

Natural Hazards

The consequences to the economy, as well as public health and safety, due to natural hazards, such as droughts, earthquakes, wildfires, hurricanes, volcanic eruptions, and tornadoes, can be devastating. No region in the U.S. is immune.

The American Geophysical Union and its network of Earth and space scientists play a critical role:

- studying the cause and predictability of natural hazards
- investigating ways to reduce the geophysical, ecological, societal, and economic impacts
- helping to create resilient communities
- educating the public



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The Impacts

Losses from natural hazards are extensive, often amounting to billions of dollars, injuries, and death.

- From 2004 to 2013, the U.S. saw estimated losses from the following disasters: \$392 billion from hurricanes, \$78 billion from heat waves and drought, \$76 billion combined from tornadoes, flooding, and severe storms.¹
- Hurricane Katrina is the costliest natural disaster in U.S. history, amounting to more than \$200 billion in losses and accounting for more than 1200 deaths.²
- Nearly 5 million Americans and hundreds of billions of dollars in property reside at less than 1.2 meters above local high-tide levels.³ Annually, flooding kills an average of 140 people and results in \$6 billion in damages.⁴
- Nearly 39% of the U.S. population lives in communities along coastal shorelines and may be at risk from tsunamis.⁵
- Spring 2011—one of the deadliest tornado seasons on record—resulted in at least \$21 billion in economic damages, \$15 billion in insured losses, and 585 deaths.⁶

- In 2015 alone, more than 68,000 wildfires burned more than 10 million acres of land.⁷ In 1995, the U.S. Forest Service spent 16% of its budget fighting fires; that number increased to 52% in 2015 and is expected to grow to more than two-thirds of the Forest Service budget by 2025.⁸
- Space weather affects operations on Earth such as satellite operations, GPS, aviation, and power. Disruption to GPS could cost the oil-drilling industry approximately \$1 million per day. A severe geomagnetic storm could damage the nation's electrical power grid and result in estimated economic costs of \$1–2 trillion and a recovery time of 4–10 years.⁹

¹U.S. Global Change Research Program (USGCRP) Climate and Health Assessment, https://s3.amazonaws.com/climatehealth2016/high/ClimateHealth2016_FullReport.pdf.

²U.S. Geological Survey (USGS), "Flood Hazards—A National Threat," <http://pubs.usgs.gov/fs/2006/3026/>; National Hurricane Center, <http://www.nhc.noaa.gov/pdf/nws-nhc-6.pdf>.

³USGCRP Climate and Health Assessment.

⁴USGS, "Flood Hazards—A National Threat."

⁵P. K. Dunbar and C. S. Weaver, "United States and Territories National Tsunami Hazard Assessment: Historical Record and Sources for Waves—Update," http://nws.weather.gov/nthmp/documents/Tsunami_Assessment_2016Update.pdf.

⁶National Weather Service (NWS), "Value of a Weather-Ready Nation," <http://www.nws.noaa.gov/com/weatherreadynation/files/Weather-Econ-Stats.pdf>.

⁷National Interagency Fire Center, https://www.nifc.gov/fireInfo/fireInfo_statistics.html.

⁸U.S. Department of Agriculture, "The Rising Cost of Wildfire Operations," <http://www.fs.fed.us/sites/default/files/2015-Rising-Cost-Wildfire-Operations.pdf>.

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The Solution

Scientific research and development are essential to the nation's prosperity and to improving America's resilience to natural hazards. The benefits of this work are notable and widespread:

- Weather events can impact the U.S. by up to a total of \$485 billion a year (or about 3.4% of the 2008 gross domestic product) as a result of weather variability.¹⁰ Better forecasting and predictability could influence this number.
- The National Oceanic and Atmospheric Administration's forecast and warning services result in \$3 billion in savings during a typical hurricane season.¹¹
- The U.S. agriculture industry sees \$460 million in annual savings from accurate El Niño and La Niña forecasting.¹²

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- Advanced flood warnings result in up to \$1.62 billion savings annually and a 10% reduction in damages.¹³
- Every \$1 spent by rail companies on receiving climate data results in \$13,140 in savings on the infrastructure costs that would be required to maintain their own climate reporting system.¹³
- From 2015 to 2027, estimated savings of \$5.1 billion (including \$1.28 billion for energy providers, \$265 million for the airline industry, and \$545 million in agriculture) are expected as a result of the National Weather Service's GOES-R satellite system (used for monitoring hurricanes, heavy rainfall, lightning strikes, tornadoes, and space weather).¹³



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⁹ National Research Council, Severe Space Weather Events—Understanding Societal and Economic Impacts, National Academies Press, Washington, D. C., 2008, <http://www.nap.edu/download/12507#>.

¹⁰ J.K. Lazo, M. Lawson, P.H. Larsen, and D.M. Waldman. "United States Economic Sensitivity to Weather Variability." Bulletin of the American Meteorological Society, 92, June 2011.

¹¹ NWS, "Weather-Ready Nation Roadmap 2.0," http://www.nws.noaa.gov/com/weatherreadynation/files/nws_wrn_roadmap_final_april17.pdf.

¹² NWS, "Value of a Weather-Ready Nation."

¹³ National Hydrologic Warning Council, "Use and Benefits of the National Weather Service River and Flood Forecasts," <http://www.nws.noaa.gov/oh/ahps/AHP5%20Benefits.pdf>