Wave Data from HF Radar

Dr. Hugh Roarty

Mr. Chad Whelan

RUTGERS
Center for Ocean Observing Leadership

CODAR
Ocean Sensors

MARACOOS
Ocean Information for a Changing World

NOAA
National Oceanic and Atmospheric Administration
Outline

• Introduction to HF Radar
• IOOS HFR Wave Evaluation Program
• HFR Wave Data Use by Weather Services
• Individual Cases of HFR Wave Data
Introduction to HF Radar
13 MHz Transmit and Receive Antenna

4 meters
Bragg Scattering

<table>
<thead>
<tr>
<th>Freq (mhz)</th>
<th>$\lambda_R$ (meters)</th>
<th>$\lambda_O$ (meters)</th>
<th>$T_O$ (seconds)</th>
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<td>5</td>
<td>60</td>
<td>30.0</td>
<td>4.4</td>
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<td>13</td>
<td>23</td>
<td>11.5</td>
<td>2.7</td>
</tr>
<tr>
<td>25</td>
<td>12</td>
<td>6.0</td>
<td>2.0</td>
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<tr>
<td>42</td>
<td>7</td>
<td>3.6</td>
<td>1.5</td>
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Doppler Spectra From the Radar

Antenna 1

1st Order (Currents)

2nd Order (Waves)

Antenna 2

Antenna 3
Radial Current Measurements from a Single Station
MARACOOS HF Radar Network

Long Range Network
5 MHz - 17 Stations
13 MHz - 7 Stations
25 MHz - 16 Stations
Outside - 6 Stations
TOTAL - 46 Stations

Western Long Island Sound
New Jersey 13 MHz
New York Harbor
Delaware Bay
Muskeget Channel
Block Island Sound
Chesapeake Bay

Winter Storm Jonas
2016/01/23 20:00 UTC

MARACOOS HF Radar Data Coverage

MARACOOS HF Radar Network
U.S. HF Radar Network

https://ioos.noaa.gov/project/hf-radar/
IOOS-NWS Project to Evaluate HF Radar Derived Wave Data

2017-2020
Project Partners

Rutgers University
Dr. Hugh Roarty
HF Radar Network Coordinator

CODAR Ocean Sensors
Mr. Chad Whelan,
Chief Technology Officer

University of Puerto Rico
Mr. Colin Evans
HF Radar Lead

NWS WFO Mt. Holly
Mr. Alan Cope
Science and Operations Officer
Mr. Walt Drag,
Senior Meteorologist

IOOS
Dr. Jack Harlan,
HF Radar Project Manager

NWS Office of Science and Technology Integration
Mr. Dennis Atkinson
Meteorologist
National Weather Service Pilot Project
Recommendations from


“the Significant Wave Height Project conclusion is a strong recommendation that the HF radar data be used for routine NWS operations”

“The Mt. Holly, San Juan, and Eureka WFOs concur on the significant value of the HF radar wave data”
Impact

A National Operational Wave Observation Plan calls for 133 wave sensors in the Coastal Subnet while only 67 are currently deployed.

Potential for some of the 160 HF Radars currently deployed to fill that gap.

Surface gravity waves have a profound impact on navigation, offshore operations, safety and economic vitality of the nation’s maritime and coastal communities.
HFR Wave Data Use by Weather Services
SeaSondes Worldwide
Ocean/Met Agencies Using SeaSonde
Wave Data Viewer

ERDDAP > List of All Datasets

12 matching datasets, listed in alphabetical order.

<table>
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<th>Grid DAP Data</th>
<th>Subset</th>
<th>Table DAP Data</th>
<th>Make A Graph</th>
<th>W MS</th>
<th>Source Data Files</th>
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<th>Summary</th>
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The information in the table above is also available in other file formats (.csv, .html, .table, .txt, .json, .jsonl, .jsonv, .jsonvKVP, .mat, .nc, .ncsax, .js, .xhtml) via a RESTful web service.

ERDDAP, Version 2.17
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MARACOOS
Ocean Information for a Changing World

IOOS
Integrated Ocean Observing System
PHI Marine Dashboard
Individual Cases of HFR Wave Data
Significant wave height data are displayed for RC10 (left panel) and for buoys (right panel). SeaSonde dt=10 min, 44065 dt=60 min, 44091 dt=30 min.

Winds are landward for the first part of this event.
Winds become seaward at the times listed below, shown in time series plots with vertical lines. The first transition occurs at WOOD and progresses northward:

- SEAB (19:00)
- SPRK (18:00)
- 44065 (17:00 / 18:00)
- BRNT (17:00)
- WOOD (14:00)
SeaSonde Wave Measurement
March 2018

Wave Height During Storm 2017

Wind Speed (m/s)

Wind Dir. From (deg CWN)
Mothers’ Day Nor’easter, May 2022

Seaside Park, NJ Wave Measurements

Brant Beach, NJ Wave Measurements

Brigantine, NJ Wave Measurements

http://hfr.marine.rutgers.edu/erddap/tabledap/realtime  Submit
Nor’easter, April 2023

ERDDAP > Slide Sorter

Sea Bright, NJ Wave Measurements

Seaside Park, NJ Wave Measurements

Holgate, NJ Wave Measurements

Brigantine, NJ Wave Measurements

http://hfr.marine.rutgers.edu/erddap/tablesap/realtime

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