Coastal Working Group, and Coastal Vulnerability Initiative

Because the goals and activities of the Coastal Working Group (WG) and the Coastal Vulnerability Initiative (CV) overlap, we are reporting on the progress and plans for these two efforts jointly, with items especially relevant for CV in red.

Activities and Accomplishments

Select research and modeling progress in the community: toward WG and CV goals

We focus here on select accomplishments most relevant for the community-defined WG and CV priorities in the CSDMS Strategic Plan:

- Specific Science Goal 1 (SSG1) involves developing a medium-complexity suite of coupled models to explore "delta evolution on decadal to millennial time scales, as affected by couplings between terrestrial, fluvial, coastal, wetland, floodplain, subsidence, ecological and human processes (Figure XXXX1)". Building a model component for dynamic river avulsions, to couple to existing delta-building models, represents the first key step toward this goal. Katherine Ratliff has completed such a module, performed an initial investigation of the upstream effects of maintaining artificial levees, and with Eric Hutton is working on the coupling stage. Collaborator Rebecca Lauzon is devising a delta vegetation/flow module. Complementary delta modeling efforts abound, including those of Doug Edmonds, William Nardin, and others using Delft3D; Man Liang using a reduced complexity model, Anthony Longjas and other using network models, Jaap Nienhuis and Andrew Ashton using CEM (and Delft3D), and Ehab Meselhe and others using the applied Integrated Compartment Model (posters and talks presenting most of these efforts available: http://csdms.colorado.edu/wiki/CSDMS_meeting_2015#Posters).
- SSG2 addresses how the "morphology, ecology, and human components of sandy coastal environments co- evolve under different scenarios of changing storm climate, sea level rise, and human manipulation—including coastal environments ranging from urban to undeveloped." Laura Moore and Orencio Duran have developed the Coastal Dune Model (CDM) and used it to explore barrier island responses to changing climate (Duran and Moore, Nature Climate Change, 2015, in references Appendix), while Collaborator Laura Rogers and others have documented how different styles of coastal development affect overwash fluxes (e.g. Figure XXXX2), and (with Jorge Lorenzo Trueba and Andrew Ashton) ultimately barrier survival (in review). A growing team of economists and geomorphologists (Marty Smith, Brad Murray, Dylan McNamara, Sathya Gopalakrishnan, Laura Moore, Andy Keeler, and Craig Landry) continue to address couplings between physical/ecological and socio-economic processes on developed sandy coastlines (McNamara et al., 2015; Smith et al., 2015, in references Appendix).

- SSG3 involves modeling rocky and soft-cliff evolution, including the effects of human manipulations from river damming to coastal armoring. As part of these efforts, Pat Limber, Chris Thomas, Andy Barkwith, Andrew Ashton and others are working to unify a version of the Coastline Evolution Model (CEM) that can address rocky coastlines and beach-cliff interactions, as well as delta-related processes (and numerous other relatively new capabilities), and to apply a Basic Model Interface (BMI). Pete Adams, Pat Limber, Dylan McNamara and others have been using CEM, coupled to various wave-transformation models, to address rocky (and sandy) coastline evolution and response to changing storm/wave climate.
- Science Facilitation Goals 1 and 3 (SFG 1, 3) involve adding models prioritized by the community to the CSDMS toolbox of coupled models. Prioritized models include the expanded version of CEM (above), the wave-transformation model SWAN, and XBeach. Pat Limber has been applying a BMI to the wave model SWAN, and coupling it to the new CEM, as part of the work related to SSG3. As part of the work related to SSG2, Nick Cohn and others have applied a BMI to XBeach.
- SFG2 calls for model benchmarking and intercomparison projects. Tom Hsu reports that participants in a recent workshop tackled the intercomparison of a range of models capable to simulating swash dynamics, and that the results will be published soon.

Community engagement activities

- To encourage input and engagement from a range of different coastal-science communities and disciplines, we have enlisted and appointed two Vice Chairs, and several Liaisons: Vice-Chair for Community Engagement, Chris Thomas (British Geological Society); Vice Chair for Coastal Vulnerability, Hans-Peter Plag (Old Dominion University); Liaisons to the CSDMS Integration Facility, Eric Hutton; to the Education and Knowledge Transfer (EKT) Working Group and the Belmont Forum deltas group, Irina Overeem; to laboratory delta modeling and stratigraphy, Kyle Straub; to the XBeach community, Ad Reneirs; to the Delft3D community and the Delta Dynamics Collaboratory, Doug Edmonds; and to the Ganges-Bramaputra research community, Mike Steckler.
- To elicit active input and contributions from as many of the Working Group members as possible, Vice Chair Chris Thomas has instituted a Newsletter; every few months, Chris has asked the WG members, via email, to send him their modeling related success stories (papers published, noteworthy results) and opportunities (e.g. graduate or postdoc positions available). Chris then collates the information he receives and circulates it, again via email, to the community. (A cumulative list of the references circulated among the WG membership appears as an Appendix below.)

Goals for the next year (synthesized from WG discussions)

Select research and modeling plans: toward WG and CV goals

- SSG1: Couple the river-avulsion model initial to CEM, and next to a marsh module (Katherine Ratliff, Marco Marani). The community has identified large-scale, long-term fluvial floodplain deposition dynamics as a key knowledge (and modeling capability) gap!
- SSG2: Continue to build on the existing Coastal Dune Model (CDM), use it to identify which types of coastlines are most vulnerable (Laura Moore, Orencio Duran, Evan Goldstein, and others), and couple it to XBeach (Laura Moore, Orencio Duran, Evan Goldstein, Peter Ruggiero, Nick Cohn, Danno Roelvink, and others), and then potentially to ground-water and weather models (intertwined with the Interagency Working Group plans). Continue efforts to measure effects of development on storm-driven sediment fluxes, and model the long-term consequences for and feedbacks with the morphological and ecological evolution of sandy coastal environments.
- SSG3: Activities listed above are ongoing.
- SFG 1, 3: Develop BMIs for a marsh model (e.g. the D'Alpaos et al. model), and a barrier-island groundwater model (e.g. SEW-WAT); and couple the Tsunami model GEOCLAW with XBeach.
- Contribute to the EKT WG, as featured models to excite and educate a range of students, the Coastal Dune Model (CDM), preferably coupled to XBeach (SSG2), and the Tusnami model GEOCLAW.
- Strive to accomplish addition model-intercomparison projects, including those addressing: a) prediction of marsh accretion rates under specified scenarios for sea-level-rise rate, suspended sediment flux, etc.; b) the 'Sand Engine' project in the Netherlands, involving a well monitored mega-nourishment of a north sea coastline, already simulated by different hydrodynamics-resolving models, but not yet by simpler models; and c) beach/nearshore data sets from Duck (North Carolina) and NCEX (California) massive experiments. Seek funding for such model-intercomparison projects.
- Investigate WG/CV involvement in the Food-Water-Energy nexus.
- To further develop the CV Initiative, hold a joint meeting with the Human Dimensions Focused Research Group, and add further Liaisons relevant to CV (see Community engagement next steps below).

Community engagement next steps

- Add WG/CV Liaisons for: the iCOASST effort (Robert Nichols, also for the Belmont Forum deltas project); the Integrated Coastal Modeling project on the Mississippi Gulf (Ehab Meselhe); the USGS coastal vulnerability efforts (Hillary Stockdon); and the US Army Corps of Engineers (TBD).
- Build on the experience with the Newsletter, to try to increase the breadth of active participants and spur new collaborations and new ideas involving coupling between different environments or processes, by: a) turning the WG email list into a moderated list that members can use for timely, and brief communications of success stories,

opportunities, and ideas; b) turn the Newsletter into a cumulative online archive of the successes (e.g. Appendix below), opportunities and ideas the circulate among the community (via the listserv); c) next, to facilitate a forum for more lengthy descriptions of ideas and calls for collaboration (from unknown potential partners), such as Webinars that can be archived through Youtube; d) to follow up on such postings with limited-time (e.g. two day) focused discussions online; and e) to alert broader communities to such postings and discussions with messages to other lists, such as the Gilbert Club and the Coastal List.

Appendix: References gathered through Community Engagement activities

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Figures

A

B

Figure XXXX1. Rearrangements to barrier island landscapes (and development) after a severe storm (Hurricane Sandy). A: Mantoloking, New Jersey (blog.ucsusa.org). B: One of the New Jersey locations studied by Rodgers et al. (in review), in their showing that development style drastically affects overwash fluxes.

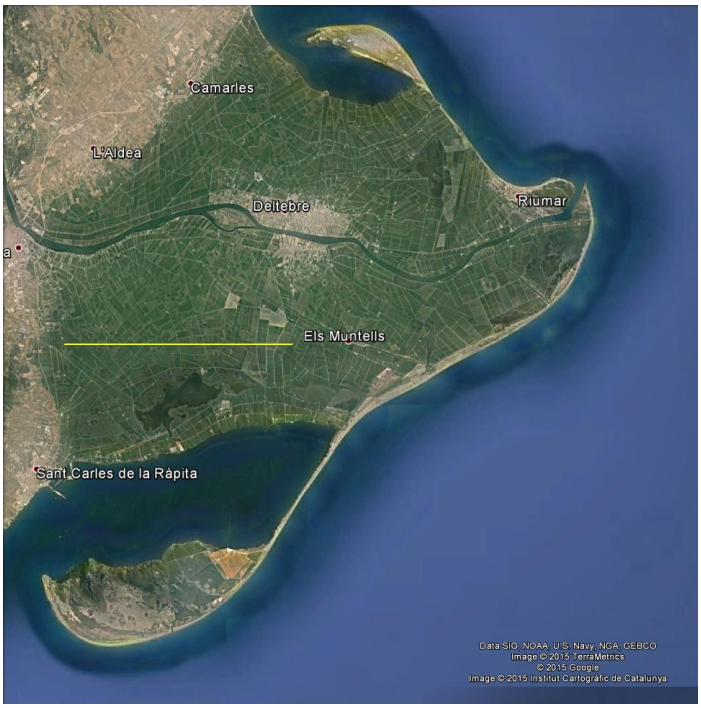

Figure XXXX2. The size and shape of the Ebro Delta in Spain have changed drastically as a result of land-use changes. Most of the world's major deltas are similarly affected by human land use in the watershed and on the delta (including manipulations of river processes). (Yellow scale bar shows 10 km.)