



*Management, Preparedness,  
and Response: Isabel and  
Future Storms*

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## **INTEGRATING SCIENCE AND MANAGEMENT FOR STORMS AND HURRICANES: A PANEL DISCUSSION**

D.F. Boesch (moderator)

University of Maryland Center for Environmental Science, Cambridge, MD 21613

### **ABSTRACT**

At the conclusion of the “Hurricane Isabel in Perspective” conference, a panel of scientists and managers discussed lessons learned. Some responses of the Chesapeake Bay to the hurricane (e.g., storm surge) were predictable, while others (e.g., restratification of water masses after passage of the storm) were surprises. The large storm surge and shoreline erosion provided a significant scientific opportunity to understand processes and verify models. Large perturbations such as this, however, must be viewed as interacting with, and frequently exacerbating, the other human and natural stressors of the ecosystem that diminish its resilience. Risks to people and property could be reduced through better communication of forecasts and warnings, public education, and efforts to make the infrastructure and shorelines less vulnerable in an era of accelerated sea level rise.

### **CONFERENCE OVERVIEW**

The conference on “Hurricane Isabel in Perspective” was a success on several fronts. First, it provided an impetus for scientists to pull together a rich array of information concerning the physical, ecological, and human responses within the Chesapeake Bay ecosystem to this unusual event. While the effects of Isabel on the estuary itself were not as dramatic as those of Tropical Storm Agnes with its heavy rains and overwhelming floods, the impacts were certainly felt by waterfront property owners. In the estuary itself, the responses were simultaneously both reassuringly predictable (e.g., the propagation of storm surge) and quite surprising

(e.g., the biophysical processes associated with destratification and restratification of the Chesapeake). In either case, Hurricane Isabel provided a remarkable opportunity to learn how the Bay works.

Second, the conference provided a rare occasion for individuals working at the local government level—those responsible for emergency preparedness and response, planning and zoning, and infrastructure management—to interact with Bay scientists and those at the leading edge of weather and storm forecasting. Much learning took place in both directions.

Third, energy and enthusiasm was developed among the participants to improve planning, dissemination of information, and incorporation of a more dynamic view of the Chesapeake Bay in its restoration. In particular, calls echoed throughout the conference to take advantage of the freshness of the storm experience to improve public understanding and response to avoid personal tragedies, economic losses, and unsustainable investments.

### **PANEL DISCUSSION**

The conference closed with a discussion among six very experienced panel members. The essence of the panelists’ viewpoints has been captured below. No doubt, some important points have been inadvertently omitted. Also, the reader should remember that the following sections are summarizations of the discussion by the author, not a verbatim representation of panelist comments. Thus, any credit goes to the panelists, but blame stops with me.

**Dr. Hans Paerl**, a highly regarded ecologist from the University of North Carolina, has had unsolicited, first-hand experience regarding the effects of hurricanes on coastal ecosystems. Working at the Institute of Marine Sciences in Morehead City, the epicenter of one of the most hurricane-prone regions on the coast of the United States, Paerl has experienced six major hurricanes that made landfall on the North Carolina coast between 1996 and 1999, as well as Isabel in 2003 [1]. In 1999 the assault seemed unrelenting, with Dennis and Floyd hitting the North Carolina coast in September and Irene passing just offshore in October. These storms led to unprecedented rainfall and prolonged flooding in the eastern part of the state.

Dr. Paerl observed that the effects of northeast storms should be considered as well as hurricanes because they can have very similar effects. But he also cautioned that storms can be very different in their impacts, largely depending upon landfall location and its influence on wind direction and speed along with rainfall patterns. The three successive storms in 1999, for example, had very different impacts.

Dr. Paerl also stressed that both science and management need to consider the context of multiple stressors and management challenges within the coastal ecosystem and associated watershed. Many of these systems are already under a high level of anthropogenic pressure, so a storm represents an additional rather than an isolated pressure. In Pamlico Sound, for example, there is a very high level of fishing pressure, including shrimp trawling. Storm-induced floods resulted in a dislocation of some fishery resources, causing increased pressure on the stocks due to concentrated harvesting. Such a scenario suggests that a need exists for more sophisticated models that can adjust predictions of storm impact as an ecosystem becomes more or less stressed by other factors over time. Paerl commented that, sadly, memories of storm effects often fade quickly. Despite the ravages of its floods, Hurricane Floyd is largely forgotten and people are once again building in the floodplains of eastern North Carolina.

**Mr. David Lyons**, Chief of the Enforcement Division in the Water Management Administration of the Maryland Department of the Environment, noted that a principal lesson from Hurricane Isabel is the need to focus on how to make people better prepared. In addition to individual preparedness, Lyons stressed the need for local government to take storms into account when building, updating, and managing infrastructure. For example, wastewater treatment plants and sewerage pumping facilities need to be carefully designed and have emergency plans in place. The region is already struggling to reduce overflows from sewerage systems that receive storm waters; planning for tidal flooding from hurricanes adds yet another requirement.

Although Isabel was a relatively dry storm (i.e., modest rainfall), it re-enforces the need to limit the proliferation of impervious surfaces and enhance stormwater management capabilities. Mr. Lyons stressed the importance of conserving and protecting natural systems that will buffer against storm damage, including the use of non-structural shoreline erosion controls. He was encouraged by presentations at the conference on improved knowledge of elevations of low-lying lands through LIDAR surveys [2, 3]. These efforts are producing very useful information in planning for both storm surge and stormwater flooding.

As suggested by Paerl, Mr. Lyons also reminded the audience that the public's memory is short and people will rapidly forget about the impacts of Hurricane Isabel. Consequently, it is important to communicate to the public now what happened and why the storm surge was so high. He further noted that many of the best management practices used for Chesapeake Bay conservation are not currently designed to cope with hurricanes and other extreme storm events. These practices range from agricultural management practices to fisheries management. An example for the latter indicates this concern: how should harvest quotas be adjusted following such storm events?

**Dr. Wilson Shaffer**, a storm-surge modeler with NOAA's National Weather Service, picked

up on the theme of the public's short memory. He emphasized that tropical storms are relatively rare events in the Chesapeake Bay region, with 70 years between the 1933 storm and Hurricane Isabel [4, 5]; both produced similar storm surges. Very few people had thought such flooding possible and most are unaware of the general axiom, "run from the water, hide from the wind." Some hid when they should have run. Overall, better education of the public is required to ensure that people respond appropriately to warnings. Also, it is important to improve public understanding of storms. For example, people should be aware that the greatest danger lies in the northwest quadrant of an approaching hurricane. Perhaps there is a need for an ensemble of models that project the worst and best case scenarios for each storm so that appropriate warnings can be provided.

**Mr. Richard Batiuk**, Associate Director for Science of EPA's Chesapeake Bay Program Office, observed that Hurricane Isabel provided an opportunity to assess what worked and what did not. For example, in many places significant erosion occurred behind bulkhead walls, whereas nearby natural shorelines with no engineered protection did not suffer serious erosion. Further, it appears that the physical processes in the Bay are of major consequence in ways not previously understood, and thus improving our understanding of these processes remains important. Hurricanes also magnify the dynamics normally occurring within the Bay, making them more obvious and amenable to quantification. The continuing assessment of the observed responses of the estuarine ecosystem to Hurricane Isabel, therefore, provides a real opportunity to substantially improve our knowledge and our ability to predict responses to phenomena—both natural and anthropogenic.

**Ms. Ann Swanson**, Executive Director of the Chesapeake Bay Commission, asked: What have science and management taught us? There is a division in perception between the scientific community (which increasingly recognizes ecosystems such as the Chesapeake Bay as highly

dynamic) and most of the public (which expects stability). How can we reconcile the ecological tendency for variability with a human desire for predictable structure? While much is known, large gaps in knowledge still exist, yet management decisions need to be made every day. Should management decisions be made only when something is well known or, in fact, because not as much is known as desired? In Swanson's experience, three elements are required to effect change: knowledge (among scientists and in the broader community); political interest; and public concern. She suggested that Hurricane Isabel has provided a window of opportunity for progress because it created public concern and, thus, political interest.

Ms. Swanson noted that an environmental agenda can be moved forward, driven by quite different interests. For example, impervious surface can be reduced in a development due to both environmental (reducing runoff) and financial (less expensive) requirements. Both arguments can have credibility with different audiences, but both yield the same result. It is crucial to consider the responses to Hurricane Isabel in this context: when dealing with a socioeconomic concern, environmental improvements could result as well. In this regard, there is a need to consider locations for future development, runoff management, shoreline stabilization and the use of living shorelines, and abatement of sediment loads to the Bay's tidal waters. She asked, based on the lessons of Hurricane Isabel, if the scientific community could identify a short list of things that should be carried out differently from both ecological and social perspectives? Isabel has provided a window of opportunity with the public for dramatic change, but it will soon close.

**Dr. Carl Hershner**, Director of the Center for Coastal Resources Management at the Virginia Institute of Marine Science, observed that Boicourt [4] mentioned integrated models of the continental shelf, estuary, and watershed as the holy grail of physical scientists who study estuaries. He pointed out that, while it is important not to underestimate

the significance of physical processes, the behavior of the ecosystem may be much more complex. Much recent information indicate that such ecosystems are dynamic over the long term as well as the short term, requiring consideration of ecosystem resilience not just in terms of how quickly it returns to “normal” after an extreme event such as a hurricane, but also the potential that it may shift to another state due to the combined pressures of chronic human alteration and acute natural events.

### CONCLUSION

The panel’s discussion was lively and seemingly well appreciated by the audience. Those who attended both the conference and concluding panel discussion are now likely committed to remembering the lessons of Hurricane Isabel as captured in these proceedings and to helping citizens understand better the risks, changes, and options confronting them in the world in which we live.

### REFERENCES

1. H.W. Paerl, B.L. Peierls, L.M. Valdes, R.S. Weaver, T. Gallo, and J.S. Ramus. 2005. Ecological effects of a recent rise in Atlantic hurricane activity on North Carolina’s Pamlico Sound system. In: Hurricane Isabel in Perspective. 2005. K.G. Sellner (ed.). Chesapeake Research Consortium. CRC Publication 05-160. Edgewater, MD. pp. 3–18.
2. Z.P. Johnson and A. Luscher. 2005. Management, planning, and policy conference sessions. In: Hurricane Isabel in Perspective. 2005. K.G. Sellner (ed.). Chesapeake Research Consortium. CRC Publication 05-160. Edgewater, MD. pp. 221–232.
3. A.E. Luscher. 2005. Improving utilization of geospatial information in coastal hazard planning in Maryland. In: Hurricane Isabel in Perspective. 2005. K.G. Sellner (ed.). Chesapeake Research Consortium. CRC Publication 05-160. Edgewater, MD. pp. 233–242.
4. W.C. Boicourt. 2005. Physical response of Chesapeake Bay to hurricanes moving to the wrong side: Refining the forecasts. In: Hurricane Isabel in Perspective. 2005. K.G. Sellner (ed.). Chesapeake Research Consortium. CRC Publication 05-160. Edgewater, MD. pp. 39–48.
5. L.H. Brasseur, A.C. Trembanis, J.M. Brubaker, C.T. Friedrichs, T. Nelson, L.D. Wright, W. Reay, and L.W. Haas. 2005. Physical response of the York River estuary to Hurricane Isabel. In: Hurricane Isabel in Perspective. 2005. K.G. Sellner (ed.). Chesapeake Research Consortium. CRC Publication 05-160. Edgewater, MD. pp. 57–64.