

Mapping and Modeling Subcommittee Meeting Notes

Feb 10th, 2015

3:30-5:00 Other related MMS business [Wilson, Gately]

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Proposed 2016 landslide modeling benchmark workshop

- Jim Kirby gave a presentation on the East Coast plan to request funding from the 2015 NTHMP grants to run this workshop.
 - Kirby provided examples of some of the possible benchmarks available.
 - Unlike other benchmarks, the primary problem with landslides is modelling the source
- There was some discussion about possibly having an outside reviewer involved for both selection of benchmark problems, and for summarizing the benchmark results. Kirby was going to consider adding funding for this.
- This workshop will be discussed further, along with the creation of an advisory committee at the MMS summer meeting.

Offshore minimum safe depth analysis and results

- Rick Wilson provided a summary of results from most of the NTHMP state/territory modelers on determining the safe depth for ships to travel beyond prior to the tsunamis arrival.
- NOAA's long time recommendation has been to use 100 fathoms (600 ft) as the safe depth, however this has not been verified by scientific analysis and is considered very conservative and unrealistic for ships to get to in some regions of the U.S.
- A Work Group of scientists and emergency managers from the NTHMP as well as members of the Coast Guard has been created to help determine if there should be a single minimum depth or if safe depths should be allowed to vary regionally.
- Thus far, results vary depending on the coast conditions:
 - West Coast (CA, OR) – 30 fathoms for distant source events, 100 fathoms for ships offshore during local events.
 - WA comments that they have a lot of small boaters, and Puget Sound and the Strait of Juan de Fuca are less than 100 fathoms depth, hence, the time needed for evacuation to 100 fathoms would be too long.
 - HI and PR recommend 50 fathoms for all events

- Comment that there is a dilemma with the cruise ships in the Virgin Islands, as they want to evacuate for both local and distant events.
 - Results from AK, East Coast, and Gulf Coast are still being evaluated.
 - Even 30 fathoms is difficult for East Coast ships to get to because of their wide shelf. However, this analysis may still be useful for delineating areas over the shelf with non-hazardous vorticity.
- Note that ship size is very important for this analysis
- Analyses will be addressed further at the MMS summer meeting

Maritime modeling and mapping guidance update

- Rick Wilson provided an update of the Mapping and Modeling Guidance for Maritime Products for review prior to the meeting
- Additional review and comments were requested in the coming weeks following the meeting
- The guidance should be completed at the MMS summer meeting

On the agenda for the next MMS Meeting (it was discussed that we would need to hold a couple conference call meetings before the official MMS summer meeting)

- Organize advisory committee for Landslide benchmarking workshop
 - Have anyone with BM problem suggestions send them to Jim
- Write-up and summarize the Tsunami Currents Workshop proceedings
 - Discuss pilot project(s) for tsunami currents (ensemble versus single model)
- Document a method for giving new inundation benchmarked models a NHTMP stamp of approval
 - and set up the initial conference call/presentation
 - send an email invitation out to the modelers
- Discuss feedback from Maritime Modeling and Mapping Guidance reviews

MMS members only - nominations and vote for new MMS State Co-Chair

- The state co-chair position held by Rick Wilson has been termed out
- Kara Gately requested nominations for a new state co-chair
- Dmitry Nicolsky was nominated and unanimously recommended to the NHTMP Coordinating Committee as the new state co-chair

MMS Meeting: May 12th, 2015 at 12 pm PDT (via Conference Call)

In attendance:

[Kara Gately](#) (MMS Co-Chair), NOAA National Tsunami Warning Center
Alaska: [Dmitry Nicolski](#) (MMS Co-Chair), University of Alaska, Fairbanks
Washington: [Tim Walsh](#), Washington Department of Natural Resources
US Virgin Islands: [Roy Watlington](#), Scientist Emeritus
Hawaii: [Kwok Fai Cheung](#), University of Hawaii
California: [Rick Wilson](#), California Geological Survey
Gulf Coast: [Juan Horriilo](#), Texas A&M University at Galveston
East Coast: [Jim Kirby](#), University of Delaware
East Coast alternate: [Stephan Grilli](#), University of Rhode Island
[Marie C Eble](#), NOAA Pacific Marine Environmental Laboratory
U.S. Geological Survey: [Stephanie Ross](#), USGS Science Center, Menlo Park, CA
[Alyssa Pampell](#), Texas A&M University at Galveston
[Pat Lynett](#), University of Southern California

Meeting Minutes: (Notes provided by Stephanie Ross, Marie Eble, and Kara Gately)

Kara: Some people had difficulties accessing the shared documents for today's meeting... Did people find the Google invitation for the meeting (with shared documents) useful or should we just stick with the group email with documents attached? One person said probably just stick with email, two said they could read both and didn't have a preference.

Agenda Item 1: Creation of the 2015 summer meeting agenda

(Discussion of draft agenda circulated prior to meeting)

Rick: requests modification of agenda... 1) Hope to move the discussion of USGS and NTHMP to Wed. morning for half an hour. One outcome of the USGS-NTHMP discussion at SSA recently is to hold a workshop attached to NTHMP meeting and it would be good to have that discussed before the joint meeting.

Kara: okay with moving both that and the source characterization discussion to Wed. and move Landslide Workshop discussion to Thursday. Okay with Jim Kirby.

Rick: Regarding the joint MMS-MES discussion. How will the mapping discussion be different at the MMS meeting than at the joint meeting?

Kara: just an update at the joint meeting.

Rick: requests modification of agenda... change 1:45 Wed. topic to "Transition from Mapping to preparedness and response" for clarity. Kara agrees.

Kara: is the time enough for the landslide discussion (about an hour)? Jim: yes.

Dmitry: landslide workshop Wednesday? Or USGS collaboration and tsunami source on Wednesday or Thursday?

Kara: Landslide tsunami workshop on Thursday; All USGS and tsunami source discussions moved from Thursday to Wednesday.

- Joint MMS/MES meeting envisioned as a round table discussion with outcome. MES has requested a document on information about all models in laymen terms. MMS will come up with a DRAFT document in advance of the joint meeting with MES.
- Agenda now allows for time at the end of the last day for unfinished business. (It was later suggested that we could use this time space for tsunami inundation benchmark presentations to MMS)

Agenda Item 2: Tsunami Currents Benchmarking Workshop Proceedings Update

A Microsoft Word Template was developed for consistency in individual papers and sent to modelers on April 26th – request for completion in 5 weeks, expecting 10 weeks. => Deadline for gathering papers is end of June

Draft Summary Report Update by Pat Lynett: Student working on graphics and bringing it all together. Some issues with the data and comparisons on Benchmark #1, specifically, the best way to present and summarize the results in a fair and reasonable manner is still under review. The rest is progressing well. Benchmark #2 results will provide the bulk of the document. Draft report should be out for comment in a few weeks. Output won't change much from second day of workshop. Complete draft within next 2 weeks. About a month later have a draft journal paper. Currently, there are three model reports submitted so far. A peer-reviewed journal article is also in the works, and anyone who wants to be a co-author MUST get their individual model report completed before the end of June.

A steering committee for help with written proceedings was created. Members prior to the meeting included: Rick W., Kara G., Dmitry N., and Pat L. Kara requested for additional members to volunteer for the steering committee. Additional members now include: Tim W., Jim K., Juan H., and Stephan G. Members of the steering committee should expect a Draft Summary Report for review in approximately 2 weeks and be prepared to help develop an introduction piece for the Tsunami Currents Workshop Proceedings.

- Early June
 - Final draft Summary Report completed
 - Draft Introduction being developed
- End of June
 - First draft of journal paper. Circulate among authors, and submit to journal.
- Early July
 - Draft of complete workshop report, including all authors' chapters and introduction

Agenda Item 3: Maritime Mapping and Modeling Guidance

Kara: Reminder that **feedback from MMS members is needed** on the document. If you're short on time, just review the Mapping & Modeling section and provide feedback on that, as we are looking to have all feedback and comments from MMS incorporated into the document in advance of the 2015 summer meeting as well as have that section of the document finalized by September 2015. Rick will re-send the current version (circa November) out to the group.

Rick: will update the Maritime Guidance document in the next 2-3 weeks and redistribute. The updated version will include: examples from recent Oregon maritime guidance work, offshore safety areas information, tsunami currents model benchmark workshop information and how to integrate into model qualification, products which adequately capture areas where eddies may be generated and travel to, (i.e. work with modeler to identify these areas and figure out a catch-all to handle model shortcomings).

Agenda Item 4: Come up with, and document, a method for giving new inundation benchmarked models a NTHMP stamp of approval

(Discussion of process)

Kara: thinking that somewhere on our website, we could have the steps to BM future models.

Steps:

- a. Complete BM 1,4,6,9
- b. Create a paper to document results.
- c. Present to MMS. How to do this? Webinar? Presentation to MMS?

Stephan: discussed this after the workshop with tiger team. In future, people would have to create a paper, maybe present to tiger team? Need a metric? This may not have been put into the proceedings.

Randy LeV may have done it afterward. There was a subgroup?

Kara: a subgroup would be okay if MMS is okay with a subgroup.

Jim: group has to say that it passed muster, in some fashion, so need a presentation to all of MMS.

Kara: So, have a simple doc on our webpage documenting the steps. Then after everyone has a chance to review, have an MMS call and/or vote by email. If accepted, new models would be added to the:

1. ["NTHMP Benchmarked tsunami models" document](#)
2. And an addendum document to the [Proceedings and results of the 2011 NTHMP Model Benchmarking Workshop](#) (Addendum document still to be created)

Kara: Would this be a circulation of the modeling results paper to MMS with time for review and questions? Or do we need a presentation to the group with discussion...

Tim: after Galveston: everyone was involved. Could lose value of the discussion if it's spread out.

Fai: a presentation would be good. Then the committee could discuss. Rick agreed.

RW: Hong Kie Thio is trying to get his model validated. He may have talked with Juan about getting Matlab results so he can make comparisons. Juan, have you discussed with HKT?

Juan: yes, but don't recall details. Hong Kie asked and received the results from Matlab.

Kara: so we should make that available as part of the process.

Dmitry: we could put into the summer meeting a slot where people could present new models if they have them

Fai: We should involve Rocky when discuss models because NOAA does not endorse or approve models. Rocky referred to the proceedings as validation and wouldn't give Fai an endorsement. Fai will fwd email from Rocky to Kara.

Summary: Kara will send out a draft document to the group for this in the next 2 weeks. Conclusion is that anyone seeking to benchmark their inundation model and receive MMS approval must complete the following steps:

1. Complete Inundation BP1, BP4, BP6 and BP9
2. Write a paper to document the experiments and results
3. Present results via webinar or in person to MMS

Then,

4. MMS votes on acceptance, if approved
 - a. the new model will be added to the ["NTHMP Benchmarked tsunami models" document](#)
 - b. And an addendum document to the [Proceedings and results of the 2011 NTHMP Model Benchmarking Workshop](#) (Addendum document still to be created)

Other Business

Kara: Regarding the joint MMS-MES meeting agenda, MES has requested a document from MMS for laymen's terms on tsunami models. This will probably include information from the ["NTHMP Benchmarked tsunami models" document](#) master list of accepted models, but make it clearer, more generalized, and easier to read.

Meeting adjourned 12:40PM PDT.

NTHMP/MMS 2015 Summer Meeting Notes

**National Tsunami Hazard Mitigation Program (NTHMP)
Modeling & Mapping Subcommittee (MMS)
Summer Meeting Notes (Reader is referred to presentations for specifics)
July 14, 15, 16, 2015
<http://nws.weather.gov/nthmp/2015mesmms/index.html>**

Rocky: Welcome, opening comments, and logistics

Kara: Plan for the day, including agenda changes to accommodate Aimee Devaris conflict

- Move discussion with Aimee Devaris and Mike Angove to 2:45
- Lunch moved to 11:30

9:15 – 9:30 Review of Goals (MMS co-chairs Dmitry & Kara)

Review of Goals

1. Finalize maritime guidance – led by Rick
2. Safe depths? Move towards consistent recommendations
 - a. Oregon and California are preparing a plan for vessel movement offshore
3. Discussion of models for landslides and currents (?)
4. Discussion on tsunami sources –led by Stephanie
5. MES/MMS Joint Meeting
 - a. Brief MMS about tsunami currents workshop, outcomes
 - b. Pedestrian evacuation travel time map development
 - i. MES has not yet asked us for anything, just initiating discussions
 - ii. Needs for models, e.g. 15” grid needs to be downsized to 3” grid for narrow passageways, bridges, etc.
 - iii. Hope is to identify best practices
6. DEM production and finalize FY16 list
7. Finalize the process on model benchmarking
8. Preparation for landslide workshop
9. Website – update and reorganize
10. Meeting wrap-up and work plan to finalize goals before next meeting

July 14 -----

9:30 – 9:50 **Discussion on updates to modeling results for offshore safe depths** *(Wilson)*

&

9:50-10:20 **Update from the NTHMP-US Coast Guard Work Group on minimum maritime offshore-safety limits/plans** *(Wilson)*

1. Offshore safe depth needed on both a state level and on a regional level
 - Going to be difficult to come up with a common standard based on results, however, MMS agrees it would be best to come up with consistent standards
 - Questions being asked: Is the regional geography limiting the ability for consistent offshore safety zones or is it the different scientific studies, models, and policy makers
2. Reviews handout entitled 'Maritime Vessel Evacuation – Minimum Offshore Safe Depths' document -> to be used by harbor masters and port authorities for mitigation and COOP planning

Tim: Brings up one Wa. State complication – At any time, there are always at least 3 ferries in the harbor. Moorage is not like large ships → if they are in the water, they are hosed, if they are moored, they are hosed...
3. Distant source guidance vs local source guidance – see document
Refer to table 1 for recommended safe depth area

Rick: Draft general maritime guidance, overall in decent shape for recreational and commercial boaters. Goal is overall coast guard involvement, not necessarily just port by port. Would be good if a sector of the coast guard can fall under one region according to the scientific information
Refer to table 1 for recommended safe depth area

Tim: Asks Rick who in the Coast Guard is he working with.
Answer: Randy Clark and immediate supervisor

Kara: What about guidance now coming from Hawaii?
Answer (Rick): Randy was concerned that cart was being put in front of horse. He would rather see more overall coast guard mentality instead of port by port - - Randy is handling that separately.

Chip Guard: Guam is in sector 10 and is following guidance – can live with Hawaii's guidance because Guam can easily get to 15-m area.

Kara: Need for clarification of local vs distant source

Dmitry: for CA, different guidance for near source vs distant source, but for AK a source that is local for one region may be distant source for another region

Rick: maybe need to give a limit, within one hour of the tsunami that would be local source

Fai: In the first hour, people are usually very confused

Chip: wording is going to be important, interpretation is one of the problems

Rick: if you are on shore and feel shaking, don't try to take boat offshore, if you're on the water you're not going to feel the shaking, will be getting alerts

Tim: In Puget Sound, most of the ships will be 2 hours away from earthquake.
4. Continued discussion on what is local and what is distant – criteria: shaking time?

Stephan: Are critical facilities separated from other ports? (Ports of Long Beach and LA vs. small local ports, for example.) Toured Ports of Long Beach and LA with Coast

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Guard and noted that the ports are quite vulnerable – Any perturbation to the local level can be disastrous.

Rick: This was addressed as part of the SAFER project, credit given to Stephanie. Large Alaska Aleutian event does cause problems within the ports, primarily currents and especially in channels. The ports are unrealistically optimistic as to what can be done during an event; ships can get underway quickly etc.

Stephan: Separate guidelines for general boaters and special contingency plans for large ports?

Rick: This is first general guidance, going toward specific guidance... There is still a lot of planning for ports needed. Captains are under port guidance, but each captain has their own authority to make decisions for their own ship.

Stephan: What about military guidelines? What do they base their decisions on? Is interested in Port of Norfolk

Kara: May be able to initiate contact through Joint Typhoon Warning Center

Rick: Single point moorings inside may be an option if boats cannot get offshore, as in the case of the east coast ports where there is a wide continental shelf.

5. Continued discussion on notifications for mariners:

Kara: Is this guidance for advisory tsunami, warning tsunami, are we going to specify?

Rick: difficult because every harbor is different, recommendation is based on arrival time and size

Kara: NTWC messages give arrival times for a limited number of local cities, need to get arrival time information to vessels; are the ETAs in USCG messages appropriate for vessels

Marie: some guidance on where vessels should get their messages

Kara: Does the Coast Guard disseminate full message information? Follow-up with the Coast Guard to learn what details, exactly, they transmit, when relaying TWC messages. We want to make sure adequate information is relayed for following the guidance.

6. Continued discussion on clarity in wording on local vs distant needed because of time considerations.

Kara : maybe another definition that needs to be determined is offshore (off the coast) vs. offshore in a bay

Kara: we have distant source at least 2 hours away, what if its 1 hour away? And there are tsunami events that are local but more than 10-15 min, still need some guidance, need to reword

Rick/Kara/Dmitry: maybe reword to “local tsunami with arrival less than 2 hours, may arrive within 10-15 min” or just “within minutes”

Marie: have space and time, could add in local because of where, then time to arrive

Tim: Emphasize variability between regions so there will likely be a need for non-standard guidance.

Rick: Purpose is to hit the highlights, keep it simple, but there will be other conditions.

Kara: Keep everything as general as possible, then each region can come out with modifications

Fai: Seems as though Islands can have their own procedures.

Rick: Maybe the categories cruise ships, tankers, etc need to be treated separately, but for most part large ships are going to be ok as opposed to smaller boats, need to

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monitor mooring lines. Cites Crescent City as example. We are lumping recreational and commercial together here so need to keep separation.

- **Kara:** Any studies on how ships fared during 2011 Tohoku? Were there large ships moored? – maybe harbors farther from the source that had ships ride it out, worth looking into to get some guidance from Japan on what worked or didn't

Fai: All large ships stayed put; small vessels evacuated.

Dmitry: Sites ship experiences during events in Sandpoint harbor. During some events, ships survived, but during others, ships were damaged.

Chip, Stephanie, and others: Discuss specific cases involving currents.

Kara: Let's make sure we are mapping their harbors correctly

STUDY: look into how ships fared during Tohoku as a real case study.

7. Safe depth table completion

- a. Puerto Rico? Victor – only does Puerto Rico and not entire Caribbean – 100M (55 fathoms). After further discussion, Victor thinks the 50 fathom specified for Caribbean is fine.

Victor: Should there be consideration of people on board cruise ship

Kara: We are choosing guidelines for ships. People best to go with ship. When ship is moored, there are micro decisions that may be best left to companies and ports. Discussion with these parties may result in some policies

Tim: Some issues 'we' have inside Puget Sound is that we can offer guidelines but different Ports inside the Sound may choose different responses.

Fai & Rick: Stick with general guidelines and let Ports work specific details out. Might be reasonable to initiate some working group to bring ports together?

8. Dmitry currents modeling presentation

- a. Presenting results on safe depth modeling in AK for Cascadia event, 30 fathom line seems to capture high current zones, but inside Dutch Harbor there are some deep passageways with high currents; local source: still high currents at 150 fathoms, 100 fathoms ok but would suggest 150 fathoms for local source

Rick: if straight line currents at 100 fathoms that they can still navigate, then probably ok

Kara: going back to guidance for advisory vs warning events: advisory – only going to have damage inside harbors

Rick: advisory vs. warning may be harbor-specific, could get no damage or a lot of damage even with an advisory

Kara/Dmitry/Rick: if 150 fathom suggestion for local source, could say at least 100 fathoms, if still feeling dangerous go to 150 fathoms

Kara/Dmitry: Update table for AK, distant source to 30 fathoms plus ½ mile offshore

Kara: maybe make wording consistent for all of west coast (depth + distance)

Kara: Any similar situations on West Coast?

Rick: No

Fai - Hawaii – for local source, have less than ½ hour to respond, so no guidance for getting offshore

Kara – Updating guidance for Pacific Islands, Hawaii, Guam: 50 fathoms
3 different regions: West Coast/AK, Pacific islands, east coast/gulf coast; within regions that have similar characteristics want to be consistent

Tim: What is travel time from Cascadia to here?

Dmitry: ~ 4hours

- b. Results shown for Unimak Island and then Kodiak

Local sources:

Travel time? Dmitry not sure

Modeling done for high tide only

Results show a safe depth in 100-150 fathom range.

Message: Ships in port should stay, those offshore should go further offshore.

Rick: Guidelines for ships inside impact region and outside impact region. **Chip:**

What is error bar for speeds? Dmitry: good question, not sure?

Kara: Advisory vs warning: everyone outside local area will be given an advisory. The worry is what guidance to provide. – How do we get back to guidance? Rick: The guidance is structured to whether or not you feel the earthquake and will be harbor specific. Some of the harbors, like Crescent City, are prepared to take ships offshore. Simple, if you feel the eq., go to high ground; if you are a ship offshore, go to safe offshore distance if possible; if in port, stay there.

Further discussion: 100 vs 150 fathoms – debris consideration? High current pockets?

Discussion leads to regional differences: East Coast/Gulf Coast/ Hawaii?

Pacific Islands, Hawaii, Caribbean: 50 fathoms

West Coast, Alaska:

East Coast: ??? Pending

Gulf Coast:

10:35 – 11:15

Update on the Tsunami Currents Benchmark Workshop report

(Pat Lynett, USC)

Benchmark #1 – generally speaking, all models did ‘pretty’ well with that.

Everyone had an offset in the numerical velocity, with u velocity lower than the data

Looks at 2 different comparisons:

1. Magnitude of fluctuations in speed
 - a. Take 1 min of model results, find zero-crossing, have mean height fluctuations, and standard deviation for fluctuations
 - b. Most models do not have all physics, meaning do not account for ‘real’ variations. Therefore, results show numerical unsteadiness of models
 - c. Models ordered in terms of increasing level of sophistication: 1-8 (Class I): shallow-water, 9-12 (Class II): weakly dispersive/quasi-3D, 13-14 (Class III): approaching 3D or fully 3D
 - i. In terms of averages, there is a clear benefit to using ‘better’ models (ie, 3-d models)
 - ii. Mean absolute relative error in fluctuation: general trend of error decrease as model sophistication increases, clearly a benefit of using a better model for this problem
 - iii. Mean absolute relative error in eddy period: on average, across models we capture the period much better than the speed

Dmitry: raises point of a model may be benchmarked but someone using the model may use it in a way that is not optimal, **Kara:** working under an assumption that modelers are competent, but that’s why there’s a need to review each other’s work

2. Total Kinetic energy
 - a. Could not ignore the glaring fact of significant offsets. Therefore, Lynett looked at time-averaged kinetic energy.

- b. Now instead of looking at top and bottom, entire in between is integrated.
- c. Results: For u-component, models generally under-predicted energy and for v-component, models generally over-predicted. Offset
Stephan: would error change if different locations in vicinity of observation?

Note: modelers had results and friction coefficients etc varied so that modeler could provide what they thought were best results

Benchmark #2

1. Hawaii case study
 - a. Hilo Tide gauge provides baseline scatter amongst models
 - b. Two velocity locations (ADCPs), 1 surface elevation location (tide gauge)
2. Statistics Analyzed
 - a. Use tide gage to establish an accuracy/model correlation for elevation
 - i. Shifted model time series to match at control point
 - ii. Take mean of each maximum/minimum, form envelope
 - iii. Relative error of envelope
 - iv. Model error ~20%, inter-model variability ~20% for 4 hours
 - b. Compare accuracy/model correlation for speed at ADCPs
 - i. Found out that data is averaged every 6 minutes
 - ii. Error grows with time (expected), inter-model difference does not grow (unexpected)
 - iii. Errors are larger, STD are consistent; a puzzling result
 - c. Mean and variation surfaces from maximum speed from each model
 - i. Examine as a wave envelope of crests
 - ii. Little variability in errors between models
 - iii. In general, in a controlled situation, expect errors of ~20% and intermodal variability of ~20%
 - iv. Examine resolution dependence, st. dev. map/mean map (relative variability between models)
 1. Debatable whether models have ability to capture physical eddies accurately, variability due partly to physics and partly to model differences
 - d. Examine numerical scheme and model physics dependence focusing on areas of high inter-model st. dev.
 - i. 20m/5m result, 10m/5m result to check convergence
 - e. Velocity threshold prediction through ensemble modeling to provide likelihood of high current speeds
3. Result Summaries
 - a. Model errors start at 10% and grow to ~50%
 - b. On average in ensemble sense, models agree with one another. For forecasting, even if go with ensemble modeling, will get large errors as time goes on.
 - c. Plots of inter-model 2-D
 - d. Pat: "When looking at currents, if in an area with eddies, it's a 'fool's errand'"
 - e. Consider mapping products using velocity threshold predictions through ensemble modeling to provide likelihood of high current speeds
4. Report development
 - o Pat - report layout: summary report, individual modeler reports

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- In progress. Pat estimates at ~50% complete. Complete draft late July/early August
- Only benchmarks 1 & 2 will be presented in report. Benchmarks 3, 4, and 5 are mentioned but no detail of results will be presented nor discussed.
- Report summary: Summary with each modeler report appended in subsequent sections.
- Large authorship, internal revisions and comments may take a few weeks
- Kara – determined steering committee for revisions at last meeting
- Pat – report layout: summary report, individual modeler reports

11:00-12:00 **Completion of the maritime mapping and modeling guidance**
(Wilson)

1:00 – 2:15 PM **Completion of the maritime mapping and modeling guidance, cont.**

1. Rick: Leads discussion on “Manifesto of Maritime Guidance”
 - a. Goal is to finalize the part MMS is responsible for
2. Guidance Review
 1. Tsunami Hazard Analysis, Modeling, & Mapping; Response
 - a. Long discussion on terminology. Definition of ‘Maritime Community’ and use of “Individuals” as intended audience.
 - i. Rick/Tim/Kara – need a definition for “maritime community”, will start an email discussion
 2. discussion on verification, validation, and mention of benchmarking.
 3. discussion on appropriateness of including in guidelines since response is outside the purview of the NTHMP. Retained for MES comment
 4. discussion on what an ‘appropriate’ source is, what constitutes high resolution
 5. Removed ‘how products should be used’
 6. Needs some tweaking. Second part of sentence redundant
 7. discussion on seiches resulted in suggestion to add “Tsunami induced” at sentence beginning.
 8. Page 4: Replace MMS with NTHMP
 9. **Additional currents benchmarking discussion -----**
 - a. Kara – MMS hasn’t had a chance to review results of workshop proceedings, premature to include in the guidance right now
 - i. Marie/Dmitry – shouldn’t mention anything about “absolute accuracy”
 - ii. Marie – say results from workshop are still being discussed/evaluated
 - iii. Wait for workshop proceedings to be finalized before we finalize guidance document
 1. Page 5: Decided that it is premature to include
 2. Page 7: Decided that it is premature to include
 3. Page 8: Decided that it is premature to include
 4. Page 9: Decided that it is premature to include
 - b. Current velocities and relationship to damage, product guidance:
 - i. Jim/Stephan – convergence of models with increasing resolution doesn’t mean its converging to correct result

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- ii. Kara – *Again need to wait until benchmarking proceedings are finalized to finalize this section*
 - iii. Dmitry/Marie/Rick – *need to say resolution needs to be appropriate for specific harbor/conditions*
 - 1. *For now, set minimum resolution at 30m*
 - iv. Rick to reword
 - c. *Identify areas where eddies may occur:*
 - i. Marie/Dmitry – *Who would review maps to identify areas where eddies will occur?*
 - ii. Kara – *assume an experienced modeler is doing the modeling*
10. General suggestion (Vasily): Add an executive summary
 11. Page 10: Product Guidance (FASTER)
 12. Tim: In “Essential Guidance for NTHMP Funded Agencies”, change “Agencies” to “Entities” since some members don’t work for government agencies, also change in guidance #1 (changed by Rick Wilson)
 13. Change to “Numerical models should be verified and meet criteria using the benchmark tests...”
 14. Dmitry – 10m grids shouldn’t be required, e.g. AK doesn’t have 10m grids available
 - a. Stephan/Kara – reword to “or the best resolution possible”
 - b. Marie – highest resolution possible may not be appropriate
 - c. Rick – change 10 m resolution to “high-resolution,” leave open for discussion on what is high resolution
 15. Marie/Tim – remove “and how they should be used”; reworded by Kara
 16. Rick – added “and tsunami from local and distant sources”
 - a. Tim/Kara – should also give plan for when no alert is given

Maritime Guidance Wrap-Up, Kara: Everybody needs to send their track changes. Postpone any outcome and summaries for tsunami currents. Hold a conference call in a month to finalize from feedback. Then another conference call to incorporate tsunami current information later.

2:45 – 3:30 PM

Welcome and discussion with NTHMP Chair Aimee Devaris and NWS Tsunami Program Manager Mike Angove

Rocky introduces Aimee Devaris and Mike Angove

1. Aimee:
 - Provides recognition of Rocky for meeting organization, Kevin Miller, and NTHMP partners for making the trip.
 - Reinforces her appreciation of NTHMP partner collaboration
 - Takes every opportunity to showcase the work of the NTHMP at HQ
2. Mike Angove:
 - State of the program is reasonably healthy. There remains an appetite to sustain program capability. We have Congressional interest, we’ve done a good job of making our appropriators aware of the importance of what we’re doing
 - Language in this year’s bill to authorize \$6M against NTHMP Grants. ~\$5.2M was authorized. Why? Program balances all needs. Not everyone was happy but...
 - Partners are encouraged to ask questions freely.

NTHMP/MMS 2015 Summer Meeting Notes

- **Rocky:** Every federal review is different because all partner needs are different. Cites one partner's lack of meeting deliverables so Grant was pulled. We have to be careful that the money that's provided is used according to plans, but understand that things change and willing to work with groups on e.g. no-cost extensions; there was some confusion on the provision this year for things that need longer time to complete within the 2 year limit (personnel limited to 1 year periods), will try to clarify in next year's information. Rocky continues with accolades to partners for their quick attention to questions posed by the review panel. All award applications were submitted by the 3pm 10 Jul deadline.
- **Mike:** Picks up on Rocky's comments to say that NWS Director, Uccellini, went to Congress to voice concern about NWS ability to work in environment with fine detail requirements. Congress gave NWS to identify and work within broad areas. ** Result is higher scrutiny. Department again requested that the Grants not be funded. This is an annual expectation and, up to now, the funds have been restored.
- **Aimee:** Takes every opportunity to serve as proponent of NTHMP. had opportunity to promote NTWC and NTHMP to Admiral Devany, focus within NOAA now seems to be more on weather-ready and resilient communities, especially coastal communities, opportunity for NTHMP to consider breadth of impact of work; NTHMP investment activities report is good but needs emphasis on value of collaboration/relationships, Aimee will add spotlight from the Chair on benefits of our collaboration. **Rick:** Asks question about Devany's response to NTHMP slant. Do they get a sense of the effort?
Aimee: Congress is very interested in collaboration and value to taxpayers and country. President has issued a number of executive orders promoting collaboration and information exchange across a wide spectrum of activities.
- Challenges: yearly Grants pullback dance; potential reprogramming of funds.
- **Tim:** Question on TWERA: any news? –in line to become a passed bill, Mike sees a trend towards a passable version of the bill and it has passed the house.
- **Stephan:** Comment on coastal resiliency: Inundation from tsunami and that from storms are the same thing. Reinforces the notion that tsunamis are important and should work to get resiliency piece of NTHMP work more visible and integrated into other mitigation activities. Multi-hazard floodmaps for the US on the agenda for a lot of agencies. Vertical evacuations... how does NTHMP fit into US "coastal resiliency".
Mike: Recognizes the importance of doing a better job of broadening collaboration.
Aimee: Reinforces the need to improve collaboration with NOAA Ocean Services (NOS).
- **Rocky:** discusses NOS Grants: \$500-\$1M minimum with matching requirements – tough for many to meet the matching criteria. There is a possibility that bill would include a change to Grant process that would open up Grants to 501-c non-profit groups, which could limit funding available to current NTHMP entities
Mike: would certainly like to see the new bill.

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- **Dmitry:** NGDC has done great job providing quality DEMs for tsunami research, would like to highlight this work, ensure it continues (Mike assures it will, has been identified as a critical need)
- **Rick:** could share names of state contacts with govt officials so they can get more information. Question (and concern) on "Investment Activity Report" states could share 1-page summaries on where money has gone with their officials to support the NTHMP investment report
 - Rocky:** The report is already 16 pages long; we are under pressure to make it even shorter. There is no room to add one page per NTHMP partner – plus, to be fair, we would have to have reports from all, not just some, and unfortunately, all partners do participate as much as others. The report really tries to highlight the accomplishments completed by grants and still remain fair.
 - Rick:** Would like input into report
 - Rocky:** Report is pretty much complete. There is one remaining data call. This report is really specific to NTHMP Grants; funds distributed and outcomes. There still needs to be annual report of NTHMP but that needs to be a separate document.
 - Kara:** More information about preparing for the annual report?
 - Rocky:** We would like to have an annual report from NTHMP. This should be brief and direct, showing completed outcomes and soon to be expected completions. Written in laymen's terms. Will be discussed more at the CC Meeting.

3:30 PM **Juan: presentation on Gulf of Mexico modelling for offshore guidance**
(not on agenda, related to Maritime offshore safety depths discussion from earlier)

Juan: Results from 3 historical sources and some probabilistic landslides for current velocity in GoM. Regional issue of a very wide and shallow continental shelf. . Looks like about 100-200 meters would be a good offshore safe depth. 100 fathom depth ok - but we would need weasel words for if you reach that level and still can't maneuver. Also, it would take a long time to get there... so maybe more like: if offshore go farther out if possible, if close to shore stay there

Jim: shallow shelf means a lot of friction, significant decrease in wave heights from shelf to shore, may be better

3. Modeled Mississippi landslide - One of the 3 historic sources, ran higher resolution model for specific locations
 - a. Results for this case show 3-6 knot range
 - b. Local Gulf of Mexico 'safe depth' looks to be 100 fathoms.
 - i. Alyssa points out that the problem is getting out there.

Rick: Are there any areas within the gulf that would be considered a distant source for other areas within the Gulf?

Kara: Probably no.

Juan: Points out that travel time to some locations could be on order 4 hours.

Kara: Juan's 100-fathom mark is good for local and anything considered distant (Gulf is a closed basin so no energy really enters the Gulf).

Kara: Still seems that regional grouping of safe depth is holding up.

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- **Kara/Marie:** MMS could use the GEM report and work with USGS to identify primary sources and create slip distributions as needed.

Kara: The TWCs would like to ensure that the operational forecast models are updated with the latest subduction zone data, such as Slab1.0, to align with CMTs and FFMs produced by USGS during and post-event

Dmitry: Slab 1.0 has deficiencies....which should be addressed. Some areas in Alaska.

Stephanie: USGS has yet to update it hazards maps for AK, so possibly some upcoming NTHMP collaboration there.

Jim/Stephan/Dmitry: additional landslide sources to be considered off coast of Florida, Cuba; still a lot of unknowns for landslides, working with USGS for landslides is important. USGS landslide help is needed in the evolving landslide sources... areas where slides haven't fallen. Make landslide sources for EC tsunami hazard a priority within USGS strategic plan

- Possibly MMS could draft a letter of support?

Victor: also include underwater volcanoes as potential source for emergency response issue

Stephanie: There is no tsunami coordinator for USGS. Tsunami Source working group is Adhoc. **Rick:** should it be more formal?

A list of all sources that have been used. Can we make a national database with tsunami sources. Towards this end.... Dmitry to send out and other people fill in. Add extra columns if needed. Or submit your own.

Titov: There is a list from the working group that he will forward on as well

Plan for USGS 2-day meeting before Annual Meeting (M-T) in Boulder. Co-chairs will bring this to the attention of the CC. USGS people cannot travel or have time constraints. The majority of them needed for this workshop are in Golden at NEIC. Boulder can only be a cost effective meeting place in the winter...

To Do: Come up with a list of needs. Co-chairs to send out an email to the group. Plan a workshop around them and Use it to bring the right people to the workshop. At workshop prioritize needs by feasibility and come up with a plan for moving forward. Kara can help prep the workshop. We need to bring in people from the GEM study and PMEL group to help plan this as well. Talk to Marie for names if needed.

Joint MMS & MES Meeting Begins -----

10:30 – 11:00

Maritime Guidance Update - Presentation (Wilson)

Status and what is needed from the afternoon joint work session to complete the task outcome

NTHMP has more experience with tsunamis so wants to provide consistent procedures for USCG

1. Provides context with video's showing tsunami impact on San Diego
 - Identifies collaborative efforts underway or in planning stage
 - Video: 2010 Chile (Maule)
 - Video: 2011 impact to south part of shelter island– very strong currents

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- More than 2 dozen harbors were damaged to the tune of ~\$100M over the course of 24 hours from two Advisory level events
 - Long term recovery issues, Crescent City waited almost 9 months to dredge the harbor because the sediment was contaminated with fuels and what not.
2. In 2010, initiated discussion on providing guidance for maritime community
 - a. Background on guidance direction – Puerto Rico had elements in place.
 - b. California has produced example products as a result of prototype work
 - c. Document development:
 - Hazard Analysis, Modeling, and Mapping is just about ready to hand off to MES for input
 - Two additional sections need development. These are 1) Response, Preparedness, and Education and 2) Mitigation and Recovery
 - Specifics of document (the reader is referred to Maritime Guidance document)
 - Discussion of efforts to determine minimum safe depth.
 - General guidelines mentioned
 - Christa vonH...: question about specification on time (clarity needed). Also has a problem with the use of the term 'large' for source size.
 - Laura: Integration with TWC messages?
 - Mike A: Confirms that this is developed in conjunction with Coast Guard. Also interested in integration with TWCs messaging
 - Discussion tabled for afternoon discussion period.
 - Rick summary: Safe depth is regionally different (3 regions): LOCAL: 1) West Coast & Alaska (30 fathoms); 2) Puerto Rico, Hawaii, Gulf Coast (50 fathoms) 3) East Coast (TBD – long continental shelf)
 - John-Sees this as a great advance & would love a color-coded map
 - Questions for group: Should there be (3) separate documents? Who should take the lead on development of each?
 1. Decision to leave as one document where subsections could be updated individually.

11:00 – 11:30

National Tsunami Hazard Assessment Update – Presentation

(Stroker, NGDC) Presenting for Paula Dunbar

1. Background: runs through NTHMP requested initial 2009 report
 2. Goals
 - a. 1st Assessment: Qualitative assessment of the hazard
 - b. 2nd Update of the 1st assessment with new database searches
- * The two documents, therefore, are not independent of one another

The presentation:

1. Most notable differences covered in updated report are for American Samoa, due primarily to the 2009 Samoa tsunami event
2. Need for additional information
3. Meteotsunamis have been identified since 1st Assessment, but as there has only been two confirmed reports, there was not enough information to include this category into update Assessment

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4. Differences between assessments presented in table form and discussed
 - a. Samoa upgraded in threat based on the 2009 event
 - b. CA is listed as VERY HIGH (change from last report), VERY HIGH => can expect runups in excess of 3 m every 50 years
5. Various tables of results presented, such as frequency of occurrence & tsunami events per State. Some clarification questions asked.
3. Special consideration for Atlantic Coast where landslides are expected to be the primary tsunami source
 - a. Note that more data is needed to do probabilistic and deterministic landslide source characterization and hazard for the EC
4. Summarizes USGS work and Canadian National Tsunami Hazard Assessment by Leonard *et al*, 2012. Correlation with US report bins provided: Canadian WC = high, Canadian NE coast = low
5. Summary: Assessment changes from 1st Assessment exist for American Samoa, Guam, N. Mariana Islands, and US West Coast
6. **Rocky:** Is there a recommended update cycle or is it event dependent?
Is there a plan for a press release?
Kelly: NCEI does plan to do a public release. Rocky requests that NTHMP be involved in some capacity. Good PR.

11:30 - 12:00

Update on FEMA's HAZUS for Tsunami – Presentation (*Biasco*)

Presenting for those who did the work

1. Background
 - a. FEMA funded methodology development in 2012-2013
 - b. Intention was to develop pilots but FEMA did not have funds at the time
 - c. Tamra provided FEMA contractor to do the work
2. Two scenarios were selected in conjunction with PMEL and WA DNR
 - a. Funded two Counties: Grays Harbor and Pacific
PMEL provided data into Hazus (Max H(x,y) and MaxV(x,y) at grid point (x,y).
Two scenario levels were run.
Provided a comparative assessment of Tsunami Methodology and Hazus Coastal flood methodology
3. Results
 - a. Economic Impact
 - b. Sensitivity analyses 1: (10m vs 30m DEM) – huge difference
 - c. Sensitivity analyses 2: damage functions
 - d. Sensitivity analyses 3 level 1 vs level 2
4. Contractor recommendations
 - a. Significant difference in results between level 1 and level 2 analyses
 - b. DEM resolution makes a huge difference in results
 - c. Future study should assess tsunami risk to lifeline components and consider damage from earthquake itself, primarily debris
5. Next steps
 - a. Pilots current out for RFP with FEMA contractors for Hilo and Crescent City
 - b. HAZUS, in general, is going through a major update to move all modules to web-based platform. The update activity is highest funding priority at this time.

Tim: Notes the importance of a building-by-building approach.

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1:00 – 1:45

Evacuation Guidelines White Paper – Work session and discussion (*MES leads*) Discussion will also address the decision support tool for populations at risk.

1. Basic model information and mapping output needs to be clarified.
 - a. Goal is to bring models out of 'black box' category
 - b. These maps have so far only been for planning and research, but is not quite a public product yet... and how the public product is best presented is under debate.
 - c. Use of mapping and modelling results is still being developed or might be iterative as we move along.

Dmitry: suggests adding information on:

- d. Model verification/validation (QA/QC) – someone notes that you could get some quality control data just from school evacuation practices.

Althea: reminds everyone that there needs to be an educational component for using these maps.

Nate: Maybe it is too young to be going out with this. This really is 'green' so maybe it's not a product for States to roll out.

John: There is always a possibility of this getting out to the public due to forces outside the NTHMP control.

Althea: recruited to help write the 'context'

Kara: Output format? Answer: Tool is ARCmap and data are raster

Rocky: Desired time frame for having a fleshed out draft? Nate thinks a draft can be ready for Jan/Feb annual meeting.

Continued discussion...

1:45 – 2:30

MMS Maritime Mapping Guidelines Discussion (*Wilson*)

1. Continuation of NTHMP Maritime Guidance
2. Breakthrough: Safe depth can be regionalized!
3. Document contents
 - a. Purpose, Intended audience, objective...
 - b. Products (thresh holds, duration, fluctuations, safe depth...)
 - c. General Maritime guidance – would like MES contribution
 - d. Appendices provide examples of two proposed products
 - Oregon maps
 - California Playbooks

*Concern raised about coordination with forecasts in real time.

Mike: Who are these playbooks for?

Rick: answer=Port Captains are the intended recipients of these playbooks.

John: How close is this to operationalizing this as a product?

-Products disseminated through Tweb?

Chip: Is buy-in by Coast Guard needed? – Yes!

Rocky: There is a national level relationship with Coast Guard

Rocky: Commends MMS and Rick for this collaborative work

HOMEWORK: MES assign a working group to contribute to the guidelines.

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2:45 – 3:00

Update on tsunami currents benchmarking workshop – Presentation (Kirby)

1. Describes process, defines expected goals and outcomes
2. Cites the enlistment of Pat Lynett to identify and set up benchmarks, summarize results, and spearhead findings publication
3. Summarizes findings

3:00 – 3:15

Laymen’s summary of MMS tsunami models – Discussion on DRAFT (Gately)

1. Table of benchmarked models
 - a. Fields (caveats/limitations; ease of use; etc.)

Kevin Richards: We are looking for a decision-making tool; not the specifics of the model; would also like cost information and contact.

Vasily: Can include tons of information but is the information necessary.

Rocky: Emergency managers might want to select a model and get

Kara: Should we include previous usage? (i.e., what projects were these used for already?)

John: Glossary should be provided with included terms

Tim: Notes that private companies are now using some of these models commercially. Should we be questioning the use of these models?

Vasily: Looks like we are building a resume for the models. Technical part is done but the usage is needed.

Laura: Can MMS identify some of the more popular models used years ago and comment on their usage?

Fai: Would NOAA allow us to post comments on someone else’s model?

Laura: Some country is using x. Should I be recommending a benchmarked model? If I do, I will be asked why.

Kevin R: The answer to why: these models have been benchmarked.

Rocky: Reinforces Fai’s comments. Should not post comments on anything on Federal website. Just post benchmarked models.

Christa: Very often asked if models are open sourced. This leads to commercial use.

Kara: List website access and affiliation, along with major projects or uses on back

HOMEWORK: MES provide required information.

3:15 – 4:00

NTHMP Outreach Products – Discussion Media outreach strategy (Miller & Rabenold)

1. Products
 - Who will make them?
 - How do we get them?Materials
 - Update Media Guide
 - Working group exists. Interest from MMS solicited.
Kara: will participate in working group
Althea: Can provide examples of Oregon products
Kelly: Notes the NCEI communications resource
John: suggest creation of a NTHMP hashtag

Continued discussion of possible resources and participants

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- Develop commemorative resource

Aimee parting remarks

1. Reinforces importance of work and impressive nature of collaboration

4:00 – 5:00

NTHMP Coordinating Committee Meeting

See Separate Agenda

[CC Meeting Minutes](#)

July 16 -----

9:00 – 10:15 AM

The landslide tsunami workshop (*Grilli and Kirby*)

Diff types of landslide (LS) tsunami mechanisms:

- SMF
- Subaerial
- Volcano collapse

Can have LS tsunamis occurring at smaller EQ magnitudes (6.7 for example) as opposed to EQ-generated tsunamis.

Use proxies using seafloor information. Conservative, but a first step.
Estimate volume, etc.

Workshop will be focused on modeling itself!

There are still scientific uncertainties on the modeling.

Complexity comes from large range of mechanisms. Underwater (rigid, rock, mud) slides, Subaerial (rigid, rock) slides... many types of mods required in simulations.

Paleo-slides off palos verdes shelf (los angeles). Borrero at al, 2001. Complex shapes and material props, variety of mechs, but idealization for modeling and experimental purposes.

Many NTHMP partners have LS tsunami potential: AK, OR, CA (Goleta, Big Sur, etc), HI (Kalapana 1975, big chunk of volcano facing Kona – volcanic collapse caused mass failure, GOM (MS delta, etc.), PR (Mona passage) , East coast (Currituck and many others, grand bank, ..)

Workshop rationale and proposed organization (tiger team or steering committee). Rocky would like to participate, helping with logistics and planning. Workshop targeted for next summer meeting, either right before or after to minimize costs.

- kick off meeting during summer meeting 2015 plus conference calls
- initial BM selection and workshop agenda
- select venue (before/after summer mtg 2016)
- preliminary list of potential BMs to follow

Will prepare pre-workshop webpage :

- BM data
- Workshop organization
- simulate BMs with variety of models and compare results

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-reach consensus on acceptable error threshold and models to use

Should it be NTHMP web site or separate for privacy? Start with Beta not on ***NTHMP.
Can they make section of NTHMP website password protected?

Invitation will be sent to potential participants with information to access site:

- ten supported participants from MMS modelers
- fifteen selected experts and grad students (\$20k support)
- minimum set of BM to perform to receive financial support

Dmitry question on fundable vs nonfundable: BM modeling not currently listed as allowable item. Rocky and Marie: expensive. Funds limited. May take people widely varying amounts of time. Rocky: allowable expenses include inputs to inundation models that meet NTHMP standard of accuracy or to demonstrate conformity with standards (Very close to BMarking!).

NOT: acquisition of raw data and development of models

Rick: changed ROP too

Rocky: may not be able to fund all BMing requests and hard to fund some but not others. If MMS prioritizes, that helps them make financial decisions.

Review of Slide lab experiments:

underwater rigid block slides (non- and streamlined) on a plane slope:
2D and 3D (see PPT slide for refs –Grilli, Imamura, etc.)

Subaerial rigid block slides (nonstreamlined) on a plane slope: 2D and 3D

SUBaerial granular slides (gravel, glass beads) on a plane slope: 2D and 3D
Granular means non-cohesive

Underwater granular slides (sand, glass beads) on a plane slope: 3D

Underwater mud slides on a plane slope: 3D

Review of lab experiments (this is also the review of BM cases: see PPT slides for details and list)

Subaerial granular: AK fjords, WA 1949, ..

Movie of lab experiment of underwater granular slide (glass beads) on a plane slopes: can see recirculation of material, as predicted

Underwater mud flow: no data on surface elevation.

Review of models/modeling approaches

Potential flow/Euler eq. modeling of rigid block (streamlined) SMFs on a plane slope:
Many case studies: PNG 1998, Unimak 1946, Kalapana 1975, Tohoku 2011, Goleta, Currituck, ... (Fryer, Watts, Day, Tappin, Greene, Geist, Grilli : see PPT for reference details)
Tohoku is controversial, probably too early to be community accepted.

Collaboration with USGS Jason Chaytor, who just did new mapping of Currituck slide (cores, etc.). Don't know what type of LS was generated

Kara: What about Grand Banks for a BM? Only have rupture time of underwater cable, not well mapped. Don't know geometry well.

Dmitry: Seward or Whittier may also be good case studies.

**Rigid slide/inviscid 3D BEM-FNPF
Computations vs. gage measurements
NHWAVE simulation of Enet and Grilli's slide experient**

See ppt for more details of Navier-stokes modeling

Modeling rigid, non-streamlined, slide as viscous fluid

Two Case studies:

1. Hypothetical: CVV flank collapse (Abadies et al., 2012). Canary islands. Very young volcano. Evidence of at least 2 prior collapses (>100,000 years old?). Simon Day thinks see evidence of recent movement

extreme scenario vs. more moderate scenario (450 cubic km vs. 80)

modeling moves from 3D domain (cylindrical) then boussinesq eventually to propagation, and then finer resolution boxes as nears shore (see simulation of it hitting Chesapeake Bay)

2. Papua New Guinea (PNG) 1998. Very complex geology (Tappin, 2003). Amphitheatre. Simulations show that LS source fits observed runup much better than straight seismic source.

Currituck (Grilli et al, 2015, Natural Hazards)

Chesapeake Bay.

Possibility of breaking into undular bores. Shorter wavelength breaking waves. Don't affect inundation too much but provide high momentum flux from breaking waves.

Discussion

Dmitry: interested to see a BM that has a subaerial LS and realistic geometry in the harbor. Have subaerial landslides that are at base of harbor for AK...

Jim: 1975 case is similar, but observational data base is sparse.

Maybe need to have people suggest cases?

Fai: some of the models are coupled, so what is the objective?

Are we validating the landslide model or the ocean model, or a coupled model?

Dmitry: a complicated situation, landslide model and ocean model... we are not benchmarking only the landslide model at all... (Jim) there is some of that... (D) do we specify the dynamics of the rigid body or let the model determine it...?

Kara: Which of these 5 types is MOST important for modeling the HAZARD (areas where we have "very high" listings) for the US coastline. Then which is best for EC and GoM where this is the most likely type of event to happen. What types common in Alaska, CA, WA, other places?

Stephan: gives a long list.

Kara: As BMs are developed, need to make sure we hit the most common/important cases.

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Dmitry: PNG is a good BM

Designated a steering committee with the following members: Dmitry, Juan, Fai, Vasily, Alberto Lopes, and Rocky wants to help with the workshop preparations.

Timeline:

Next couple months conference calls and emails. Draft proposal.
By October 1 have list of BMs to discuss via MMS conference call.
Also a list of attendees (non-NTHMP people).

10:30 – 11:00 AM **DEM production/issues** (*Stroker, NGDC*)

(note: NGDC is now the National Center for Environmental Information, NCEI)

Jim Kirby comment on new USGS subaerial data for Hurricane Sandy area...

Marie question about whether state partners see DEMs before they go public. Kelly said that they always go out to the state partners and they rarely get a response. Tim clarified that maybe they don't go to the right state partners. Maybe there needs to be a list. Kara said this has been discussed before and that the NTHMP reps are the primary state partners. Should be sent to them before being sent to other state agencies.

Dmitry circulated a document asking what different states wanted regarding DEMs. [The list he compiled should be used.](#)

Chip asked what database they're using for Guam and CNMI; have been waiting on information in order to be able to respond to Dmitry.

Dmitry wants the wish list for FY16. First need to find out what FY15 items were done. Chip can't find out what the latest DEMs are; he hasn't been able to find them. Kara found that Guam DEM 1/3 arcsec (10m) completed 2008, Mariana Trench 6 arcsec 2012.

Fai's students complain that DEMs from NCEI don't compare with aerial photos (more than a pixel). Kelly said that NCEI needs to hear problems like that, so please let them know!

First test should be to have students capture the issues in a powerpoint, etc. and send it back to NCEI.

Some people (for example Chris Goldfinger) collect data on NSF funds but don't share it openly; they don't even share where it was collected.

Over and over we are noticing a need for a well documented procedure for DEM development and delivery...

Summary of steps:

1. Need list of all state point-of-contacts (POCs) to make it easier for Kelly.
 - a. Each state rep will be the POC, and it is their responsibility to disseminate information and needs forum NCEI further

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- b. The list of state reps is kept up-to-date on the MMS website
2. DEM prioritization occurs at the summer meeting
3. Once a model is selected for development, all known and local data will be passed on from the state POC to NCEI in timely fashion.
 - a. States need to let NCEI know about problem areas, issues, mismatches.
4. NCEI will notify to state POC via email when the DEM is complete and ready for review
 - a. MMS co-chairs will be CC'ed on the email
5. The state POC will have one month to review (with an option to extend for another month).
 - a. States need to let NCEI know about problem areas, issues, mismatches.
 - b. Co-chairs will follow up after 3 weeks if no feedback returned
6. NCEI will consider the DEM final and post to their website

***This process is to be written up and submitted as a **Guidance DEM document**

Rick question on CA issues: Long Beach – have you remodeled using new version of L.A. grid? Kelly said could extend grid into Port of Long Beach. Still seem to be some questions. Not sure if grid was redeveloped; may have just been a spot correction. Kara and Marie will look into it.

DEM wish lists for FY16: (see Dmitry's table in the PPT that he updated on the spot)

- Destin
- Cape Coral, FL Region south of Tampa Bay
- Possibly CNMI or Guam
- False Bay
- Larsen Bay
- Port Lions
- Karluk
- New lidar of EC could provide updates.
- Kelly will look into data,

Rick: CA doesn't need anything; AK is more pressing.

Rocky: If there's any work proposed by CNMI for FY15, regretfully the grant will not be awarded.

Tim: asked in general about the priority about having one new data set cut into these as opposed to all new? Tim should talk with Sue and Kelly. If there's new data and you'd like to see an update, discuss it with them to help them prioritize. Don't need anything for FY16.

Jim: don't need update unless new data is collected. Although, do have new subaerial data.

Kara: Maybe prioritize at our 2-month call.

Dmitry: Why do we have to prioritize?

Kara & Marie: Funded for 4 NTHMP selected DEMs per year and 4 PMEL-selected DEMs per year (for forecasting). If the NTHMP 4 overlap with the PMEL selected ones, they go down the list of NTHMP priorities.

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Fai: using mean high high water for datum? That's problematic for a large area. No, it's mean high. Rick said they offered to do one that was maybe NAD80 instead. A different datum can be used if it's requested. Fai uses mean sea level and makes local adjustments. CA would still want mean high water for inundation mapping. Marie said that can introduce slopes because each tide gage is different. Rick: may be good to find out how much extra work it is to use Vdatum. Marie said they do the original datum first and then the adjustment.

Agenda change: Dmitry's talk will be later today.

11:15 – 11:30 **Update on Steps for MMS Benchmarked Models** (*Gately*)

Updated matlab script will be available on NTHMP website.

NOAA can't make an approval on a recommendation but NTHMP can.

Jim: description of issues is different than what's in table 4. Like this version (what Kara's showing) better than the report's table 4 version. Lots of discussion.

Should draft papers be available for review by other people than just MMS?
Could be inundated with models to be benchmarked. Could be good or bad.

Presenting to MMS: can request a delay if don't approve, if it's not looking good.

Kara will update the document one more time (get rid of all the comments) and send it out in about a month.

Do we want to keep the requirement that they're open source? People could use the models in inappropriate ways.

11:00 – 11:15 **Update of Inundation Map Guidelines Document** (*Nicolosky*)

See Dmitry's updated document.

Discussion of adding something about an external peer review of maps, on page 2

Discussion of how the maps are reviewed. USGS standards? Individual state standards? Internal vs. external standards. Rocky suggested to trust the states that they'll have people developing maps following reasonable standards. Adding peer review to the process will bog things down. Rick suggested a softer statement that new maps, or maybe just their inputs should be presented to the MMS. Marie asked if we want to burden the MMS with that much extra work, also that there was a task identified yesterday to compile all the sources used by the NTHMP partners. Rocky suggested that if there isn't a problem we shouldn't be taking on extra work. Rick suggested as example that the east coast group presented their maps and got feedback from MMS. Tim pointed out that maps are notoriously hard to review. Rick suggested that could add "if the modelers want feedback, they can present maps to the MMS".

NTHMP/MMS 2015 Summer Meeting Notes

Rewrite #6 on page 2. “all relevant tsunami sources must be considered” might be too encompassing. “Relevant” means different things for different uses. Change to “a suite of tsunami sources reviewed by the state geological survey or an equivalent entity”.

“Collaboration between forecast and inundation modeling groups is encouraged”. Good sentence. Leave as is!

“The NTHMP MMS is the review body to ensure NTHMP funded proposals generating inundation maps meet these guidelines”. Do we really want to add a review process, or maybe just a discussion of the quality of the product? Rocky: semi-annual progress review: just are you making progress, it’s not about the quality of the work. Want the grant review process by the co-chairs to be “yes” or “no”, not details that can add difficulties. Table this discussion and pick it back up via email.

Map categories: do we need 3?

Table whole discussion for now, running long.

11:30 – Noon **Maintenance: Review & update of outdated materials on website** (*Gately*)

A redrawn version of the website was presented with more organization and structure. Many things are out of date. Suggest adding dates to documents or links so users know when they were updated. Maybe add a nice graphic.

All the benchmarking documents should be organized together, maybe open up to their own page. Modeling guidance: it has the only link that opens to a separate page as opposed to a pdf.

Under GIS products: Would like people to be able to quickly find the best website location for accessing NTHMP inundation mapping products... including online viewers and GIS downloads.

Kelly has a nice living document on google drive for DEM updates and development. We could use it and maybe do an update to the website every 6 months or so. (Grab from the google drive every 6 months or so, NOT LINK TO THE DRIVE).

Kara will send out an updated MMS website design (with updated documents) to Rocky and they will work together to come up with a mock-up website, which MMS can then review before going live.

1:00 – 1:30 PM **Review and Evaluation of MMS Performance Metrics (new tasks and guidance based on the NTHMP Strategic Plan)** (*MMS Co-Chairs*)

Update outcome terminology: change to “inundation and/or evacuation maps” instead of “all NTHMP-funded inundation model results” publicly available.

NTHMP/MMS 2015 Summer Meeting Notes

Marie suggested putting things on big discovery portal (NOAA's?)

Show of hands who's testing higher resolution model results: CA, WA, East Coast ...

Develop a list of harbors and ports soon, so that can see how many need to be done to meet 25% by 2017. How define maritime products: currents, playbooks, overtopping, offshore safety zones; the key is maximum currents. (Work on that one). Rick suggested that probabilistic work could also fall under this.

=====

MMS co-chairs: Finalize MMS workplan for FY15 and FY16

See Kara's notes.

All comments on maritime guidance by August 10. Rick will send a clean version.

Tsunami Currents BM workshop proceedings.

Draft by Pat out for review by mid august

Steering committee to begin work on intro: Develop draft oct.1?

No cost extension has been approved

USGS collaborations

-letter of support

-develop workshop planning committee: Gately, Ross, Wilson

List of needs from NTHMP/MMS for USGS (need it ASAP): these needs should include MES (Nate will send email asking for their input)

Then Nate and Stephanie will come up with USGS people to meet those needs

.....[see Kara's ppt]

2:15 – 2:30 PM **Items needing CC approval and planning for the 2016 Annual Meeting** (*MMS Co-Chairs*)

Gary Chock offered to speak on ASCE tsunami standards

2:45 – 3:15 PM **NHWAVE - Tsunami inundation benchmark presentation to MMS** (*Jim Kirby, East Coast*)

Benchmarking: Synolakis et al. from PMEL

10 BM tests (see Jim's ppt)

NHWAVE Model description: fully nonlinear non-hydrostatic 3D solver for surface wave motion developed by Ma et al (2012). (see ppt for more details including governing and momentum equations, grid configuration, time stepping and spatial finite volume scheme, hydrodynamic considerations).

Grid configuration: Godunov-type finite volume method.

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All code is available to everyone. (Only one part is from somewhere else and it's publically available).

Analytic BM

Documentation provided to MMS

BP (BM Problem) 1: solitary wave on a simple beach.

BP4: solitary wave on a simple beach (breaking case and nonbreaking case).
Fai Cheung pointed out that waves can become very steep if you don't turn off the dispersion term.

BM6: solitary wave on a conical island by Briggs et al (1995)

BM7: Monai Valley. Don't have a comparison of where wave gauges are.

ENET-GRILLI LANDSLIDE:

Discussion: need more information from USGS to help identify where the potential slide deposits are now and how big they are, instead of modeling ones that have already failed.

Waves die off faster than seismically produced tsunamis.

Dmitry: runup at Monai:
How to go forward? Circulate report.....

3:45 - 4:15 PM **Revisit any MMS unfinished business, items of concern, or hot topics of discussion (MMS Co-Chairs)**

3:30 Rick: Maritime response planning.
Example from Marina del Rey and King Harbor workshop 6/4/2015
(see Rick's ppt with agenda for marina del rey and King Harbor tsunami response playbook workshop)

Tabletop exercises using playbook. Cascadia (less than 2 hours to respond). Northern Chile.

Evaluation of docks overtopping piles using FASTER water-level value
Question: in terms of overtopping, how well do you have it timed/correlated to the tide?

Question: isn't it cutting close on that piling in the example photo? Answer: There's 30% built in so that's as high up the piling as it will go.

Keep the maximum line on the maps? Keep the map with max inundation line for the community in the playbook but put the decision back on the community.

Question: how confident are you with your error bars that you're not exposing yourself to liability? Rick responded that they're trying to be very conservative.

Units: m/s vs. knots (about 1.1 mph)

NTHMP/MMS 2015 Summer Meeting Notes

Let Rick know if you'd like any information. Fai would like a summary. Rick will be putting that together.

Dmitry: Going forward with the mapping guidelines. Will send the version with yellow highlights and ask us to review them.

4:12 Summary and Adjourn

NTHMP/MMS Workshop: Tsunami Currents Meeting Notes

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Workshop Notes: Monday, Feb. 9th, 2015 ¹

In attendance: <http://nws.weather.gov/nthmp/2015annualmeeting/attendees.html>

Introduction: MMS co-chairs, Rick Wilson & Kara Gately

Purpose and Goals of Workshop [Wilson] - [Presentation File](#)

Purpose: satisfy requirement for 2013-17 NTHMP strategic plan to evaluate numerical accuracy of tsunami currents.

Goals:

- Compare predictions
- Establish community standards
- Can benchmarks be improved

Outcomes:

- adequacy and accuracy of currents
- Group to write report to summarize the workshop, results, and process
- Follow-up on benchmark improvements

Q. If a model passes these tsunami benchmarks, are they valid for inundation too? A. No... MMS reminds modelers that they CAN do the benchmark problems individually and then contact MMS for pass/fail approval. MMS will be providing more information on this process.

Overview of Benchmark Problems [Lynett] - [Presentation File](#)

Objectives: get a handle on accuracy and variability for decoupled velocity

1. **BM#1:** not the most geophysical but good to get a handle on model runup
 - a. Data to compare
 - i. Time series of velocity components in wake
 - ii. Can model get the magnitude and frequency of the vortex shedding?
 - b. 3 different configurations
 - i. Dissipation submodels included, 0.01 mannings value, HYDROLOGICALLY SMOOTH
 - ii. Optimized results – get your best fit.
 - iii. All dissipation submodels NOT included => no spinning or wave should be created... what is the equivalent numerical dissipation and how does it compare to the physical dissipation

¹ These notes may have some inaccuracies and the reader should consult the forth-coming official MMS Workshop proceedings report for a full description of the workshop, modeling techniques, and definitive results.

2. **BM#2:** Hawaii ADCP from Pearl Harbor 2001
 - a. Boundary inputs were standardized as best as possible by putting in wave right above harbor
 - b. Low (6 min) sampling rate on the ADCP data
 - c. Questions to consider:
 - i. What level of precision can we expect with regards to resolution?
 1. 20 m
 2. 10 m
 3. 5 m
 4. Look both at local and spatial specifics
3. **BM#3:** New Zealand ADCP 2011 event
 - a. A good case for looking at how tides may play a role.
 - b. 3 cases:
 - i. Drive model with free surface elevation
 - ii. Tsunami only simulation
 - iii. Tsunami + tide simulation
4. **BM#4:** Flow through a built environment (model must be able to resolve buildings)
 - a. Requires moving shoreline
5. **BM#5:** Breaking solitary wave past conical obstacle

Modeler Presentations

Yalciner and Kanoglu (METU, Turkey) - BM problems: 1,2,3,4,5 - [Yalciner Presentation File](#)

NAMI DANCE model - Solves NLSW, based on TSUANMI N2, TIME project of UNESCO

- **BM#1**
 - Dissipation submodels included - poor timeseries fit
 - Optimal - Vortex flow is there and reaches steady state
 - Dissipation submodels NOT included - vortex flow not there
- **BM#2**
 - Resolution comparison - all same
 - No difference between different mannings
 - Pretty good match with E-W/N-S ADCP timeseries (the 20m res almost looks better here)
 - Maximum speeds are adequate, but better inside the harbor than at entrance
 - (Pat) Did you look at the animations or speeds? A. haven't looked at them yet
- **BM#3 Tauranga**
 - Incident wave timeseries have good fit for surface elevation and ADCP
 - Tide gauge timeseries has large discrepancies after 20 hours
- **BM#4**

- Compare free surface velocity AND momentum flux information recorded through tank
- Modeled momentum flux is very low (B1)
- B6, B4, B9 have fair comparisons...
- BM#5
 - Free surface elevation measurements look good for Gauge 1,2... 4,5
 - Modeled data looks worse behind the island (gauge 3,6)
- BM#4 expanded... (using MOST and ComMIT) [Kanoglu Presentation File](#)
 - Loaded up grid for Seaside and buildings into ComMIT
 - Created boundary conditions
 - Some issues with arrival times, magnitudes adequate
 - There is some sort of scaling issue going on... with MOST, the results are very sensitive to how the problem is set up
 - (Pat) if time isn't scaled right then your velocity shouldn't be scaling correctly either
 - (Diego, Pat) try using different friction coefficients

Q. Are we asking too much to try and fit with just ONE manning coefficient?? A. Likely yes. (Diego A./Pat L.)

Horrillo and Knight (NTWC, AK) - BM problems: 1,2 - [Presentation File](#)

ATFMv2 model

- BM#1
 - Problems:
 - NO vortex shedding was ever seen with the original upwind-downwind scheme
 - However, advection treated as in "VanLeer" Manner with U/V as piecewise linear functions across the mesh (to avoid loss of calculation of the velocity), DID produce good results
 - couldn't reach a steady state right away...
 - OPTIMIZED: M=0.015, and horizontal viscosity of $5 \times 10^{-6} \text{ m}^2/\text{s}$ gave good results for both T1&T2. Max speed .24 m/s
 - Indication that bottom friction is not enough, need internal friction
 - INVISCID result: (no horizontal friction in model) keep manning = 0.01
 - From the modeler:
 - There is a need for higher order scheme
 - Extremely sensitive to small variations
- BM#2
 - Hilo TG amplitude was a little low, period pretty good. Control point looked good too.
 - Q. (Pat L.) what's going on in the first 30 minutes? A. Up/down dip... not sure, will follow-up with Bill Knight
 - reasonable ADCP fit
 - PROBLEM: unsure how to do the best match with 6 min averaged data

- Next time modeler hopes to try to match the amplitude at the tide gauge, not the control point, in hopes of being able to better achieve the V component at the gauge
- Resolution changes had no effect

Arcas (NCTR) - BM problems: 1,2,3,4 - [Presentation File](#)

MOST model

- BM#1:
 - was challenging to get it optimized, highly sensitive over the submerged island
 - Inviscid, $n = 0$: (no physical friction, but model has numerical friction) we get a wake with two standing vortices behind the island. It settles into a steady state
 - Prescribed, $n=0.01$: disorganized vortex shedding, U-vel is underestimated on gauge1
 - Optimized, $n=0.025$: nice vortex shedding that reaches steady state quite soon (U-vel for gauge behind island, still underestimated the horizontal velocity => wake behind the island is a little longer than it should be.
 - (Juan) including the horizontal velocity equation will shorten that
- BM#2:
 - ISSUE: Tide gauge tsunami arrival is before the max peak at the control point.
 - No difference in resolution changes. For wave amplitudes problem is very converged.
 - The overall magnitude of the currents is there, even though the peak to peak and timeseries waveform may not be exact
 - E-W and N-S current speeds show DO changes in resolution, but highest resolution is not always best. Low/high seem to have similar results, but the medium resolution has differences
 - (Pat) Late timeseries peaks may be from eddies.
 - $Cf=.01/.03$ results for tsunami currents are quite sensitive to the friction coefficient
- BM#3:
 - Tsunami Only:
 - good fit with sea elevation time series
 - tsunami currents: decent fit with ADCP data (U/V) but speed is underestimated by MOST
 - produce a solution with tidal velocities
- BM#4:
 - 0.025 friction coefficient to stabilize the code with use of buildings
 - Pretty good agreement with first three points, but not the last... have very small modelled values there, probably because of the high friction used
 - Model results have delayed arrival... To optimize, modeler would like to use a different friction coefficient from wet and dry points
- BM#5:
 - top the island, as in video

- Good comparison with amplitude and the overall features of the flow (looking at snapshots from experiment with model snapshots)
- Arrival time is good for points in front of the island, but as it travels around the island and comes back around the island, the arrival times become delayed
- Velocity is overestimated behind the island

Q. (Fai) Does the model make it to the top of the hill behind the island? A. No. I believe I'm using too much friction.

Comment on BM#4: (H. Yeh) The control point is VERY important, interested in the reflected wave as well. On BM#1: 2D model can't do without tweaking the parameters, flow become very 3D, same with #5. Using an unreasonably large value of N is necessary to promote mixing... Could be very unrealistic, but because of the nonsteady and non-uniform flow pattern, it works.

Nicolisky (UA-F, AK) - BM problems: 1,2 - [Presentation File](#)

Alaska Model

- BM#1:
 - $n=0.012$ (optimal), looks good with nice vortex shedding and easily reached steady state
 - Uvel underestimated for all Manning Coef's
- BM#2:
 - Control point: great fit (model result from NEOWAVE)
 - Tide Gauge: good initial fit on waveform, but model overestimates the amplitude and the fit decreases over time
 - Decent match with ADCP data, but again, hard to know with the 6min averaging
 - Max speed at 3 m/s
- BM#4: Good comparisons
 - Matches at control point
 - Nice fit for flow velocity and depth at all points but with late arrival on the last point

Tolkova (NWRA, WA) - BM problems:1,2,3,4,5 - [Presentation File](#)

Cliffs model - (MOST with the wall in between wet and dry nodes)

- 2 possible difference schemes for $Q(k,j)$ steady state equation
 - centered difference (Cliffs)
 - average between left and right cells (Cliffs2)
- BM#1:
 - $N=0$ vortex shedding
 - $N=0.01$
 - $N=0.015$ optimal

U1 is over-estimated by model for both $n=0.01$ and optimal

Extra dissipation of reflected wave in MOST model, but Cliffs solves this (for example: MOST gave correct timeseries for 3 hours, Cliffs for 6...)

- BM#2:
 - Input a single pulse into the boundary to judge response at control point.
 - Control point is dead on, Hilo TG is adequate
 - Comment from the modeler on the need for better benchmarking using real observational data not simulated inputs
 - Good fits with e-w, n-s currents, only minor differences between the resolutions
 - Cliffs2 (using the second type of differencing scheme) showed better results than Cliffs
- BM#3:
 - Again sent in unit pulse
 - Good results for all cases
 - Huge spatial variability in the BM setup, there's a 3 x 3 area around the ADCP location
 - Modeling using the exact location of the ADCP shows some problems
- BM#4:
 - Input WG (5m) thru left boundary
 - Overall, good-to-decent fit through all points...Not quite matching overall amplitude and waveform for first few stations
 - A no houses comparison was made as well
 - Note that the gauges are down a clearing, not behind house. Explains some of the similarity in the with/without house model runs.
 - Used the same coefficient from the paper, for both.
 - Acknowledges that it would make sense to have a different friction coefficient.
 - Some concern and discussion about the BM#4 setup and the existence of a wall across the south side.
- BM#5:
 - Later arrival for points behind the island
 - Modeler feels that MOST cannot do this benchmark because it cannot handle this type of topography.

BM#3 extended: (Modeled by Dmitry N.) In ocean, you can't observe the whole wave front. You have DARTs. You can use impulse response to forward model, and you only need a single DART timeseries, with pre-computed responses that have nothing to do the source.

Pre-computed response control type modeling DOES rely on the problem being linear, and wave reflections do have a non-linearity but it wasn't an issue with these BMs.

LeVeque (UW, WA) - BM problems: 1,2,3,4,5 - [Presentation File](#)
GeoClaw - no dissipation terms, adaptive refinement grid resolution

- BM#1:
 - $N=0.015$ (optimal)
 - Have to increase the velocity to get steady state shedding
 - No run with no friction, but 0.001 still has shedding, albeit more chaotic
 - Very sensitive to parameters in the numerical method (even time steps)
- BM#2:
 - Hilo using full propagation from Japan - pretty good fit on observations - TG location very sensitive to changes
 - Talk about the ADCP measurements in the vertical. Lots of 3D structure to flows that we can't hope to capture with 2D simulations
 - difficult to match with time history because of the transportation of eddies back and forth across the comparison points.
 - Discussion on this, and that in general, with the existence of eddies, trying to match timeseries exactly doesn't make a lot of sense
 - Slightly bigger areas of max velocity when the grid resolution is refined from 20 to 5, but same patterns
 - No difference in control points for varying resolution
 - Modeler Q. how well should the match at the control point predict the fit at the TG
 - Our model is not capturing what the EQ model that was used to create this benchmark got...
- BM#4:
 - Good amplitude match at gauges, but no reflected waves
 - Model guesses because model doesn't have dispersion?
 - Reasonable flow depth, last gauge poor
 - Reasonable velocity and momentum flux, but again last gauge poor

Yamazaki/Bai (UH, HI) - BM problems:1,2,5 - [Presentation File](#)

NEOWAVE model - Hydrostatic hybrid scheme -> "breaking termination" non-hydrostatic, and flip back and forth.

Some prior model validation through 2011 Tohoku tsunami (Honolulu coast and Penguin Bank)

- Can reproduce tsunami induced current as observed on HDFR near Penguin Bank
- BM#1: (note: resolution does affect the shape of the conical island)
 - 2 cm resolution (tried, 1,2 ,3) gives best results
 - No viscosity incorporated yet
 - As resolution increases, so does the strength of the vorticity as well as the oscillation frequency of the vortices
 - With $n=0$, modeled vortex results are still the same
- BM#2:
 - Had to fill in the grid boundary edge to keep model stable.

- Model results do not depend on resolution
- Pretty good fit for amplitude and velocity time series
- Strength in vorticity increases with increased resolution, but the general characteristics stay the same
- BM#5: $n=0.012$
 - Resolution does not change results
 - Vortices are generated in wake and around the island
 - The initial wave profile is not well resolved, although amplitudes are fine
 - Vortex strength is weaker than in higher resolution, but general pattern is the same
 - The run-up process involves vortices as well

Conclusions:

Can reproduce the mean flow (tsunami induced current) which is less sensitive to resolution

Numerically generated vortex field depends on:

- Spatial and temporal resolution
- Bottom friction
- Numerical scheme
- Generation mechanism

Lynett (USC, CA) - BM problems:1,2- [Presentation File](#)

COULWAVE model

Backscatter model is important for perturbations (interface mixing) - though it increases the computational time by a factor of two, so only used when needed to show a difference

- BM#1:
 - Optimal (1cm resolution) and using backscatter model
 - Roughness height = 0.015 hydraulically smooth
 - All dissipation models off (when no limiters used, simulations crash from instability) – no steady state pattern achieved
 - Prescribed bottom friction: resolution of 0.015m
 - Friction factor formulation is very important
- BM#2:
 - Control Pt.
 - Changing the resolution has no impact
 - Input wave looks fine, 20 m resolution output off by 20 cm.. or so
 - Numerically converging at 20m resolution
 - Time series differences better done by subtracting the wave envelope
 - 5 & 20 m resolutions match, but the 10 meter had an eddy at HA25...
 - ...something worth considering
 - HA26 eddies the whole time
 - Eddy variability and error are quite similar

- Variation amongst resolutions is only where the eddies are => 20 meters likely ok in areas where you don't have eddies

Modeler's leaving thought: In areas where tsunami currents are controlled by eddies, what value does a deterministic solution have?

Zhang (VIMS, VA) - BM problems: 1,2 - [Presentation File](#)

SCHISM: Semi-Implicit Cross-scale Hydroscience Integrated System Model (3D model)

- BM#1:
 - phase is very sensitive to model inputs, Δt and C_d
 - 2D
 - With dissipation, $n=0.01$
 - Without dissipation, $n=0$ => no flow (for 3D as well)
 - 3D with dissipation and 10 vertical layers
 - Large differences between 2D/3D models (3D performs best)
- BM#2: jetty resolved by splitting triangles by 4 for grid resolutions, took isobaths line as the upper boundary for Hilo harbor entrance (only did 2D modeling on this)
 - No change with resolution (it seems this model did not have the troublesome eddy off jetty that others did which caused the 10m resolution to be different.
 - (Pat) looks like the main eddy is larger in your model than the others
 - Pretty good fit overall at ADCP and tide gauge

Macias (Univ of Malaga, Spain) - BM problems:1,2,3,4,5 - [Presentation File](#)

HySea model – composed of several different numerical schemes depending upon the problem.

- BM#1: was most difficult for the modeler of all the problems
 - 112 numerical experiments - Problem extremely sensitive to changes, wanted to know more
 - 1st, 2nd, 3rd order methods
 - Friction law,
 - changes in friction coefficient
 - changes in boundary conditions
 - Problem extremely sensitive to changes, wanted to know more
 - Changing the Manning coefficient actually ended up having the most positive effect
 - Optimal choice was difficult
 - Amplitude and velocity had different best configurations
 - Friction:
 - Higher sensitivity for low values
 - Lower sensitivity for higher values
 - Boundary Condition (BC)
 - Implementation is crucial

- If perturbations do not leave, they become problematic
 - Order:
 - Don't even bother with 1st order
 - 3rd not necessarily better
 - Higher the order the better the BC must be
- BM#2:
 - good match at control point
 - good velocity and amplitude comparisons at the ADCP
 - sensitivity to friction
 - Hilo TG fit is pretty good
 - Very little sensitivity to resolution
 - Although modeler notes resolution outside the harbor is important
- BM#3:
 - Tsunami only – good fit
 - Tide only – good fit
 - Tsunami+Tide – good fit
- BM#4: good fit, but again, no reflected waves
 - Didn't quite get initial flow depth data, but the rest fit well.
 - This part of the talk was covered very fast due to time restraints
- BM#5: non-dispersive versus dispersive (for the first time)
 - Dispersion is mandatory for this problem
 - Friction has more of an effect for locations behind the obstacle

Model run times on GPUs are fast. A 50x speedup on 1 GPU. 10 GPUs gives a 277x speedup – a full Tohoku run in ~ 7 min.

Pampell (TAMU-G, TX) - BM problems: 1,2 - [Presentation File](#)

TSUNAMI3D model – optimized for submarine landslide cases (3D)

- BM#1: was most difficult problem for this group
 - Optimal solution
 - Vortex shedding with steady pattern
 - Captures velocity, amplitude, and period – gave gauge1 a little lower than obs
 - is inviscid
 - has artificial viscosity (10^{-4}) same as the effective viscosity for this flow
 - free slip BC
 - N=0.01 (experimental friction factor)
 - No slip BC – “logarithmic law of the wall”
- BM#2: Reasonable fits... good at control point, not quite as good farther in. Smoothing helped when comparing results to the ADCP data (difficulty comparing with the 6 min data again)

(Pat) Numerically fine, but not really geophysically correct – model does not show eddies like the others do.

Discussion:

Q. How best to compare among models using two point sources which have eddies going back and forth?

Q. Can the models be used for our maritime hazard purposes? Maximum velocity is important for NTHMP.

We need more observational data.

- Q. What is most important to model correctly? Eddies off shore, near shore currents, etc? A. It depends upon the need... calm areas, boat entrance to harbor, etc.
- Discussions about accuracy already... Q. but are we addressing the ADEQUACY of this tomorrow?
- For the engineering community, height of crest to prevent inundation, maximum depth for scour, forces applied to a ship (max vel.), time of arrival - what the engineering community needs is a clear report or documentation of these assumptions
- From the Emergency Management perspective, real observational scenarios are best and it was surprising how well each of the models did on BM#2. Encouraging... or we're all doing it wrong.
- Q. Could we talk about modelling tides tomorrow (Zhang)
- BM problems forced by timeseries, engineering uses a ground movement for source

The following request from MMS was announced and sent out via email: Please provide 1-3 things which you feel would improve the tsunami current benchmark problems, setup procedures, and/or presentation of model results.

Workshop Notes: Feb. 10th 2015 ²

The Potential of Near-Field HF Radar Tsunami Velocity Observations for Alerts and Heights Based on Modeling [Barrick] - [Presentation File](#)

An overview on tsunami detection from CODAR HF Radar sensors:

- How HF radar “sees” the tsunami
- The development of a tsunami detection algorithm for use in early warning
- HF radar observations of tsunami currents can be used to infer the wave height near the coast, when used in conjunction with good tsunami models

Questions:

1. Elena Suleimani: What is Q-factor: Non-linear empirical trigger unrelated to velocity.
2. Elena S. follow-up: How are tsunami velocities distinguished from others: Spatial scales
3. Diego A.: what you are measuring in wave elevation? No, we measure the velocity: two velocities: orbital and phase (the big velocity)
4. Diego A. follow-up: Which velocity is measured: Answer: orbital measured
Compared with data? No, with ADCP velocity data only

Modeler Presentations

Kirby (UD, DE) - BM problems: 1,2,3,4,5 - [Presentation File](#)

Questions:

Chip Guard: On #3, how wide is channel?

Kirby defers to Grilli who says to count the grid cells: each are 40-meters. 15 cells x 40 == 600m wide.

Zhang: If you turn off all friction and dissipation you get vortices. Says that he represents the only group who couldn't get vortices.

Juan Horillo: Provided his thoughts on 3D model. Results between 3D and 2D do not make sense to him.

² These notes may have some inaccuracies and the reader should consult the forth-coming official MMS Workshop proceedings report for a full description of the workshop, modeling techniques, and definitive results.

Kirby: Thought it would be worth pursuing, particularly with 3D models, 2-D models over-predict eddy energy. 3D tend to under-predict

Grilli: Surface elevation varies very slightly within the ADCP. Not a lot of variation in surface elevation but there is great velocity field variation

Lynett: Points out that feature seen in plot isn't eddies

Diego: Comment - Areas in where there are differences is where there are eddies; Velocity at 20-m resolution looks more like 5-m resolution than 10-m resolution.

Kirby: Don't have vorticity field to look at here with me.

Diego: Comment - He did plot the vorticity and sees an effect of eddies

Diego: Comment - Only problem for which all models are getting the same result for a real-life case.

John: Flow depths were dropping substantially: Requests comment on changes taking place; is reflection taking place between measured areas?

Kirby: cannot comment at this time

Dmitry: Comment – possible reason for grey band in plots

Dmitry: Hilo harbor: models produce different results.

Grilli & Kirby speculate movement by the current string.

NOS person? Nope; upward looking ADCP

Roeber (Tohoku University, Japan) - BM problems: 1,2,5 - [Presentation File](#)

- As shown in all presentations, u-component is underestimated by model. Off by a factor of two so 'wonders' if there is something wrong with the data.
- Used full domain; has seen others clip the domain but he used the full domain.
- He did modify bathymetry

Questions:

Zhang: #1 results – 1st gauge, the gauge is located at the end of the circulation zone so you might be pulling data out from the wrong location. Zhang had good results with 3D model.

Lynett: Clarification – Zhang didn't move the gauge – don't move the gauge

Li (AECOM, CA) - BM problems: 1,2,5

Presented by Hong Kie Thio

Clawpack-based code (inundation) GeoClaw, FUNWAVE

- Essentially uses GeoClaw except for a modification to use fixed telescoping grids. They find it to be faster and provides better performance.
- Ran old benchmarks too – looks ‘pretty good’ but there are some issues in run-up.
- Runs through current benchmarks (#’s 1, 2, 4, 5)

Questions:

1. Elena Tolkova: Code is based on GeoClaw?
Thio: yes
2. Tolkova: Please explain why there is no inundation in bottom panel of #4.
Randy: Depends on Manning Coefficient and Grid resolution.
Diego and others: found the same low inundation results
Hong Kie does not know what parameters were used – will check

Arikawa (PARI, Japan) - BM problems: 1,2,4 - [Presentation File](#)

STOC (2D) & CADMAS-SURF (3D) models

- Quasi-3D model
- STOC: Storm surge & tsunami simulator
- BM 1 – STOC-ML (2D) results == bad; 3D results == good
- BM 2 – STOC-ML == good results
- BM 4 – STOC-ML

Questions:

1. Lynett: What is numerical dissipation – what are advection terms (how are you handling advection terms) – Leap frogging in time and space so have fairly large numerical errors
2. How do you choose eddy viscosity? Ve
3. So far lab scale, Ve is probably very very large
4. Zhang: Finest grid is for 3D model usually people do opposite;
Lynett: Wondering why you made grid choice; Why is 3D model used in inner most nest; closest to shore

Presenter: Calculation time maybe

Lynett: answer - Want to resolve flow around structures; something that 2D doesn’t do as well.

5. Rick: Harbor areas
Port/Harbor areas we use STOC model
Are models publically available? Yes
Are data publically available – probably ok for research purposes

Sampath (Centriod Pic, CA / Idaho National Labs) - BM problems: 1,2,5 - [Presentation](#)

[File](#)

SPH model

- Designed for astrological problems – relaxed Jacobi solver
- Used for compressible fluids
- (<http://www.nadir.tk/phd-thesis>)
- BM 1: he was able to set up vortices by changing the problem (island size and parameter tweaking)
- BM 2: problems with runs
- Overall – looking for collaboration with and advice from other modelers.
- Has done movie graphics so generated a mega wave

Questions:

1. Juan Horrillo: can create particles so maybe create and throw away particles instead of recycling them back.

Particles are inherently known by neighbors so creation of new ones might create instabilities so went with recycling

Lynett: Methods to include turbulence -- will discuss together later

Summary and discussion of model results intercomparisons [Lynett] - [Presentation File](#)

- **What do we NEED from our models.**
- **What can we realistically expect from our models.**

Notes from Discussion (one perspective):

B#1:

- (Marie) split models into groups, don't compare optimized with other results...
- (Pat) BM#1 is a canonical problem, it's something really simple that you can test your model against... but there is an argument that this IS not geophysically accurate and maybe another problem should be used. The CHALLENGE is the friction... it's super smooth. Way less than geophysical.
- (Zhang) don't compare 2D with 3D
- Suggestion to use frequency for result summation
- Look at goodness of fit for the last 60 seconds of timeservers, and also look at frequency (structural engineers are concerned with period)
- We need to decide what is an allowedable standard deviation....

- Metric looked at should be something that looks at the mean or the median
- (George) From a hazard standpoint looking at the max is possibly better
- Analysis should only include models that converged after reached a quasi-steady state
- Suggestion for a second dataset from the lab to confirm truth
- Keep B#1? If we can't create a wake with a simple model, how do we model anything overland?
- (grili) a 3D model is needed for eddies...
- (Elena S.) WC modelling needs to take into account source location and directionality
- Since we are mostly 2D modelers, don't think frequency is something we can look at (if 3D then yes...)
- Look at integrated energy over an average cycle, includes both the frequency effect and the amplitude effect. If you have energy correct, then you have a decent production of frequency...
- (Grili) B#1 – dispersion important
B#2 – dispersion not important.... Separate out models that use dispersion
- Modelers provide CONVERGENT result for OPTIMUM configuration. Use a metric of integral of energy in a period.
 - Not sure what acceptable deviations are for this yet...

B#2:

- Envelope timeseries ... because of phase differences it's not easy to compare timeseries
- Good agreement, all models within 20 cm, and between 10-20 cm/s
- Why use the 10m resolution versus others... why not use all?
- Does the model data need to be de-sampled?? Or find out what the original averaging method for the ADCP data was...?
- The ensemble mean average is better than all results.

Possibly moving forward, do we want to...

- Duration of currents greater than 1.5 knots... this is more variable and not sure we currently have to observations necessary for it, but could get them. Can't expect accuracy greater than 1-2 hours.
- Models differ where eddies are generated... You can't just blindly use a single model result because the variation is high.
- As a group, for model velocities, we have converged... but this doesn't show up for individual models
Ensemble means are converging much faster

- You have to use standard deviation to have knowledge of your confidence
- “Thresh-holding” maritime hazard maps into greater than 1.5 m/s banding, (or > 2m/s, or 3-6 knots, etc.) seems to work pretty well for maritime hazard. We need to find the preferred threshold limits, or sweet-spots. “One example is from Pat Lynett and others (2014) paper addressing the relationship between current velocity and damage severity. These current threshold bins are from 0-3 knots for no damage, 3-6 knots for minor to moderate damage to occur, 6-9 knots for moderate to major damage to occur, and above 9 knots for major to complete damage to occur. The current thresholds might be less (2-5-8 knots) if harbor facilities are older or not maintained.
- Experienced modelers could identify these areas of vorticity based on bathymetry and structural elements which may produce vortices. These areas can be identified on current hazard maps.
- How is this different than maximum vorticity?
- How do you propose to judge models as a combined B#1/2 pass?
- To improve the benchmark for HILO: Model from the source rather than control point? Benchmark it as the model would be used in practice. If you want to use your own source, use the DART as a control point. Metric is the TG and 1 ADCP.

Notes from Discussion (another perspective):

Grilli: Asks for identification of models in results

1. Ask ourselves: what are we doing? Remind ourselves of what we are modeling
2. Question: What should we get from a model? Pat decided look first at range. He is trying to come up with statistics to show that models are appropriate to use.
3. BM 1 All results submitted are summarized (some model results are best (after tweaking parameters, aka friction...) while other model results are strictly following benchmark results)
 - Range consideration means offset is ignored
 - Single spike will skew results
 - Focus is on evaluation metric and what to expect from model performance
 - Tim Walsh asks: does this include results from models that didn't converge. Pat: Not all results here converged so we would need to require that models converge.
 - Gary Chock: RMS of all peaks – measure of maximum deviation of peaks. Bestows engineering perspective on what would be useful. Not only magnitude but also characterization of results in statistical way is needed.
 - Diego: Need to know what the metrics will be so appropriate results are submitted for evaluation.
 - Pat: Is BM 1 appropriate as a metric
 - Grilli: Suggests having two groups re-run BM1 and conduct testing

- Elena S.: Harbor characteristics are important
- Pat: How to move forward: 2D models just cannot adequately model eddies...
- Spaniard 1: Use maximum velocity as metric
- Pat: integrated energy as a metric should be correct – this will take offset into account.
- Trying to come up with the optimum result.
- Kirby: Careful about defining an averaging period...
- Volker: Suggest more runs with other specifications
- Vasily: provide results and parameters that were used.

Criteria: Modelers provide:

1. A convergent result
 2. Period, kinetic energy ($u^2 + v^2$), 3D Models == vertical integration of ($u^2 + v^2$)
4. BM 2
- Results of all 12 models (10-meter resolution) show very tight and consistent performance.
 - As a group, models are consistently 10-20 cm/sec error.
 - Average error across entire time series
 - Model max speed across entire time series. (max model velocity subtracted from max data)
 - Duration of currents greater than 1.5 knots – unstable statistic
 - Eddies are problems – do a better job
 - Thresh holding: gives areas of confidence → gives some support to looking at bins of velocity.
5. How would you propose to judge models using BM1 and BM2?
 6. Benchmark for Hilo: Should be used as a real problem.
 7. Randy: Agree that there is value at having a signal control point. Specify more than 1 single control point.

Plan for writing summary report:

- Create a proceedings report –
 - Keep it non-NOAA, just technical proceedings report
 - in it limit the amount of pages (2, 5? written pages per benchmark), total max of pages (15?). These will be determined.
 - have standardized graphics (created by Pat)
 - have standardized document sections
 - for full disclosure and easy comparison, make sure headings and subsections are detailed and cover things like modifications made to the benchmark.

- Have a results section that is written by Pat solely or some other outside source
- Also create a scholarly journal article submission with summarized outcomes.
 - Pat to write and then send out for review and approval.
- Also set up a data repository for all the benchmark results
 - Hosted by USC, along with the benchmark problems
 - Would provide access to the data for future reference,
 - Possibly handy for engineers who need to look at things not summarized in the NTHMP proceedings, like flow depth, maximum velocity, momentum flux, etc.

★ **A Microsoft Word Template Document with Table of Contents, Headings, Subsections, and Figure listings, will be created and circulated to the modelers for use in their individual reports.**

Workshop Summary and the Path Forward [Wilson, Gately] - [Gately Presentation File](#)

Summary:

Workshop attendance and participation was wonderful. The modelers were very prepared and the presentations led the way for valuable and interactive group discussions.

BM#1: Several modelers had difficulties with this one. The parameters needed to reach an “optimal” solution varied greatly. Some people had trouble getting the model to even shed vortices much less reach a steady state.

BM#2: Overall, most people did well on this one. The various resolutions all performed similarly, with the only obvious difference being in the spawning, location, and size of the eddies. Overall, modeled velocities had a 1-2 m/s error and the modeled amplitudes were within 20 centimeters of each other at the Hilo tide gauge.

BM#3-5: Were done as a whole or in part by several modelers as well, and the results were encouraging.

Path Forward:

The MMS co-chairs will be working closely with Pat Lynett to summarize the results of the workshop in a statistical and graphical manner that best highlights the model results. As there is very little observational data for tsunami currents, it is difficult to benchmark a single model in a manner which fully validates it for all possible scenarios. Hence, three paths forward were discussed:

- Individual state modeling – use the results of the workshop to identify the error or confidence you have in your model, and go forward with it, in a manner that represents that error to the public.
- Hazard Binning of Results – by grouping the velocities into separate bins related to the hazard and damage potential, you can increase your confidence in an individual model results and

provide a usable product for harbor response planners; areas where vortices are developed and move to can be identified by experienced modelers on the hazard/damage potential maps

- NTHMP ensemble modeling – work with NTHMP partners and states to perform ensemble modeling, perhaps through a shared platform, to ensure results are more consistent and possibly more conservative in capturing areas of strong currents