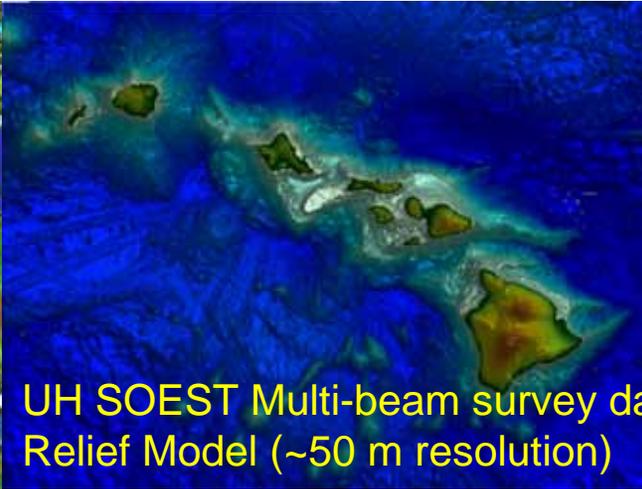
- Barometric tide due to pressure drop
- Wind setup at shores
- Storm waves: 12 – 16 sec waves of up ~30 m high generated by winds
- Coastal wave processes: wave breaking, setup, and swashing/runup
- What is storm surge?
- What do you need for planning and emergency management?



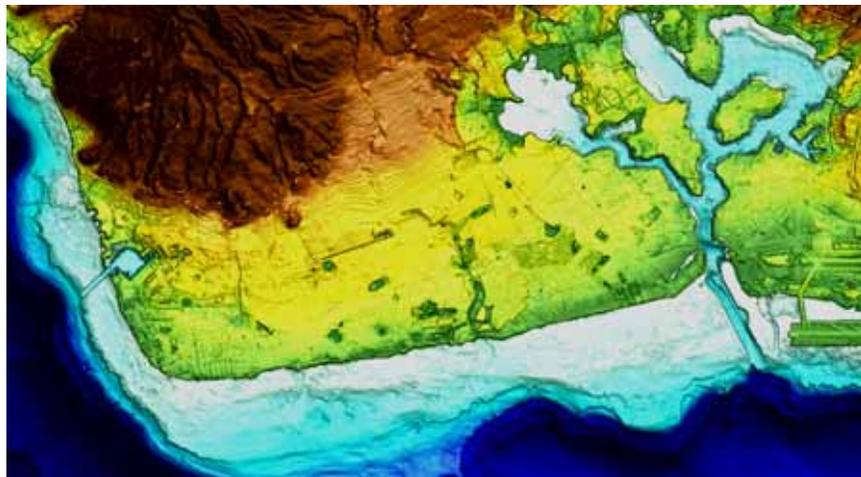
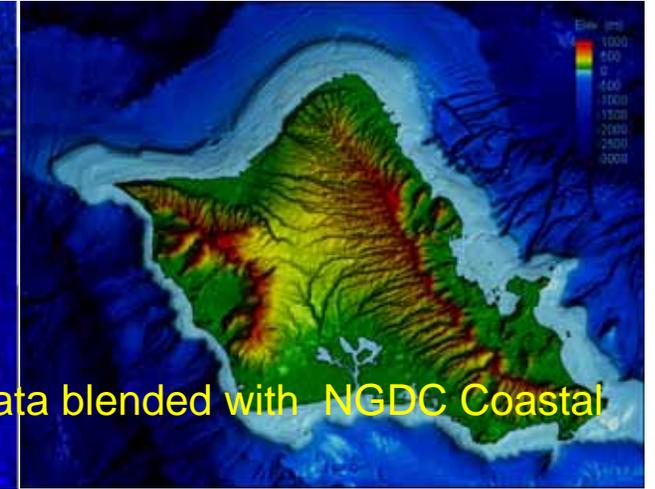
# Digital Elevation Model



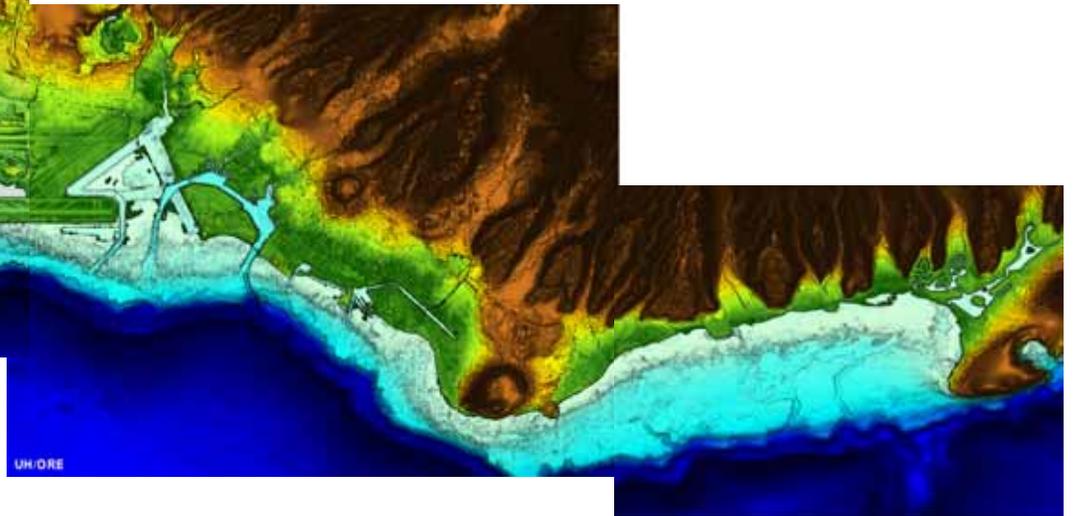
NGDC ETOPO1 (~2 km resolution)



UH SOEST Multi-beam survey data blended with NGDC Coastal Relief Model (~50 m resolution)



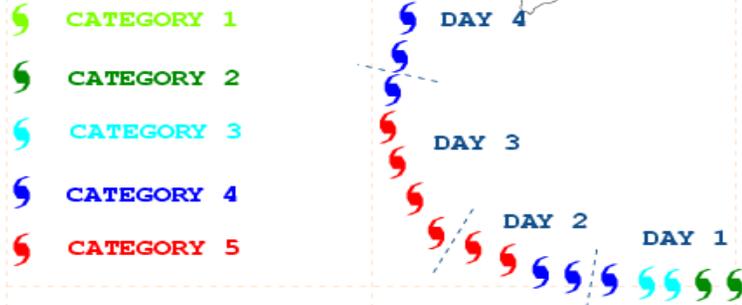
NOAA, FEMA & USACE LiDAR from -40 to 15 m elevation blended with USGS NED (1~2 m resolution)



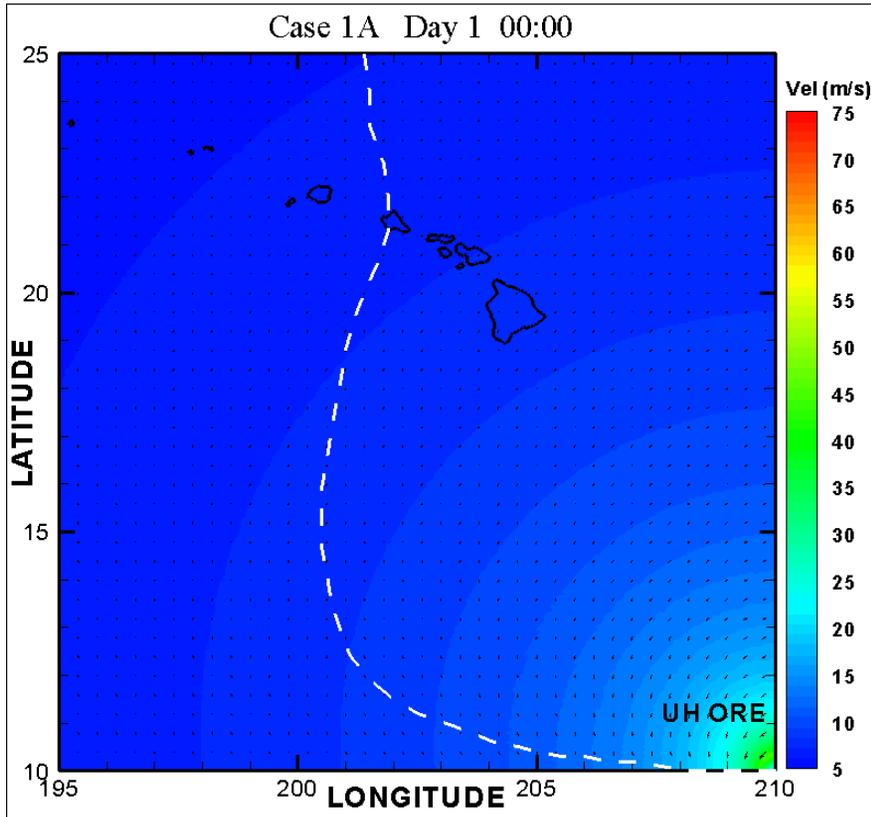
UH ORE

## Case 1A from NWS CPHC

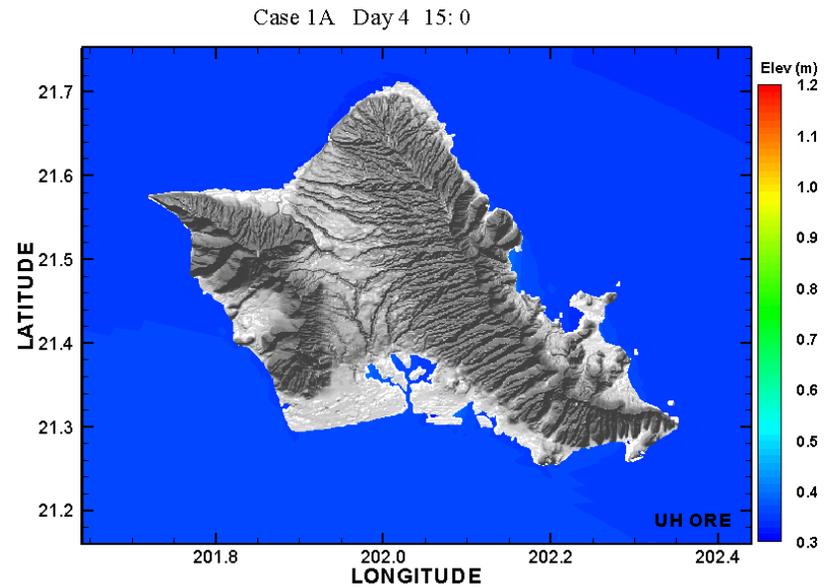
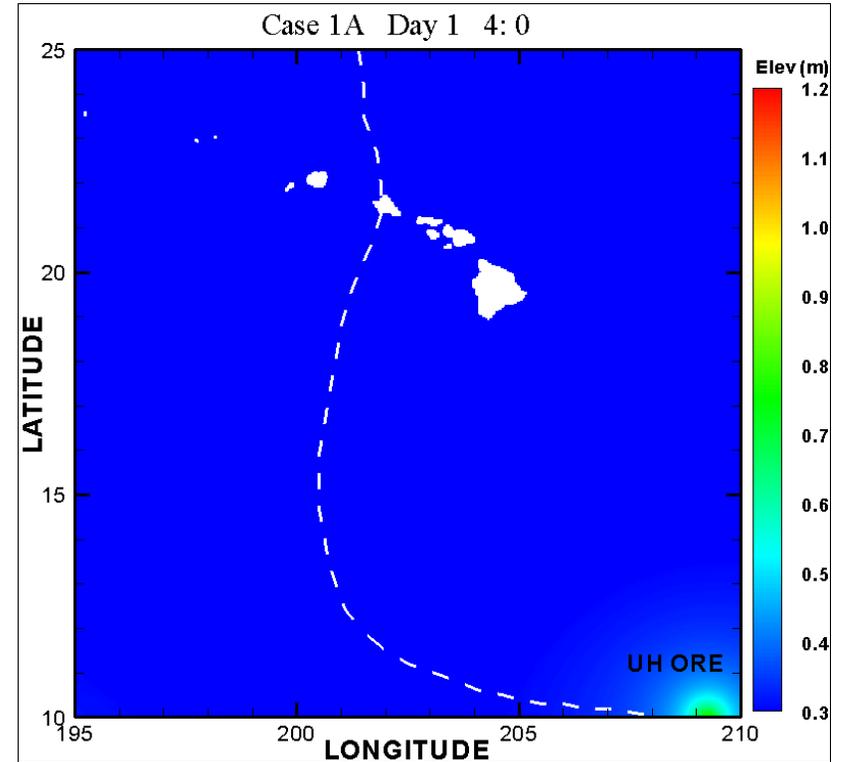
- Hurricane Iniki 1992 rerouted to Oahu
- Present sea level at high tide



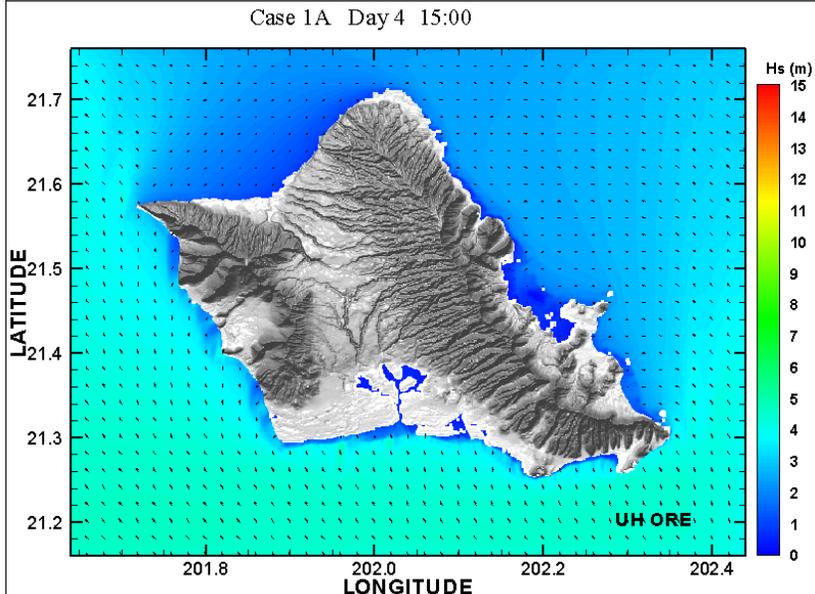
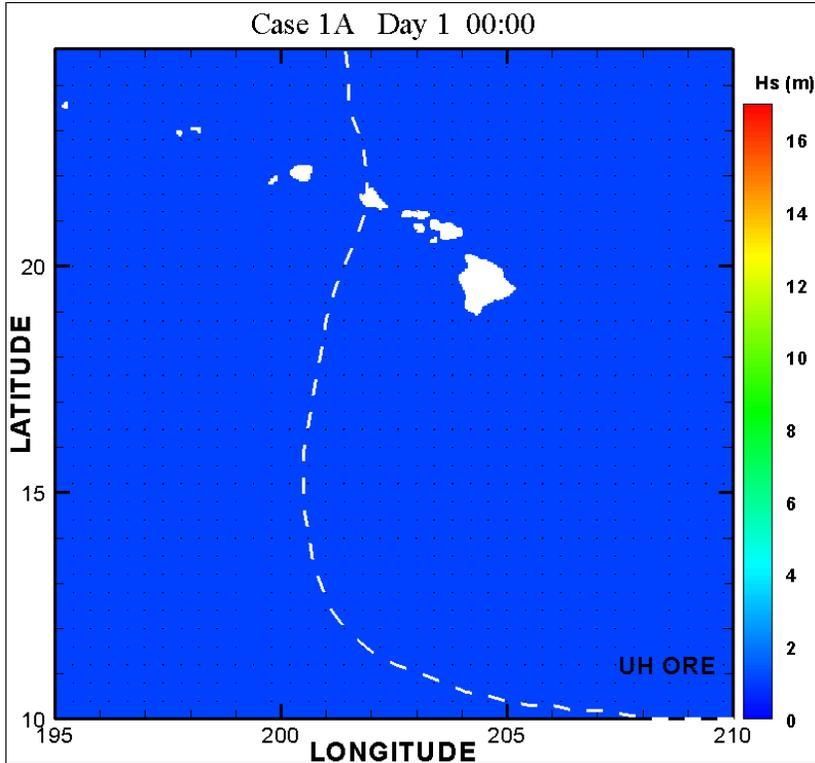
## Parametric Wind Field



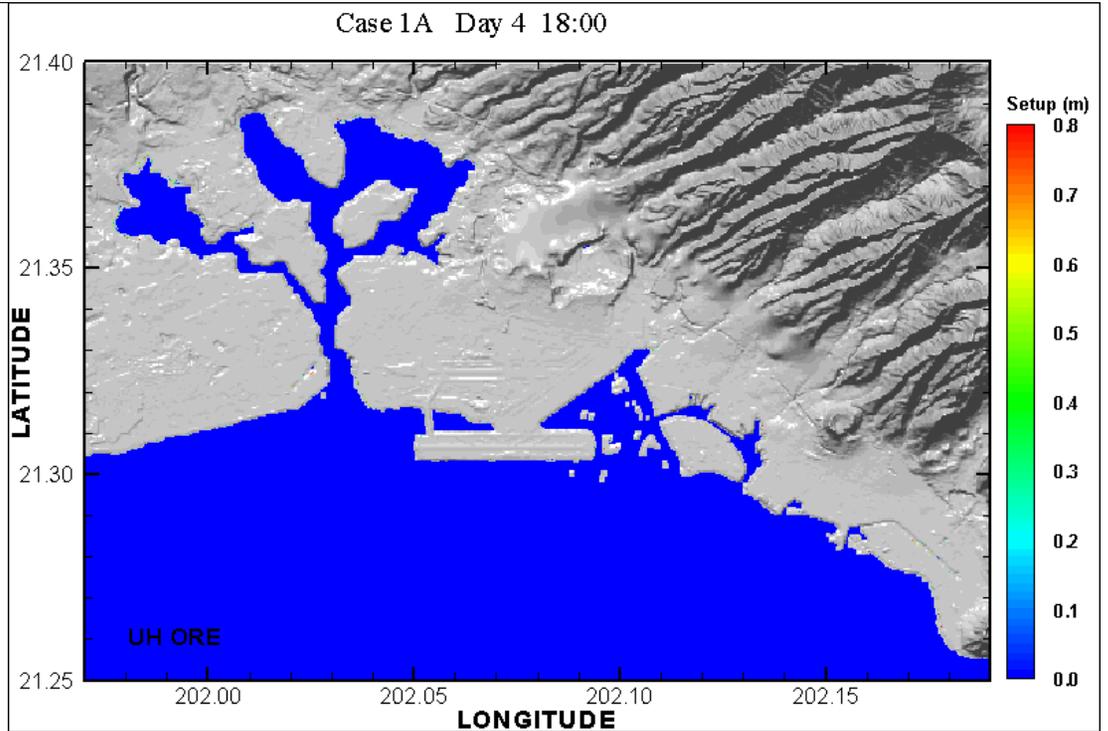
## Storm Surge and Water Level



# Hurricane Wave Energy



# Wave Setup

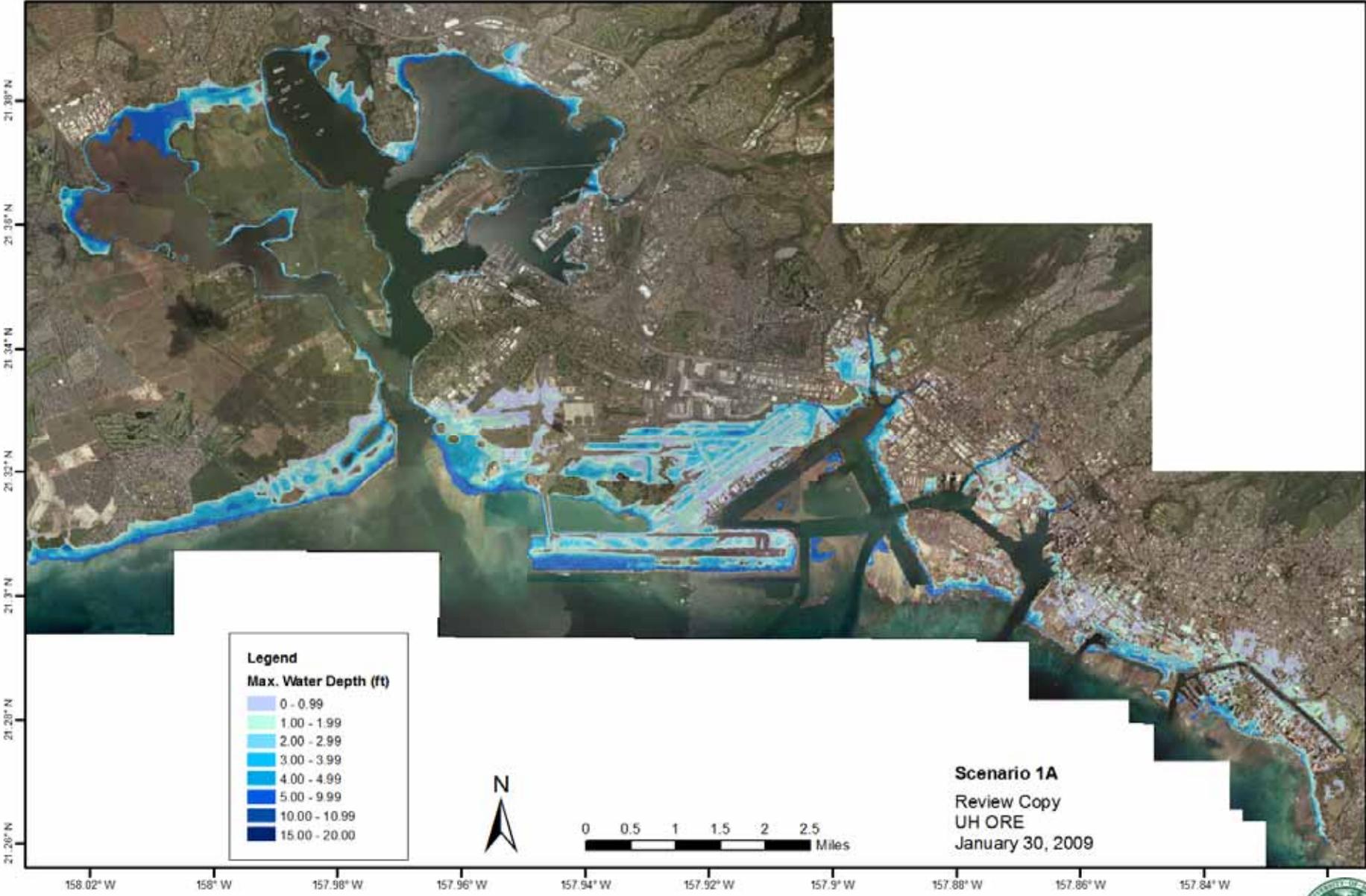


CASE 1A	Hs (m)	Tp (s)	Setup	Surge	SWL
Pearl Harbor	6.12	15.0	0.6	1.25	1.85
Honolulu Harbor	6.08	13.7	0.7	1.05	1.75
Waikiki	6.05	13.7	0.7	0.90	1.60

# Hurricane Scenario 1A Wave Activity

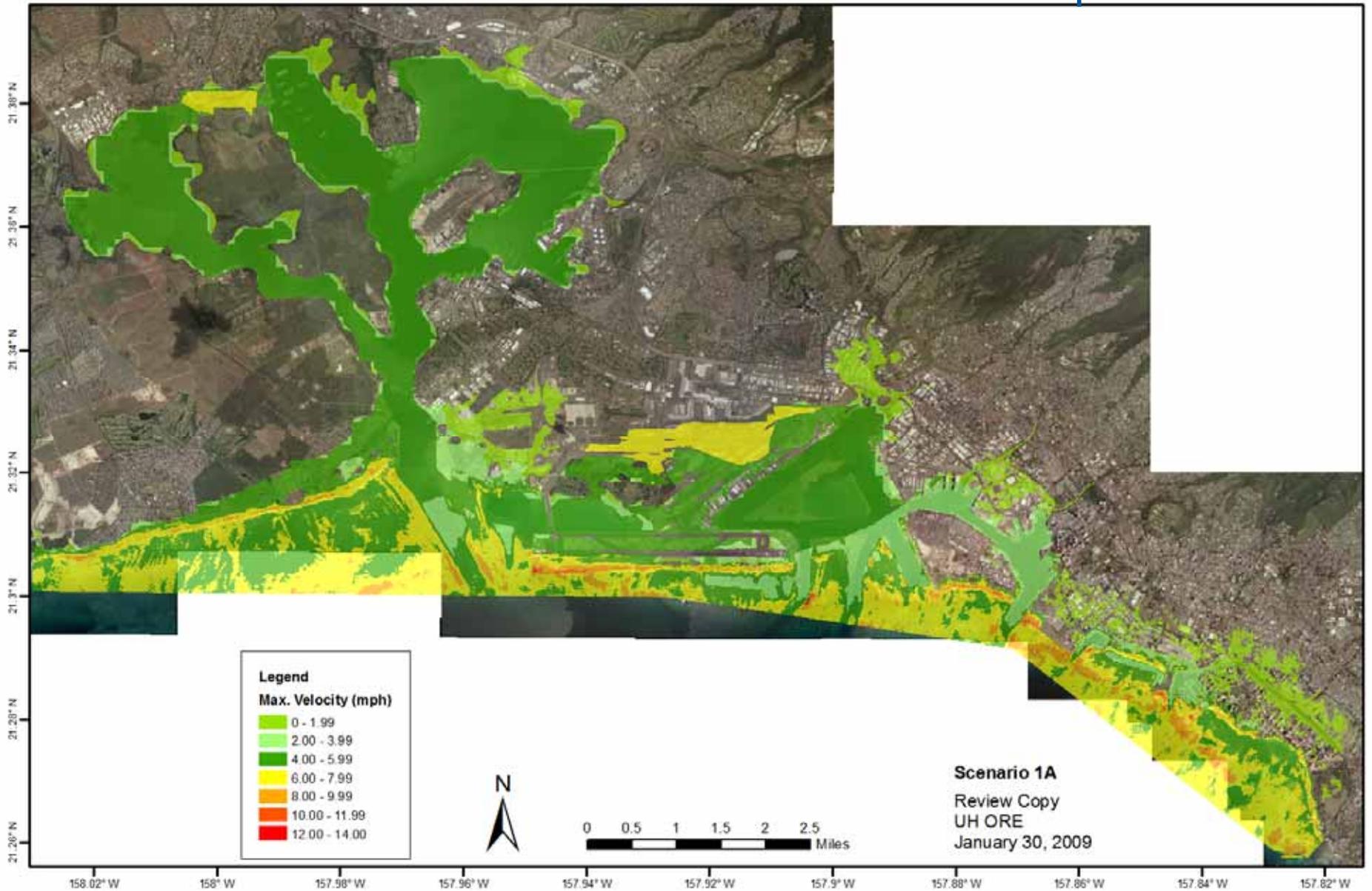


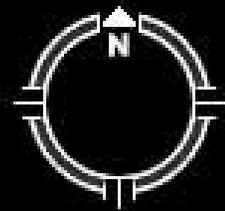
# Hurricane Scenario 1A: Maximum Flow Depth



# Hurricane Scenario 1A: Maximum Flow Speed

1A





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## Concluding Remarks and Future Work

Computer modeling is an indispensable tool in coastal flood hazard assessment.

Computer models are not perfect and must be operated and the data interpreted by experienced personnel.

NOAA Coastal Storm Program will fund mapping of storm-induced and tsunami inundation at projected sea levels.

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Future presentation: *What if a Category 4 Hurricane Came Onshore at Ewa When the Sea Level is 1 m Higher?*