

# V&V and Benchmarking for the CMS Phase I – Waves and Hydrodynamics

- Matagorda Bay, Texas

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CIRP Technical Discussion

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# Matagorda Bay & East Matagorda Bay



## Two Large Bays

- Matagorda Bay
- E. Matagorda Bay

## Two Main Rivers

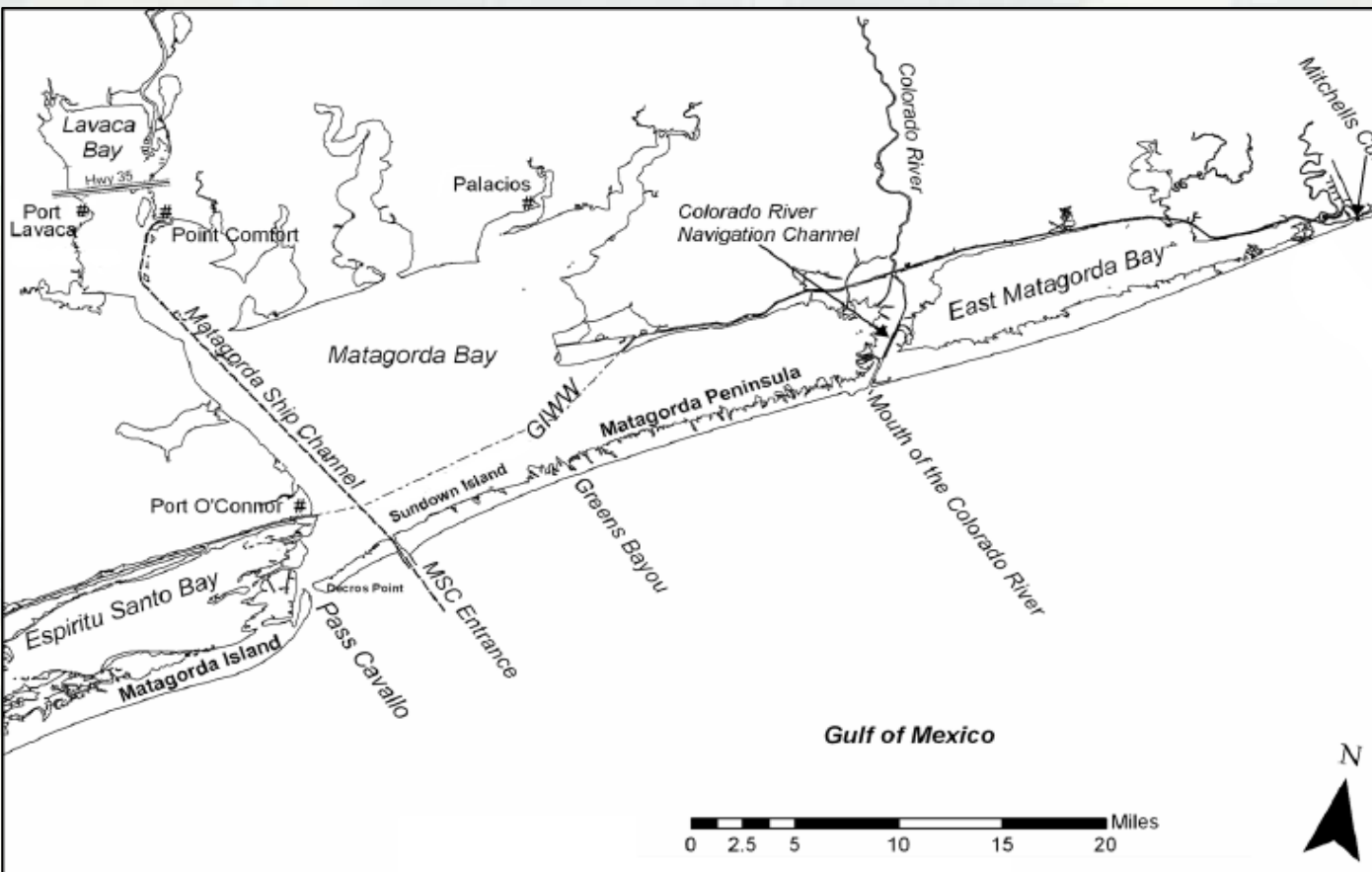
- Colorado River
- Lavaca River

## Four Inlets

- Matagorda Ship Channel (MSC) Entrance
- Pass Cavallo
- Mouth of the Colorado River
- Mitchells Cut

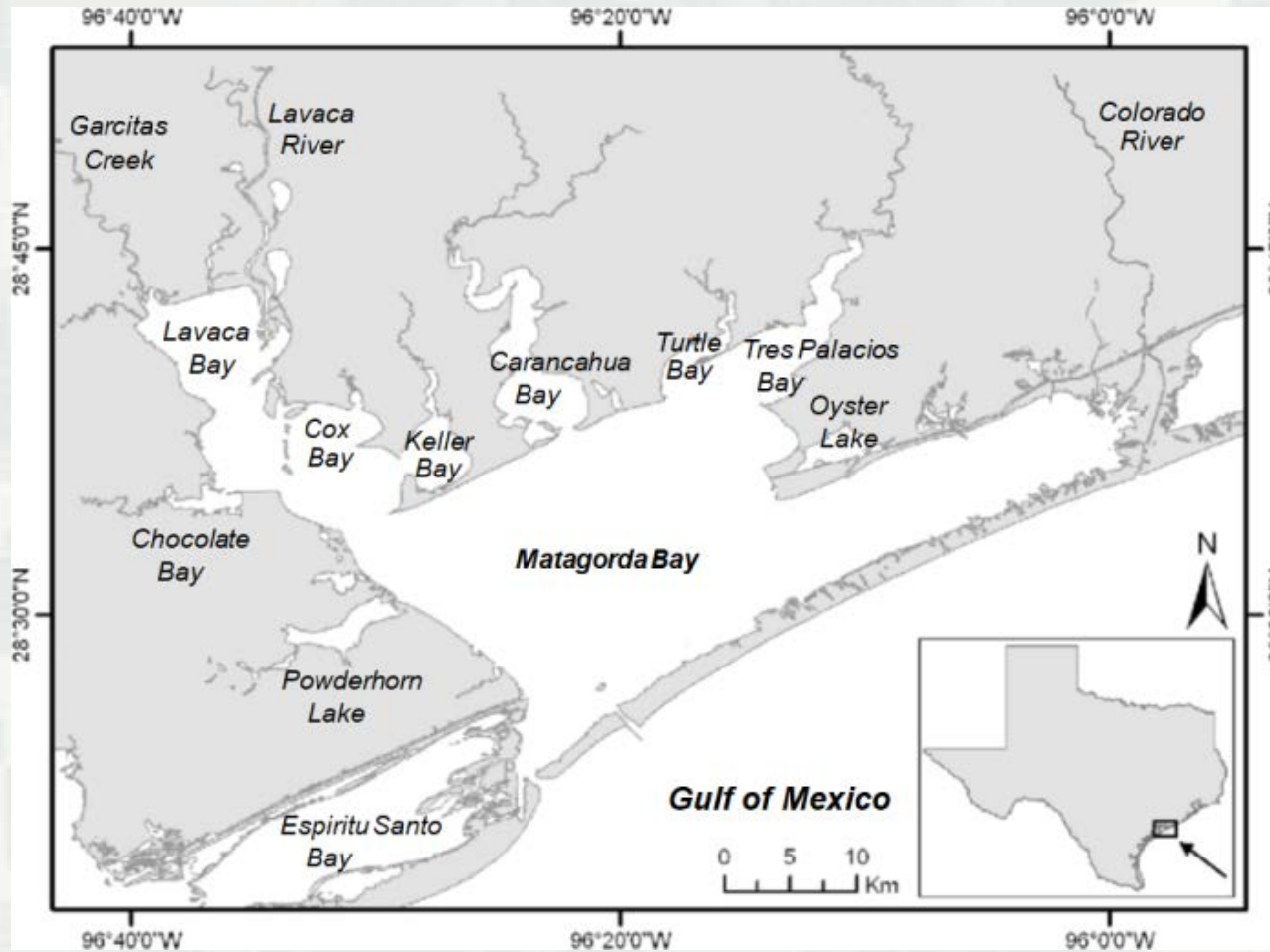
## Two Major Waterways

- MSC
- GIWW





# Matagorda Bay Estuarine System



## Estuarine System

- Matagorda Bay
- Lavacaca Bay
- Cox Bay
- Killer Bay
- Carancahua Bay
- Turtle Bay
- Tres Palacios Bay
- Oyster Lake
- Chocolate Bay
- Powderhorn Lake
- Espiritu Santo Bay
- Colorado River
- Lavaca River
- Carcitas Creek



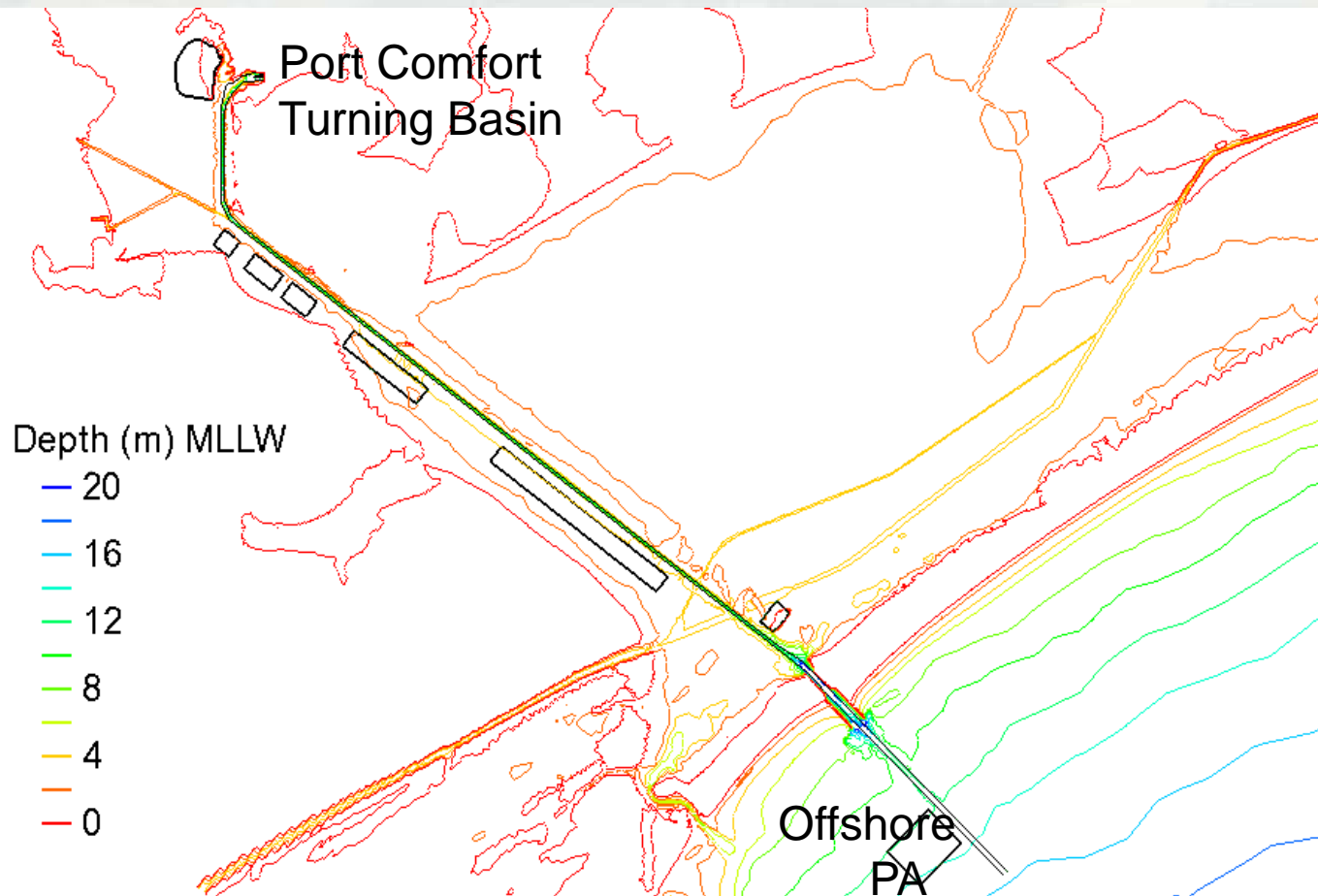
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# Existing Bathymetry and Future Plan



## Proposed MSC widening/deepening project

- Widen entrance channel from 91 to 183 m; deepen depth from 12.2 to 15 m
- Widen main channel from 61 to 107 m; deepen depth from 11.6 to 14.3 m
- New Placement Areas (PA) along ship channel



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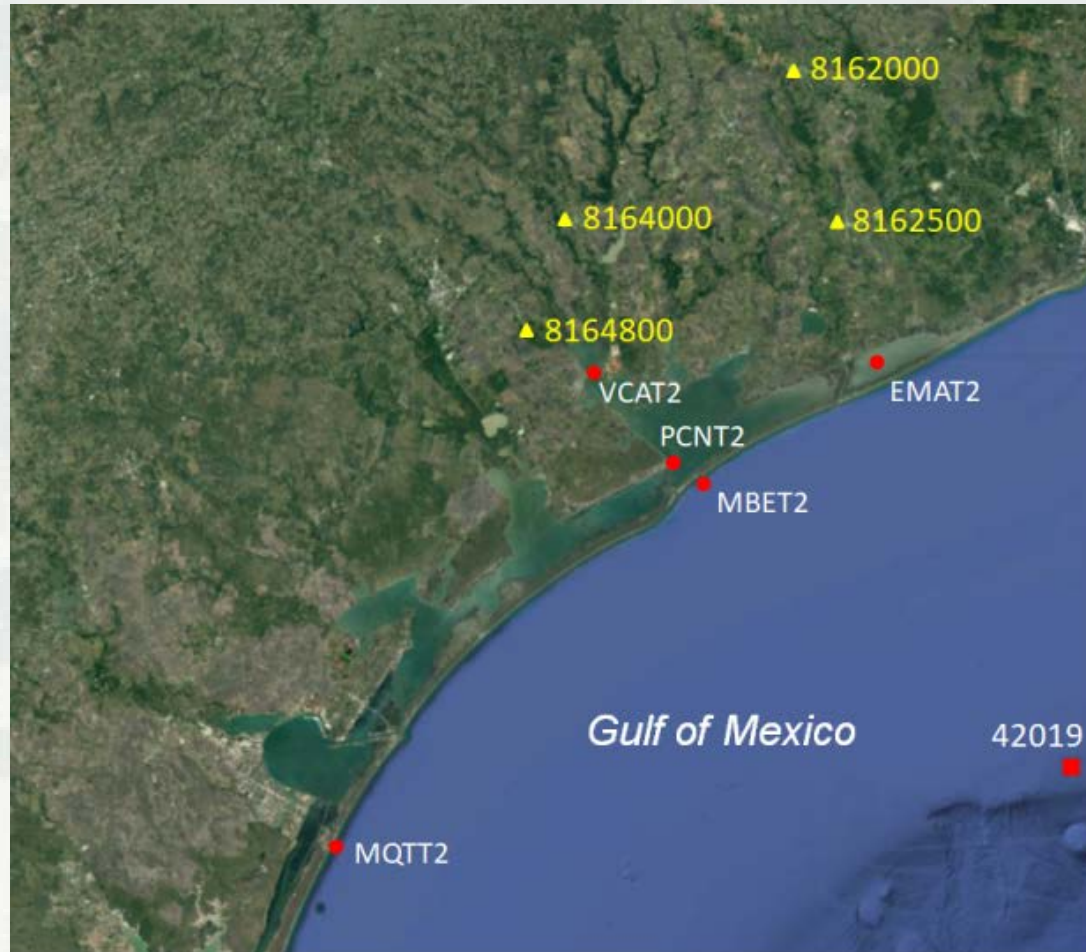
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# Long-term Coastal Stations



## NDBC Buoys (wind wave)

- 42019 – Freeport, TX
- 42020 – Corpus Christi, TX

## NOAA Coastal Stations (wind, water levels)

- MBET2 (8773767) – MSC Entrance
- PCNT2 (8773701) – Port O'Connor
- VCAT2 (8773259) – Lavaca Bay Bridge
- EMAT2 (8773146) – East Matagorda Bay
- MQTT2 (8775870) – Bob Hall Pier

## USGS (river discharge)

- 8162000 – CR at Warton, TX
- 8162500 – CR near Bay City, TX
- 8164000 – Lavaca River near Edna, TX
- 8164800 – Placedo Creek, Placedo, TX



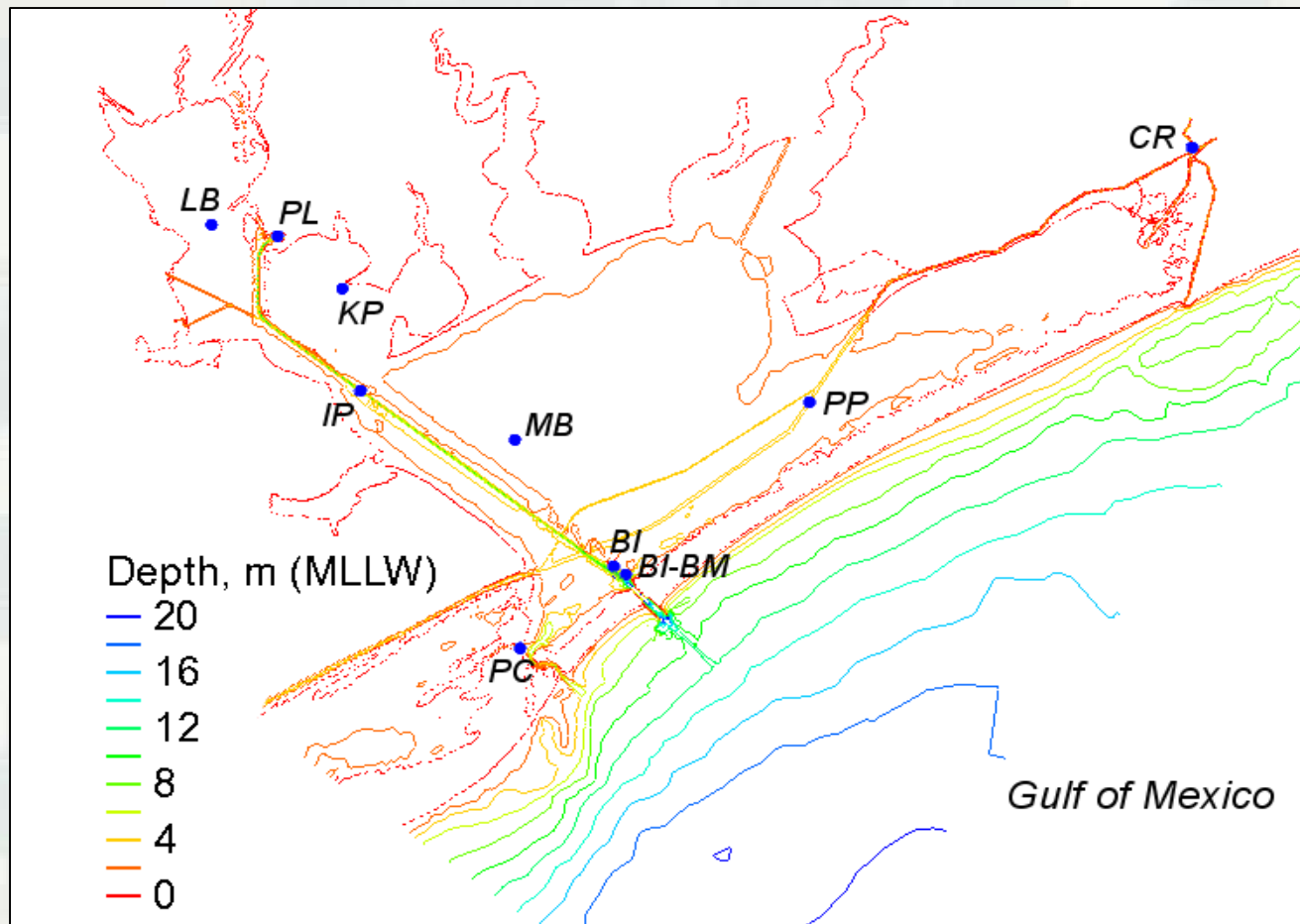
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# 2005 (Sep-Dec) Field Data Collection



**Water Level Data**  
CR, PL, MB, BI,  
BI-BM, PC

**Current Data**  
MB, BI-BM

**Salinity Data**  
All ten stations



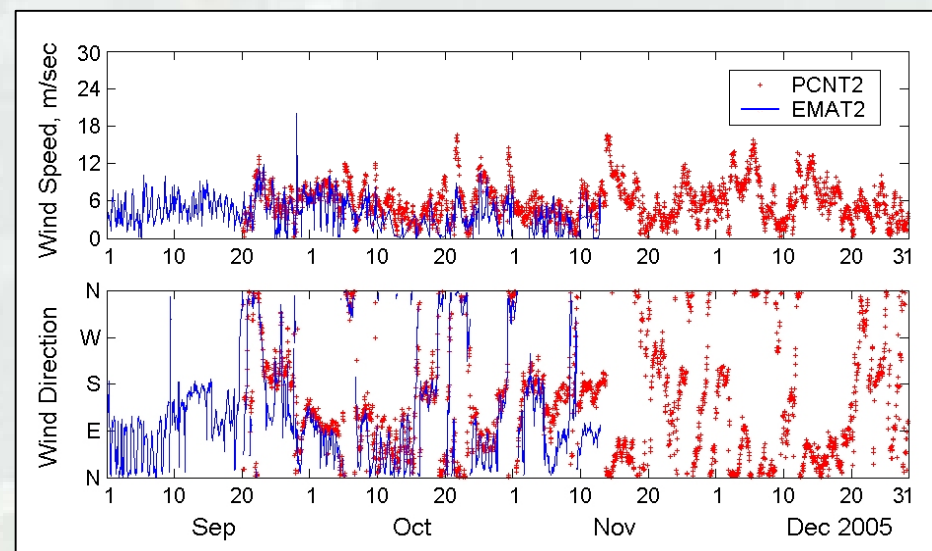
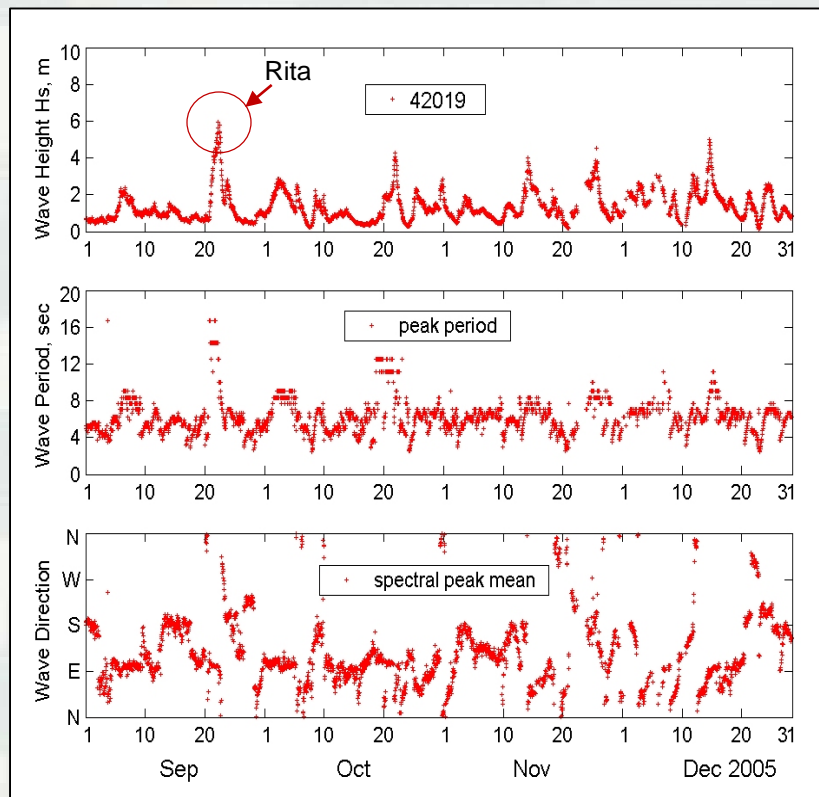
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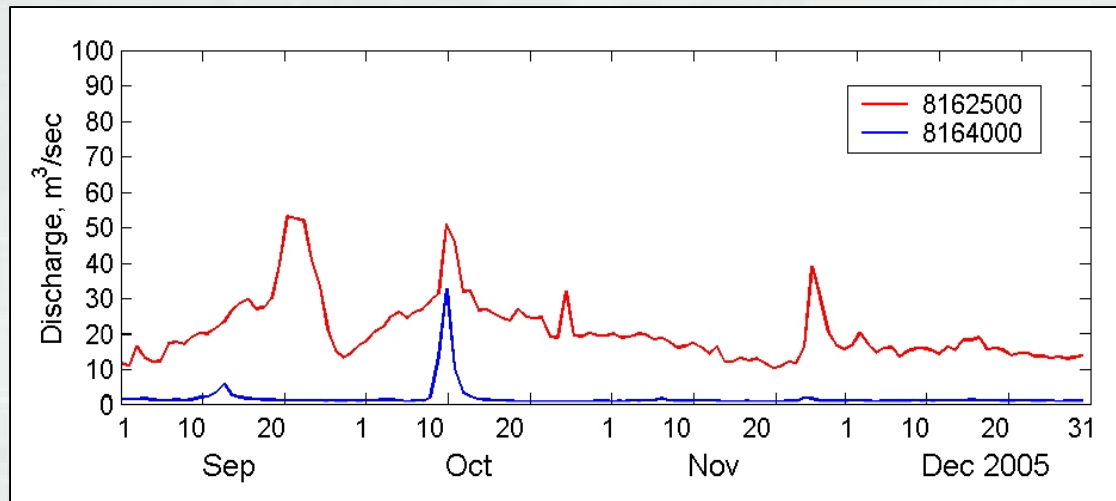
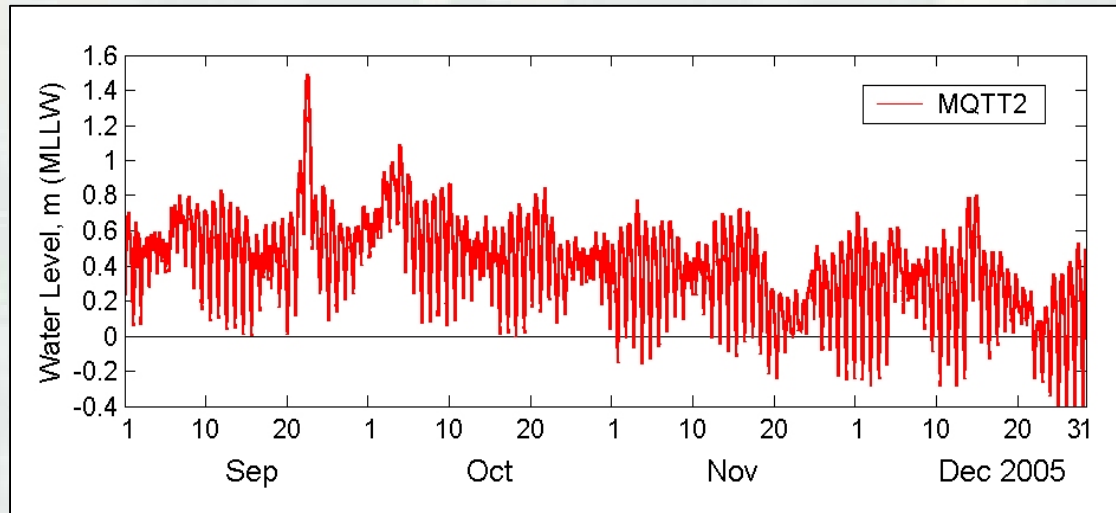


# Examples of Coastal Wind Wave Data





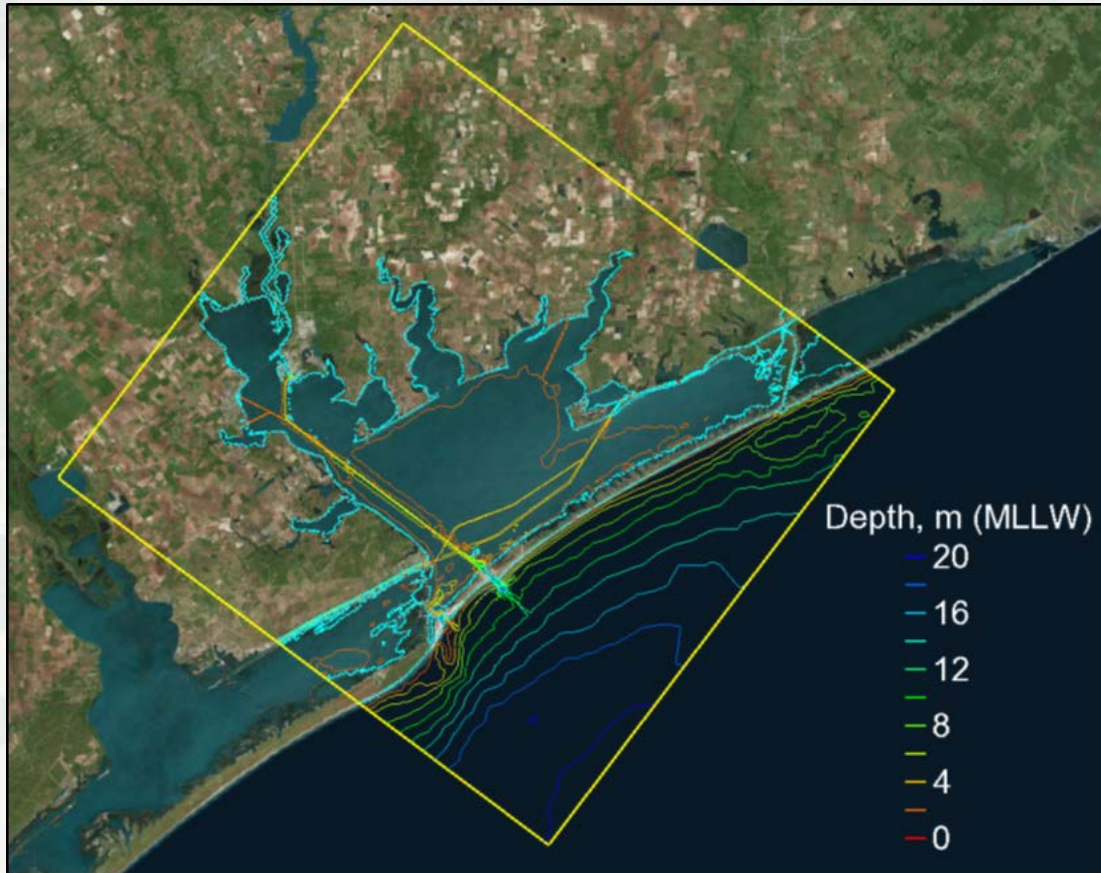
# Examples of WL and River Flow Data







# CMS Model BC & Model Settings



CMS model domain (yellow box)  
Varying cell spacing: 20 m to 500 m



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## Calibration (WL, Waves, Currents):

September 2015

## Validation (WL, Waves, Currents):

October 2015

## CMS forcing

- WL – MQTT2
- Wind – EMAT2 & PCNT2
- Wave – 42019
- River discharge – 8162500 & 8164000

## CMS-Flow

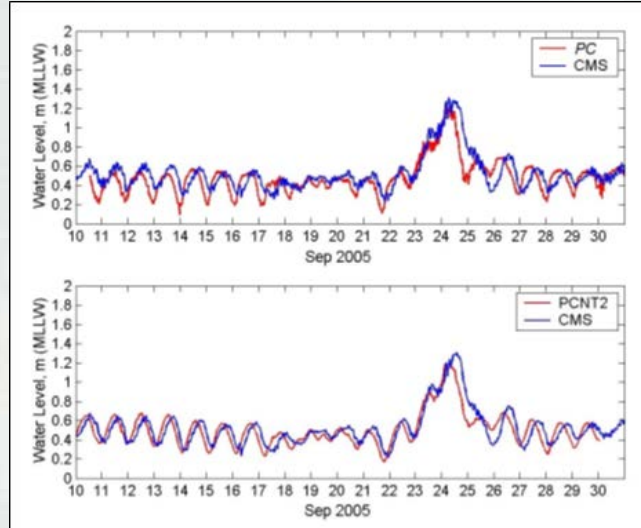
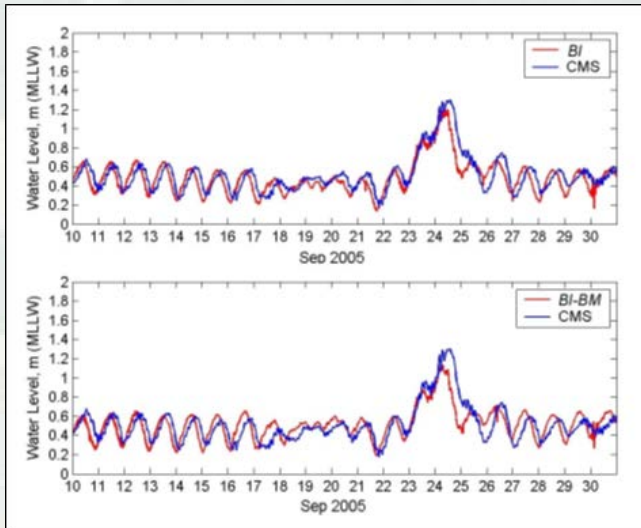
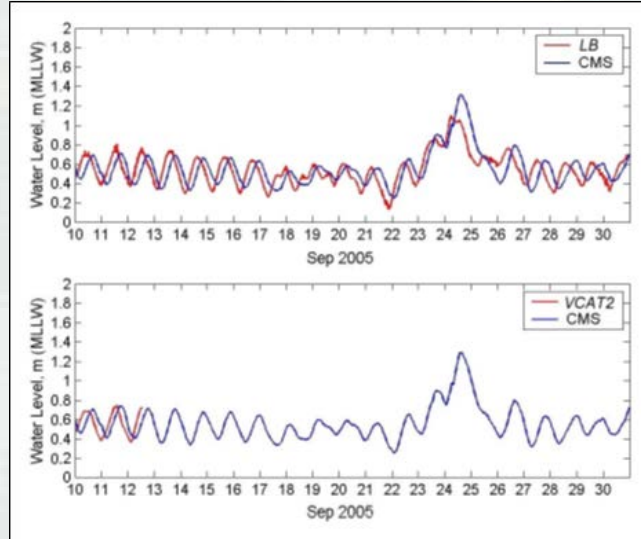
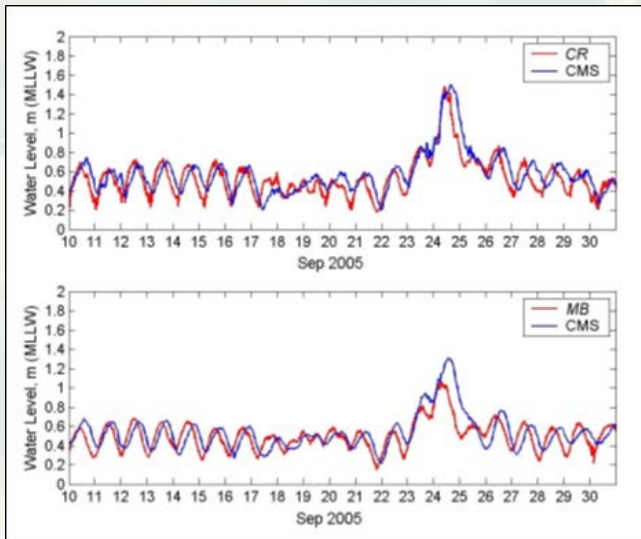
- Bottom friction:  
Manning's  $n = 0.021$ , open coast  
 $n = 0.015$ , inside bay



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# Model Calibration: CMS WL vs Data



Bias  $\sim -0.005$  to  $0.04$  m

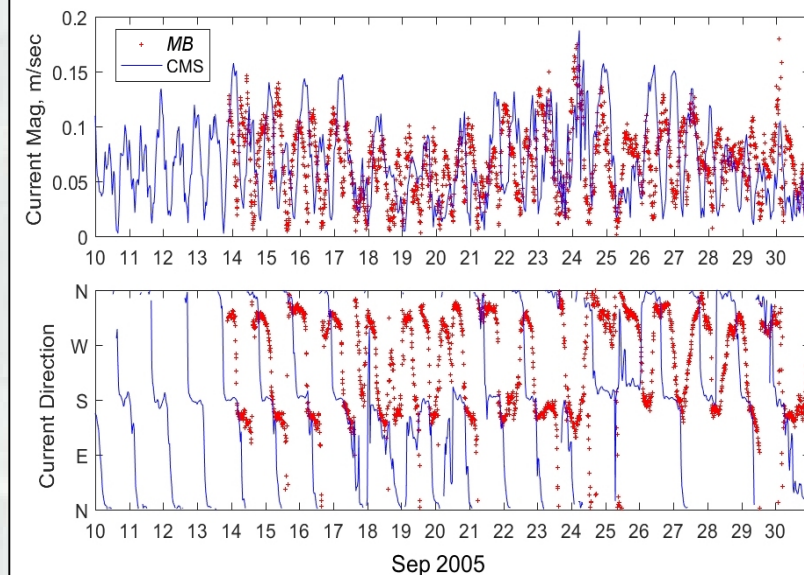
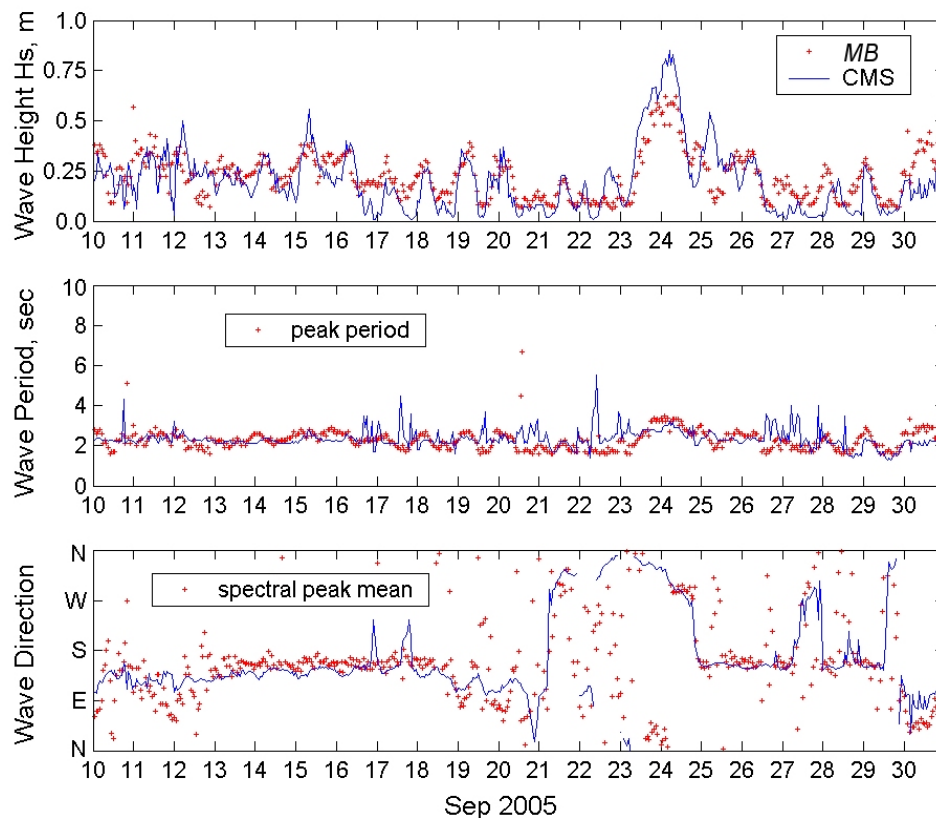
Correlation  $\sim 0.7$  to  $0.9$

Root-mean-square-error  
 $\sim 0.1$  to  $0.13$  m





# Model Calibration: Waves and Currents



Bias = -0.03 m; Correlation = 0.42  
Root-mean-square-error = 0.05 m



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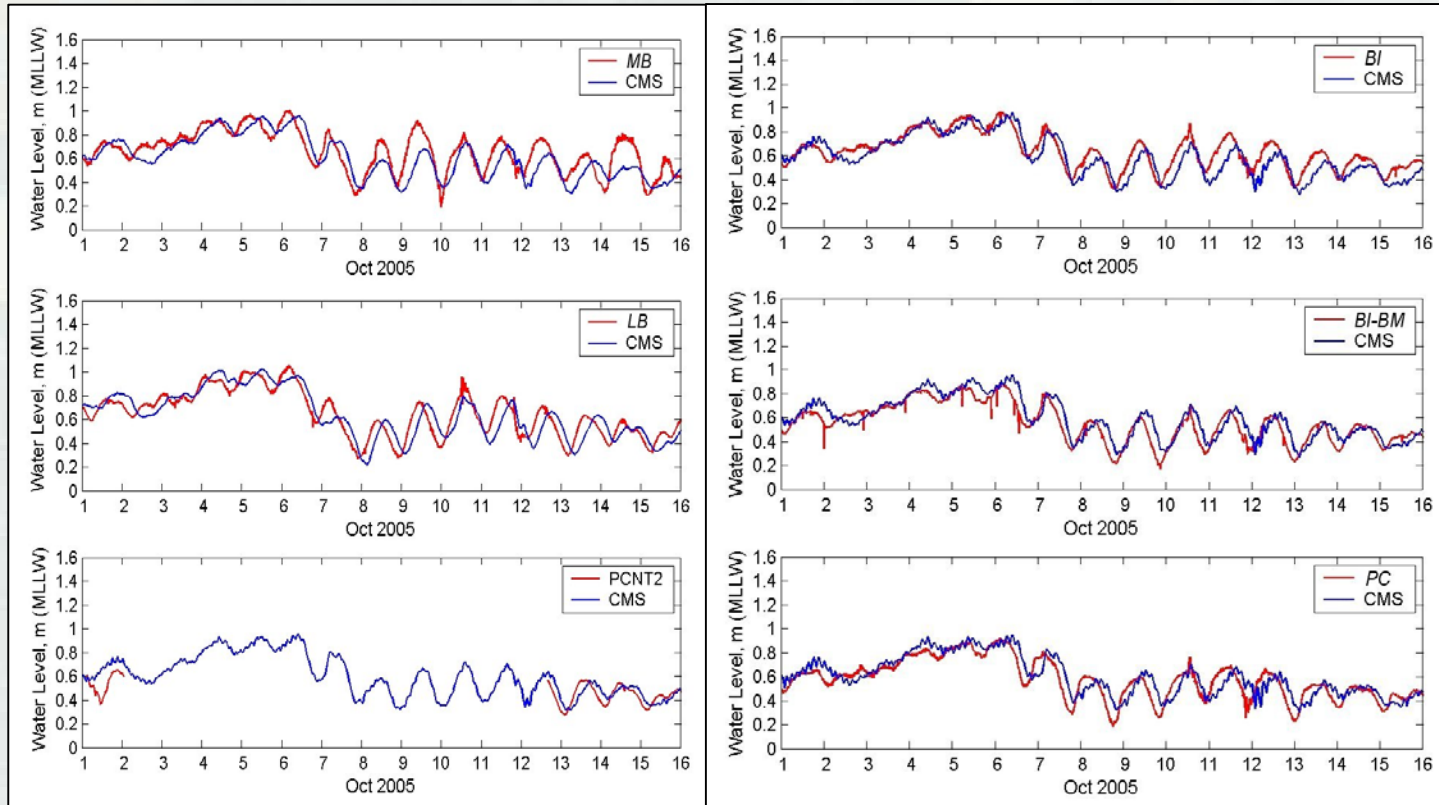
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# Model Validation: CMS WL vs Data



Bias ~ -0.05 to 0.04 m; Correlation ~ 0.7 to 0.9

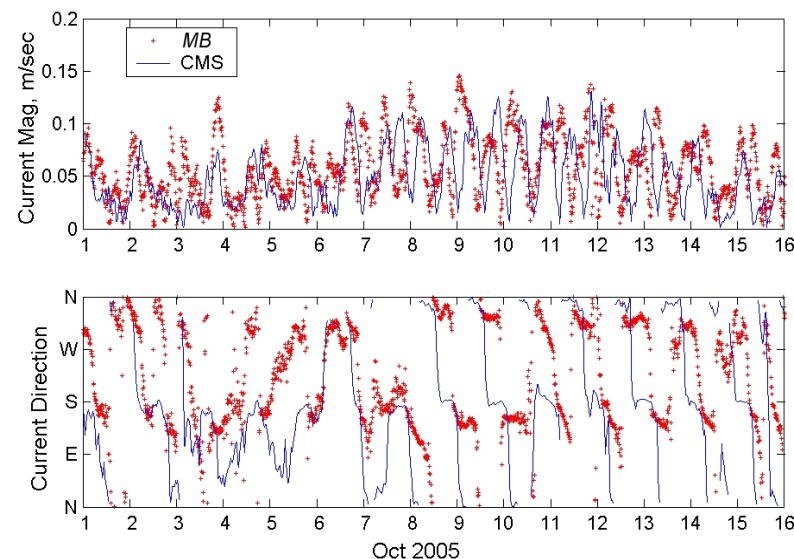
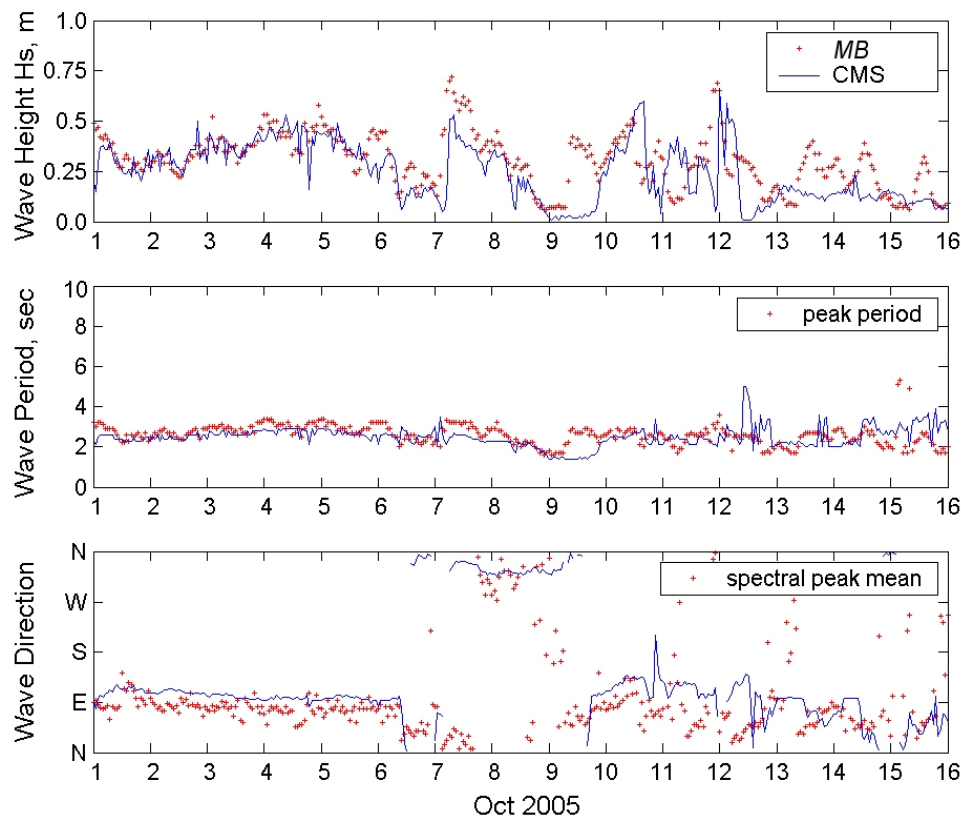
Root-mean-square-error ~ 0.08 to 0.13 m







# Model Validation: Waves and Currents



Bias = -0.04 m; Correlation = 0.32  
Root-mean-square-error = 0.05 m



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