Regional and Local Modeling at MCR in Support of Channel Maintenance and Jetty Modification

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MCR Numerical Modeling

Overview

Regional 2D and 3D Modeling:

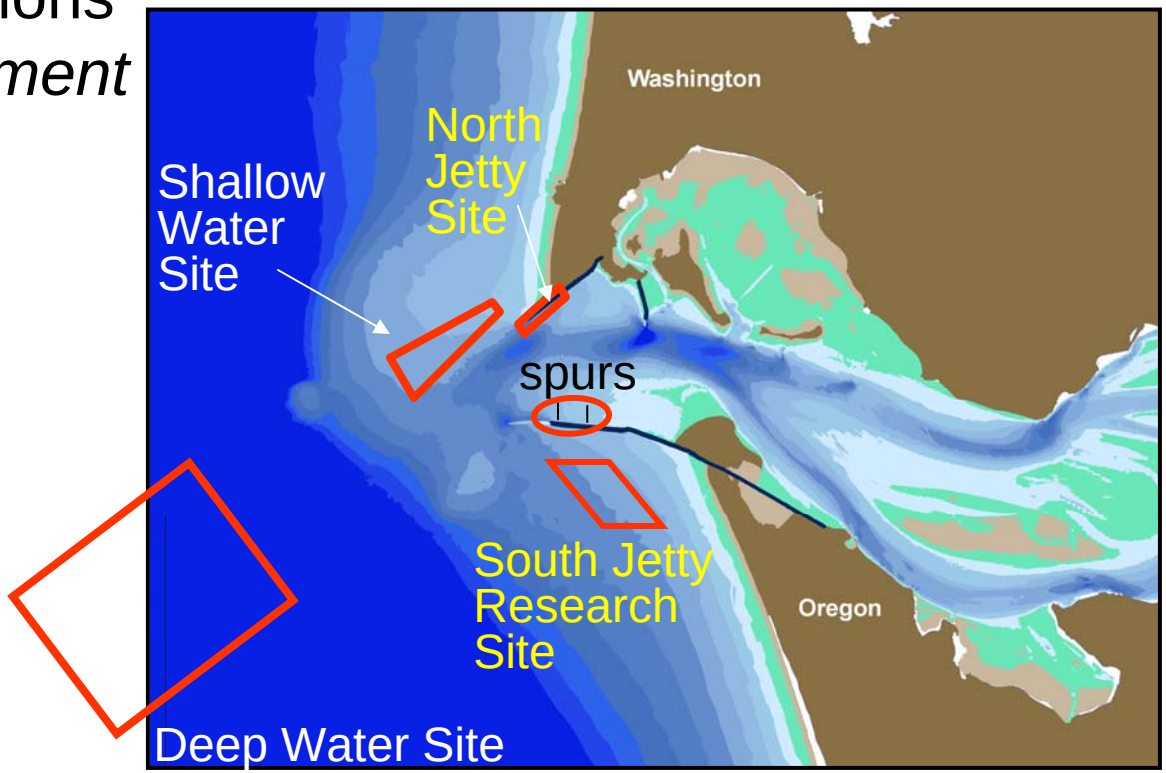
Jetty and spur modifications

- *circulation, wave, sediment transport, salinity*

Local 3D Modeling:

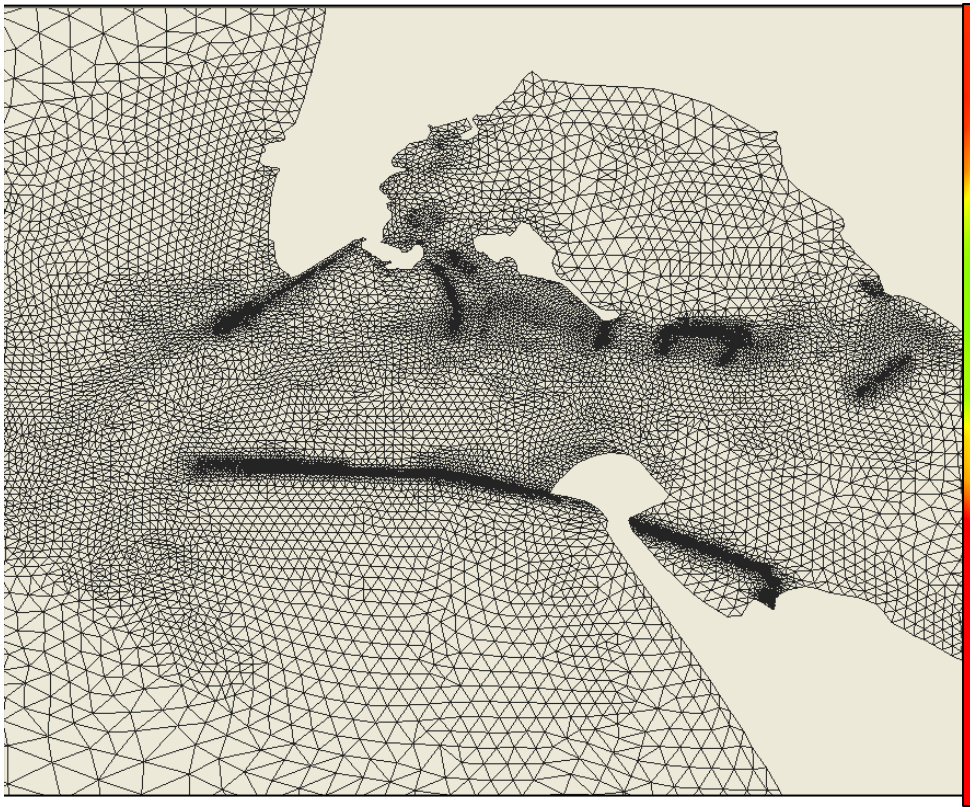
Dispersion at nearshore and offshore disposal sites

- *significance of wind, sediment transport rates, and pathways*

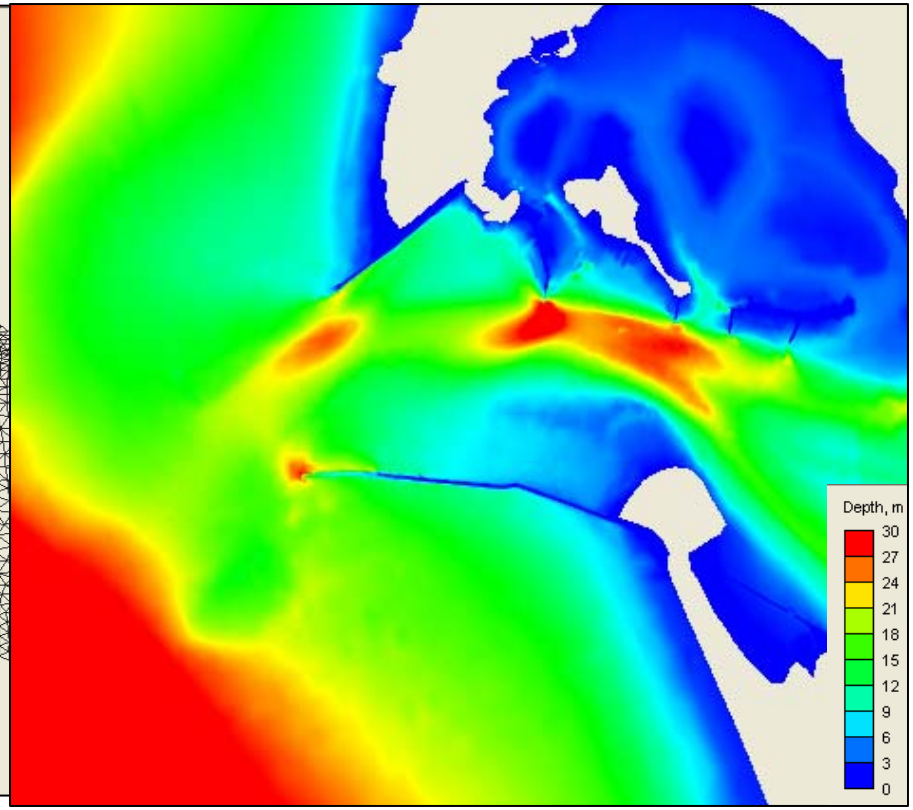


Circulation Modeling at the Mouth of Columbia River Estuary

High-resolution ADCIRC Mesh

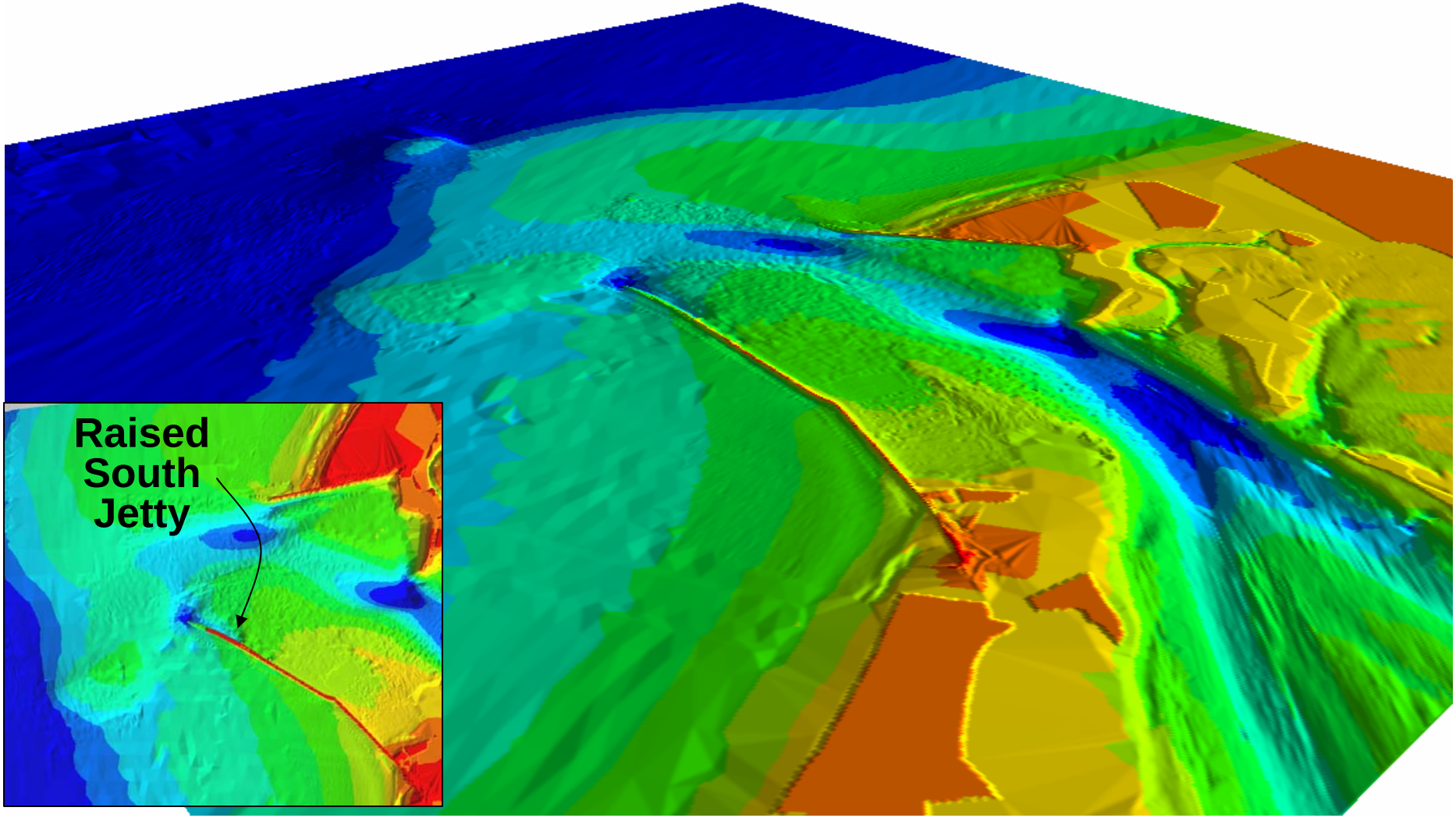


Higher resolution at jetties and dikes



Detailed land-bottom topography

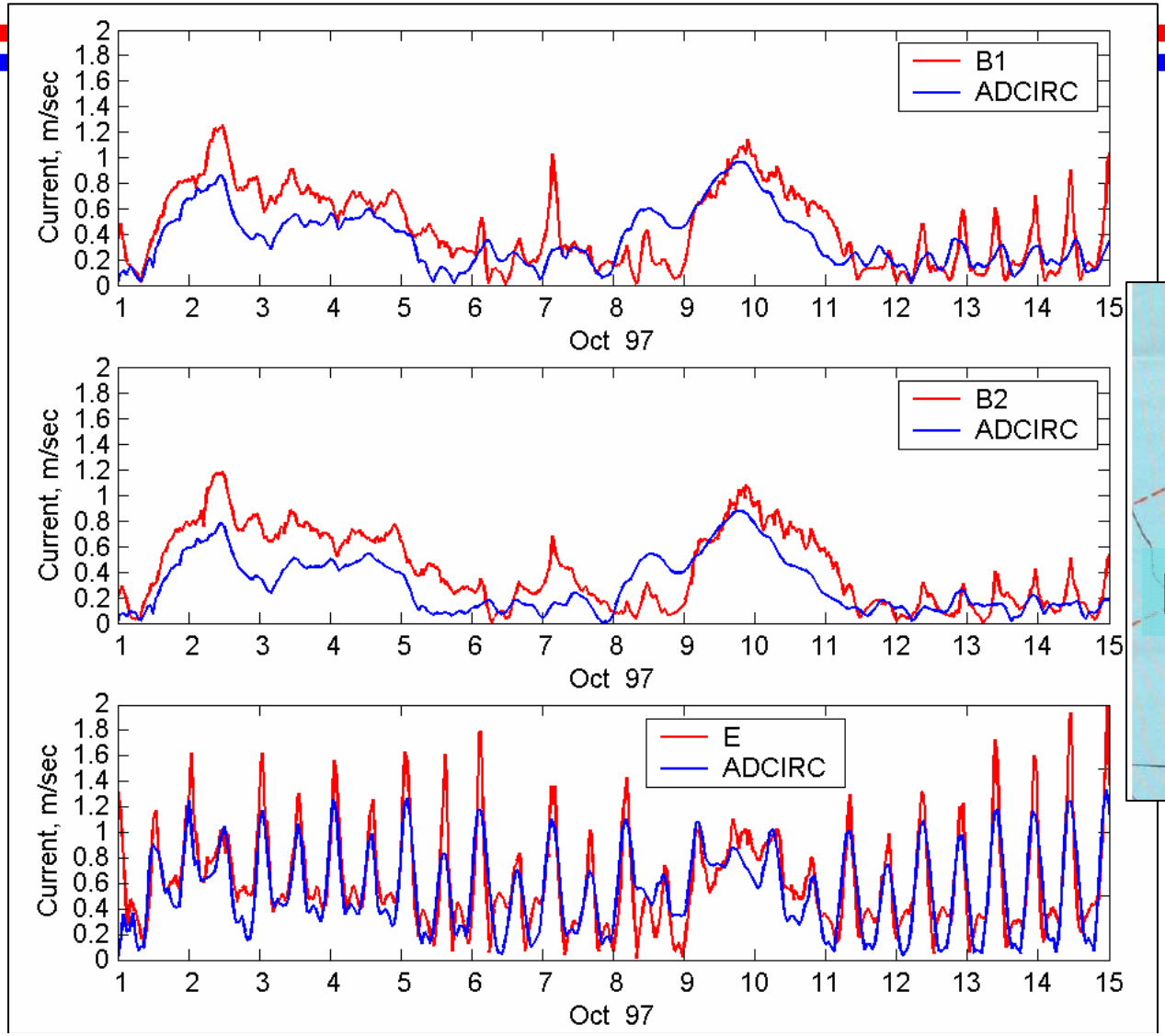
Bathymetry near the MCR Jetties

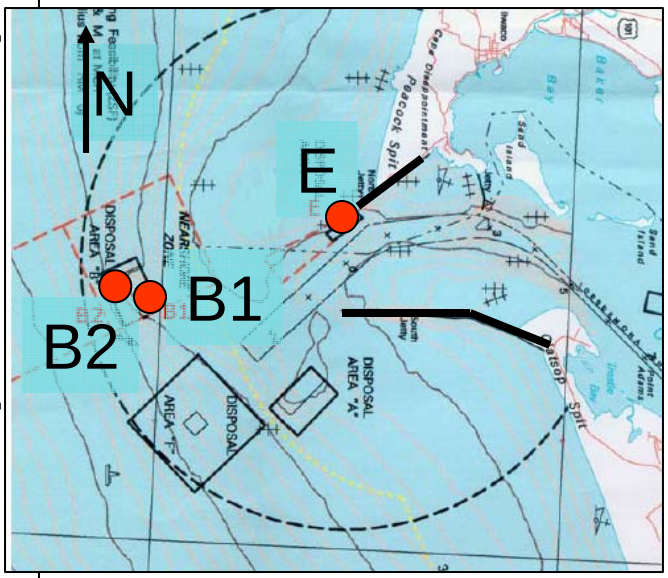


Circulation Modeling Validation

Measured and Calculated Currents

Three offshore sites during October 1997 storm

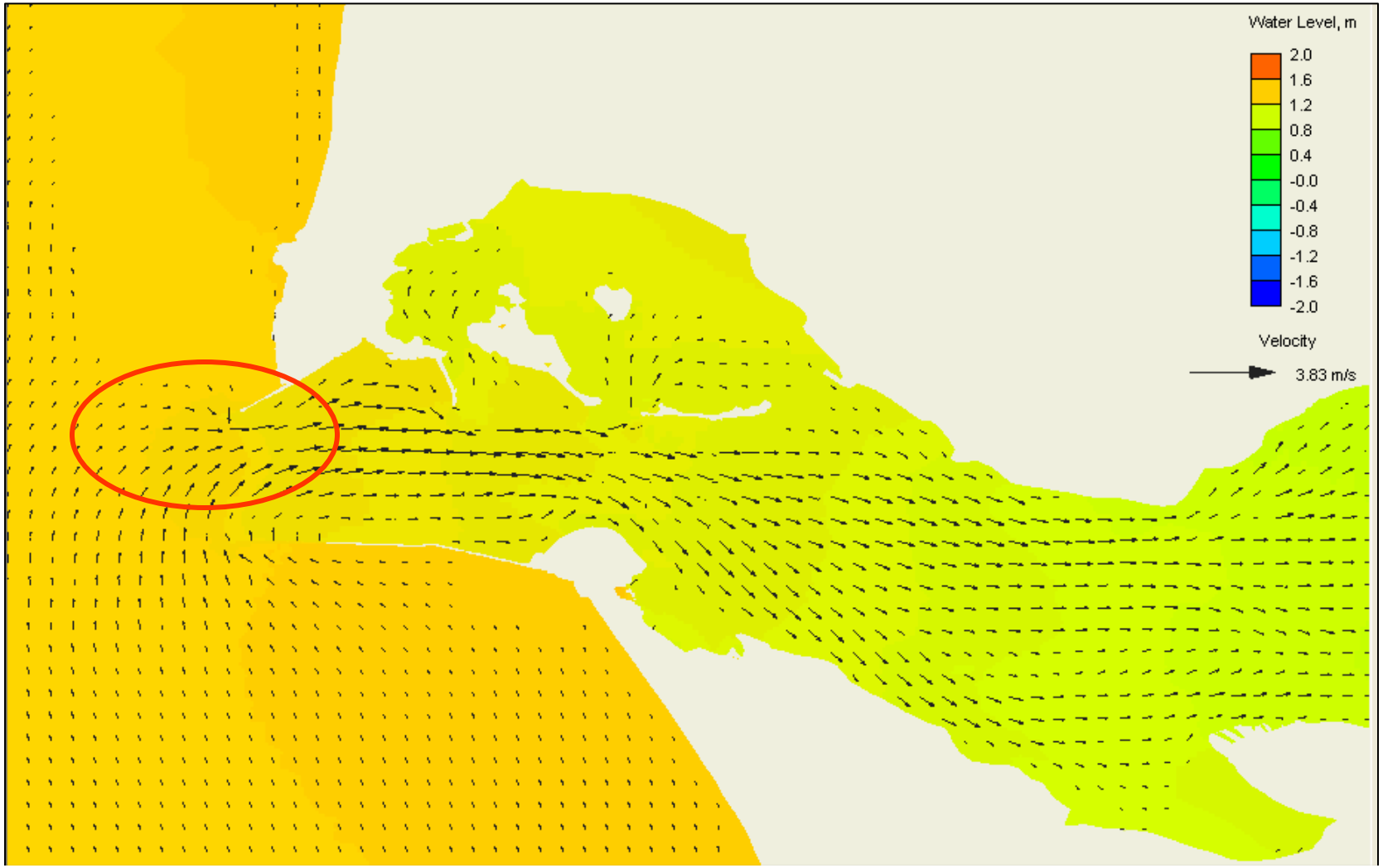




Regional Implications of Jetty Modifications

Calculated ADCIRC Maximum Flood Current

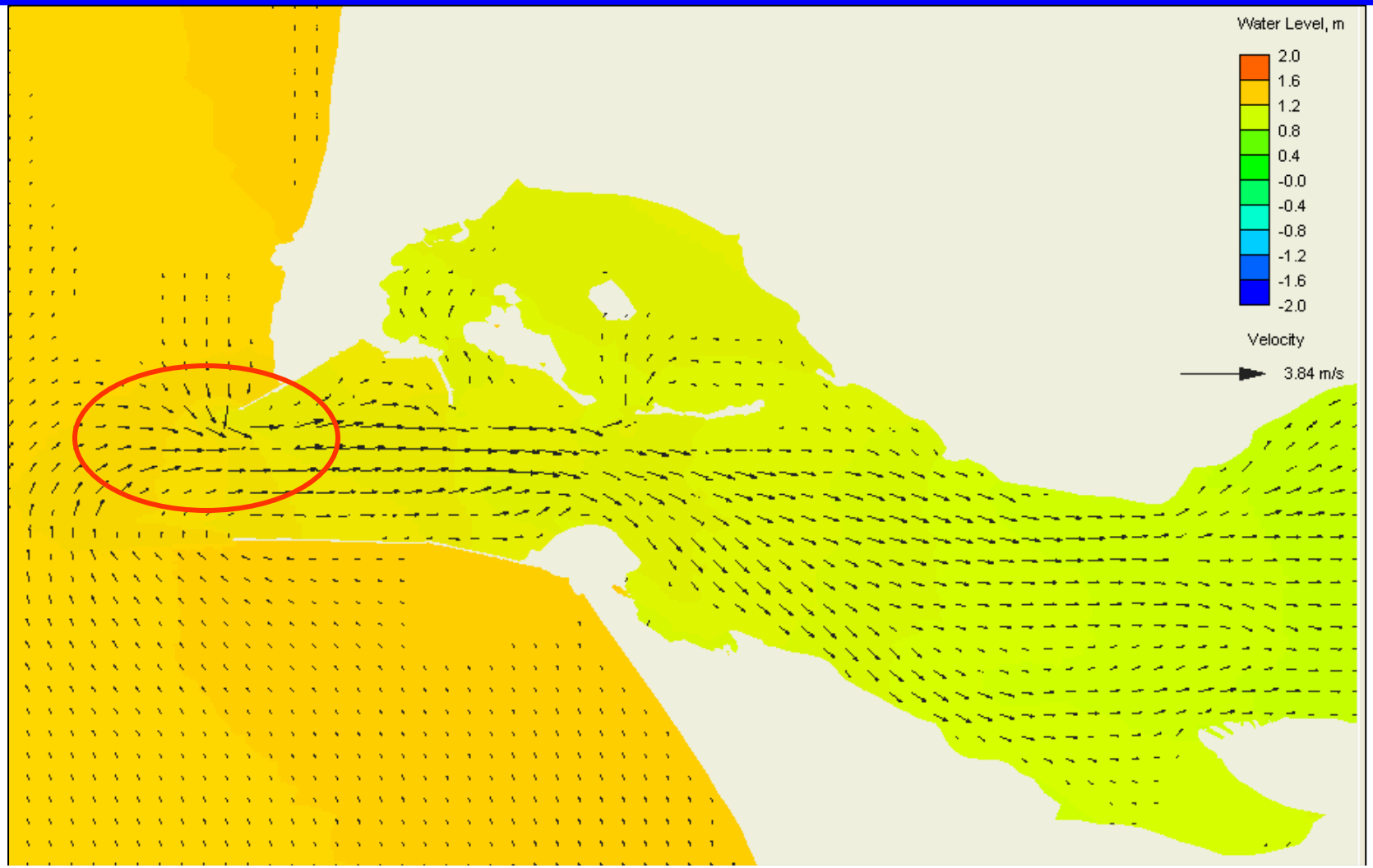
19:00 UTM, 4 October 1997 – Existing Condition



Regional Implications of Jetty Modifications

Calculated ADCIRC Maximum Flood Current

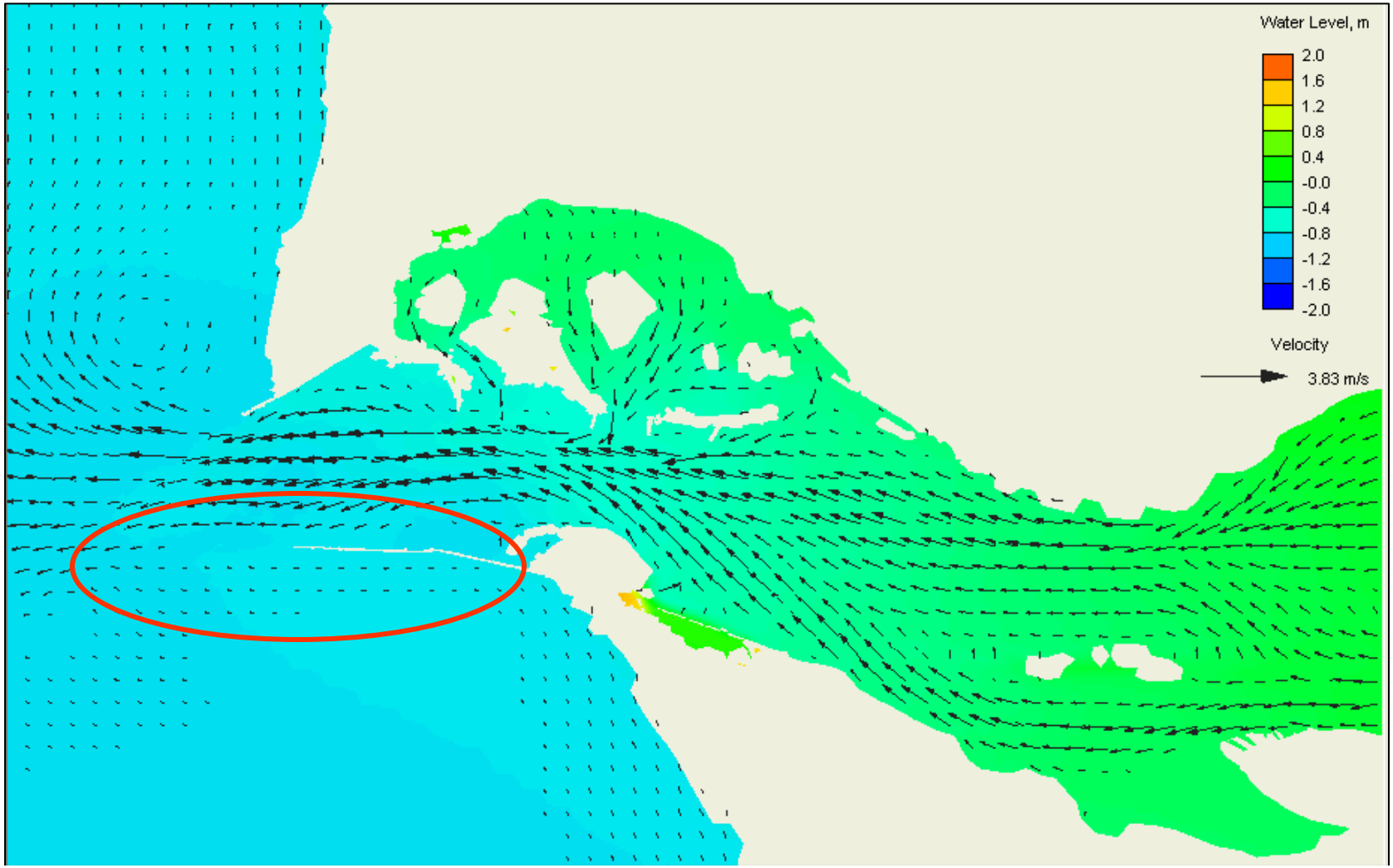
*19:00 UTM, 4 October 1997 – **Raised S Jetty***



Regional Implications of Jetty Modifications

Calculated ADCIRC Maximum Ebb Current

01:00 UTM, 4 October 1997 – Existing Condition



Regional Implications of Jetty Modifications

Calculated ADCIRC Maximum Ebb Current

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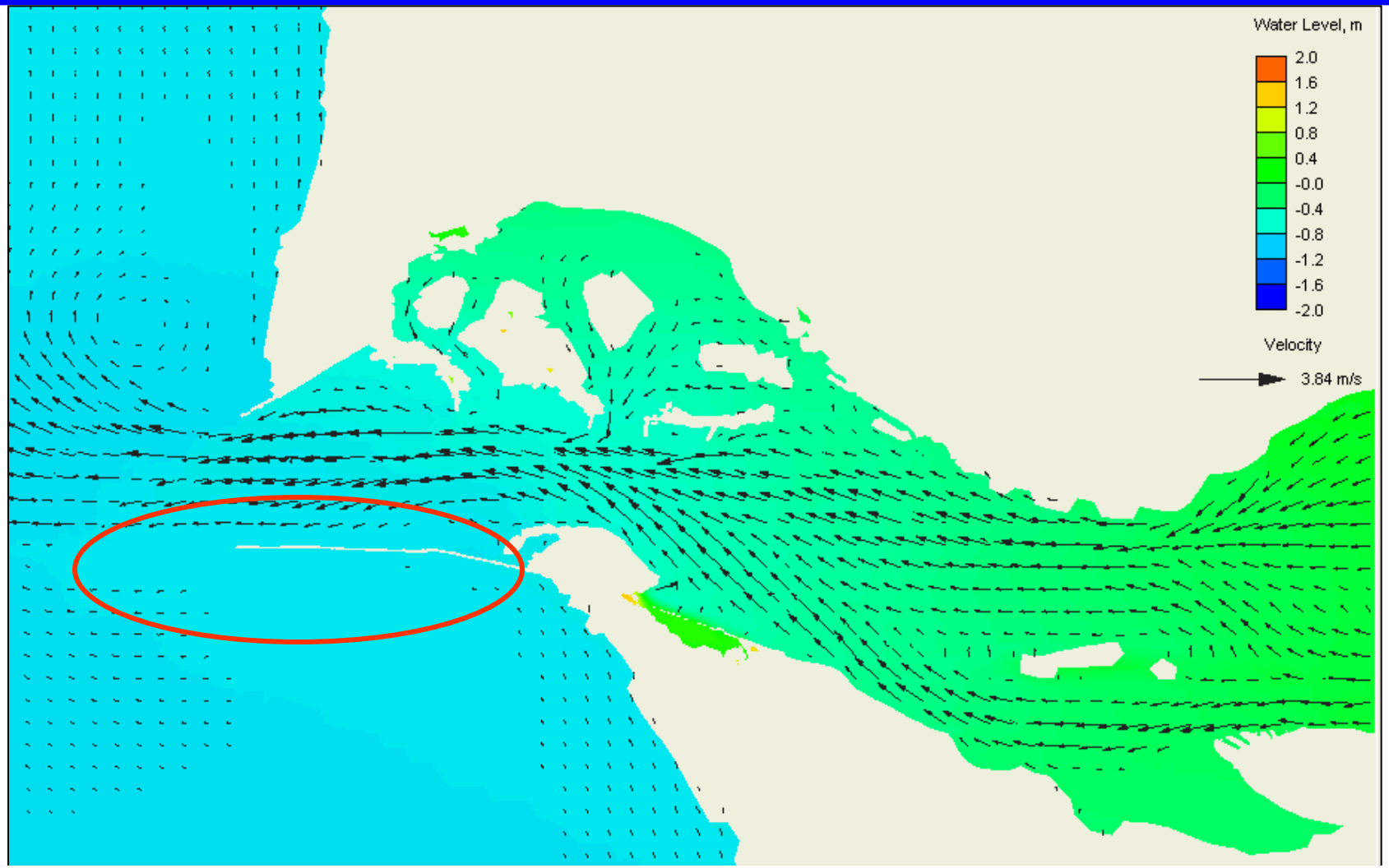
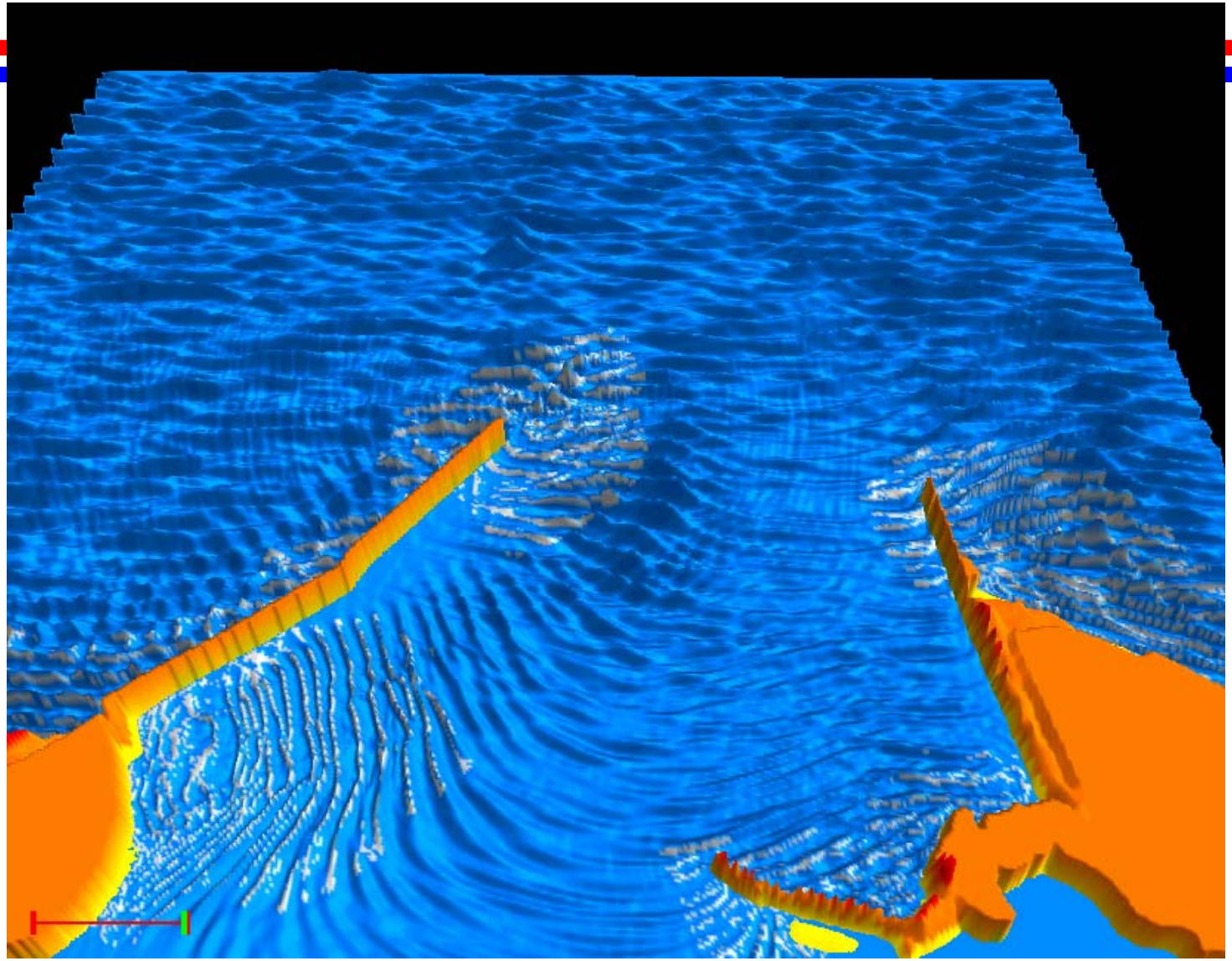


Wave Modeling at the Mouth of Columbia River Estuary

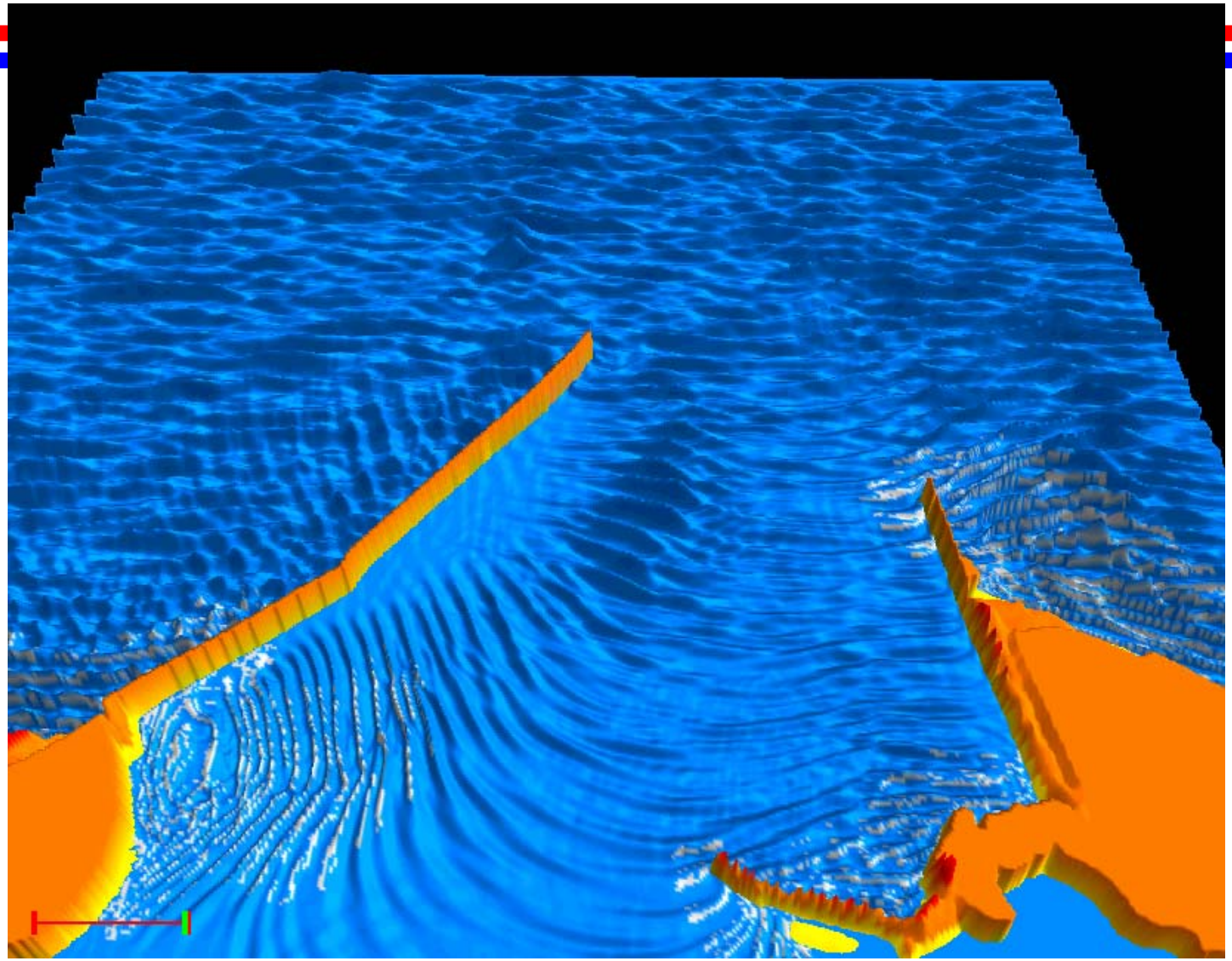
- Energetic Waves
- Strong Currents
- Large Ebb Shoal
- Jetties
- Modeling
  - Large domain
  - Wave-current interaction
  - Diffraction & reflection
  - Wind wave generation
  - Wind-induced current
  - River current

	STWAVE	BOUSS-2D
Wind-Wave Generation	✓	
Shoaling & Refraction	✓	✓
Wave Breaking	✓	✓
Wave-Current Interaction	✓	✓
Nonlinear Interactions		✓
Diffraction & Reflection		✓
Wave-Induced Currents	Explicit	Implicit

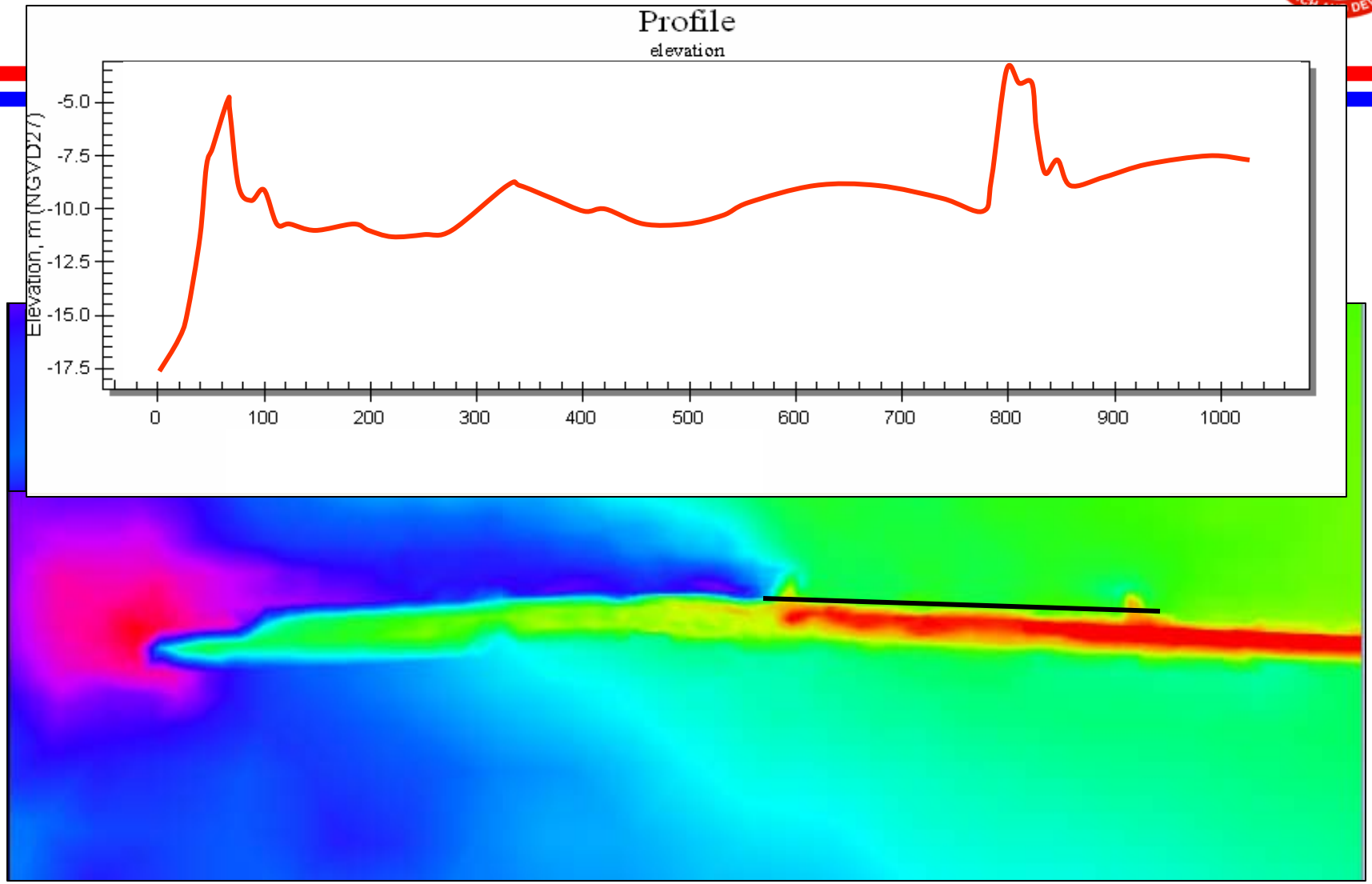
Interaction of Waves with Jetties: Existing Configuration (Nonlinear Bouss-2D)



Interaction of Waves with Jetties: Raised South Jetty (Nonlinear Bouss-2D)

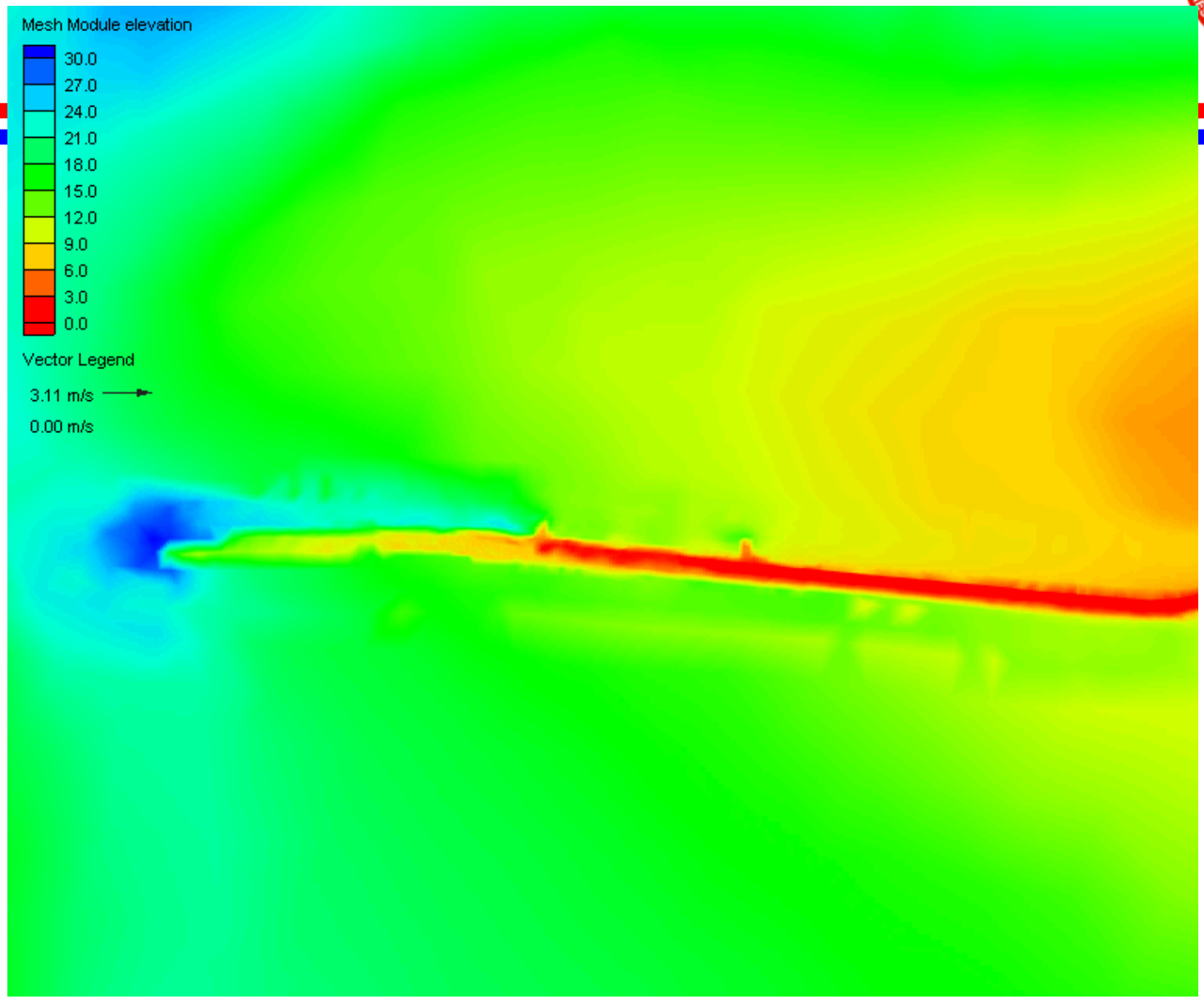


South Jetty Spur Cross-Sections



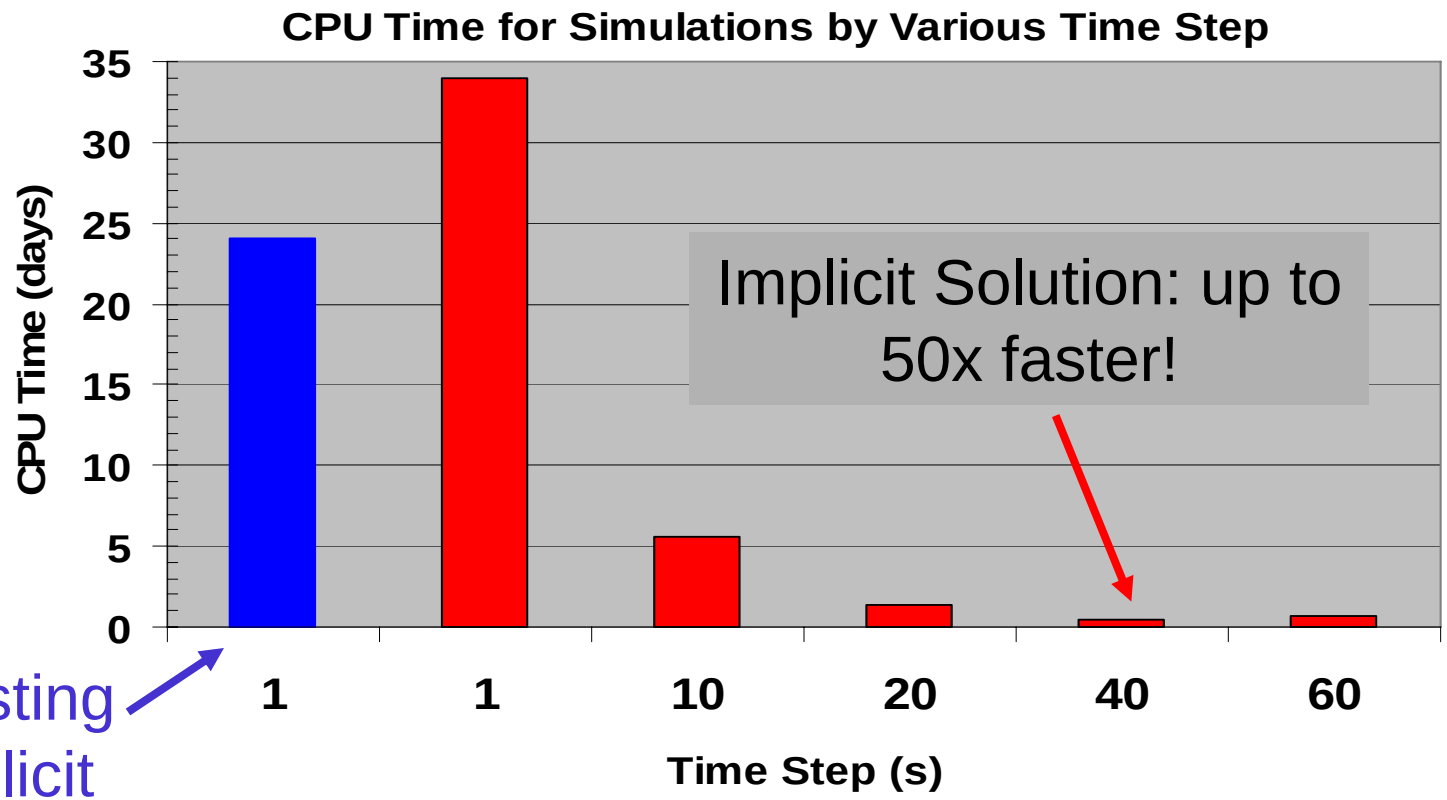
Wave and tidal current in vicinity of spurs

Note deflection of current by spurs



New Capability: Implicit Version

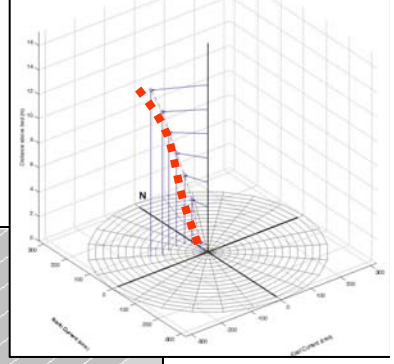
→ faster long-term simulations, with capability for detailed resolution



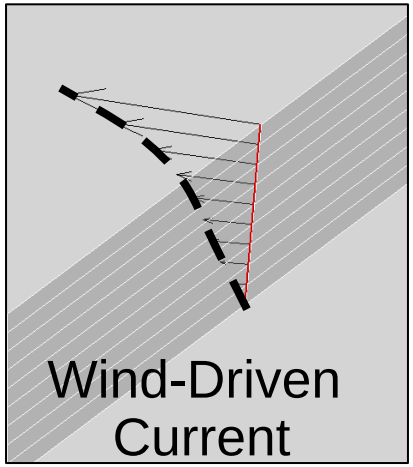
Existing Explicit Version

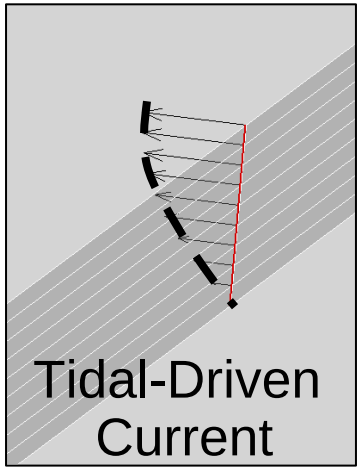
M3D Current Prediction
1-10 October 1997

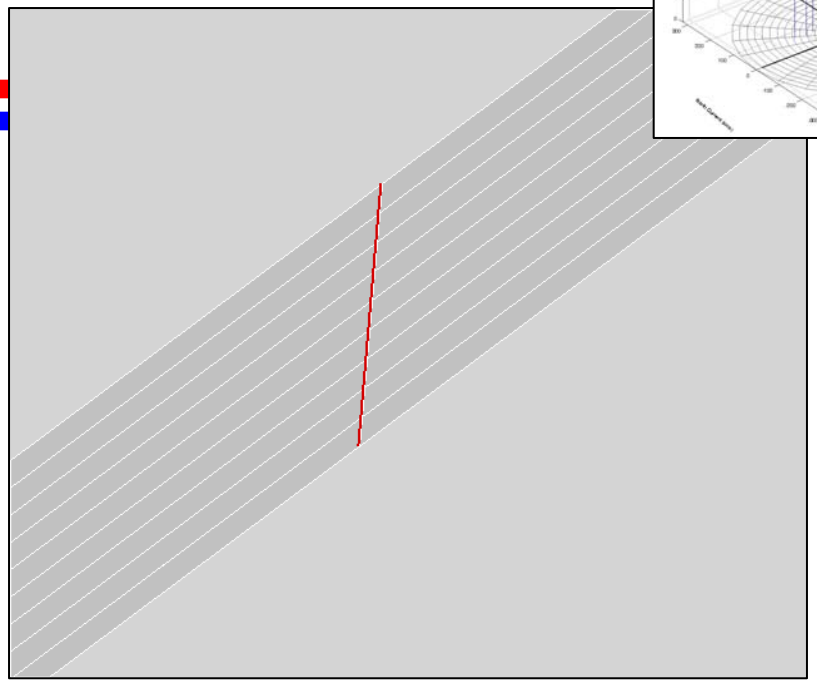
Measured currents

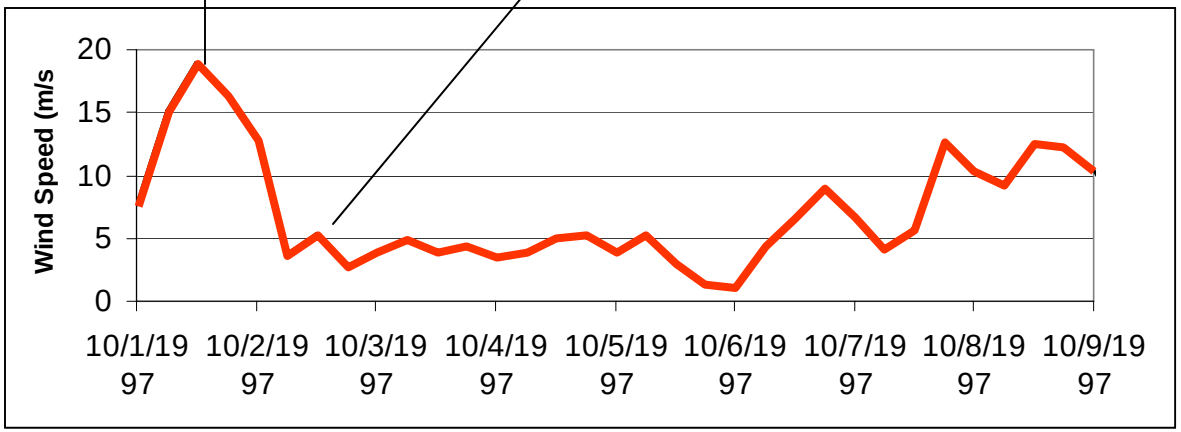


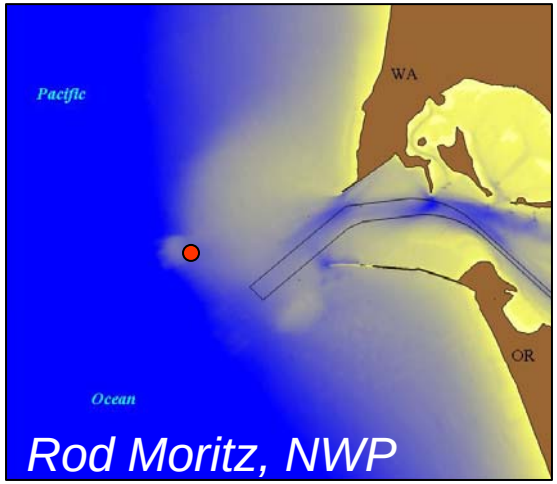
Predicted Currents







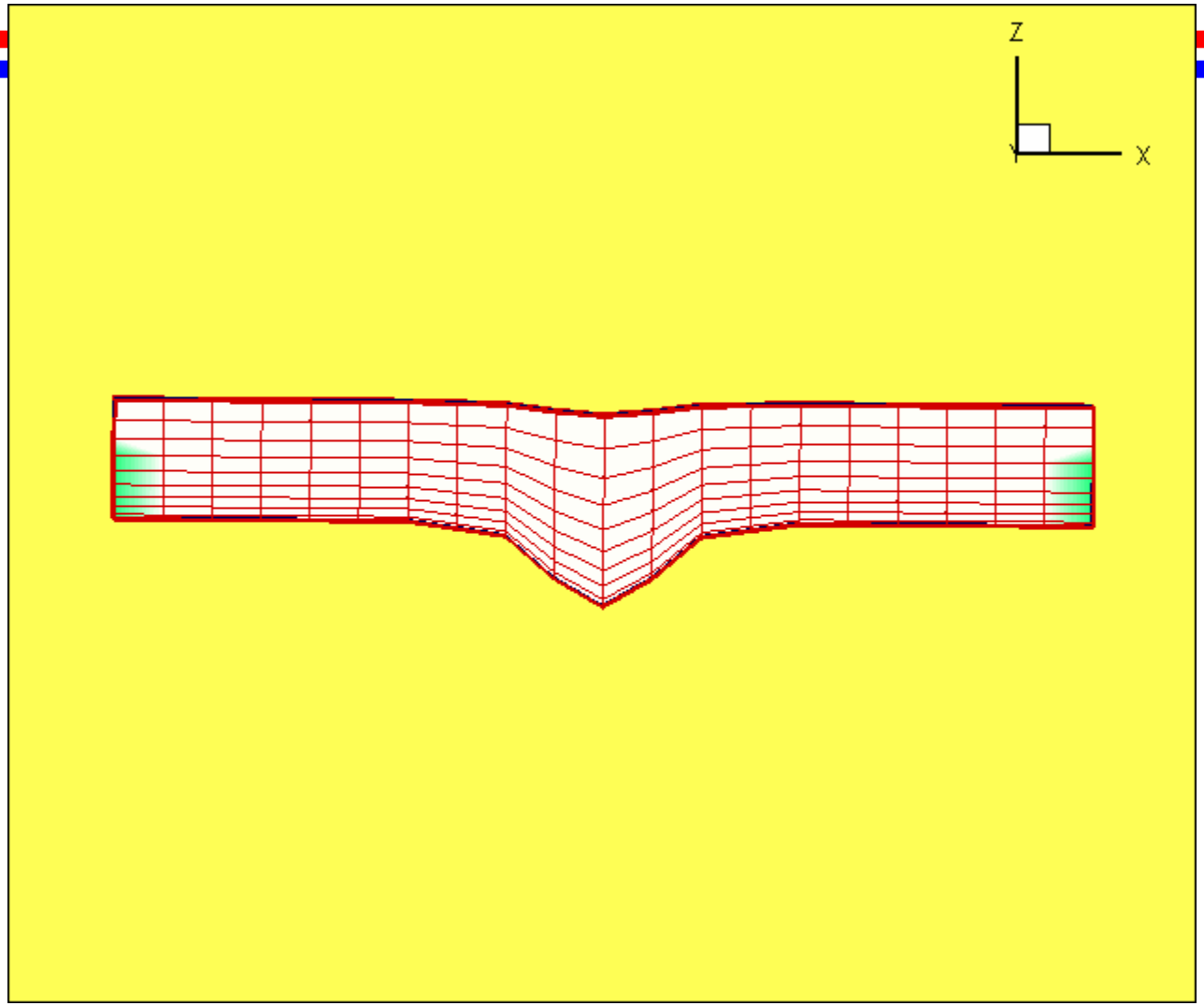




Rod Moritz, NWP

M3D –Salinity Transport

Idealized Channel Test Case



MCR Numerical Modeling Efforts

Summary of Applications

1. Changes in circulation, waves, salinity, and sediment transport in response to jetty modification or degradation.
2. Performance of spurs to protect jetties.
3. Long-term morphologic change (decades) in response to engineering actions.
3. Performance of Shallow-water Site and Deep-water Site.
4. Fate of dredged material placed in southern nearshore to protect south jetty and halt beach profile lowering.