MHKiT-MATLAB Introduction and Demonstration

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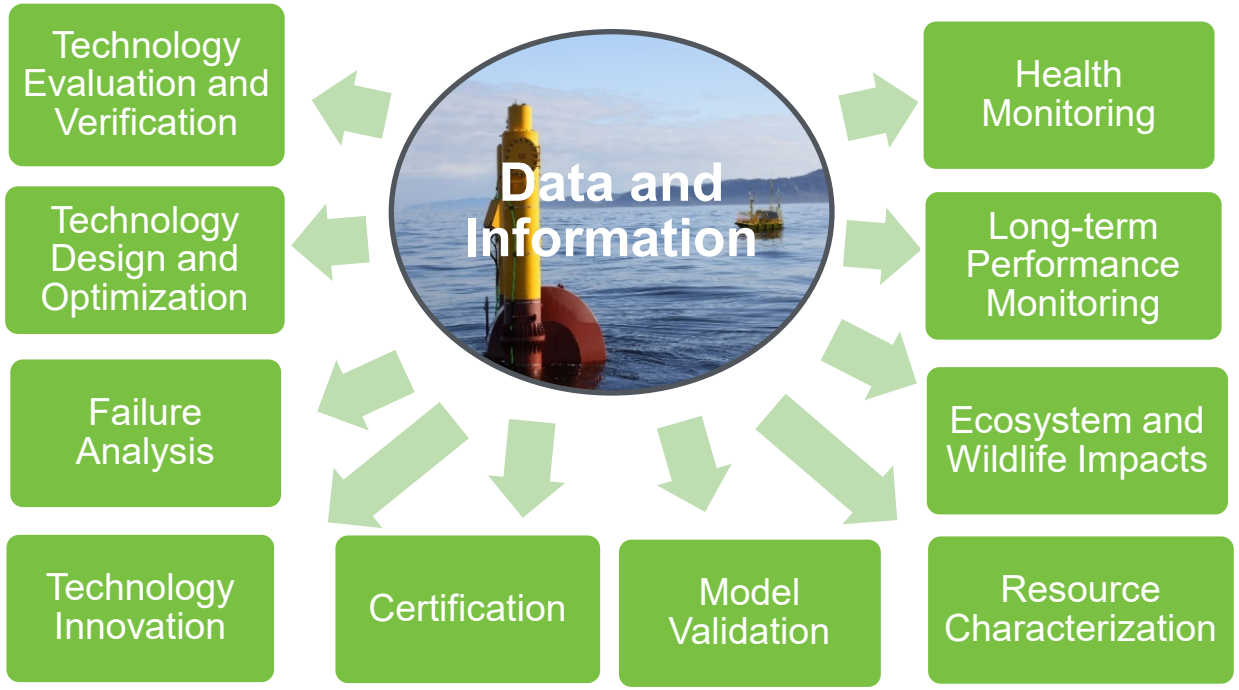
Overview

- Introduction to MHKiT
- MHKiT Documentation and Installation
- Overview of GitHub Repository
- QC Module Demonstration
- River Module Demonstration
- Q&A

Importance of Data in Marine Renewable Energy

The ability to collect, ingest, condition, reduce, quality control, process, visualize, and store data in a standardized way is critical at all stages of Marine Renewable Energy (MRE) research and technology/project development



What is MHKiT?

An open-source and standardized suite of MRE data processing functions that provides the ability to ingest, condition, reduce, quality control, process, visualize and store MRE data.

MHKiT is hosted on GitHub for easy access and collaboration

MHKiT Solves Problems and Adds Value

A verified suite of MRE data processing functions:

- **Rapid data processing**
- **Eliminates common code creation**
- **MRE Community Common development platform**
- **Standardized, referenceable, and readable code base**

MHKiT MATLAB

MHKiT Python User

Interact with MHKiT using Python

MHKiT MATLAB User
(with MHKIT-Python Installation)

Interacts with MHKiT using MATLAB

Handles calls to and data from MHKiT Python

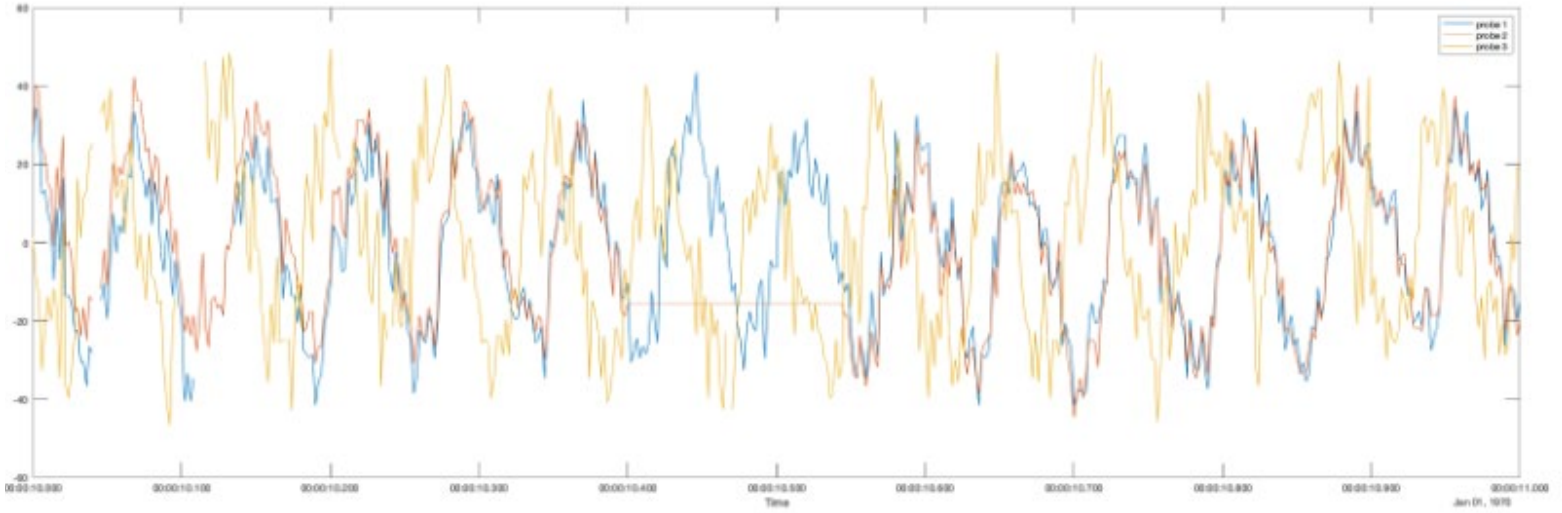
MHKiT Modules

MODULES		
Wave	Quality Control	Utilities
River	Power	
Tidal	Loads	

These modules provide functionality for calculating metrics needed by the MRE community as well as those required for conformity with IEC TS and recommendations.

MHKiT-MATLAB includes continuous integration software tests that are run using Travis CI.

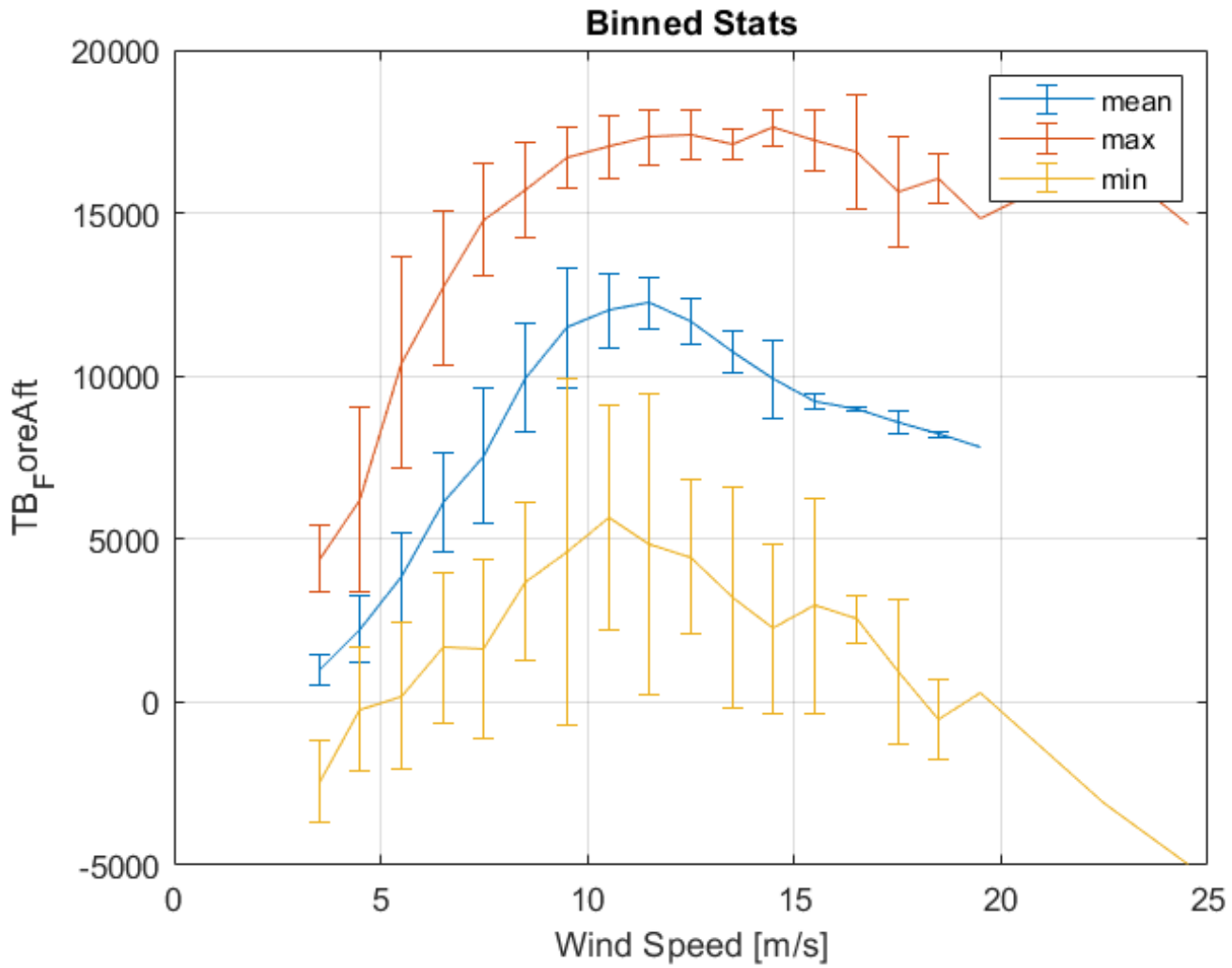
Quality Control



- Contains QC checks for:
  - timestamps
  - missing data
  - Corrupt data
  - Data is in expected range
  - Data does not exceed an expected delta within a time window
  - Data outliers

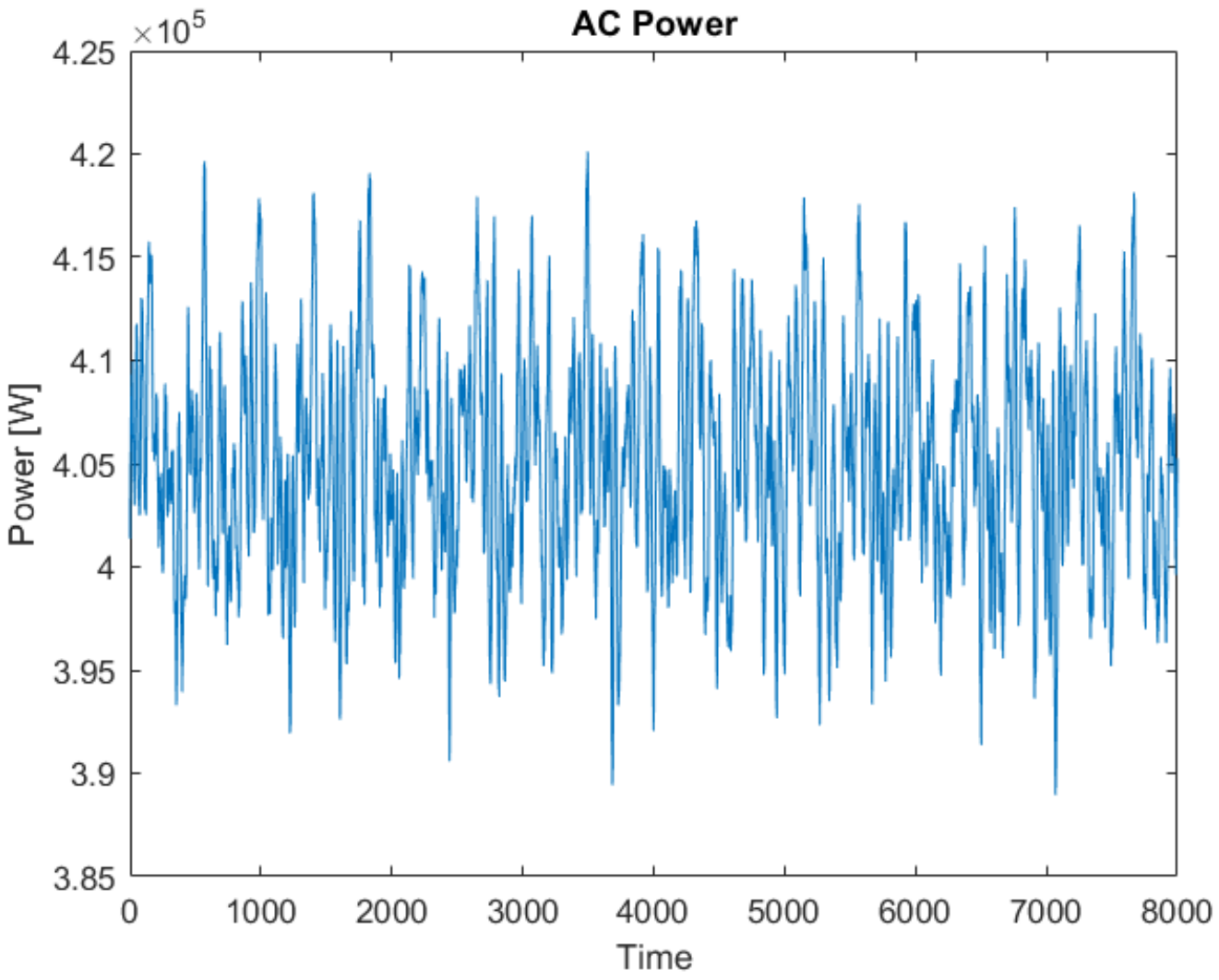
Loads

- Damage Equivalent Load
- Statistics
- Blade Moments



Power Quality

- Harmonics
- Interharmonics
- Harmonic Distortion
- Instantaneous Frequency



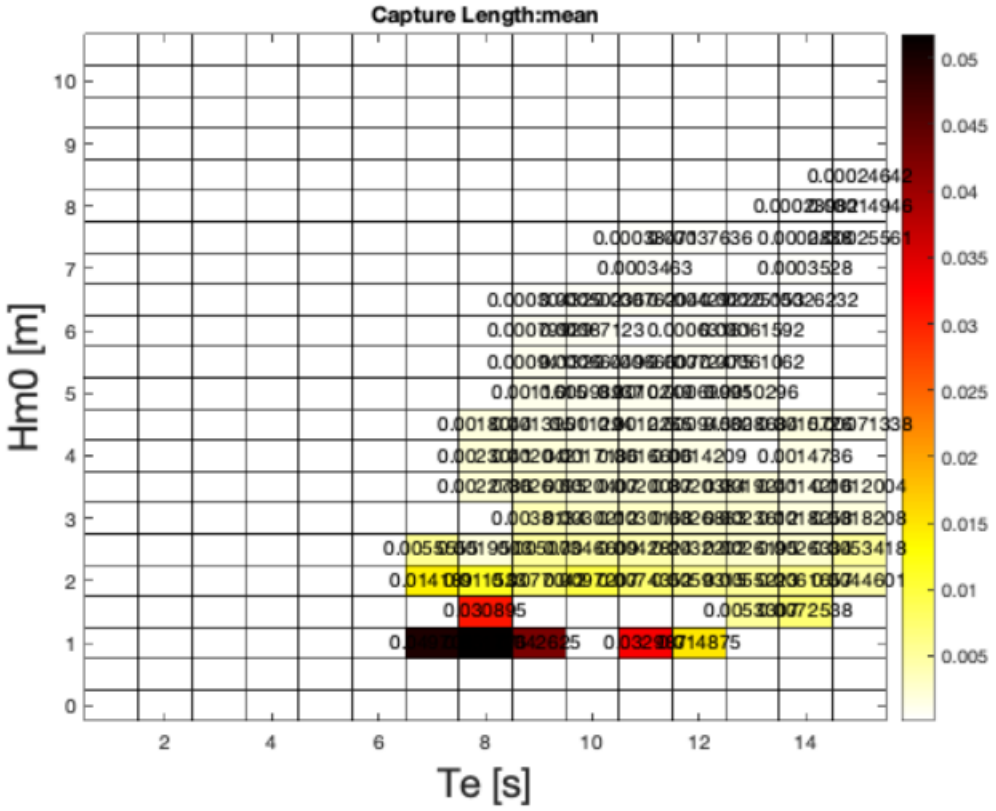
Wave Resource Module

- Spectrum: Elevation, Pierson Moskowitz, Bretschneider, Jonswap
- Significant Wave Height
- Energy Period
- Surface Elevation
- Frequency Moments
- Periods: zero crossing, average crest, average wave, peak, energy,
- Spectral Bandwidth
- Spectral Width
- Energy Flux
- Wave Celerity
- Wave Number

PacIOOS Wave Buoy 196: Ritidian Point, Guam

Wave Performance

- Capture Length
- Matrices: Capture Length and Power
- Mean Annual Energy Production



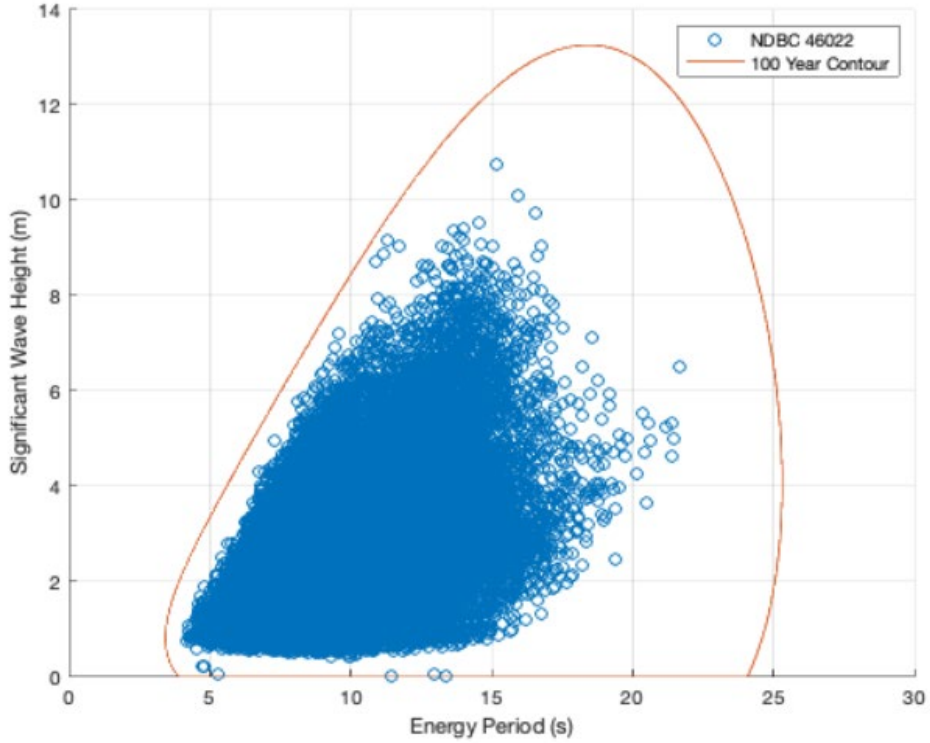
Other Wave Functionality

Data IO Functions

- WEC-Sim
- NDBC
- SWAN (not on pip yet)
- WPTO Hindcast (not on pip yet)
- CDiP (coming soon)

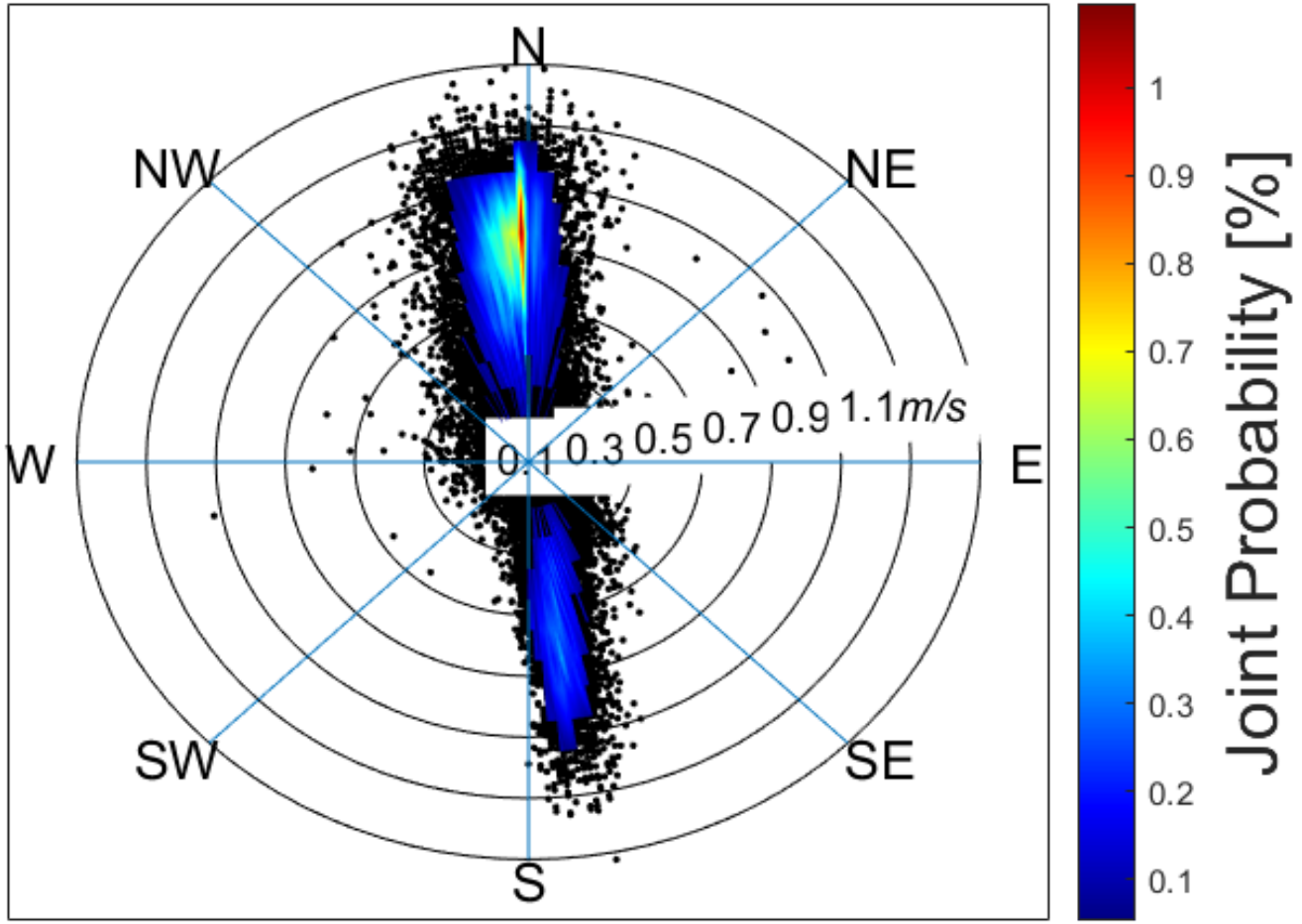
Extreme Sea-state Analysis

- Environmental contour analysis



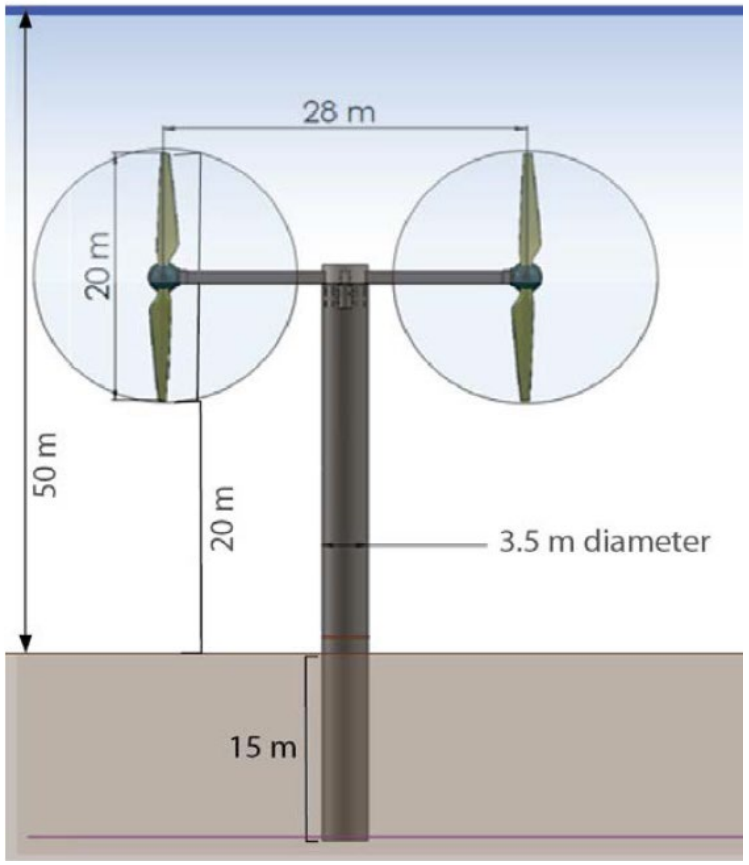
Tidal Resource

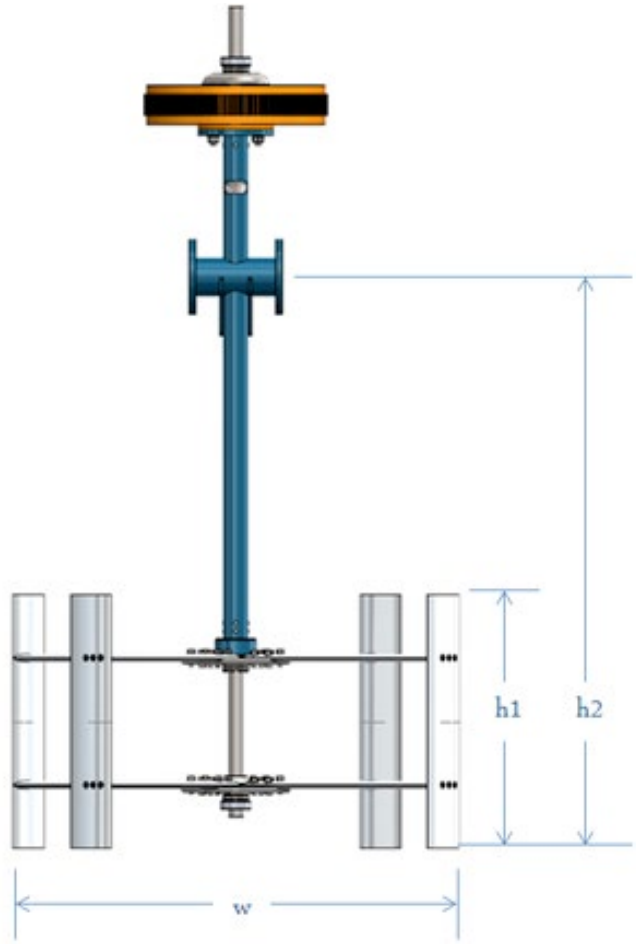
- Principal Flow Directions
- Exceedance Probability
- Froude Number
- Joint Probability Dist.- Velocity



Tidal & River Performance

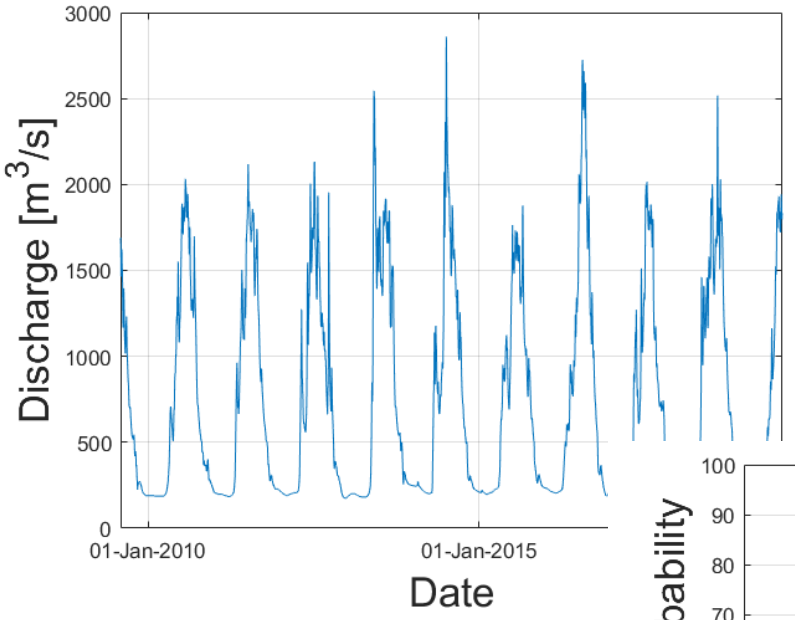
- Projected Capture Area
  - Ducted
  - Circular
  - Rectangular
  - Multiple circular
- Other Functions
  - Tip Speed Ratio
  - Power Coefficients

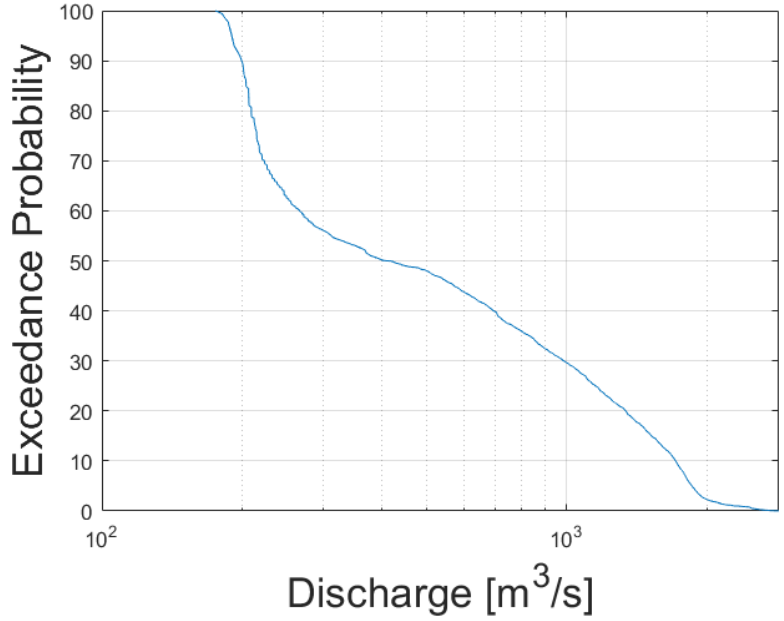




River Resource

- Froude Number
- Exceedance Probability
- Discharge to Velocity
- Velocity to Power
- Power Produced





Other River: IO function for USGS data

MHKiT Future Development

- Mooring (IEC)
- Noise (IEC)
- Utilities
- Meteorological
- Uncertainty Characterization
- Environmental and acoustic impacts
- Powering the Blue Economy applications
- Instrumentation specific processing codes- i.e. ADCPs and ADVs
- MHKiT data processing workflows
- Additional QC and transformation capabilities
- MHKDR data ingestion and upload

Thank you!

Contact us:

- Rebecca Fao (Rebecca.fao@nrel.gov)
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MHKiT Resources:

- Documentation: https://mhkit-software.github.io/MHKiT/index.html
- Provide Input/Feedback:
  https://github.com/MHKiT-Software/MHKiT-MATLAB/issues

The National Renewable Energy Laboratory is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC. under contract No. DE-AC36-08GO28308.

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