Modeling Mixed Sediment Transport in GIWW and West Galveston Bay, Texas

ERDC
Engineer Research & Development Center

Lihwa Lin, USACE

Christopher Reed, Reed and Reed Consulting, LLC

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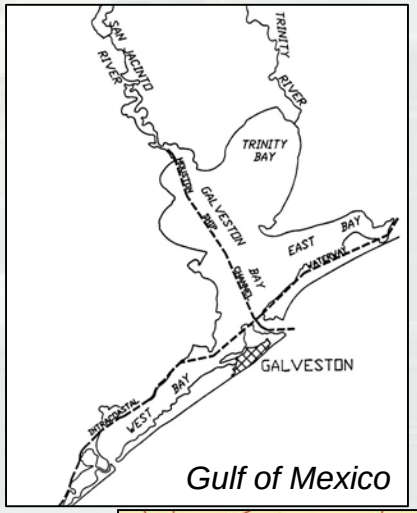
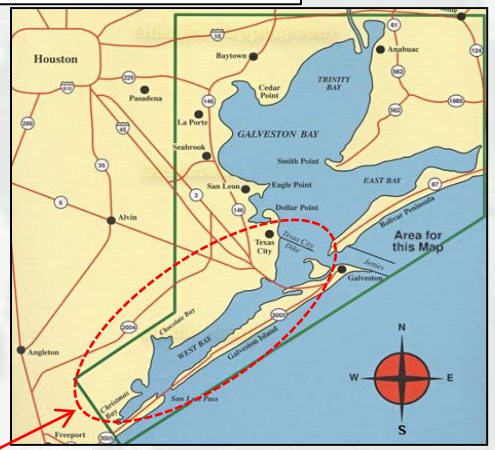
Outline

- Background & Objectives
- Numerical Models & Settings
- Hydro, Wave, and Sediment Transport Simulations
- Shoreline Protection Alternatives
- Summary & Conclusions



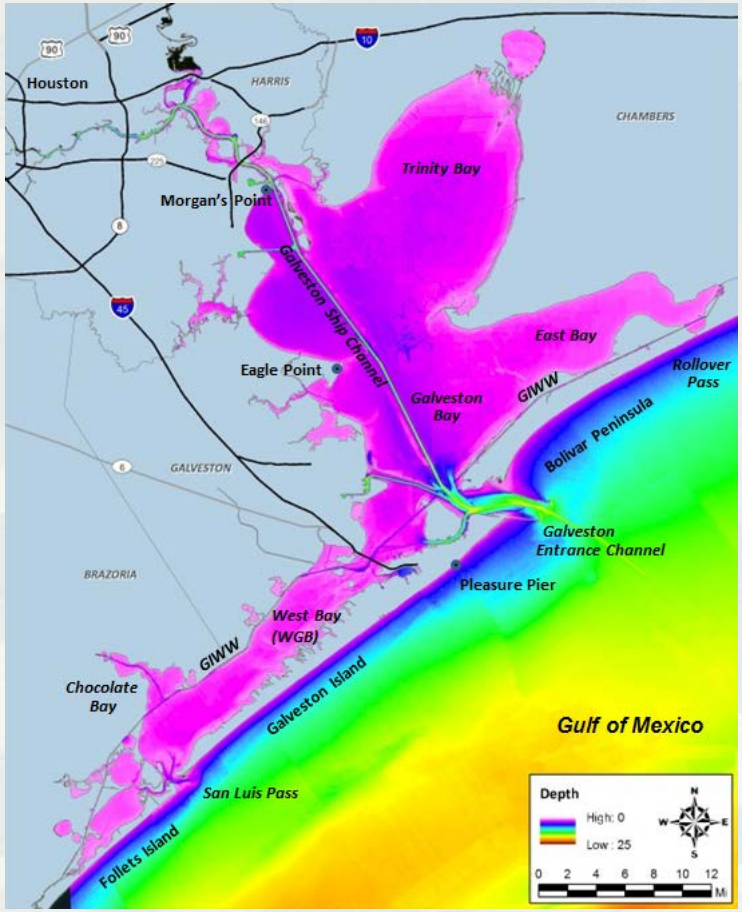


West Galveston Bay (WGB)

Background

- The Gulf Intracoastal Waterways (GIWW), a light-draft inland channel mainly for barge transportation, runs along the west side of West Galveston Bay (WGB), Texas.
- Extensive shoaling in the WGB GIWW in recent years has resulted in the need for more frequent dredging.
- USACE Galveston District considered shoreline protection alternatives to reduce high shoaling rate in the GIWW.
- RSM and CIRP assisted in the studies.

Galveston Bay System



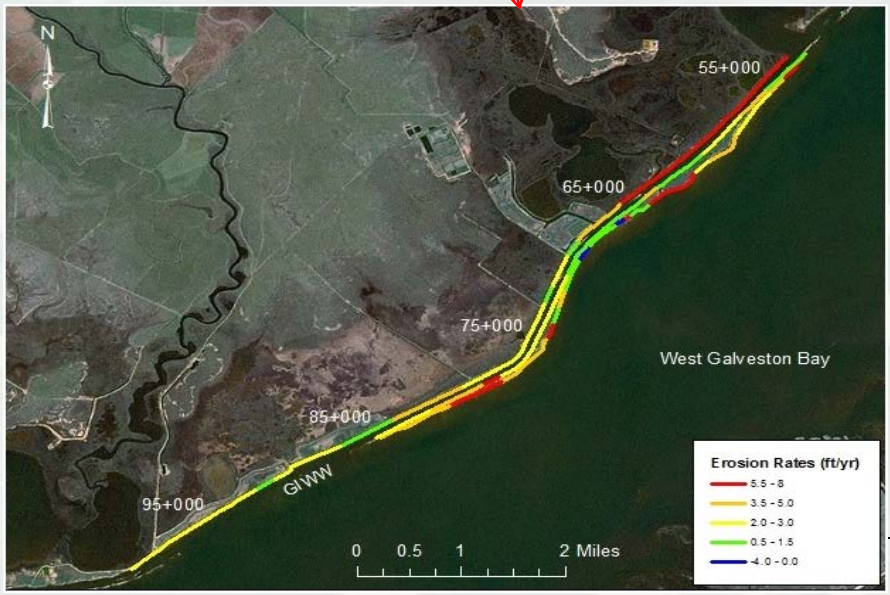
Muliti-inlet system:
1. Galveston Bay Entrance
2. San Luis Pass
3. Rollover Pass

Four subbays:
1. Galveston Bay
2. Trinity Bay
3. East Bay
4. West Bay (WGB)

Two main channels:
1. GIWW
2. Houston Ship Channel (HSC)

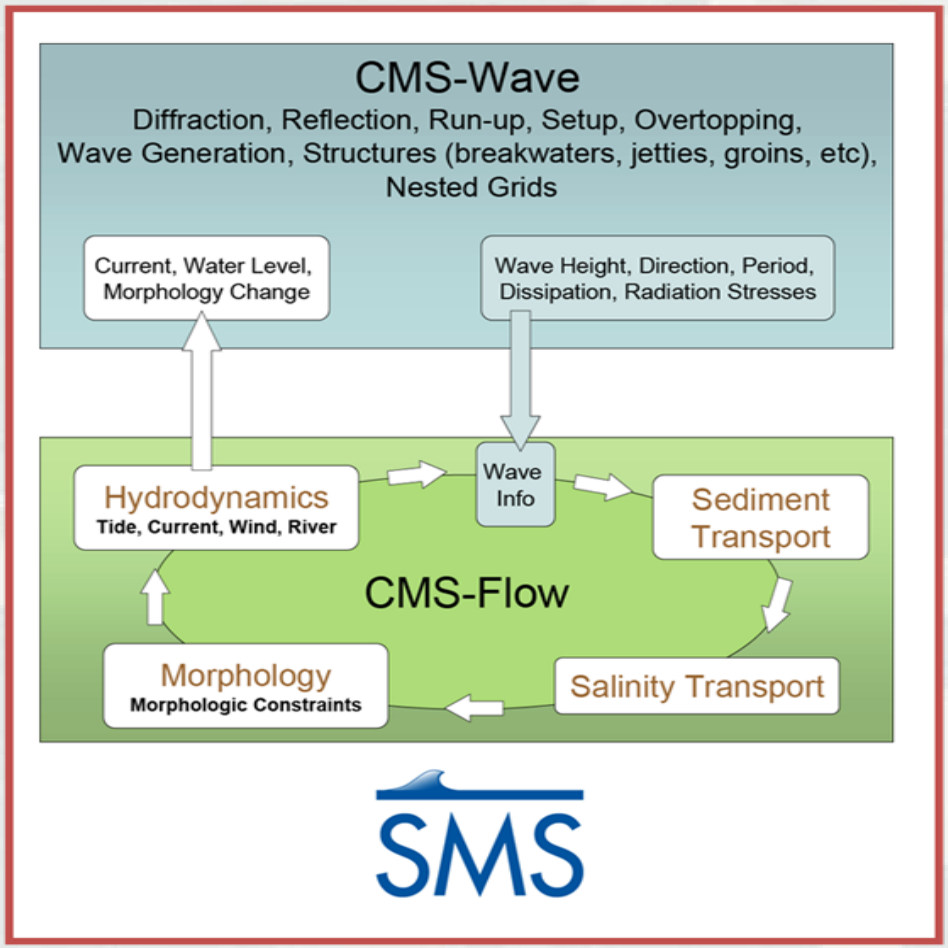
Galveston Bay on average 7-9' deep; WGB ~ 5-7' deep
GIWW, 125' wide, 12' deep; HSC, 530' wide, 45' deep

Placement Area (PA) 63 and 64

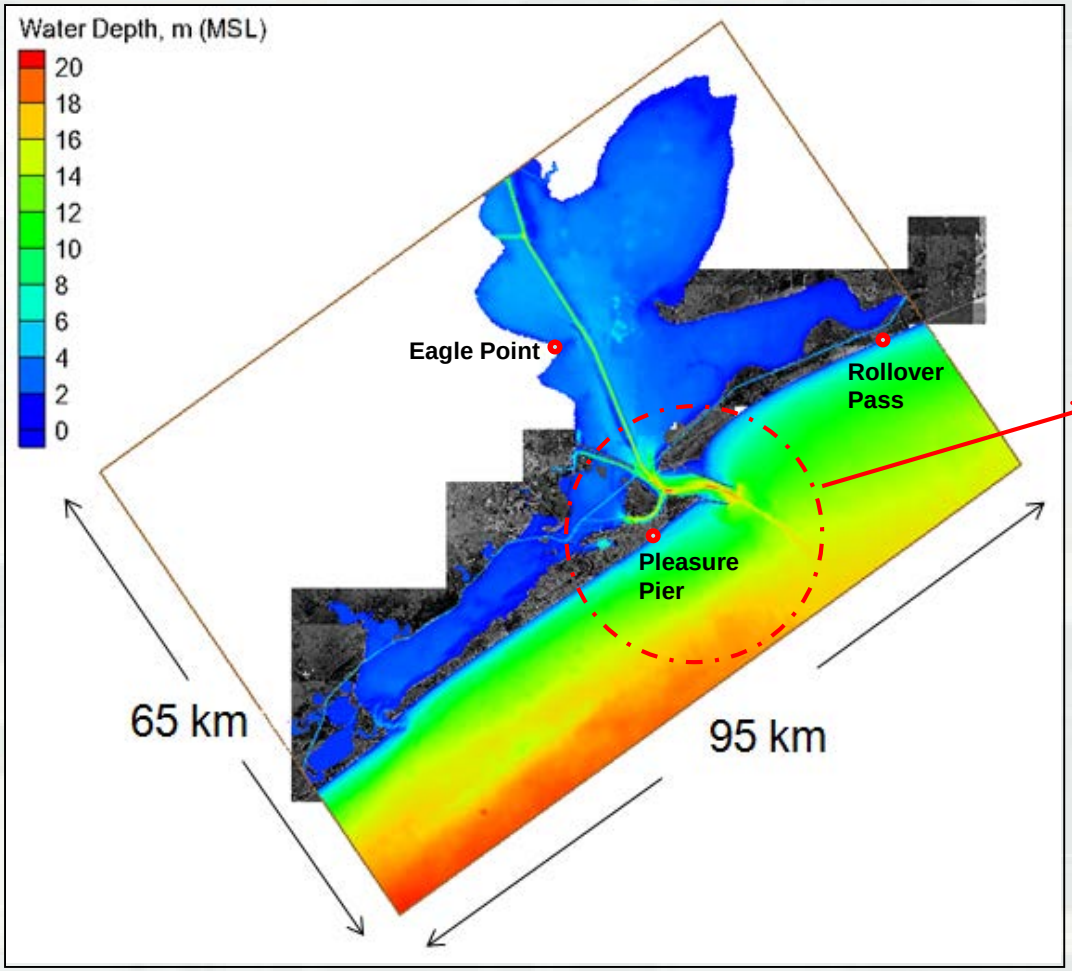


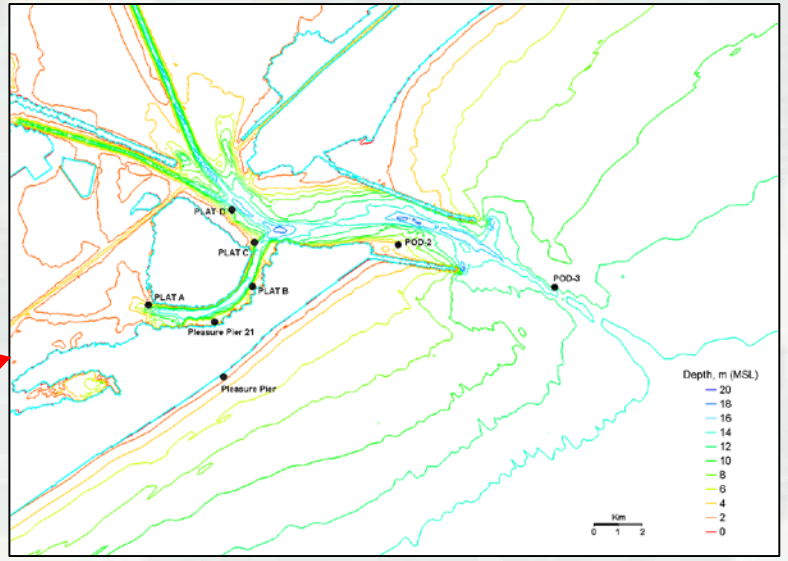
Numerical Models

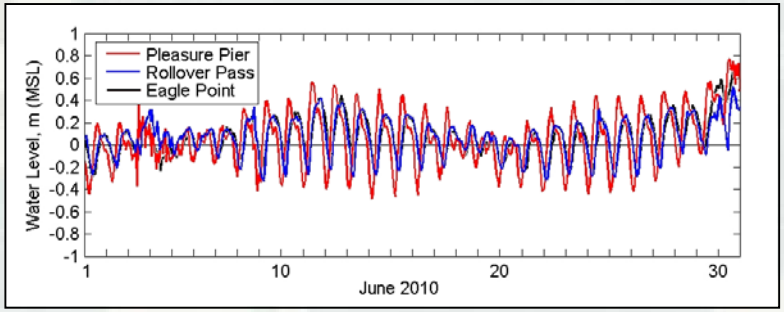
Coastal Modeling System (CMS)



CMS Grid and Water Level Input

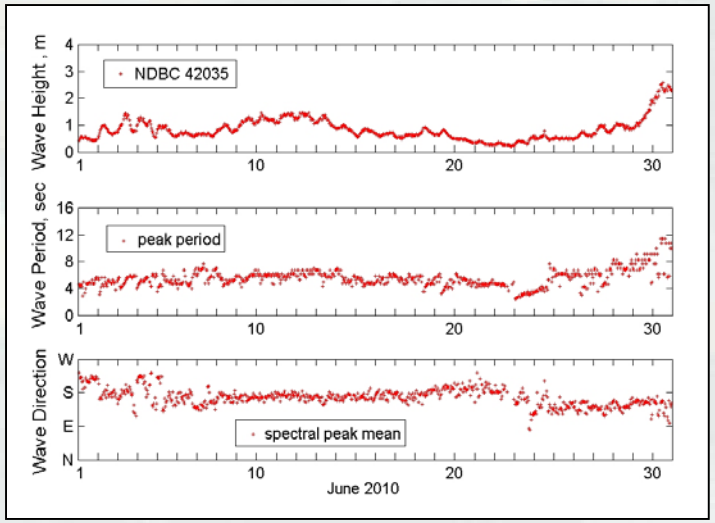


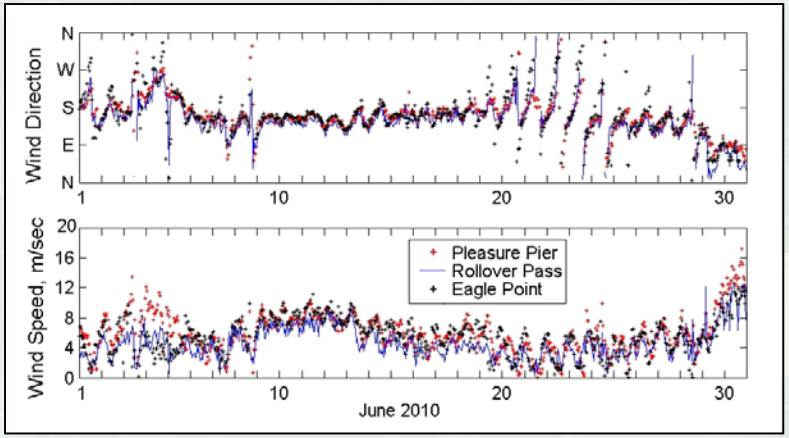


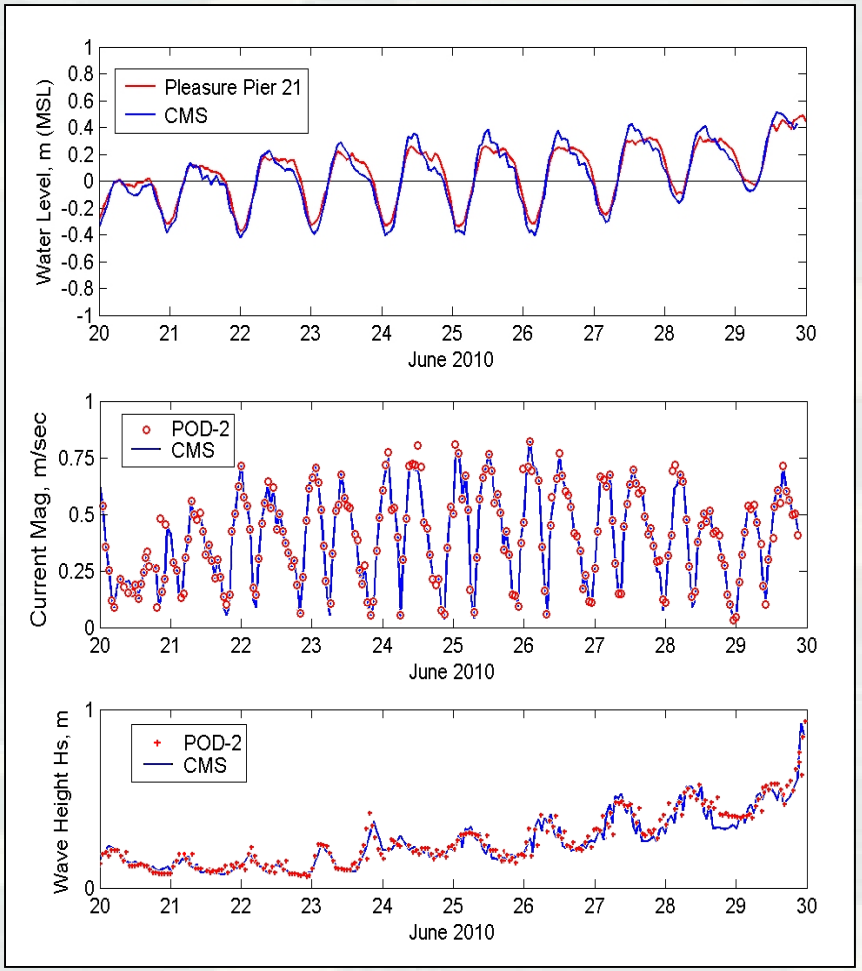


Model Calibration: June 2010

Wind Wave Input & Model Calibration

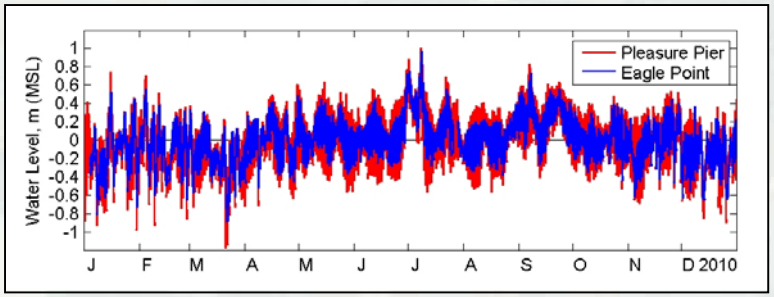


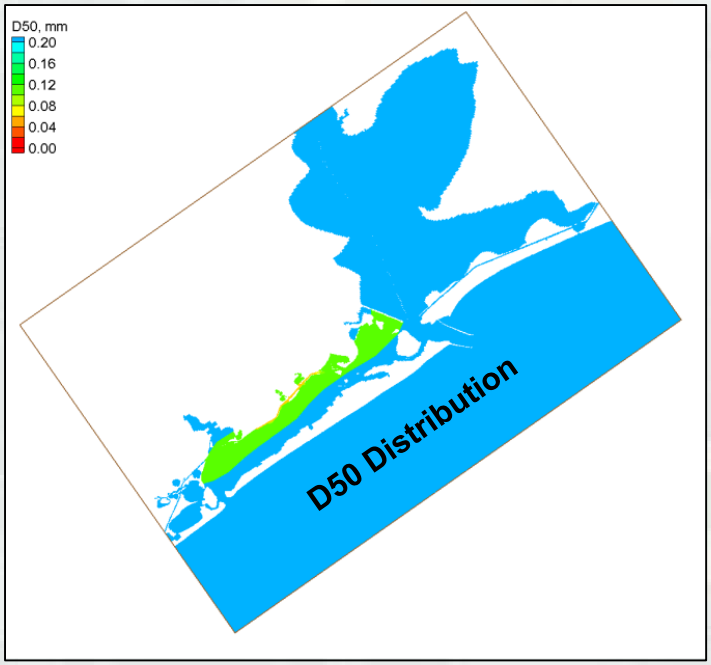


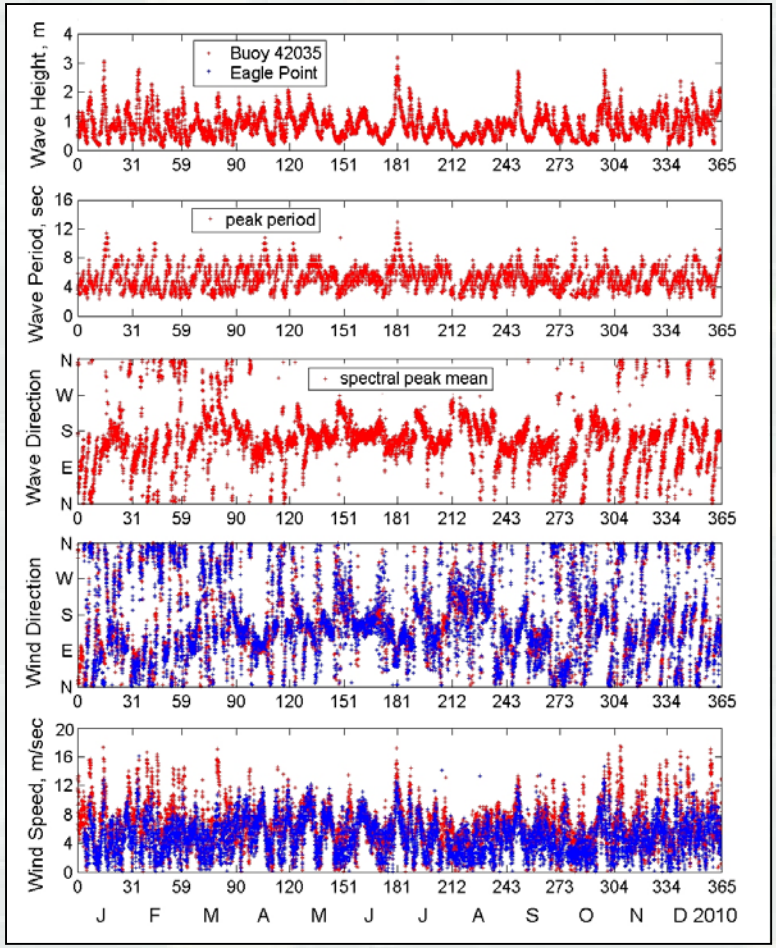


Model Calibration: June 2010

Mixed Sediment Transport Modeling

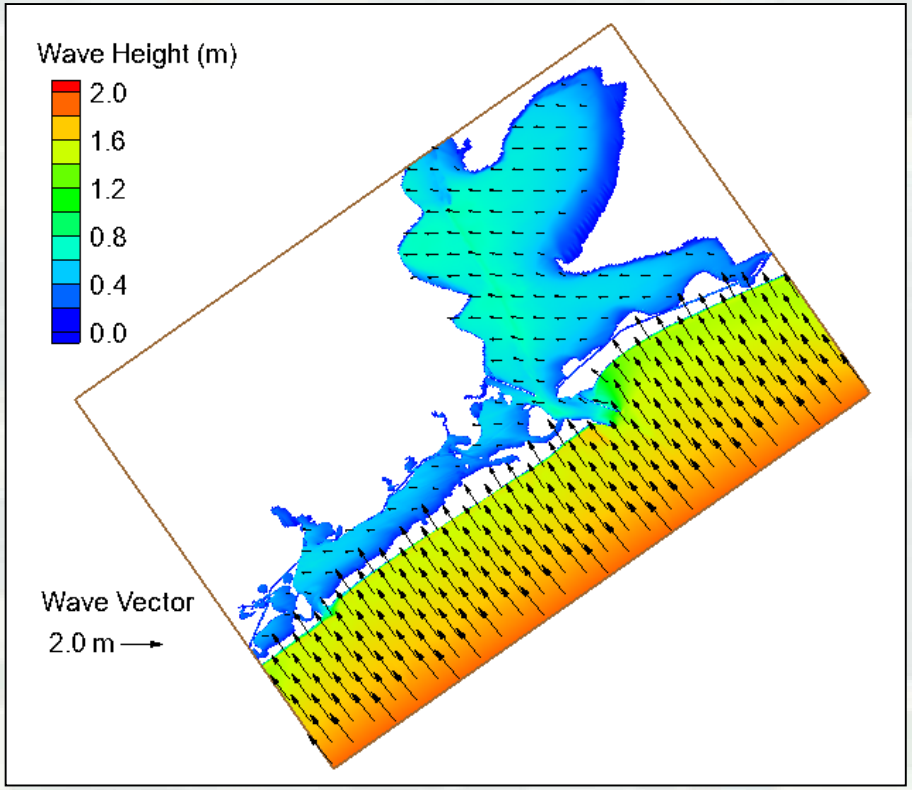


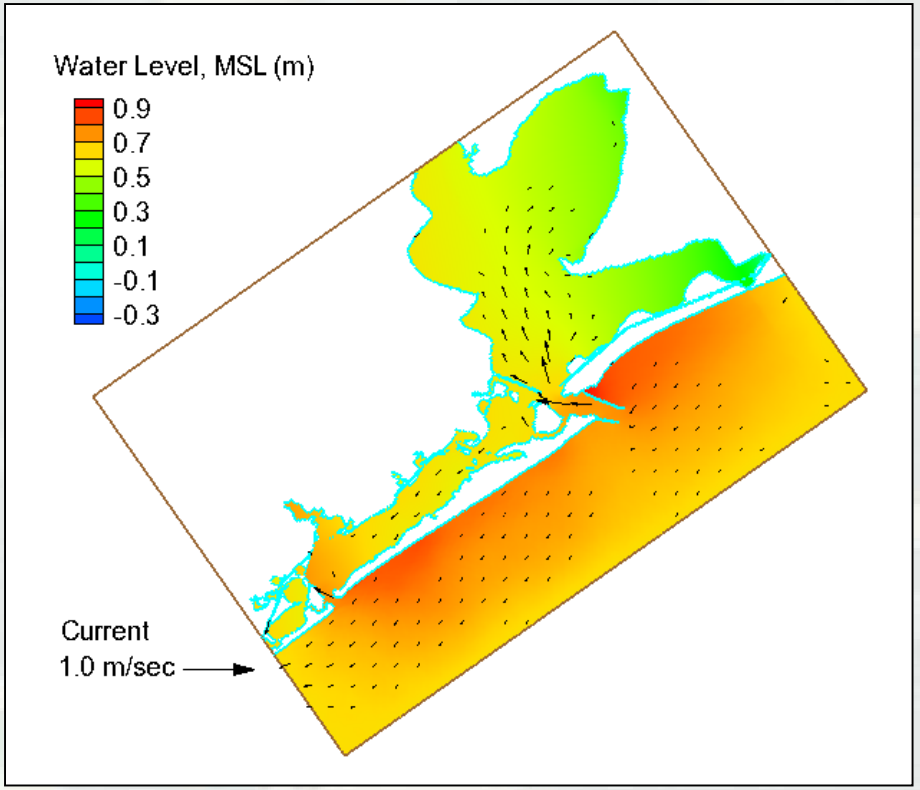




Sediment Transport Modeling: 1-yr Simulation: 2010

Example Model Wave and Flow Fields

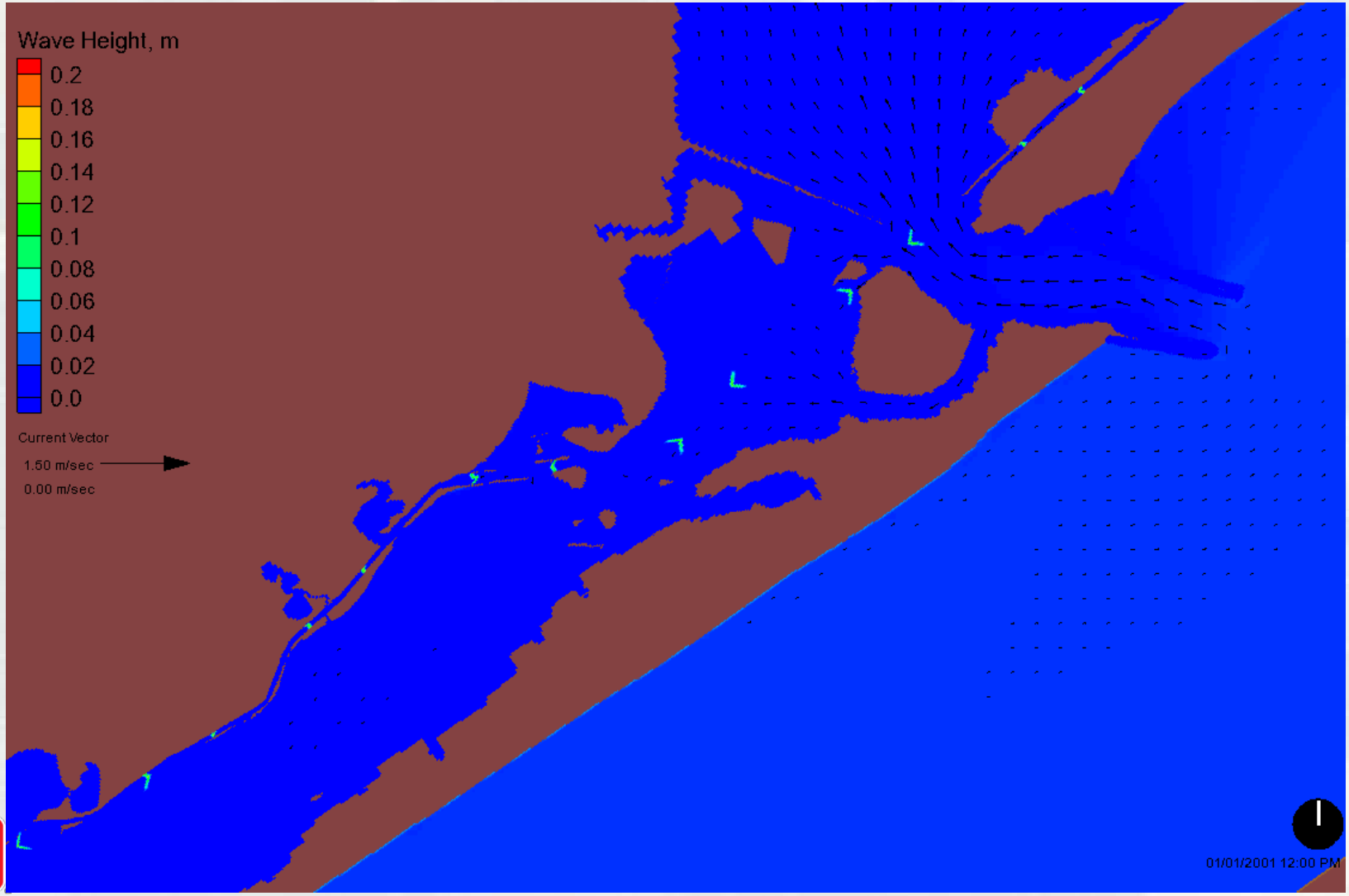




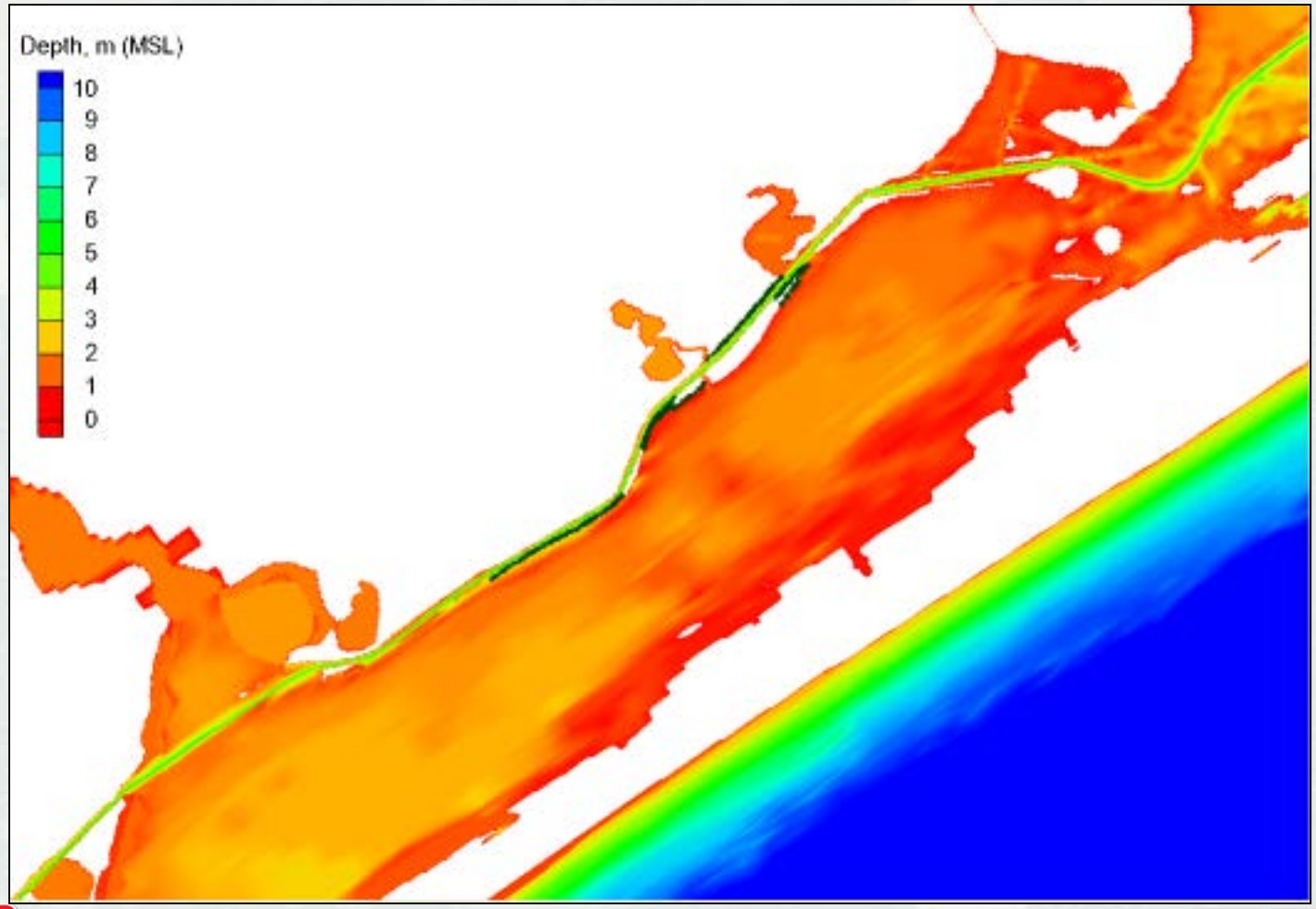
Calculated wave and flow fields at 2100 GMT, 29 June 2010

Barge Traffic Simulation

Barge Speed = 5 mph (1 Barge/Hr Each Way)

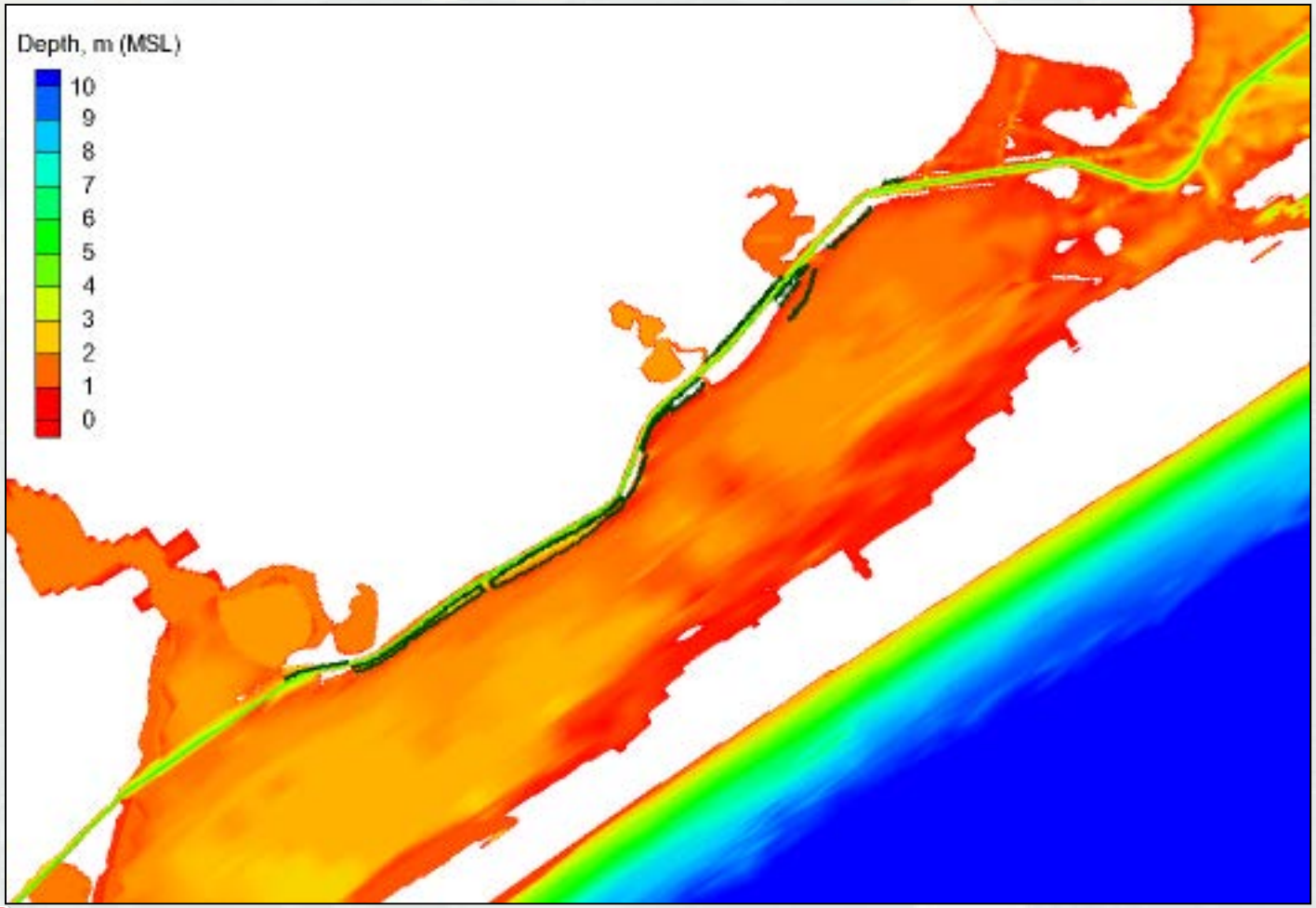


Proposed Priority 1 Alternative



Extend existing revetments to protect shoreline

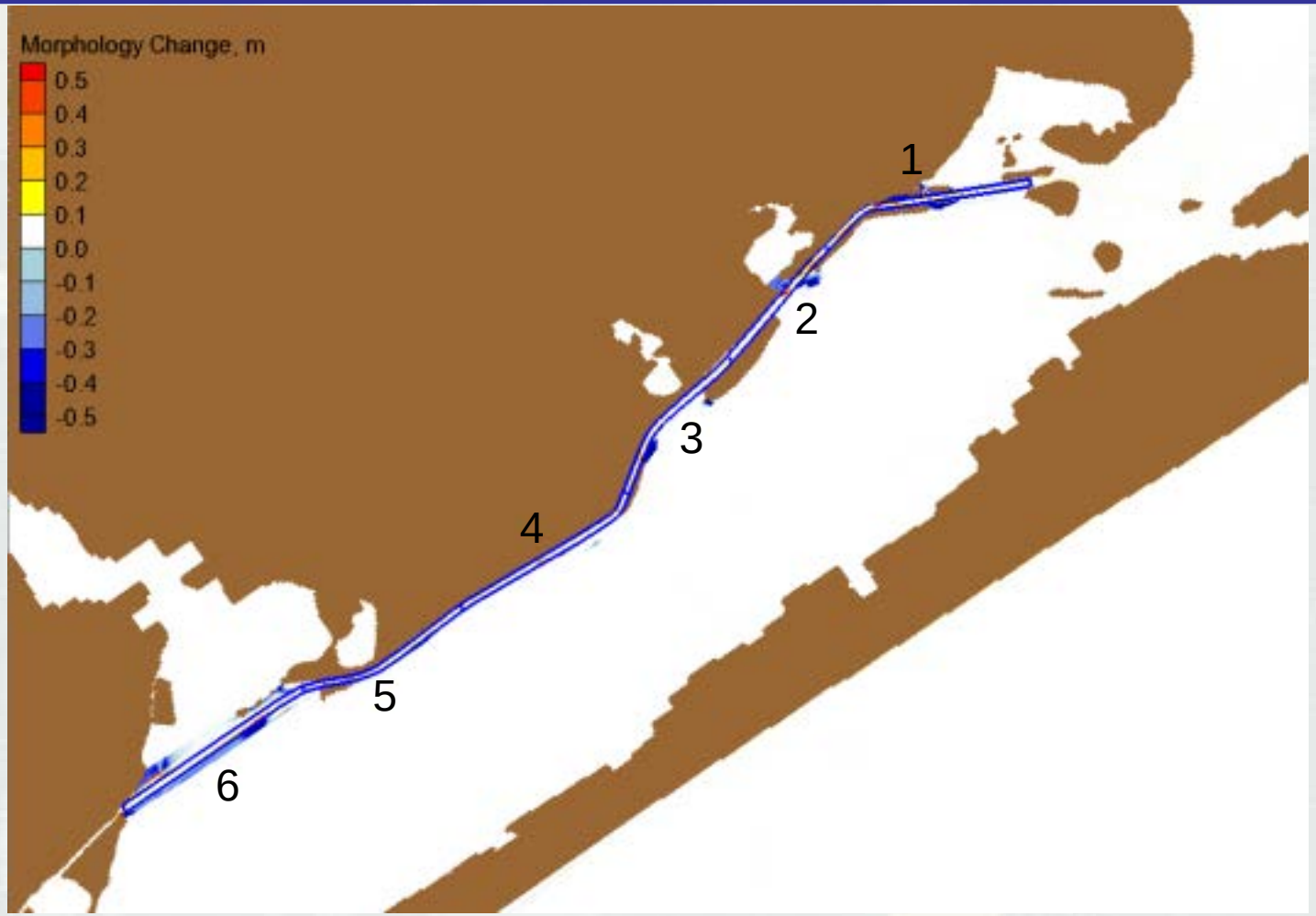
Proposed All Priorities Alternative



Restore PAs with shoreline protection revetments

Model Morphology Change (m)
Existing Configuration – Jan-March 2010

Model Volume Change
6 Channel Sections



Model Volume Change (CY*)
Jan-Dec 2010

Channel Sections	Existing Channel	Priority 1 Structures	All Priorities
1	156,140	155,440	148,920
2	89,530	74,030	35,680
3	125,630	48,840	41,150
4	550	2,750	3,130
5	3,360	2,770	8,880
6	21,530	21,640	25,990
Total (Sec1-6)	**396,750****	**305,470 (23% reduction)**	**263,750 (34% reduction)**

* Calculation based on model hydrated (wet) volume

** Agreed with recent annual average dredge volume ~ 400,000 CY

Summary & Conclusions

- US Army Engineer RSM, CIRP and Galveston District are teamed up to investigate remedial solutions to reduce the excessive channel shoaling in the GIWW along the west side of WGB, Texas.
- A Coastal Modeling System (CMS) is used to simulate mixed sediment transport in Galveston Bay multi-bay-and-inlet system. The CMS performance is validated by current and wave field data collected in June 2010.
- The model results indicate fine sediments from PAs and shoreline erosion are the main source for channel shoaling in GIWW.
- Based on the model simulation, the shoreline protection and barrier island restoration Alternatives 'Priority 1' and 'All priorities' can reduce GIWW channel shoaling by 23 and 34%, respectively.

Thank you!

Questions?

Lihwa Lin, Email: Lihwa.Lin@usace.army.mil