MEMORANDUM

TO: Ocean Protection Council

FROM: Amber Mace, Executive Director

DATE: December 16, 2011

RE: Spotlight on Science: Coastal Vulnerability to Climate Change—Looking Beyond Sea Level Rise

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Briefing Panel Objectives

1. Provide a targeted presentation of the latest scientific understanding of coastal vulnerability to climate change, including increased risk from coastal hazards such as erosion, storm events, flooding and inundation, and beach loss.
2. Clarify how the scientific communities' evolving understanding of what we can expect can better inform and bolster state efforts to prepare for and adapt to our changing coastal environment.
3. Highlight efforts the state and other partners have already undertaken to prepare for and adapt coastal communities to increased risk from coastal hazards.
4. Identify potential future efforts to reduce risk of coastal hazards, protect public health and safety, and bolster the resiliency of coastal communities.

Spotlight on Science Presentations

Introduction from Skyli McAfee, OPC Science Advisor

Dr. Gary Griggs
OPC-SAT Co-Chair, Distinguished Professor of Earth Sciences and Director of the Institute of Marine Sciences, University of California Santa Cruz

"The Vulnerability of the California Coast to Climate Change and Extreme Events"

- Discuss the relationship between sea level rise and coastal hazards
- Provide a snapshot of the drivers of coastal hazards over the last century, and discuss how sea level rise will interact with those drivers over the coming century
- Discuss current projections of how the drivers of coastal hazards will change over the coming century with increasing sea levels

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Dr. Patrick Barnard
Coastal Geologist, USGS Pacific Coastal and Marine Center, Santa Cruz

"Storminess and Extreme Coastal Water Levels: Historical Observations and Future Projections for the California Coast"

- Characterize extreme storms we already experience in California and provide a snapshot of resulting economic losses – extreme storms are extremely damaging to California's coastal communities
- Synthesize recent scientific literature, which has documented an increase in the severity of coastal storms and winter storm seasons over the last several decades
- Discuss future projections, and highlight the need to better understand the links between sea level rise and extreme storms, and how that is critical to decision-making

Rebecca Smyth
West Coast Director/Regional Division Chief, NOAA Coastal Services Center

Coastal Climate Adaptation: Bringing Science to Adaptation Efforts

- Update on the upcoming National Academy of Sciences study on sea-level rise and storminess along the west coast
- Provide examples of the types of decision support tools available to coastal resource managers with a focus on the SLR viewer
- Discuss examples of communities/groups in California working on coastal climate adaptation - San Diego, Ventura, Southern Monterey Bay, SF Bay/Adapting to Rising Tides, Gulf of Farallones, and Humboldt Bay

Closing points from Dr. Amber Mace, Executive Director, OPC

Background

Coastal hazards and extreme events in conjunction with sea-level rise will increase the vulnerability of California's coastal communities. Coastal impacts magnified by future sea-level rise include: 1) storm wave damage to coastal development and infrastructure during periods of elevated sea levels; 2) continued retreat of cliffs and bluffs; 3) progressive flooding and inundation of low-lying areas; 4) seasonal loss of beaches; and 5) flooding along coastal rivers and streams. However, these types of hazards and extreme events are not so different from what we already periodically experience. These impacts are driven by a multitude of pre-existing factors, such as El Niño events and natural coastal erosion cycles. The scientific community is striving to understand how sea-level rise will interact with the myriad of known driving factors to potentially increase the severity and frequency of coastal hazards and extreme events over the coming century. In particular, extreme storms already result in significant economic losses along the California coast. A recent series of studies indicate an increase in the severity of coastal storms and winter storm seasons over the last several decades. Thus, climate change impacts to

the California coast must be assessed through a thorough understanding of the combined effects of sea-level rise and extreme storms.

Sea-level rise *alone* will not likely cause significant flooding, inundation or erosion over the first half of the 21st century. Rather, through roughly 2050, the highest probability and most damaging events will likely take place when increasingly elevated sea-level occurs simultaneously with large El Niños – which are in part characterized by high tides and large waves. Between 2050 and 2100, when sea-levels approach 18 to 69 inches above the present, the effects of sea level rise (flooding and inundation) and combined effects of sea-level rise and large waves (damage to coastal structures, cliff erosion, beach loss) will have much greater impacts.

OPC Role

The OPC plays a critical role to help prepare for and reduce the harmful impacts of climate change on public health and safety, the economy, and ocean and coastal ecosystems by engaging decision-makers and encouraging adaptation to climate change at all levels of government. While the state has already undertaken ambitious and bold strategies for reducing greenhouse gas emissions with the passage of AB 32, the Global Warming Solutions Act, and SB 375, the Sustainable Communities and Climate Change Protection Act of 2008[1], it is just starting to develop and implement approaches for adapting to the changes ahead that will occur under even the most optimistic scenarios for reduced greenhouse gas emissions.

The first *California Climate Adaptation Strategy*, a collaborative product of many state agencies, was released in 2009.[2] The OPC led development of the sector strategy on "Ocean and Coastal Resources," which identified several strategies to reduce future hazards to coastal ecosystems and infrastructure. Following up on the strategy's release, the OPC has continued to lead and coordinate efforts of the Coasts and Oceans Climate Action Team (CO-CAT), a broad coalition of state agencies seeking to find practical ways of addressing climate change in their decision processes. In 2010, the team developed the *State of California Sea-Level Rise (SLR) Guidance Document* to assist in incorporating sea-level rise into state planning and decisions. A subsequent resolution of the OPC in 2011, among other things, instructed state agencies to implement the guidance document and to adopt adaptation principles from the 2009 state adaptation strategy.[3]

Moving forward, the OPC is committed to implementing actions identified in the Council's March, 2011 resolution on sea-level rise. The OPC will continue to coordinate, and work in collaboration with, the inter-agency CO-CAT. The OPC will work to ensure that decision-

[1] For more on AB 32 see http://www.arb.ca.gov/cc/ab32/ab32.htm; for more on SB 375 see http://www.arb.ca.gov/cc/ab32/ab32.htm.
[2] See http://www.climatechange.ca.gov/adaptation/.
[3] For a copy of the guidance document and the OPC resolution related to sea level rise see http://www.opc.ca.gov/2010/12/climate-adaptation-and-sea-level-rise/.

makers throughout California have the tools, information, and guidance that they need to successfully develop and implement coastal adaptation plans.

Speaker Bios

Dr. Gary Griggs

Gary Griggs received his B.A. in Geology in 1965 from the University of California, Santa Barbara and a Ph.D. in Oceanography from Oregon State University in 1968. He has been a Professor of Earth Sciences at the University of California, Santa Cruz for 43 years and has served as Chairman of the Department of Earth Sciences, Associate Dean of Physical and Biological Sciences, and has been the Director of the Institute of Marine Sciences since 1991.

He chaired the University of California Marine Council for 9 years and is a member of the Scientific Advisory Team to the California Ocean Protection Council. In 1998 he was given the Outstanding Faculty Award in the Division of Physical and Biological Sciences at UC Santa Cruz. The UCSC Alumni Association honored him with a Distinguished Teaching Award in 2006. The Monterey Bay ocean community honored him in 2007 with the Ed Ricketts Award for Sustained Research in Marine Science. In 2009 the California Coastal Commission and Sunset Magazine named him as one of California's Coastal Heroes, and in 2010 he was named a Fellow of the California Academy of Sciences.

His research is focused on the coast of California and includes coastal erosion and protection, beaches and the effects and impacts of sea level rise. He has written or co-written over 155 articles published in professional journals as well as several books: *The Earth and Land Use Planning*; *Geologic Hazards, Resources, and Environmental Planning; Living with the California Coast; The Santa Cruz Coast: Then and Now; Living with the Changing California Coast; and Introduction to California's Beaches and Coast.*

Dr. Patrick Barnard

Patrick Barnard has been a coastal geologist with the USGS Pacific Coastal and Marine Science Center in Santa Cruz since 2003. His research focuses on the dynamics and evolution of the high-energy beaches of California, with an emphasis on storm and climate-change related impacts. He got is BA from Williams College, his MS from University of South Florida, and his PhD from UC Riverside.

Rebecca Smyth

Rebecca (Becky) Smyth is the West Coast Regional Director and Regional Coastal Services Division Chief for the National Oceanic and Atmospheric Administration's (NOAA) Coastal Services Center, working to link information and technology with the people managing the west coast's ocean and coastal resources. Her projects with NOAA include building capacity of local and state managers along the west coast in order to plan for and mitigate coastal hazards and risks associated with climate change, and to improve coastal and ocean data and tools for ocean planning. In her work supporting regional ocean partnership efforts along the west coast and

nationally, Becky is a member of Executive Committee for the West Coast Governors' Agreement on Ocean Health. Previous arriving in California, Becky spent 7 years in Washington, DC as senior program analyst at the NOAA Ocean Service, responsible for legislative issues, agency strategic planning, policy development, and budget formulation. She started her career there as a John A. Knauss Sea Grant Fellow. Becky has an M.S. in environmental coastal ocean science from the University of Massachusetts – Boston and bachelor's of science from Boston College. *Contact*: NOAA Coastal Services Center, 1330 Broadway, Suite 1135, Oakland, CA 94612 Telephone: 510-251-8324, e-mail: Rebecca.smyth@noaa.gov