



Aug 30, 2018
NCST Advisory
Committee Meeting

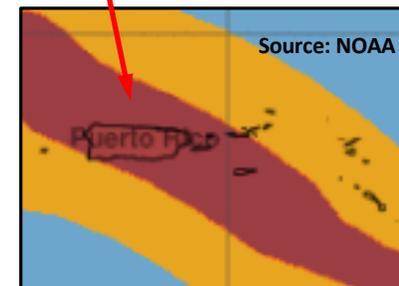
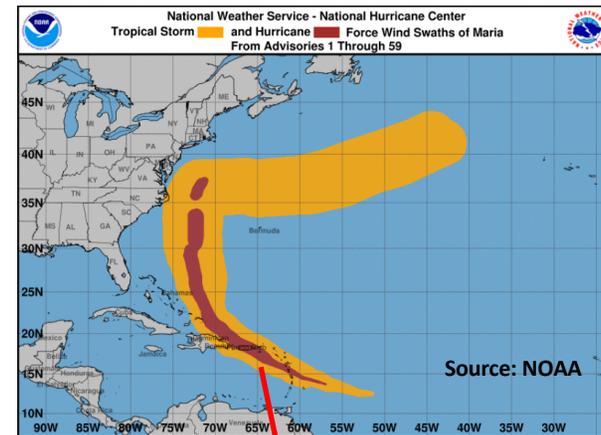
NCST Technical Investigation of Hurricane Maria's Impacts on Puerto Rico: An Introduction

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Hurricane Maria's Hazards in Puerto Rico

- TS Maria formed west of the Lesser Antilles on Sept 16*.
- Maria intensified to Category 5 status in two days, with sustained winds of 175 mph*.
- Hurricane Maria made landfall in Puerto Rico on Sept. 20 as a strong Category 4 storm*.
- Most intense hurricane to strike Puerto Rico since the Category 5 Okeechobee Hurricane of 1928**.
- Maria impacted Puerto Rico just 13 days after Hurricane Irma, which brought tropical storm-force winds to the entire Commonwealth***.

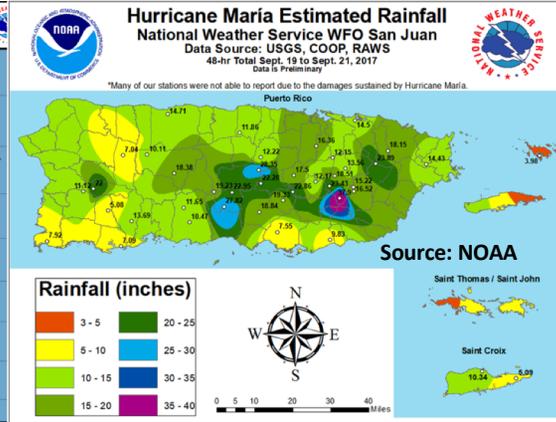
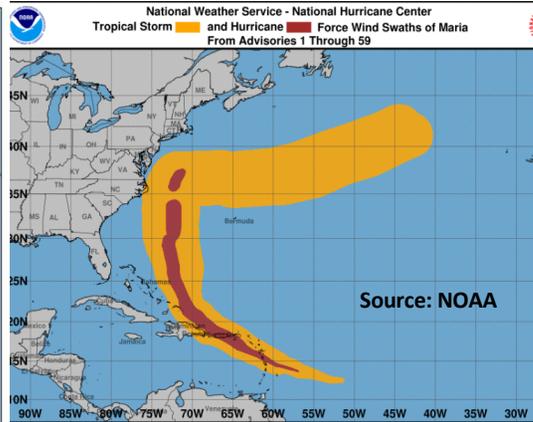
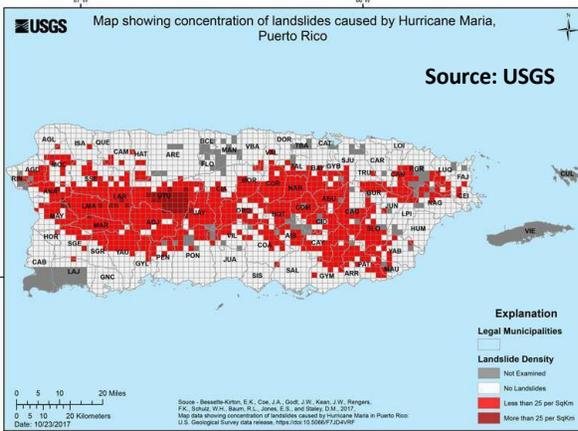


*Source: <https://www.nhc.noaa.gov/archive/2017/MARIA.shtml>;
<http://www.weather.gov/sju/maria2017>

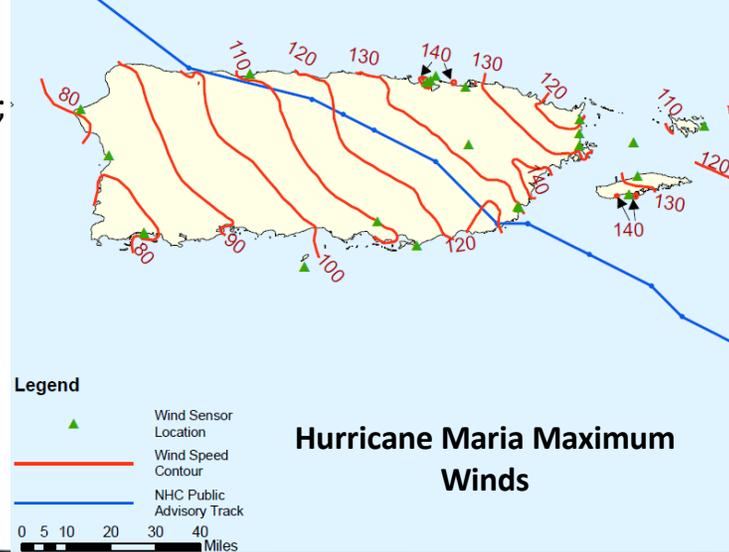
**Source: <https://www.nhc.noaa.gov/outreach/history/#okee>

***Source: <https://www.nhc.noaa.gov/archive/2017/IRMA.shtml>

Hurricane Maria's Hazards in Puerto Rico



- **Winds:** Maria made landfall as a strong Cat 4 storm; the storm tracked diagonally across PR, with hurricane-force winds extending over the entire Commonwealth (~3.4 million people); maximum estimated peak wind gusts were 140+ mph (National Hurricane Center [NHC], NIST)
- **Storm Surge:** Surge produced inundation up to 9 ft along the southeastern coast of PR (NHC)
- **Rain:** Extensive rainfall, with max 38" (NHC)
- **Landslides:** Many hundreds of landslides occurred throughout mountainous regions (USGS)



Population Exposure to Hurricane Maria's Hazard



- **Exposed Population:** The entire Commonwealth of Puerto Rico was exposed to Maria (total population is approximately 3.3 million*).
 - **Mortality:** Puerto Rico's Department of Public Safety certified 64 deaths related to the storm**, but later updated this estimate to 1,427*** on June 13, 2018.
- The New York Times** and other news organizations estimate that the actual death toll could be over 1,000, based on analysis of daily mortality data from Puerto Rico's Vital Statistics Record Office.
 - Harvard School of Public Health conducted a population-based survey and estimated 793 to 8,498 deaths.****
 - George Washington University is completing a study of excess mortality in Puerto Rico.*****

*Source: <https://www.census.gov/quickfacts/PR>

**Source: Robles, F., Davis, K., Fink, S, Almukhtar, S., 2017. "Official Toll in Puerto Rico: 64. Actual Deaths May Be 1,052." *The New York Times*. December 9, 2017

*** Puerto Rican Government, 2018. "Transformation and Innovation in the Wake of Devastation: An Economic and Disaster Recovery Plan for Puerto Rico," a preliminary report dated July 9, 2018 and released for public comment.

****Source: Kishore N, Marques D, et al. *Mortality in Puerto Rico after Hurricane Maria*. *NEJM* 2018; 379:162-170

*****Source: Milken Institute School of Public Health News Release, May 30, 2018:

<https://publichealth.gwu.edu/content/milken-institute-sph-project-will-estimate-excess-mortality-puerto-rico-tied-hurricane-maria>

NIST Director Establishes NCST



The NIST Director established a Team under the National Construction Safety Team (NCST) Act on February 21, 2018 to conduct a technical investigation of the effects of Hurricane Maria on the U.S. territory of Puerto Rico and characterize:

- (1) the wind environment and technical conditions associated with deaths and injuries;*
- (2) the performance of representative critical buildings, and designated safe areas in those buildings, including their dependence on lifelines; and*
- (3) the performance of emergency communications systems and the public's response to such communications.*



National Windstorm Impacts Reduction Program (NWIRP)

- NWIRP was established by the U.S. Congress is to achieve major measurable reductions in the losses of life and property from windstorms.
- In the 2015 NWIRP reauthorization, Congress designated NIST as the Lead Agency for NWIRP. Other designated Program agencies are the Federal Emergency Management Agency (FEMA), the National Oceanic and Atmospheric Administration (NOAA), and the National Science Foundation (NSF).
- NIST is primarily responsible for planning and coordinating the Program, which includes:
 - Ensuring that the Program includes the necessary components to promote the implementation of windstorm risk reduction measures;
 - Supporting the development of performance-based engineering tools, and working with appropriate groups to promote the commercial application of such tools;
 - Requesting the assistance of Federal agencies other than the Program agencies, as necessary;
 - Coordinating all Federal post-windstorm investigations to the extent practicable; and
 - When warranted by research or investigative findings, issuing recommendations to assist in informing the development of model codes, and providing information to Congress on the use of such recommendations.

<https://www.nist.gov/el/materials-and-structural-systems-division-73100/national-windstorm-impact-reduction-program-nwirp>

NWIRP Study of Hurricane Maria (Puerto Rico)

- Under the National Windstorm Impact Reduction Act Reauthorization of 2015 (Public Law 114-52), NIST is conducting a scientific study of Hurricane Maria's impacts on Puerto Rico and subsequent recovery processes.
- Goals of the NWIRP study of Hurricane Maria are to determine:
 - 1) *The impacts to and recovery of small and medium-sized manufacturers (SMMs), with a focus on supply chain disruption, as well as businesses in retail and service industries;*
 - 2) *The impacts to and recovery of education and healthcare services;*
 - 3) *The impacts to and recovery of infrastructure systems in Puerto Rico, with a focus on infrastructure that supports the functioning of critical buildings (i.e., hospitals and schools) and emergency communications.*

Agenda

- NCST Investigation Goal 1a: the wind environment (Joseph Main)
- NCST Investigation Goal 1b: the technical conditions associated with deaths and injuries (Thomas Kirsch and Judith Mitrani-Reiser)
- *Discussion of Goal 1*

- NCST Investigation Goal 2: the performance of representative critical buildings, and designated safe areas in those buildings, including their dependence on lifelines (Joseph Main and Ken Harrison)
- NCST Investigation Goal 3: the performance of emergency communications systems and the public's response to such communications (Erica Kuligowski and Marc Levitan)
- *Discussion of Goals 2 and 3*



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