Adapting to Shifting Tides: Science and the Policy Implications of Coastal Change

Joint Penrose/Chapman Conference; Galveston, Texas, 14–19 April 2013

PAGE 435

Acceleration of sea-level rise (SLR) in response to global climate change is well under way. Global SLR averages about 3 millimeters per year over the past several decades, in comparison to an average rate of a fraction of a millimeter per year over the past few thousand years. The increased rate of SLR is exacerbated on a regional scale by decadal scale oscillations in sea level that are due to oceanographic processes, varying wave climate (wave height, period, and direction), coastal subsidence due to subsurface fluid extraction, and anthropogenic alterations in sediment supply to the shoreline, in particular the alteration of sediment delivery and distribution within deltas.

There are also complex morphological feedbacks, including ecological influences, on coastal change. Other major effects include cliff and bluff retreat, as well as coastal flooding, groundwater intrusion, and soil salinization that may extend tens of kilometers inland from the shoreline. Severe storms (e.g., cyclones and hurricanes) result in an abrupt response of coasts to SLR and/or tipping points in coastal evolution (e.g., inlet opening). In turn, SLR will exacerbate the impacts of extreme storms over the long-term. At human time scales, these changes are essentially irreversible.

Eighty-four coastal and social scientists from twelve countries attended the first joint Penrose/Chapman conference in Galveston, Texas, to discuss the increasing threat of global climate change on coastal environments (http://www.geosociety.org/penrose/13Texas.htm). The objectives of the conference were to provide a forum for discussing the latest advances in coastal system response to both natural and anthropogenic influences, assess the state of current coastal change and its causes from a perspective of the recent geologic record; and ensure that the outcomes of this meeting are conveyed to the general public and to policy makers.

The first 4 days of the conference were devoted primarily to talks and poster sessions aimed at synthesizing the state of knowledge on the causes, effects, and record of sea-level rise, coastal subsidence, severe storms, and changes in wave climate. Also discussed were sediment delivery and dispersal in coastal systems, biological influences on coastal sedimentology and morphology, and the societal consequences of coastal change.

The final day was devoted to discussion of how science can and should inform the public and policy makers about the realities of ongoing coastal change and how it can be more effective in initiating appropriate policy responses. Decisions need to be made now to minimize future impacts of coastal change, particularly because the cost of mitigation is increasing as coastal assets rapidly grow.

There was strong consensus on several issues. First, to secure a sustainable future, society must learn to anticipate, live with, and adapt to the dynamics of rapidly evolving coastal systems. Participants recognized that the pace of change is outstripping the ability of policy makers and community leaders to mitigate impacts related to global change.

Second, to assess regional vulnerability and resilience to coastal hazards, it is essential to understand the physical effects of the hazards including how they affect coastal communities. Well-intentioned policies and infrastructure projects that fail to understand these connections often end up futile or even counterproductive.

Finally, coastal response to anthropogenic influence coupled with natural variability is occurring at unprecedented rates in many areas. Furthermore, coastal response to climate change is a global issue. There is a need to increase international collaboration to share and expand our knowledge and to assist those countries where change is occurring at alarming rates but where the scientific information needed for mitigating change is lacking. Discussions focused on Bangladesh and the Philippines. These areas have tens of thousands of kilometers of coastline with large populations that are subject to multiple geohazards.

Scientists can take immediate action to help mitigate coastal hazards. This includes conducting system analyses of coastal areas, making usable geohazard maps and other accessible information systems that can be used by planners to predict change, and suggesting adaptive management approaches to minimize costs of improving coastal resiliency and social and ecosystem outcomes, given the inherent uncertainty of future coastal evolution. This will require a range of scientific input across the natural, engineering, and social sciences. Such action, attendees agreed, is the scientific community's professional responsibility.

Financial support for this conference was provided by the Geological Society of America, American Geophysical Union, Geological Society of London, Society for Sedimentary Research, and the Shell Center for Sustainability of Rice University.

—JOHN ANDERSON, Rice University, Houston, Texas; email: johna@rice.edu; GARY GRIGGS, University of California, Santa Cruz; ROBERT NICHOLLS, University of Southampton, Southampton, UK; and KRISTAN UHLENBROCK, American Geophysical Union, Washington, D. C.