HF Radar and Near-Shore Buoy Ocean Wave Measurement

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1. INTRODUCTION

The National Weather Service (NWS) currently uses wave data collected from near-shore buoys as part of their operational marine forecast process. However, the buoys collect data only for a very few point locations. To supplement the buoy data and provide data for larger areas of the ocean, High frequency (HF) radar can be used.

The main purpose of this study is to develop a better understanding of characteristic strengths and limitations of the HF radar wave data over the northern New Jersey coastal waters so the NWS can use the data with confidence.

2. METHODS

- The primary HF radar sites analyzed were Sea Bright, Seaside Park, and Brant Beach. The primary buoys used in this study were buoy 44065, east of Sandy Hook, and buoy 44091, east of Barnegat Light (Figs. 1, 2, & 3).
- An important aspect of this project is evaluating the data's reliability, so statistics were produced on the frequency of missing (Fig. 4) and erroneous data (Fig. 5).
- Hourly data on wave height and other wave parameters were analyzed and compared to similar wave data from near-shore buoys (Figs. 6 & 7).
- The data was organized by source, time periods, and for HF radar, by various distances from the shore (range cells).
- More specific analysis of the data was conducted for time periods during which events, such as coastal storms, occurred (Figs. 8, 9, & 10).

3. RESULTS

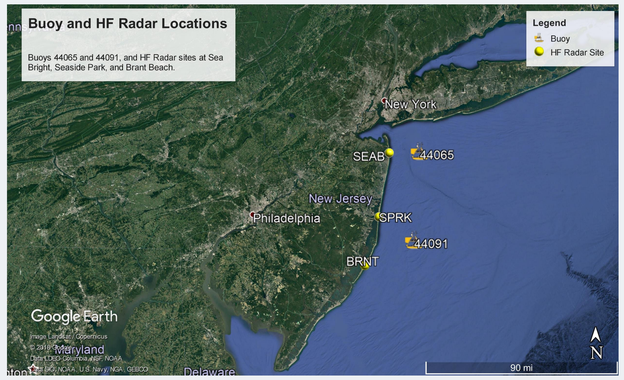

Fig. 1: Locations of 3 HF Radar Sites and 2 Near-Shore Buoys

Fig. 2: Sea Bright HF Radar Site

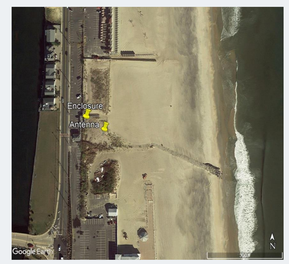

Fig. 3: Aerial View of Sea Bright HF Radar site

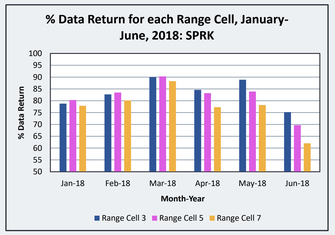

Fig. 4: Available Data at 3 Range Cells at Seaside Park, January-May 2018

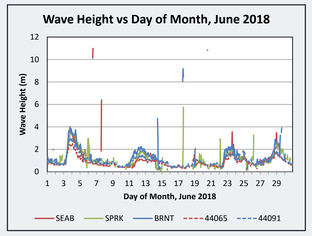

Fig. 5: June Wave Heights Showing Erroneous "Spikes"

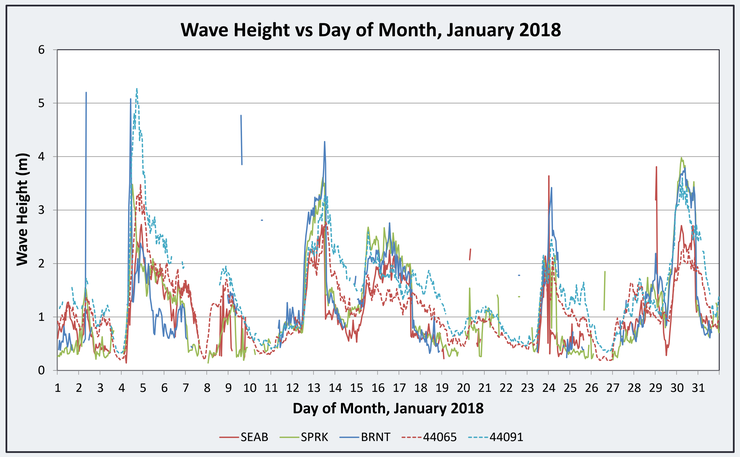

Fig. 6: Wave Height in January 2018, Data from HF Radar and Buoys

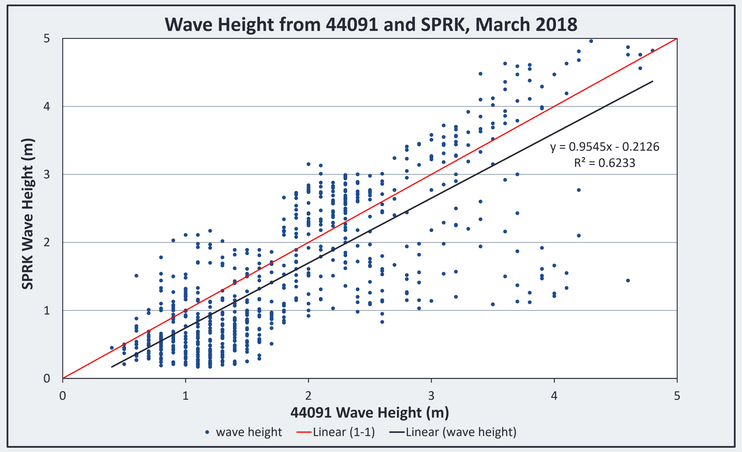

Fig. 7: Correlation Between Seaside Park and Buoy 44091 Data, March 2018

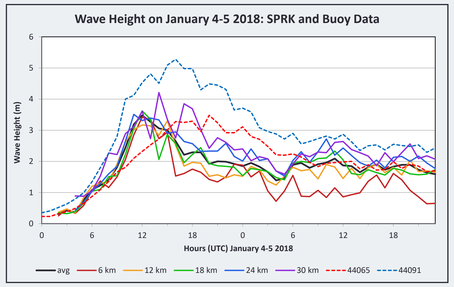

Fig. 8: Wave Height on January 4 and 5, 2018: Seaside Park Range Cells and Buoy Data

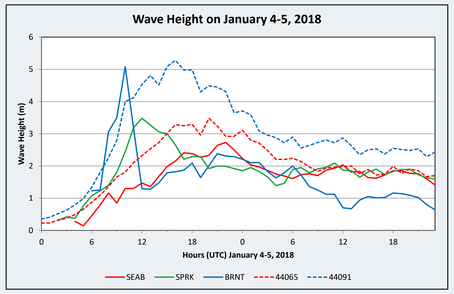

Fig. 9: Wave Height on January 4-5, 2018: All HF Radar and Buoy Data

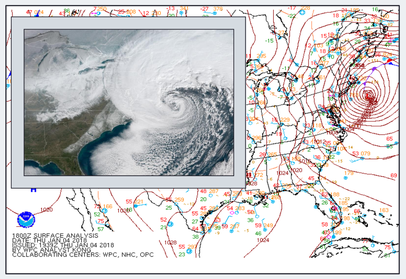

Fig. 10: Blizzard of January 4, 2018 (courtesy of NWS)

4. CONCLUSIONS

- Wave height trends from the HF radar sites generally correspond to buoy observations, especially for building seas ahead of a storm approaching from the south (onshore wind).
- HF radar wave heights often drop off too quickly compared to buoy wave heights after a storm passes to the north of New Jersey (offshore winds).
- In some cases, HF radar wave heights behind a storm (offshore winds) increase with distance from shore, as expected. However, this seems to be more the exception than the rule.
- HF radar wave heights are more frequently missing when seas are relatively low (<1m). This is a tolerable error because operational monitoring focuses more on higher waves.
- Comparing wave heights for HF radar site SPRK vs. buoy 44091, there was a steady improving trend from February through June.

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