Caribbean Hurricanes

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Why the Caribbean region?

- More than **50%** of the 44 million people living in the Caribbean reside within **1.5km of the coast** – Mimura et al (2007)
- Post hurricane recovery time = hurricane return time
- Caribbean region needs to be informed to prepare for impacts of climate change

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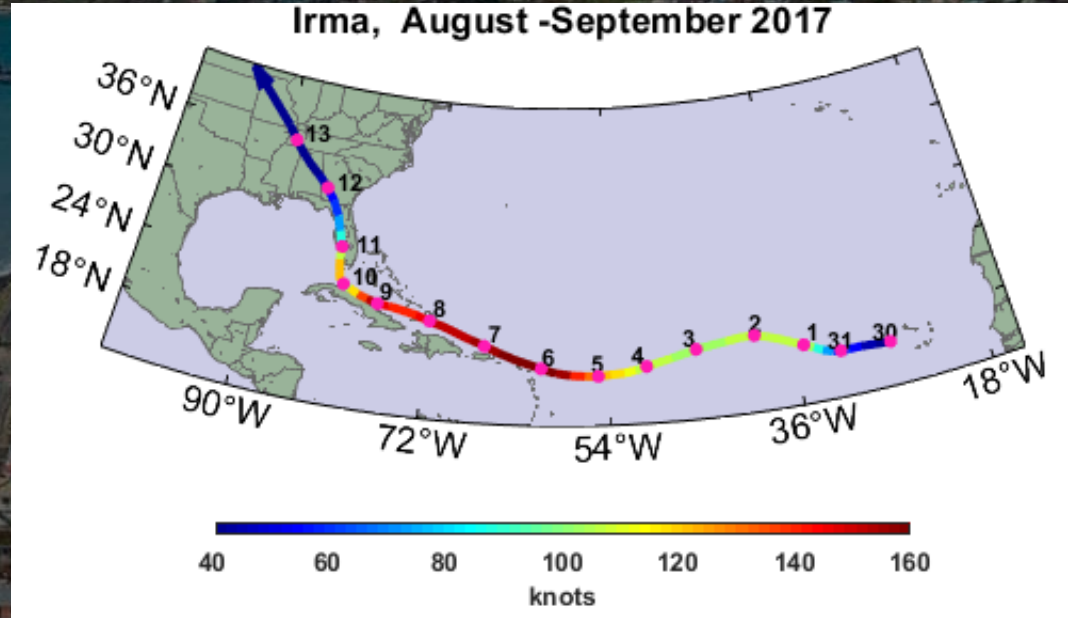
Hurricane Irma & Maria, 2017

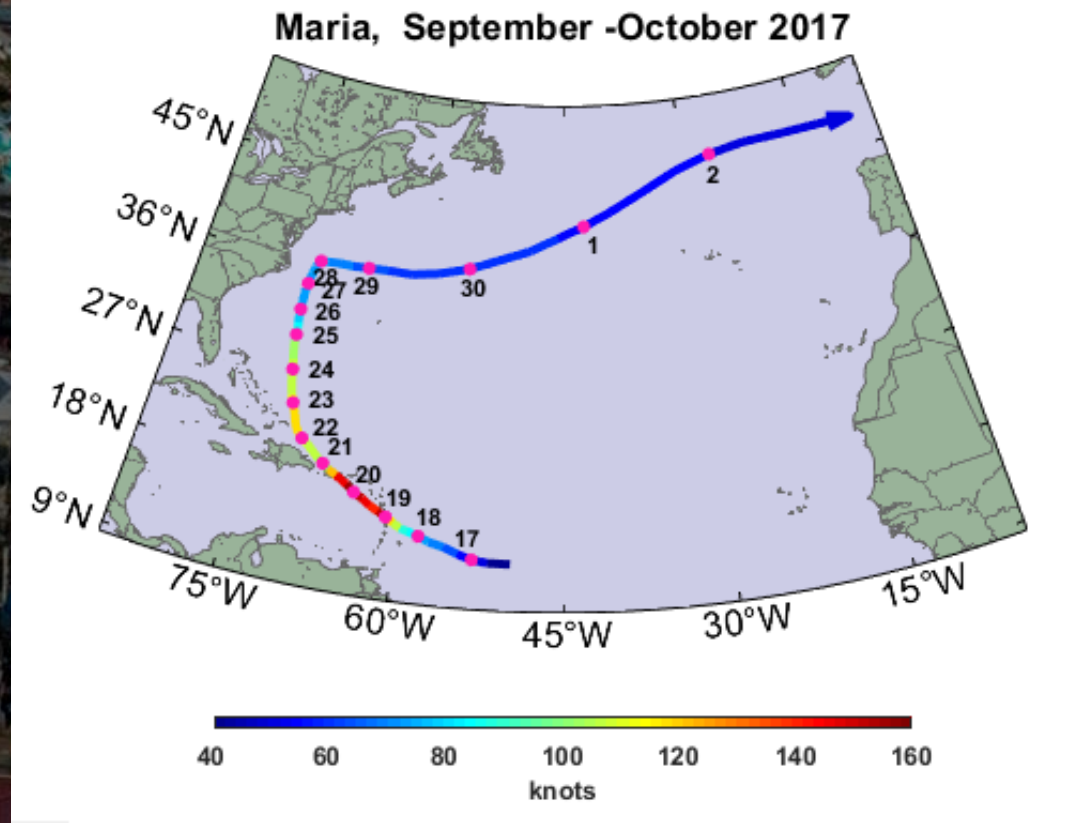
Irma

- losses = **2.8bn USD** in the Caribbean alone (Cangialosi et al, 2018)
- Made **7 landfalls** in total and 4 were cat 5 strength (NOAA)
- Peak winds of 180mph (NOAA)

Maria

- Puerto Rico hit with total rainfall of **375mm** (Keellings and Ayala, 2019)
- **1.31bn USD** estimated cost to Dominica (NOAA)





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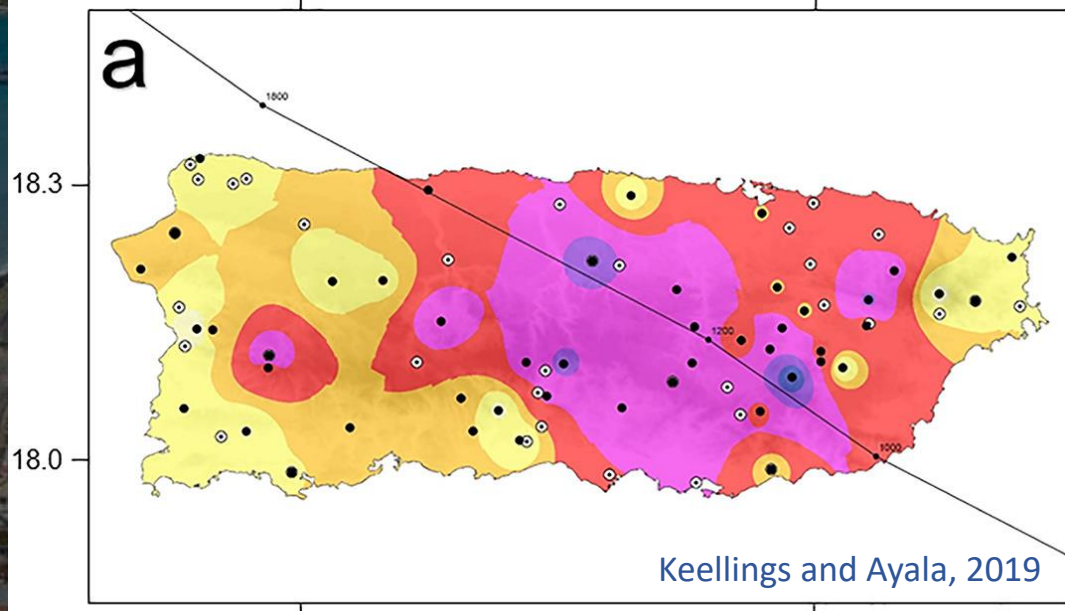
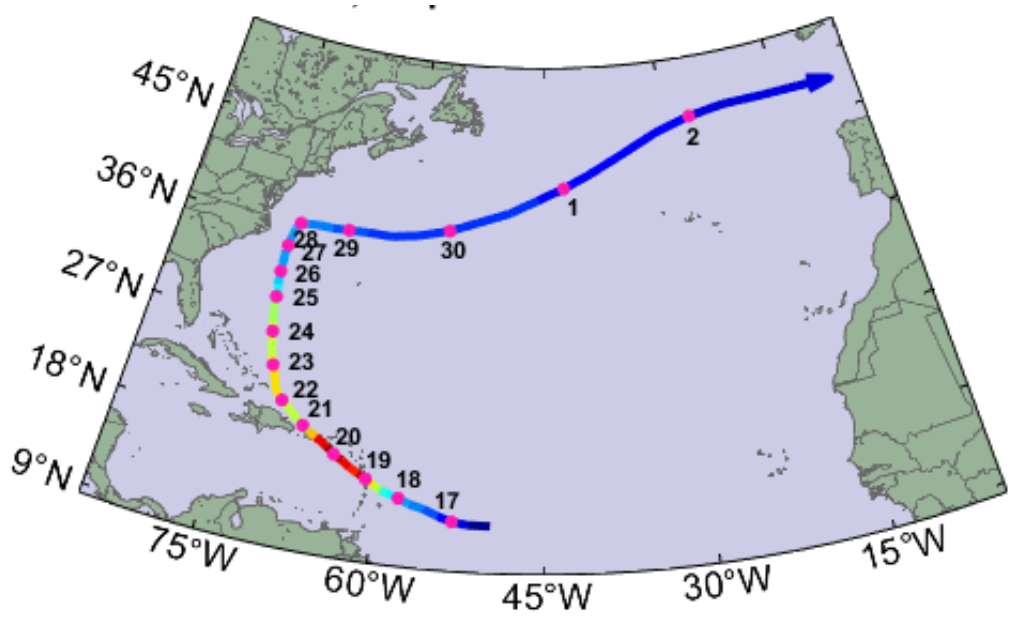


Keellings and Ayala, 2019



Hurricane Maria Six Hourly Track

Rainfall (mm)

< 100	300 - 400	600 - 700
100 - 200	400 - 500	700 - 800
200 - 300	500 - 600	> 800

Hurricane Maria Stations

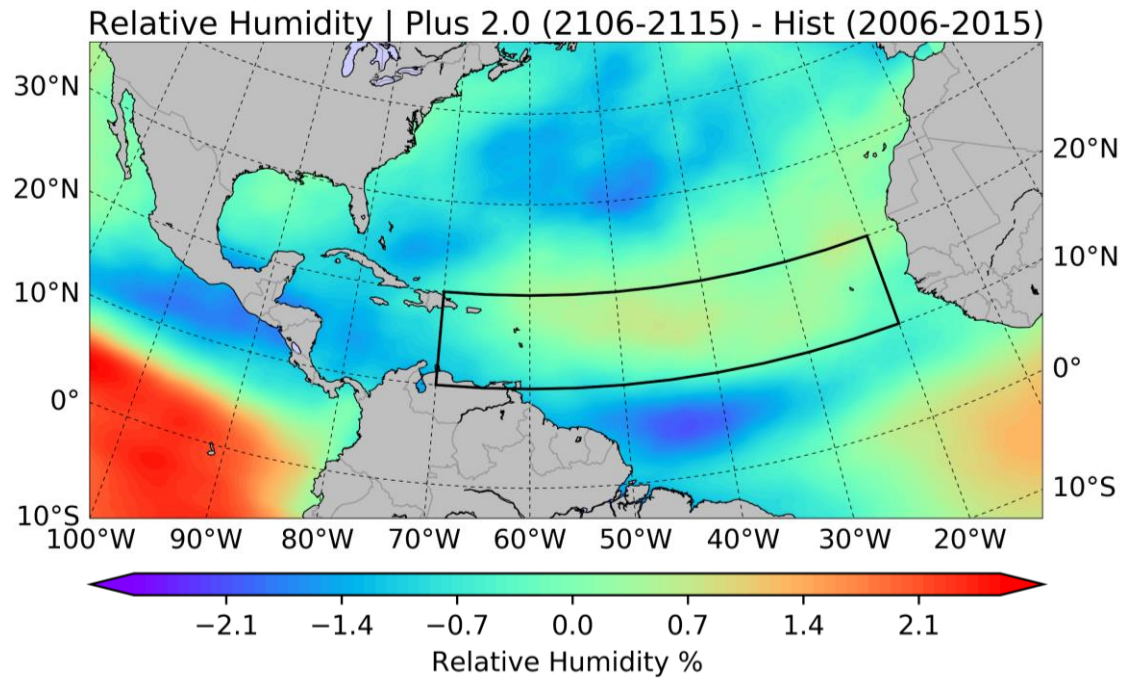
Historical Stations 1956-2016

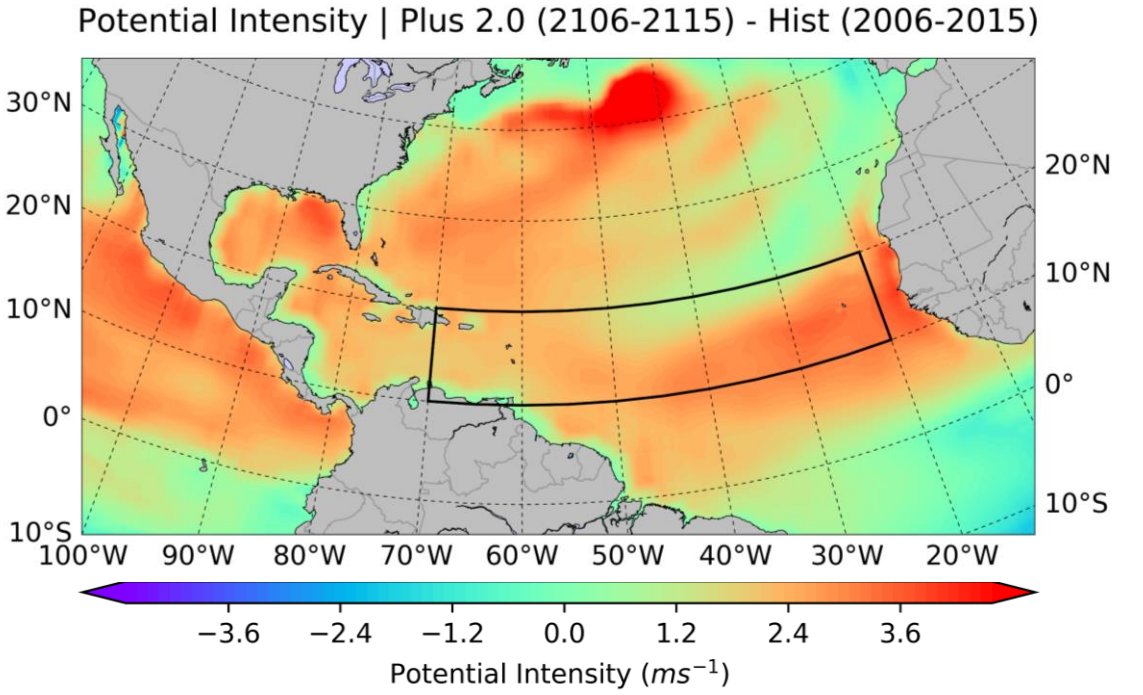
40 60 80 100 120 140 160

knots

Factors affecting hurricane development

- High sea surface temperature (above 26.5°C)
- High lower-tropospheric humidity
- Low vertical Wind shear (below 10ms^{-1})
- Steep Vertical Temperature Gradient
- None-zero Coriolis Force





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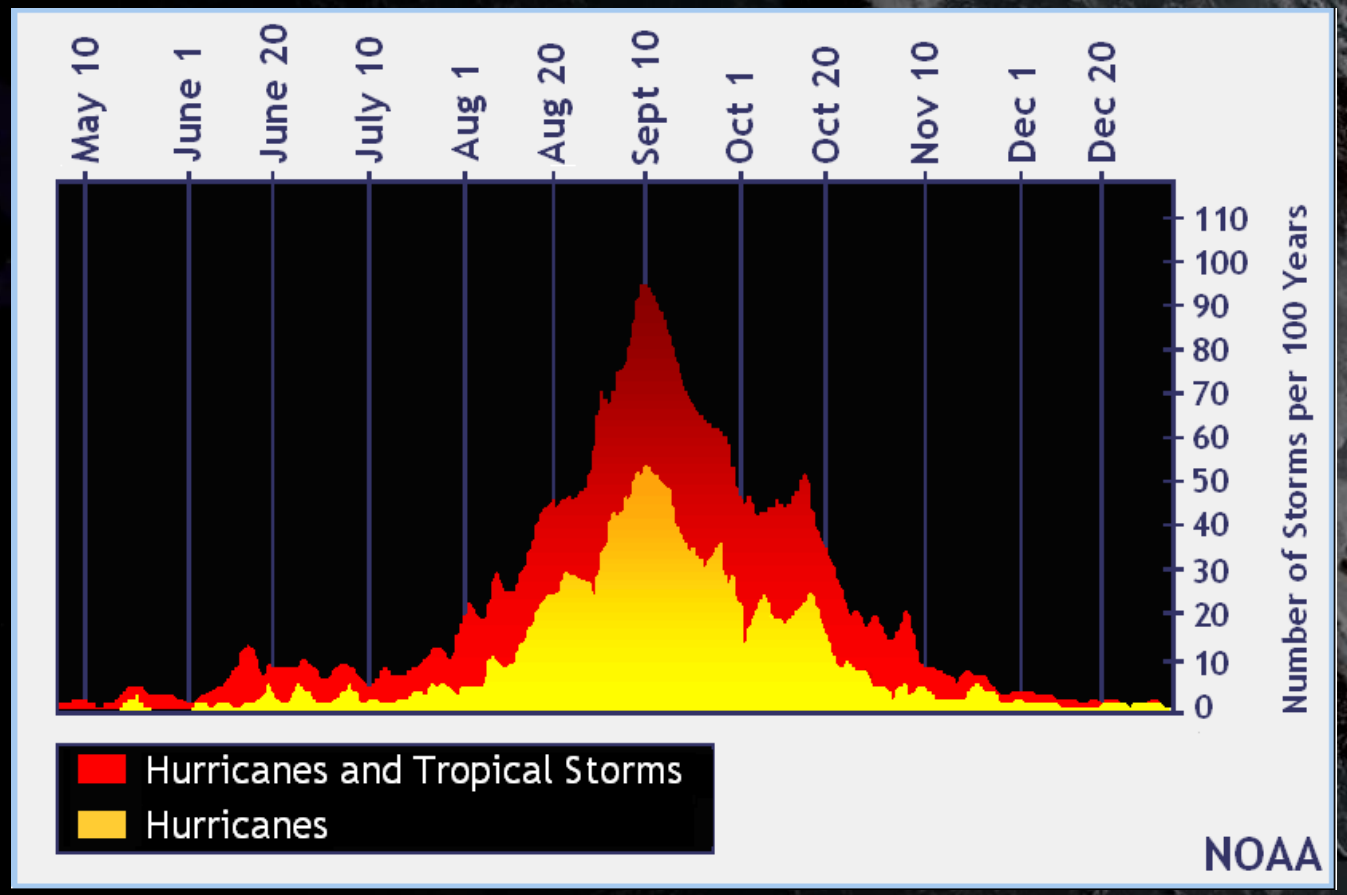
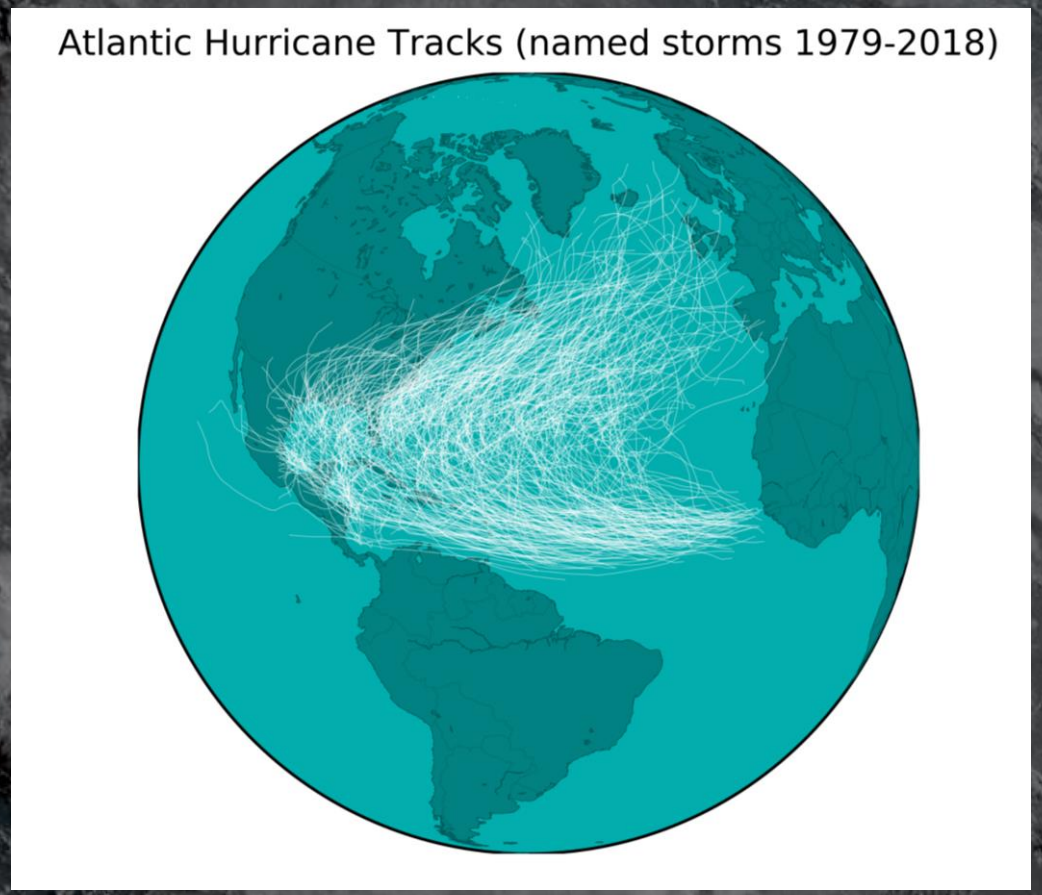
The Atlantic Basin





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Experiment Set Up

Half a degree of Additional warming, Prognosis and Projected Impacts (HAPPI)

- Stabilised historical, 1.5°C and 2.0°C scenarios
- 250 years of data per scenario
- Output from model used to calculate Potential Intensity, Relative humidity, wind shear and outflow temperature

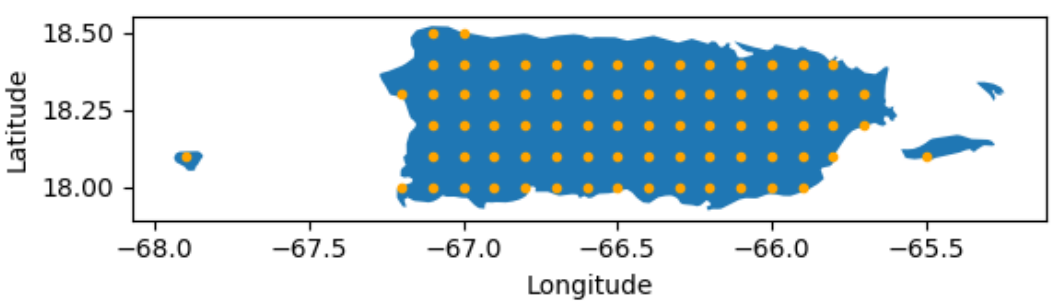
Kerry Emanuel Hurricane Model

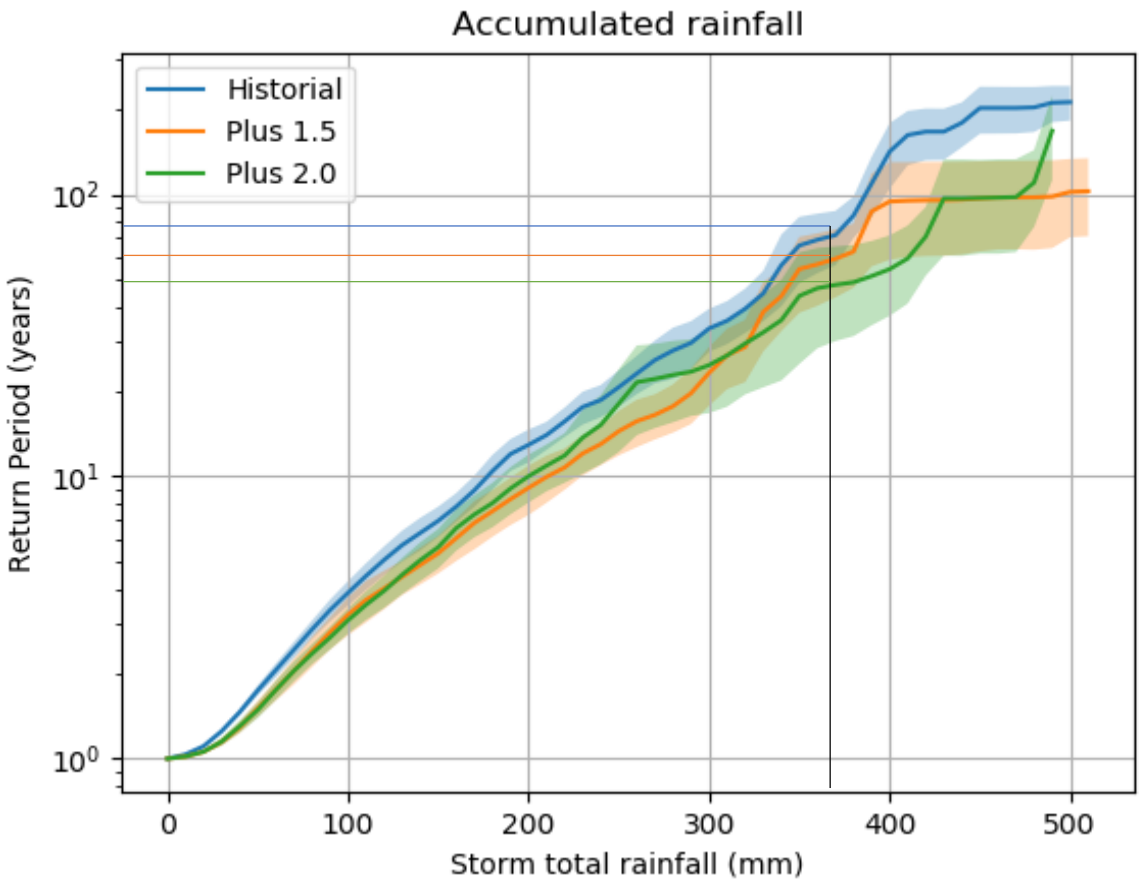
- Genesis by random seeding
- Intensity model (40kt = hurricane)
- Tracking with Beta and Advection model

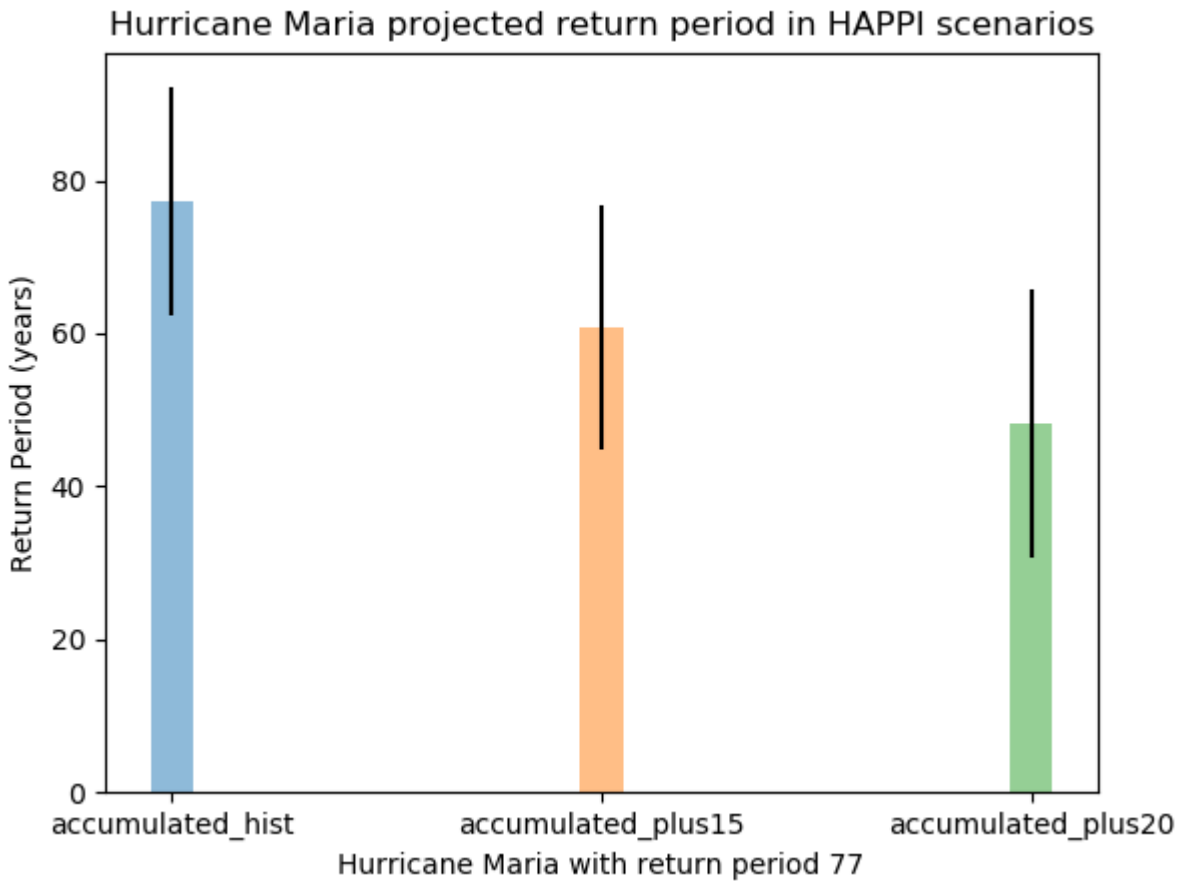
Method to estimate hurricane rainfall

- Tropical Cyclone rainfall algorithm (Emanuel et al. 2008)
- Model generates rainfall estimates along storm tracks, incorporating several major rainfall mechanisms:
  - surface frictional convergence
  - vortex stretching
  - TC interaction with both topography and wind shear.
- Computationally cheap, shown to give good estimates of rainfall risk compared to gauge-based observations

Return Period of Accumulated Rainfall







Thank you for listening!