

Symposium on Sea-Level Rise in California

Friday, October 26, 2012 | 10:00am-3:00pm
At the Observation Post in the Presidio

Notes

Findings and California Highlights of the National Research Council's (NRC) Report *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*.

Dr. Gary Griggs, Institute of Marine Sciences at University of California, Santa Cruz and NRC Scientific Committee member

Dr. Griggs discussed the findings from the NRC report and the key implications for the State of California.

Global Sea-Level Rise: The major contributors to global sea level rise are the thermal expansion of ocean water, ice melt, ground water and storage behind dams (which appear to balance each other out and were not included in the Committee's sea level estimates). Other factors that influence sea level include tectonic activity such as land subsidence and uplift.

Regional Sea-Level Rise: Regional sea-level rise is calculated by adjusting global sea-level rise for local land contributions, tectonic impacts, atmospheric ocean circulation patterns in the Pacific, and storm surges. For areas North of Cape Mendocino, a major earthquake of magnitude 8.0 or greater would lead to land subsidence of 1-2 meters and a tsunami that would occur immediately.

Uncertainties: Regional projections are more uncertain than global projections because there are more factors involved. Also, uncertainty increases as estimates are made further into the future.

Sea-Level Rise Projections: Sea-level rise projections for California are detailed in the table below.

NRC Sea Level Rise Projections for California

<i>Time Period</i>	<i>North of Cape Mendocino</i>	<i>South of Cape Mendocino</i>
2000 - 2030	-4 - +23 cm (-0.13 -- +0.75 ft)	4 - 30 cm (0.13 -- 0.98 ft)
2000 - 2050	-3 - + 48 cm (-0.1 -- +1.57 ft)	12 - 61 cm (0.39 -- 2.0 ft)
2000 - 2100	10 - 143 cm (0.3 -- 4.69 ft)	42 - 167 cm (1.38 - 5.48 ft)

What value of SLR to use locally? First determine the sea-level rise value from nearest tide gage. Next take into consideration the projected lifespan of the project

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or facility, the cost of replacing the facility, and the impacts or consequences of damages to the project or facility that could occur from sea level rise.

Changes in storm climate:

In the past, major storm damage has come from confluence of large waves, and high tides during a strong El Niño event. For example, in San Francisco a 1940 storm event caused water to be 11 inches above normal, and in 1982, a storm caused water to be 12 inches above normal.

Future storminess: The effect of climate change on storminess is not clear. There has been an increase in wave heights according to record, but the record only consists of 35 years of data. This data only falls within a warm PDO cycle, and it remains to be seen what the impacts will be on a cold PDC cycle.

Questions and Answers:

Q: If there was a major earthquake on San Andreas tomorrow, will that have a major impact on the 2030 estimate?

A: Most motion along the San Andreas Fault is horizontal. Some uplift in places, but will not have a big effect. Ultimately impacts will be different based on the epicenter of the earthquake.

Q: Is there a probability related to the ranges?

A: No, the Committee did not assign probabilities.

Q: How and what assumptions did the Committee use for the rate of melting for ice sheets? This seems to be the biggest variable, and the rate of ice sheet melt has been changing dramatically.

A: The two glaciologists on the committee were relatively conservative. They considered records from the last decade or two, and the projections in the NRC values are thought of as worst case scenarios. Greater rates of melting are unfavorable with the glaciologists since we have not seen anything happen historically at this rate.

Q: In your talk, you made reference to the sensitivity of projections to greenhouse gas (GHG) emissions. Is it possible to split apart uncertainty into the part that is driven by human activity and the part that is not so that we can understand how human response can reduce the impact?

A: Since there were 13 people on committee, each person was not involved intimately in each section, and I was part of coastal impacts section. Different IPCC models (A1, A2... see *IPCC Fourth Assessment Report*) were used to generate the sea-level rise estimates. For more information, I suggest looking at the report.

Q: Did your group discuss how to present the earthquake and tsunami issue to the public in a way for communities to be responsive?

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A: First to clarify – two things would happen: 1) Subsidence, which includes a vertical drop of 1-2 meters instantaneously along the coast, and 2) Tsunami wave runup, which would occur within minutes. Earthquakes of magnitudes 8-9 (comparable to the Tōhoku earthquake in Japan, 2011) could see wave runup of 10 meters or more in wave height. The past provides some of the best examples of what could happen. As people have collective amnesia – short disaster memory – and tend to forget that past disasters have happened. But there are good images and maps to remind us about the impacts of past events. One good example is Brian Atwater's book: [Orphan Tsunami of 1700](#). The book shows images from tsunamis all over Japan, Indonesia, and others.

Q: How much confidence do you have in the north spit record tidal record in North Bay?

A: Would need to look at the record to see how long the tide gage has been in operation.

Updates on California Sea-Level Rise and Adaptation Guidance

Michael McCormick, Governor's Office of Planning and Research (OPR)

Background on who OPR is/ what it does

OPR is official arm of governor's office, and works with local governments and regional groups. OPR is currently putting together a "Vision for the Future" document about how to prepare for population growth from 34 million to 50 million by 2050 plus climate change. The effort will address two main questions: 1) What does CA look like after climate change has started to impact and the state with 50 million people? 2) How are we going to accommodate changes that are occurring with climate change?

State efforts on adaptation

- **California Climate Adaptation Strategy Update:** The 2009 California Climate Adaptation Strategy is in the process of being updated and the public version will be available later this year. The update contains program level policies and seeks to coordinate individual agency policies into statewide priorities. The intent is for the update to be released by governor and make these high level priorities the priorities of the Governor.
- **California Climate Adaptation Policy Guide** - Just released (mid 2012). Provides a framework how local governments to assist them with can moving forward on adaptation.
- **State hazard mitigation plan:** In progress. OPR is working with CalEMA to complete the plan, and will be addressing climate change.
- **General plan guidance update:** In progress. The last update was in 2003, and did not include guidance on climate change. This update will include climate change.
- **CEQA:** OPR is continuing to support discussions of climate impacts and mitigation in CEQA documents. CEQA might not be the most efficient place to

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consider climate change since CEQA happens at the end of project development, but still worth including as a last filter.

- **Connecting state and local efforts:** OPR has found out that local governments rely on state guidance in absence of other guidance, and it is very helpful for local entities to have specific guidance developed by the state. If we can work effectively with local partners, and tailor guidance to local needs, adaptation will occur more seamlessly and with better outcomes.

Amy Vierra, Natural Resources Agency

Amy coordinates the California Ocean and Coastal Climate Action Team (CO-CAT), which includes all 16 state agencies which have jurisdiction over ocean and coastal issues. The group works to discuss and come to consensus on issues.

- **Developed Interim Sea-Level Rise Guidance:** While the NRC report was being completed, the CO-CAT worked together to develop guidance for addressing sea-level rise in state projects. CO-CAT agreed to use Vermeer and Rahmstorf projections.
- **Sea-Level Rise Resolution:** After completing the guidance document, the Ocean Protection Council adopted resolution that directs state agencies to use the interim guidance to inform in their planning. Many state agencies have done this.
- **Next steps:** Now that NRC report is complete, CO-CAT intends to integrate the new sea-level rise rates into the guidance, and the guidance will no longer be “interim.” CO-CAT will meet in 10 days and map out a process to update the guidance. The goal is for the guidance to be easy to understand and scientifically accurate. The Interim Guidance and Resolution provided important policy guidance that will continue to apply as we move forward. For example, the updated guidance document will continue to recommend a risk assessment and scenario planning approach and will also continue to direct state agencies and non-state agencies using state funds not to use projections in the bottom third for any given time period. Updated document should be ready by early spring
- **2012 Climate Adaptation Strategy Update:** The CO-CAT developed the Coastal and Oceans Chapter of the report. The 2012 Strategy is an update to the 2009 report and is consistent with the 2009 strategy recommendations. Public draft will be released before end of year.

Questions and Answers:

Q: Will there be guidance to cities and counties on how to include SLR and erosion in general plan update? Don't have funding or expertise on how to deal with this issue. Do you have recommendations for what to do and whether there will be funding to implement?

A: Amy- The SLR guidance document is a resource that Local Governments can take into account in planning efforts.

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A: Michael- In response to the question about updating general plan guidelines, this will be part of the Local Coastal Program update process. Also, many communities are completing Climate Action Plans, but they need guidance on how to incorporate sea-level rise into these plans. Right now most plans are focused on reducing greenhouse gas emissions.

A: Susan Hansch (California Coastal Commission) – the Coastal Commission has long been involved in addressing SLR, and recently completed an internal draft of SLR policy guidance for Local Coastal Programs and Coastal Development Permits, which is currently undergoing staff review. Public draft for review starting in Dec 2012. The guidance is will address LCP actions to prepare for sea level rise, uses the NRC sea level rise projections, and also provides guidance on how to modify projections for local conditions. CCC needs everyone’s help to review the guidance document.

Q: There are lots of local officials who get elected with different perspectives. Do you have plans to educate elected officials and get them up to speed on climate impacts and SLR?

A: Michael- Have been working the Institute for Local Governments Commission – but we need to do a better job at communicating these issues and making them easier to understand. SLR is not easy to communicate.

Q: I have a question about working sea-level rise into CEQA as a regulatory baseline. For educating local officials, this gives a minimum requirement to make sure climate change is in place. Is the Governor committed to making sure there is a regulatory baseline? Is there a mandate for climate adaptation?

A: Michael- Don’t know whether the governor is committed to a mandate on climate adaptation. The state is starting with an administrative route first, and is working to integrate adaptation in policy guidance documents. The State is embarking on CEQA update, and will consider adaptation in the update.

A: Gary- Suggestions for ways to communicate: A colleague and I were required to do a climate vulnerability assessment for the Santa Cruz Climate Action Plan. They took the approach that what we see in the future is not different from what we have seen in the past; there will just be more of these events. There are good records of past disasters that many have forgotten about. It helps to see history. Can’t argue with that. This is a non-controversial way to talk about future changes in events.

Agency Guidance Updates

Susan Hansch, California Coastal Commission

- Local Coastal Programs (LCPs) are a key method to implementing change along the entire California coast, and are a critical method for adaptation.

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- The Coastal Commission's draft guidance highlights the sections of the Coastal Act relevant to sea level rise and outlines the key steps for addressing sea level rise in LCP and permitting decisions.

Joe LaClair, San Francisco BCDC

Joe LaClair works on science and collaboration work relating to SLR and recently updated BCDC's SLR policies to help the Commission make permit decisions on projects that are in the bay and along salt marsh shoreline.

- **Bay Plan Amendment and Sea Level Rise Policy:** BCDC's SLR policy requires the following:
 - Projects in the Commission's jurisdiction must do a risk assessment and vulnerability assessment using the best available science.
 - Projects must develop an adaptive management strategy for resilience until 2100.
 - BCDC must work to development a regional sea level rise strategy.
- **Adapting to Rising Tides:** BCDC is also working on the Adapting to Rising Tides (ART) project, which involves conducting a vulnerability assessment at the sub-regional level in Alameda County. The plan is to extend the project to other counties and apply lessons learned to the regional strategy. The project is a collaborative effort with Becky Smyth and Becky Lunde from NOAA CSC and others.
- **Regional Strategy:** Joint policy committee adopted a work plan to advance a regional strategy for the 9 county Bay Area. Work is underway.

Nadine Peterson, State Coastal Conservancy

The Coastal Conservancy is a non-regulatory agency funded through bond money. The Conservancy developed a Climate Change Policy and Project Selection Criteria, and recently developed guidance to assist applicants in complying with the Climate Change policy in 2011. The guidance factored in Griggs' work and other guidance from CO- CAT, and is intended as a step by step process for someone who is getting funding from the conservancy. Anyone considering project on shoreline has to address sea level rise or they won't be funded. The guidance walks applicants through two steps: First applicants conduct a quick initial vulnerability assessment using existing online maps. Then if the area appears to be vulnerable, applicants conduct a more detailed assessment. The Conservancy is updating the guidance to reflect the NRC sea-level rise projections.

Lenae VanValen, CalTrans

Lenae VanValen works in the climate change branch of CalTrans, and is responsible for addressing sea-level rise. In May 2011, the Cal Trans climate change work group provided guidance and direction regarding sea level rise and developed an internal project initiative document. The document helps staff address sea level rise as part of the planning process and engineering and design, and helps project development teams incorporate and be aware of sea level rise threats. CalTrans plans to update

guidance based on new OPC guidance and the NRC report guidance is in alignment with the guidance from COCAT and OPC.

Christy Bowles, State Parks

In 2011 State Parks developed a draft sea-level rise and extreme events document. The document, which is in internal review, was developed by an internal committee, and is currently being updated to incorporate NRC findings. The document walks a manager through the process of vulnerability and risk assessments. In conjunction with first draft, Parks developed a sea level rise viewer that allows managers to view impacts. Staff want to incorporate the new NRC sea level rise numbers into the viewer.

Ron Flick, State Boating and Waterways and Oceanographer at Scripps Oceanographic Institute

Ron Flick is an employee at Boating and Waterways and is also a researcher with Scripps. Many figures in NRC report are from Boating and Waterways research dating back to 1984. Ron is hoping to have the funding to maintain the oceanography program in the future.

Tom Kendall, Army Corps of Engineers, SF District.

Partners with many in the state to develop large investment projects. This is a slow process with phased investment strategies. Since there is a huge lead time, need to consider adaptation at start of this process. Army Corps has developed sea-level rise guidance, which requires projects to do several sea level rise scenario analyses. Scenarios bracket historical trends to something slightly above interim guidance, and above NRC guidance. All of the SF District projects are in California. District staff want to make sure scenarios are in alignment with state and local partners.

Discussion:

Q: A common theme seems to be everyone is updated guidance documents. How are all of these documents going to be accessible to the public?

A: Michael McCormick to audience: Would it be helpful to have a clearinghouse?

Audience answer: Yes, it is difficult to keep it all straight. There needs to be a systematic set of guidance. Problematic if we are all using different numbers.

Michael: Ultimately the State's Climate change portal adaptation tab will be a clearinghouse for State guidance and other reference points. The 2012 Adaptation Strategy should coordinate efforts and will be a single point of reference.

Q: In BCDC policy process there was some resistance to inserting numeric projections. Will the Coastal Commission's guidance include numbers?

A: Charles Lester, Executive Director, CCC:

- The Coastal Act gives the CCC the ability to address SLR now.

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- Not the point to agree on one number. But rather that it is happening, that there are uncertainties, and that we have to use scenario planning.
- The Commission's guidance will include numbers, but the numbers will change.

Joe LaClair, BCDC:

- Most important thing is to start doing something and to do a vulnerability assessment. For example, Port of Redwood city completed a risk assessment and made changes to the design of the Port. The Port designed their facility to be resilient to 18.4 inches of sea level rise projected out to 2060, and have a strategy to update seawall based on changes in sea level rise.

Cathy Shafer, FEMA

- FEMA doesn't really deal with SLR, but does deal with existing conditions, and is in the process of unveiling a new set of maps over the entire coast. The last time maps were updated was in 1990s so this is a radical change. When new maps are available for SF bay and the open coast, Cathy hopes they will prompt discussions about flood risk.

Sorting Through the Toolbox

John Rozum, NOAA Coastal Services Center and Ecosystem-Based Management (EBM) Tools Network

The EBM Tools Network is a partnership to align tools and people who need them. John Rozum described different types of tools that exist, the different problems that tools can solve, and the challenges with tools. CSC and the EBM Tools Network is completing a Tool Decision Guide in 2013 with information on how to choose the best tool for your work and tool case studies. For more information on tools, visit the EMB Tools Network website: <http://www.ebmtools.org/>.

Announcements

- Climate Change Vulnerability Assessment Training: Sacramento. Nov 6-8, 2012. Co-hosted by EcoAdapt and CA LCC. Contact: Danielle LaRock, Danielle.LaRock@fws.gov. Three-day training open to all partners (state agencies, NGOs, tribal organizations, feds) focused on learning the vulnerability assessment framework. The event includes a tools café, discussion, and exercises.
- King Tides Initiative: upcoming king tide events are expected on Nov 13-14-15 and Dec 12-13-14. Take photos of the highest tides in winter to show areas vulnerable to today's high tides and places that could be flooded on

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more regular basis as SLR rises. If there is a big storm with storm surge there may be even higher than high tides at those six days.

- Climate Smart Actions for Natural Resource Managers Workshop: Oakland. Nov 29. Contact: Nancy Schaefer, nschaefer1@comcast.net and/or visit <http://baeccc.org/>. BAECCC is hosting an event focused on “climate smart” actions for national resource managers. There will be presentations on projects conducting planning and implementation that take climate smart actions.
- Beyond Bathtub: Modeling and Responding to Sea Level Rise and Shoreline Change Workshop: Costa Mesa. Dec 19. Contact: Kristen Goodrich, kgoodrich@trnerr.org or Sarah Flores, sflores@scc.ca.gov. Event will include a panel of scientists and managers discussing how to plan for SLR beyond bathtub modeling work, as well as updates on SLR guidance and bidirectional conversation between scientists and managers concerning what is working in terms of getting scientific information out and managers’ needs.
- California Climate Action Planning Conference: San Luis Obispo. Jan 31-Feb 1, 2013. Co-hosted by OPR. Contact: Michael McCormick, michael.mccormick@opr.ca.gov or visit <http://planning.calpoly.edu/ccapc2013>. Local gov’ts and climate action planning. Participants across the board. Focuses on local governments and regional efforts moving forward on adaptation. Complementary event to the Governor’s Extreme Events conference series and the April conference on adaptation as priority for local and regional governments.
 - To receive information about this and other events, sign up for OPR email lists at www.opr.ca.gov.
- Shore and Beach Preservation Association Northern California workshop: Pacifica. April 2013. Contact: Bob Battalio, BBattalio@esassoc.com.

Next Steps for Progress Discussion

Q: Can anyone provide case studies of decisions made using SLR guidance?

- Ocean Beach Master Plan at the SPUR website. Finalized but not implemented. Visit <http://www.spur.org/ocean-beach>.
- Adapting to Rising Tides (ART) has four case studies by BCDC staff of permits issued, recreational access, etc. Visit www.adaptingtorisingtides.org.
- Examples of CCC permit and planning decisions will be included in the Commission’s SLR guidance document when it is issued for review in December.

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- The back of the SCC guidance mentions case studies, including some planning and some managed retreat. As a case study per se, it is not well-written at this point, but it would be a good project to write lessons learned.
- Visit the Climate Adaptation Knowledge Exchange for resources at <http://www.cakex.org/>.
- The next draft of the Climate Adaptation Strategy will have some case studies.
- The OPR website has write ups and presentations including case studies around the state from an event April 9 climate change conference in Los Angeles. Visit http://www.opr.ca.gov/s_climateconference.php.
- Check out the Living Shorelines demonstration project: whether reefs can provide multiple objectives, restore habitats, lower wave action, stabilize shoreline... Contact: Marilyn Latta, mlatta@scc.ca.gov.

Discussion: Regarding current needs to move forward with sea level rise planning:

- With regard to the spreadsheet of tools John Rozum discussed and available in the Symposium packet, it might be nice to have a tool for selecting a tool. Enter basic parameters and it spits out three or four tools you could use. Help direct the user towards what tool is appropriate to use.
 - o The EBM Tools database is searchable by parameters.
 - o For a decision-tree, trying to do that to some degree with decision guide that is currently in development, but the guide will be a static document/not interactive. Though with enough funding anything can be done. ;)
- We are not starting from scratch: there is an existing regulatory structure. Start with how we currently deal with flooding and flood issues; where to go from there. We're using a new thought process with how we deal with it, so would be good moving forward. Heads nod, including FEMA.
- Future discussion could focus on how to get info to elected officials.
 - o CSBPA workshops such as the Northern California one mentioned during the announcements are one venue whose purpose is to do that. (Bob Battalio)
 - o Planners say, "I'm not the decision maker, the elected are." The electeds say, "it's the public." Everyone else thinks someone else is the driver. Need to build better stories and have communications around the stories that don't focus on issues that can be debated. Need innovative communication strategies and reaching out to a broader audience than just ourselves.
- Sometimes do need legislation or mandate. Or a lawsuit to force people to do something they don't want to do.
 - o A state or local board member was overheard telling the Army Corps that it's good they have difficult rules because the only way they'll comply is if they have rules that make them.

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- We should pay attention to factors dictating whether a decision maker does something or not: they ask themselves, do I have the expertise, etc. If you need a vulnerability assessment for \$100k, then need to write an adaptation plan, then need to implement, adapt the plan, and monitor, that's resource intensive. Meanwhile, this information can feed into what locals are doing every day - they are or can be doing adaptation now and just don't know it. We need to integrate this information into decisions being made every day, already.
- Adaptive management is always framed positively as the expedient thing to do. Staff at the CA Ocean Science Trust would be interested in a forum focused on how to do adaptive management, including mechanical examples of what it looks like and how it fits into the adaptive planning context.
- The Ocean Protection Council is seeking input on what ranges will be for the SLR Guidance update.