



Extreme Weather Risk in a Changing Climate: Enhancing prediction and protecting communities

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DRAFT/PRE-DECISIONAL

PCAST Working Group

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Scene Setter:

- The most immediate danger that Americans face from climate change is the worsening of extreme weather disasters, such as hurricanes, floods, droughts, heatwaves, and wildfires.
- Extreme weather disasters have caused over \$1 trillion in damages over the last seven years, and in 2022 alone, displaced an estimated 3.4 million Americans from their homes.
- The fundamental modeling capabilities, however, exist within federal agencies to better inform households, business, and community leaders of the probabilities (location, severity) of extreme weather hazards.
- This report recommends steps to dramatically improve our quantification of extreme weather risk and the development of a national adaptation plan which, taken together, can protect the lives, livelihoods, and property of Americans for generations.



Operational Weather Prediction:

- Predict weather a short time into the future from conditions today
- Responsibility of the National Oceanic and Atmospheric Administration (NOAA)

Climate Science Research:

- Climate is the likelihood of weather, such as the chance of a 90-degree day on July 14, 2023 in Washington DC or a Cat 5 hurricane in Miami in September of 2032
- Decades of work by the NOAA, NASA, DOE and NSF climate centers on likelihood of extreme weather has led to steady progress that has recently surged ahead
- The four main climate science centers **collectively** now have the ability to assess risks of extreme weather through midcentury far more accurately than we can do today

Operational Effort by NOAA, NASA, NSF and DOE

- Estimate extreme weather risks at fine geographic scale through midcentury



Recommendation 1: *A National Effort to Quantify Extreme Weather Risk*

*To prepare for dangerous weather one needs to know how damaging it is likely to be and how frequently it will occur. A levee designed for a 100-year storm producing 15 inches of rain is not adequate if the 100-year storm now packs 25 inches. We **recommend a focused federal effort** to provide estimates of the annual risk that a weather event of a given severity will occur in any location and year between now and midcentury. These include extremes of temperature, rainfall, and wind speed.*

- **1.1. U.S. climate-modeling centers** supported by the National Oceanic and Atmospheric Administration (NOAA), National Science Foundation (NSF), Department of Energy (DOE), and National Aeronautics and Space Administration (NASA) **should enhance their high-resolution modeling capabilities and state-of-the-art statistical methods to quantify the current and near-future risks of extreme weather** at a resolution of 10 km or finer. This will require both agency prioritization and collaboration.
- **1.2. The White House should designate a lead agency to maintain an extreme weather data portal where observations and modeling products are regularly updated and widely accessible**, using an analysis-ready format that enables downstream users and hazard models on smaller scales to assess the local risks of wildfire, flood, drought, and other weather-related hazards.



Recommendation 2: An Improved Ecosystem for Climate Risk Assessment

To prepare for changing patterns of extreme weather, the nation will require information beyond the probabilities of extreme temperature, rainfall, and wind speed. One must be able to predict the severity of resulting weather hazards, (e.g., flood, fires and droughts) and the human and economic losses they will cause. We recommend steps that will enable the development of high-quality private and public sector tools to better measure and evaluate extreme weather-related risks across the country.

- **2.1 Designate an inter-agency group to inventory and release federal data** that are useful to develop and test weather-hazard models, which predict flood, fire and drought from extreme weather, and hazard-loss models, which predict human and financial losses from hazards or directly from extreme weather such as significant heat, cold, hail, or wind. This effort should include any relevant and available fine-scale elevation data and other physical information, as well as data on Federal disaster and insurance claims needed to validate risk models, with appropriate safeguards to protect privacy and security.
- **2.2 The National Oceanic and Atmospheric Administration (NOAA) and the Federal Emergency Management Agency (FEMA) should develop guidelines for measuring the accuracy of weather-hazard and hazard-loss models with skill scores** and promote the use of skill-scoring among federal agencies that rely on assessments of climate and weather hazards including flood, drought, storm, and wildfire, and the human and economic damages they cause.
- **2.3 Fund research**, potentially through multiple agencies, **on risk-assessment modeling systems** that use extreme weather probabilities, weather-hazard models, and hazard-loss models **to quantify the likelihood and economic costs of extreme weather events.** This effort should aim to foster improved quantification of weather-hazard risks in the public and private sector, through improved access to models and data, and a robust ecosystem of model evaluation and testing.



Recommendation 3: A National Adaptation Plan to Mitigate Extreme Weather Risk

To prepare for changing risks from extreme weather, the provision of information will not be enough, especially given uneven resources across local communities. The federal government can **accelerate preparedness by creating a national plan that guides and supports investment at all levels**, and by funding research that illuminates which policy responses are effective and equitable.

- **3.1** The White House should develop and publish a National Adaptation Plan to prepare for and mitigate increased risks from extreme weather. The Plan should include:
 - **A systematic approach to mapping high-danger zones** for each extreme weather hazard, updated as estimates of risk are improved.
 - **Decision frameworks to assist local communities** in making plans to mitigate or adapt to extreme weather risk.
 - A plan for **distributing federal funds for disaster preparation that reduces existing barriers** for low-income communities to access and make use of federal grants and programs.
 - **Guidelines for equitable allocation of disaster relief.** These guidelines should anticipate the potential for recurring extreme weather events, so that relief programs work to mitigate future dangers to a community.
- **3.2** **Fund research on the adaptation** of households, real-estate and insurance markets, and local **governments to changing climate and extreme weather risk.** This effort should aim to illuminate the behavior of households and firms in response to evolving climate and weather risks, and the benefits and costs of alternative policies aimed at mitigating and adapting to these risks. NSF may be best positioned to lead this effort.

