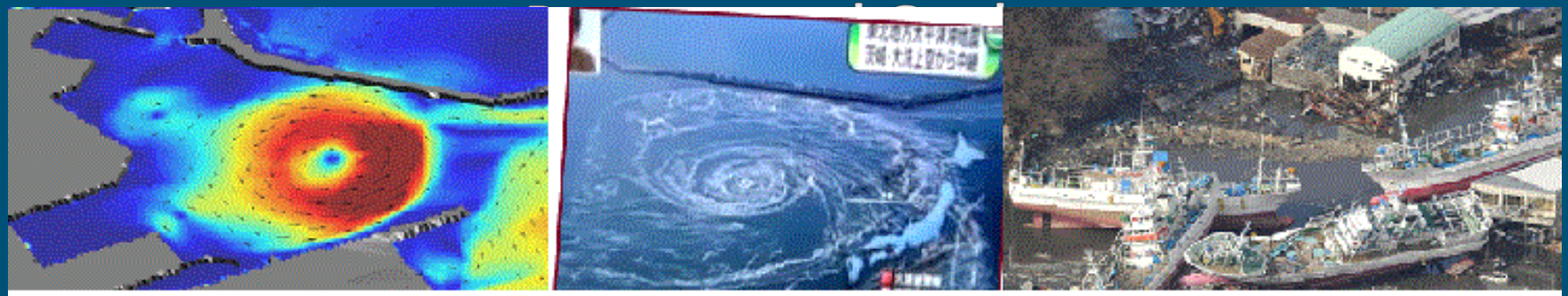
NTHMP Mapping and Modeling Subcommittee

Tsunami Current Model Benchmark Workshop



NTHMP Mapping & Modeling Benchmarking Workshop: Tsunami Currents

PURPOSE:

1) Satisfy the requirement of the FY2013-2017 NTHMP Strategic Plan for the Mapping and Modeling Subcommittee to develop and run a benchmarking workshop to evaluate the numerical tsunami modeling of currents.

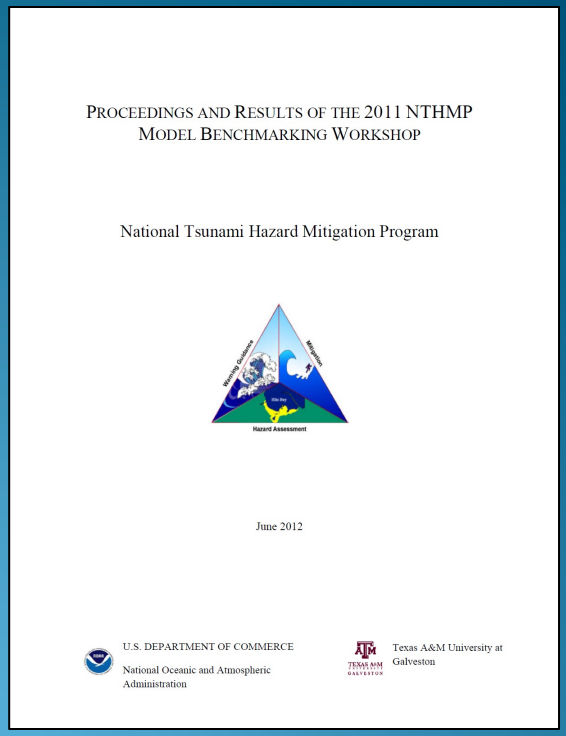
2) Verify the accuracy/adequacy of current models for use by NOAA and NTHMP partners to help produce accurate and consistent maritime and other hazard reduction products.

2011 NTHMP Inundation Modeling Benchmark Workshop

In 2011, less than one month after devastating Tohoku-oki event, NTHMP partners (states, territories, feds) participated in inundation modeling benchmarking workshop in Galveston, Texas.

Fulfilled a requirement by the 2006 Tsunami Warning and Education Act to *"use inundation models that meet a standard of accuracy defined by the Administration (NOAA) to improve the quality and extent of inundation mapping"*

436 page report completed in 2012 summarized the workshop and verified the adequacy of numerical model platforms tested.



PROCEEDINGS AND RESULTS OF THE 2011 NTHMP
MODEL BENCHMARKING WORKSHOP

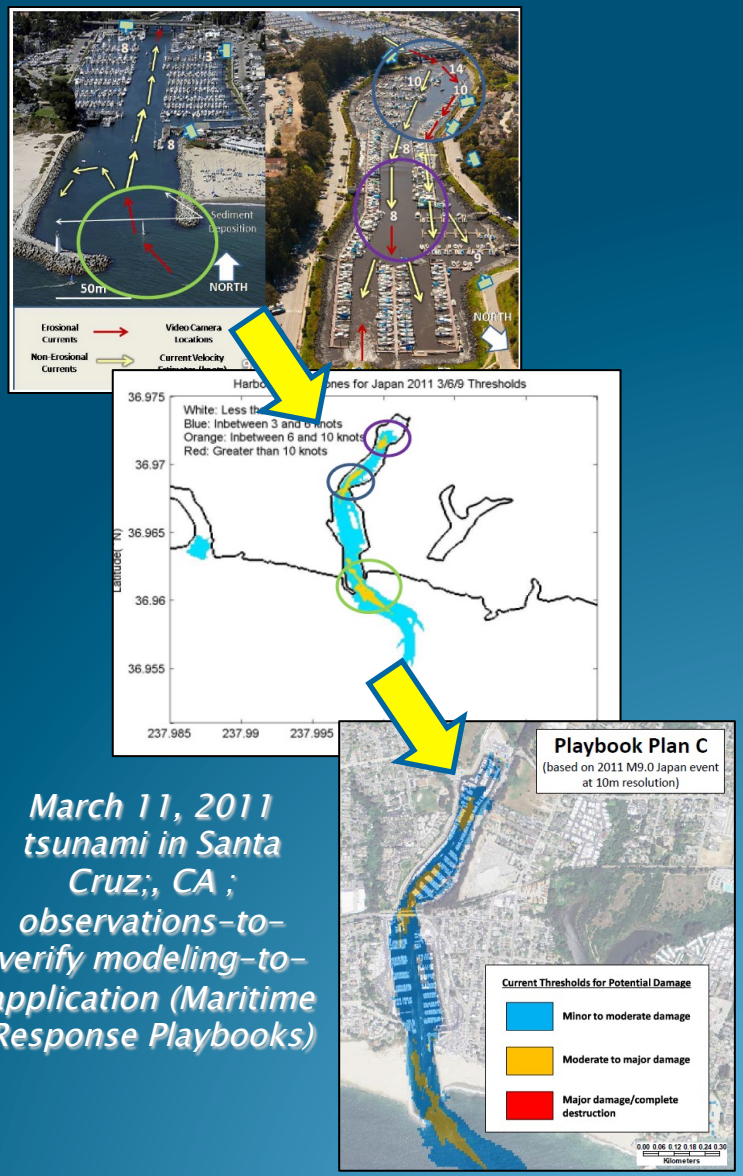
National Tsunami Hazard Mitigation Program

June 2012

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

Texas A&M University at Galveston

Expected Goals and Outcomes from Workshop



March 11, 2011 tsunami in Santa Cruz;, CA ; observations-to-verify modeling-to-application (Maritime Response Playbooks)

Goals:

- *Compare current predictions from various tsunami propagation models.*
- *Establish "community standards" for accuracy/adequacy for use, and verify current models meet those standards.*
- *Determine if benchmarks can be improved.*

Outcomes:

- *Determine accuracy/adequacy of current models for use on NTHMP products.*
- *Establish group to write a report summarizing the benchmarks, the workshop, and model verification process.*
- *Follow up on benchmark improvements.*

Benchmark 1: Steady, shallow flow over a bump)

SHALLOW-WATER FLOW AROUND MODEL CONICAL ISLANDS OF SMALL SIDE SLOPE. II: SUBMERGED

By Peter M. Lloyd[1] and Peter K. Stansby[2]

ABSTRACT: Experiments have been cond
islands used in the tests have side slopes
with a steady, subcritical free stream show
the island apex was relatively small. Flo
important in producing this unsteady wak
become less vigorous and eventually stop.
side slope exerting relatively little influen
which used a rigid top plate to produce t
Pictures of the surface flow patterns produ
(2D) and three-dimensional (3D) shallow-w
been run for comparison with the laborato
provides a severe test for the models. Alt
submerged island wakes their mode of gen

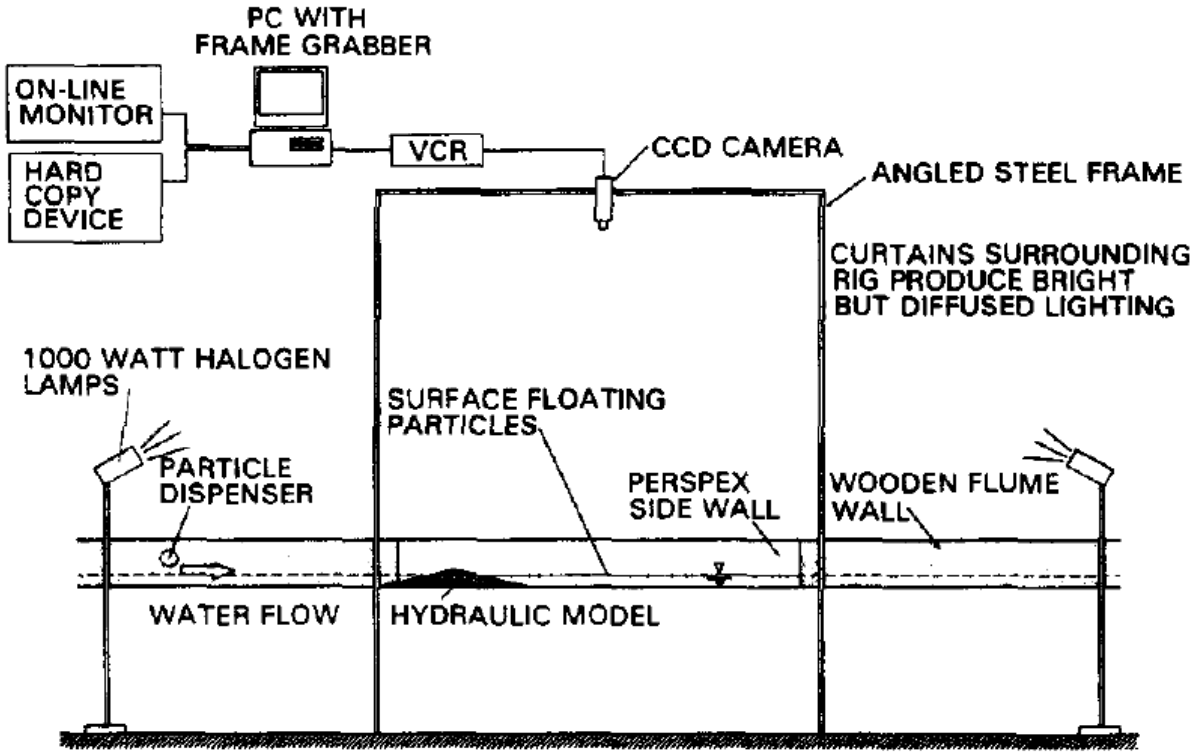
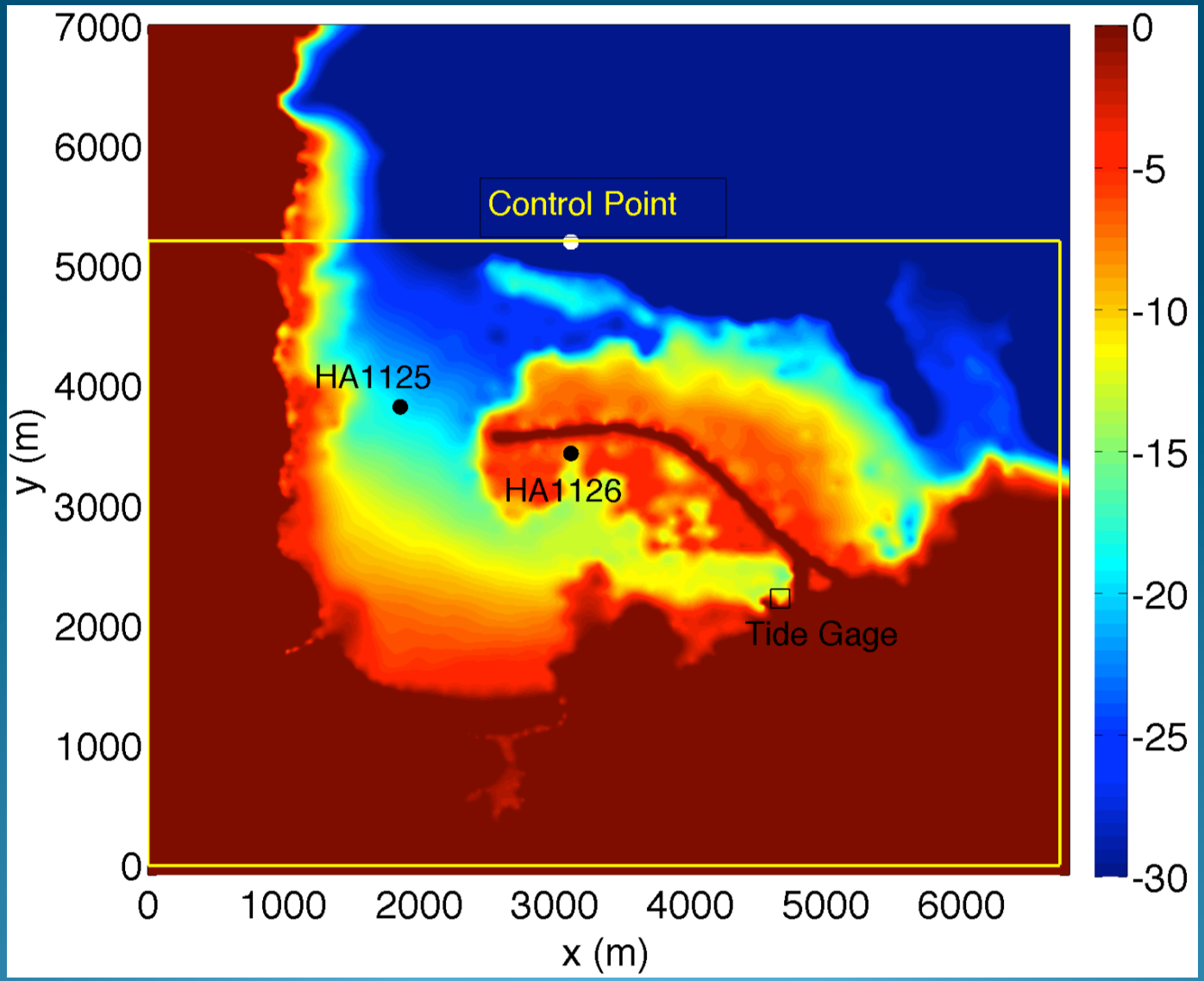
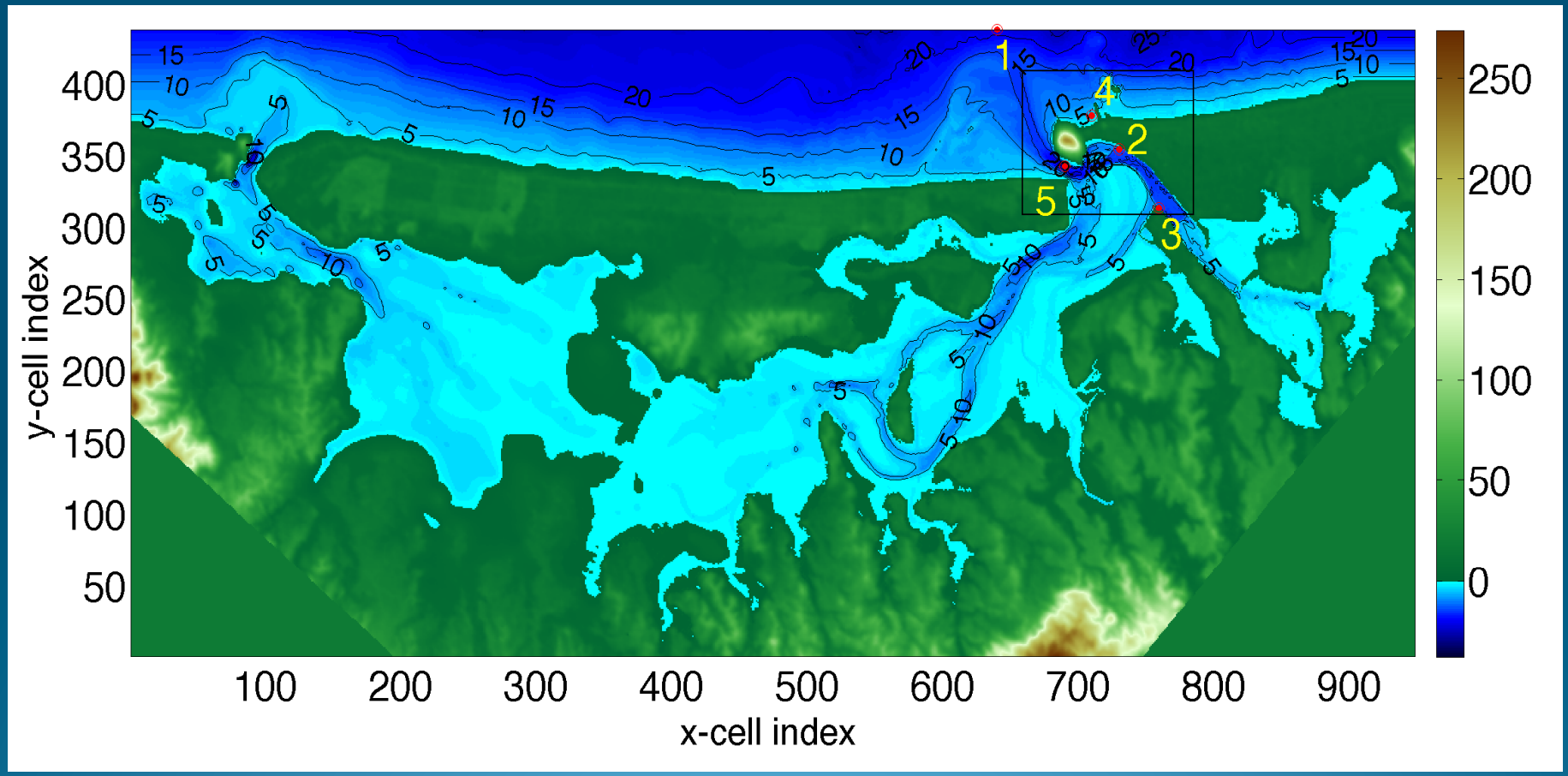


FIG. 3. Schematic View of PTV Setup

Benchmark 2: Hilo Harbor (Tohoku data)

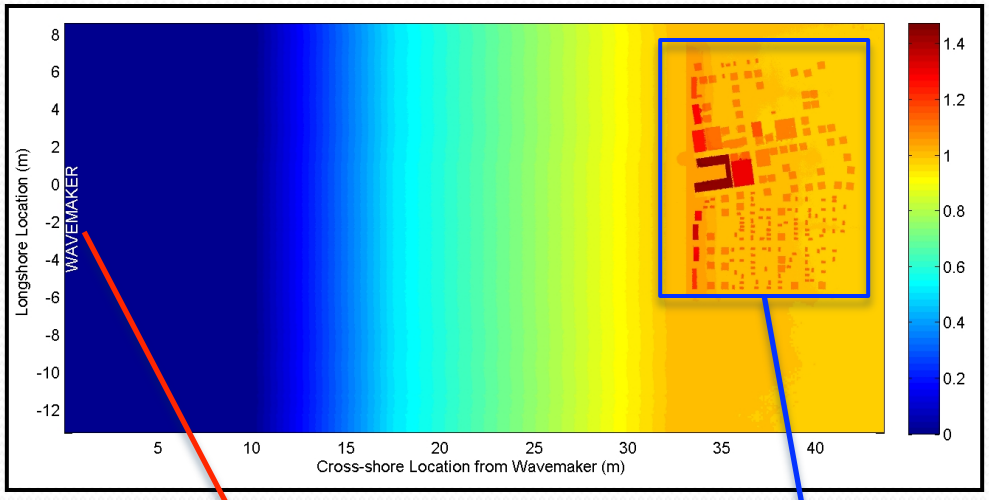


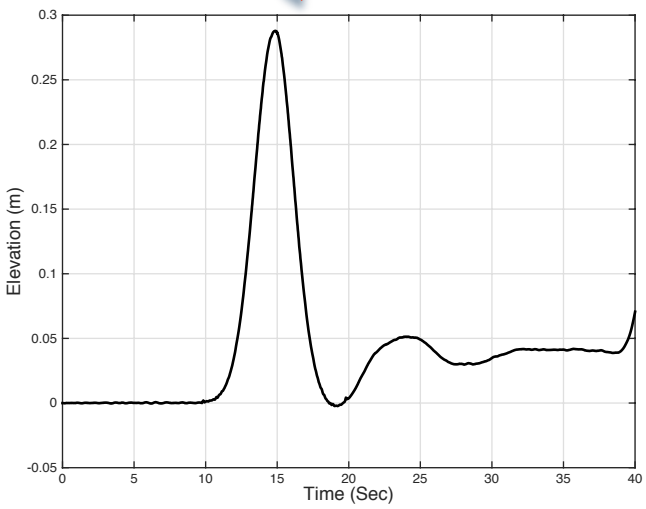
Benchmark 3: Taurangua Harbor

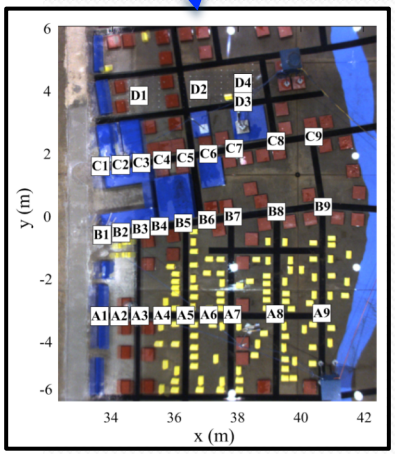


Benchmark 4: Seaside, OR lab experiment

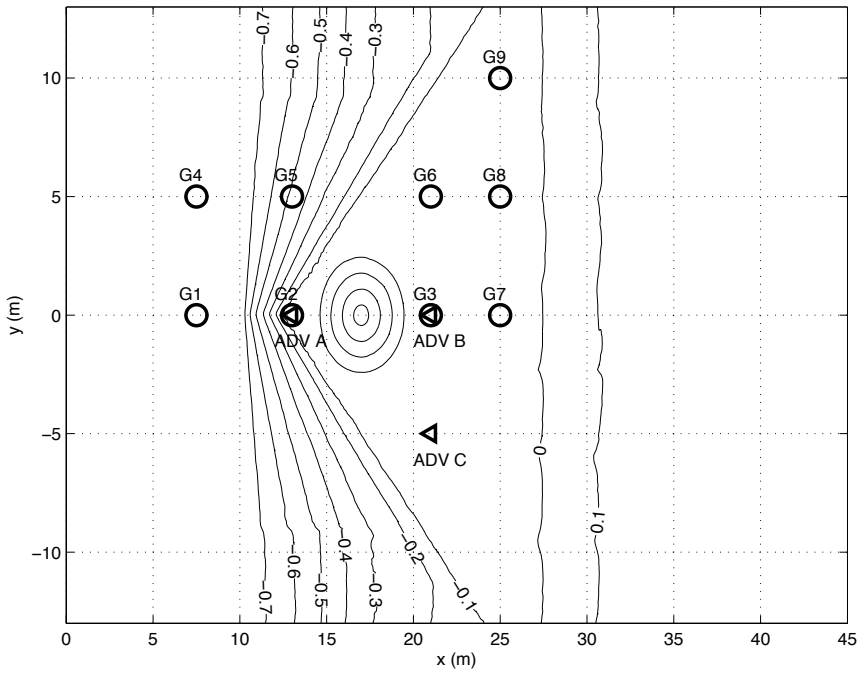
- A single long-period wave propagates over a combination of linear slopes and onto a model of the town of Seaside, Oregon.
- Main objective: provide a comparison of calculated momentum flux, velocity and inundation depth with measured data at B1, B4, B6 and B9 gauges.
- For simulation the wave was generated by forcing the boundary condition on the left side of domain.

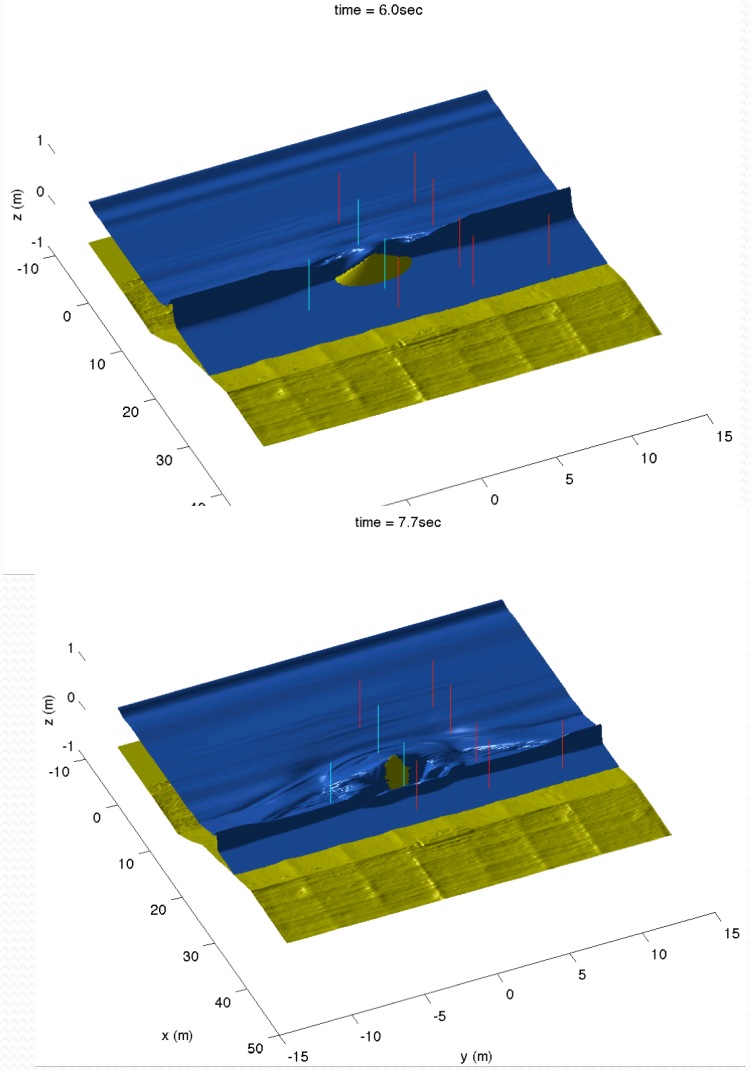






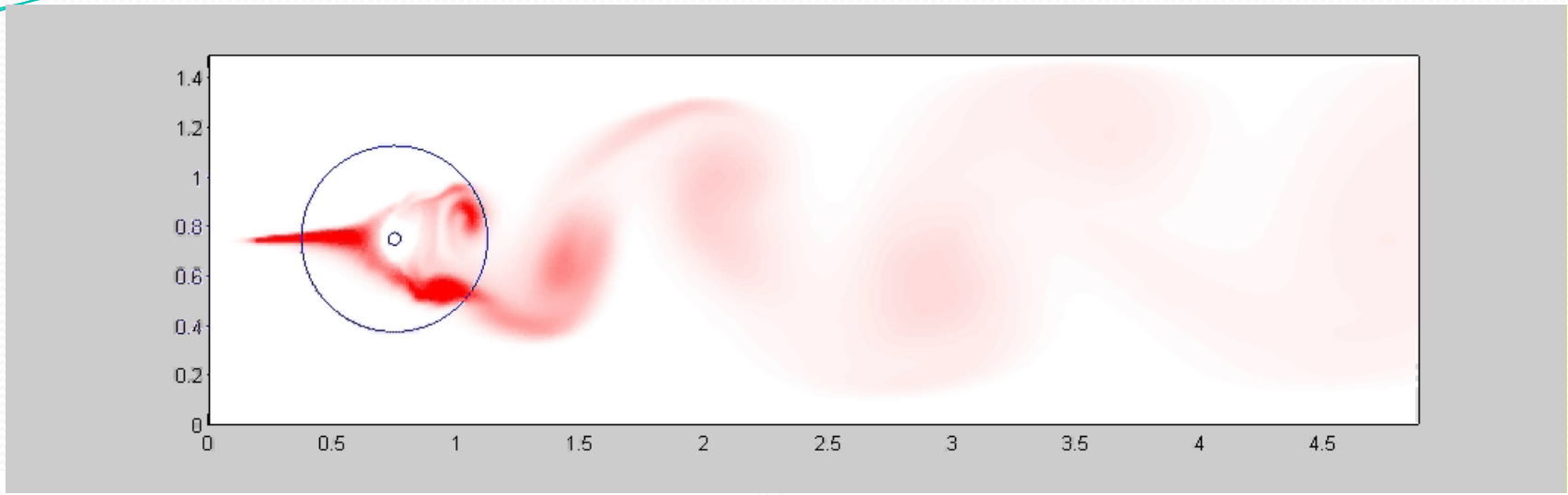
Benchmark 5: Solitary wave runup on a shelf with a conical island

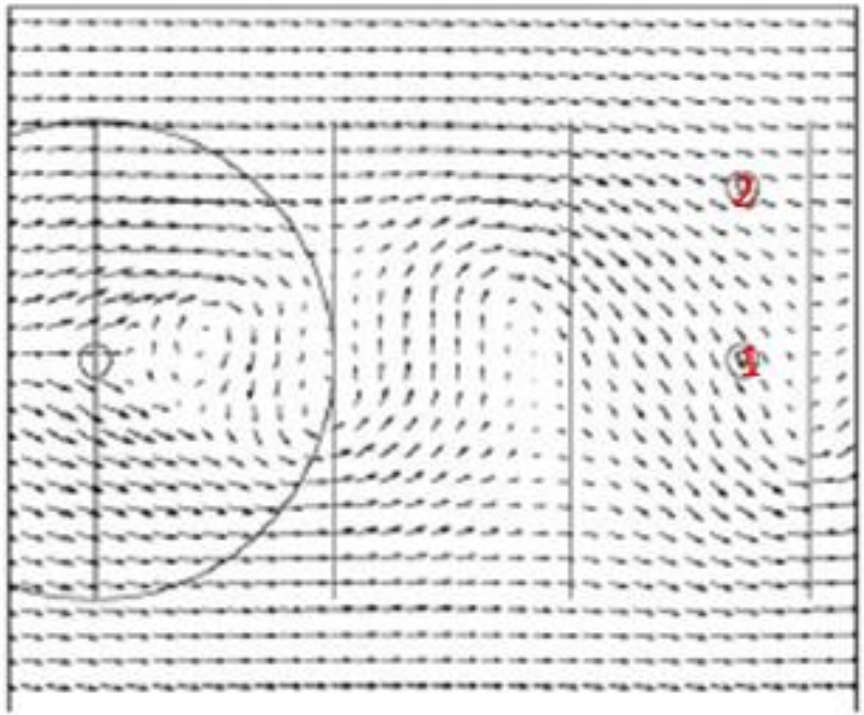


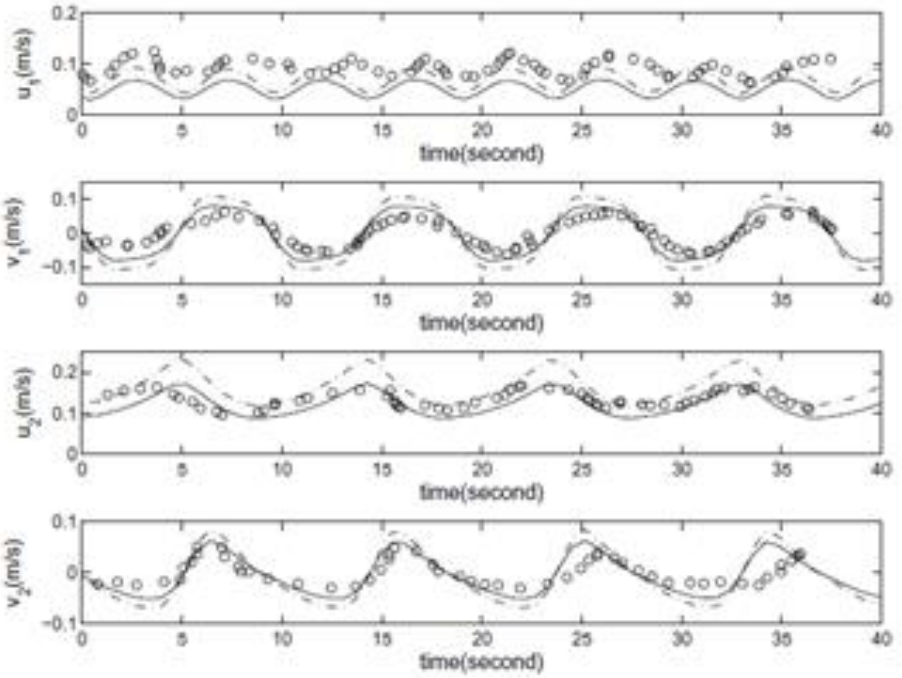


Lynett – experiment at OSU

Overview of Datasets – Benchmark 1







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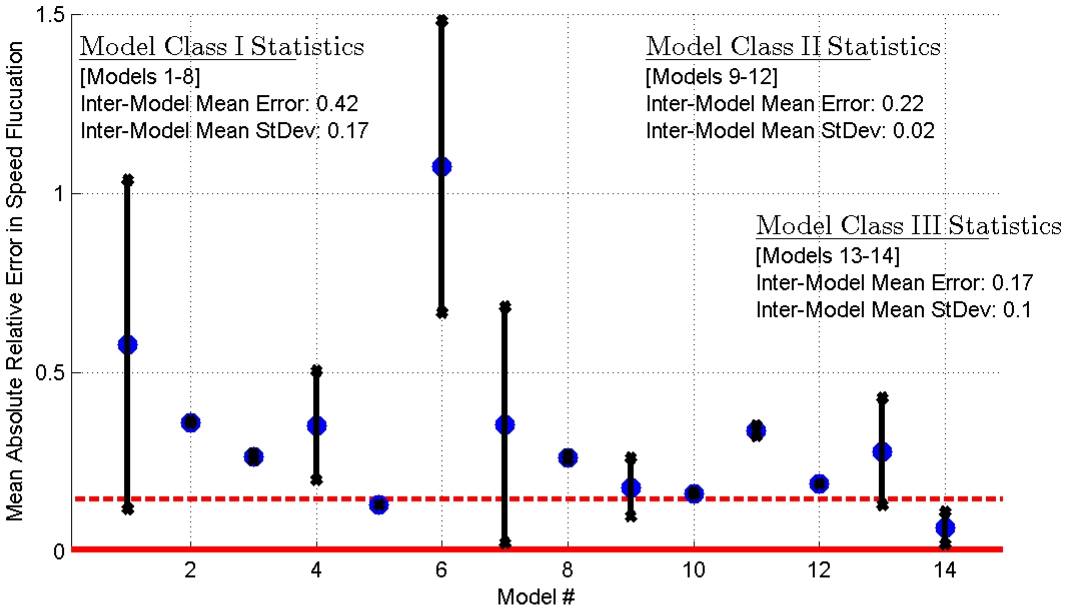
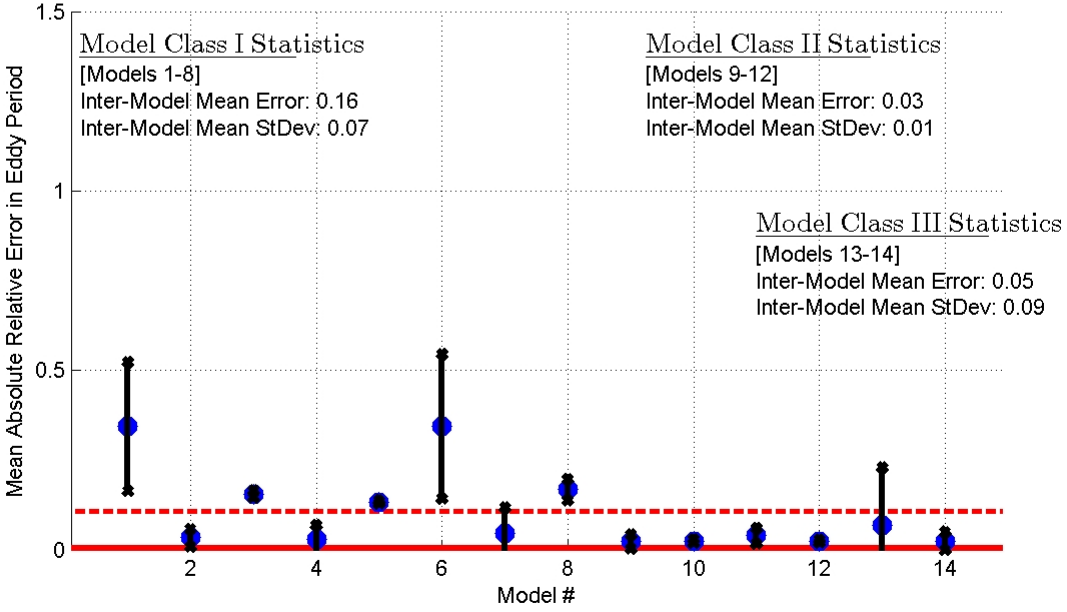
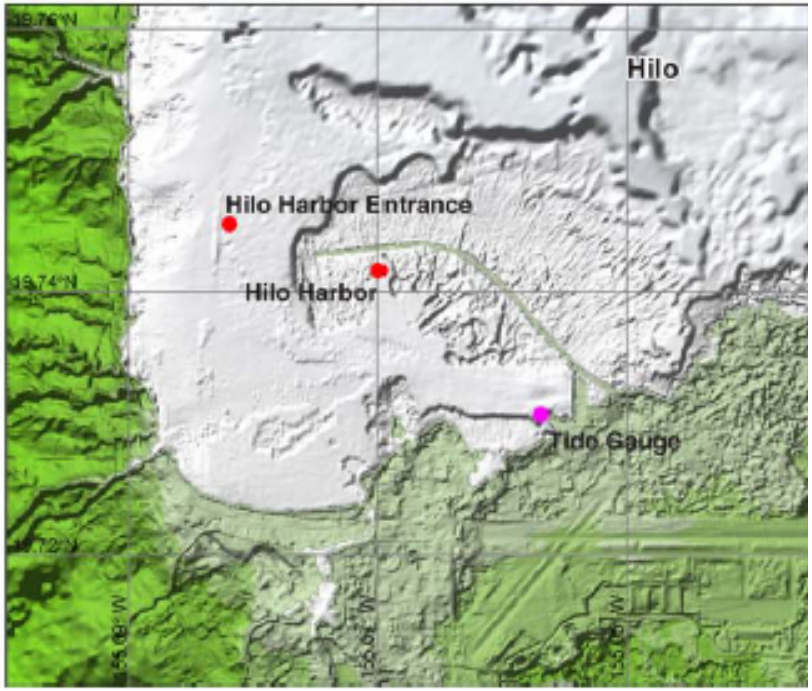
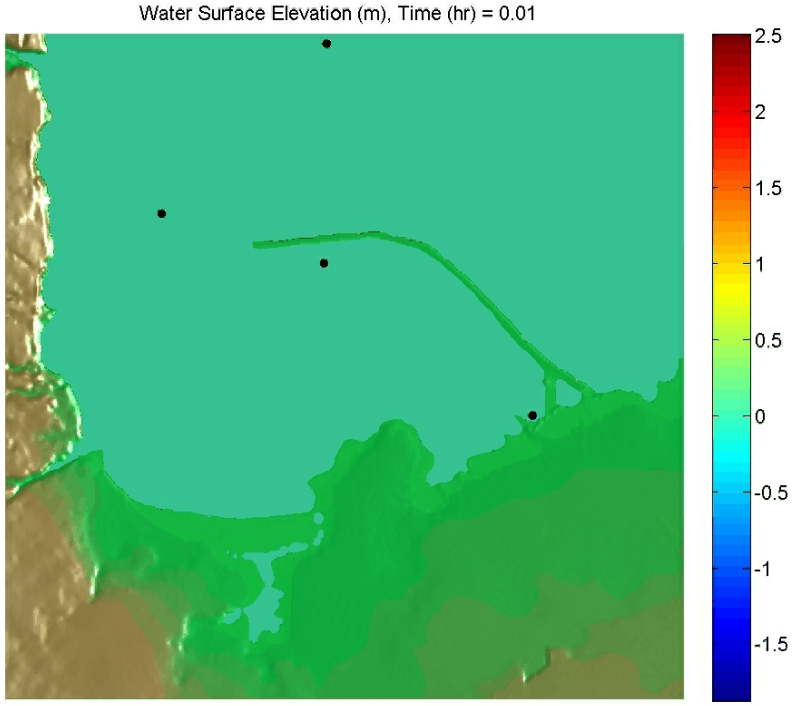
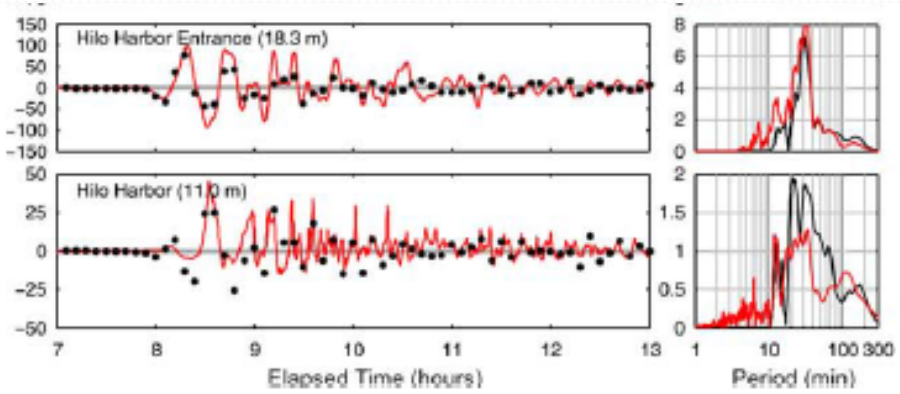


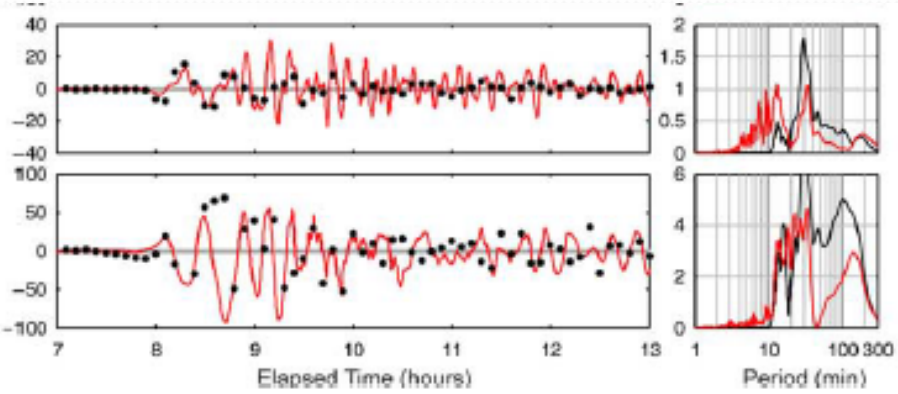


Overview of Datasets – Benchmark 2









Benchmark #2

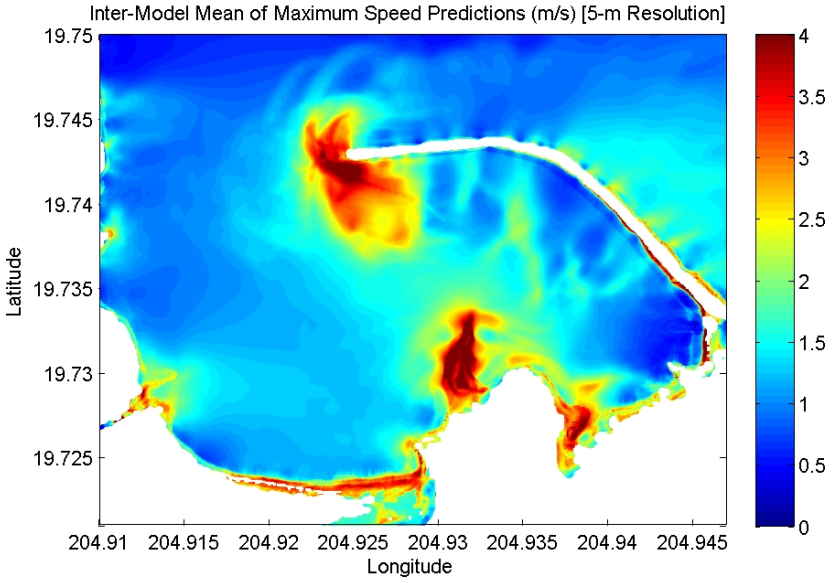
This is a field dataset, recording the Japan 2011 tsunami in Hilo Harbor, Hawaii. While modelers will of course aim to achieve the best agreement with the measured data, this is not the primary goal of this exercise. Here, we aim to understand the importance of model resolution and numerics on the prediction of tidal currents:

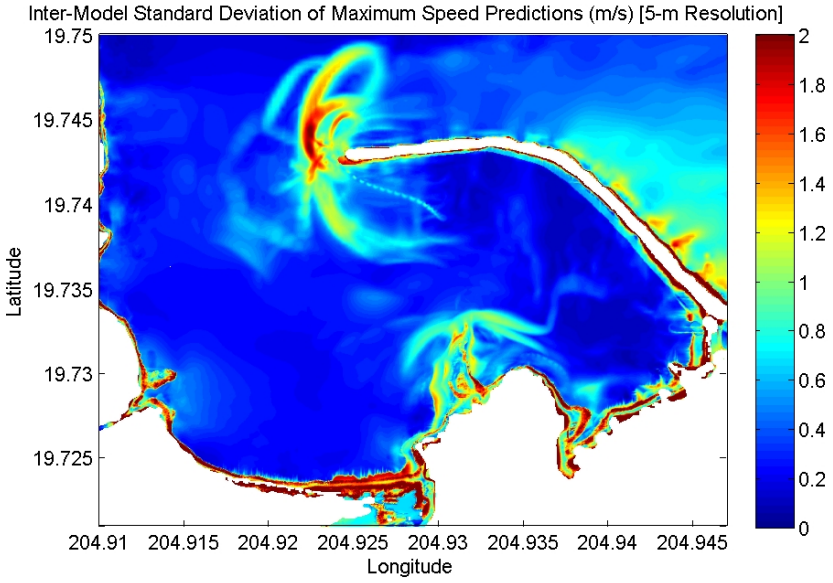
- What level of precision can we expect from a model with regard to modeling currents on real bathymetry?
- Will a model converge with respect to speed predictions and model resolution?
- What is the variation across different models, using the same wave forcing, resolution, and bottom friction?

Overview of Datasets – Benchmark #2

Analysis approach here will follow closely the discussion during the workshop

3) Inter-model 2D surface comparisons
   - Create mean and variation surfaces from the maximum speed data provided by each modeler for the three different resolutions

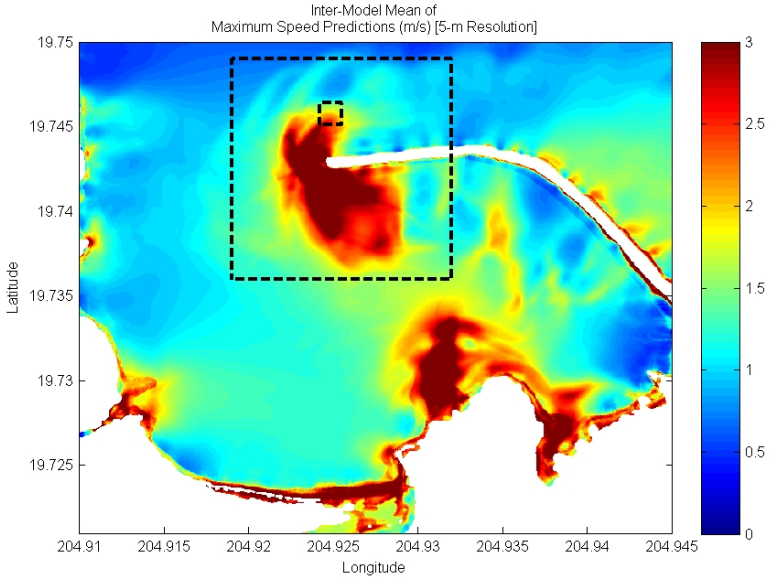


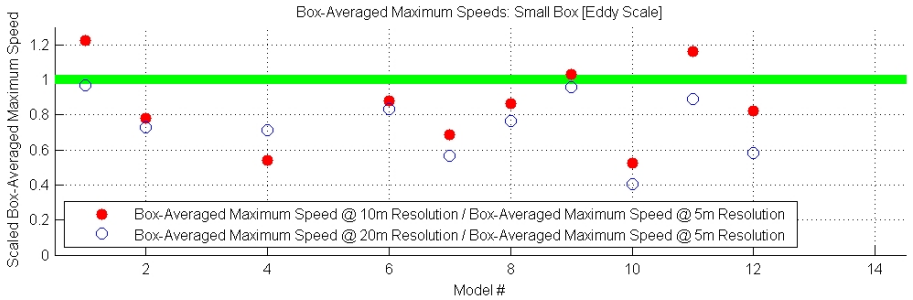


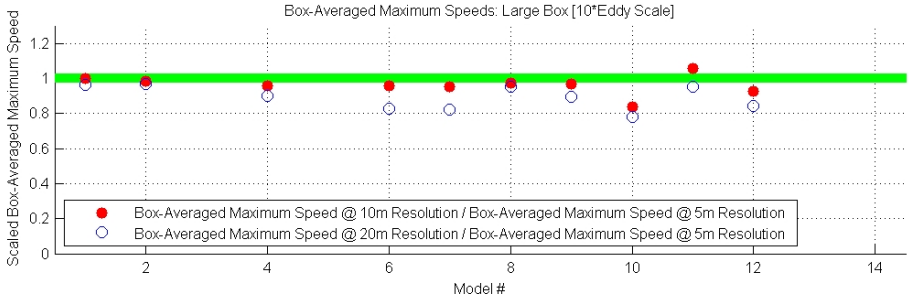
Overview of Datasets – Benchmark #2

Analysis approach here will follow closely the discussion during the workshop

3) Inter-model 2D surface comparisons
   - Examine resolution dependence, both locally and in the spatially-average sense
   - Examine numerical scheme and model physics dependence, focusing on the areas of high inter-model standard deviation





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Overview of Report

- Summary report / journal paper is at about the 50% mark
- Complete draft probably not ready to be circulated in late July / early August
- The authorship of the journal paper is going to be large; internal revisions and comments may take a few weeks

Inter-Model Analysis of Tsunami-Induced Coastal Currents

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[v] NorthWest Research Associates, 4118 148th Ave NE Redmond, WA 98052-5164, USA
[w] Virginia Institute of Marine Science, College of William & Mary, Center for Coastal Resource Management, 1375 Greate Road, Gloucester Point, VA 23062-1346, USA