

Science of preparedness

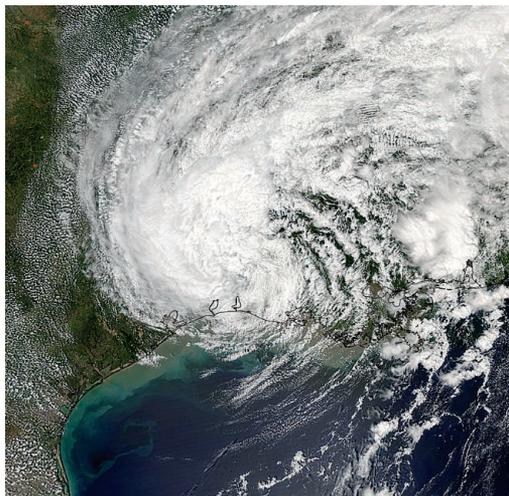
Our hearts go out to those affected by hurricanes Harvey and Irma and by earlier monsoons across South Asia. These events are compelling reminders of the important role that science must play in preparing for disasters. But preparation is challenging, as reflected in the many facets of the “science of preparedness.” Certainly, modeling and forecasting storms are critical, but so are analyses of how agencies, communities, and individuals interact to understand and implement preparedness initiatives.

Hurricane tracking has received much recent attention as Harvey and Irma moved across the Atlantic. Information about the hurricanes’ movements was combined with other data through the use of large-scale computer models to estimate likely tracks and other characteristics of these storms. The physical principles underlying weather are understood well enough to generate equations that can extend initial values into the future, but the equations, the methods used for solving them, and available underlying data all have limitations. Additional empirical parameters are introduced to produce workable models. It is variations and uncertainties that allow the development of several different models that make distinct predictions about future tracks.

The public has become used to seeing depictions and comparisons of the results of these different models, allowing individuals to develop an intuitive sense of the uncertainty associated with these ambitious calculations. The convergence of the models as storms approach can allow agencies and communities to act before a storm’s arrival, particularly if plans have been prepared in advance that are ready to be triggered. Extending the accuracy of the models as far into the future as possible will allow more time for the public and government officials to make and implement decisions that may mitigate damage and help prepare for the immediate aftermaths. The United States government recently passed the Weather Research and Forecasting Innovation Act of 2017, which

includes aims to improve longer-range forecasting.

Long-range estimates of the number and expected severity of storms in an upcoming hurricane season are also challenging because they are driven in part by changes in Earth’s climate. These estimates depend on empirical data regarding long-term trends from previous seasons as well as computational models. Physical principles suggest that increases in storm intensity is a very likely consequence of global warming (see www.gfdl.noaa.gov/global-warming-and-hurricanes).



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These long-range predictions may be useful for urban planning and forward-looking budgeting to prepare, not for a particular event, but rather, for the likely occurrence of storms over time in a given location.

The science of preparedness also relates to the development and evaluation of disaster management plans. Work in this area involves analysis of previous events to discern whether responses were effective in mitigating potential adverse outcomes or may have, in some cases, made them worse. Coordination between different agencies, the timeliness and clarity of decisions made by officials, and prior identification and mobilization of resources have all been identified as key factors of management plans. In addition, progress

has been made in developing computational models that simulate events such as disease outbreaks, such that the responses of virtual individuals are modeled in response to different scenarios. With appropriate development, such tools may be useful for exploring a wider range of circumstances and enhancing preparedness without such a strong dependence on data from previous actual events.

The recent storms have dramatically affected many people. We must increase attention on refining tools to improve preparedness, but keep in mind that improved tools are useful only if appropriate steps are implemented. This will require coordinated efforts between agencies and the public to develop resources and trust.

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