The SMS Steering Module Coupling ADCIRC and STWAVE

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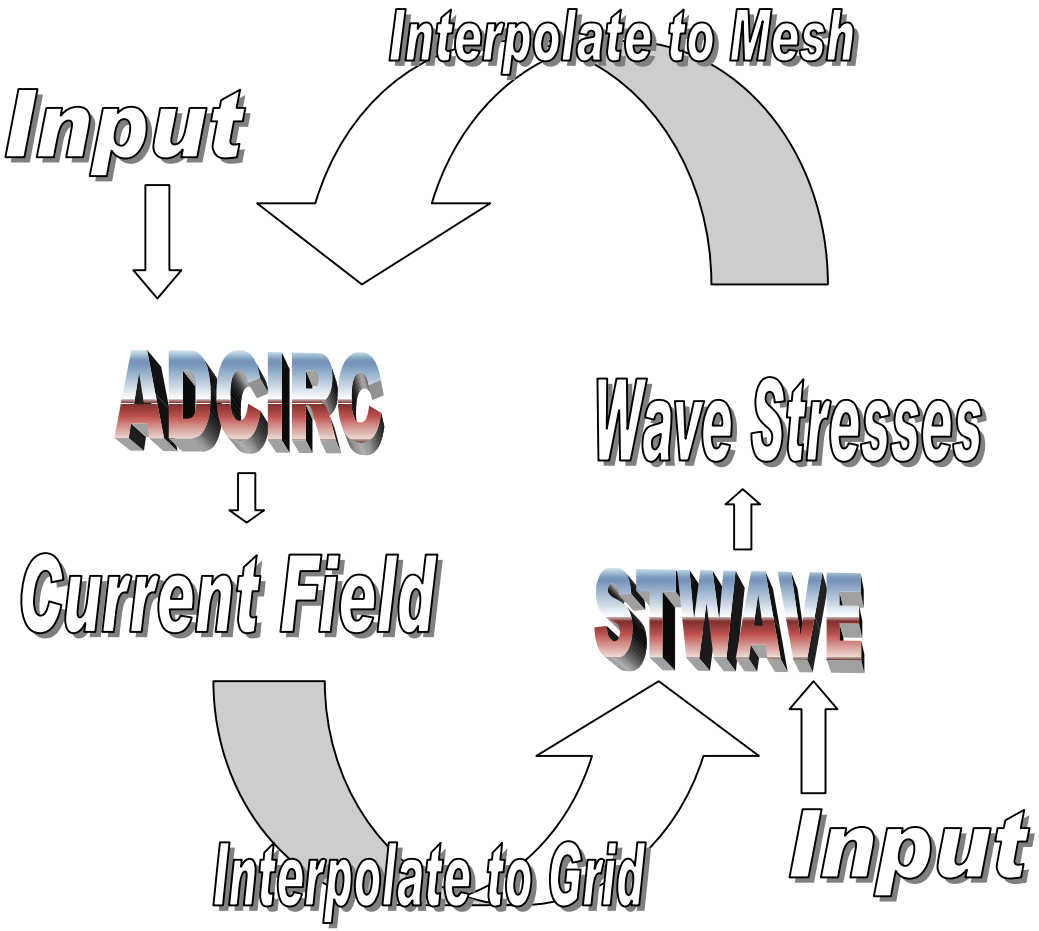
Steering Module Objectives

- Simplify data sharing between models
- Monitor model runs
- Save time by automating repetitive user tasks
- Achieve more accurate results from models

ADCIRC←→STWAVE



- Challenges:
  - Steady state vs. transient
  - Domain Size
    - ADCIRC: large mesh
    - STWAVE: small grid
  - Output organization

ADCIRC-STWAVE Coupling

ADCIRC

- Finite element numerical model
- Time dependent
- Large area application
- Computes nodal elevations and velocities
- Optional wave stress input

STWAVE

- Finite difference numerical model
- Steady State
- Small area application
- Computes wave stress, magnitude and direction
- Optional current input

ADCIRC-STWAVE Coupling

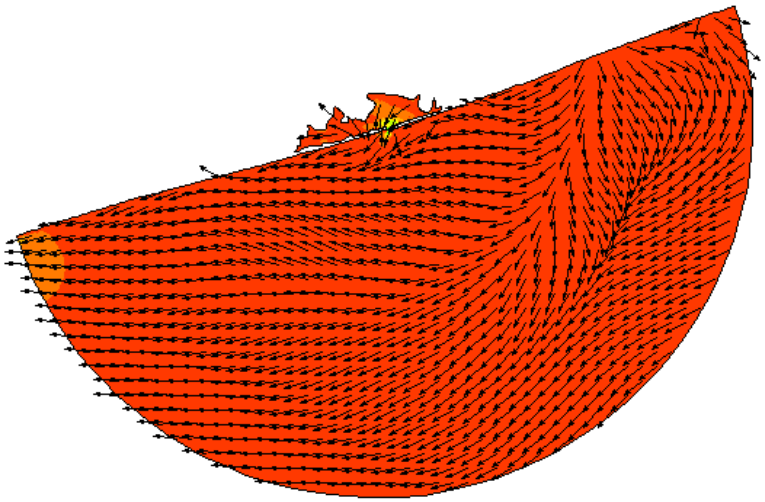
- Input/Output Sharing
  - STWAVE gets current data from ADCIRC
  - ADCIRC input from STWAVE wave radiation stress output
- Potential coupling issues:
  - Steady state vs. transient
  - Domain Size
    - ADCIRC: large mesh
    - STWAVE: small grid

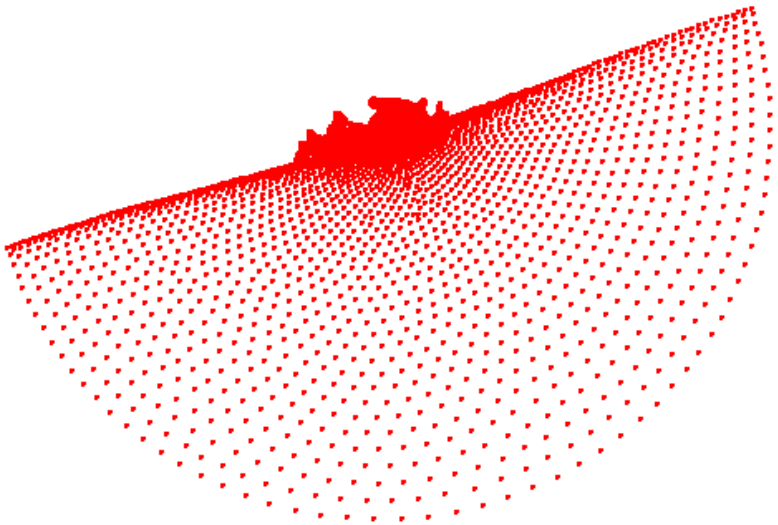
Conventional Method

1. ADCIRC mesh and STWAVE grid generation
2. Specify model run parameters
3. Save simulation and run ADCIRC
4. Read solutions and interpolate data to grid
5. Save simulation and run STWAVE
6. Read solutions and extrapolate data to mesh
7. Update model run parameters
8. Repeat Steps 3-7

Currents

ADCIRC Current Solution -> Scatter



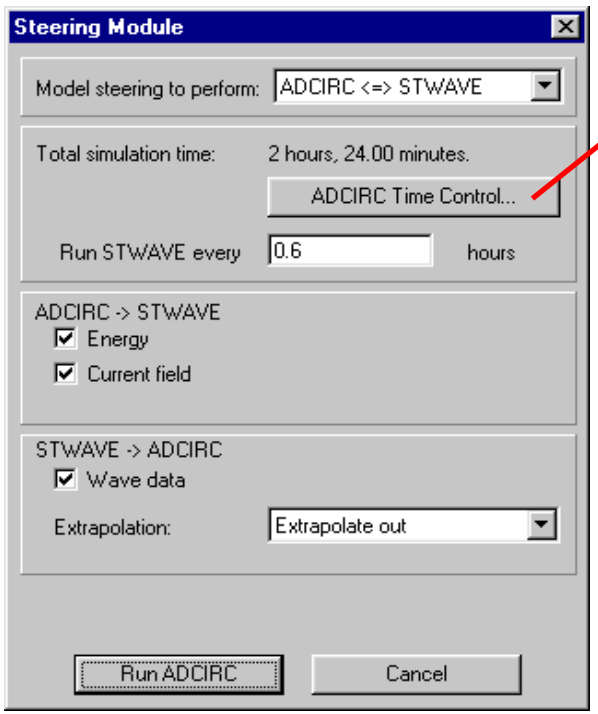


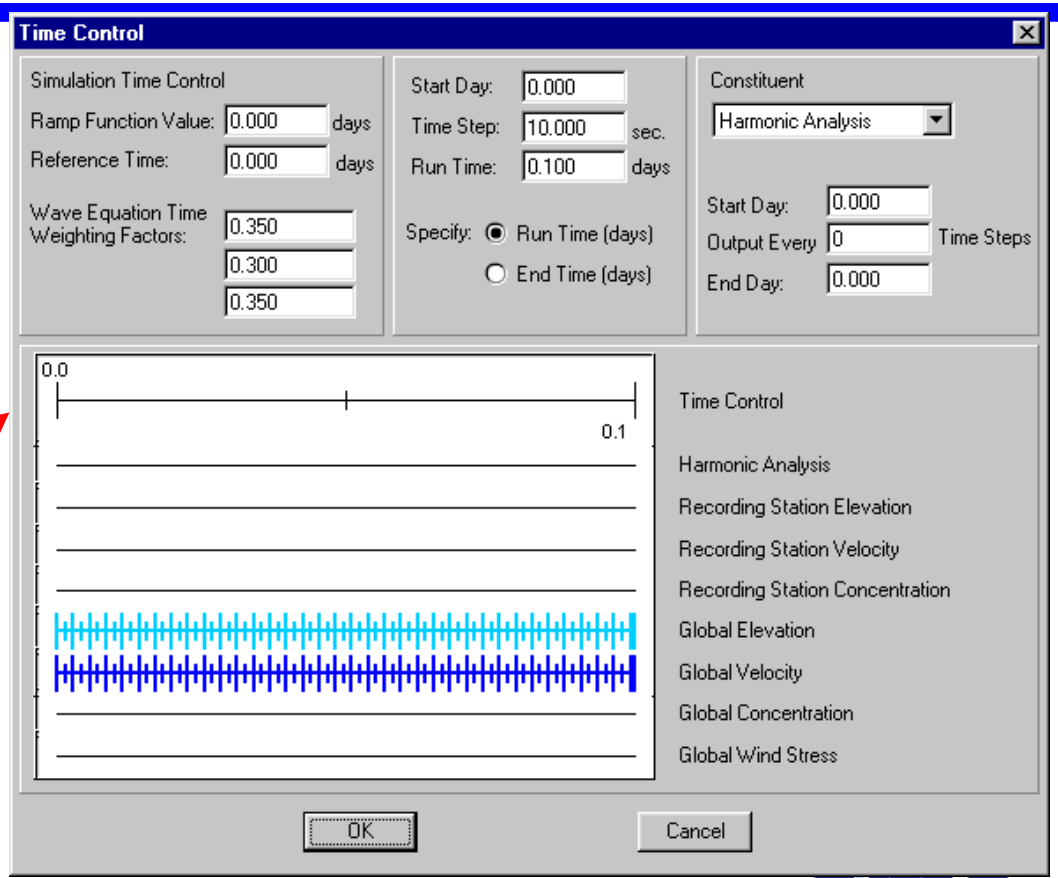
Automated Steering Method

1. ADCIRC mesh and STWAVE grid generation
2. Specify model run parameters
3. Specify steering parameters
4. Launch steering

Steering Process

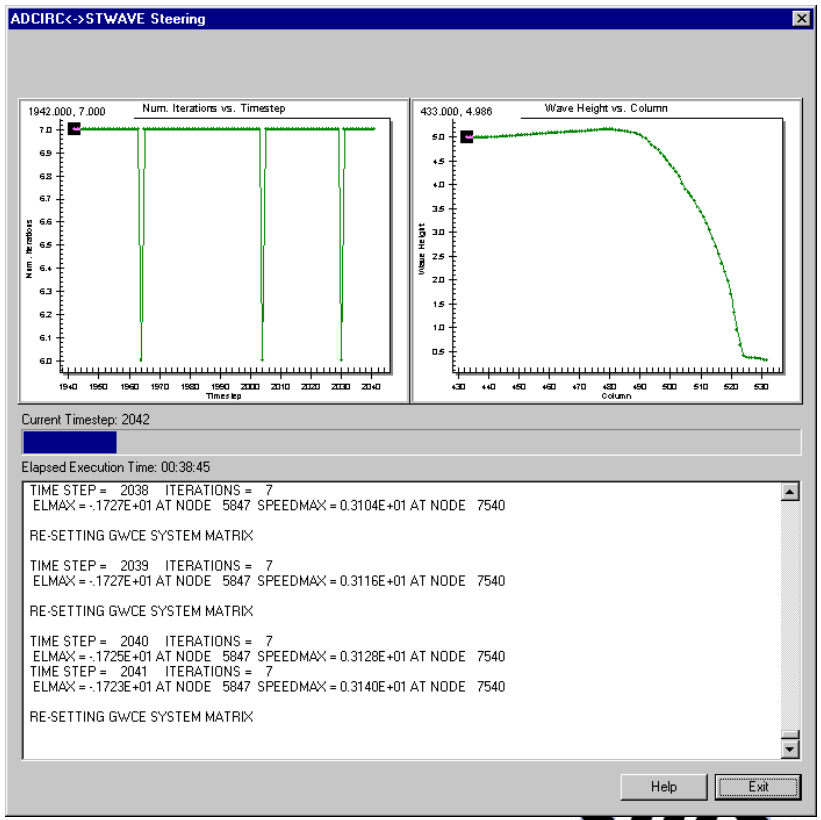
- Specify:
  - Simulation times
  - Run frequency





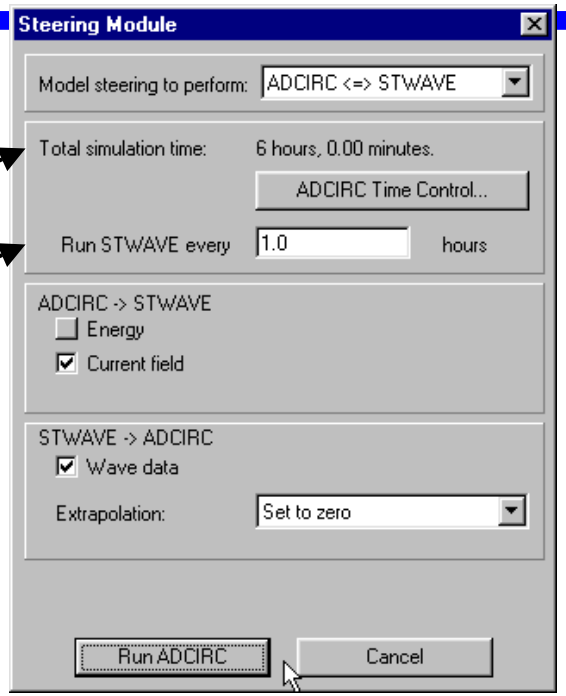
Steering Module Process

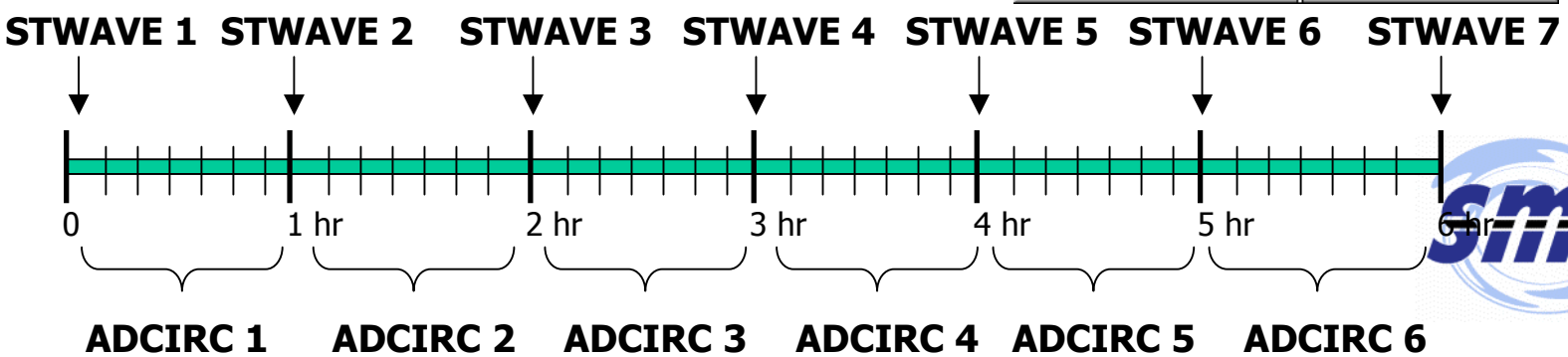
- Automated Process:
  - Launches numeric model
  - Monitors model completion
  - Data interpolation
  - Saves necessary files
  - Repeat



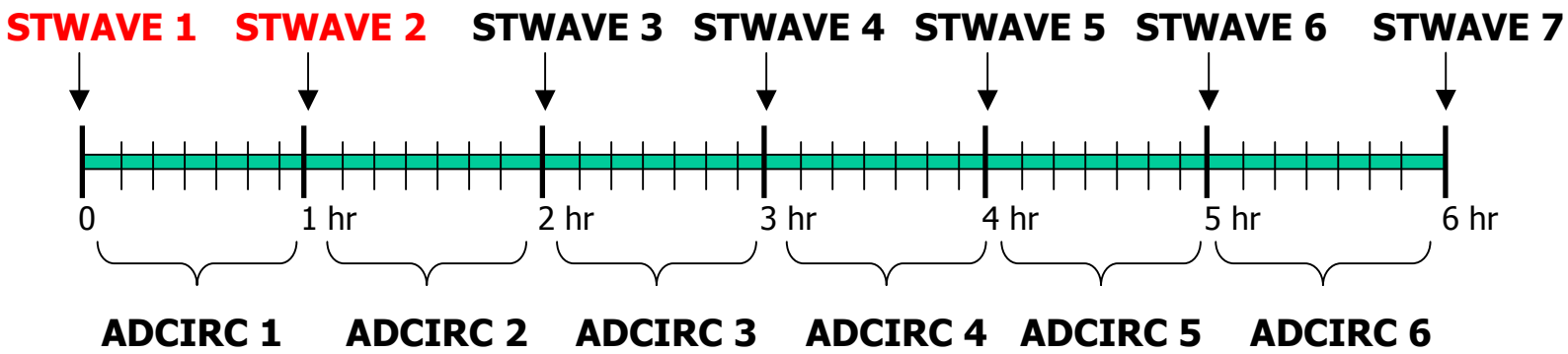
Steering Module Timeline

- Example:
  - Total ADCIRC simulation time: 6 hrs
  - Time step: 1 minute (60 time steps per steering step)
  - Run STWAVE every 1 hr



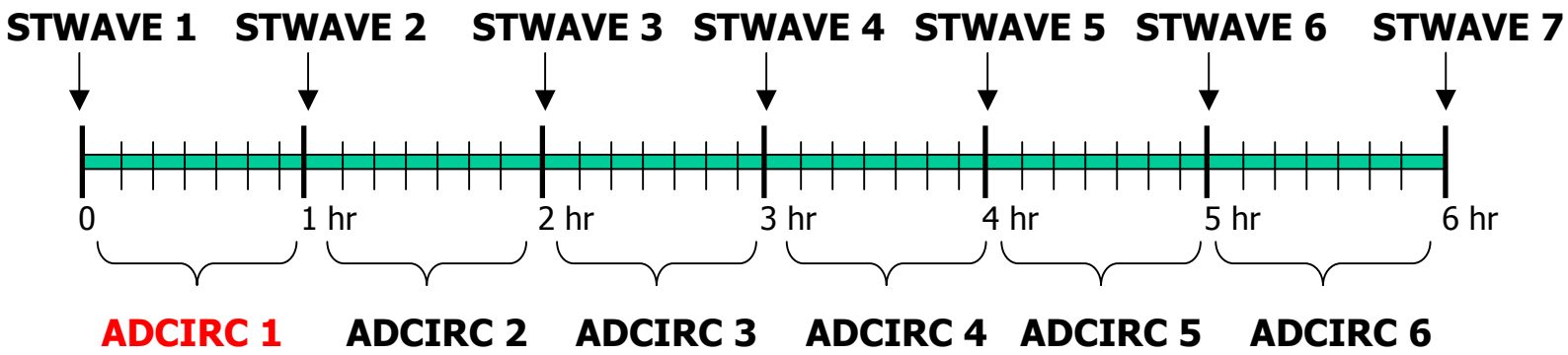


Steering STWAVE



- Read ADCIRC velocity solution (except for STWAVE 1)
- Interpolate values to STWAVE grid
- Save STWAVE simulation
- Launch STWAVE

Steering ADCIRC

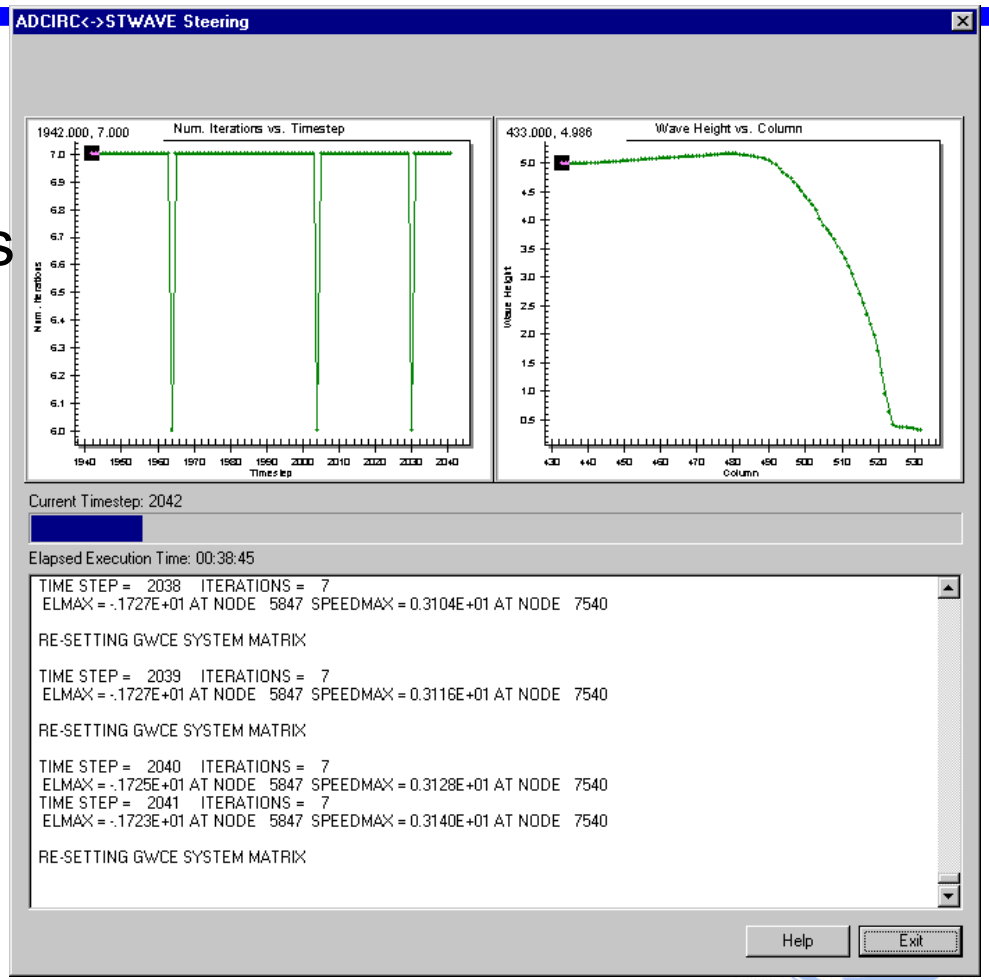


- Read STWAVE radiation stress solutions
- Interpolate values to ADCIRC mesh
- Create Unit 23 input file for ADCIRC – Save new Simulation
- Launch ADCIRC
  - Writes Success/Error in status
  - Solution appended to file

Model Wrapper

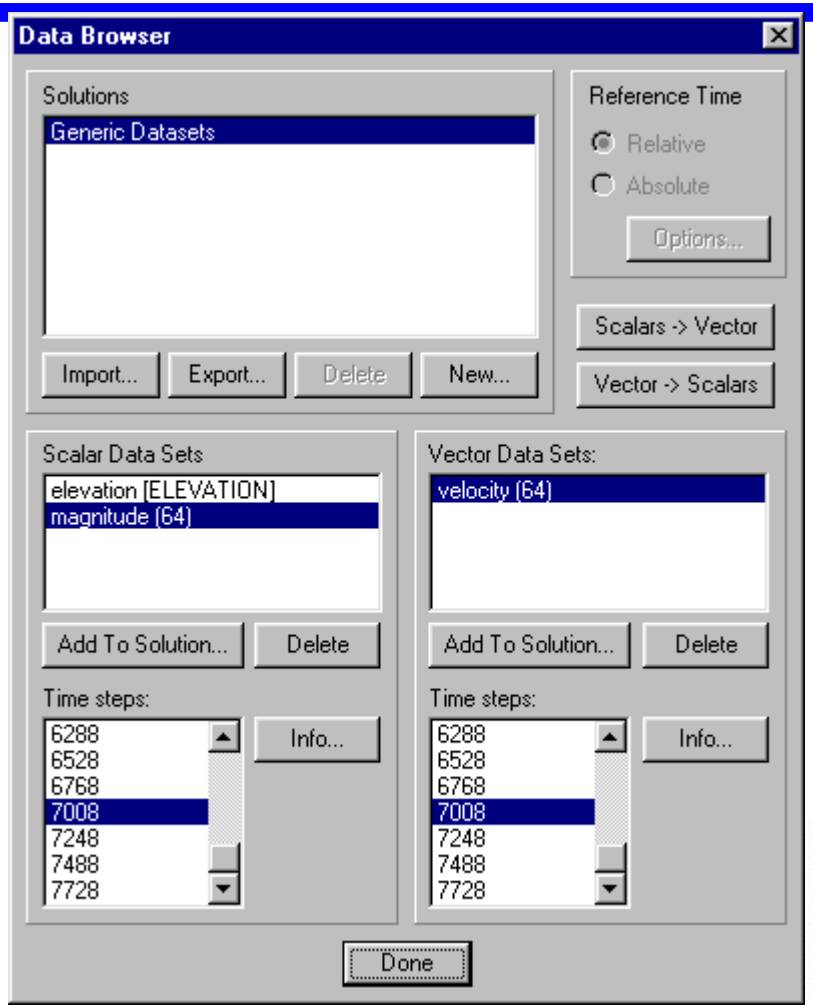
Features:

- Custom real-time plots
- Elapsed time
- Progress bar
- Better CPU management

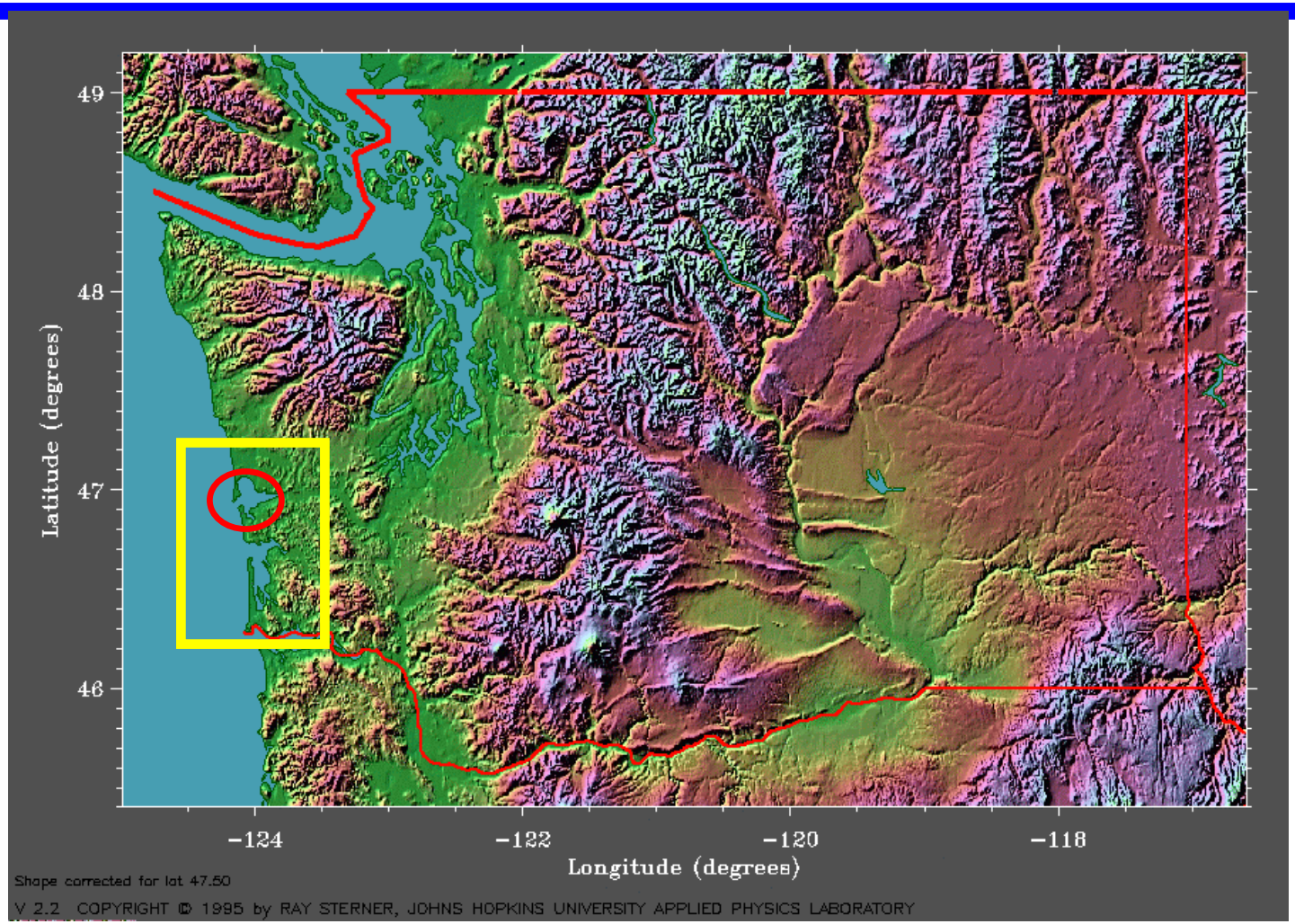


Viewing Results

- Import into SMS using Data Browser/File Open
- Scalar contours
- Vector arrows
- Film Loops



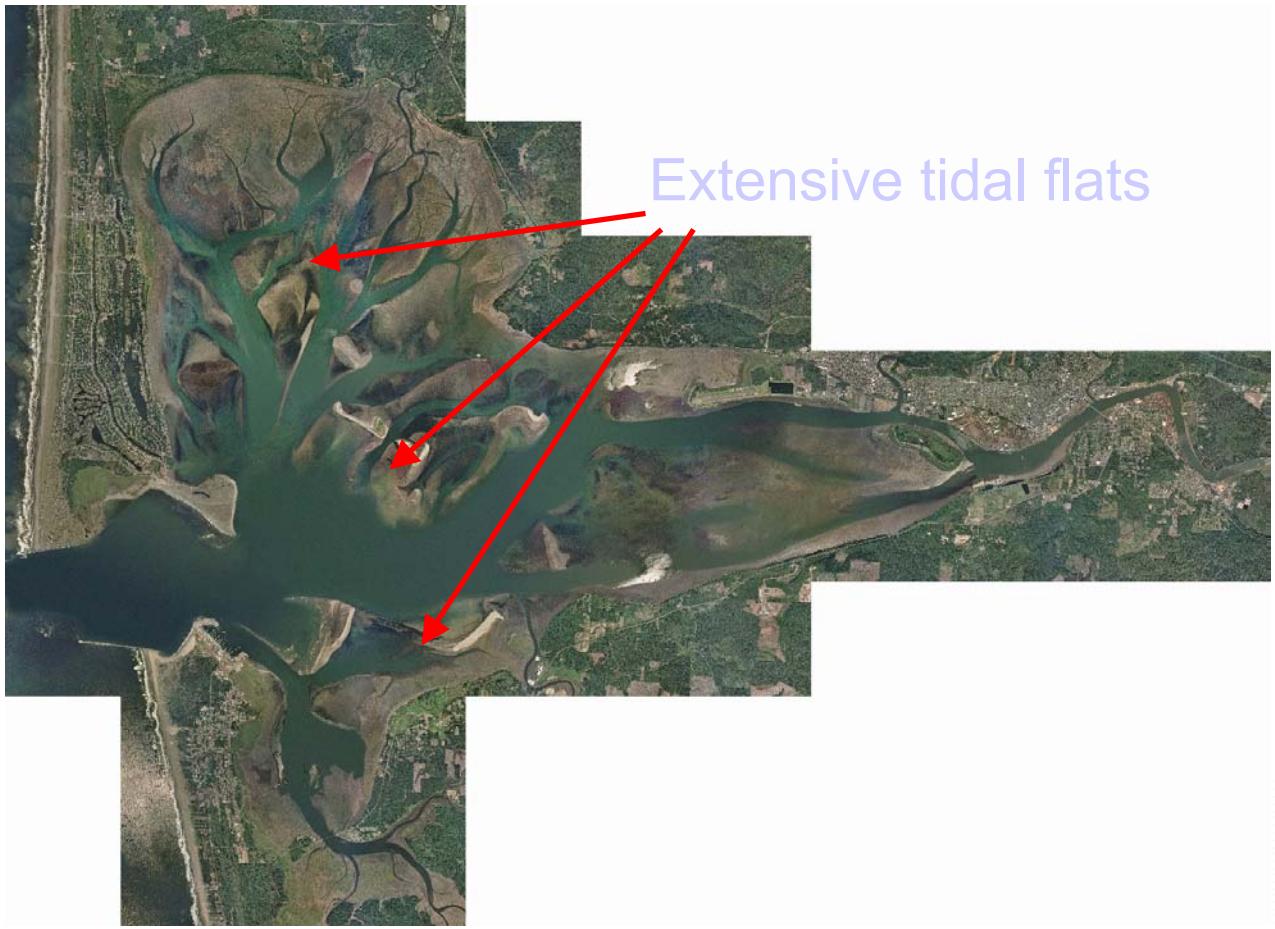
Grays Harbor Case Study



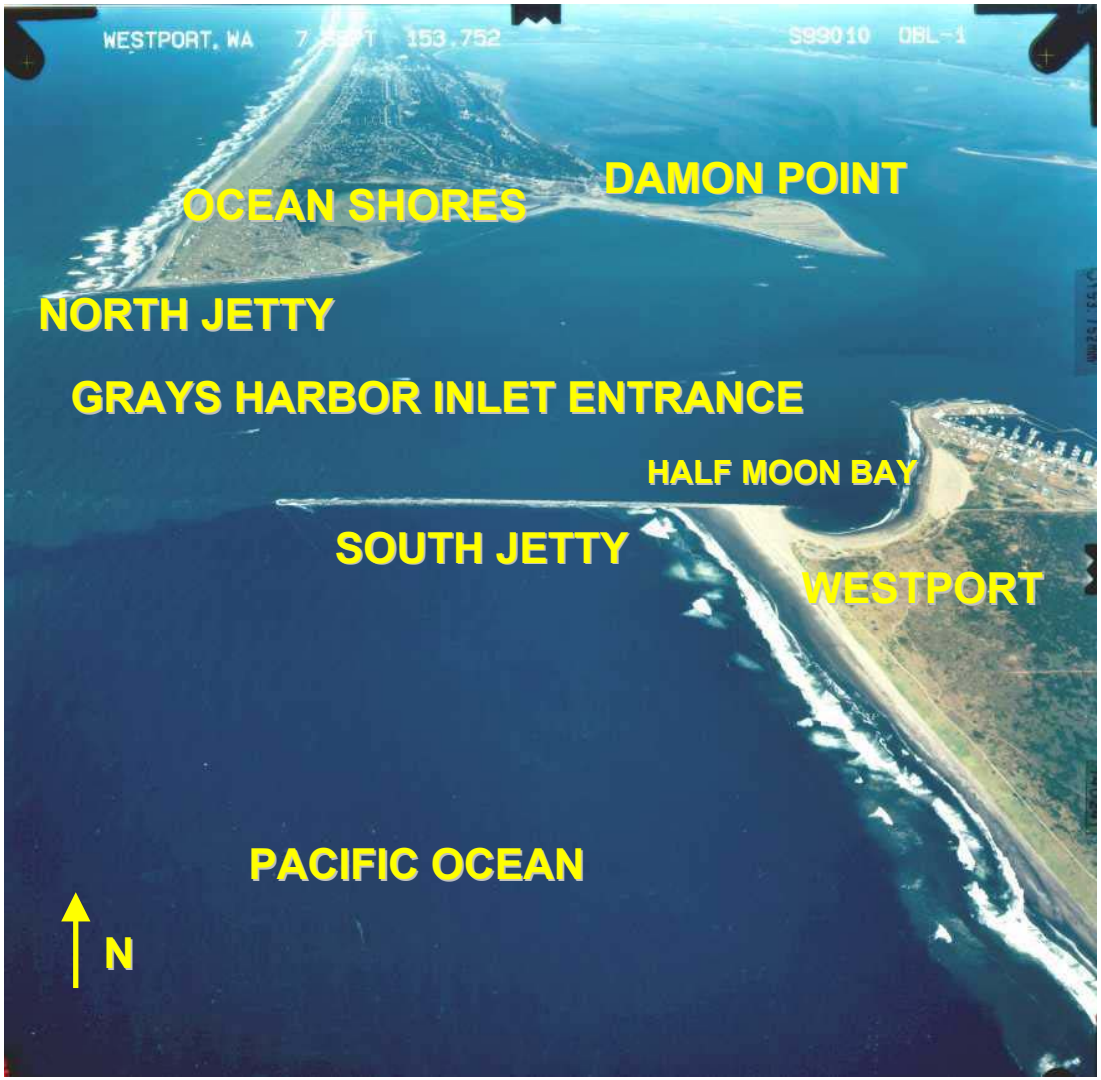
Grays Harbor Case Study

- Physical Environment
- Engineering Motivation
- Coupling Effects on Model Results

Physical Environment



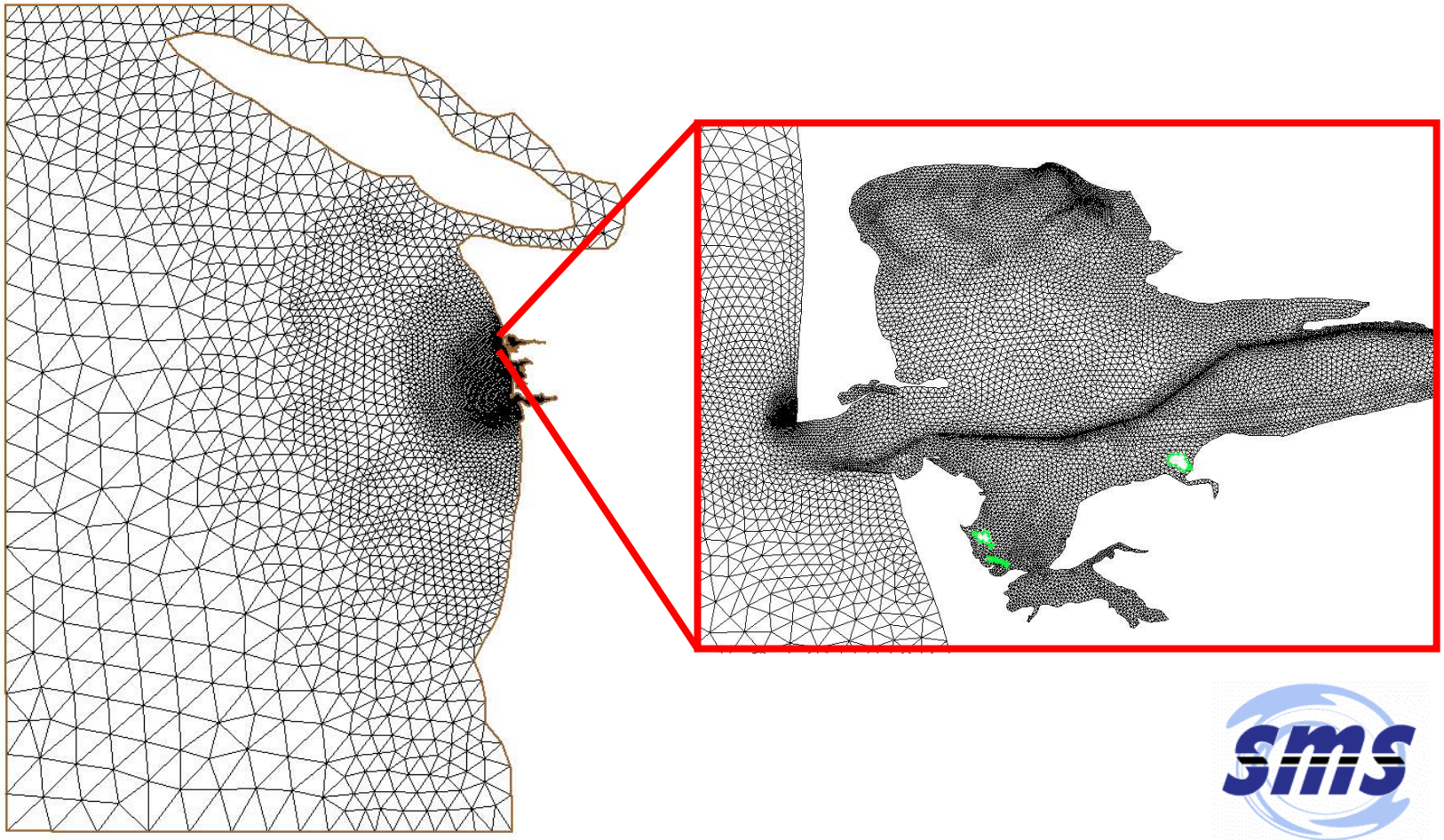
Physical Environment



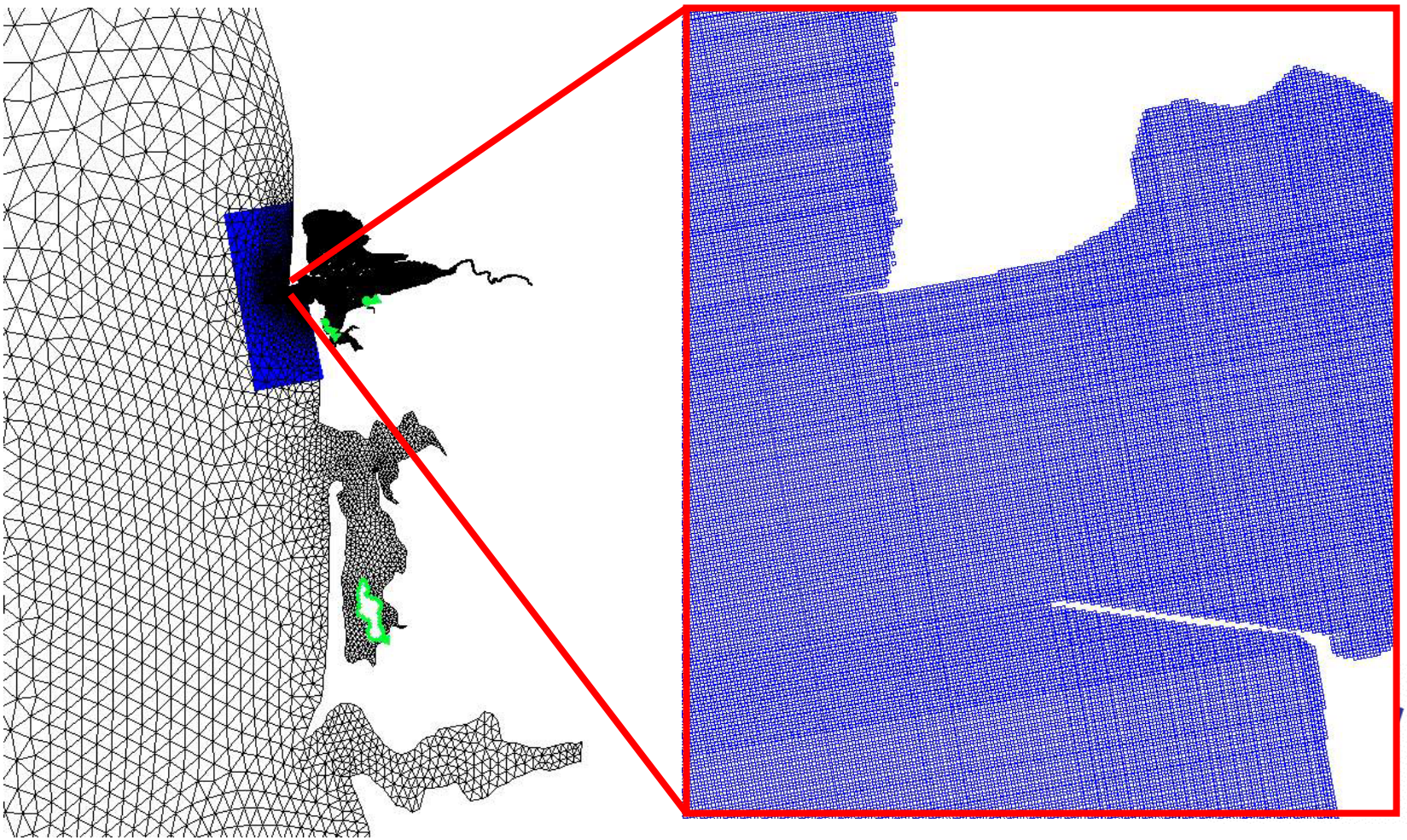
Engineering Motivation

Channel Realignment:

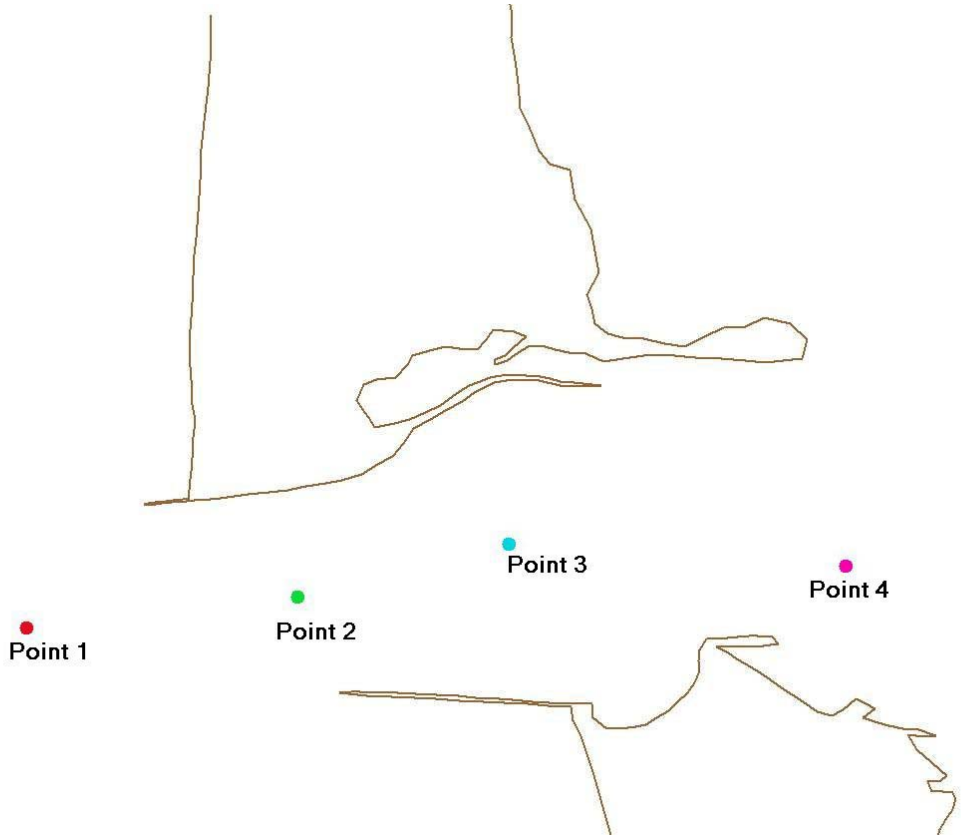
ADCIRC Mesh



STWAVE Grid

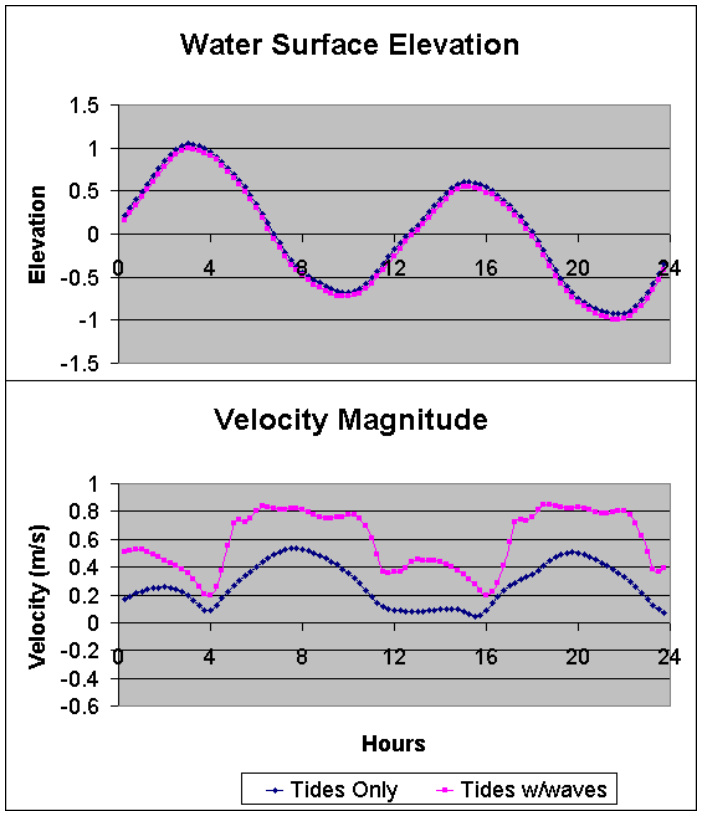


Case Study Results

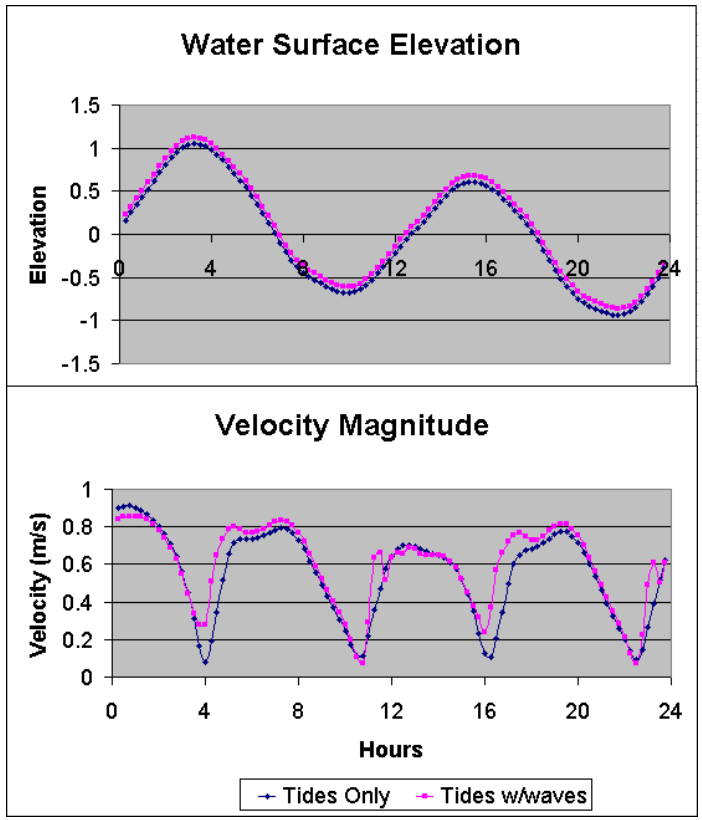


Location of Observation Points

Case Study Results

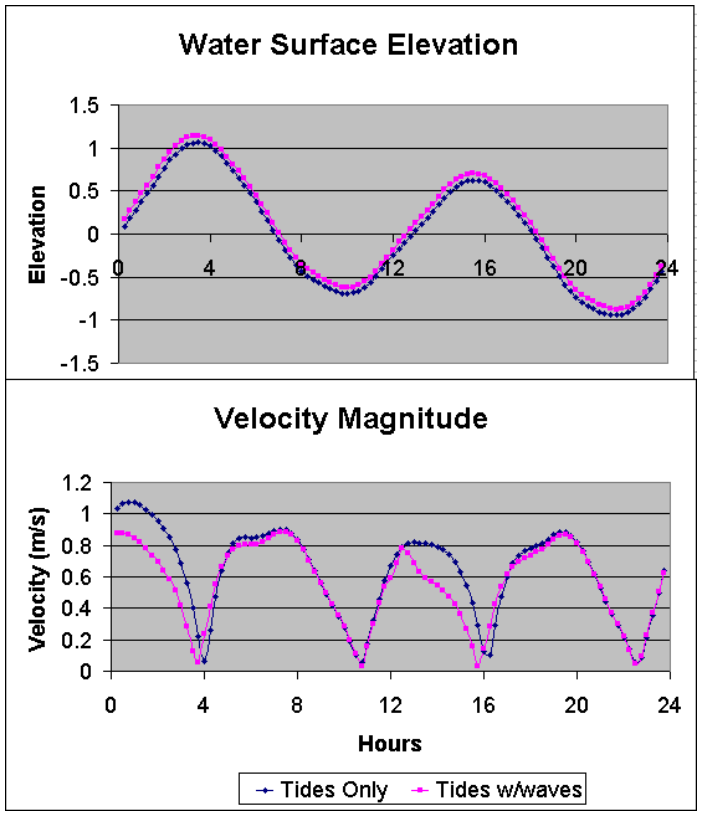


Point 1 outside of inlet

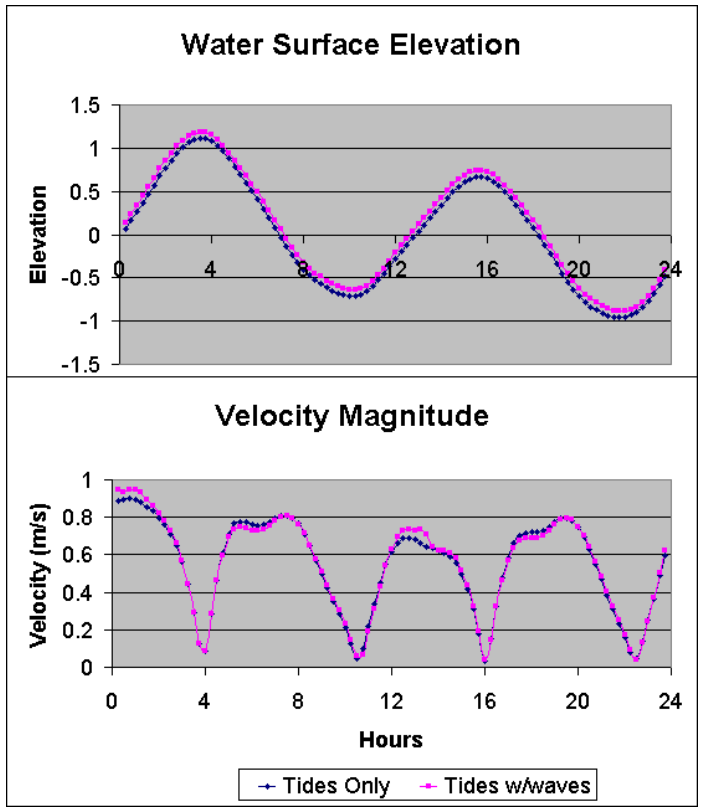


Point 2 inside mouth of inlet

Case Study Results

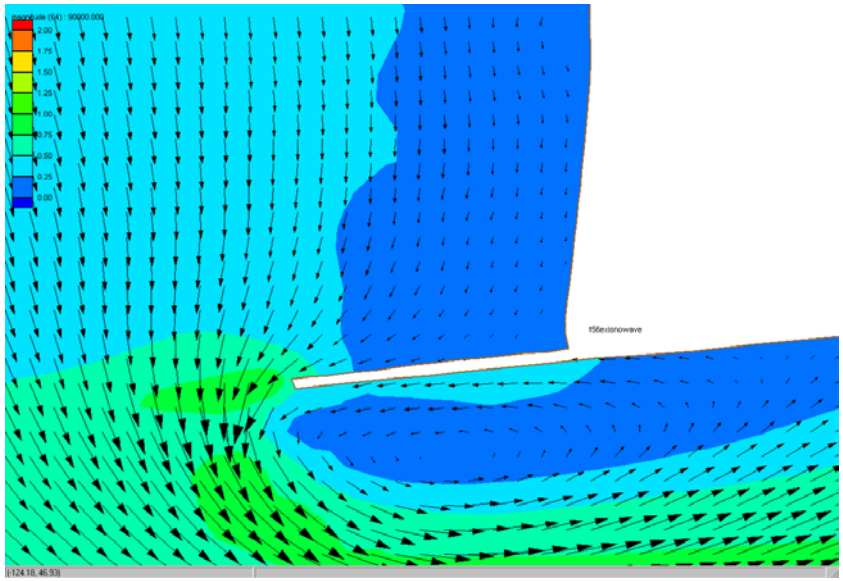


Point 3 inside mouth of inlet



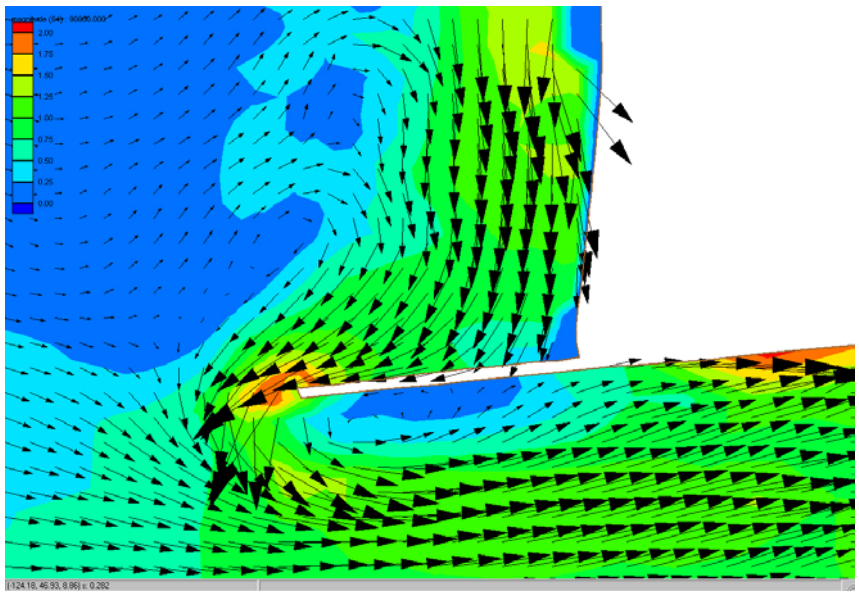
Point 4 inside harbor

Currents

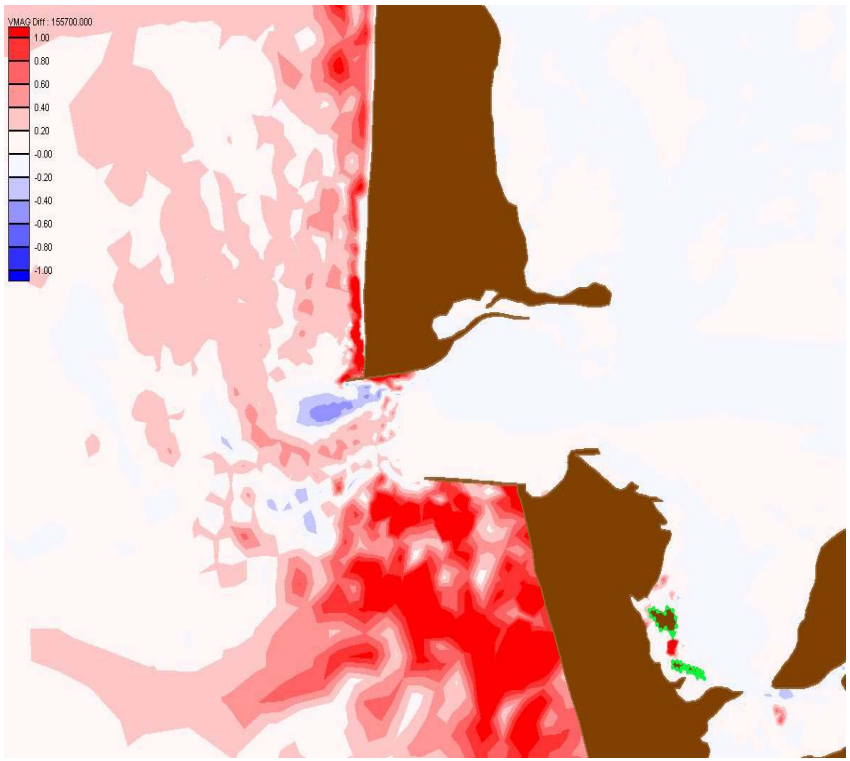


Tide Only

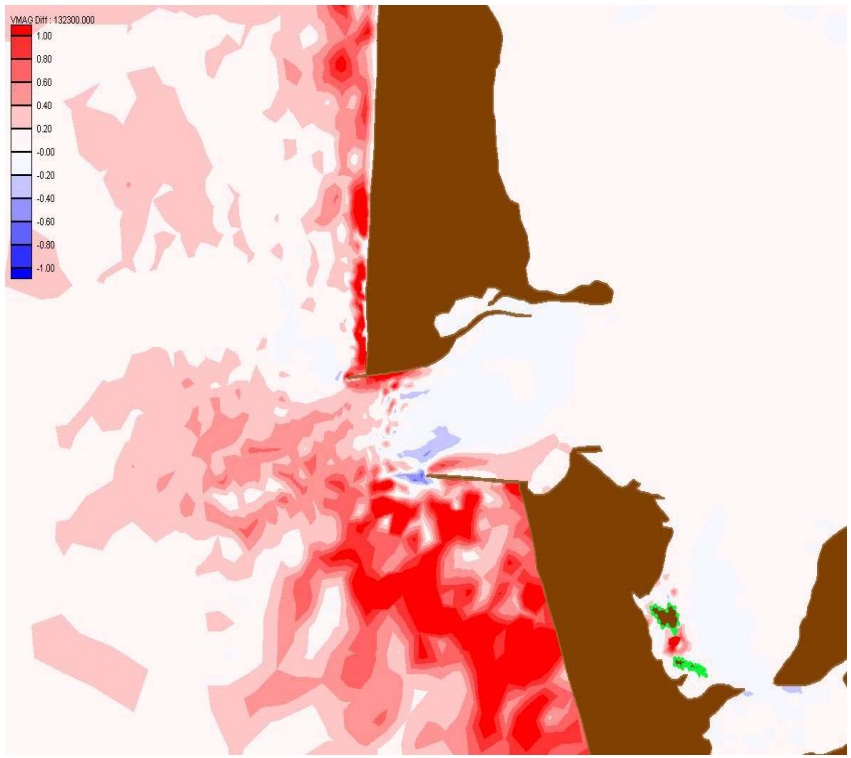
Tide with Waves



Velocity Magnitude



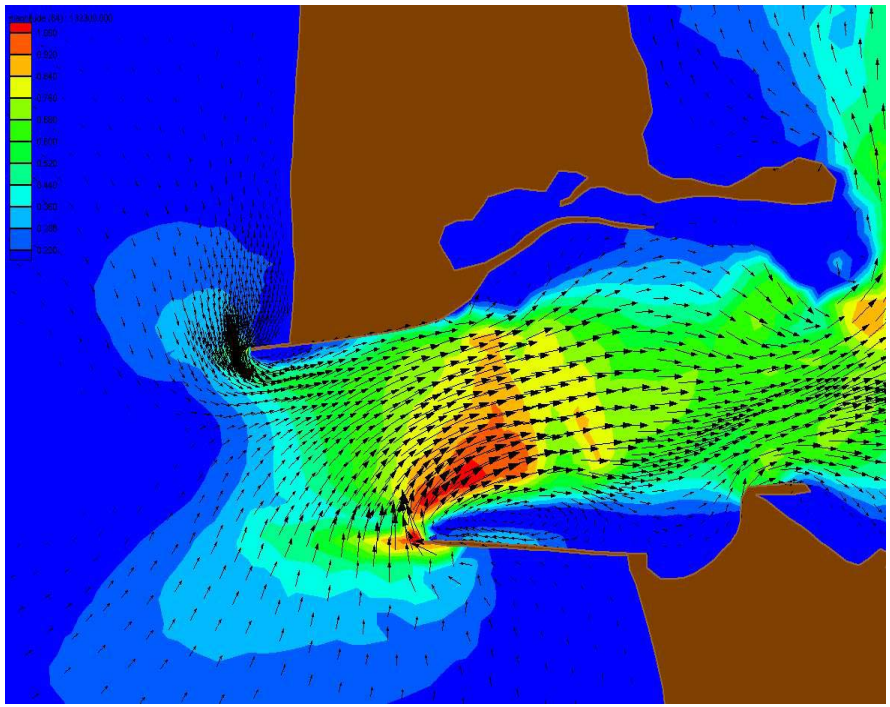
Peak Ebb



Peak Flood

Case Study Summary

- More Steering Module features on the way
- STWAVE→ADCIRC:
  - Higher velocities near mouth of inlet
- ADCIRC→STWAVE
  - Ebb: increase in wave height
  - Flood: flattening of waves



Steering vs. Standard Methods

- Conventional Method
  - Repetitive manual data interpolation
  - User monitors model runs
  - Time intensive
  - To labor intensive to be practical
- Steering Module
  - Automated data interpolation
  - Model runs monitored by SMS
  - Reduces overall time to run models
  - Less user error produces more accurate results