Experimental NWS Coastal Waters Forecast With Wave Detail

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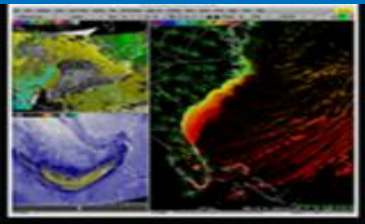
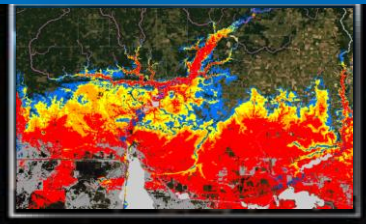
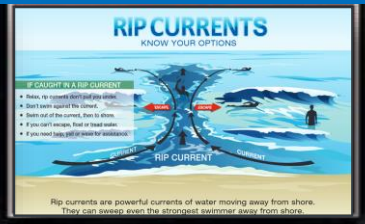
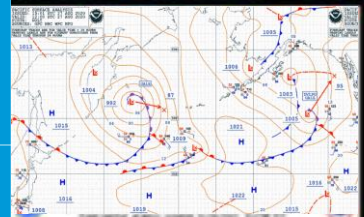
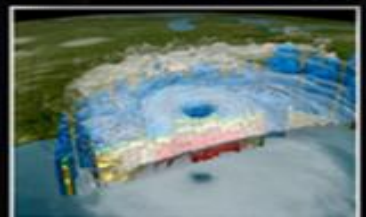
Special Thanks: Matt Scalora (ILM), Jeff Lorens (WRH), Darren Wright (NOS) and the NWS National Wave Team

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”.

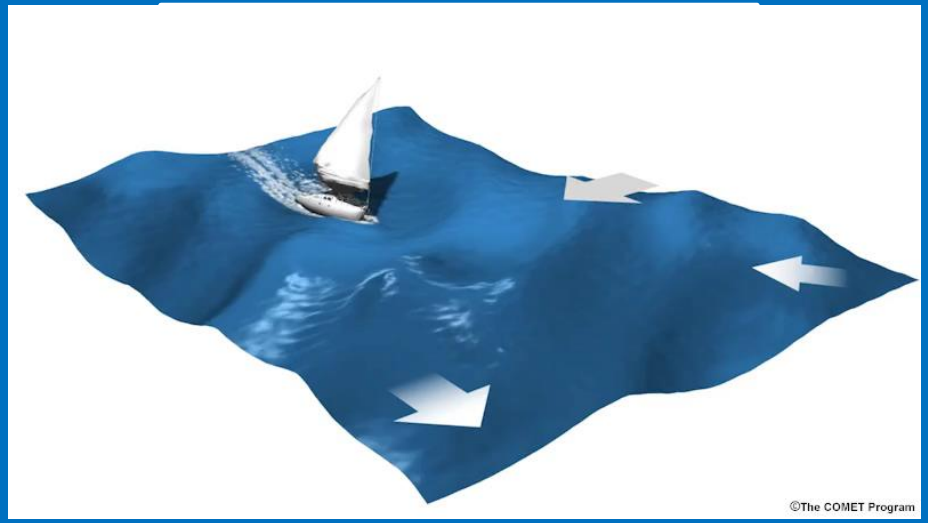
Height, Period, and Direction Critical to Diagnose This Hazard

- **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)

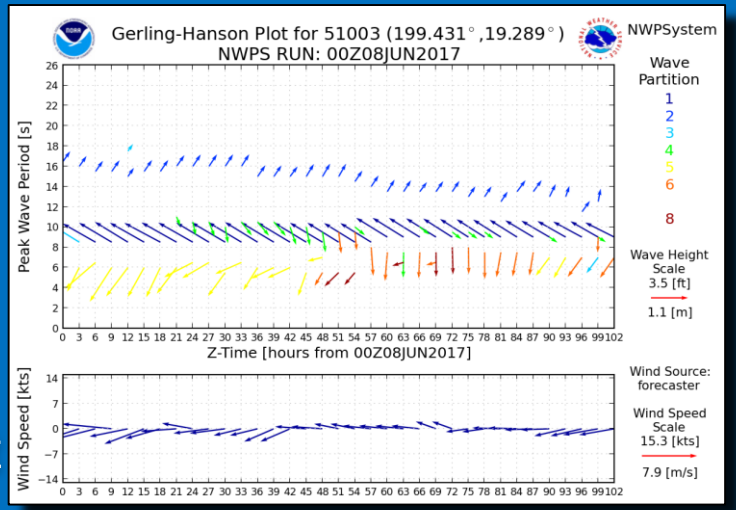
- **Current forecast format: Seas 2-3 ft.**
  - Mariner – “That might not be that bad.”
- **Proposed forecast format: NE 2-3 ft at 4 sec.**
  - Mariner – “I have a flat bottom boat, no way I’m going out in those short period seas.”

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.

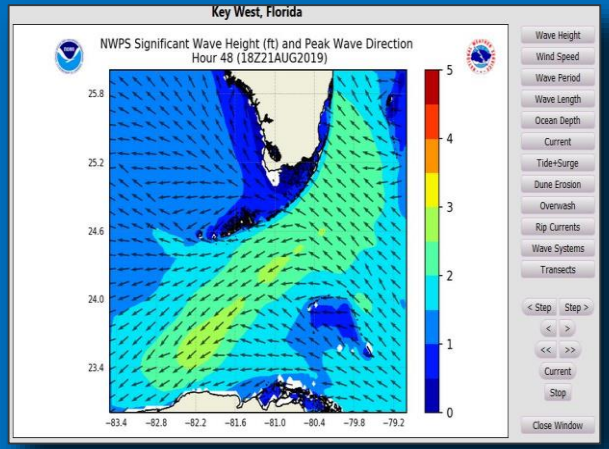


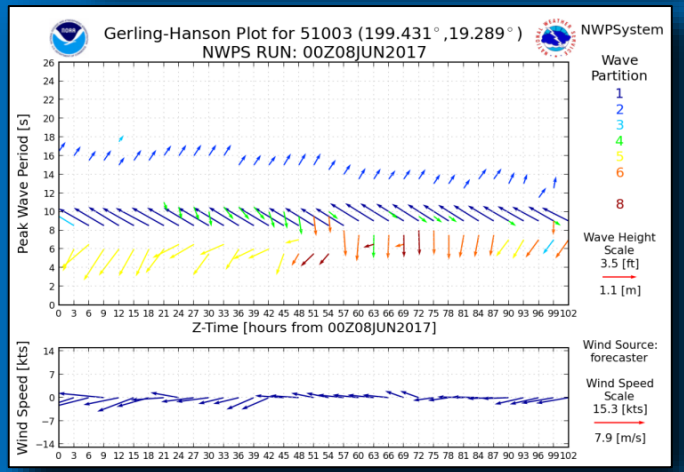
What About “Wind Wave” and “Swell”?

- 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.

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: [Height(m)^2 x Period(s)] - highest first.

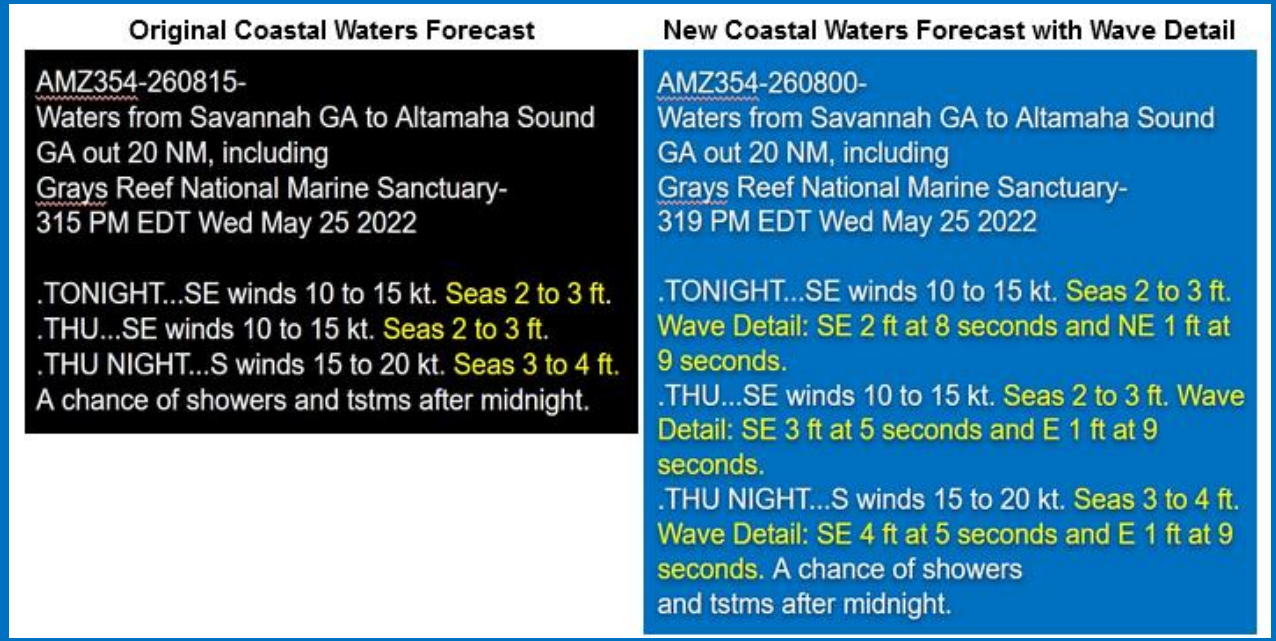
Proposed New CWF Format for Waves

- 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



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.
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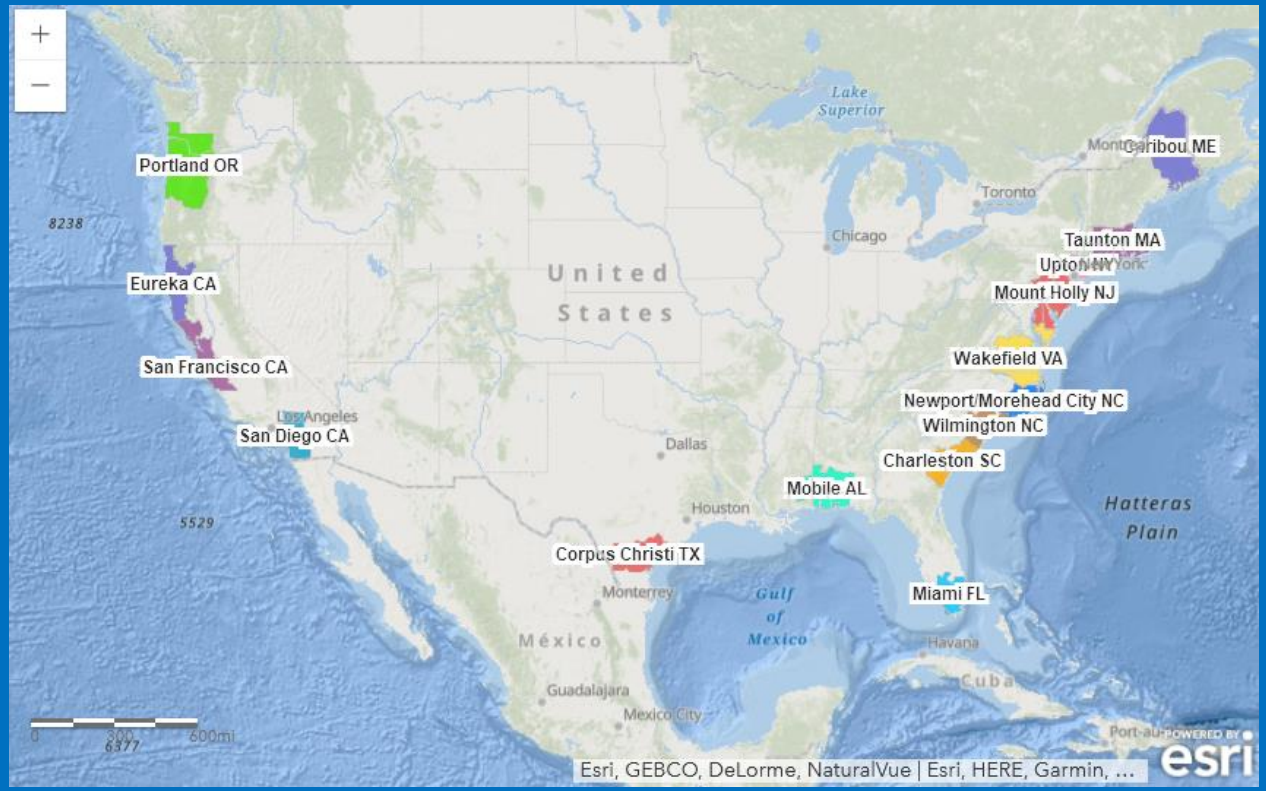
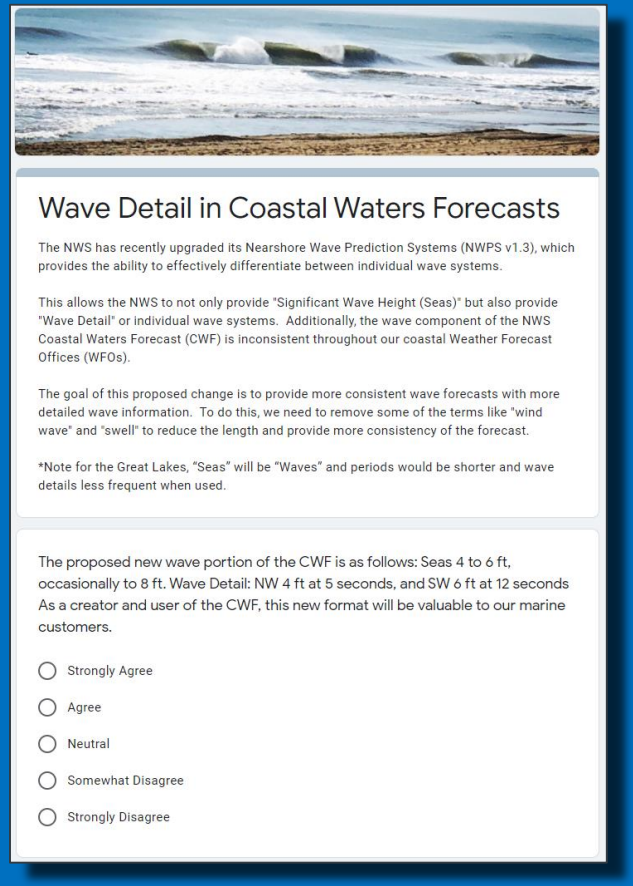
Map of All Participating NWS Offices



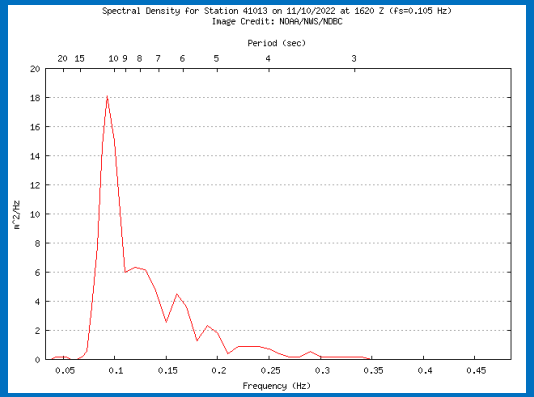
Survey

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

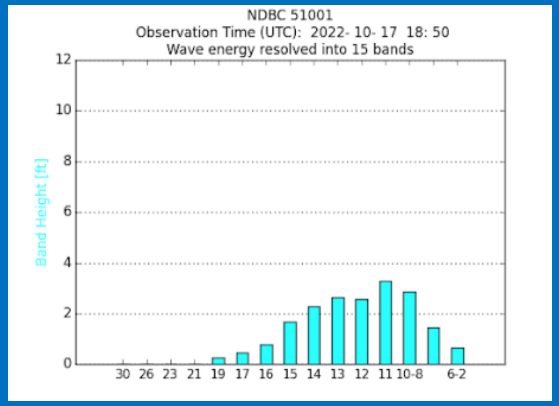


Next Steps

- 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