



# *Nearshore Wave Prediction System*

André van der Westhuysen<sup>1,2</sup>

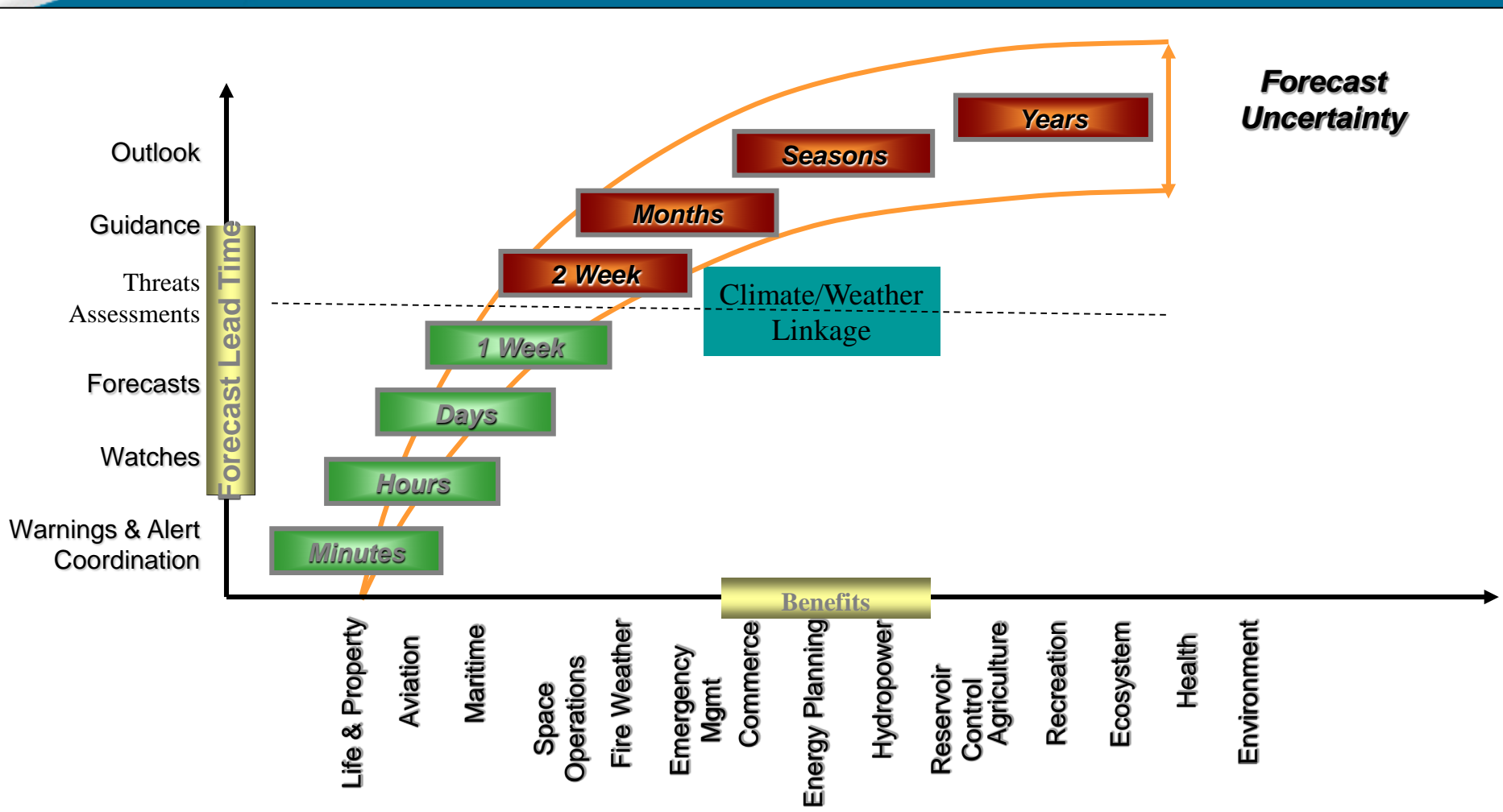
<sup>1</sup>*NOAA / National Weather Service  
National Centers for Environmental Prediction*

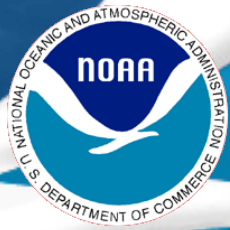
<sup>2</sup>*I.M Systems Group, Rockville, MD*





# Intro: Seamless Suite of Weather Forecast Products



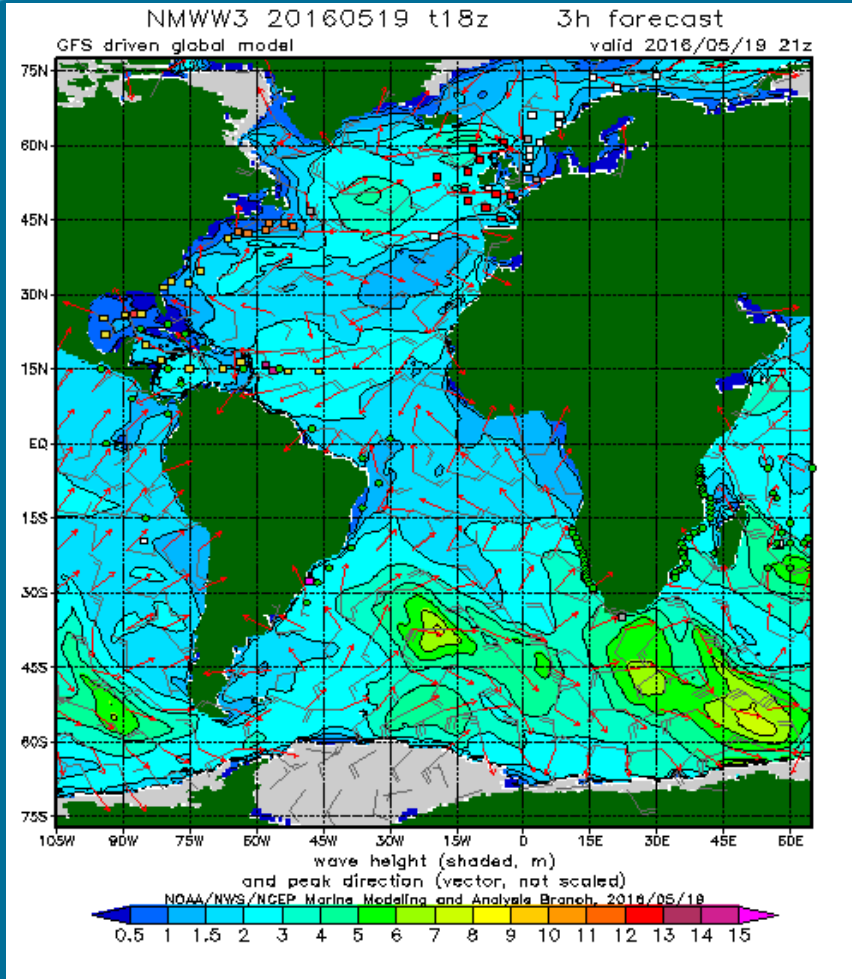


# Data types and access

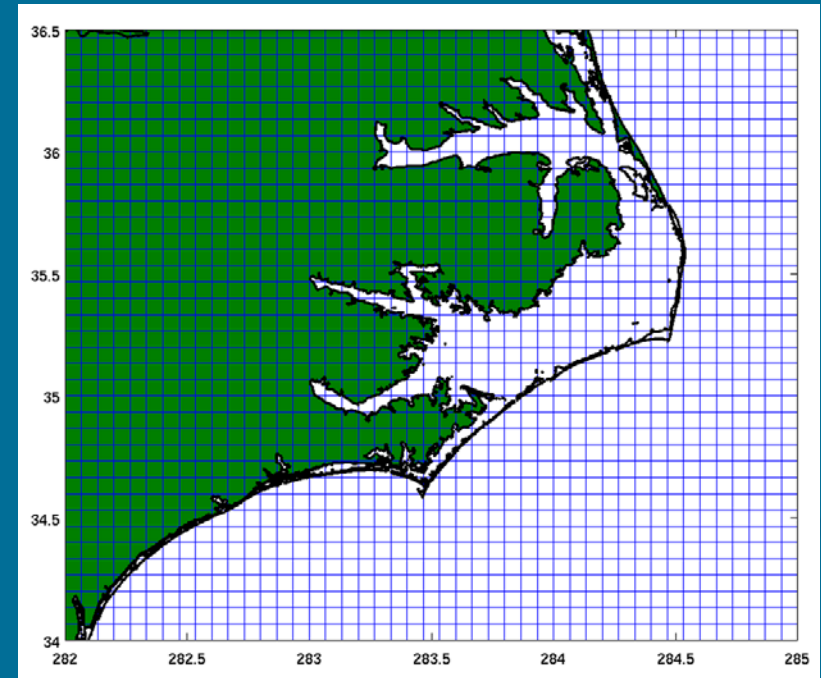
- High-resolution (5 km – 200 m) fields of:
  - Official forecast wind field
  - Significant wave height
  - Mean wave direction
  - Mean wave period
  - Global model current fields
- Fields of individual wave systems
- Future: Rip Current and Erosion/Overwash hazards
- Example viewer: NWPS validation viewer
- Data access:  
<ftp.ncep.noaa.gov/pub/data/nccf/com/nwps/prod/>



# Ocean waves and Coastal downscaling

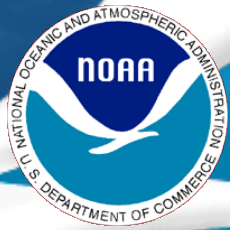


## Coastal application

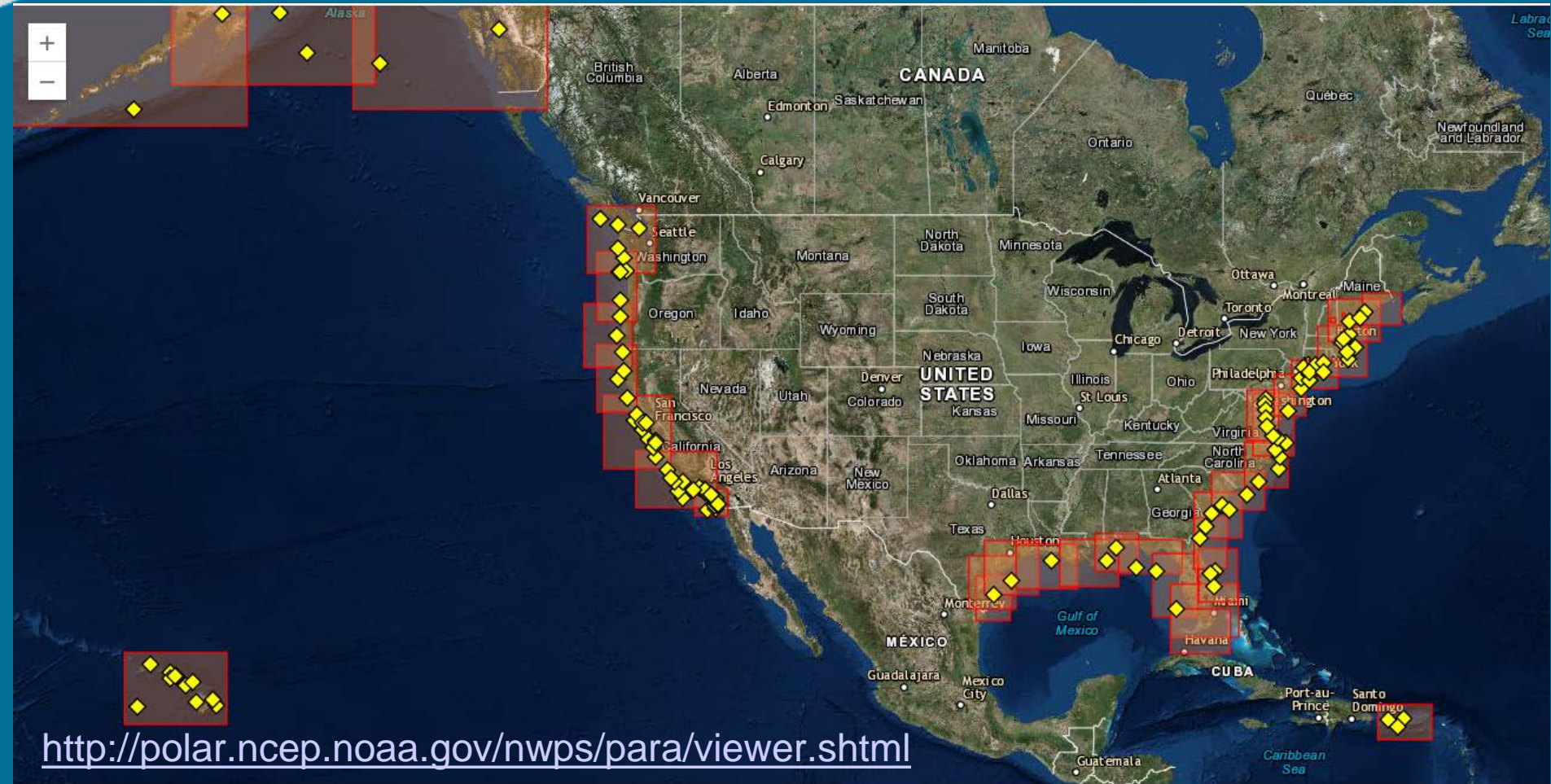


- *Desired resolution: 1.8 km - 200 m*
- *Hourly output, out to 6 days*
- *Forecaster consensus wind forcing*





# Nearshore Wave Prediction System SWAN-based operational coastal wave model

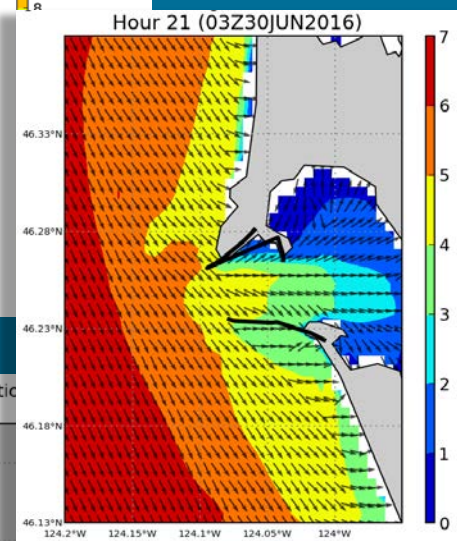
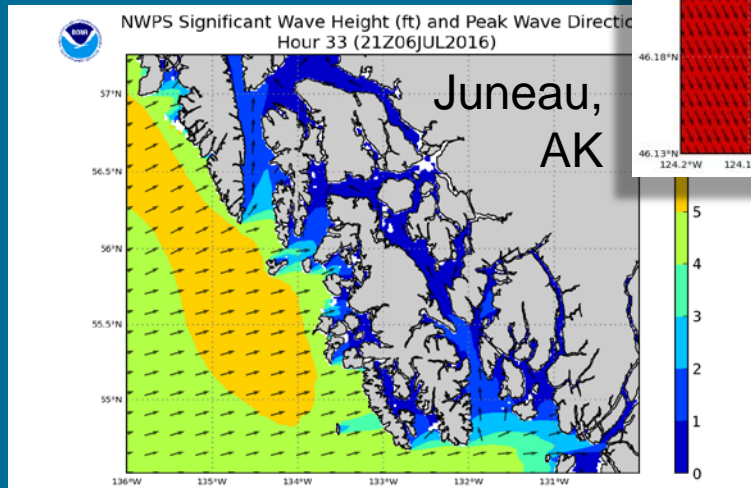
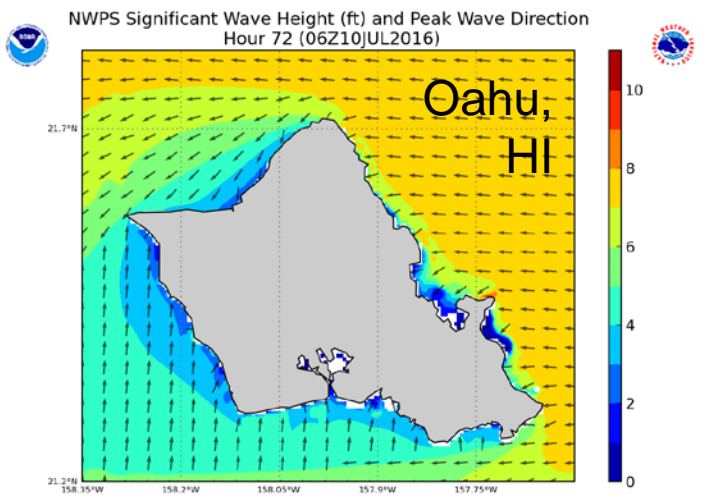
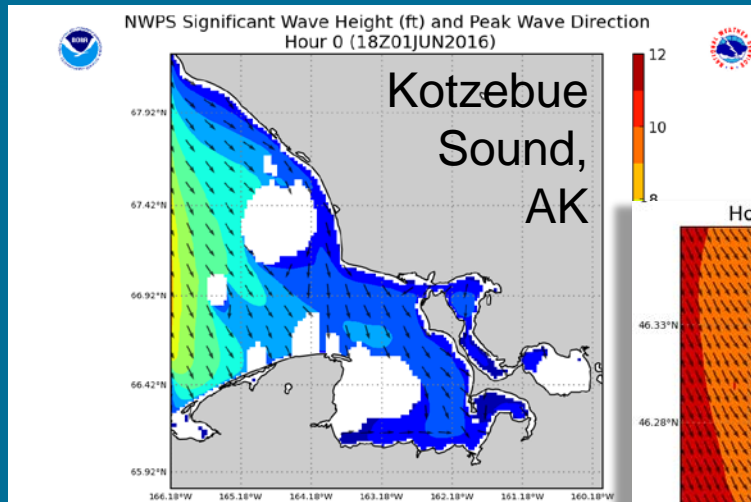
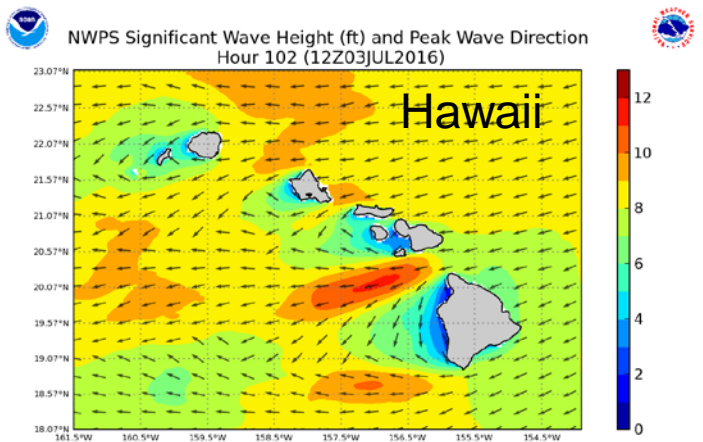


<http://polar.ncep.noaa.gov/nwps/para/viewer.shtml>





# Example NWPS output



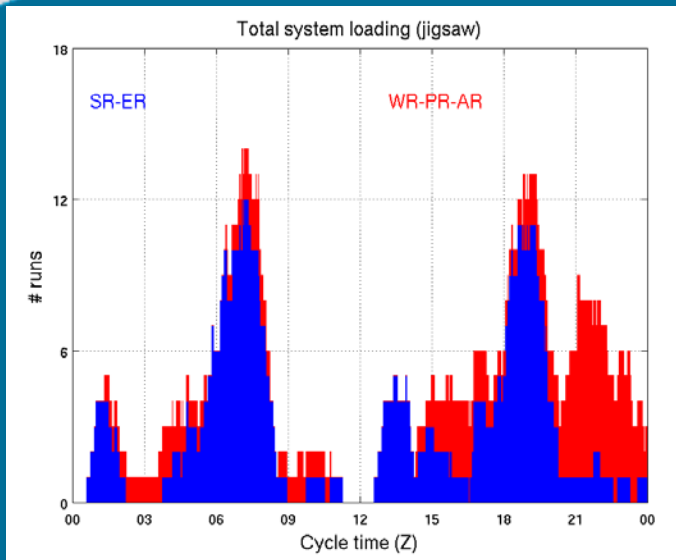
Columbia  
River  
Mouth,  
OR





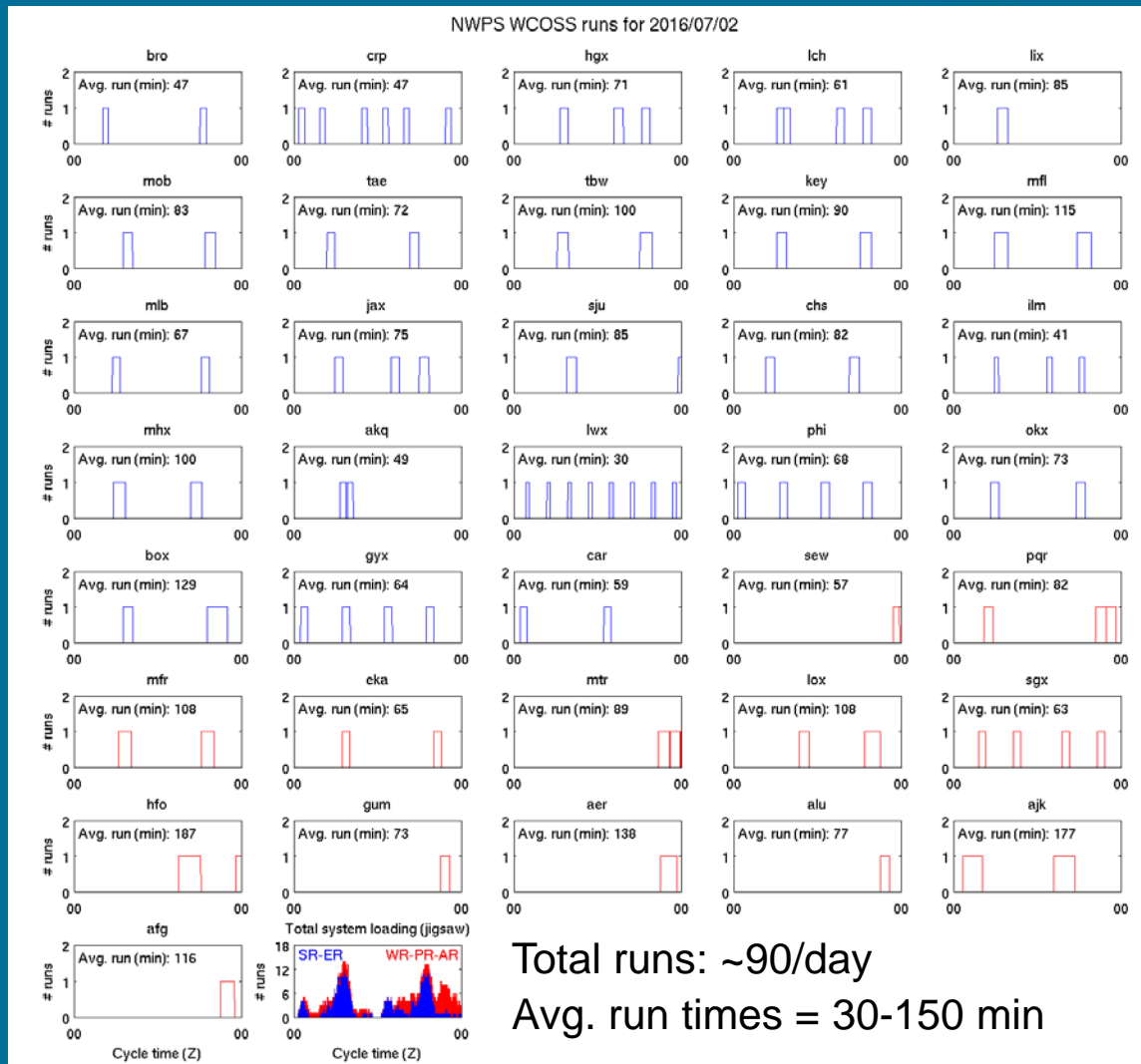


# On-demand run triggering



**Blue: Southern and Eastern Regions**

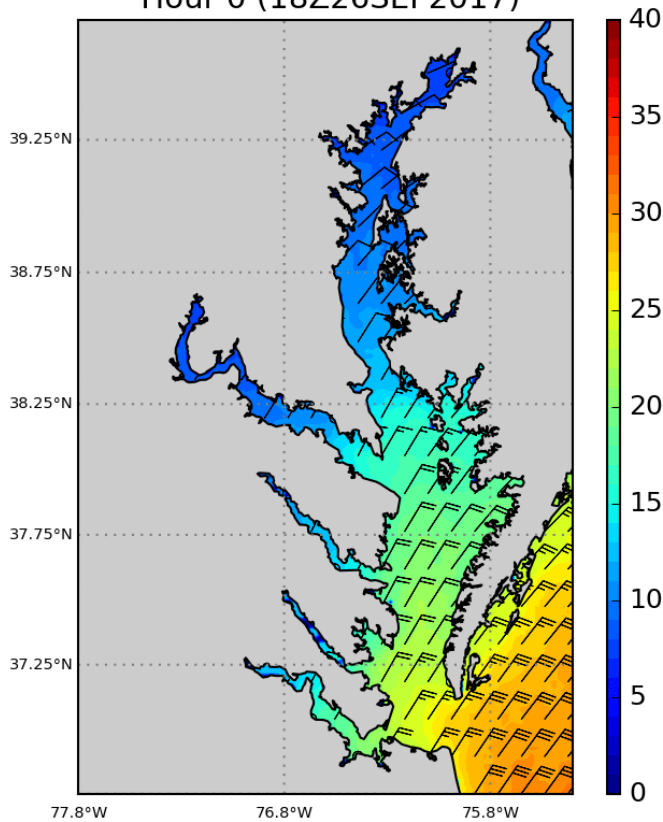
**Red: Western, Pacific and Alaska Regions**



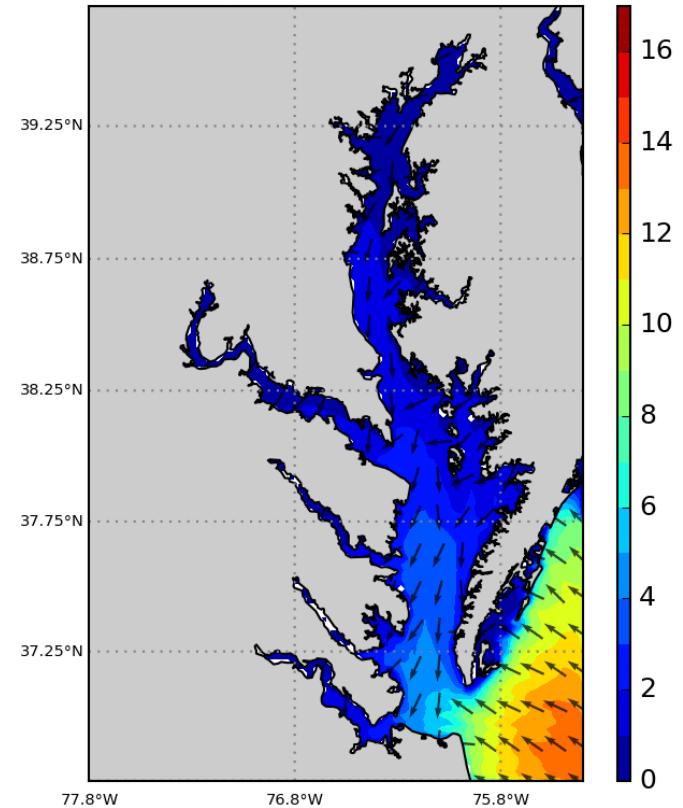


# Example output: Baltimore/Washington Forecast wind field, generated wave field

NWPS Wind (knots)  
Hour 0 (18Z26SEP2017)



NWPS Significant Wave Height (ft) and Peak Wave Direction  
Hour 0 (18Z26SEP2017)



<http://polar.ncep.noaa.gov/nwps/>



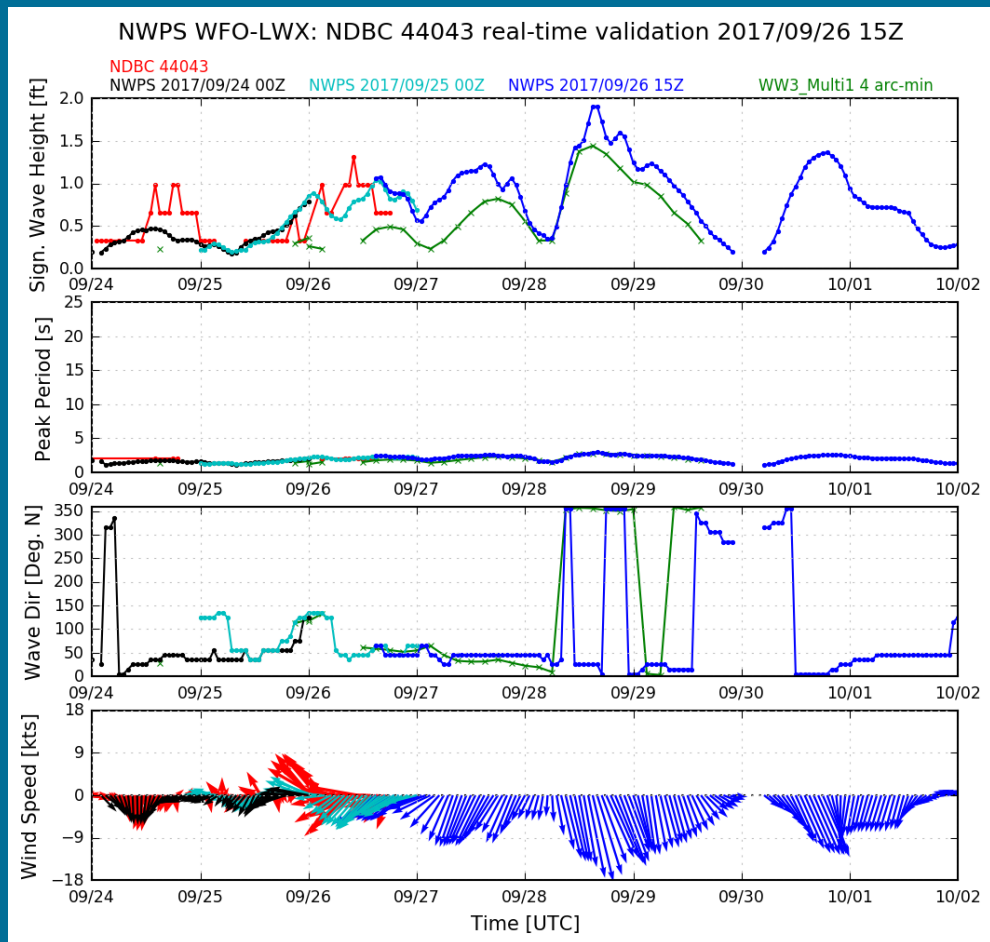




# Validation: Baltimore/Washington Patapsco, MD



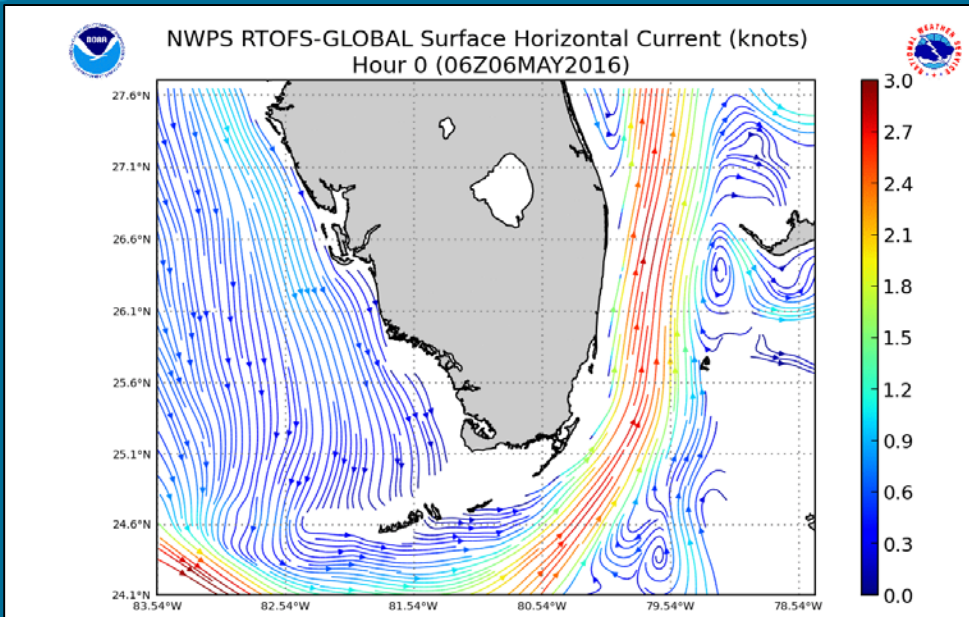
NWPS Nearshore Wave I





# Wave-current interaction

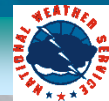
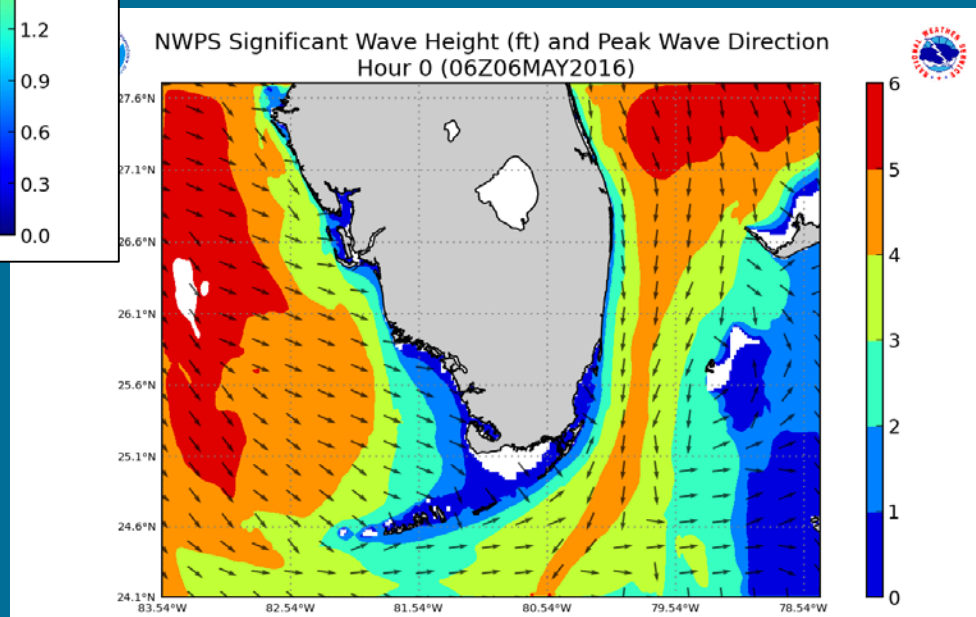
## Example: Miami, FL

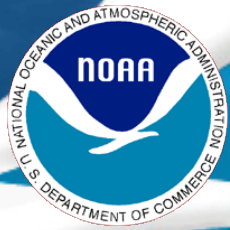


Surface currents from NOAA's global circulation model RTOFS

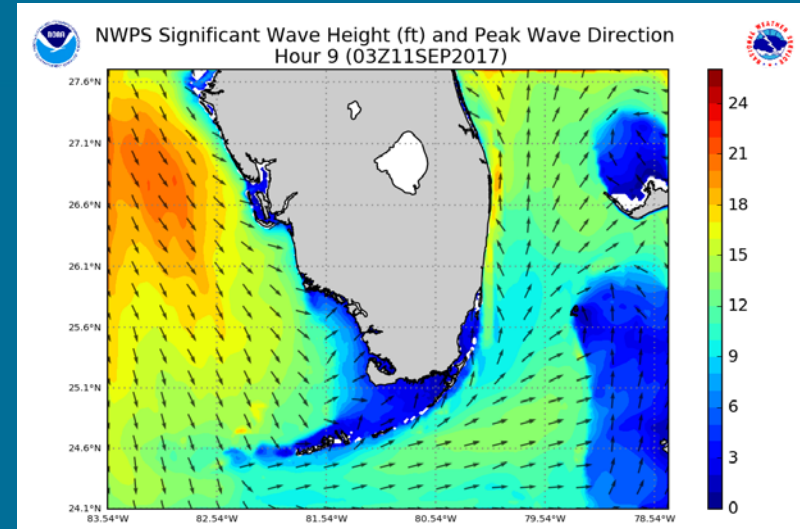
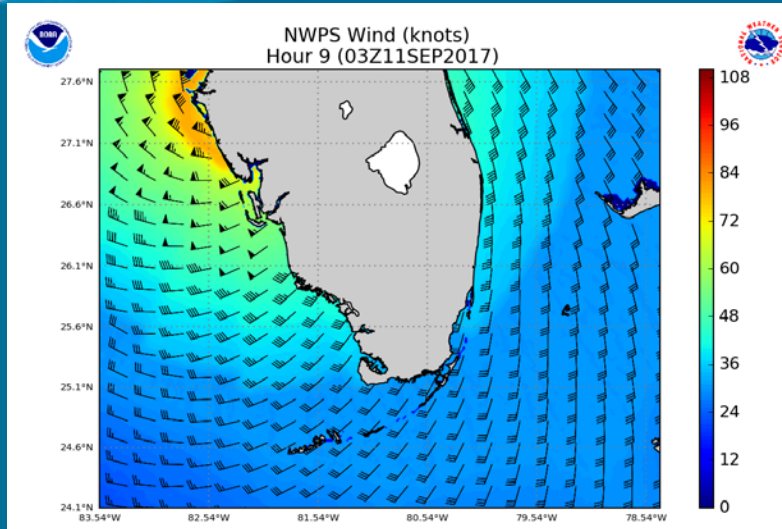
<http://polar.ncep.noaa.gov/nwps/>

## Coastal wave response



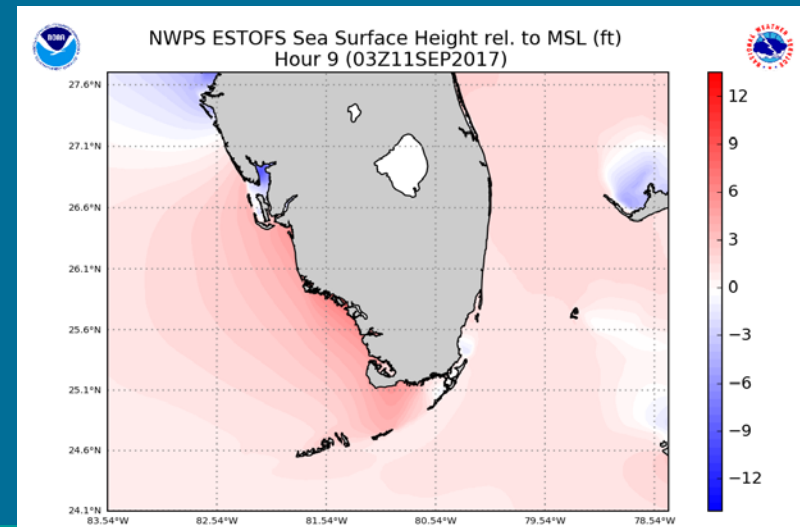


# Inclusion of tide and surge water levels Hurricane Irma (2017/09/11)



Hurricane wind field

Tide + wind surge  
(ESTOFS model)





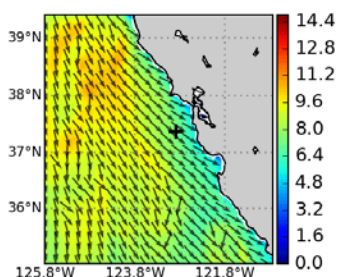


# Dealing with complexity: Wave systems

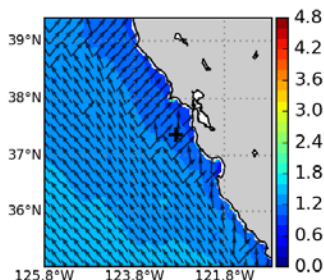
## ML clustering, e.g. Monterey, CA (2 systems)

NWPS Wave Systems: Top: Hs (ft) and Dir; Bottom: Tp (s) and Dir  
Hour 0 (06Z24SEP2017), SC = 0.65 (0.28/6)

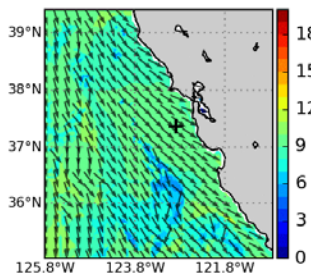
\*\*\* EXPERIMENTAL - NOT FOR OPERATIONAL USE \*\*\*



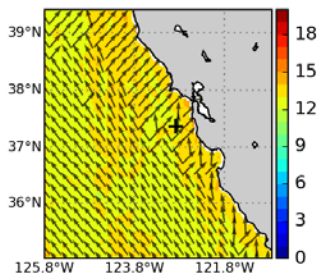
Hs,  
sys1



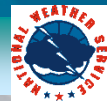
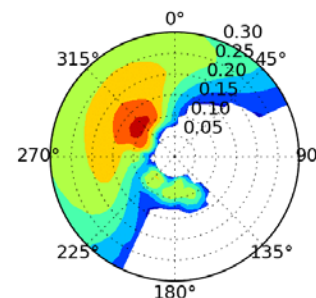
Hs,  
sys2



Tp,  
sys1



Tp,  
sys2



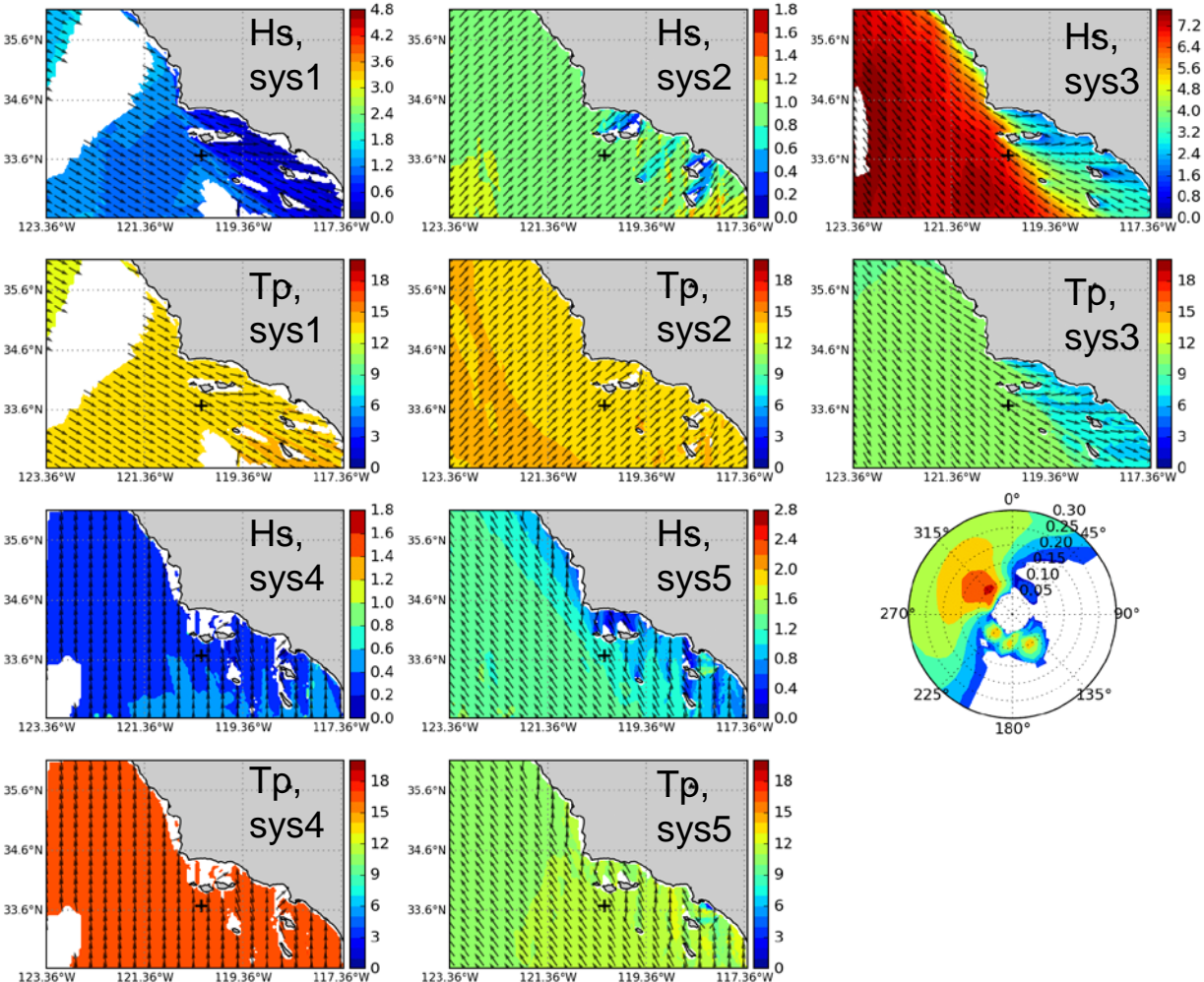




# Dealing with complexity: Wave systems ML clustering, e.g. Los Angeles, CA (5 systems)

NWPS Wave Systems: Top: Hs (ft) and Dir; Bottom: Tp (s) and Dir  
Hour 0 (18Z23SEP2017), SC = 0.71 (0.76/6)

\*\*\* EXPERIMENTAL - NOT FOR OPERATIONAL USE \*\*\*





# Future: Erosion/overwash guidance Hurricane Irma (2017/09/11)



## Total Water Level and Coastal Change Forecast Viewer



Regions Favorites

Information Show Most Recent Forecast Select Forecast Date

- selected site
- dune impacts unlikely
- potential dune erosion
- potential overwash
- potential inundation

3 km

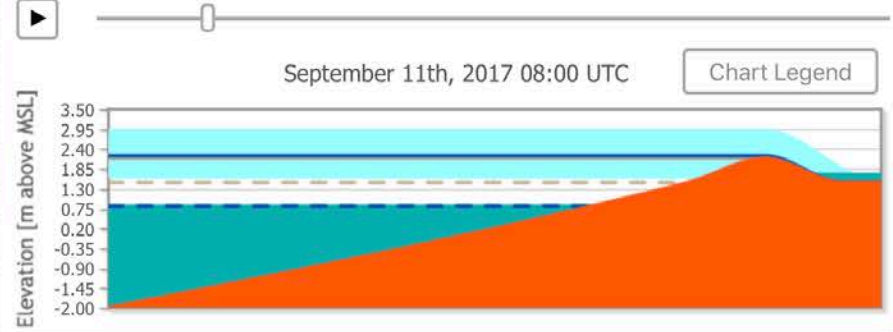
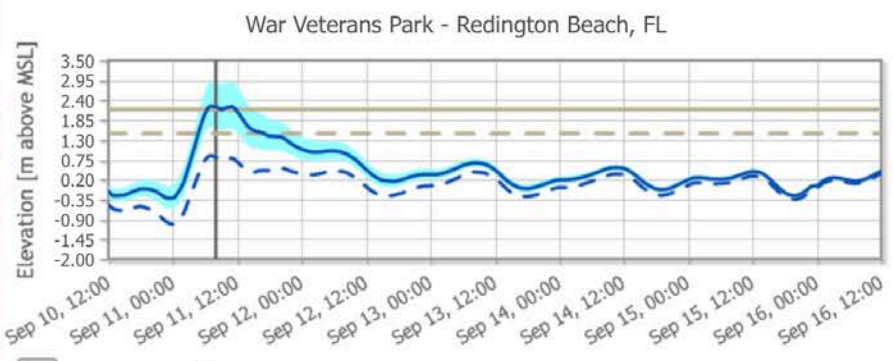
Leaflet | © Esri, DigitalGlobe, Earthstar Geographics, CNES/Airbus DS, GeoEye, USDA FSA, USGS, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Regional Coastal Change Forecast

Potential Inundation - 19 Site(s)

Potential Overwash - 307 Site(s)

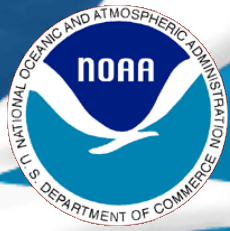
Potential Dune Erosion - 127 Site(s)



Time of Peak TWL [UTC]	Tide + Surge @ Peak TWL [m]	Wave runup @ Peak TWL [m]	Peak TWL [m]	Dune Toe Elev. [m]	Dune Crest Elev. [m]
09-11-2017 07:00	0.24	1.99	2.23	1.47	2.14

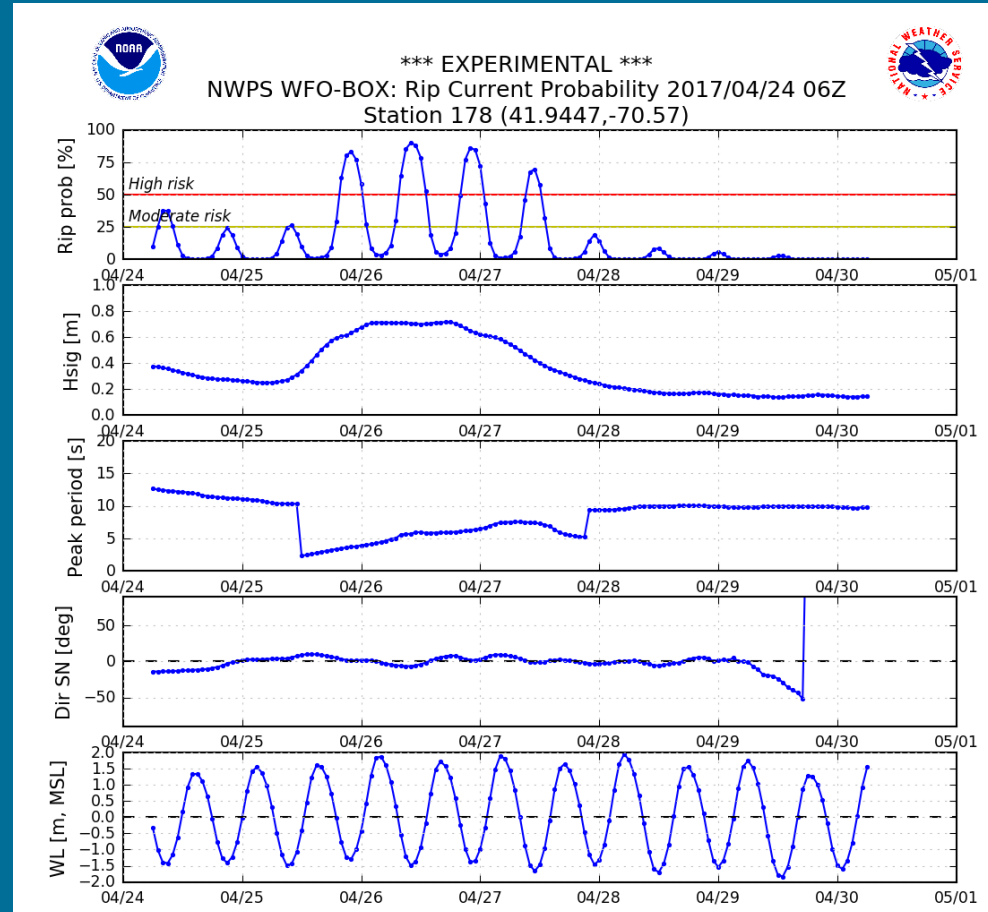
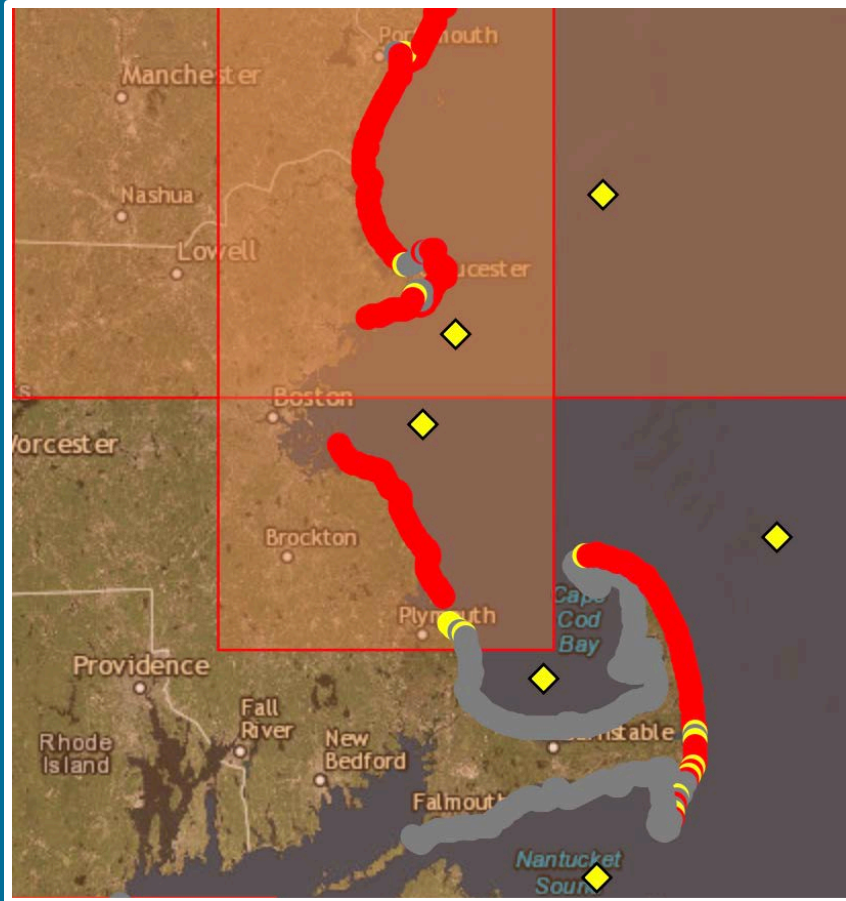






# Future: Rip Current guidance

## Example Cape Cod/Boston, MA



<http://polar.ncep.noaa.gov/nwps/para/viewer.shtml>





# Summary

1. Nearshore Wave Prediction System provides on-demand, high-resolution wave model output. Spatial resolution: 2 km – 200 m. Temporal resolution: Hourly, out to 6 days.
2. Coverage for all of Continental US, Alaska, Hawaii and Puerto Rico.
3. Wave model takes into account official forecast winds, offshore surface currents, tide & surge water levels.
4. Output includes basic wave parameters, wave systems, and in future rip current and erosion/overwash guidance.
5. Model visualizations at (non-operational): [polar.ncep.noaa.gov/nwps/viewer.shtml](http://polar.ncep.noaa.gov/nwps/viewer.shtml)
6. **Contact:** [Andre.VanderWesthuysen@noaa.gov](mailto:Andre.VanderWesthuysen@noaa.gov).