

Future Design Storms for Resilient Infrastructure

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Precipitation – Hurricanes & Climate Change in NC

How do we merge climate science with highway design to ensure that our infrastructure is more resilient in the future?

Designing to the increasing likelihood of more intense precipitation

Precipitation &
Future Design Values?

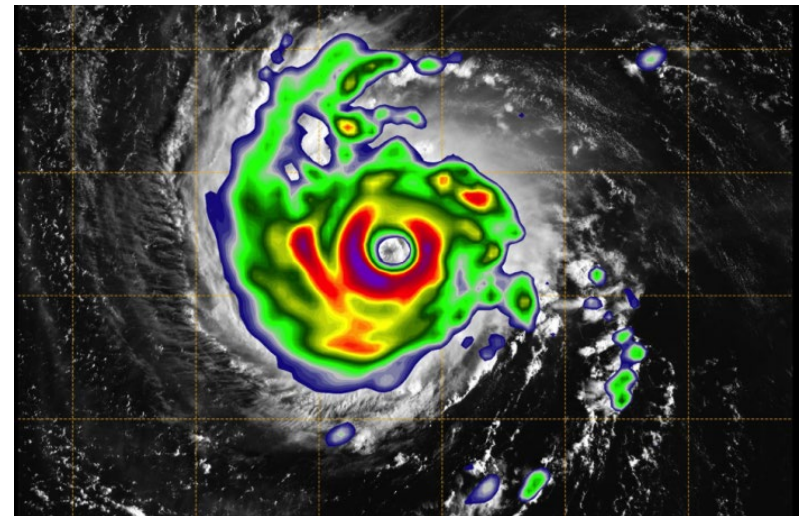
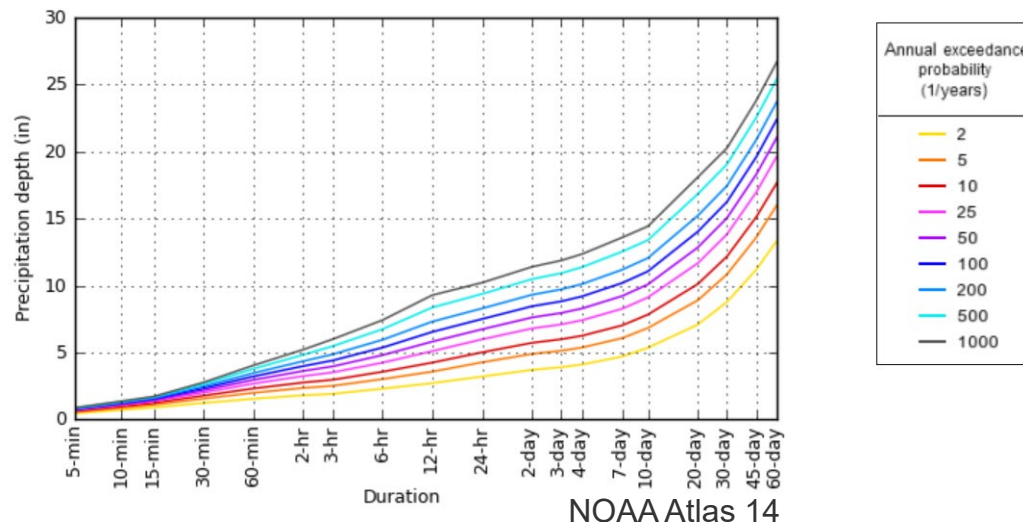
Requires many years of future
climate

(downscaled climate model
rainfall data)

Precipitation &
Future Storms - Hurricanes?

Idealized
atmospheric modeling
(idealized experiment rainfall
data)

Intensity, Duration, Frequency Curves



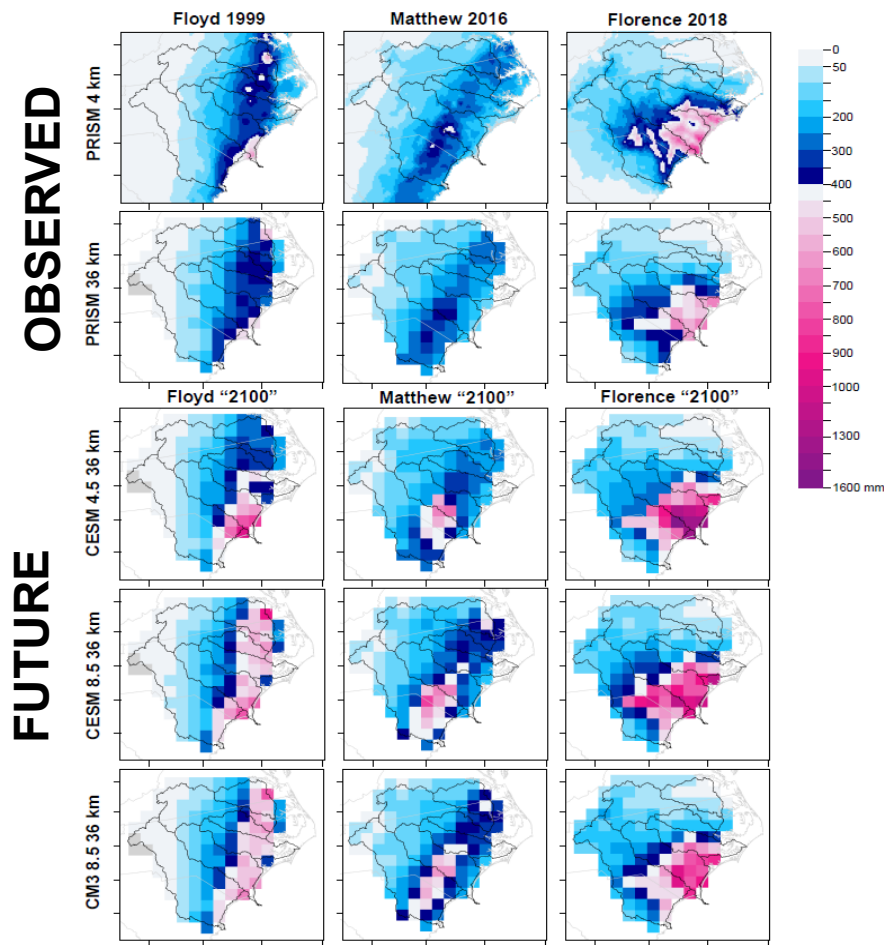
Satellite Image: NASA/NOAA/Naval Research
Laboratory Monterey/JPL-Caltech

Precipitation IDF Curves

End of Century Change

(Probabilistic high GHG emission scenario)

Future IDF (Delta) to Hurricane Florence



IDF Delta applied for duration period of each Hurricane

(Floyd, Matthew, Florence)

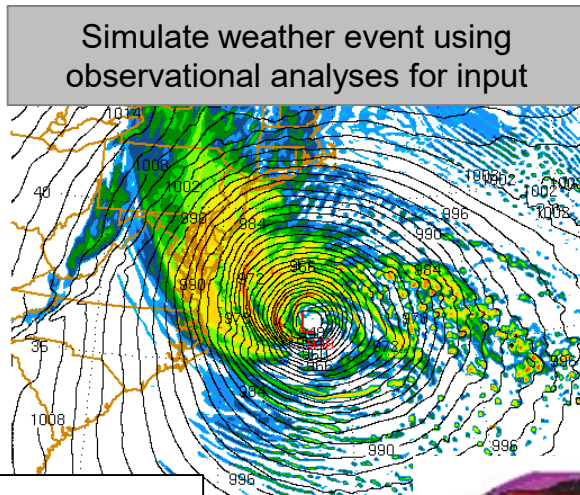
The change from blue to pink in the color scale occurs at 400 mm, which corresponds to 1000-year rainfall, based on the mean 1000-year rainfall in the study area (386 mm for 72h duration and 397 mm for 96h duration) from NOAA Atlas 14.

Idealized Atmospheric Modeling Experiment

Pseudo Global Warming (PGW) Method

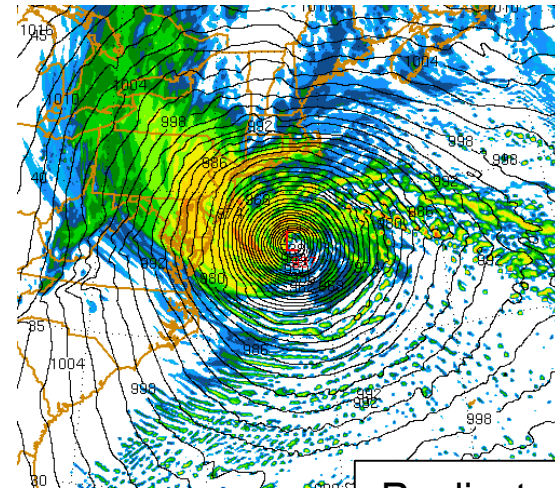
- Simulate weather event with observational input
- Apply climate model projected changes to input, re-run “future” or “past” version of event
- Can run for events or seasons, with “future or past environments”

Hurricane Sandy
Historical

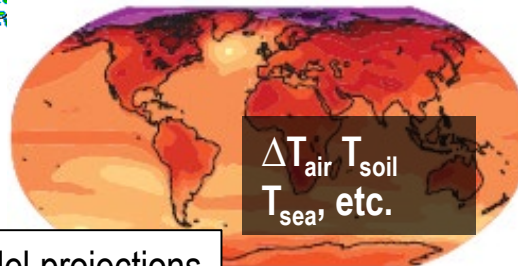


Set of hi-res
model
simulations

Hurricane Sandy
Future



Replicate set of hi-res
simulations



Climate model projections

Figure Courtesy:
Gary Lackmann (NCSU)

There are multiple methods to better understand how rainfall may change in a warmer climate

We should consider using **different methods** that provide future rainfall data *and their advantages/disadvantages*

Cross comparing these methods will increase our confidence in rainfall changes at regional to local scales

AND ULTIMATELY
Better-Informed Future Design Standards