



## Coastal Model Test Bed (CMTB)

### Numerical Model Testing and Evaluation at the FRF

Numerical models developed at the Engineer Research and Development Center (ERDC) Coastal and Hydraulics Laboratory (CHL) are used by engineers, scientists, and coastal planners in Corps Districts, ERDC, and public and private agencies to simulate complex scenarios at a reasonable cost. The Coastal Model Test Bed (CMTB) has been initiated to evaluate the strengths and weaknesses of these numerical models and to focus efforts on improving estimates. The CHL's Field Research Facility (FRF) in Duck, NC, is a coastal processes observation facility focused on high spatial and temporal resolution measurements to solve complex nearshore research questions. With the CMTB, the data puts the FRF in a unique position to be the center of expertise for model evaluation because of the historic data (30+ years) as well as the operational real-time measurements. The use of this extensive coastal measurement database in a modeling framework will promote rapid enhancement of model capability. Similarly, by running simultaneous simulations with real-time data, a better understanding of modeling best practices can be obtained.

### Problem

- The high resolution data collection ongoing at the FRF presents the unique opportunity to evaluate coastal models using real-time conditions. By running these models in near real-time with the most recently collected data available, the models can be evaluated more frequently and for longer durations. The longer durations allow for errors to be fully quantified, reducing uncertainties in model application.
- In numerical modeling, there are various parameters that can be adjusted to allow model output to fit observational data. Oftentimes these parameters are based on assumptions on physical parameters that are difficult to monitor. Efforts will be made to measure these parameters accurately and apply relationships to these models.
- Studies will be undertaken to better understand how the refined model parameterization can be best applied, allowing for best practices to be established. Sensitivity studies will be undertaken to evaluate how numerical model output responds to a range of input conditions.

### Technology

- Model Integration to an established observational environment with high-resolution measurements and real-time numerical model capability.
- Models run on local High Performance Computing (HPC) cluster dedicated to the CMTB.
- CMTB is developed on open source software allowing for modular and flexible development without the added cost of licenses.

### Benefit

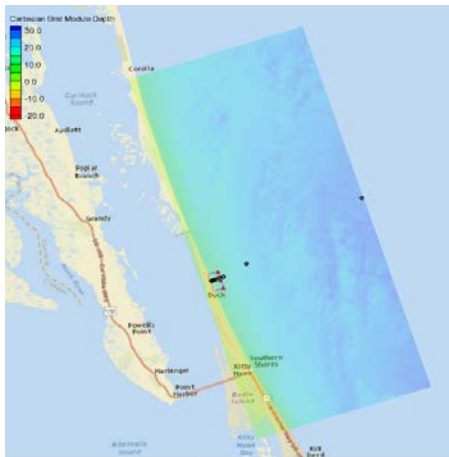
Continual operation of the CMTB allows for near real-time modeling of various parameters over longer durations helps

- Quantify the error associated with different models, to allow for less uncertainty in application
- Create best use practices when employing these numerical models
- Understanding sensitivity of models to different *tunable* parameters and how to remove uncertainty in application.

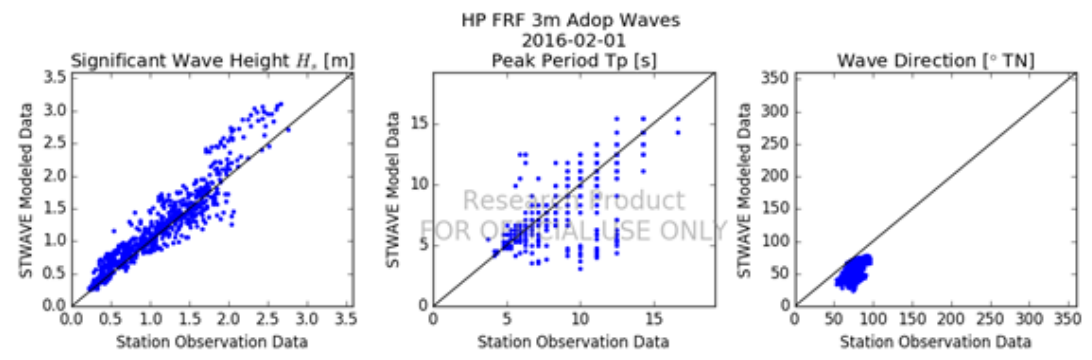
### Status

The CMTB is currently under development and has the STEady state nearshore WAVE (STWAVE), model running in both half- and full-plane modes. A study is currently underway evaluating the effects of bathymetry inversions on wave modeling. There are plans to incorporate a user interface to tie together the model and the user, allowing for easy *spin-off* studies. The next planned model incorporation is Cross-Shore numerical model, CShore (1D) and C2Shore (2D), morphologic models. Once evaluations have been completed, data and model evaluations and output will be available to the public *via* the FRF website and the newly designed Data Integration Framework (FDIF).

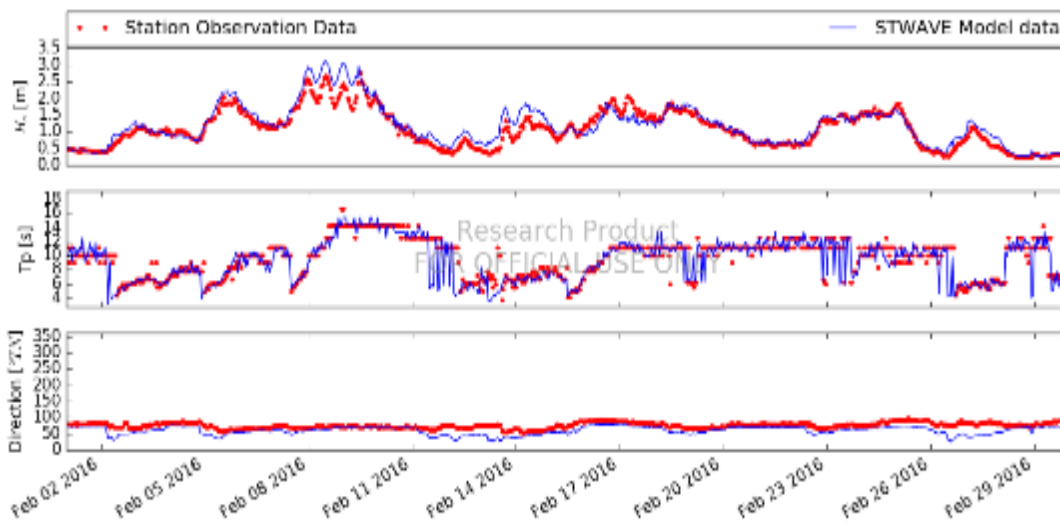
## Image and Caption



The **top left** image is the Regional (parent) simulation grid, with colors corresponding to depth. The FRF cross-shore array of wave gauges is shown with black dots while the small box is the Local (nested) simulation grid. A simulation was run for the duration of February 2016. The results for the 3 m model-observation stations are shown in a one-to-one comparison plot at the **center** while a time series comparison is shown at the **bottom**. For the month of February, it can be seen that the model performed relatively well in 3 m of water.



HP Time Series Comparison at FRF 3m Adop Waves  
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