

Experimental NWS Coastal Waters Forecast With Wave Detail

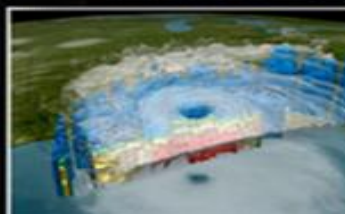
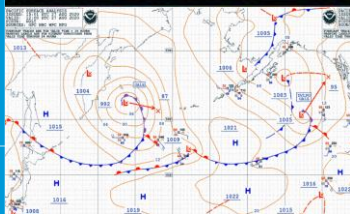
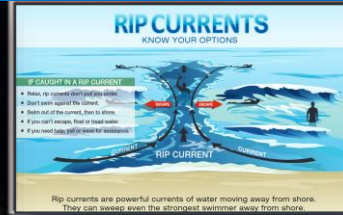
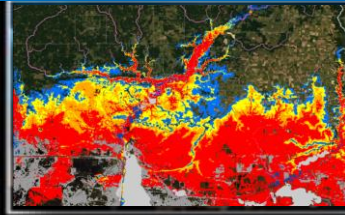
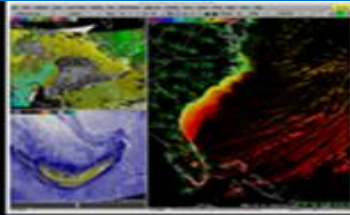
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Special Thanks: Matt Scalora (ILM), Jeff Lorens (WRH), Darren Wright (NOS) and the NWS National Wave Team



NOAA
National
Weather
Service





NWS National Wave Team



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Building off a Pilot Project at NWS ILM (2020) – Why Did We Do This?



Waves have three fundamental variables: height, period, direction.



Very common to have coexisting waves at any point in the ocean, all with unique heights, periods, and directions.



Each one of those may be of interest to a particular mariner (examples to come). In addition, each wave group may pose different impacts on vessel behavior and surf zone hazards.



We're currently oversimplifying by only providing a combined sea state variable – “significant wave height”.



Height, Period, and Direction Critical to Diagnose This Hazard



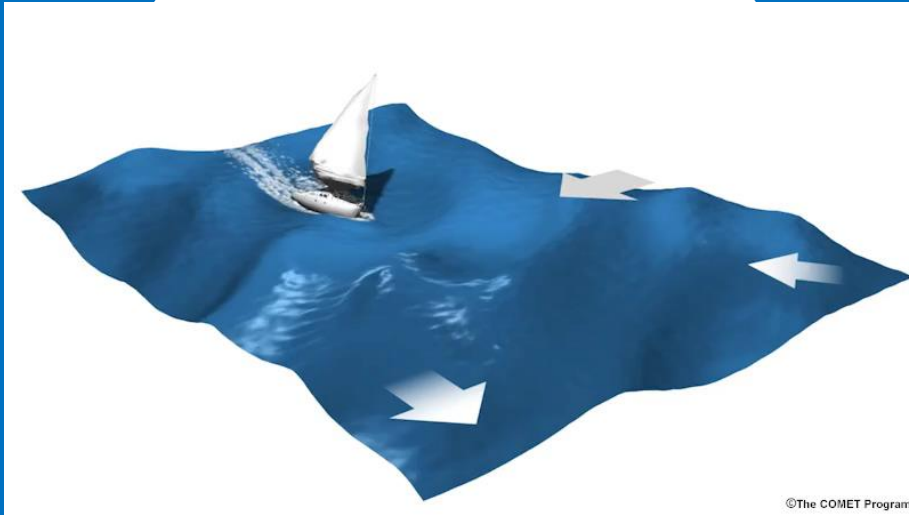
- **Current forecast format:
Seas 8-10 ft.**
 - Mariner – “Seems dangerous, but I got this. I have a big boat.”
- **Proposed forecast format:
SW 8-10 ft at 22 sec.**
 - Mariner – “Uh oh, that is coming at me? That can produce 20 ft breaking waves! I’m not going anywhere near that inlet.”

Height, Period, Direction Also Critical to Determine This Hazard (Steep, Choppy Waves)



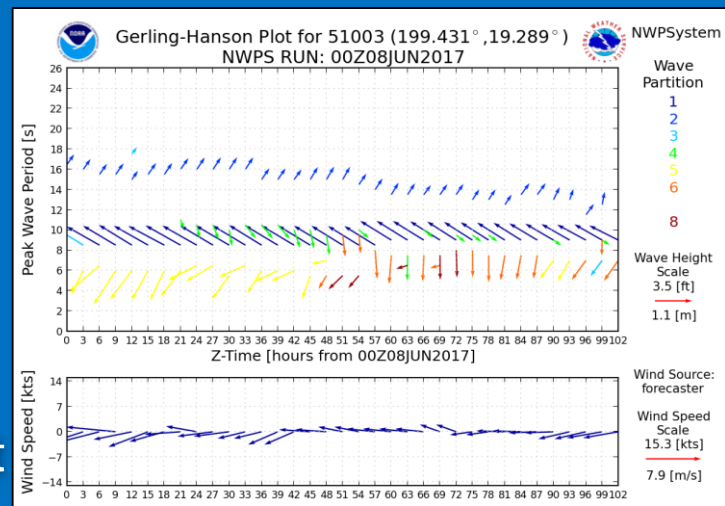
- **Current forecast format:**
Seas 2-3 ft.
 - Mariner – “That might not be that bad.”
- **Proposed forecast format:**
NE 2-3 ft at 4 sec.
 - Mariner – “I have a flat bottom boat, no way I’m going out in those short period seas.”

Multiple Coexisting Wave Groups: A Common Occurrence



Can You Imagine If...

- We gave a wind speed forecast but no wind direction?
 - Winds 20-30 kts
- Or maybe only providing mean daily temperature instead of high and low.
 - These things go hand in hand and are fundamental to producing a complete forecast.
- For waves - **height, period, and direction** of the main wave systems present are fundamental to producing a complete forecast.
- Leaving this information out of the forecast is over-simplifying the sea state.





What About “Wind Wave” and “Swell”?



- Most West Coast and Hawaii offices provide “Wind Wave” and “Swell” terms in their CWF.



- However, they do not include all of the vital height, period and direction information.



- The experiment adds that info to allow us to focus on how waves occur in nature, and utilize the full suite of guidance from the NWPS model.

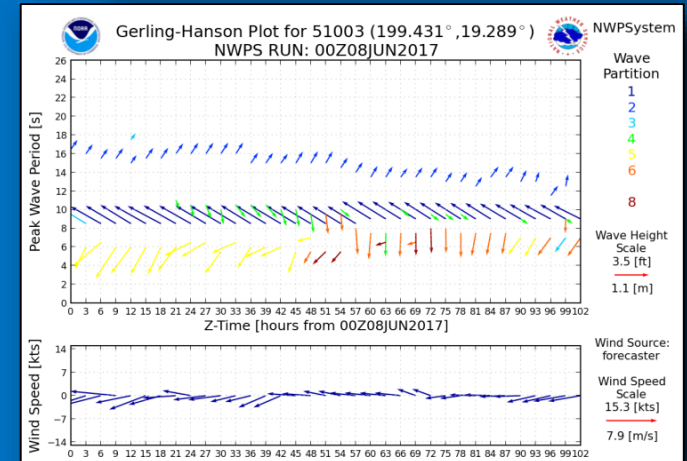
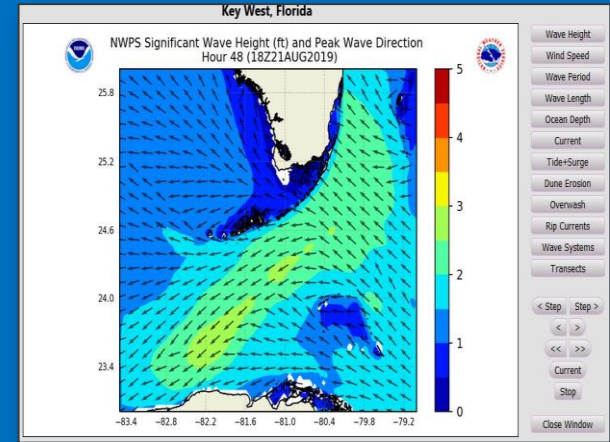


- We’ve also added Significant Wave Height, to allow users to quickly compare the forecast to what is being observed by buoys.



NWPS Gives Us a Leg Up

- High resolution wave forecasts run on demand using GFE winds and WW3 boundary conditions
- Outputs all the wave systems to give mariners wave height, period, and direction forecast information





Proposed New CWF Format for Waves



- **From:** Seas 5 to 7 feet.



- **To:** Seas 5 to 7 ft. Wave Detail: NE 6 ft at 5 seconds and SE 3 ft at 15 seconds.



Common East Coast Example





Proposed New CWF Format for Waves



- **From:** W swell 5 feet. Wind Waves around 3 ft.



- **To:** Seas 4 to 6 ft. Wave Detail: W 5 ft at 20 seconds and S 3 ft at 4 seconds.



Common West Coast Example





Proposed New CWF Format for Waves



Significant Wave Height
(optional range)



- Seas 5 to 7 ft, occasionally to 9 ft. Wave Detail: NE 5 ft at 5 seconds and SE 2 ft at 13 seconds.
- **Note:** Optional range in significant wave height, if meaningful. Use standard deviation to determine if range is necessary.





Proposed New CWF Format for Waves



Optional Occasional Waves



- Seas 5 to 7 ft, occasionally to 9 ft. Wave Detail: NE 5 ft at 5 seconds and SE 2 ft at 13 seconds.



- **Note:** If waves hit a certain threshold (average of the highest 1/10) then the formatter will include **occasional waves**, as in the example above.





Proposed New CWF Format for Waves



- Seas 5 to 7 ft, occasionally to 9 ft. Wave Detail: NE 5 ft at 5 seconds and SE 2 ft at 13 seconds.



First wave system



Note: All possible combinations of two wave systems are scanned to potentially combine (Pythagorean theorem) based on having similar period and direction.



Wave systems are ordered by their wave energy: $[\text{Height(m)}^2 \times \text{Period(s)}]$ - highest first.





Proposed New CWF Format for Waves



- Seas 5 to 7 ft, occasionally to 9 ft. Wave Detail: NE 5 ft at 5 seconds and SE 2 ft at 13 seconds.




Second wave system



Note: If only one main wave system exists, you'd only include one. Currently providing up to 2 wave groups in the Atlantic Basin, up to 3 on the West Coast and up to 4 in Hawaii.



NWS Webpage Comparison

Original Coastal Waters Forecast

AMZ354-260815-
Waters from Savannah GA to Altamaha Sound
GA out 20 NM, including
Grays Reef National Marine Sanctuary-
315 PM EDT Wed May 25 2022

.TONIGHT...SE winds 10 to 15 kt. **Seas 2 to 3 ft.**
.THU...SE winds 10 to 15 kt. **Seas 2 to 3 ft.**
.THU NIGHT...S winds 15 to 20 kt. **Seas 3 to 4 ft.**
A chance of showers and tstms after midnight.

New Coastal Waters Forecast with Wave Detail

AMZ354-260800-
Waters from Savannah GA to Altamaha Sound
GA out 20 NM, including
Grays Reef National Marine Sanctuary-
319 PM EDT Wed May 25 2022

.TONIGHT...SE winds 10 to 15 kt. **Seas 2 to 3 ft.**
Wave Detail: SE 2 ft at 8 seconds and NE 1 ft at 9 seconds.
.THU...SE winds 10 to 15 kt. **Seas 2 to 3 ft.** **Wave Detail: SE 3 ft at 5 seconds and E 1 ft at 9 seconds.**
.THU NIGHT...S winds 15 to 20 kt. **Seas 3 to 4 ft.**
Wave Detail: SE 4 ft at 5 seconds and E 1 ft at 9 seconds. A chance of showers and tstms after midnight.

NWS Formatter Comparison

Current CWF

AMZ250-032315-

Coastal waters from Surf City to Cape Fear NC out 20 nm-
1116 AM EDT Sat Aug 3 2019

.REST OF TODAY...E winds 10 kt. Seas 3 ft. A slight chance of tstms.
Showers.

.TONIGHT...E winds 10 kt, becoming NW after midnight. Seas 3 to
4 ft. A chance of showers with a slight chance of tstms in the
evening, then a slight chance of showers after midnight.

.SUN...NW winds 10 kt, becoming S in the afternoon. Seas 3 to 4 ft.
Isolated showers and tstms in the afternoon.

.SUN NIGHT...SW winds 10 kt. Seas 3 ft. A chance of showers and
tstms.

.MON...SW winds 10 kt. Seas 2 to 3 ft. A chance of showers and
tstms.

.TUE...SW winds 10 kt, increasing to 10 to 15 kt. Seas 3 to 4 ft. A
chance of showers and tstms.

.WED...SW winds 10 to 15 kt. Seas 4 to 5 ft. A chance of showers and
tstms.

CWF with Wave Detail

AMZ250-032315-

Coastal waters from Surf City to Cape Fear NC out 20 nm-
1116 AM EDT Sat Aug 3 2019

.REST OF TODAY...E winds 10 kt. Seas 3 ft. Wave Detail: SE 3 ft at
6 seconds and SE 2 ft at 10 seconds. A slight chance of tstms.
Showers.

.TONIGHT...E winds 10 kt, becoming NW. Seas 3 to 4 ft. Wave Detail:
S 4 ft at 9 seconds. A chance of showers with a slight chance of
tstms, then a slight chance of showers.

.SUN...NW winds 10 kt, becoming S. Seas 3 to 4 ft. Wave Detail: SE
4 ft at 7 seconds. Isolated tstms.

.SUN NIGHT...SW winds 10 kt. Seas 3 ft. Wave Detail: SE 3 ft at
7 seconds. A chance of tstms.

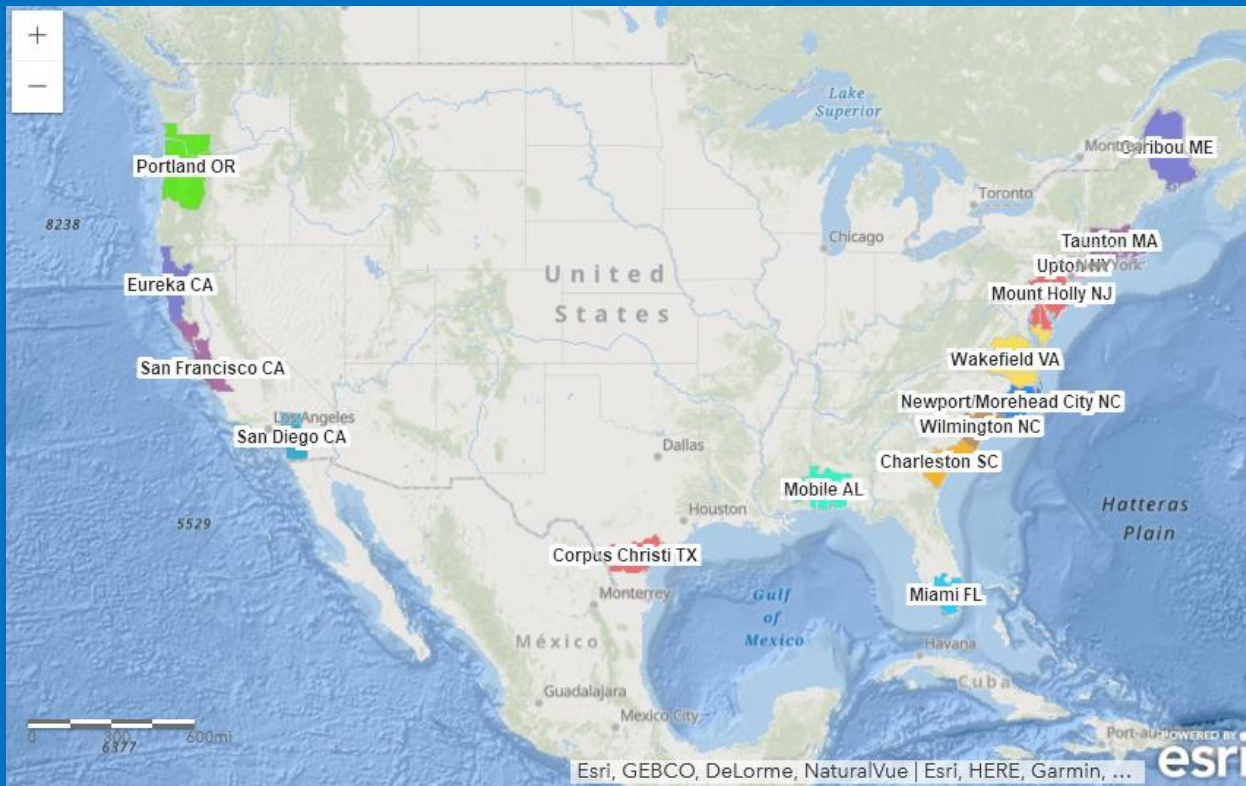
.MON...SW winds 10 kt. Seas 2 to 3 ft. Wave Detail: S 3 ft at
7 seconds and SE 2 ft at 10 seconds. A chance of tstms.

.TUE...SW winds 10 kt, increasing to 10 to 15 kt. Seas 3 to 4 ft.
Wave Detail: SW 3 ft at 6 seconds and SE 3 ft at 9 seconds. A chance
of tstms.

.WED...SW winds 10 to 15 kt. Seas 4 to 5 ft. Wave Detail: S 4 ft at
6 seconds and SE 2 ft at 9 seconds. A chance of tstms.



Map of All Participating NWS Offices



Survey

- The NWS National Wave Team has developed a survey to solicit feedback
- View at:
www.weather.gov/marine/WaveDetail



Wave Detail in Coastal Waters Forecasts

The NWS has recently upgraded its Nearshore Wave Prediction Systems (NWPS v1.3), which provides the ability to effectively differentiate between individual wave systems.

This allows the NWS to not only provide "Significant Wave Height (Seas)" but also provide "Wave Detail" or individual wave systems. Additionally, the wave component of the NWS Coastal Waters Forecast (CWF) is inconsistent throughout our coastal Weather Forecast Offices (WFOs).

The goal of this proposed change is to provide more consistent wave forecasts with more detailed wave information. To do this, we need to remove some of the terms like "wind wave" and "swell" to reduce the length and provide more consistency of the forecast.

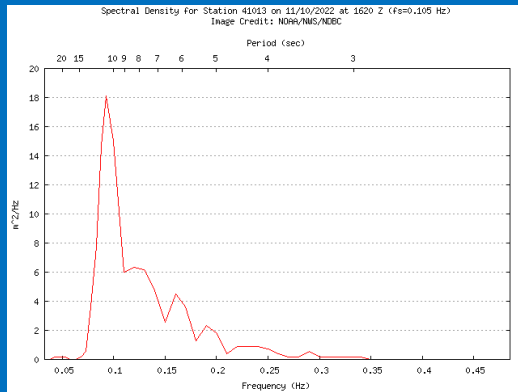
*Note for the Great Lakes, "Seas" will be "Waves" and periods would be shorter and wave details less frequent when used.

The proposed new wave portion of the CWF is as follows: Seas 4 to 6 ft, occasionally to 8 ft. Wave Detail: NW 4 ft at 5 seconds, and SW 6 ft at 12 seconds. As a creator and user of the CWF, this new format will be valuable to our marine customers.

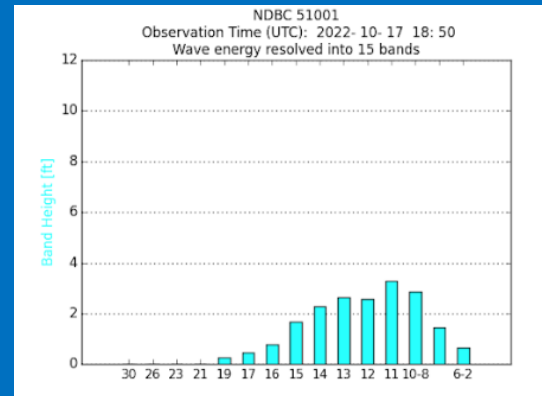
- Strongly Agree
- Agree
- Neutral
- Somewhat Disagree
- Strongly Disagree

Next Steps

- Alignment with NDBC wave reporting/display.
- Address NOAA Weather Radio Broadcast Cycle Concerns.
- Listen to the feedback!
- Test Operational Capabilities.
- Enhance Tabular/Graphical Wave Products.



NDBC Spectral Density Plot



HFO Spectral Wave Plot in more Common Terms



Thank you! Questions?

More Info: www.weather.gov/marine/WaveDetail

