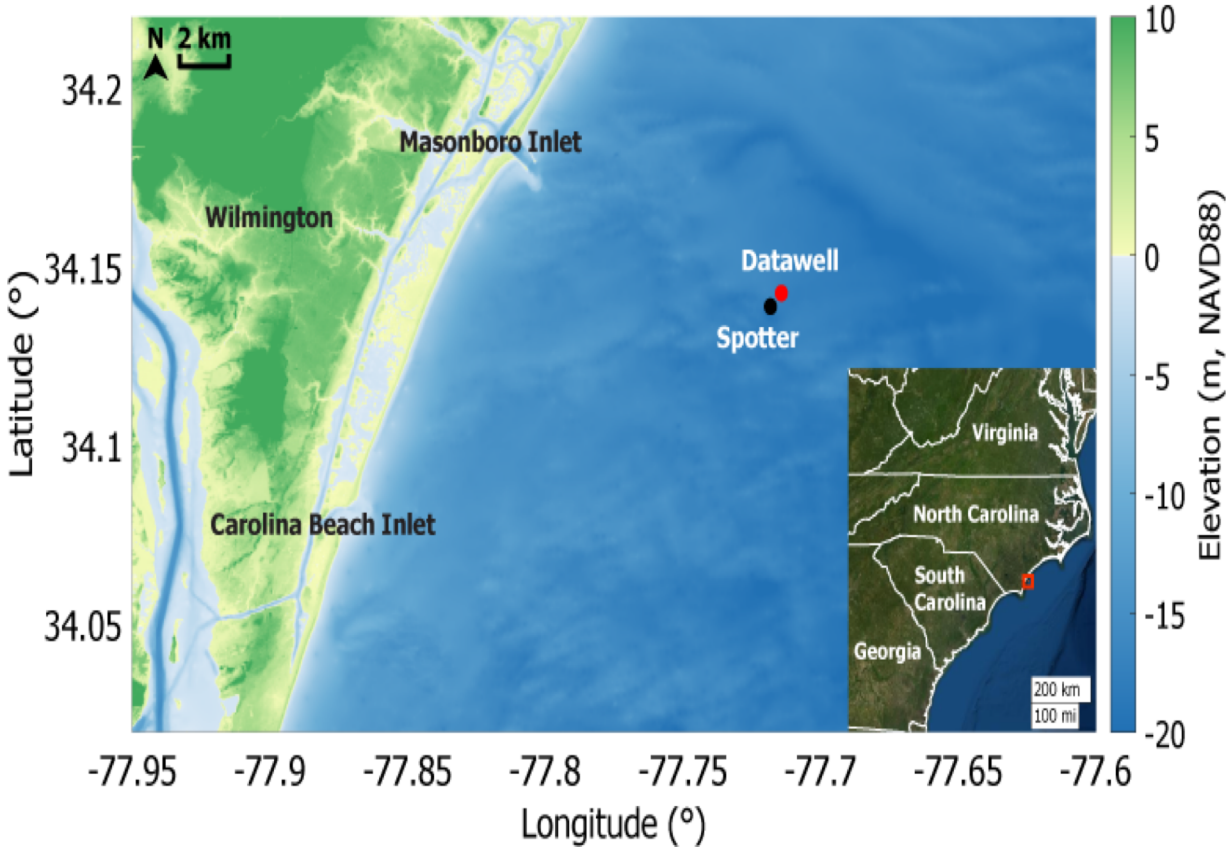


SECOORA
Southeast Coastal Ocean Observing Regional Association

Exploring Lower Cost Alternatives to Measure Waves

The UNCW Experience

IOOS
Integrated Ocean Observing System

Background

- UNCW has provided real-time wave data along the NC and SC coasts since 2005
- Experience with a variety of platform types
- Platforms range from traditional “industry standard” systems to “in house ” solutions

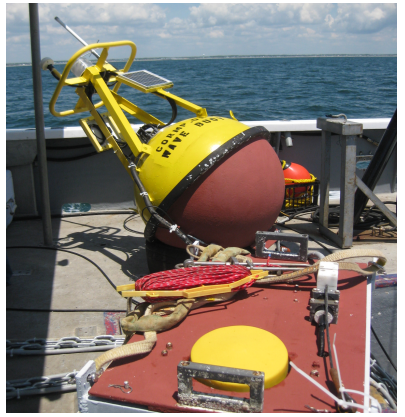
NDBC Buoy

Pros:

- Turnkey system
- Proven Industry standard
- NDBC support (telemetry, QC, data archival)

Cons:

- Purchase Cost -$250K
- Maintenance - $60K/year
- Availability of USCG vessels of opportunity & NDBC contractors for servicing



In House Design

Pros:

- Lower-cost construction
- Assembled using available components (e.g., ADCP)
- Serviced by local personnel
- Modular
- Provided currents and waves

Cons:

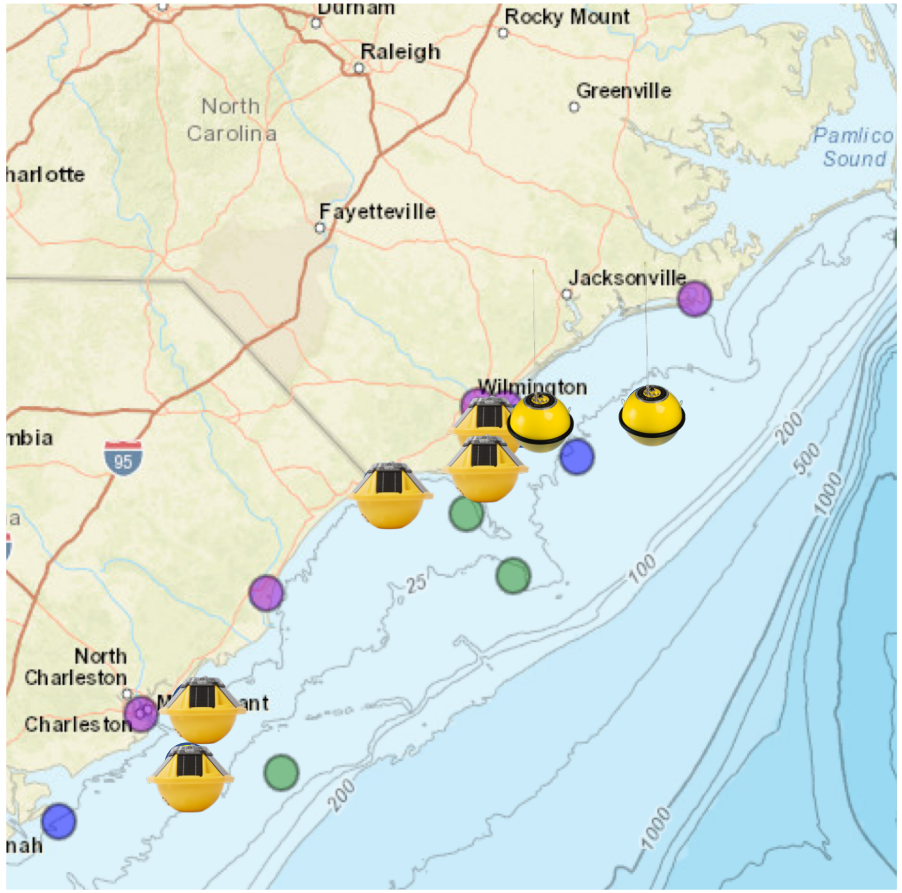
- Required diver-servicing
- 4-5 service visits per year
- Inductive cable frequently damaged
- Two-point mooring difficult to maintain in storm season

Challenges

- Growing demand for reliable wave observations (more sites and less down time)
- High cost associated with purchase, operation, and maintenance of traditional wave buoys (including personnel, vessels, telemetry, etc.)
- High risk environment (boat strikes, vandalism, theft and loss)
- Limited funds for O&M or replacement

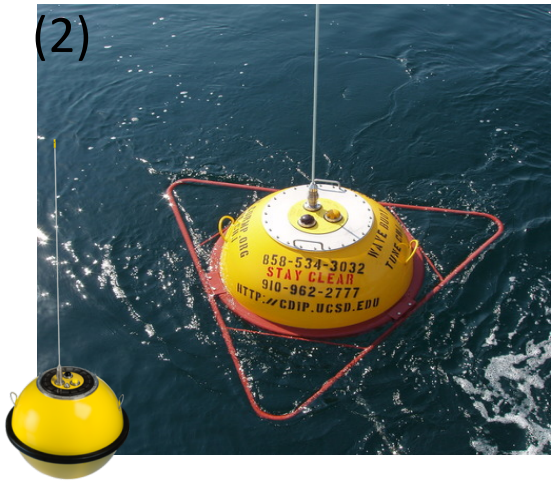
Need for significantly less expensive alternatives, including turnkey options that are easier to deploy and maintain

Current Status



- UNCW operates or supports 7 real-time wave buoys
- Includes two types of turnkey platforms:

Datawell Waveriders (2)



Support provided by SECOORA, partnership with CDIP & USACE

Sofar Spotters (5)

Funded by SECOORA & US Coastal Research Program

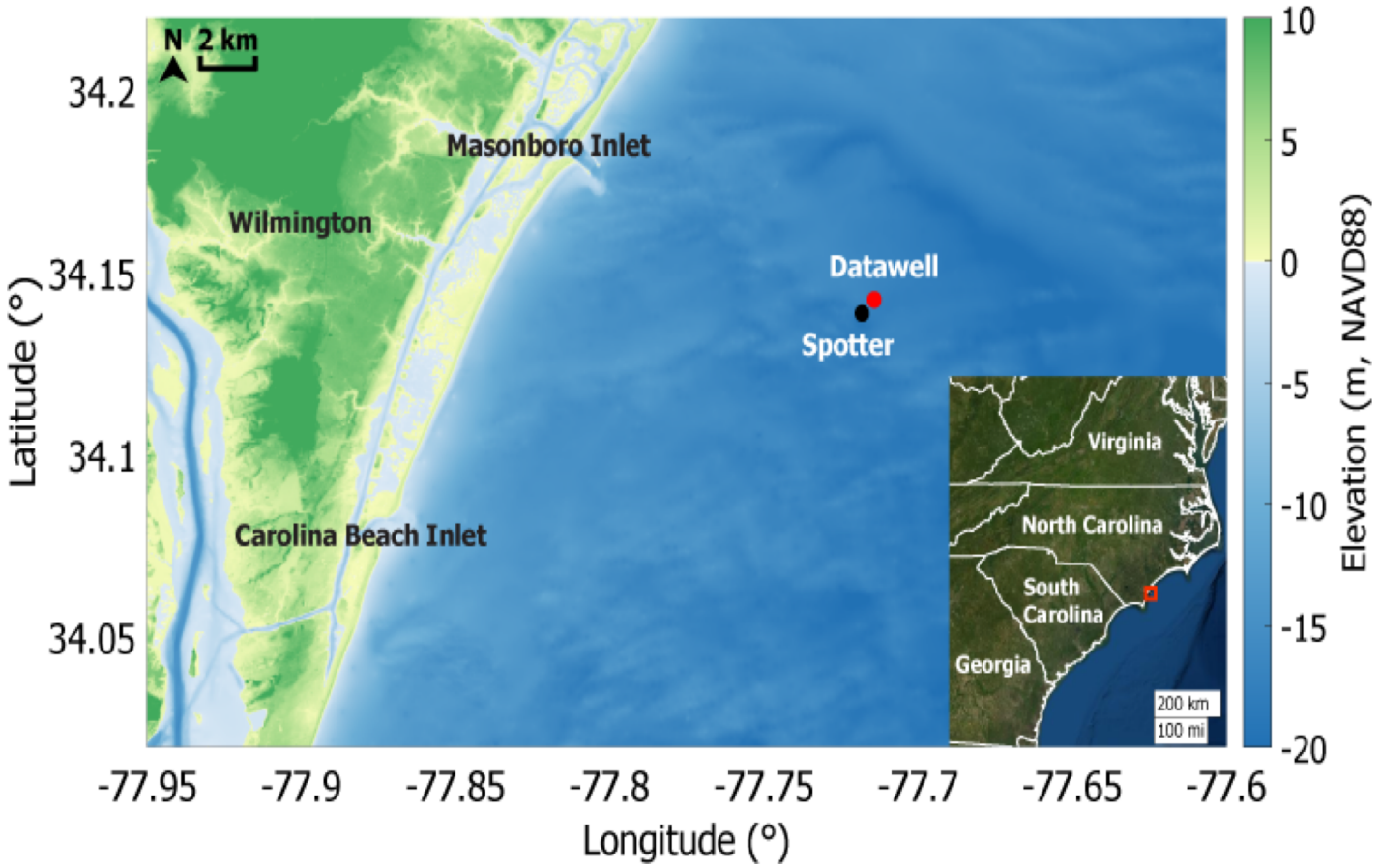
WaveRider

- Buoys, as configured for CDIP, cost ~$65K
- Mooring supplies & batteries for a 2 year deployment, ~$12k
- Turnkey mooring. Very little assembly, detailed manuals and instructions provided
- Requires vessel with davit capable of lifting ~500 lbs for deployment
- 1 m size is more visible to vessels, but strikes do occur. Large steel hull more likely to damage a vessel.
- Durable and resilient
- Data management, data analysis, qa/qc, and telemetry provided by CDIP at ~$25k per buoy.
- Real-time spectral wave data provided. Highly accurate wave height, period, and directional data.

Sofar Spotter

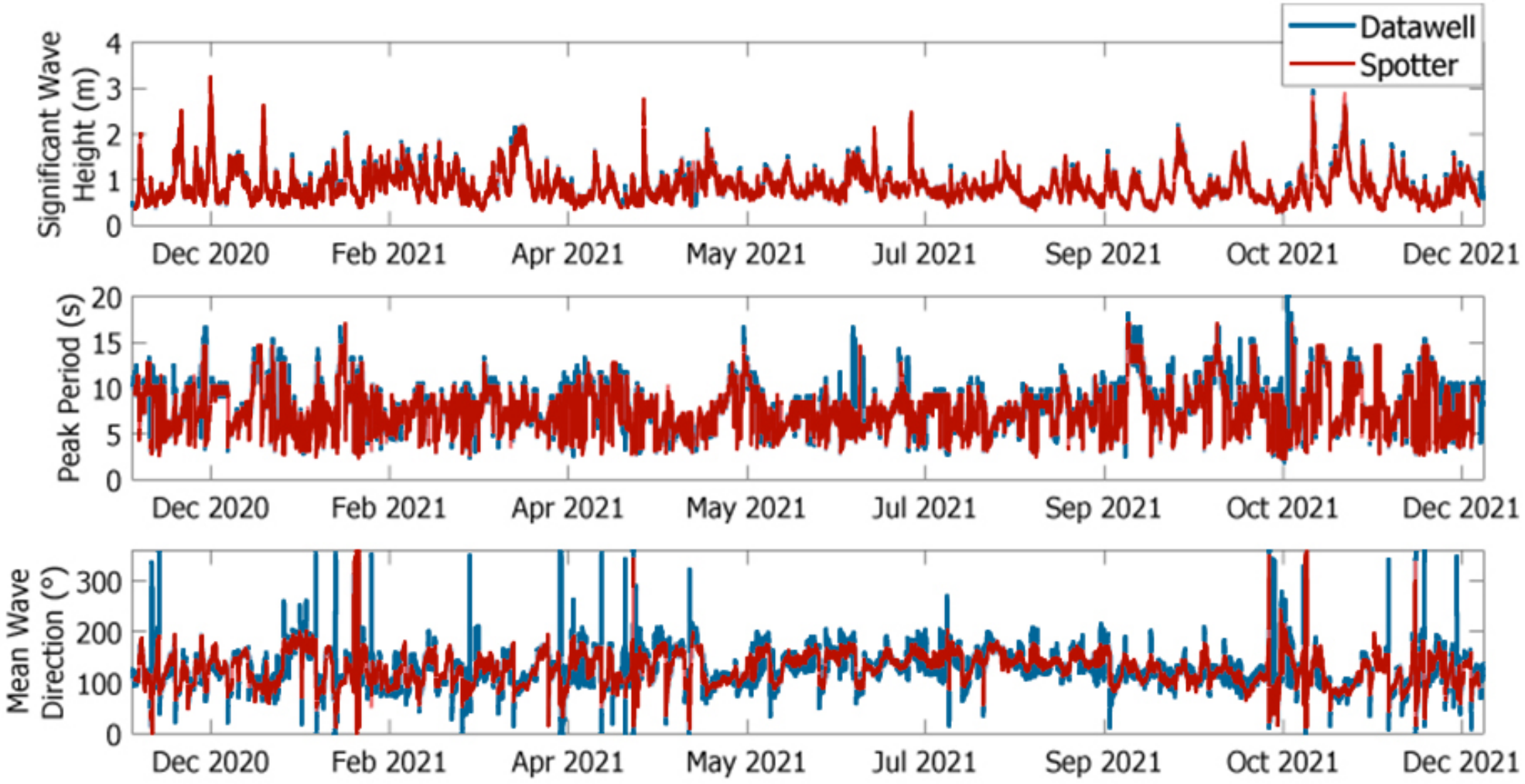
- Buoy cost $5K, purchase includes satellite telemetry for 1 year. Additional telemetry ~$1,080/year. Anchors cost ~$100, but we re-purpose old buoy chain.
- Can be deployed from small vessel (no davit required).
- Some experience needed to fabricate mooring. UNCW uses polypropylene and stainless hardware (~$200). Or, Sofar can provide a mooring.
- Spotter data dashboard to view data and API to share data. Dashboard includes geofencing and timefencing for asset monitoring. “Track” mode aids in recovery of loose buoy.
- Provides mean and peak wave period, direction; has mode to parse “sea” and “swell” waves to reflect real local sea conditions.
- Spectral data can be available in real-time (with tradeoffs) or stored/downloaded from SD card.
- Some QAQC of real-time data necessary. Some data anomalies present when local conditions change rapidly. More responsive to chop than Waverider.
- Small size increases potential for vessel strike, but also less likely to cause significant vessel damage.

Data Comparison

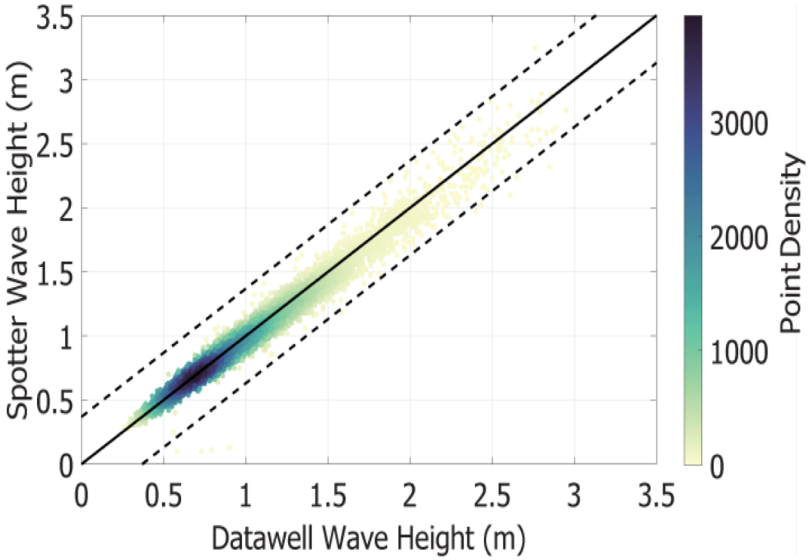


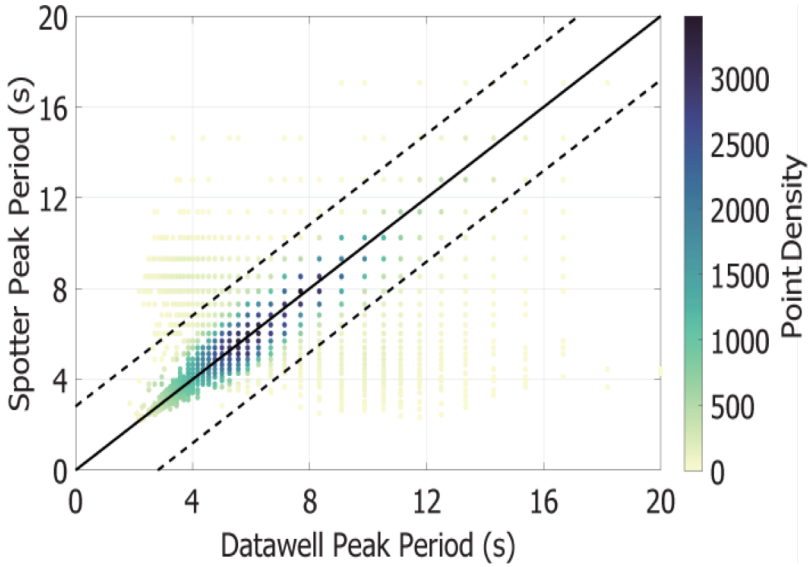
Dr. Joe Long (UNCW) evaluated data from a 20-month month deployment of a Sofar Spotter next to the ILM2 Datawell Waverider

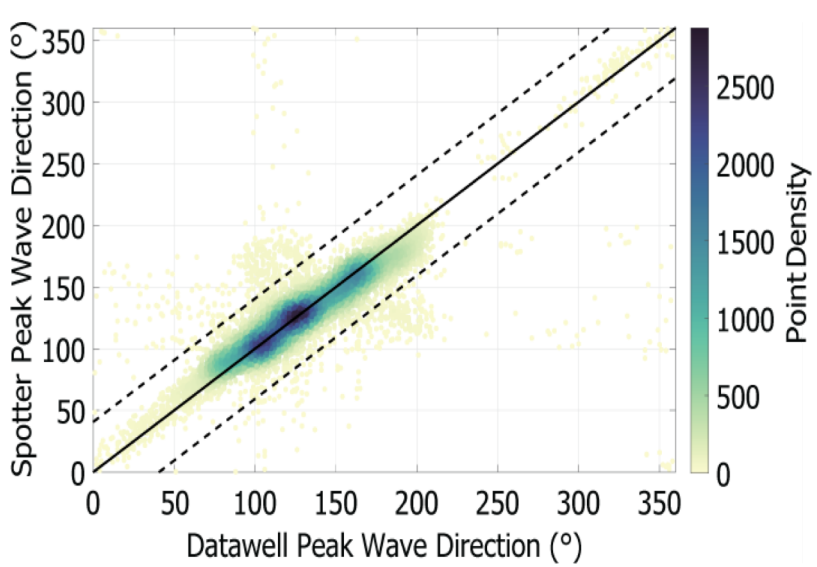
Data Comparison



Data Comparison







Wave Parameter	RMSE	Bias	R^2	% of Spotter Points Within 1σ of 1:1 Line
Significant Wave Height	0.06 m	-0.01 m	0.98	97
Peak Period	1.65 s	-0.18 s	0.64	90
Mean Period	0.27 s	-0.09 s	0.93	97
Mean Direction	22.23°	-0.28°	0.84	97
Peak Direction	21.89°	-0.43°	0.67	93

Spotter Well Suited For

- Deployment sites are easy to access or only accessible by small boat
- Applications where real-time spectral data are not required
- Temporary or short-term studies
- Applications where there is a high risk of asset loss
- Applications with limited budget
- Users with less data management experience

Current UNCW Applications

- Increase availability of wave data at existing meteorological buoys – including new buoy at entrance to Charleston Harbor Shipping Channel (CORMP)
- Nearshore wave information to support studies of coastal geomorphic change (USCRP; Long et al.)
- Validation of nearshore wave models (Long et al.)
- Observations to support rip current forecasts for ocean rescue groups (CORMP).
- Quantifying wave attenuation associated with glacial sills and impact on sedimentation within fjords with glacial sills. (Hawkes et al.)
- Ocean Technology courses in Oceanography and Coastal Engineering Programs.

Other Application

- Backyard Buoys: community-led ocean observing project funded by the NSF Convergence Accelerator.
  - Collaborators: Sofar, PacIOOS, NANOOS, and AOOS. The goal of Backyard Buoys is to empower Indigenous and coastal communities to collect and use ocean data to support maritime activities, food security, and coastal hazard protection.

BACKYARD BUOYS

Final Thoughts

Additional opportunities for SECOORA:

- Targeted deployments (model validation, event-specific collection, technology performance trials)
- Support for public events - fishing tournaments, surf contests
- Citizen Science and student training activities

Lastly, some “operational” lessons learned:

- Know your study area (to ensure you have a robust mooring design)
- Strategic buoy placement for ease of permitting
- More maintenance due to weight of biofouling organisms (~ 3x/year)
- Be mindful of competing uses (e.g., shrimpers, commercial fishing) and avoid high traffic area
- PUBLICIZE THE BUOY LOCATION!!!!

Image credit UNCW: Chris LaClair, UNCW and Walter Prause, Charleston Harbor Pilots Port Manager

SECOORA
Southeast Coastal Ocean Observing Regional Association

Data comparison questions: Joe Long (longjw@uncw.edu)

Operational questions: Chris LaClair (laclairc@uncw.edu)

CODAR OCEAN SENSORS

In-Situ

IOOS Integrated Ocean Observing System