

# Design Wave Conditions for Puerto Rico and the U.S. Virgin Islands

Matthew Perkins

Faculty Advisor: Dr. Miguel Canals

URI Project Coordinator: Gema Vinuales

UPRM Project Coordinator: Dr. Alberto Figueroa

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# Objectives

- Determine the design wave height and period of extreme return periods
- Provide methodology of the statistical analysis used in the determination of these values

# Background



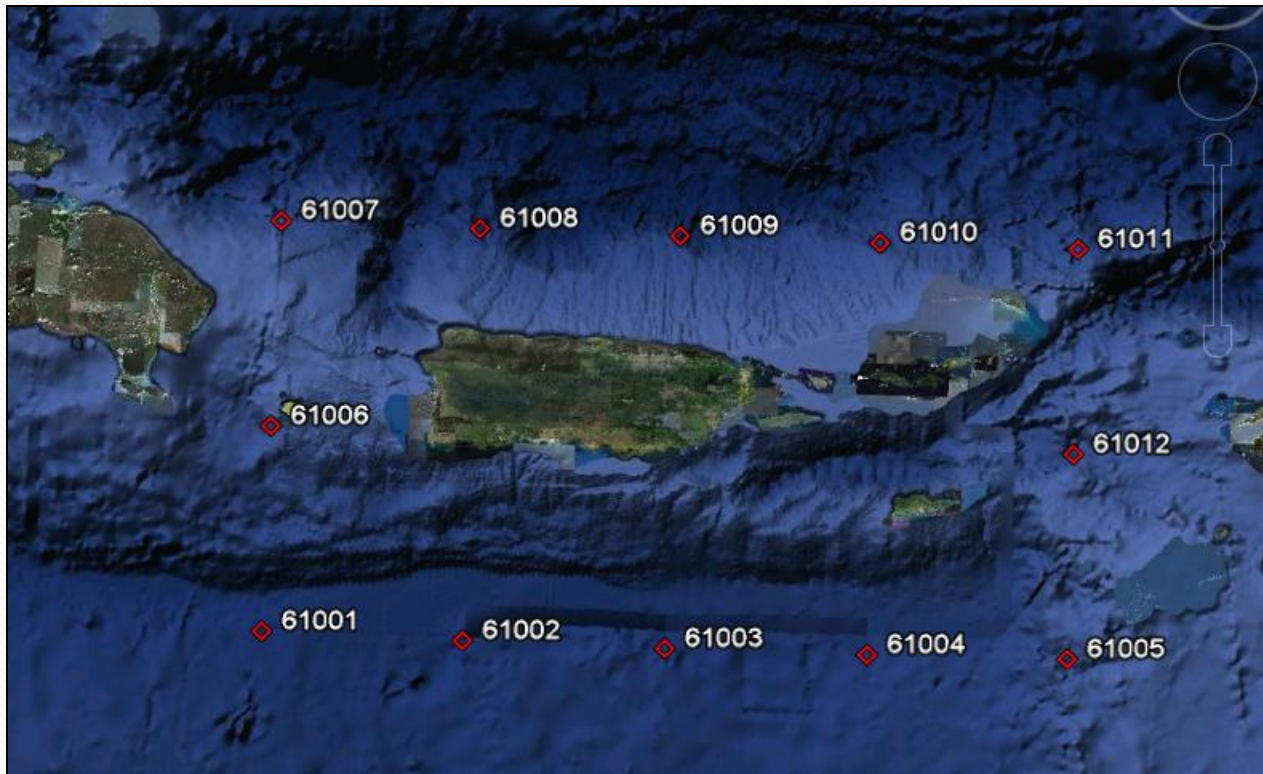
# Geographic Research Area



# Method

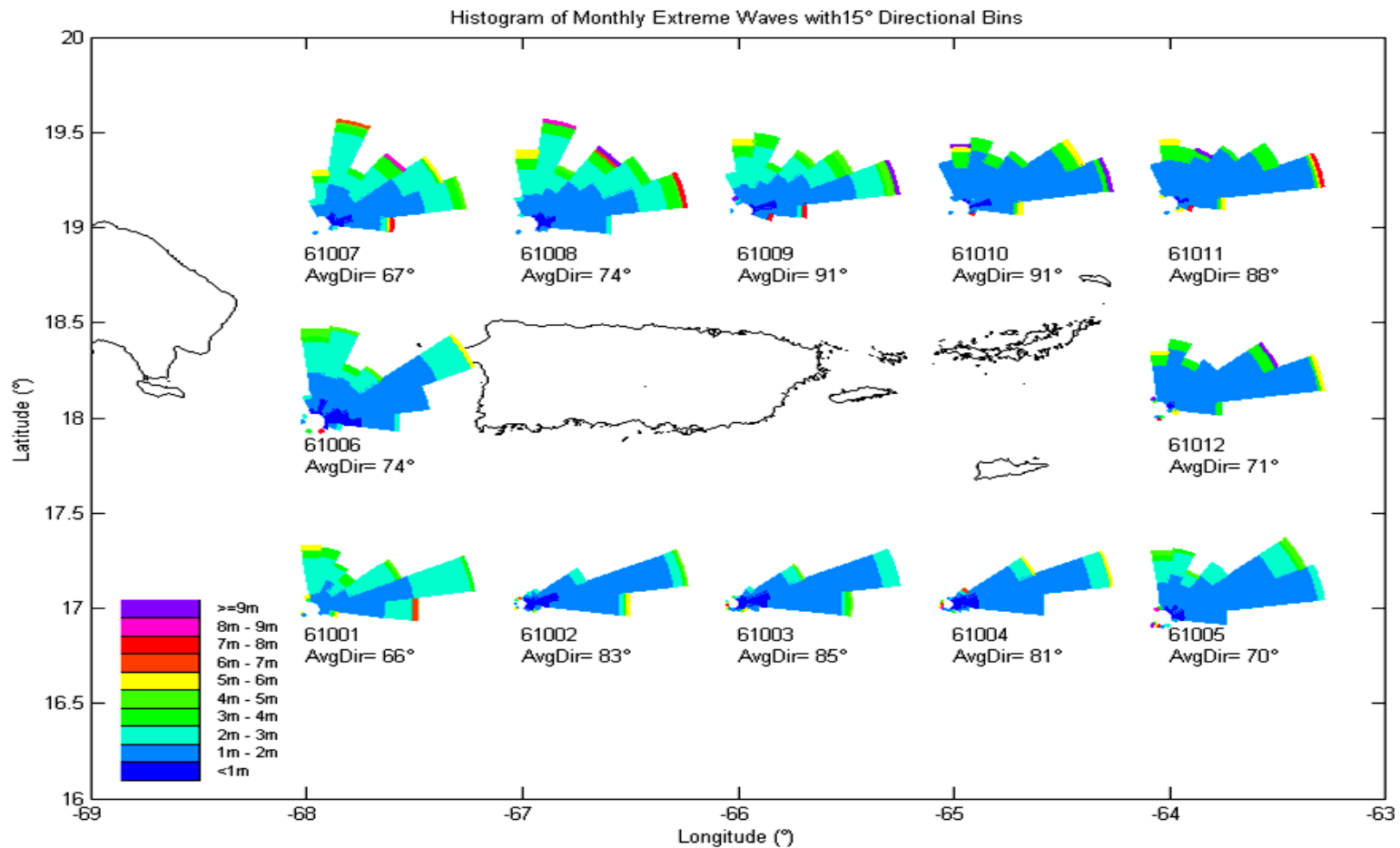
- Data collection and selection.
- Nonexceedance probabilities were assigned to each term of a descending set of significant wave height data
- A Gumbel distribution was fitted to the significant wave height data
- Using Gumbel distribution fit, significant wave height and period of desired return periods were calculated.

# Data Collection

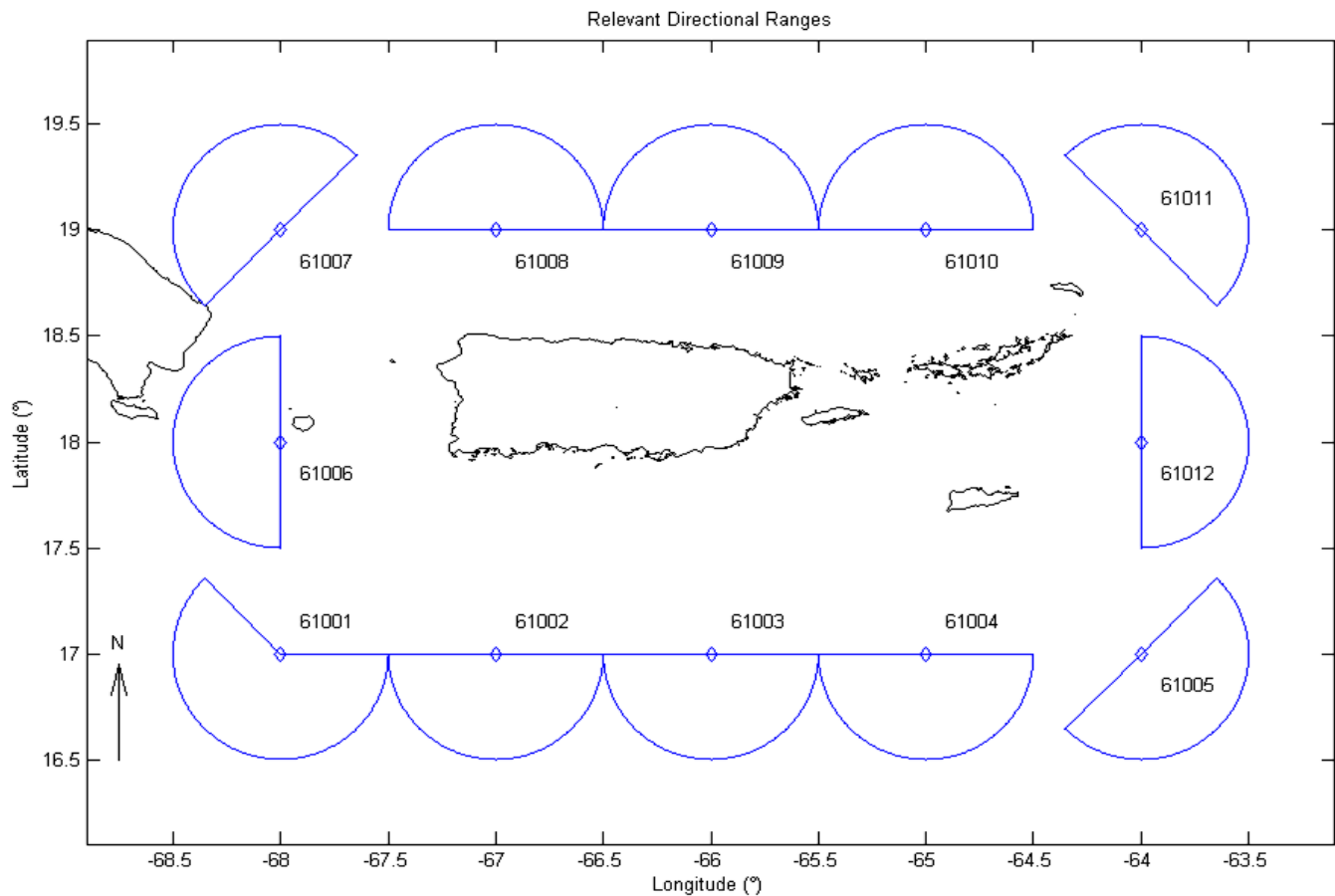


Station	Latitude	Longitude
61001	17°N	68°W
61002	17°N	67°W
61003	17°N	66°W
61004	17°N	65°W
61005	17°N	64°W
61006	18°N	68°W
61007	19°N	68°W
61008	19°N	67°W
61009	19°N	66°W
61010	19°N	65°W
61011	19°N	64°W
61012	18°N	64°W

# Wave Climate

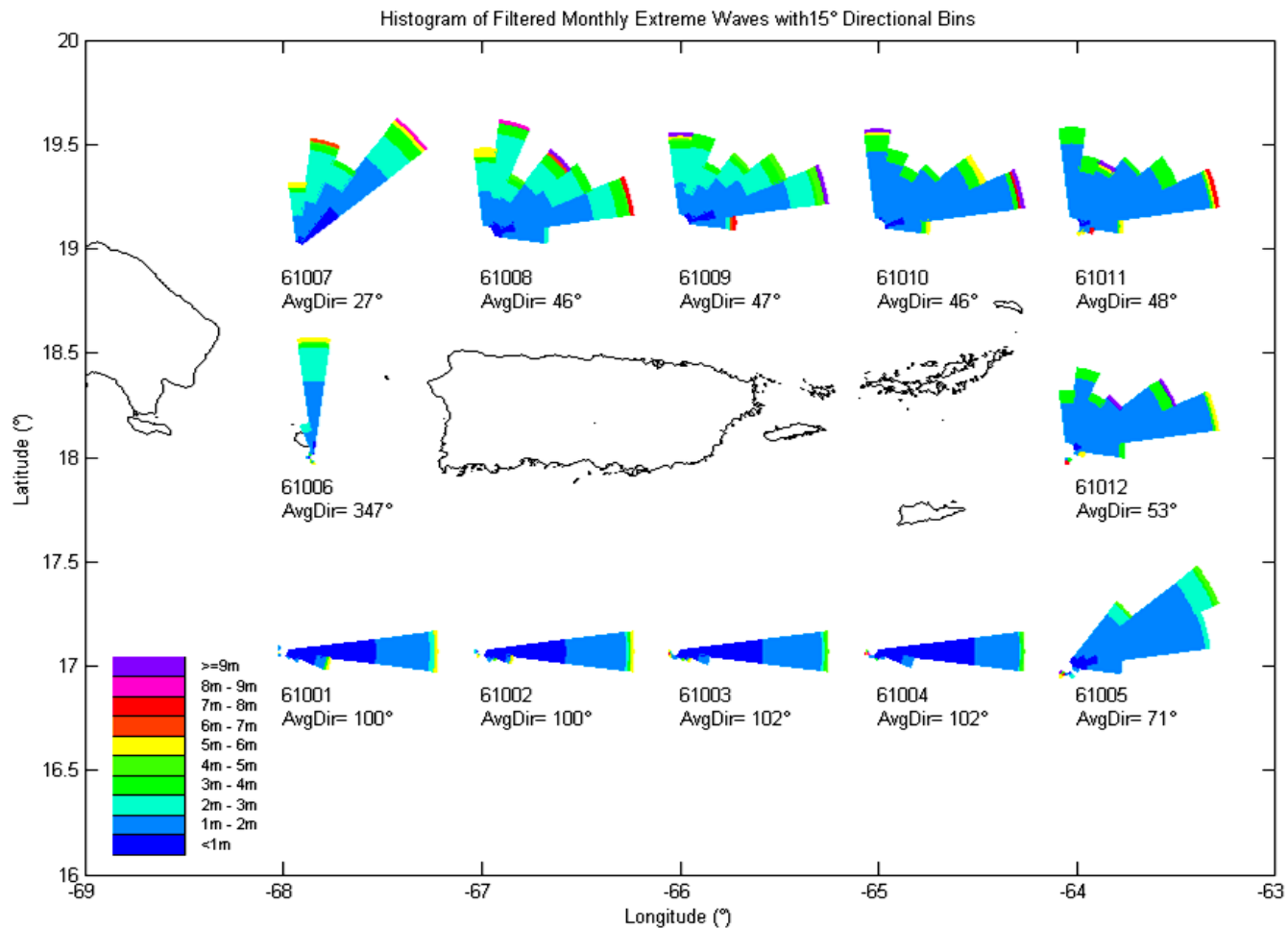


# Data Selection



Station	Min Direction	Max Direction
61001	135	360
61002	180	360
61003	180	360
61004	180	360
61005	225	405
61006	90	270
61007	45	225
61008	0	180
61009	0	180
61010	0	180
61011	315	495
61012	270	450

# Filtered Wave Climate



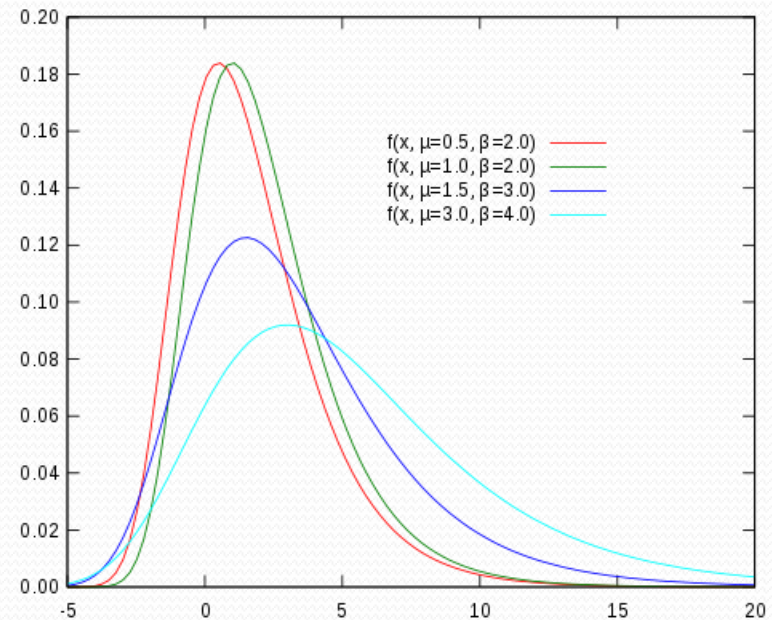
# Statistical Analysis

$$f(m) = 1 - \frac{m}{N + 1}$$

$$F(x) = e^{-e\left(\frac{x-B}{A}\right)}$$

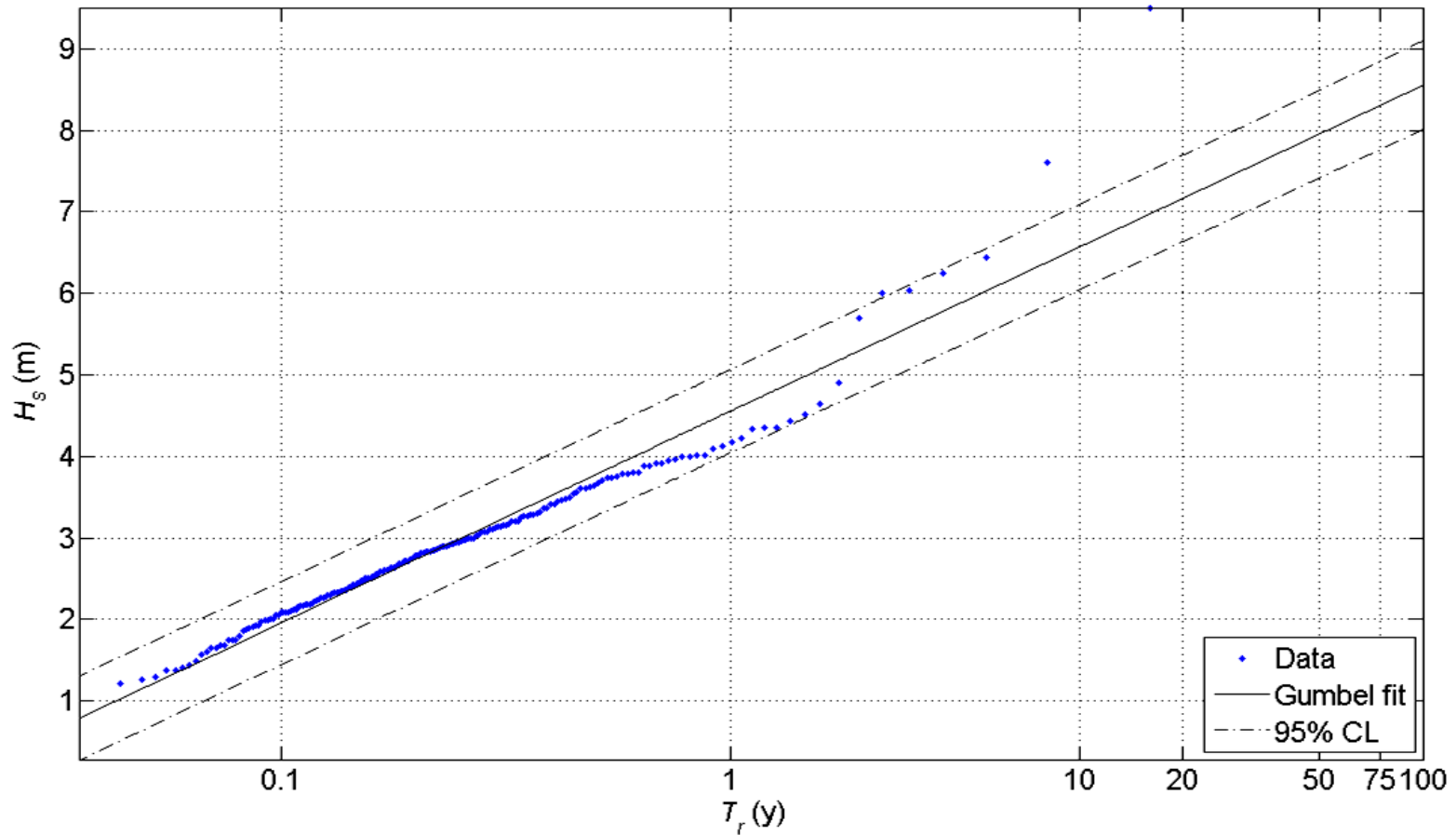
$$A = 0.779\sigma_x$$

$$B = \bar{x} - 0.4500\sigma_x$$



# Gumbel Fit

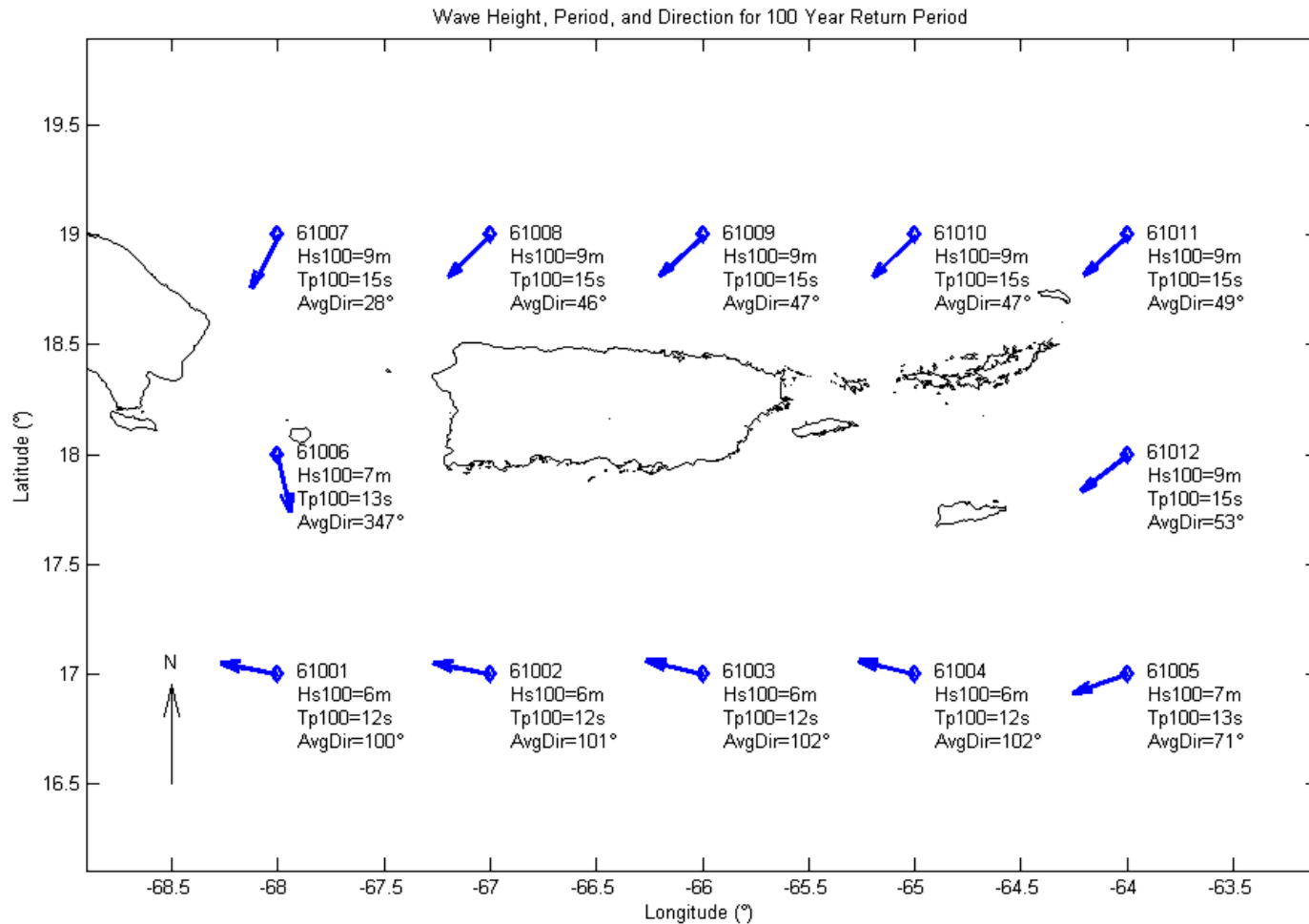
WIS Station: 61007, Years: 1980-1999, Dirm.: 28



# Data

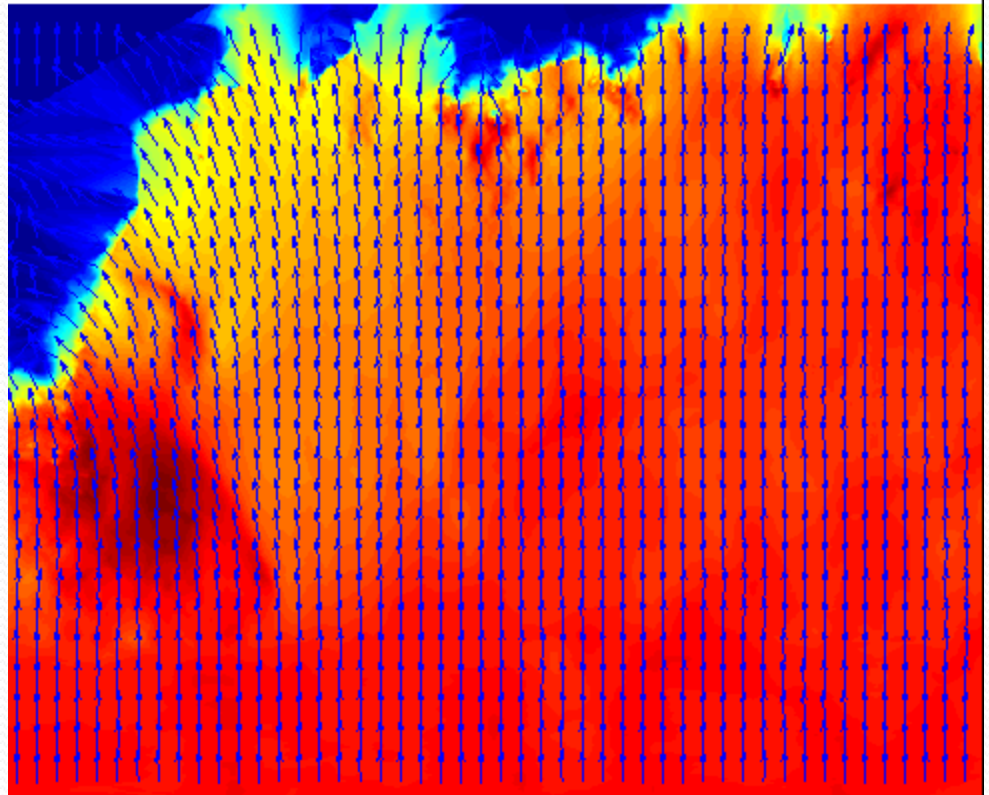
Station 61007							
Return Period (y)	Significant Wave Height (m)	Peak Period (s)	Upper 95% confidence Limit of Significant Wave Height	Upper 95% confidence Limit of Peak Period	Mean Wave Direction (T)	Longitude	Latitude
100	8.56	14.63	9.10	15.09	27.55	-68	19
75	8.31	14.41	8.85	14.88			
50	7.96	14.11	8.50	14.58			
20	7.17	13.39	7.70	13.88			
10	6.57	12.82	7.10	13.32			
1	4.56	10.68	5.07	11.26			

# End Result



# Recommendations

-How to use this data



# Future Work



Buoy	Latitude	Longitude	Description	Owned/Maintained
41053	18.476°N	66.099°W	San Juan, PR	CariCOOS
41115	18.376°N	67.280°W	Rincon, PR	CariCOOS
42085	17.860°N	66.524°W	Ponce, PR	CariCOOS
41052	18.251°N	64.763°W	St. John, Virgin Islands	CariCOOS

# References

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