



Wave Data Sources along the U.S. Coastline

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WAVE DATA SOURCES ALONG THE U.S. COASTLINE



Outline:

1. U.S. Data Sources
2. U.S. Measurement Data Sets
3. U.S. Measurement Data Sets - Pitfalls
4. DoD USACE Wave Information Study (WIS)



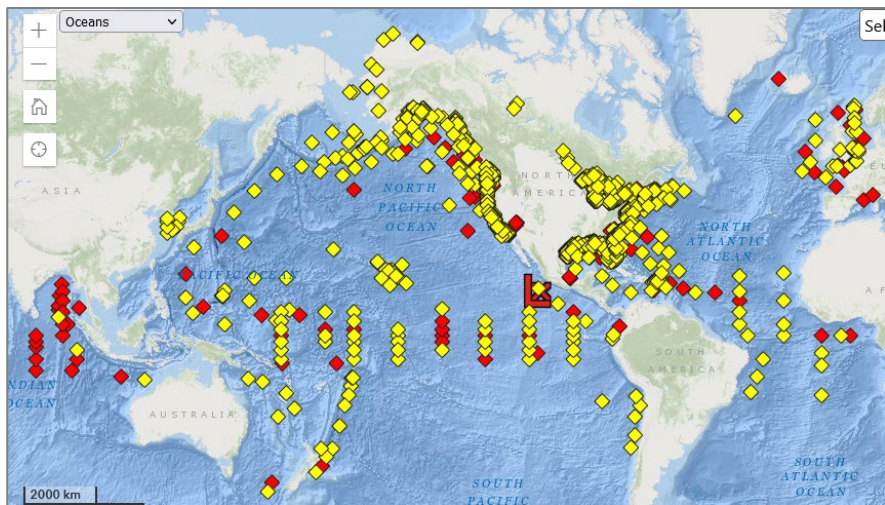
U.S. DATA SOURCES



NATIONAL DATA BUOY CENTER

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

- Stations (~2024):
- 1339 deployed
 - 1047 reporting



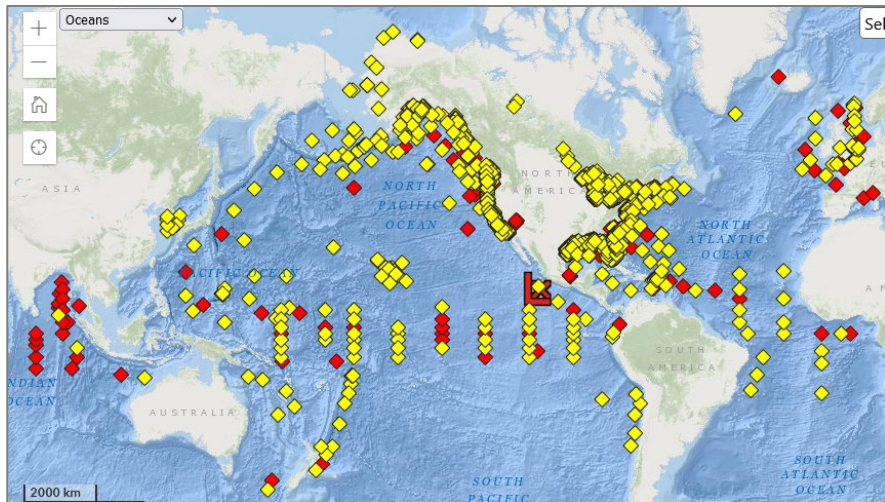


U.S. DATA SOURCES



NATIONAL DATA BUOY CENTER

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



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- 1339 deployed
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CDIP
coastal data information program

Monitoring and Prediction of
Waves and Shoreline Change



SIO USACE DPR

Stations (~2024):

- 191 deployed
- 87 reporting



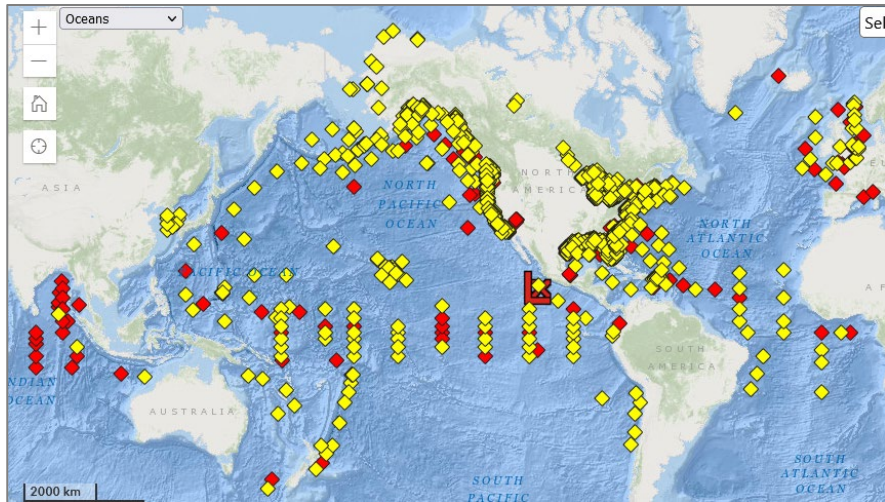


U.S. DATA SOURCES



NATIONAL DATA BUOY CENTER

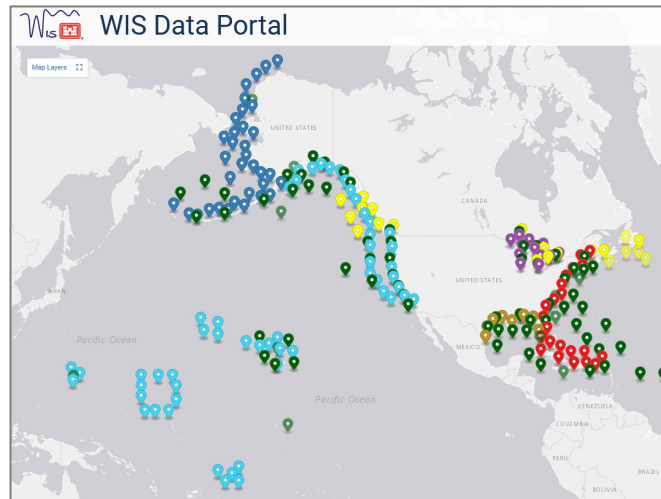
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



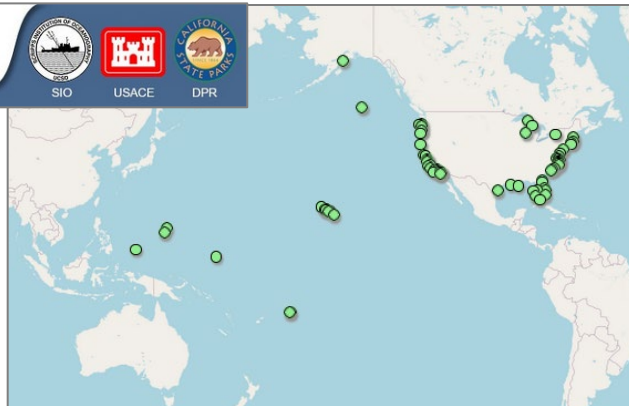
- Stations (~2024):
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 - 1047 reporting



- Stations (1980 - 2023):
- 3983 save points



- Stations (~2024):
- 191 deployed
 - 87 reporting





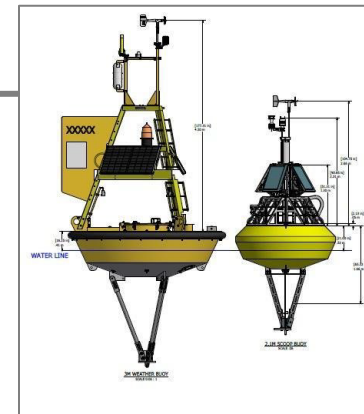
NOAA NATIONAL DATA BUOY CENTER (NDBC)



NDBC Stations (~2024):

- 147 deployed
- 125 reporting

1. NDBC website - <https://www.ndbc.noaa.gov/>
2. Official NOAA archives at the National Center for Environmental Information (NCEI)
<https://www.ncei.noaa.gov/access/marine-environmental-buoy-database/>
3. NDBC Distributed Oceanographic Data Systems framework (DODS)
<https://dods.ndbc.noaa.gov/thredds/catalog/data/catalog.html>
4. NDBC website == DODS in different formats.



Unit of Measure: Time Zone:

Click on the graph icon in the table below to see a time series plot of the last five days of that observation.



Wind Direction (WDIR):	SE (130 deg true)
Wind Speed (WSPD):	3.0 m/s
Wind Gust (GST):	4.0 m/s
Wave Height (WVHT):	0.4 m
Average Period (APD):	5.0 sec
Mean Wave Direction (MWD):	ENE (60 deg true)
Atmospheric Pressure (PRES):	1020.0 mb
Air Temperature (ATMP):	28.2 °C
Water Temperature (WTMP):	28.6 °C
Dew Point (DEWP):	24.6 °C
Heat Index (HEAT):	32.7 °C
Wind Speed at 10 meters (WSPD10M):	3 m/s
Wind Speed at 20 meters (WSPD20M):	3 m/s
Combined plot of Wind Speed, Gust, and Air Pressure	



NDBC Stations (~2024):

- 147 deployed
- 125 reporting

NDBC website - <https://www.ndbc.noaa.gov/>

NATIONAL DATA BUOY CENTER

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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INFORMATION▼
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SEARCH▼

Station ID Search [Station List](#)

View the latest observations near [East Pacific Tropical Depression Three-E](#).

Station 41009 [\(LLNR 840\)](#) - **CANAVERAL 20 NM East of Cape Canaveral, FL**

Owned and maintained by National Data Buoy Center
3-meter discus buoy
SCOOP payload
28.508 N 80.185 W (28°30'27" N 80°11'6" W)

Site elevation: sea level
Air temp height: 3.4 m above site elevation
Anemometer height: 3.8 m above site elevation
Barometer elevation: 2.4 m above mean sea level
Sea temp depth: 2 m below water line
Water depth: 42 m
Watch circle radius: 115 yards

Right whales are active off FL from November to April. Speed restrictions of 10 knots apply to vessels 65 feet or greater in specific areas and times along the U.S. East Coast. It is illegal to approach right whales within 500 yards. To learn more about right whales and rules protecting them, go to: <http://www.nmfs.noaa.gov/pr/shipstrike>.

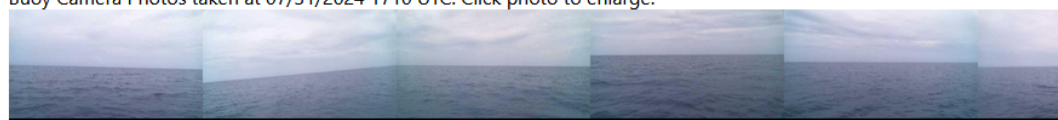
[Latest NWS Marine Forecast](#)

[Important Notice to Mariners](#)

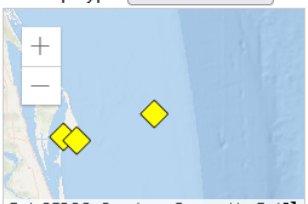
[Search And Rescue \(SAR\) Data](#)

[Meteorological Observations from Nearby Stations and Ships](#)

Buoy Camera Photos taken at 07/31/2024 1710 UTC. Click photo to enlarge.



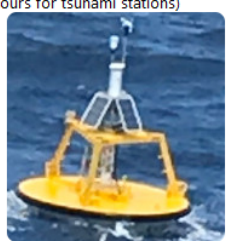
Map Type: Oceans ▼



Esri, GEBCO, Garmi... Powered by Esri

Large icon indicates selected station. [Disclaimer](#)

Stations with recent data
 Stations with no data in last 8 hours
 (24 hours for tsunami stations)



80° National Data Buoy Center Station ID: 41009 07/31/2024 1710 UTC

 View the latest observations near [East Pacific Tropical Depression Three-E](#).

Station 41009 ([LLNR 840](#)) - CANAVERAL 20 NM East of Cape Canaveral, FL

Owned and maintained by National Data Buoy Center
28.508 N 80.185 W (28°30'27" N 80°11'6" W)

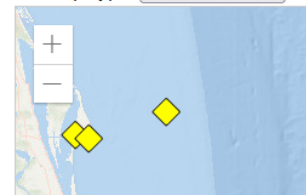
Available historical data for station 41009 include:

- **Quality controlled data for 2024** ([data descriptions](#))
 - **Standard meteorological data:** [Jan](#) [Feb](#) [Mar](#) [Apr](#) [May](#) [Jun](#)
 - **Spectral wave density data:** [Jan](#) [Feb](#) [Mar](#) [Apr](#) [May](#) [Jun](#)
 - **Spectral wave (alpha1) direction data:** [Jan](#) [Feb](#) [Mar](#) [Apr](#) [May](#) [Jun](#)
 - **Spectral wave (alpha2) direction data:** [Jan](#) [Feb](#) [Mar](#) [Apr](#) [May](#) [Jun](#)
 - **Spectral wave (r1) direction data:** [Jan](#) [Feb](#) [Mar](#) [Apr](#) [May](#) [Jun](#)
 - **Spectral wave (r2) direction data:** [Jan](#) [Feb](#) [Mar](#) [Apr](#) [May](#) [Jun](#)
 - **Supplemental Measurements data:** [Jan](#) [Feb](#) [Mar](#) [Apr](#) [May](#) [Jun](#)
- **Historical data** ([data descriptions](#))
 - **Standard meteorological data:** [1988](#) [1989](#) [1990](#) [1991](#) [1992](#) [1993](#) [1994](#) [1995](#) [1996](#) [1997](#) [1998](#) [1999](#) [2000](#)
[2001](#) [2002](#) [2003](#) [2004](#) [2005](#) [2006](#) [2007](#) [2008](#) [2009](#) [2010](#) [2011](#) [2012](#) [2013](#) [2014](#) [2015](#) [2016](#) [2017](#) [2018](#)
[2019](#) [2020](#) [2021](#) [2022](#) [2023](#)
 - **Continuous winds data:** [2012](#) [2013](#) [2014](#) [2015](#) [2016](#)
 - **Spectral wave density data:** [1996](#) [1997](#) [1998](#) [1999](#) [2000](#) [2001](#) [2002](#) [2003](#) [2003b](#) [2004](#) [2005](#) [2006](#) [2007](#) [2008](#)
[2009](#) [2010](#) [2011](#) [2012](#) [2013](#) [2014](#) [2015](#) [2016](#) [2017](#) [2018](#) [2019](#) [2020](#) [2021](#) [2022](#) [2023](#)
 - **Spectral wave (alpha1) direction data:** [1996](#) [2012](#) [2013](#) [2014](#) [2015](#) [2016](#) [2017](#) [2018](#) [2019](#) [2020](#) [2021](#) [2022](#)
[2023](#)
 - **Spectral wave (alpha2) direction data:** [2012](#) [2013](#) [2014](#) [2015](#) [2016](#) [2017](#) [2018](#) [2019](#) [2020](#) [2021](#) [2022](#) [2023](#)
 - **Spectral wave (r1) direction data:** [2012](#) [2013](#) [2014](#) [2015](#) [2016](#) [2017](#) [2018](#) [2019](#) [2020](#) [2021](#) [2022](#) [2023](#)
 - **Spectral wave (r2) direction data:** [2012](#) [2013](#) [2014](#) [2015](#) [2016](#) [2017](#) [2018](#) [2019](#) [2020](#) [2021](#) [2022](#) [2023](#)
 - **Supplemental measurements data:** [2017](#) [2018](#) [2019](#) [2020](#) [2021](#) [2022](#) [2023](#)
 - **Ocean data:** [2008](#) [2009](#) [2010](#) [2011](#) [2012](#)

[Tropical Depression Three-E](#)



SEVERAL 20 NM East of Cape Canaveral, FL

Map Type:



Esri, GEBCO, Garmi... Powered by Esri

Large icon indicates selected station. [Disclaimer](#)

 Stations with recent data
 Stations with no data in last 8 hours
 (24 hours for tsunami stations)



Speed restrictions of 10...
...500 yards. To learn more
<http://www.nmfs.noaa.gov>

[Ships](#)

click photo to enlarge.



SIO COASTAL DATA INFORMATION PROGRAM (CDIP)



CDIP Stations (~2024):

- 181 deployed
- 87 reporting

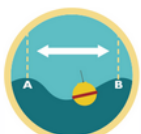
<https://cdip.ucsd.edu/>

Waves, Currents and Temperatures

Parameter Summary



Hs
Significant Wave
Height



Tp
Peak Period



Dp
Peak Direction



SST
Sea Surface
Temperature



Current Speed



Current Direction

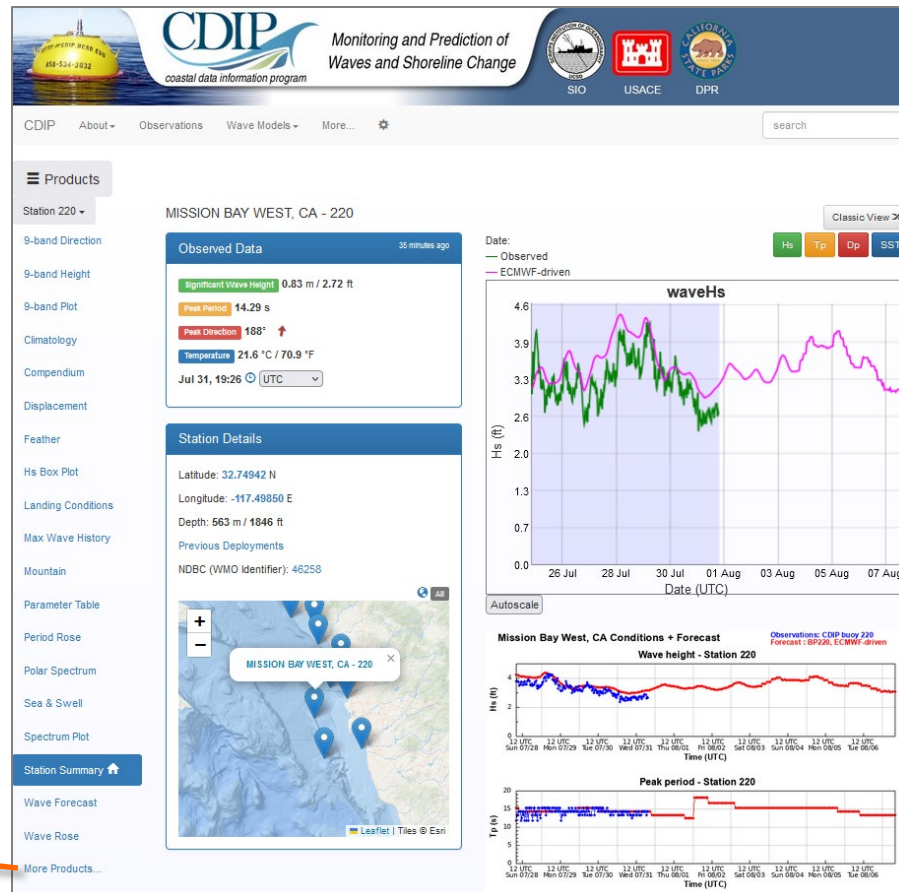


Air Temperature

CDIP Stations (~2024):

- 181 deployed
- 87 reporting

<https://cdip.ucsd.edu/>



CDIP Monitoring and Prediction of Waves and Shoreline Change

Station 220 - MISSION BAY WEST, CA - 220

Observed Data (35 minutes ago)

- Significant Wave Height: 0.83 m / 2.72 ft
- Peak Period: 14.29 s
- Peak Direction: 188° ↑
- Temperature: 21.6 °C / 70.9 °F

Station Details

- Latitude: 32.74942 N
- Longitude: -117.49850 E
- Depth: 563 m / 1846 ft
- Previous Deployments: NDBC (WMO Identifier): 46258

Station Summary

- Wave Forecast
- Wave Rose
- More Products...

Wave height - Station 220

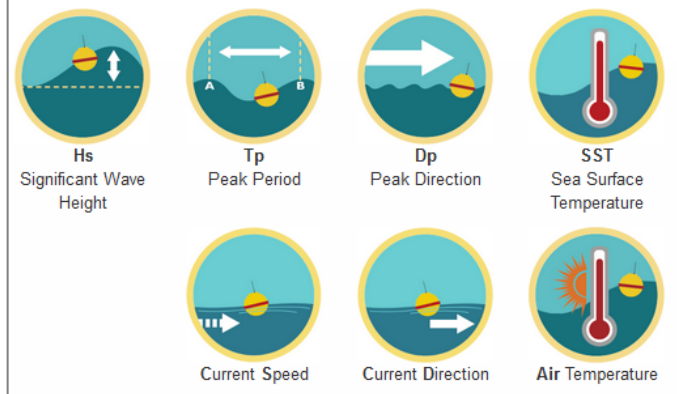
Wave height (Hs) in feet vs Time (UTC) from Sun 07/28 to Tue 08/06. The chart shows observed data (green) and ECMWF-driven forecast (pink).

Peak period - Station 220

Peak period (Tp) in seconds vs Time (UTC) from Sun 07/28 to Tue 08/06. The chart shows observed data (green) and ECMWF-driven forecast (pink).

Waves, Currents and Temperatures

Parameter Summary



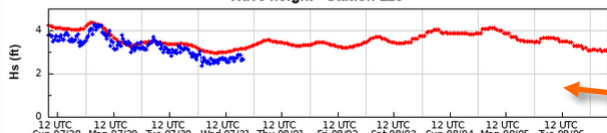
- Hs**: Significant Wave Height
- Tp**: Peak Period
- Dp**: Peak Direction
- SST**: Sea Surface Temperature
- Current Speed**
- Current Direction**
- Air Temperature**

220 - MISSION BAY WEST, CA Notice:01/12/2024 Replaced buoy

Mission Bay West, CA Conditions + Forecast

Observations: CDIP buoy 220
Forecast: BP220, ECMWF-driven

Wave height - Station 220



Station Info

- Data server: Realtime data, Historic data
- Availability
- Product descriptions

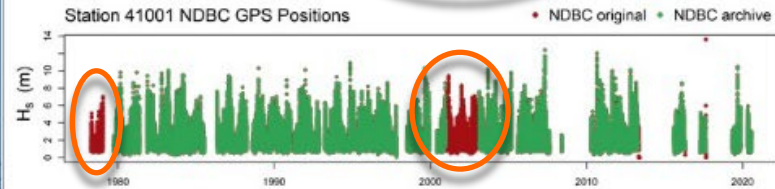
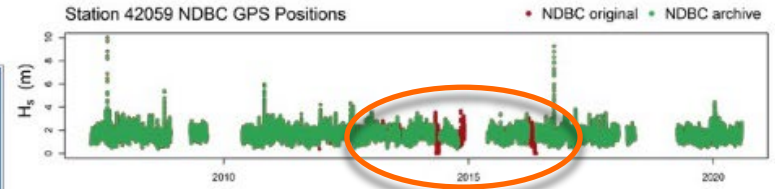
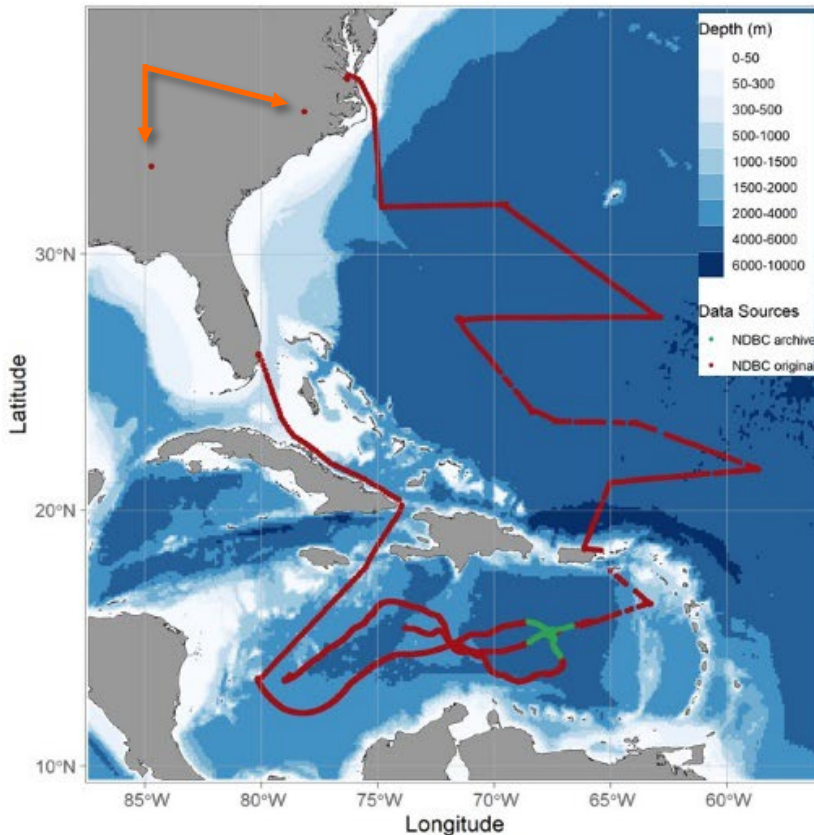


OBSERVATIONAL DATA STORAGE ERRORS

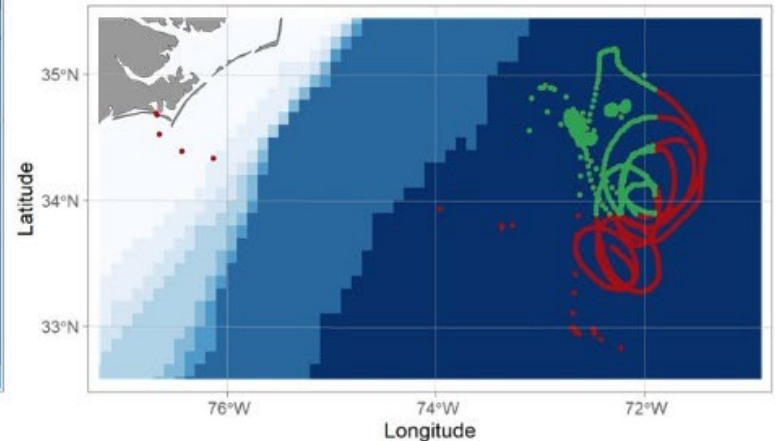


Question: How accurate are the wave measurement data that are used for USACE WIS validation, wave related R&D and wave model improvements?

Station 42059 NDBC GPS Positions



Station 41001 NDBC GPS Positions

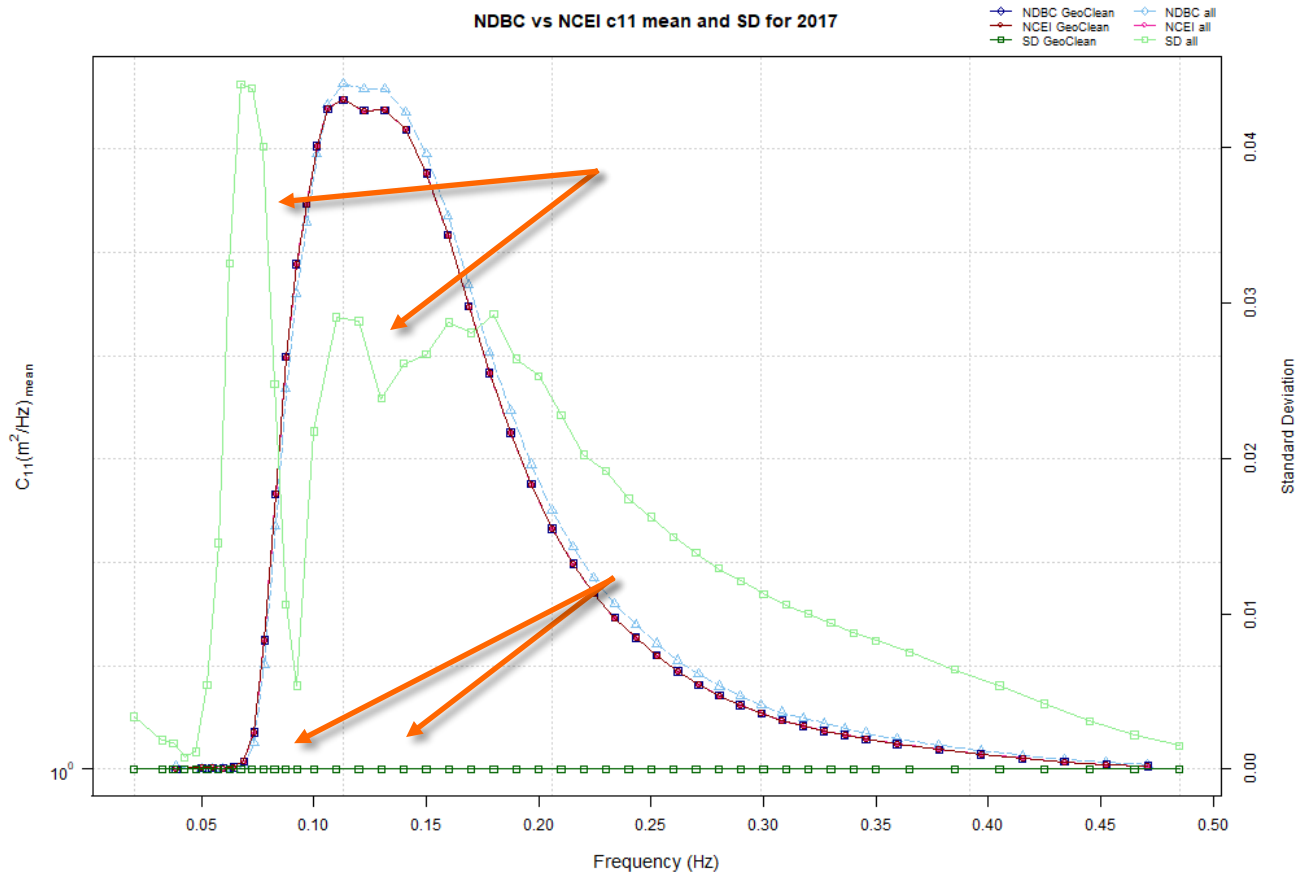




OBSERVATIONAL DATA STORAGE ERRORS



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OBSERVATIONAL DATA STORAGE ERRORS



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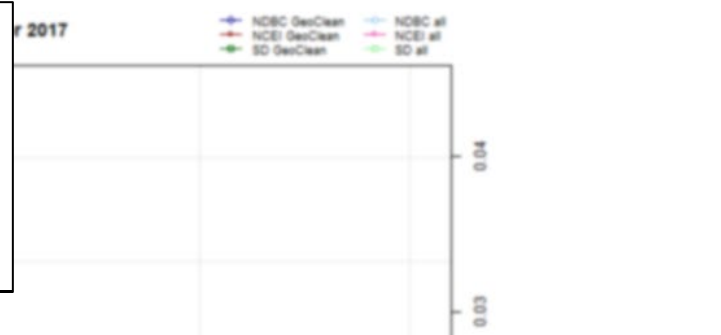

ERDC/CHL CHETN-I-??
MONTH 2021



US Army Corps of Engineers

Utilizing Data from the NOAA National Data Buoy Center

By Candice Hall and Robert E. Jensen

www.nature.com/scientificdata

Check for updates

OPEN DATA DESCRIPTOR

USACE Coastal and Hydraulics Laboratory Quality Controlled, Consistent Measurement Archive

Candice Hall^{1,2} & Robert E. Jensen¹



OBSERVATIONAL DATA STORAGE ERRORS



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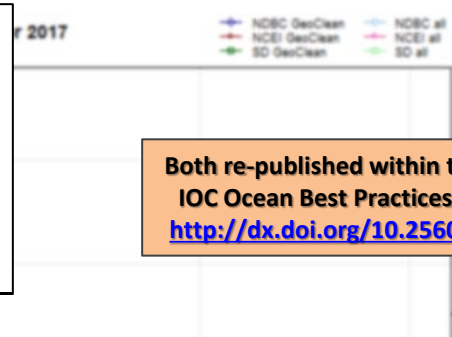
ERDC/CHL CHETN-I-??
MONTH 2021



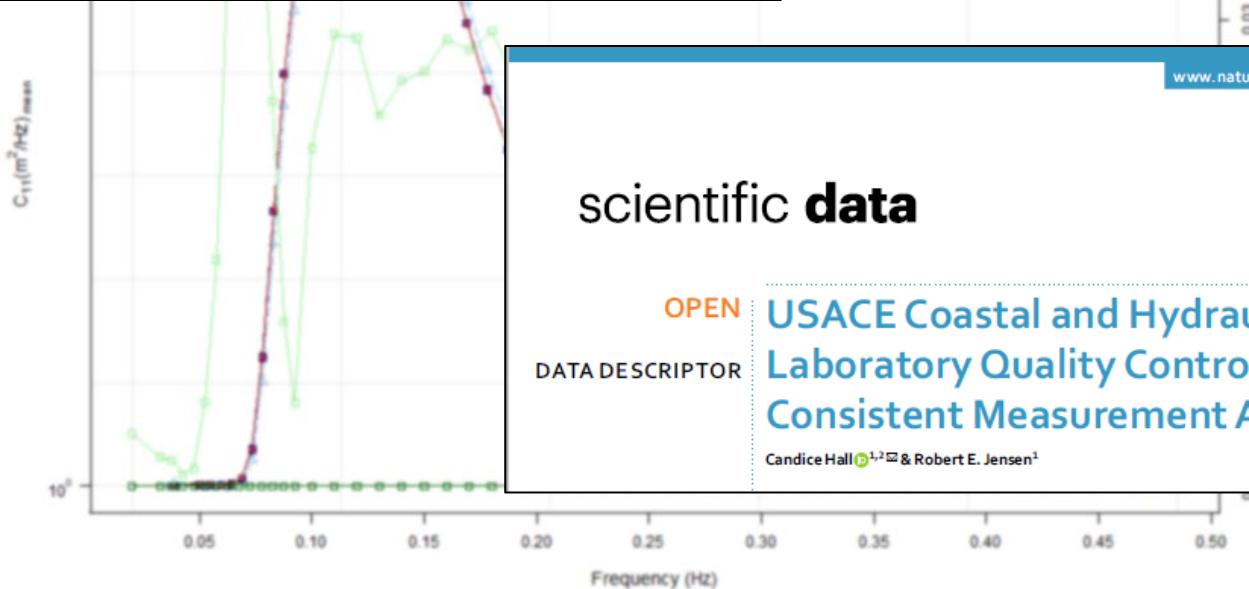
US Army Corps of Engineers

Utilizing Data from the NOAA National Data Buoy Center

By Candice Hall and Robert E. Jensen



Both re-published within the UNESCO / IOC Ocean Best Practices Repository:
<http://dx.doi.org/10.25607/OBP-1087>



www.nature.com/scientificdata

scientific **data**

OPEN DATA DESCRIPTOR

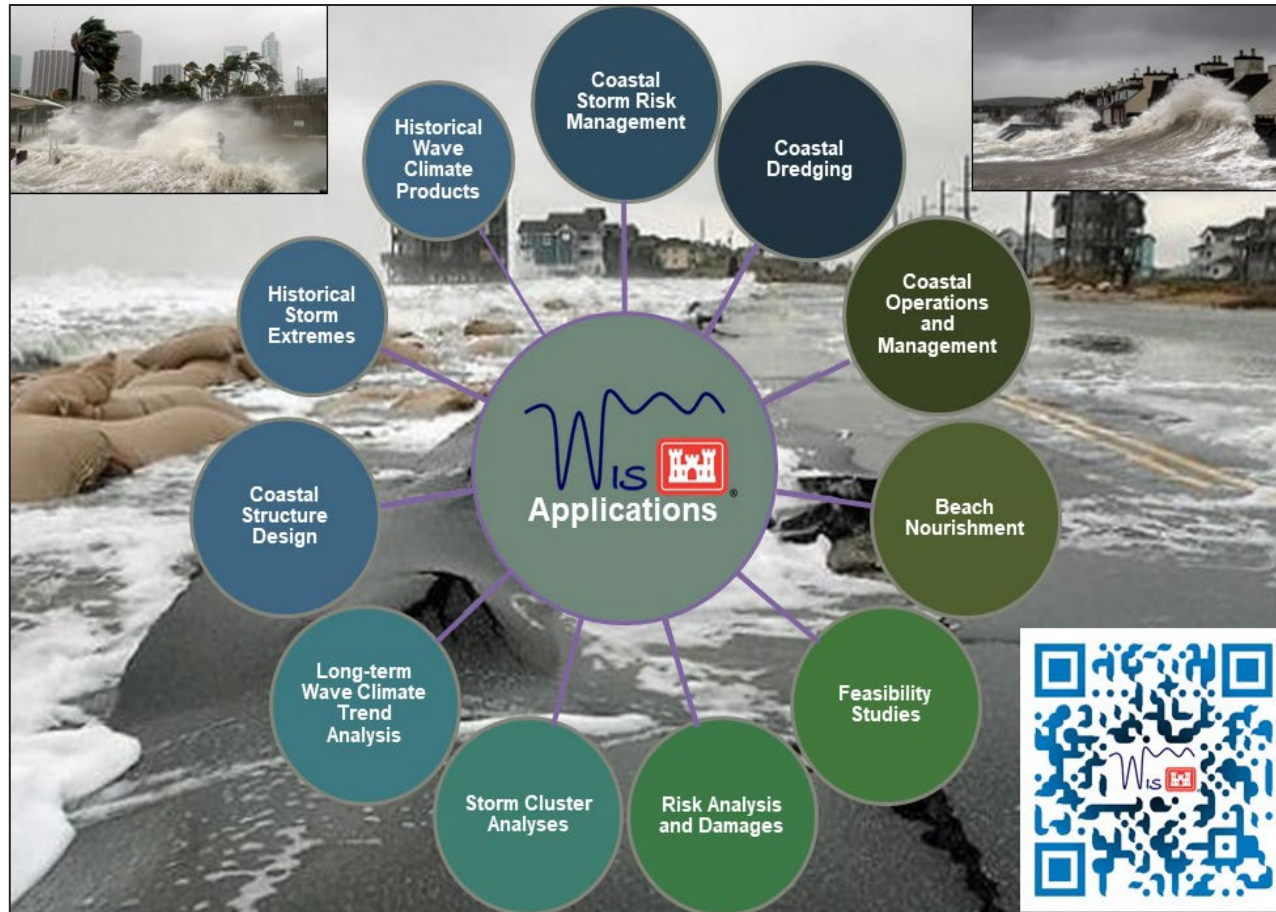
USACE Coastal and Hydraulics Laboratory Quality Controlled, Consistent Measurement Archive

Candice Hall^{1,2} & Robert E. Jensen¹

Check for updates



USACE WAVE INFORMATION STUDY (WIS)

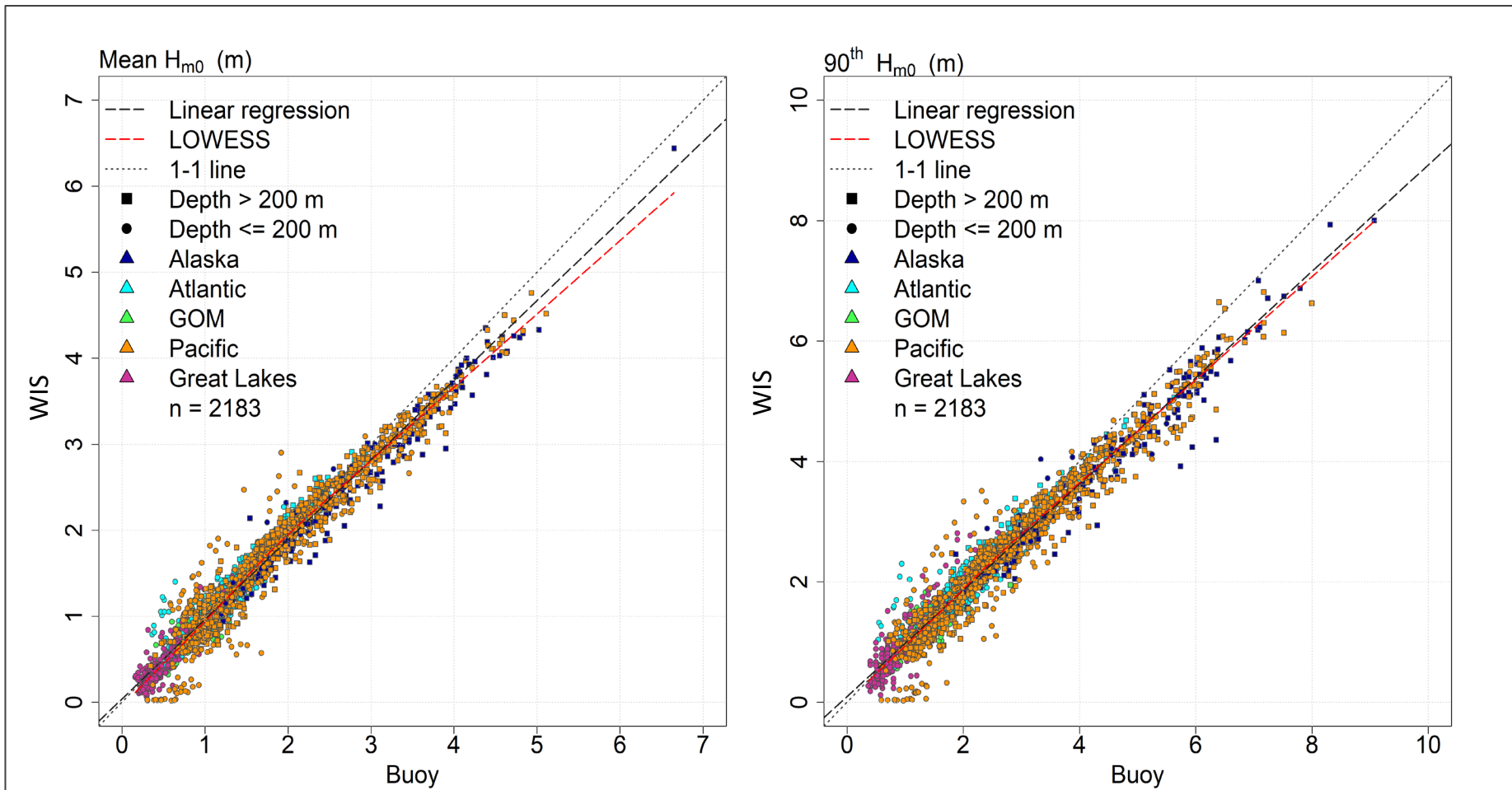




USACE WIS VALIDATION AND VERIFICATION (V&V)



WIS V&V against in situ moored buoys.

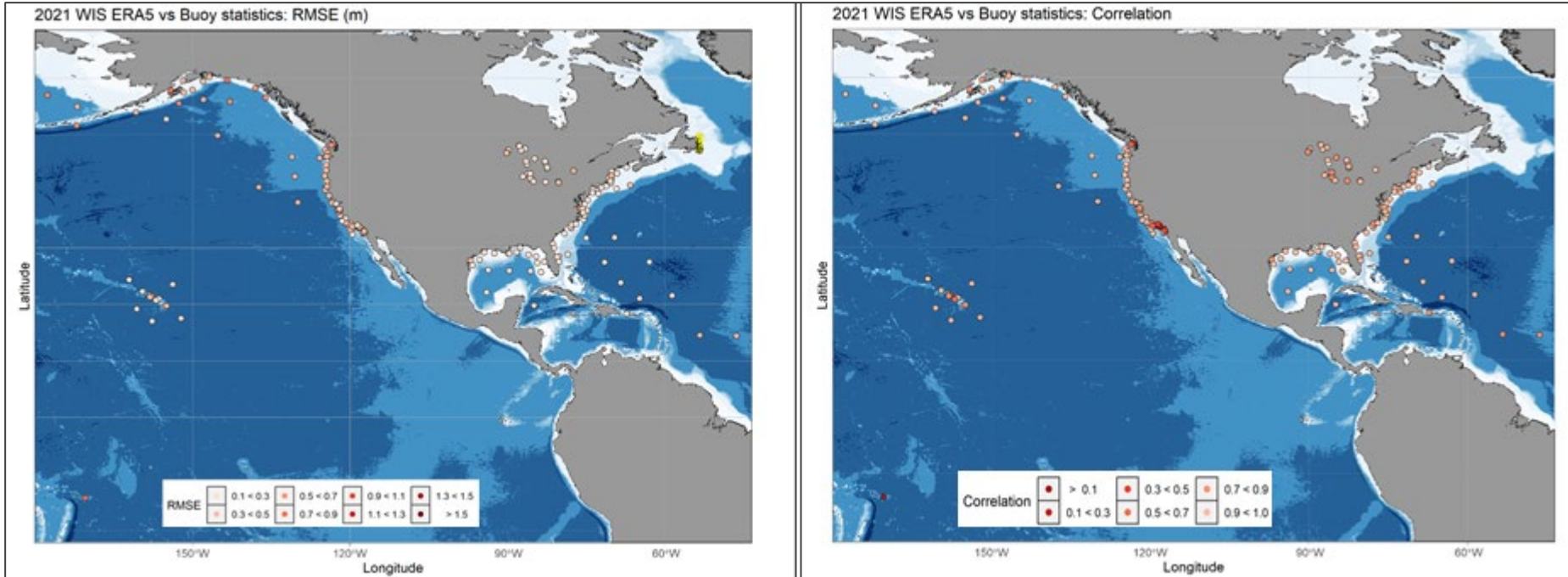




USACE WIS VALIDATION AND VERIFICATION (V&V)



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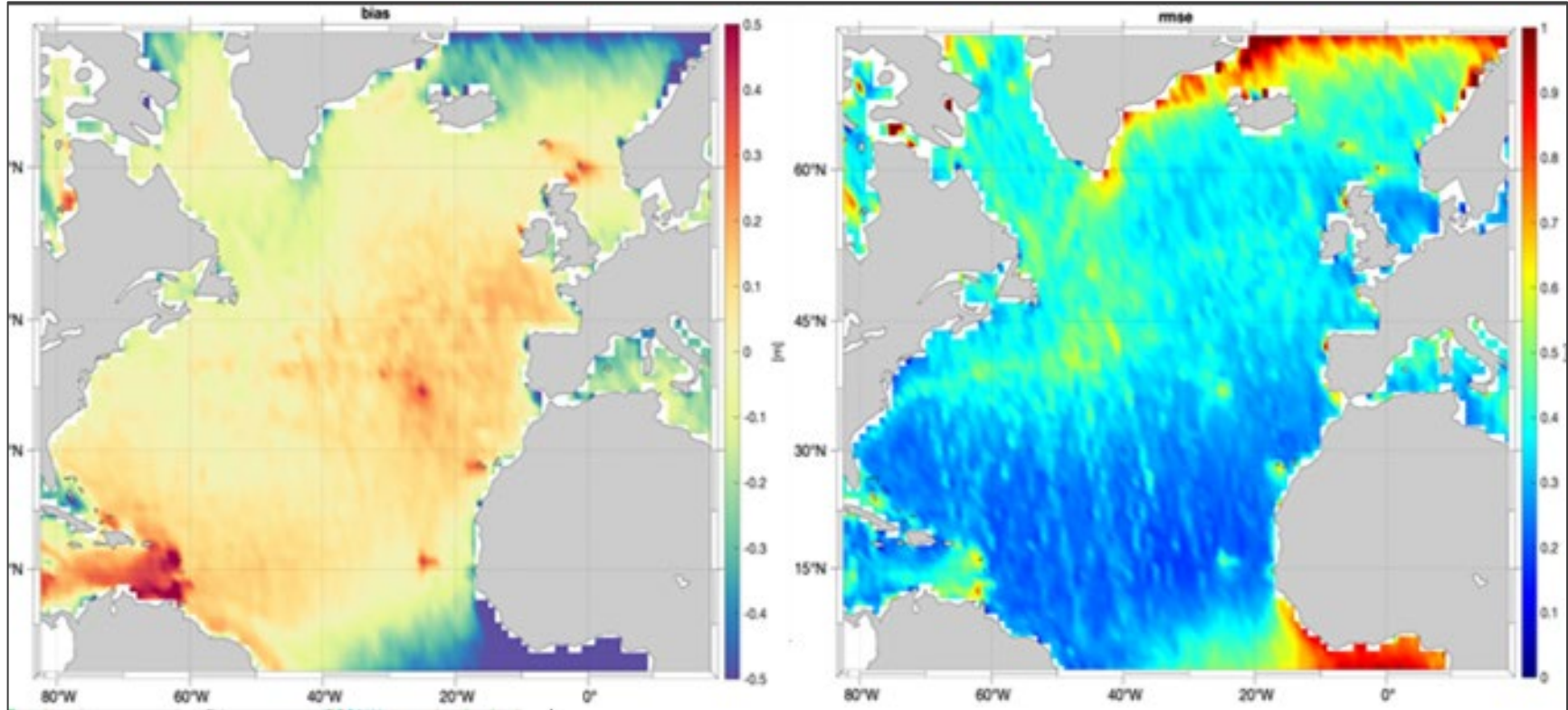




USACE WIS VALIDATION AND VERIFICATION (V&V)

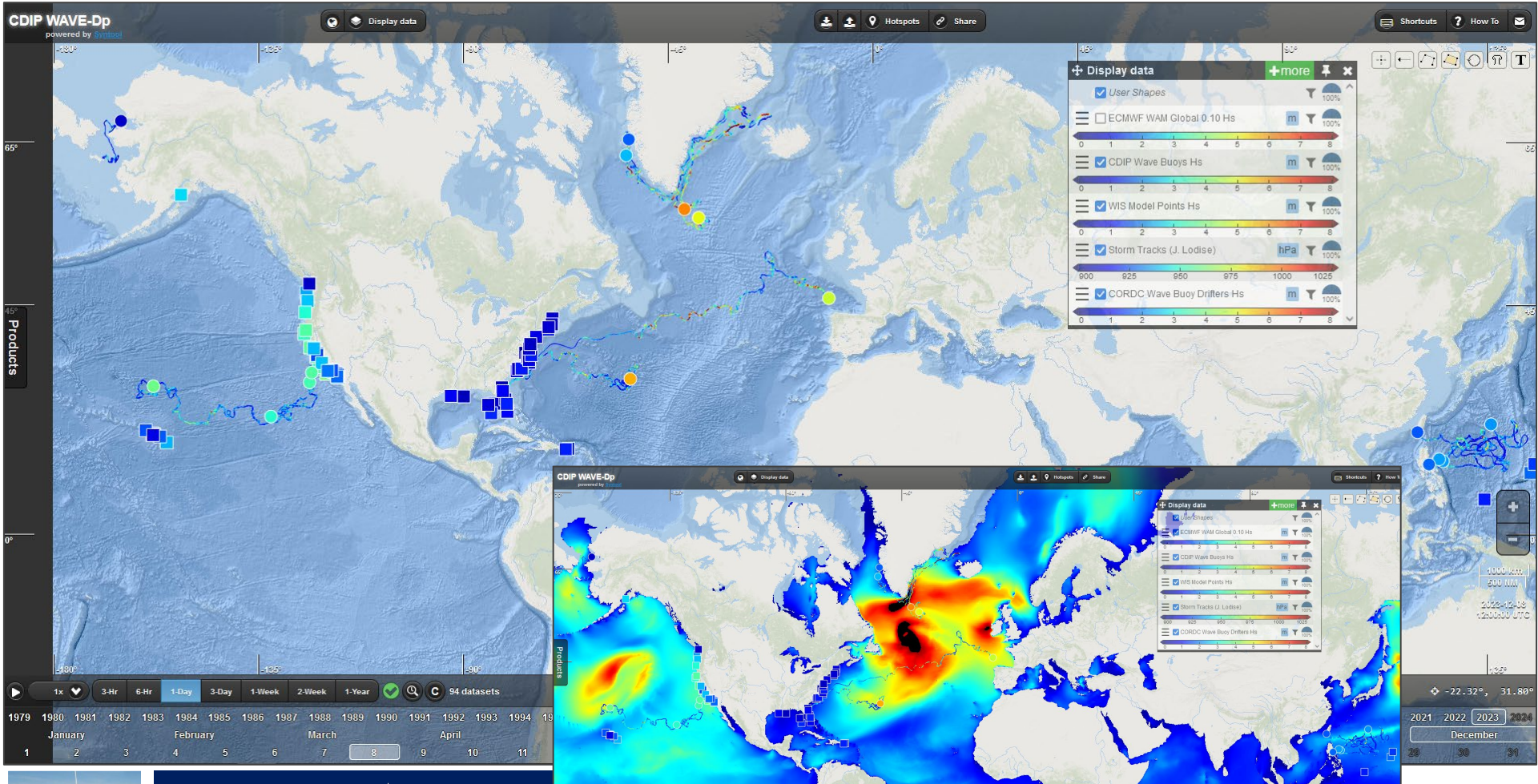


WIS V&V against in situ moored buoys and satellite datasets.





USACE WIS COLLABORATIONS

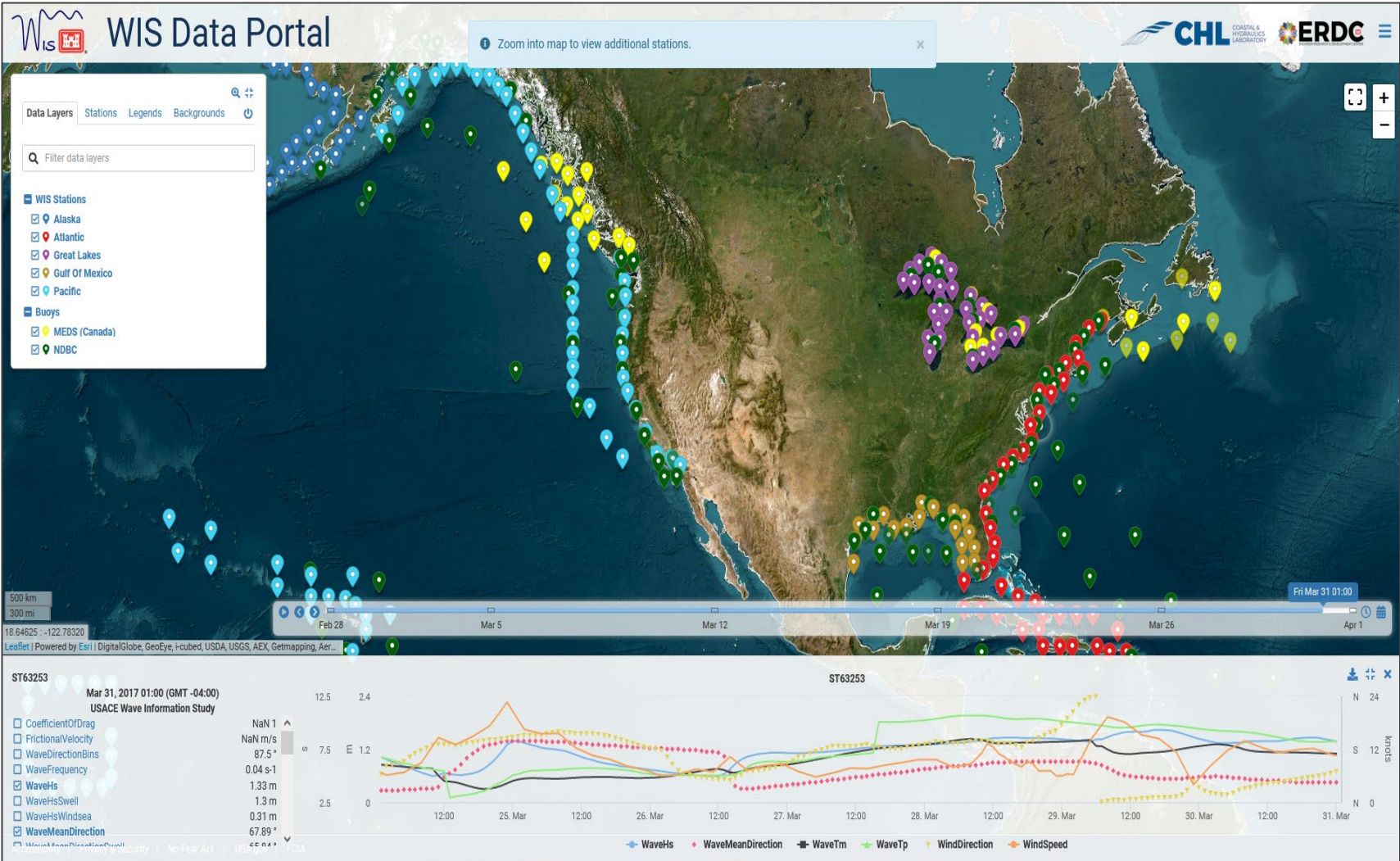


UC San Diego



SCRIPPS INSTITUTION OF OCEANOGRAPHY

USACE WAVE INFORMATION STUDY (WIS)





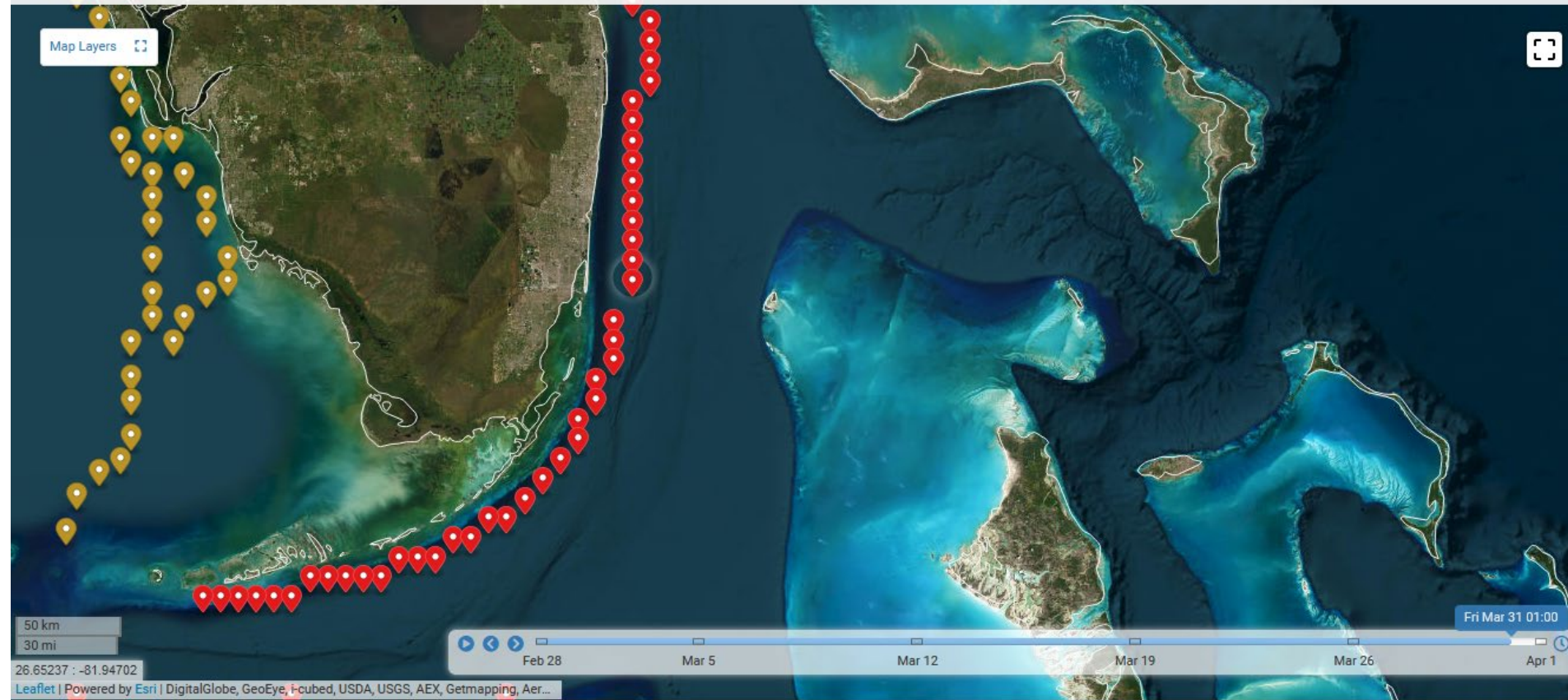
USACE WAVE INFORMATION STUDY (WIS)



WIS Data Portal



Map Layers





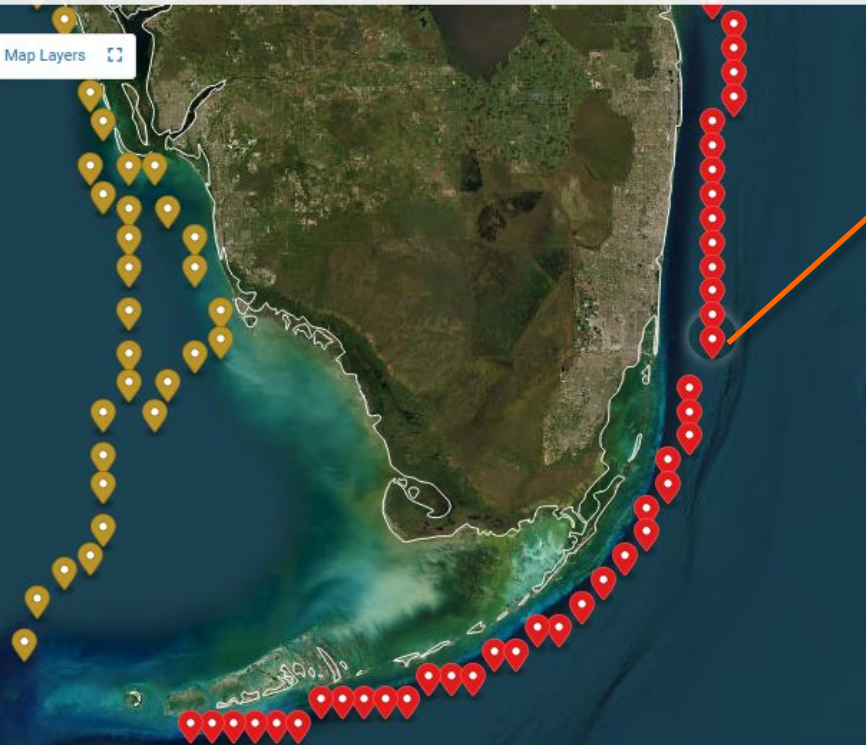
USACE WAVE INFORMATION STUDY (WIS)



WIS Data Portal



Map Layers



Overview

Atlantic Station ST63470

USACE Wave Information Study

The Wave Information Studies (WIS) is a US Army Corps of Engineers (USACE) sponsored project that generates consistent, hourly, long-term (30+ years) wave climatologies along all US coastlines, including the Great Lakes and US island territories.

Extents Spatial: 25.8333°N, 79.9167 °W

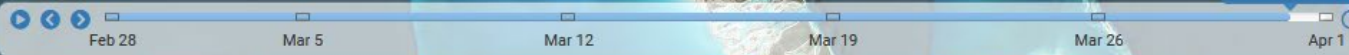
Extents Temporal: 1980-01-01T01:00:00Z - 2023-01-01T00:00:00Z

Extents Depth: 314.0

Zoom In

For issues/updates, please see the [WIS website](#)

Fri Mar 31 01:00



50 km
30 mi

26.65237 ; -81.94702

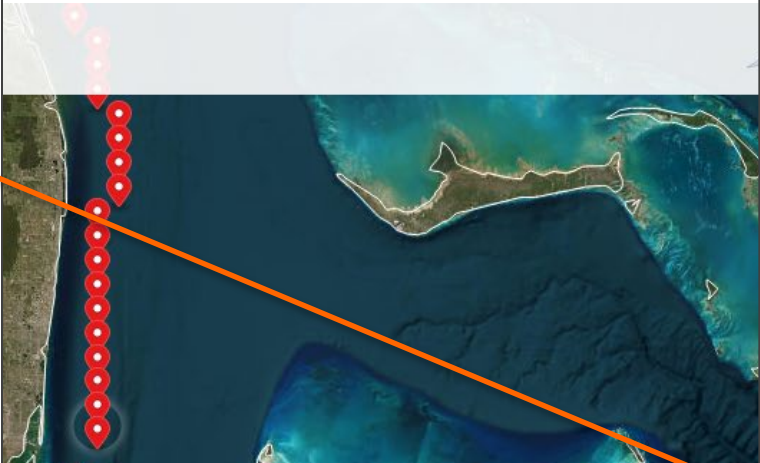
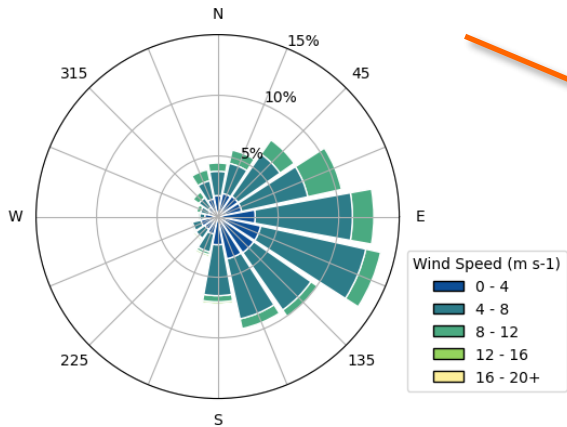
Leaflet | Powered by Esri | DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aer...



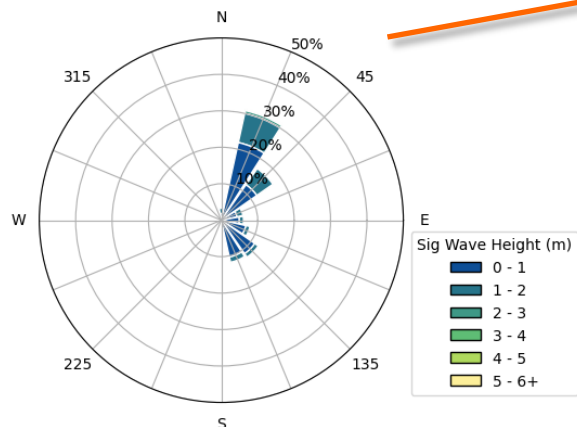
USACE WAVE INFORMATION STUDY (WIS)



WIS Atlantic Hindcast: 63471
 2022-01-01T00:00:00Z - 2022-12-31T23:00:00Z
 Loc: -79.916702° / 25.75° Depth: 341.9800109863281 [m]
 Total Obs: 8760



WIS Atlantic Hindcast: 63471
 2022-01-01T00:00:00Z - 2022-12-31T23:00:00Z
 Loc: -79.916702° / 25.75° Depth: 341.9800109863281 [m]
 Total Obs: 8760



Overview

Data Export

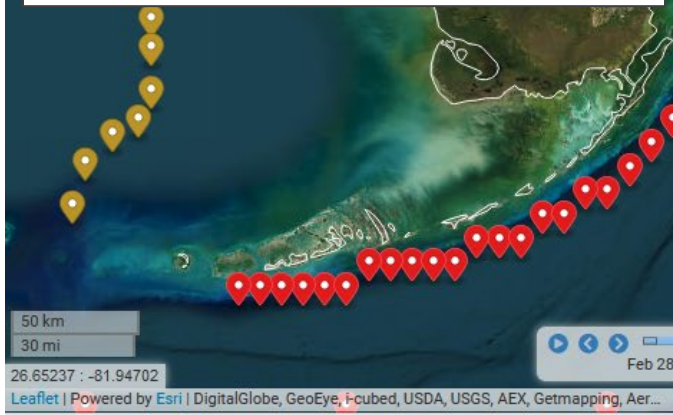
- [Generic Export](#)
- [2D Spectra](#)
- [Time Series \(ONELINES\)](#)
- [Mean-Max Summary Tables](#)
- [Extremes Analysis Table](#)
- [Wave Percent Occurrence](#)
- [Wind Percent Occurrence](#)

Plots

- [Wind Rose](#)
- [Wave Rose](#)
- [Mean & Max Wave Height Duration](#)
- [Wave Height Duration Distribution](#)
- [Yearly Wave Height Time Series](#)
- [Extremes Analysis Plot](#)

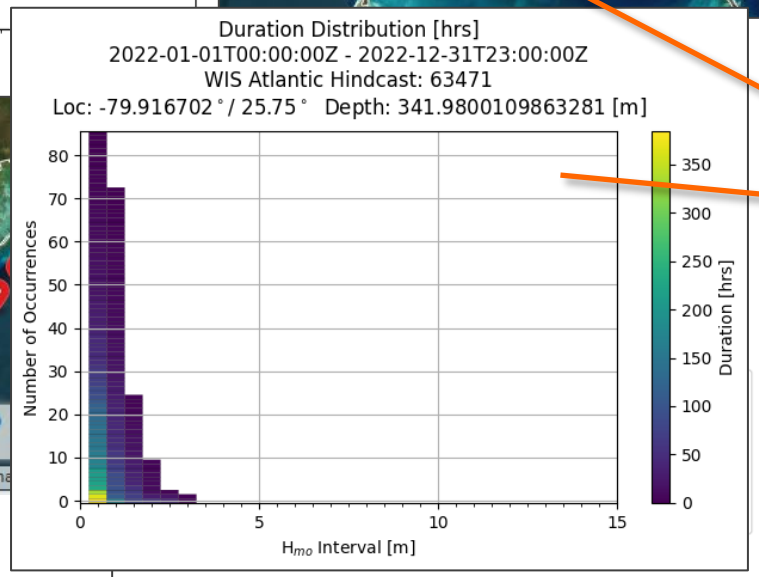
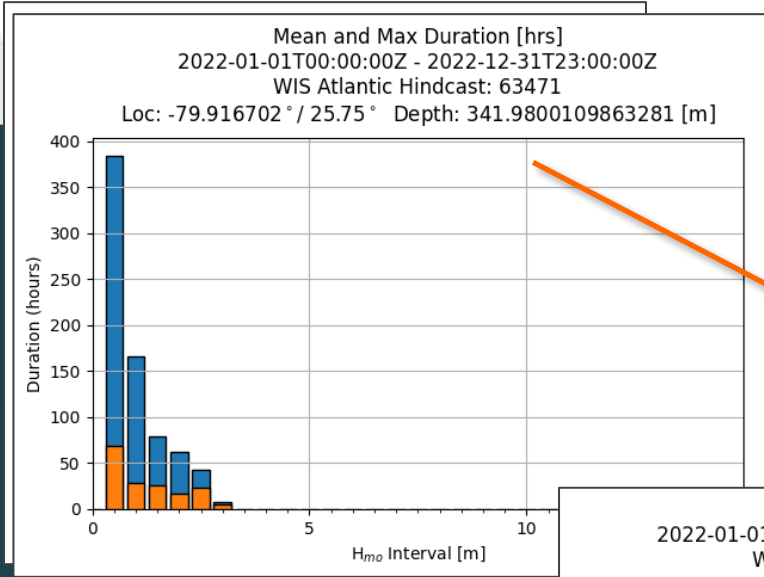
Input for Models

- [CMS-Wave](#)
- [Export Group Summary \(0\)](#)





USACE WAVE INFORMATION STUDY (WIS)



Overview

Data Export

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- Time Series (ONELINES)
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- Wind Percent Occurrence

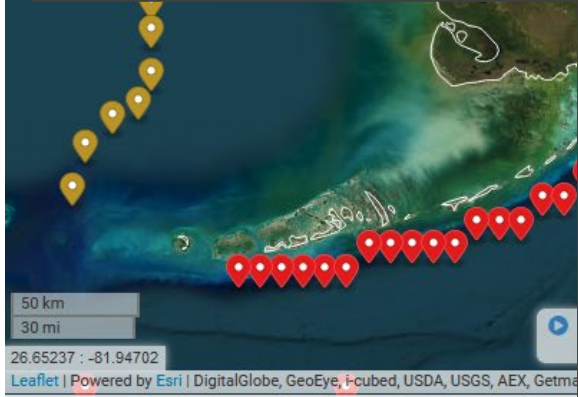
Plots

- Wind Rose
- Wave Rose
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- Wave Height Duration Distribution
- Yearly Wave Height Time Series
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Input for Models

- CMS-Wave

[Export Group Summary \(0\)](#)

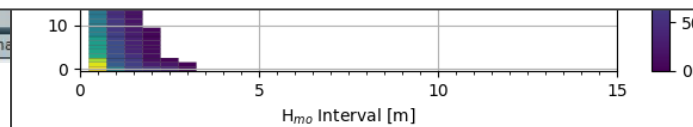
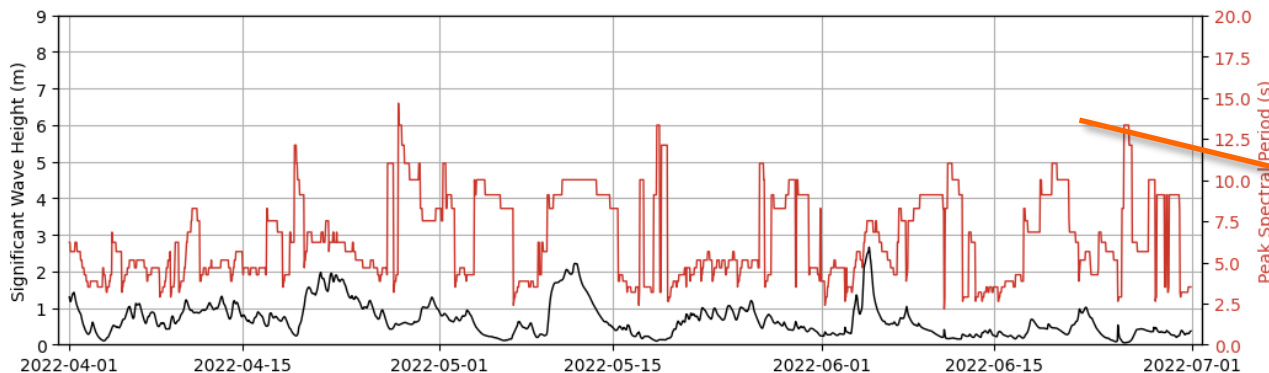
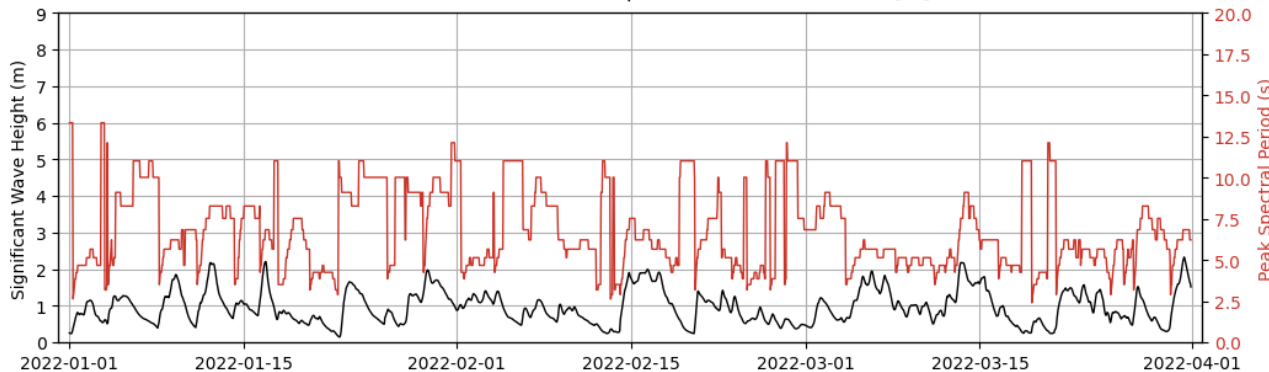




USACE WAVE INFORMATION STUDY (WIS)



Wave Conditions
2022-01-01T00:00:00Z - 2022-12-31T23:00:00Z
WIS Atlantic Hindcast: ST63471
Lat: -79.92° / Lon: 25.75° Depth: 341.9800109863281 [m]



Overview

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Plots

- Wind Rose
- Wave Rose
- Mean & Max Wave Height Duration
- Wave Height Duration Distribution
- Yearly Wave Height Time Series
- Extremes Analysis Plot

Input for Models

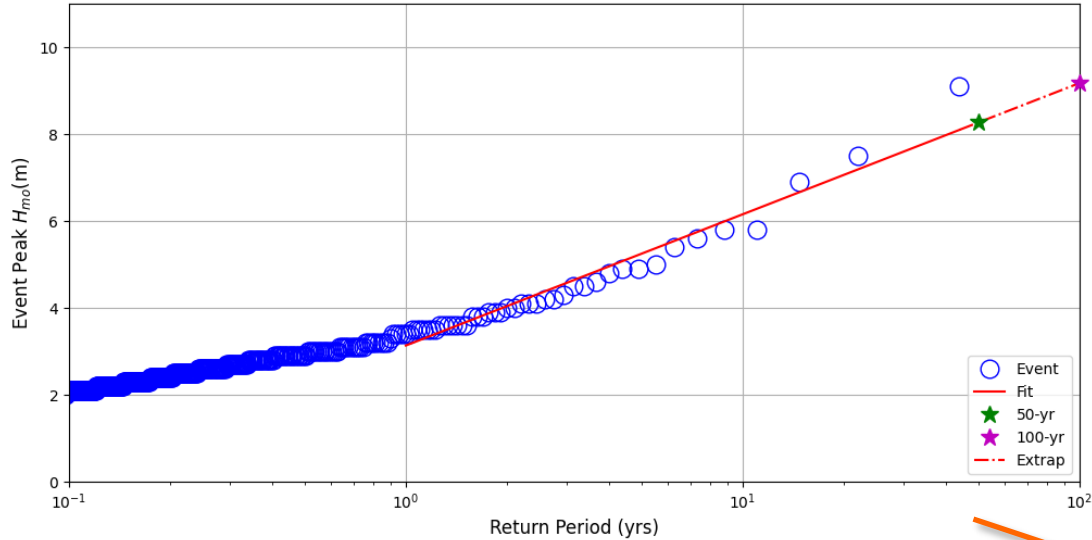
- CMS-Wave
- Export Group Summary (0)



USACE WAVE INFORMATION STUDY (WIS)



Storm Event Return Period of 43-yr (1980-2022) Wave Hindcast
 Atlantic Station ST63471: Lat: 25.750° Lon: -79.917° Depth: 341.9800109863281m
 Linear Fit to top 43 events: $H_{mo} = 3.13 + 1.31 \cdot \ln(R)$



Top 10 Events based on Peak H_{mo}

Event	Date/Time(UTC)	H_{mo}	T_p	θ_{mean}	Event	Date/Time(UTC)	H_{mo}	T_p	θ_{mean}
1	1992/08/24 08:00	7.5	10.0	45.2	6	2022/11/10 05:00	5.4	13.2	15.4
2	2017/09/11 07:00	6.9	11.0	163.6	7	1998/11/05 14:00	5.0	9.6	181.4
3	1999/10/16 00:00	5.8	9.8	164.9	8	2012/10/27 00:00	4.9	12.1	20.3
4	2004/09/26 01:00	5.8	13.8	14.6	9	1994/11/14 14:00	4.9	9.8	32.2
5	2004/09/04 19:00	5.6	13.0	7.3	10	2020/11/09 04:00	4.8	8.6	100.6

An event is defined as any period when $H_m > 1.00m$

θ_{mean} is direction that waves are arriving from

Overview

Data Export

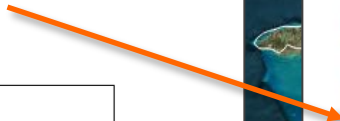
- Generic Export
- 2D Spectra
- Time Series (ONELINES)
- Mean-Max Summary Tables
- Extremes Analysis Table
- Wave Percent Occurrence
- Wind Percent Occurrence

Plots

- Wind Rose
- Wave Rose
- Mean & Max Wave Height Duration
- Wave Height Duration Distribution
- Yearly Wave Height Time Series
- Extremes Analysis Plot

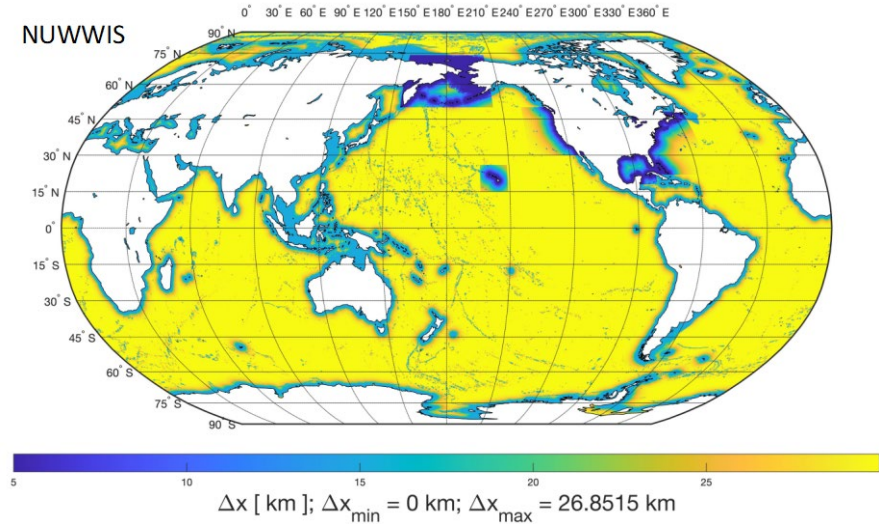
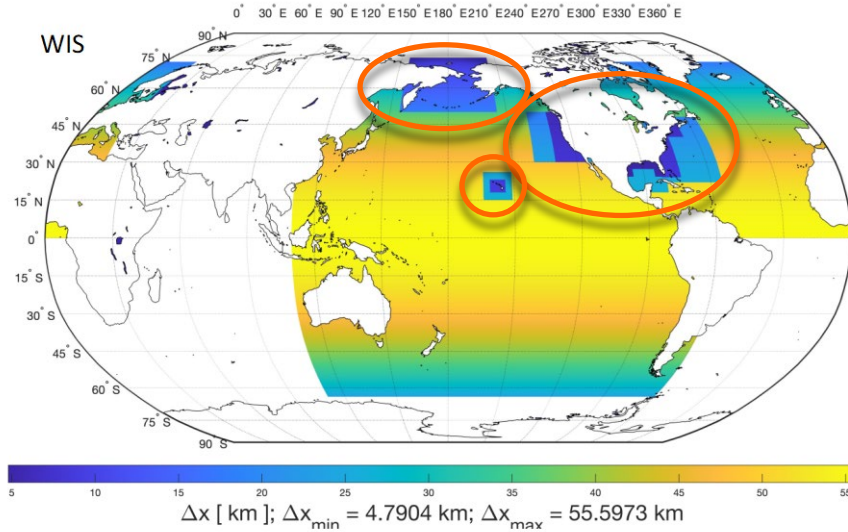
Input for Models

- CMS-Wave
- Export Group Summary (0)





Nearshore Unstructured Worldwide Wave Information Study

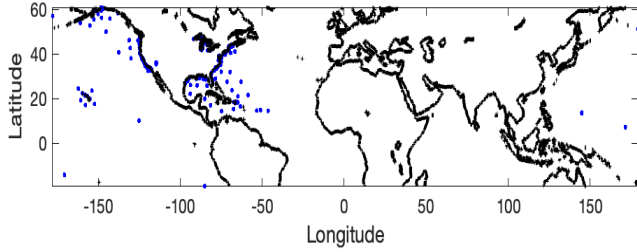




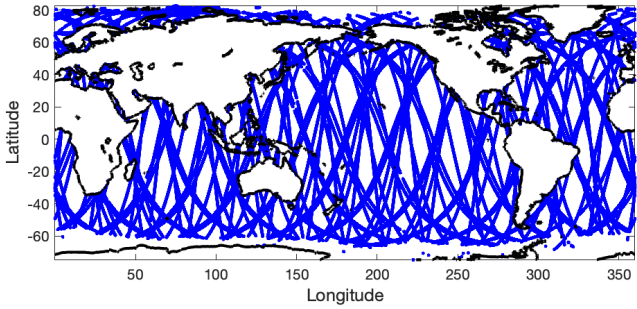
USACE FUTURE: NUWWIS



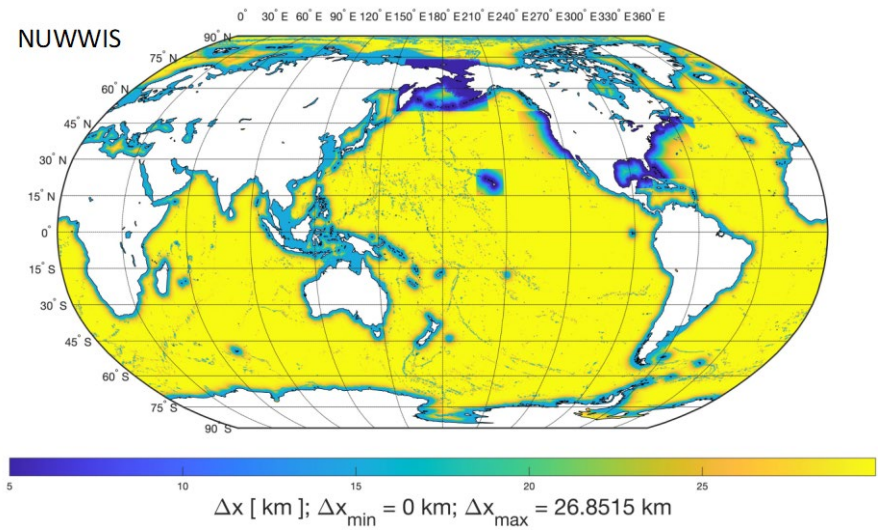
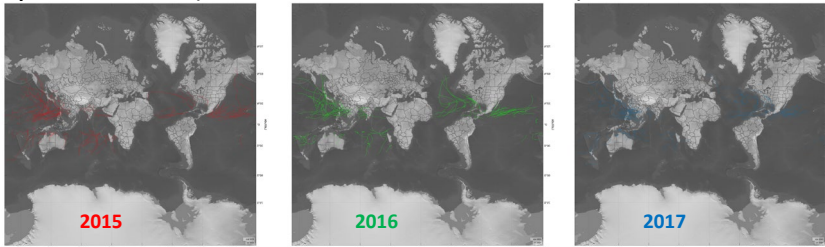
Buoys



Satellites

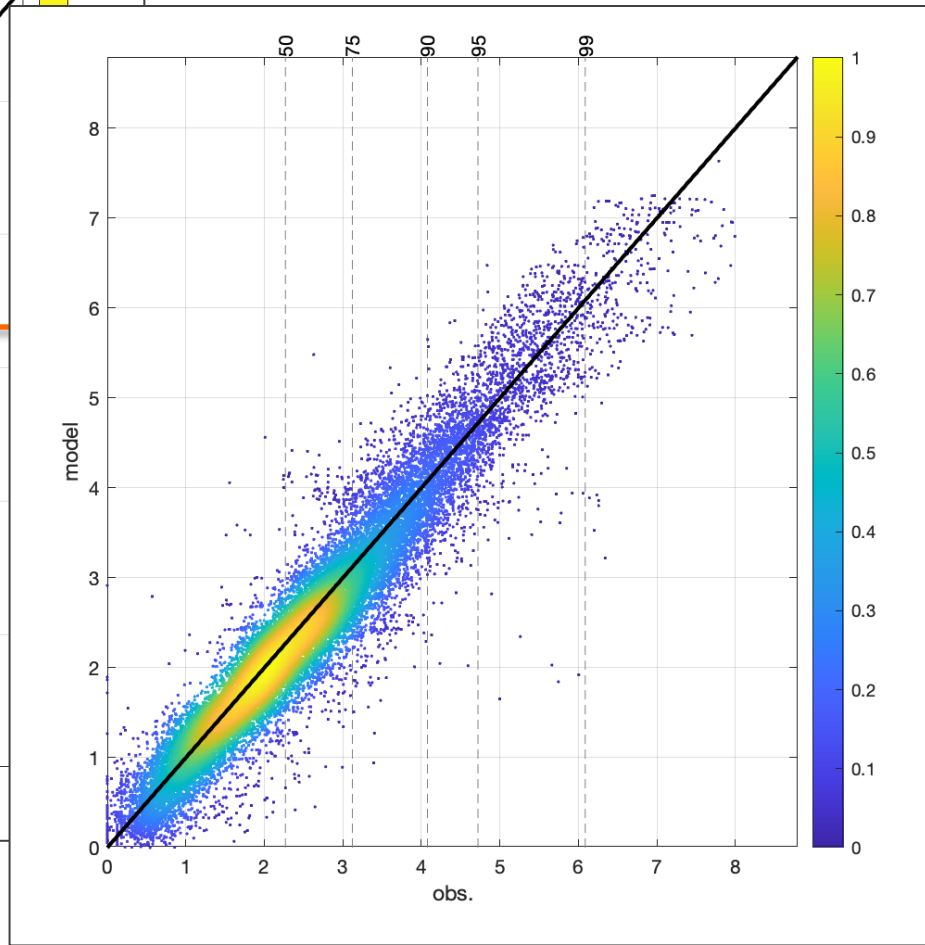
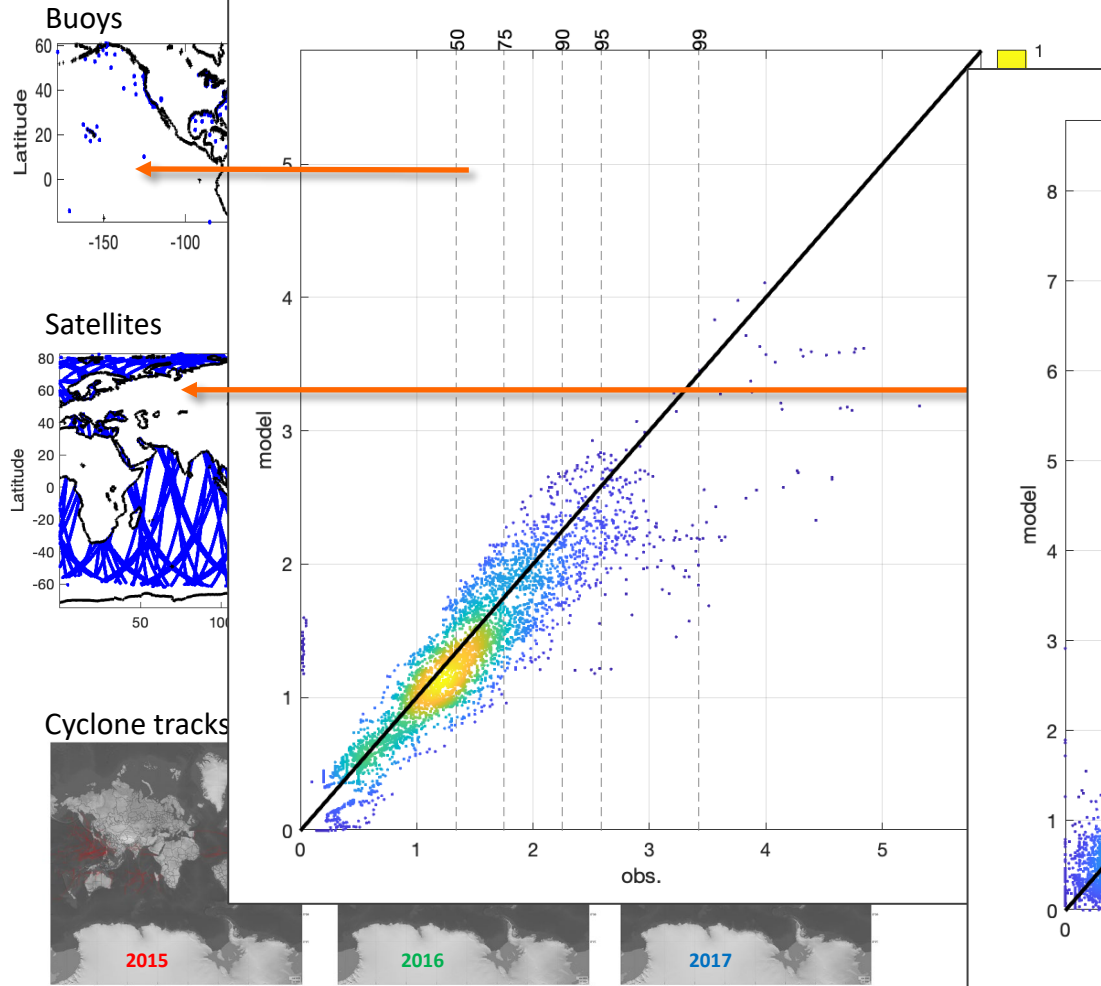


Cyclone tracks (IBTrACS.since1980.v04r00.nc)





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QUESTIONS?

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