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NCST Advisory
Committee Meeting

NCST Technical Investigation of Hurricane Maria's Impacts on Puerto Rico: Preliminary Project Plan for Characterization of Hazards

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Goal 1: The Wind Environment and Technical Conditions Associated with Deaths and Injuries

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Associated with Deaths and Injuries

this presentation

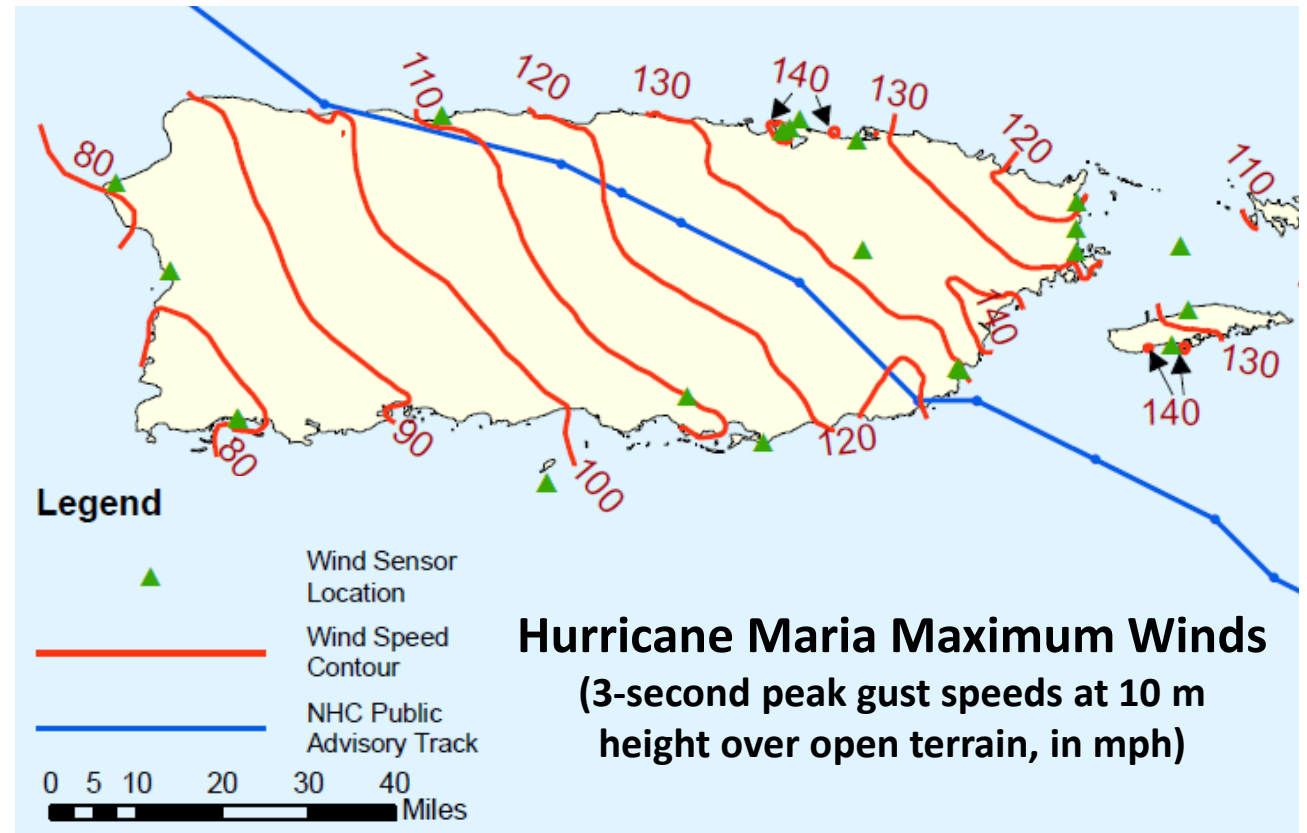
Project: Characterization of Hazards

Objective: To characterize the wind environment associated with Hurricane Maria's impact on Puerto Rico, using measurements and modeling of the time-dependent hurricane wind-field in conjunction with wind tunnel studies of topographic effects, and to document other hazards associated with the hurricane, including storm surge, rainfall, flooding, and landslides.

Background

Hurricane Maria subjected Puerto Rico to multiple hazards:

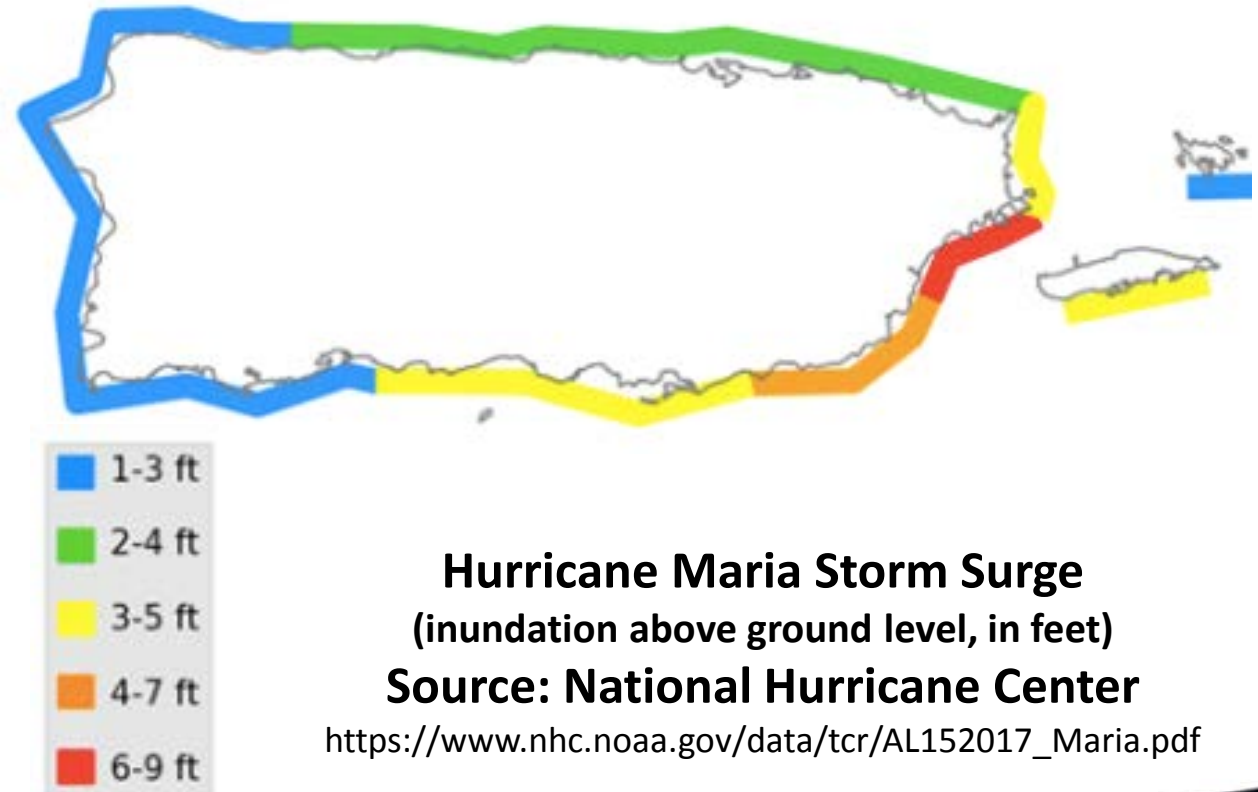
- High winds: peak gusts exceeded 140 mph



Background

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- High winds: peak gusts exceeded 140 mph
- Storm surge: peak coastal inundation exceeded 6 ft



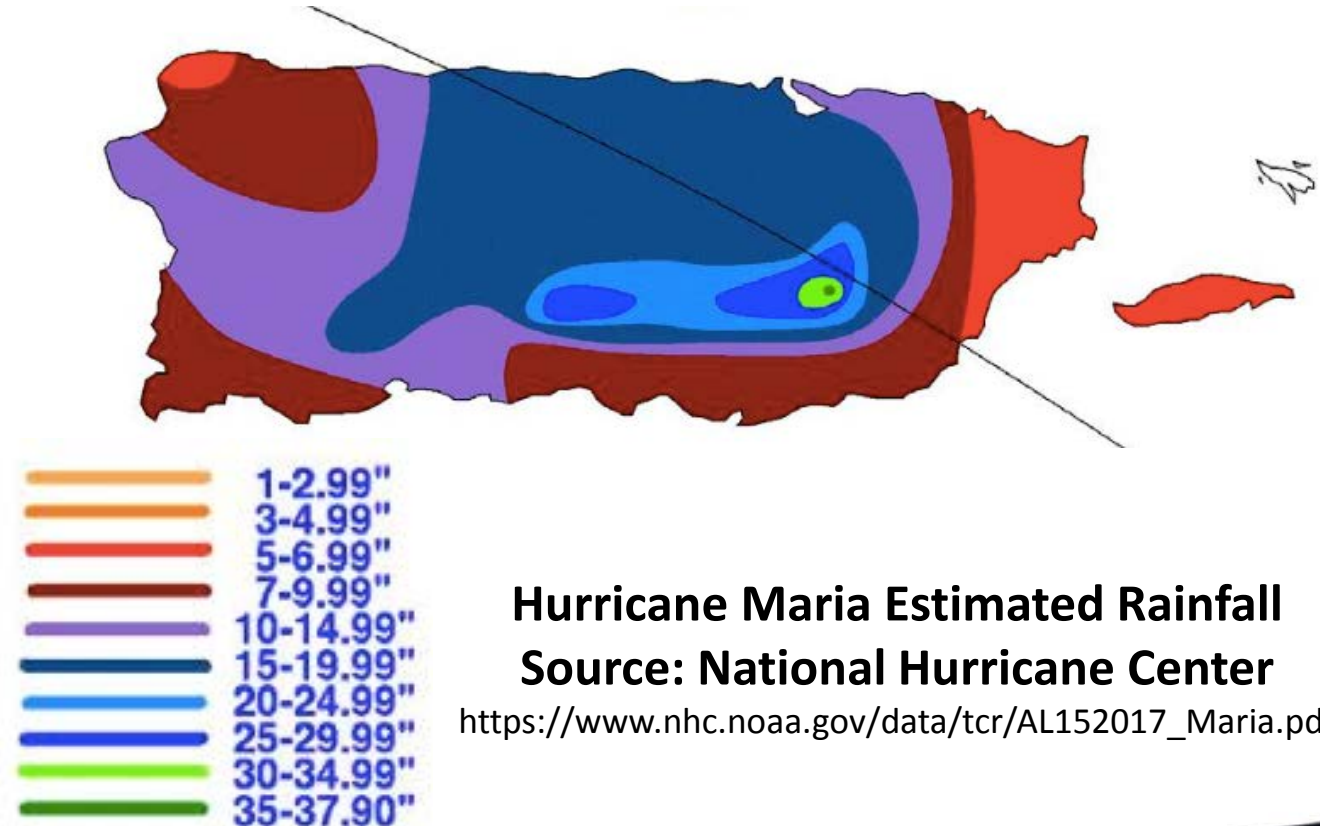
Hurricane Maria Storm Surge
(inundation above ground level, in feet)
Source: National Hurricane Center

https://www.nhc.noaa.gov/data/tcr/AL152017_Maria.pdf

Background

Hurricane Maria subjected Puerto Rico to multiple hazards:

- High winds: peak gusts exceeded 140 mph
- Storm surge: peak coastal inundation exceeded 6 ft
- Rainfall, flooding: total rainfall of 5 - 40 inches



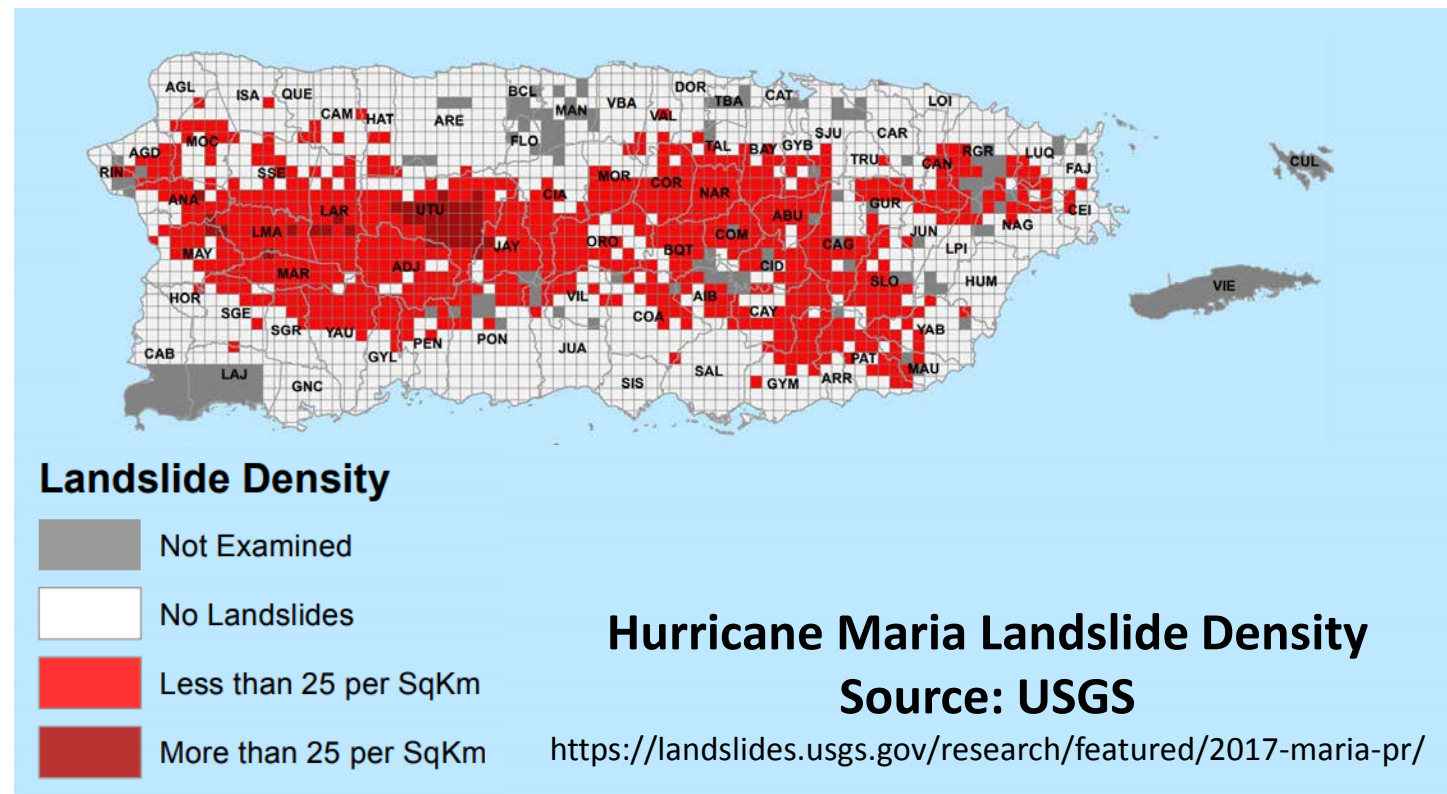
Hurricane Maria Estimated Rainfall
Source: National Hurricane Center

https://www.nhc.noaa.gov/data/tcr/AL152017_Maria.pdf

Background

Hurricane Maria subjected Puerto Rico to multiple hazards:

- High winds: peak gusts exceeded 140 mph
- Storm surge: peak coastal inundation exceeded 6 ft
- Rainfall, flooding: total rainfall of 5 - 40 inches
- Landslides: many hundreds occurred



Preliminary Project Plan: (1/4) Overview

- Hazard characterization will support multiple aspects of the investigation:
 - Deaths and injuries
 - Performance of critical buildings and designated safe areas
 - Dependence of critical buildings on lifelines
 - Emergency communications systems: performance and public response
- Primary focus will be on characterization of the wind environment, including topographic effects
- To document other hazards, outreach to other federal agencies is planned (NOAA, NASA, USGS) to identify relevant data sources and modeling capabilities

Preliminary Project Plan: (3/4) Wind Environment

- Develop a time-dependent wind-field model of Hurricane Maria's impact on Puerto Rico that optimally matches available measured data:
 - **Initial model:** topographic effects incorporated using existing empirical methods
 - **Final model:** topographic effects incorporated based on wind tunnel testing
- Characterize topographic wind speed-up effects based on wind tunnel modeling of Puerto Rico's topography
- Perform a probabilistic wind hazard analysis to evaluate the influence of topographic effects on design wind speeds in ASCE 7-16

Preliminary Project Plan: (4/4) Other Hazards

- Coordination with other agencies is planned to identify relevant data sources and modeling capabilities to characterize other hazards:
 - Storm surge: NOAA
 - Rainfall and flooding: NOAA, NASA, USGS
 - Landslides: USGS
- Both spatial and temporal variability of hazards will be considered
- Interaction of hazards can be significant and will be considered:
 - Wind-driven rain
 - Storm surge and rain-induced flooding
 - Effect of prior rainfall from Hurricane Irma

FY18 Planning Tasks

- Other agencies with relevant data sources and modeling capabilities for hazard characterization will be identified
- Regions of Puerto Rico will be identified where wind-tunnel testing of topographic effects is needed and requirements will be established for modeling and measurements
- Contract specifications will be developed:
 - Wind-field modeling and probabilistic wind hazard analysis
 - Wind-tunnel testing of topographic effects
- Plans will be developed for in-house modeling of topographic effects using CFD (computational fluid dynamics)