

# Science and the Storms: the USGS Response to the Hurricanes of 2005

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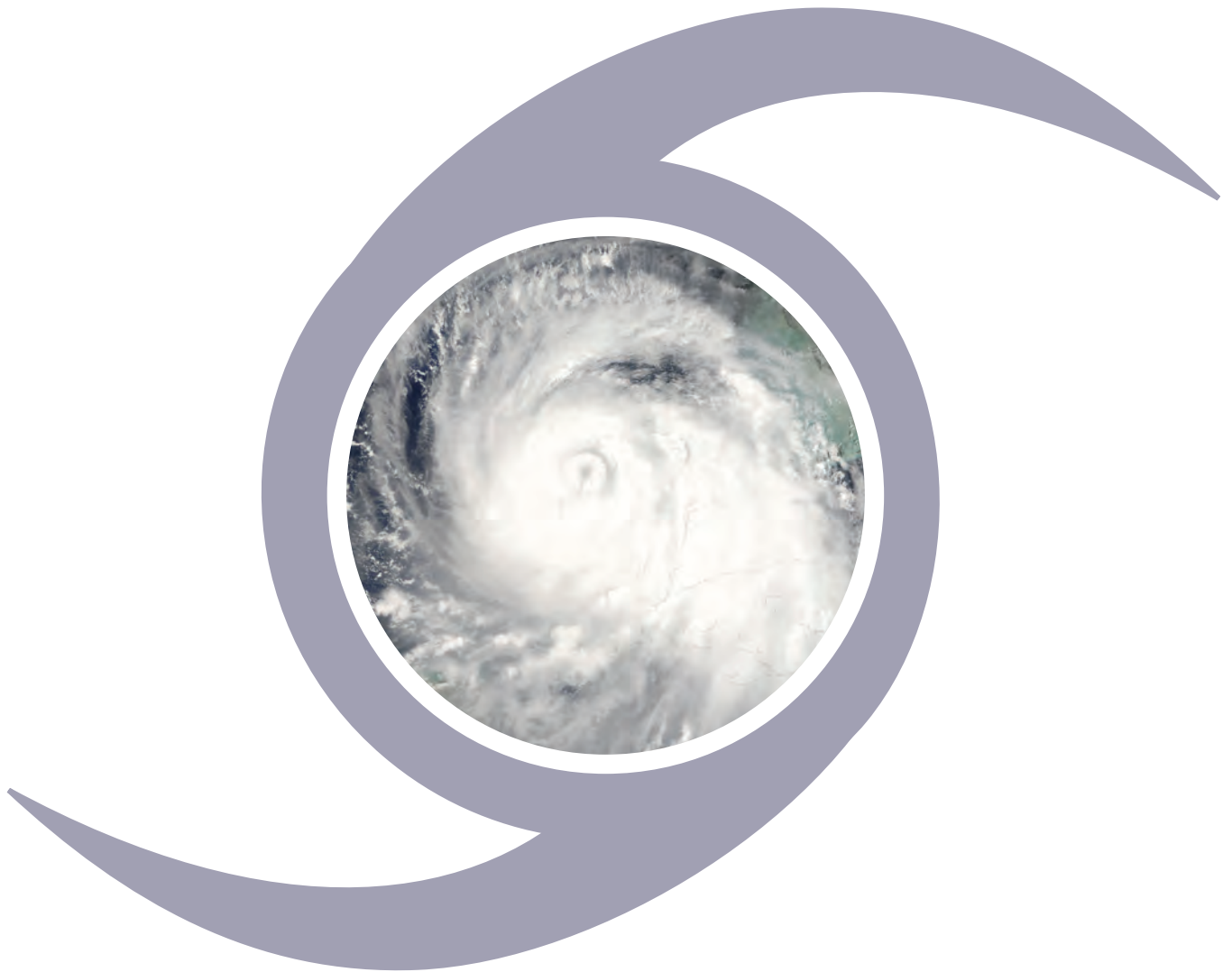






# Science and the Storms: the USGS Response to the Hurricanes of 2005

Edited by G.S. Farris, G.J. Smith, M.P. Crane, C.R. Demas, L.L. Robbins, and D.L. Lavoie



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## Foreword

One of the primary missions of the U.S. Geological Survey (USGS) is to serve the Nation by providing reliable scientific information, thereby minimizing loss of life and property from natural disasters such as earthquakes, volcanic eruptions, and hurricanes. A recent test of that mission was the need for scientific response to the destructive hurricanes of 2005, especially Hurricanes Dennis, Katrina, Rita, and Wilma.

As employees of the Nation's largest water, earth, and biological science and civilian mapping agency, USGS scientists have been studying hurricanes and hurricane-related impacts for decades. They have measured and studied flooding and water quality. They have used the latest technology—from satellite imagery and geographic information systems to lidar (light detection and ranging)—to view and analyze damage to the barrier islands and coastal wetlands that protect people and property. They have examined the effects of hurricanes on land, water, vegetation, and wildlife.

With this background, USGS scientists were positioned to immediately begin applying their scientific and technological knowledge and skills to the devastating hurricanes of 2005. And they did so with great vigor. They examined the cycles of hurricanes and their relation to sea water surface temperature. They looked at oil slicks and chemicals in the flood waters and the sediments in and around New Orleans and studied the flood protection systems there. They recorded the effects of the hurricanes on manatees off the coast of Florida and on birds whose fall migration was disrupted by these ferocious storms. They analyzed the destruction of bridges, and they measured debris. They looked at the landscape of the Gulf Coast and measured enormous changes due to hurricane winds and flooding. Overall, USGS scientists performed dozens and dozens of other studies that hurricane season, many of them documented in this volume.

As USGS scientists performed their research, they also provided volunteer humanitarian assistance by boat rescues after Katrina. They also used their technology to map 911 callers seeking rescue. Meanwhile, other USGS staff donated water, food, and blood and made their offices and homes available to evacuees. For performing these activities, USGS received the Service to America Medal, described in this report.

This volume is but a snapshot of the work that USGS biologists, geologists, geographers, and hydrologists, working together, provided during these natural disasters. And our scientists will continue to be engaged in hurricane research.

This collection of articles is for the American people, to illustrate how science can make a real difference in their lives. Many decisions are being made about the future of coastal areas, and our citizens deserve well-thought-out decisions based on a sound foundation of unbiased science. It is this kind of impartial science that USGS, working with many other agencies, intends to continue to bring to the American people on a daily basis and when disasters strike.

Mark D. Myers  
Director

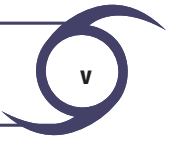
## Preface

*Science and the Storms: the USGS Response to the Hurricanes of 2005* is designed to give a view of the immediate response of the U.S. Geological Survey (USGS) to four major hurricanes of 2005: Dennis, Katrina, Rita, and Wilma. Some of this response took place days after the hurricanes; other responses included fieldwork and analysis through the spring. While hurricane science continues within the USGS, this overview of work following these hurricanes reveals how a Department of the Interior bureau quickly brought together a diverse array of its scientists and technologies to assess and analyze many hurricane effects. Topics vary from flooding and water quality to landscape and ecosystem impacts, from geotechnical reconnaissance to analyzing the collapse of bridges and estimating the volume of debris. Thus, the purpose of this report is to inform the American people of the USGS science that is available and ongoing in regard to hurricanes. It is the hope that such science will help inform the decisions of those citizens and officials tasked with coastal restoration and planning for future hurricanes.

Chapter 1 is an essay establishing the need for science in building a resilient coast. The second chapter includes some hurricane facts that provide hurricane terminology, history, and maps of the four hurricanes' paths. Chapters that follow give the scientific response of USGS to the storms. Both English and metric measurements are used in the articles in anticipation of both general and scientific audiences in the United States and elsewhere. Chapter 8 is a compilation of relevant ongoing and future hurricane work. The epilogue marks the 2-year anniversary of Hurricane Katrina. An index of authors follows the report to aid in finding articles that are cross-referenced within the report. This report will be available online at <http://pubs.usgs.gov>.

In addition to performing the science needed to understand the effects of hurricanes, USGS employees helped in the rescue of citizens by boat and through technology by "geotagging" 911 calls after Katrina and Rita so that other rescuers could find persons trapped in attics and porches. They also delivered food and water to residents stranded along the lower Mississippi River for several days. That work is reported in chapter 3 of this volume.

A great number of scientists contributed to this peer-reviewed report designed for a general audience. Because they work for USGS—an unbiased, multidisciplinary science organization that focuses on biology, geography, geology, geospatial information, and water—they are dedicated to the timely, relevant, and impartial study of the landscape and natural resources of the Nation, as well as natural hazards, like hurricanes, that threaten the Nation. To learn more about their work, visit the USGS Web site ([www.usgs.gov](http://www.usgs.gov)).



## Acknowledgments

We are grateful to the many people who contributed to this report. Our deepest gratitude goes to the more than 100 scientists who wrote the articles that describe how the U.S. Geological Survey used its science to respond to the Nation's needs after the significant hurricanes of 2005: Hurricanes Dennis, Katrina, Rita, and Wilma.

We also wish to acknowledge the dozens and dozens of independent peer reviewers who read and commented on these articles to improve them and check for accuracy. Along that line, we are aware of the important work of the USGS scientists who performed the final review of these articles: Jim D. Petty and Elisabeth M. Brouwers, biology; Keith J. Lucey, water; Jeffrey D. Spooner, geography; and Kathie Rankin and Vito F. Nuccio, geology.

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