

# Experience with sediment transport and morphology simulation

East Coast partners:

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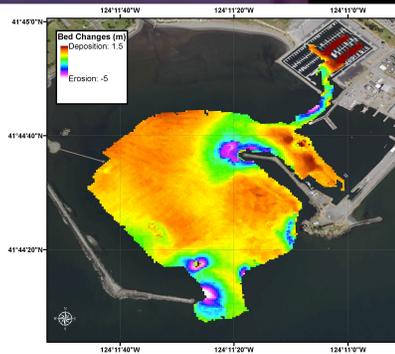
Stephan Grilli - URI

To date:

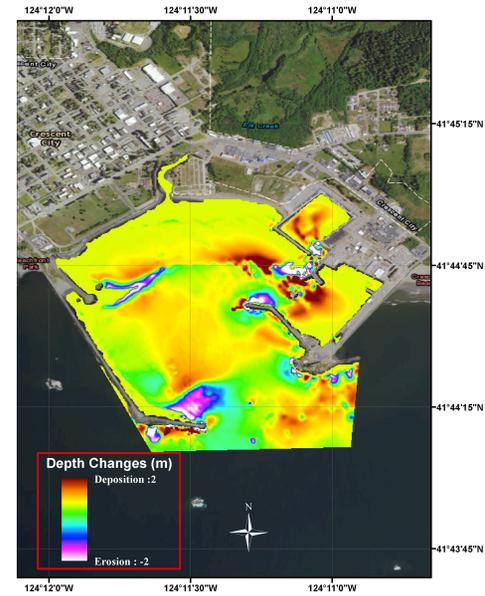
- Depth-integrated suspended load model added to Boussinesq code FUNWAVE-TVD
- Morphology adjusts through local pickup/deposition effects, driven by suspended load model
- Test calculations carried out for:
  - Laboratory dam-break experiment for surge on an erodible planar slope
  - Crescent City, CA during Tohoku 2011 event
- Speculative examples carried out for erosion of:
  - Undeveloped barrier island (no or minimal restrictions on erosion)
  - Built-up barrier island (hard, unerodible surfaces, large spatial variations of averaged frictional effects)
- 3D nonhydrostatic model NHWAVE implements a 3D suspended load model, adjusts morphology using same approach.

# Erosion, deposition effects on navigation

## Morphology change inside Crescent City, CA harbor during Tohoku 2011 event



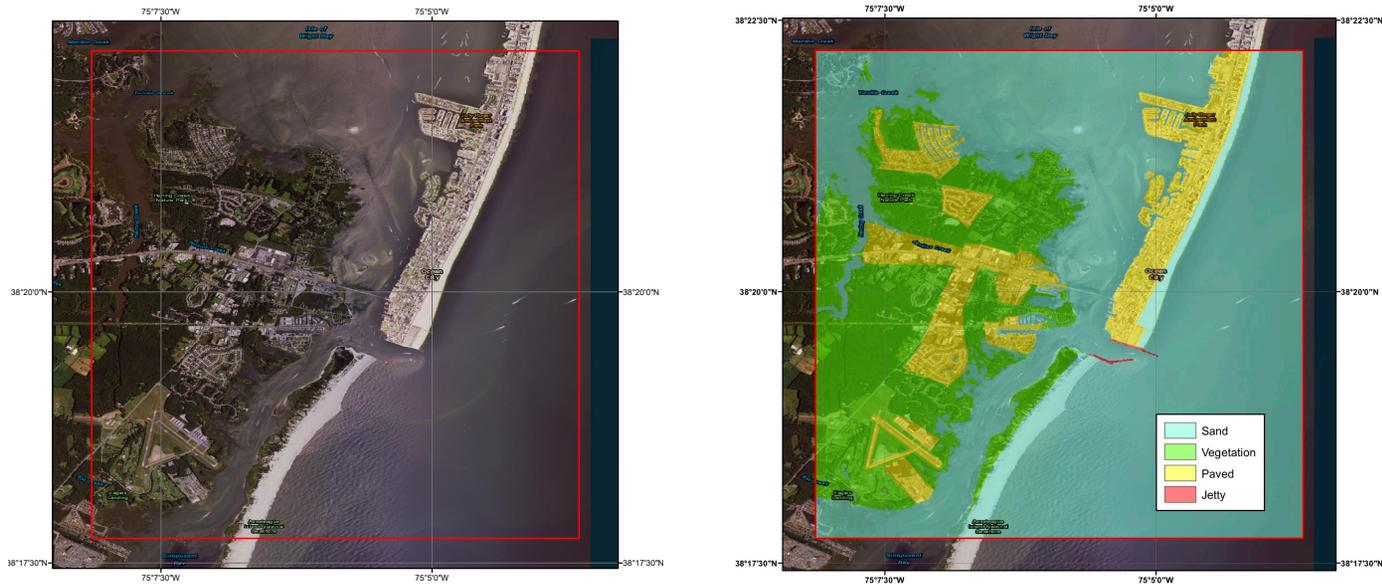
Measured (Wilson et al., 2012)



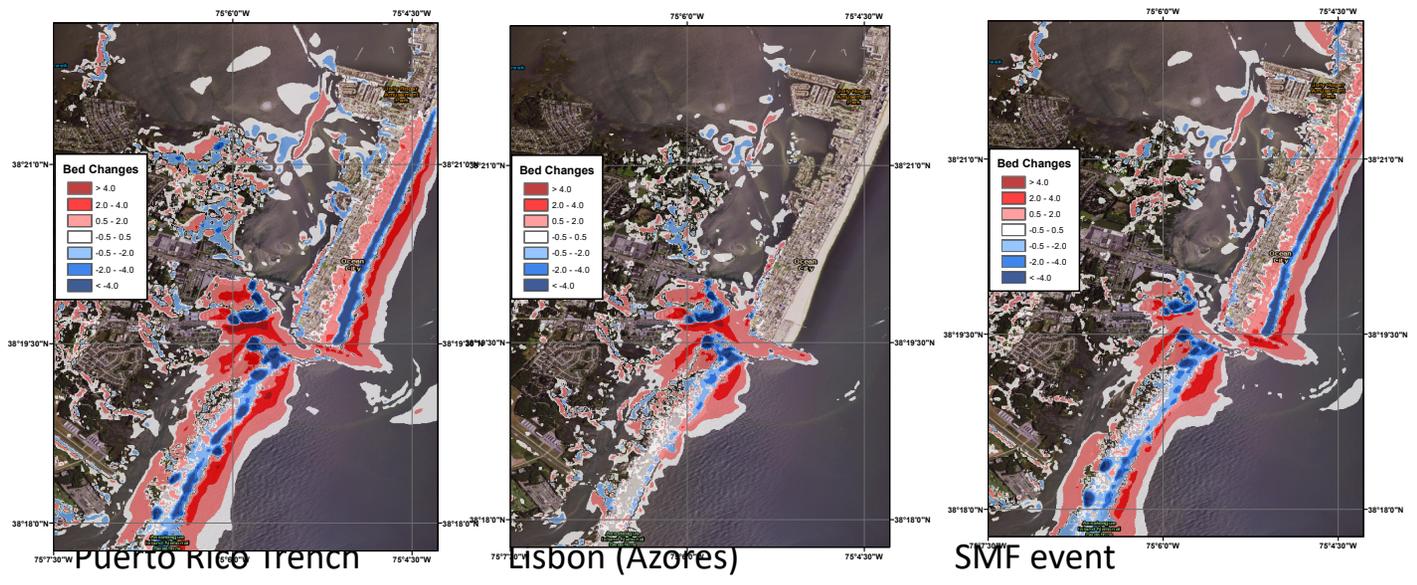
Calculated (Tehrani et al., 2016)

# Effect of erosion on hazard levels

Hypothetical test case based on Ocean City, MD

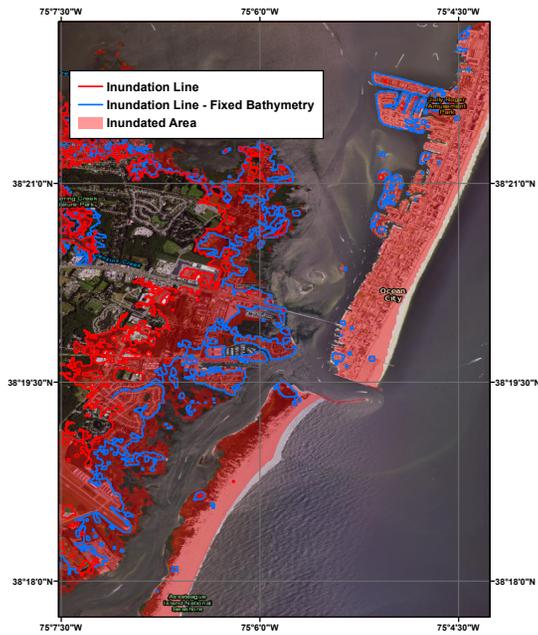


# Morphology change for 3 sample events

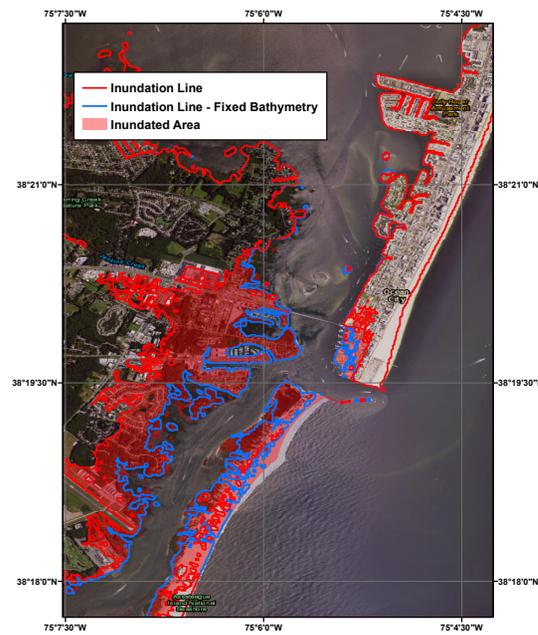


# Increased inundation area

CVV



Lisbon



**Comparison between inundated area in Ocean City inlet region for static and dynamic bathymetry conditions**

Tsunami	Inundated Area (Static)	Inundated Area (Dynamic)	Inundation Area Increase (%)
Puerto Rico	7.03 km <sup>3</sup>	10.61 km <sup>3</sup>	51
Landslide	9.46 km <sup>3</sup>	13.43 km <sup>3</sup>	42
Volcanic cone collapse	10.94 km <sup>3</sup>	19.25 km <sup>3</sup>	76
Lisbon	1.28 km <sup>3</sup>	7.02 km <sup>3</sup>	547

- Manuscript submitted to Coastal Engineering – rejected due to:
  - Neglect of bedload transport effects
  - Thoughts that experimental comparisons didn't constrain the model tests well enough.
- Bedload component has been added to FUNWAVE-TVD (Exner equation)
- Sediment and morphology model (including bedload) included in released version 3.3 of FUNWAVE-TVD, available at:

<http://github.com/fengyanshi/FUNWAVE-TVD>

## Going forward:

- Redo model tests (including choice of different examples) for augmented model
- Discussions of previous model verifications point out that the selection of test cases that sit in a relevant range of parameter space is difficult. (For example, most experiments on wavemaker-generated solitary waves have time scales that are way too short in comparison to typical tsunami behavior)
- Application of this sort of modeling in NTHMP work automatically implies the need for a benchmarking process – apparent need for a workshop