Application of CMS to Grays Harbor, WA: Morphology Change

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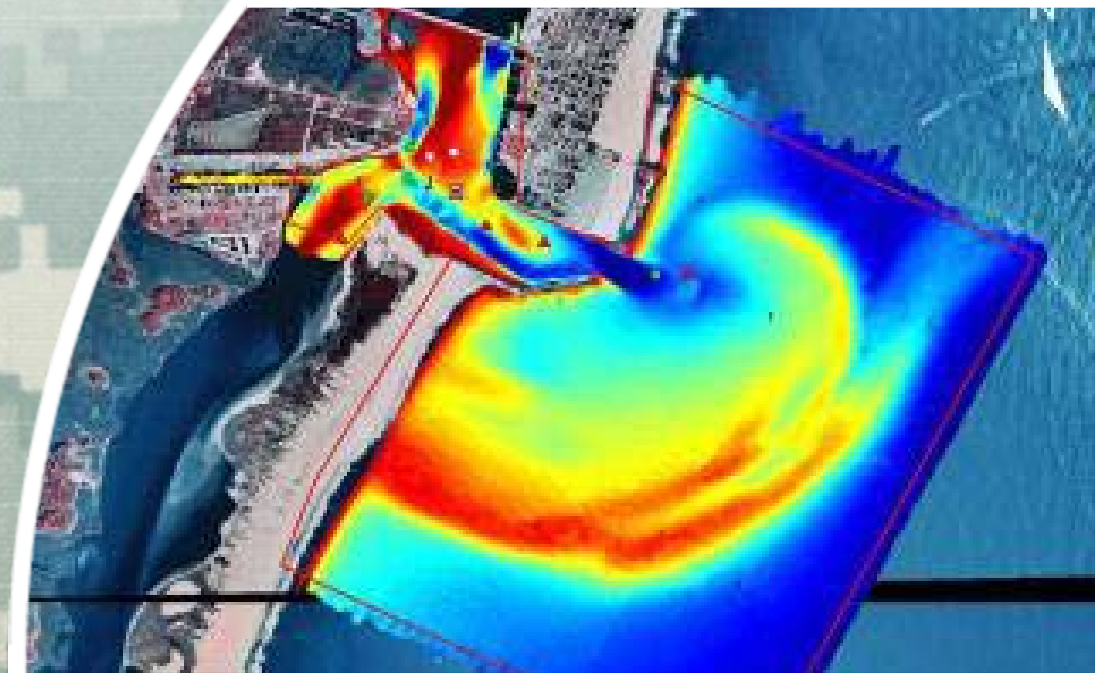

US Army Corps of Engineers

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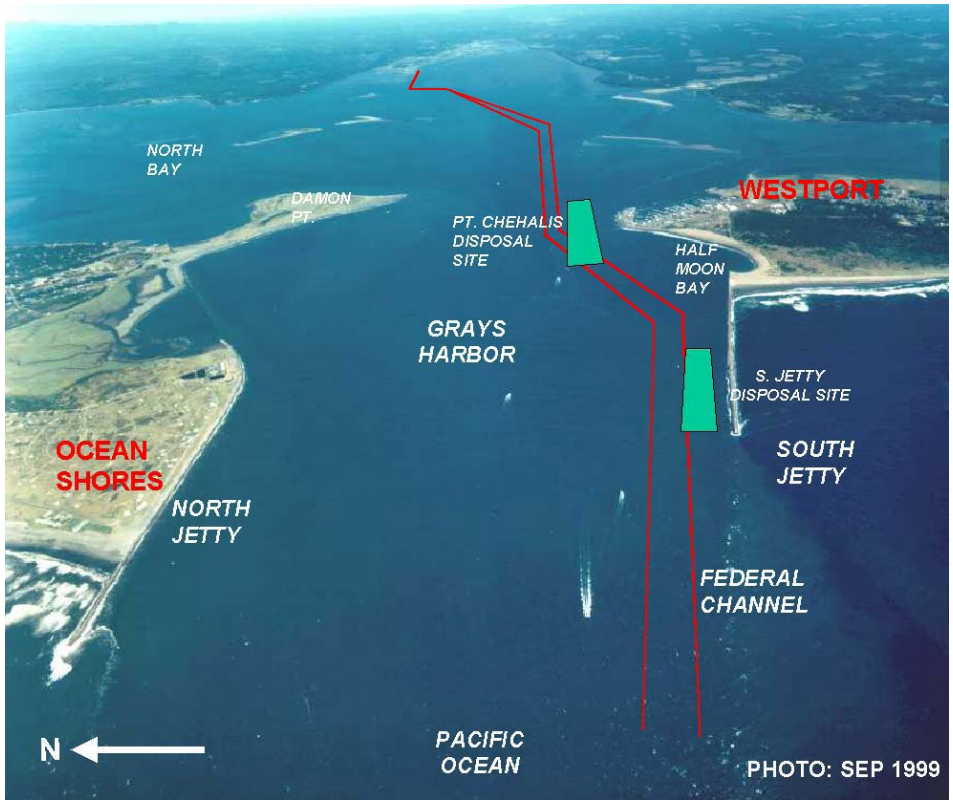
Introduction – Grays Harbor

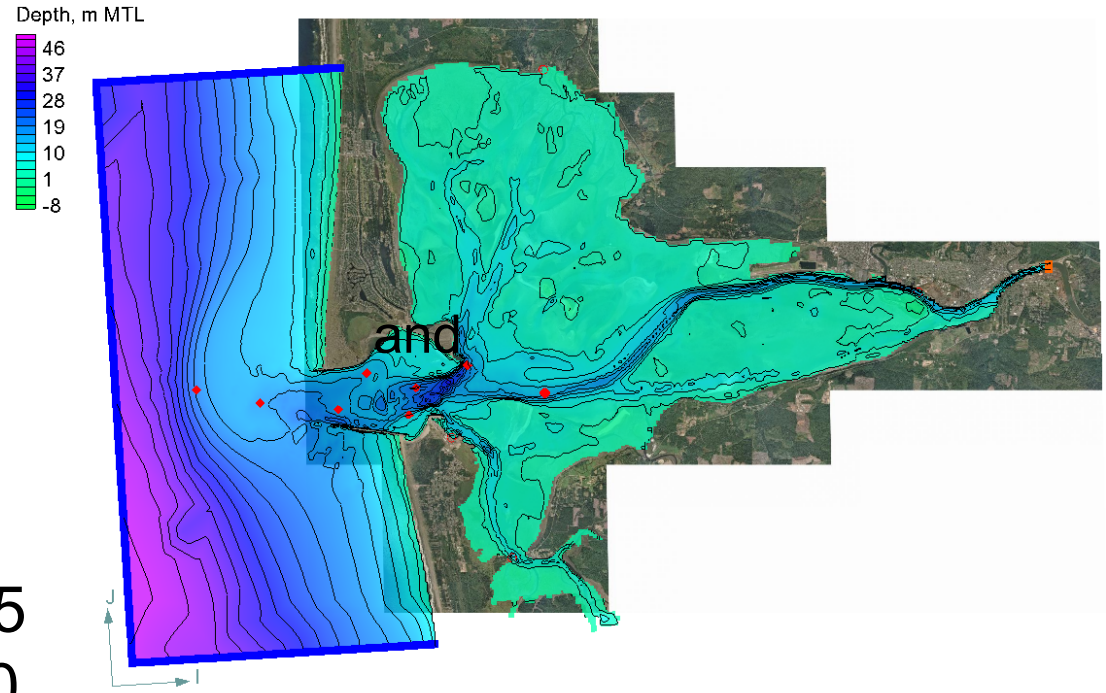
- Surfaces area:
  - 91 sq mi (MLLW)
- Inlet is 2 mi wide
- Deep draft channel since 1896
- Maintenance dredging since 1990 after deepening to 46 ft



Model Setup (1 of 2)

General

- Simulation period
  - 27 days Sept-Oct 1999
- Computational grid
  - 67k cells
  - 28-200 m cells
  - Same for CMS-Flow CMS-Wave



Waves

- Steering interval: 3 hr
- Bed friction coef.: 0.005
- Diffraction intensity: 3.0
- Forcing (NOAA buoy 46029)
  - Waves
  - Wind

Model Setup (2 of 2)

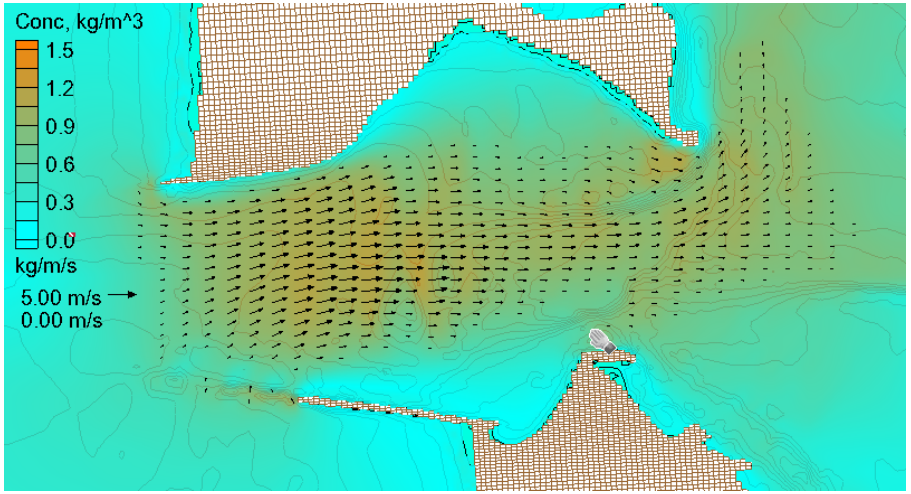
Flow

- Time step: 15 min (5-30 min)
  - Flow and sed.: 15-30 min
  - Waves: 3 hrs
- Manning's n: 0.018 (calibrated)
- Forcing
  - WSE time series from Station 1
  - River flux BC (assigned to zero)
  - Wind from Hoquiam Airport

Sediment transport

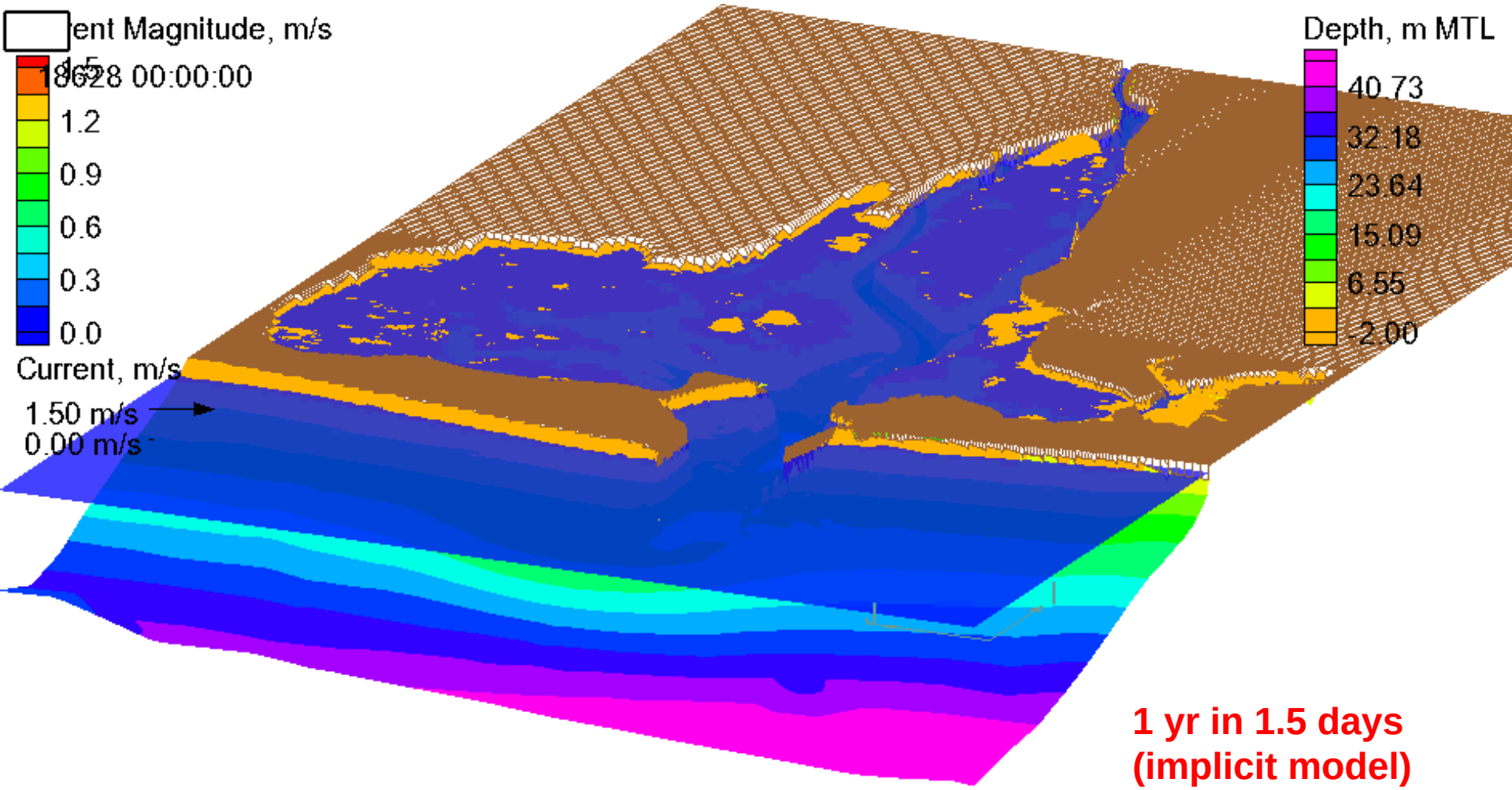
- Non-equilibrium transport model
- Time steps
  - Transport: 15 min
  - Morphologic: 15 min
- Lund-CIRP
- Adaptation length: 10 m

Sediment Concentration and Transport



- Constant grain size: 0.3 mm
- Bed-slope coefficient: 1
- Transport scaling factors: 1
- Morphologic scaling factor: 1

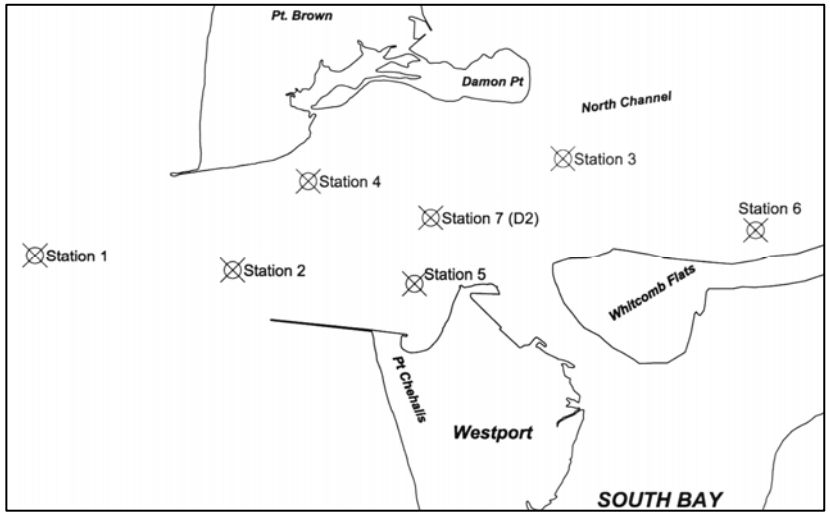
3D SMS Animation - Current Magnitude, Water Surface Elevation, and Water Depth

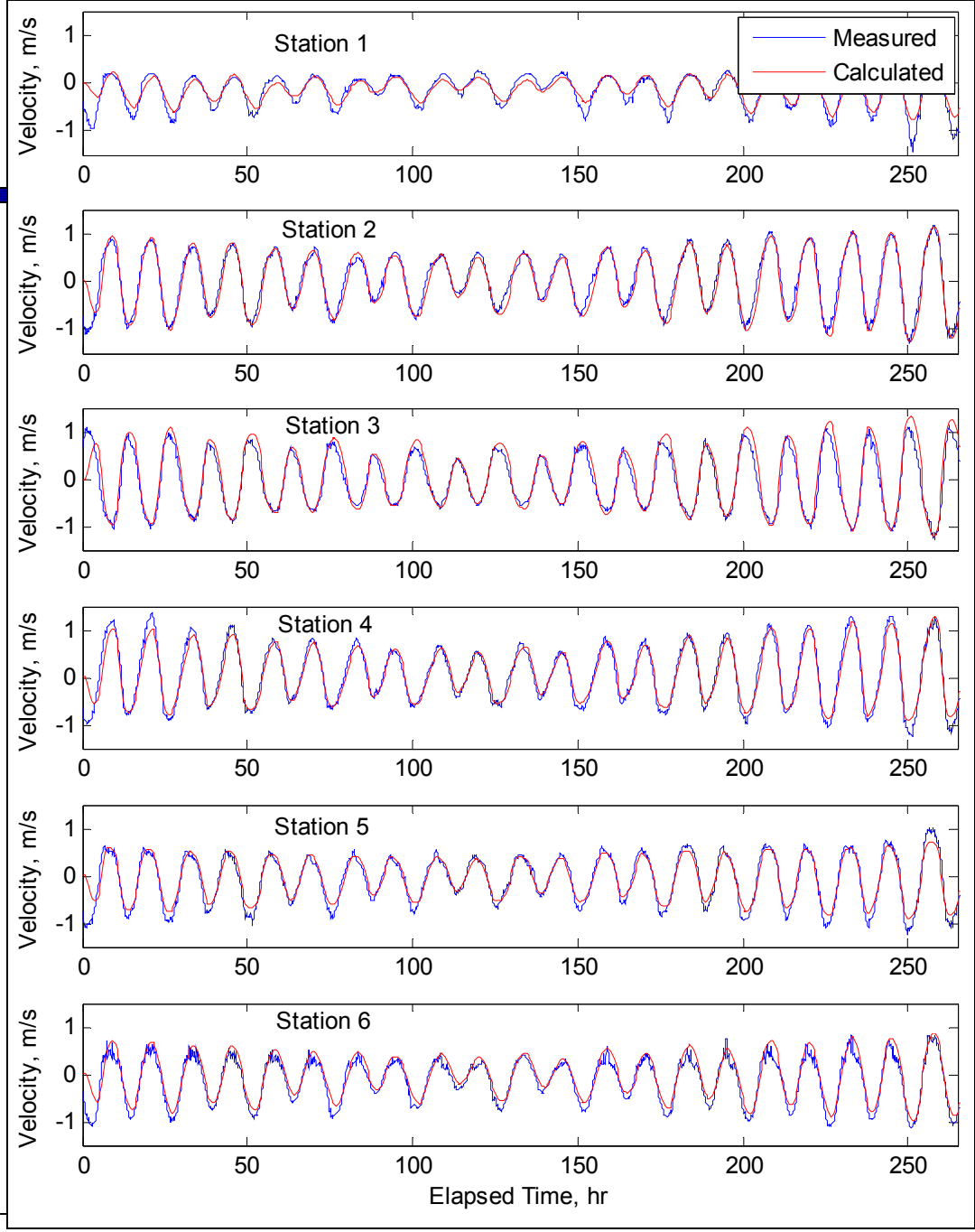


1 yr in 1.5 days (implicit model)

Current

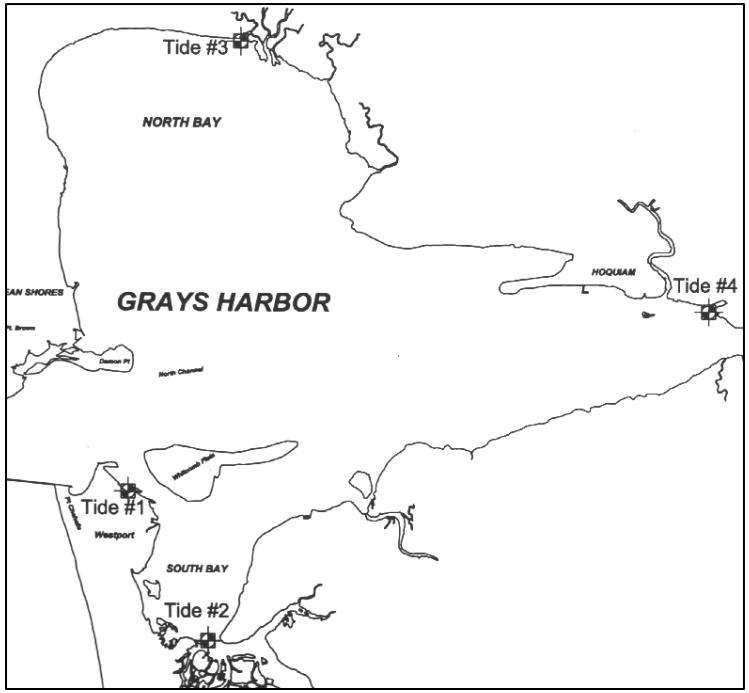
- Depth-averaged current along principle component
- Time from 14 Sep 09

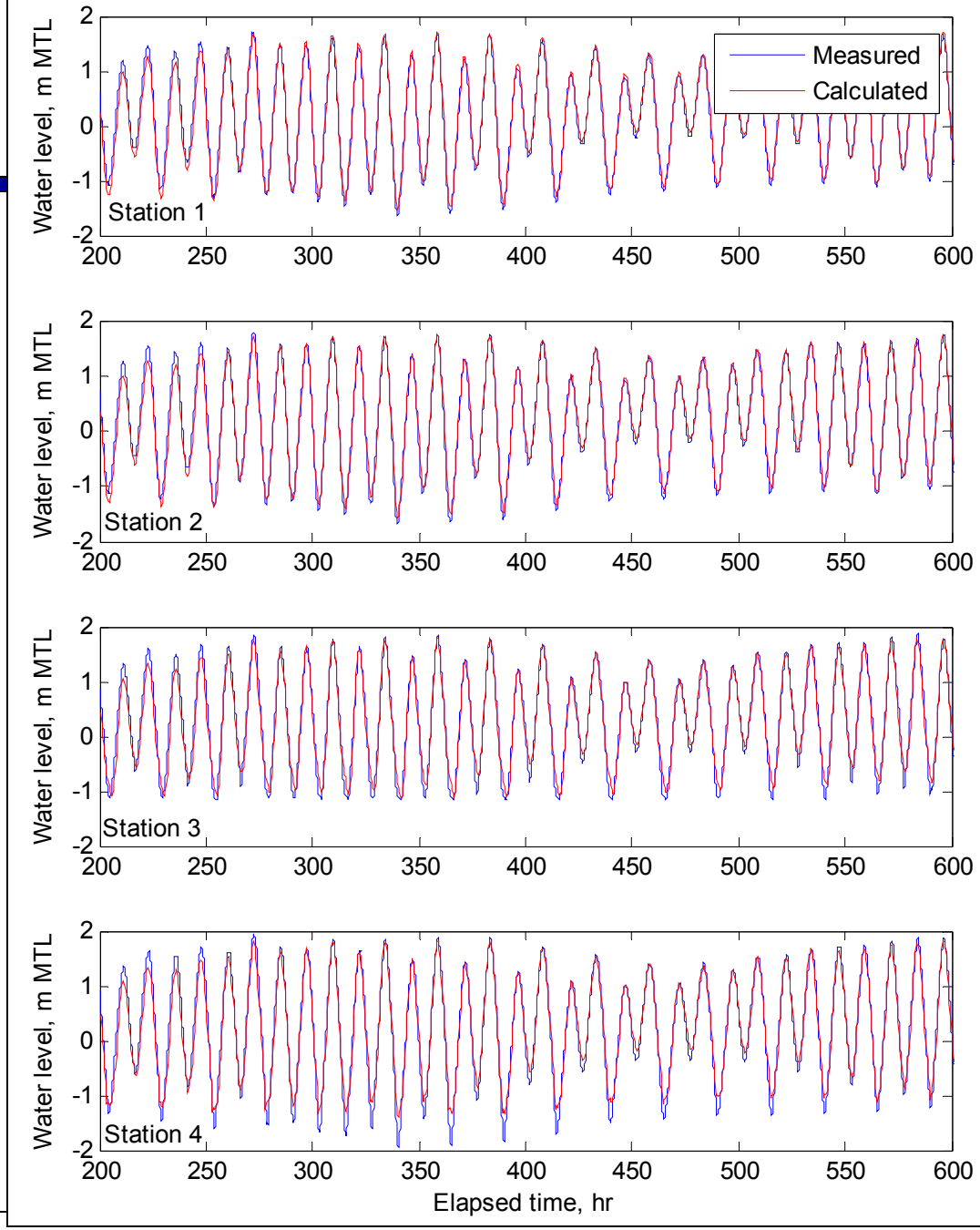




Water Level

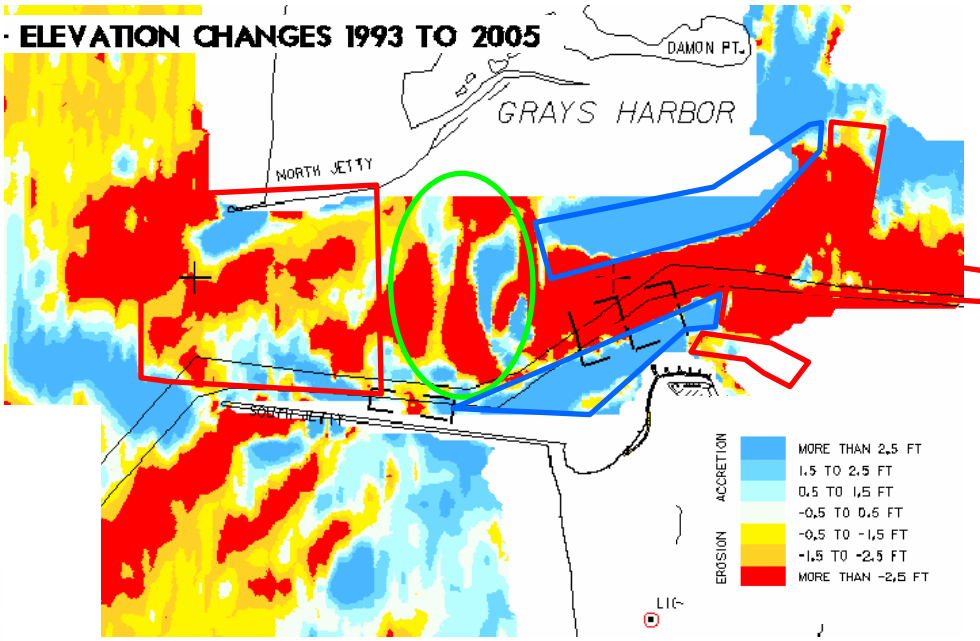
- Ramp up period observed
- Bottom friction likely needs to be adjusted

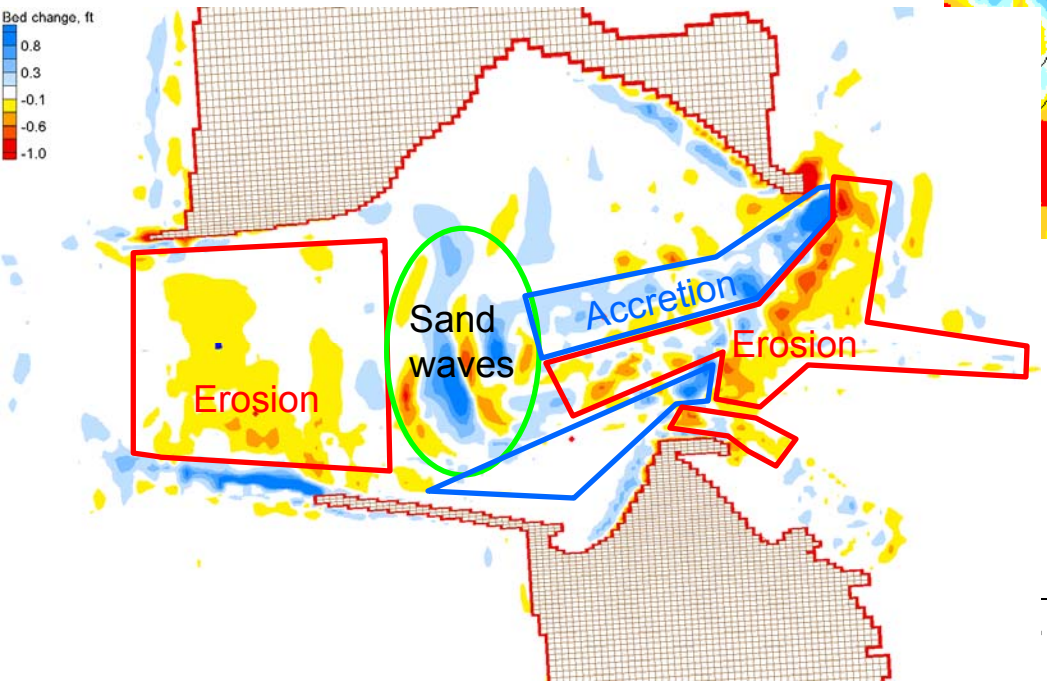




Morphology Change Comparison

- 27-day simulation from 14 Sep 2009
- General patterns captured





Local differences due to short period trends, sand waves, etc.

Need multi-sized sediment transport

Grays Harbor -- Future Work

- Include river flux
- Multiple-sized sediment transport
- Sediment transport calibration
  - Comparison with suspended sediment concentration measurements
- Long-term simulations 1993-2005
  - Include dredging as source term in sediment model
- Telescoping grid