Nearshore Wave Climatology of the New Jersey Shelf

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INTRODUCTION

- The National Weather Service is moving to incorporate coastal wave data from HFRs (Figure 1) into their marine forecasting workflow
- The HFRs supplement existing buoys and sometimes are primary validation for model guidance.
- Coastal wave data contributes to marine safety thereby supporting NOAA's Weather-Ready Nation.

METHODS

1. Several High Frequency radar stations (Figure 2) were operated along the coast of New Jersey collecting surface currents and wave data.
2. Buoy data from the National Data Buoy Center were utilized in the comparison.
3. Monthly wave height statistics were generated from hourly time series data from 2017 to 2022.
4. Wave height correlations were made between the HFR and buoy measurements.

RESULTS

- Monthly statistics calculated from the two data sets were comparable for the region (Figure 6 & 7).
- For the monthly statistics the HFR measurements nearshore showed higher mean wave height.
- However in a sample from this year The HFR wave measurements were biased low compared to a nearby buoy (Figure 8 & 9).

Nearshore wave measurements from High Frequency radar (HFR) can help fill gaps in the National Waves Plan

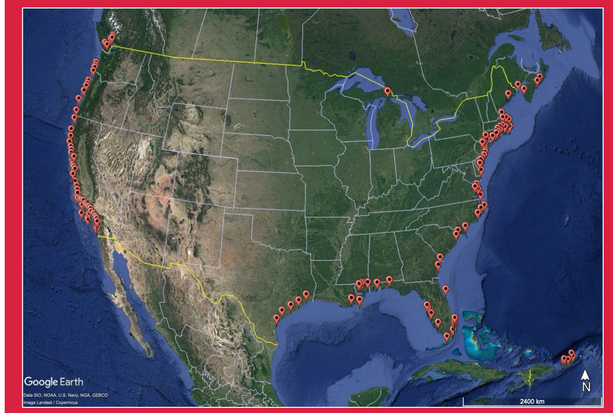

Figure 1: Map of the continental United States showing the locations of High Frequency radar stations.

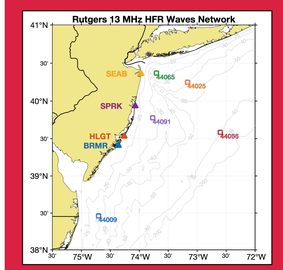

Figure 2: Map of the study area showing the location of the HFR stations (triangles) and NDBC buoys (squares).

Figure 3: Photo of HFR antenna installed at Seaside Park, NJ.

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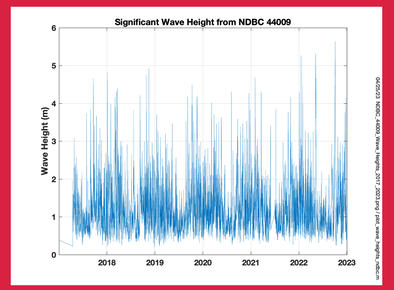

Figure 4: Time series plot of significant wave height at NDBC buoy 44009 from 2017 to 2023

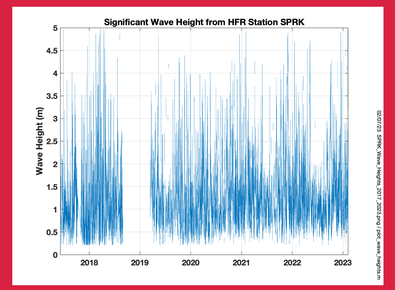

Figure 5: Time series plot of significant wave height at NDBC buoy 44009 from 2017 to 2023

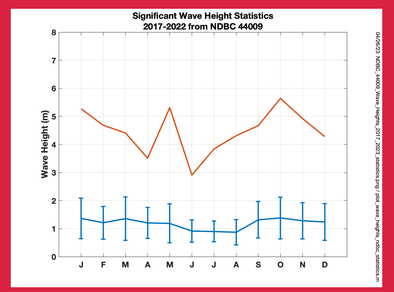

Figure 6: Monthly statistics of mean (blue line), standard deviation (error bars) and maximum (red line) wave height from NDBC buoy 44009.

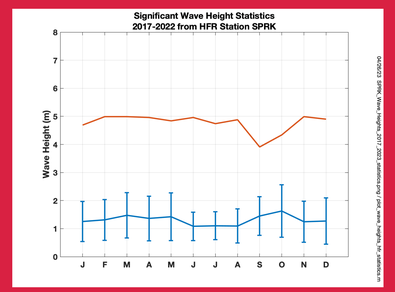

Figure 7: Monthly statistics of mean (blue line), standard deviation (error bars) and maximum (red line) wave height from HF radar station at Seaside Park, NJ (SPRK).

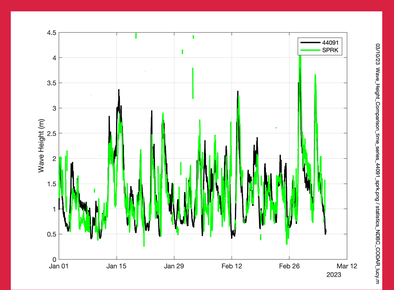

Figure 8: Significant wave height time series plot from Jan. 1 to Mar. 6, 2023 from wave rider buoy 44091 (black) and SPRK HF radar (green) .

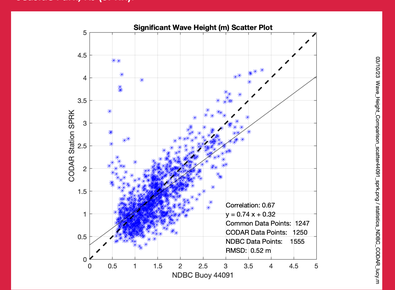

Figure 9: Significant wave height scatter plot from January 1 to March 6, 2023 from wave rider buoy 44091 (x axis) and SPRK HF radar (y axis) .

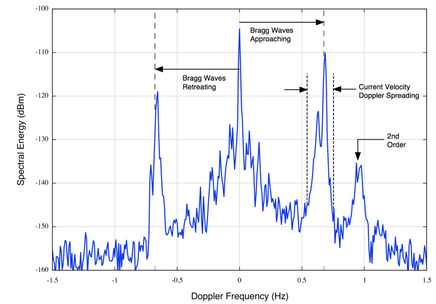

Figure 10: Doppler spectrum from the SeaSonde HF radar. The echo which contains surface current information is located at ±0.6 Hz. The second order Bragg scatter which contains wave information is located at +0.9 Hz.

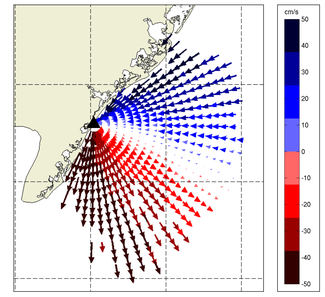

Figure 11: Example of the typical output from an HF radar station, radial map of surface currents once an hour. The blue vectors show currents toward the radar while red vectors indicate currents moving away from the radar station.

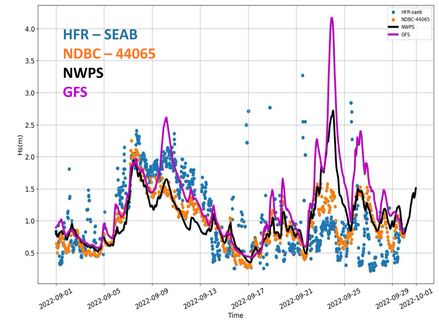

Figure 12: Time series plot of significant wave height outside New York Harbor for September 2022. The data sets include HFR at Sea Bright, NJ (blue), NDBC buoy 44065 (orange), Nearshore Wave Prediction System (NWPS, black) and Global Forecast System (GFS, magenta).

DISCUSSION

- HFR measurements are helping to validate NWPS and highlighting the need to improve GFS due to inadequate resolution and a calibration issue (Figure 12)

MARACOOS
IOOS Integrated Ocean Observing System
NOAA