Foreword

Tempests in a Greenhouse: Assessing Coastal Risk in a Changing Climate

Among the greatest threats posed by climate change is the risk to hundreds of millions of coastal inhabitants from both rising seas and more intense hurricanes. This heightened societal exposure has profound implications for people and communities, various stakeholders and businesses, and the stability and resilience of our built and natural environment. In this important edited volume by Jennifer M. Collins and James Done, key experts in the field provide a blueprint for assessing and managing the coming risk through an assessment of the collective evidence from models and observations, and insights from a variety of case studies and approaches, with a range of perspectives that reflects current uncertainties about projections and impacts.

It's worth taking stock of what we already know about climate change and coastal risk. Even in the absence of changing tropical cyclone characteristics, for example, sea level rise means worse storm surges. The 14-foot storm surge at Battery Park from 2012 Superstorm Sandy, for example, contained the better part of a foot of global sea level rise. That meant 25 more square miles of flooding and billions of dollars in additional damage.

Tropical cyclones, moreover, are reaching higher peak intensities, driven by the additional energy that comes from increased evaporation from warmer oceans, and the latent heating of the atmosphere that comes when that rising moisture condenses into clouds and rainfall. That means more direct wind damage from landfalling storms, but, all else being equal, greater intensities come with bigger storm surges, and more coastal flooding.

The additional moisture in the storms leads to greater inland rainfall rates and flooding. That means more catastrophic "compound flooding" events where storm surge backs up estuaries as flooding rains continue to fall. The two worst flooding events in US history—the 2017 landfall of Hurricane Harvey in Texas and the 2018

landfall of Hurricane Florence in the Carolinas—happened within the past 5 years. That's not a coincidence.

We're now dealing with more dangerous and damaging storms. Some might call these natural disasters, but how "natural" are they, really? The scientific consensus is that we wouldn't be seeing these stronger, wetter storms if not for the human factor of carbon pollution and a warming climate. We should probably be calling these increasingly dangerous storms "unnatural disasters."

When it comes to policy and planning, there's also much we know. We know enough, for example, to justify substantial mitigation, that is, taking actions to ramp down carbon emissions and stop the continued warming of the planet that is fueling the growing coastal threat. And we know enough to justify adaptation—taking measures to instill greater coastal resilience in the face of both the heightened threat that already exists and the additional threat we are committed to in the form of continued sea level rise.

But there are many gaps in our knowledge and understanding that remain in both the scientific and policy realm. Will we see more landfalling hurricanes or not? If so, where? Are tropical islands at particular risk? Think Puerto Rico and the deadly landfall of category 5 Maria in 2017.

Are there better ways to define hurricane risk that would aid emergency planners? For example, are there metrics of damage we can define that incorporate compound impacts of wind and flood damage? How are damages and insured losses likely to change in the future? There are uncertainties in the climate model projections and complications that arise from the differences in how flood and wind damage is insured that create nontrivial challenges here. How can "counterfactual" analysis (consideration of what damages might have resulted if the details of a particular event had been different in various ways) be used by insurers to better assess risk? And last but not least, how do socioeconomic and demographic factors influence exposure and risk and how we go about reducing it?

The value of this book is its effort to identify the gaps, fill them in where possible, and, perhaps most importantly, provide a rigorous, scientifically based framework for continued updating and refining of our methods for assessing and reducing coastal risk from tropical cyclones. It is a must-have resource for scientists, insurers, reinsurers, real estate managers, city planners, emergency planners, policymakers, and anyone connected in one way or another to matters involving coastal risk.

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