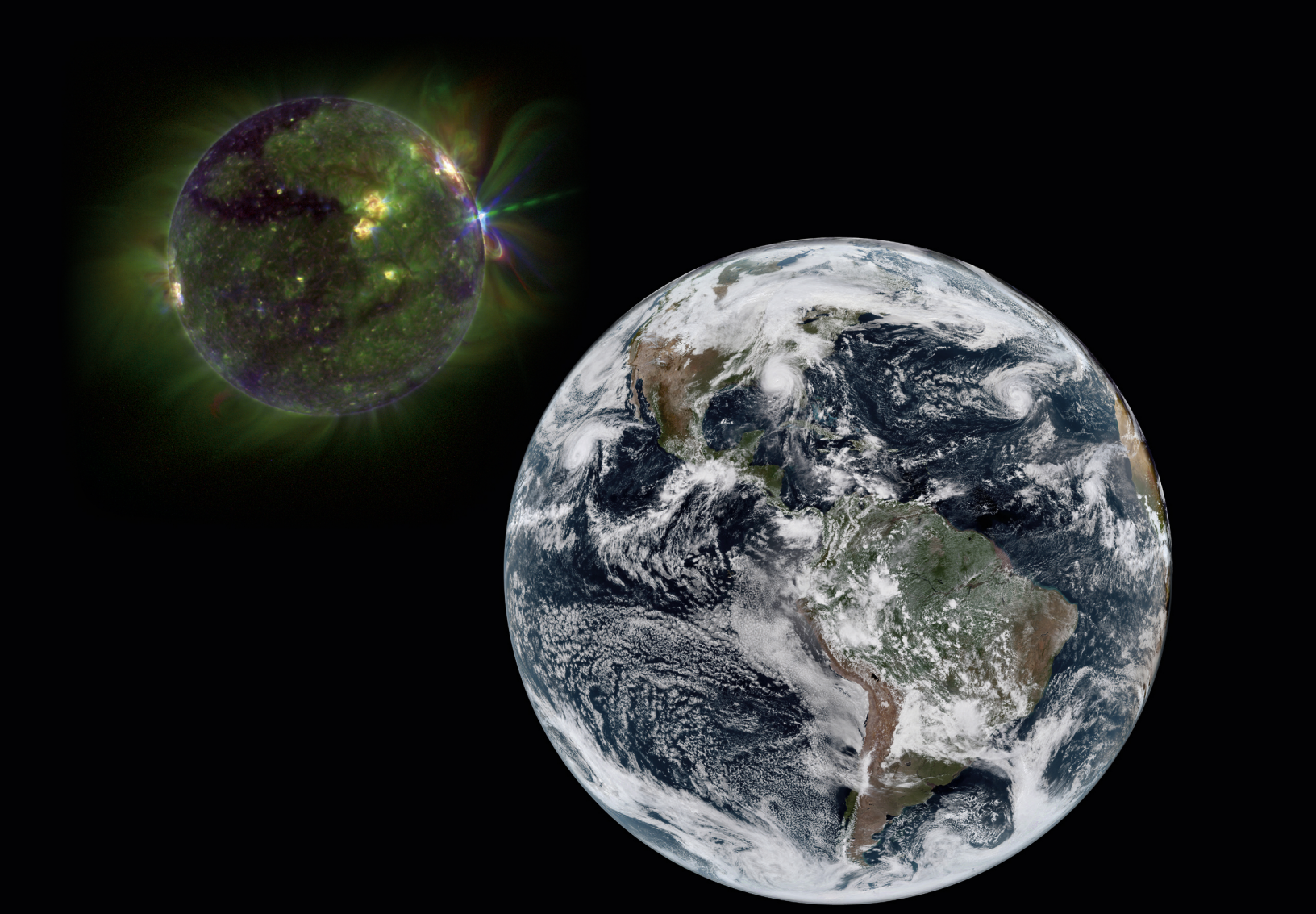

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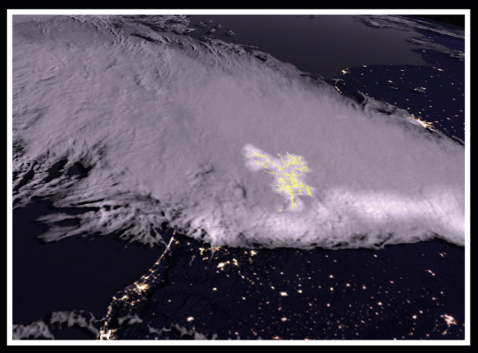
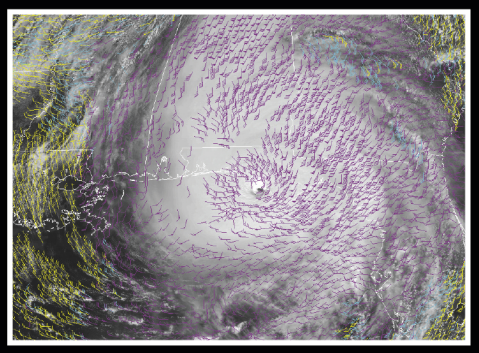
A New Generation of Geostationary Environmental Satellites





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Steven J. Goodman
Timothy J. Schmit
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THE GOES-R SERIES

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A New Generation of Geostationary Environmental Satellites

Edited by

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Timothy J. Schmit

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Upper Left: Extreme ultraviolet imagery reveals the onset of a major solar flare and eruption.
Image credit: Daniel Seaton/University of Colorado

Middle: True color image of Hurricane Michael in the northern Gulf of Mexico.
Image credit: Daniel Lindsey/NOAA

Lower Left: Lightning flash with extreme horizontal extent illuminating a storm complex over Uruguay.
Image Credit: Michael Peterson/University of Maryland

Lower Right: Satellite derived upper level, mid level, and lower level wind fields in the vicinity of Hurricane Michael.
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Preface

It is not every day when you get to be a part of history, and it is even rarer to see and participate in an endeavor that positively changes the lives of billions now and in the future. The Geostationary Operational Environmental Satellites (GOES)-R Series (GOES-R) provides exactly that—a technical, intellectual, and scientific adventure to observe and understand our planet and to inform and instruct us all on how to see the world and to thrive on it. It was my privilege to be a part of the team that brought GOES-R to completion and delivered the satellites to the world.

The United States deployed the first geostationary satellites to observe weather and other environmental phenomena over 50 years ago. The National Oceanic and Atmospheric Administration (NOAA), working with the National Aeronautics and Space Administration (NASA) and with many academic and industrial partners, has been continuously operating GOES since 1975, and over the years GOES observations have gradually become a part of daily lives. Through the first 15 GOES, NOAA and NASA learned how to build instruments and satellites to deliver nearly continuous observations of high impact environmental phenomena such as severe storms, hurricanes, flash floods, fires, volcanic eruptions, and solar storms, and showed us which measurements were the most informative. But when the last satellite, GOES-15, was launched in 2010, it was flying with technology developed in the 1980s.

Between 1999 and 2006, NOAA led an effort, working with NASA and a broad coalition of experts from throughout the Earth observing, solar imaging, and space weather monitoring community, to envision what was necessary and what was possible for the future GOES. In the 44 years since the first GOES was launched, our understanding of the entire Earth environment has expanded, technology for satellites and Earth observing instruments has grown tremendously, and most significantly, our ability to process and interpret mammoth data rates from multiple sources has changed our perception of what could be done with a new GOES system.

The GOES-R Series is the result of that reimagining of geostationary observations and their place in monitoring the overall Earth, solar, and space environment.

In the chapters that follow, you will learn from those same scientists and engineers, numerical modelers, instrument developers, programmers, and program managers who considered the possibilities and then worked for decades to make GOES-R a reality. These men and women and the teams they led and worked with are the true visionaries of our Earth observation world, and we all benefit from their focus. Their reward is to revel in the wealth of data and information GOES-R is providing and will continue to provide for another 20+ years.

As you read through this wonderful book (or skip directly to your favorite chapter), I ask you to do two things. First, pay attention to how the authors describe what defined the instrument or application in question, what was the requirement that drove them. But also look at how they have continued to explore the ultimate possibilities of what we might learn from the measurements. These research efforts and aspirational applications will determine the ultimate value of GOES-R. Second, as you read, have a computer nearby so you can visit your favorite NOAA website with GOES-R data (https://www.goes-r.gov/) available for inspection, and look at the amazing video loops and movies—these are not simulations—coming from the GOES-R instruments. Above all else, it is the introduction of the real-time movie views from the many sensors that set GOES-R apart from everything that came before it.

Stephen Volz
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We wish to acknowledge the support of NOAA, NASA, and the GOES-R Program as well as our academic and industry partners. This work, like the GOES-R mission, is truly a collaborative effort. Also thanks to Elsevier and Hilary Carr for their guidance and support in preparing this book for publication. Lastly, the editors would like to thank Greg Mandt, our long-time GOES-R System Program Director, for his leadership and unfailing support of the GOES-R team through the development and launch of the first satellite in the series.