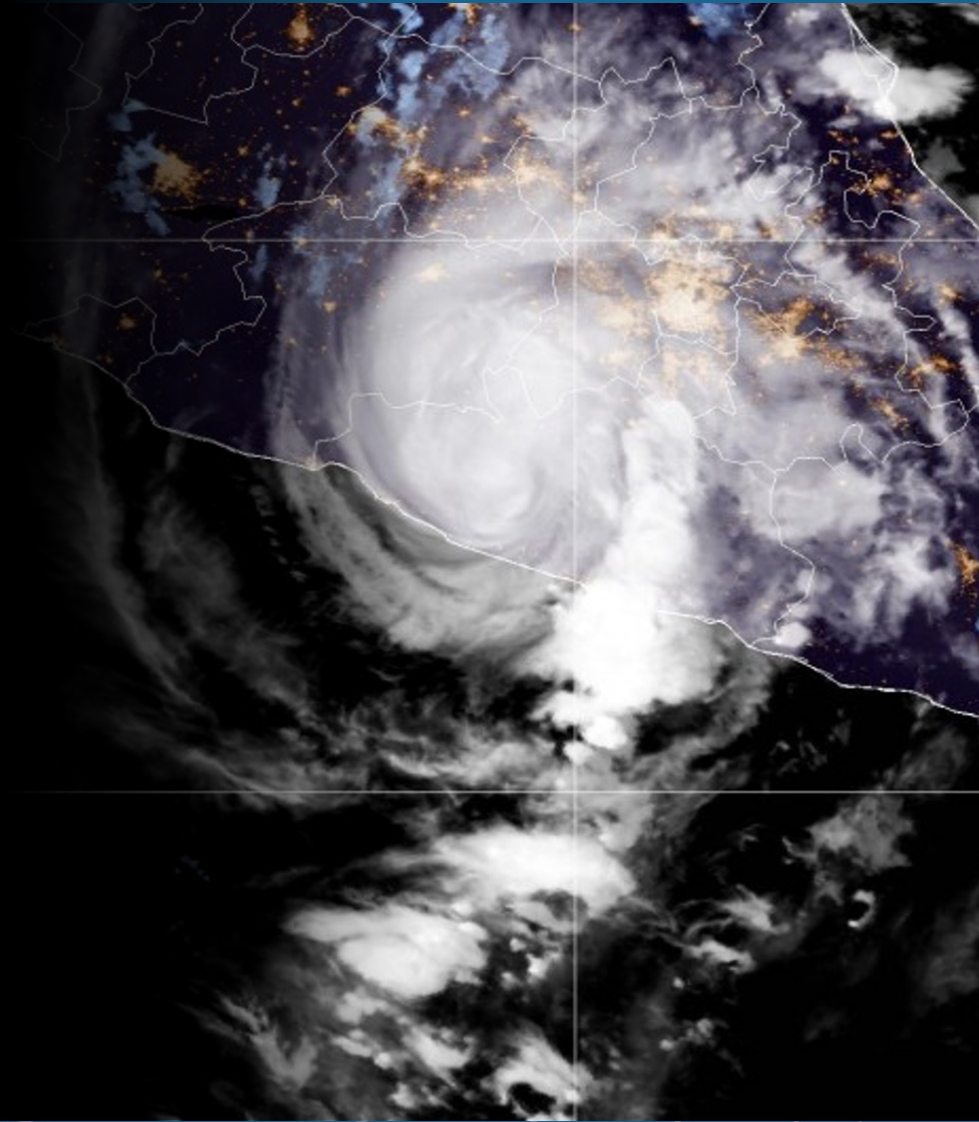


Climate Projections and High-Impact Weather

Dr. James Done

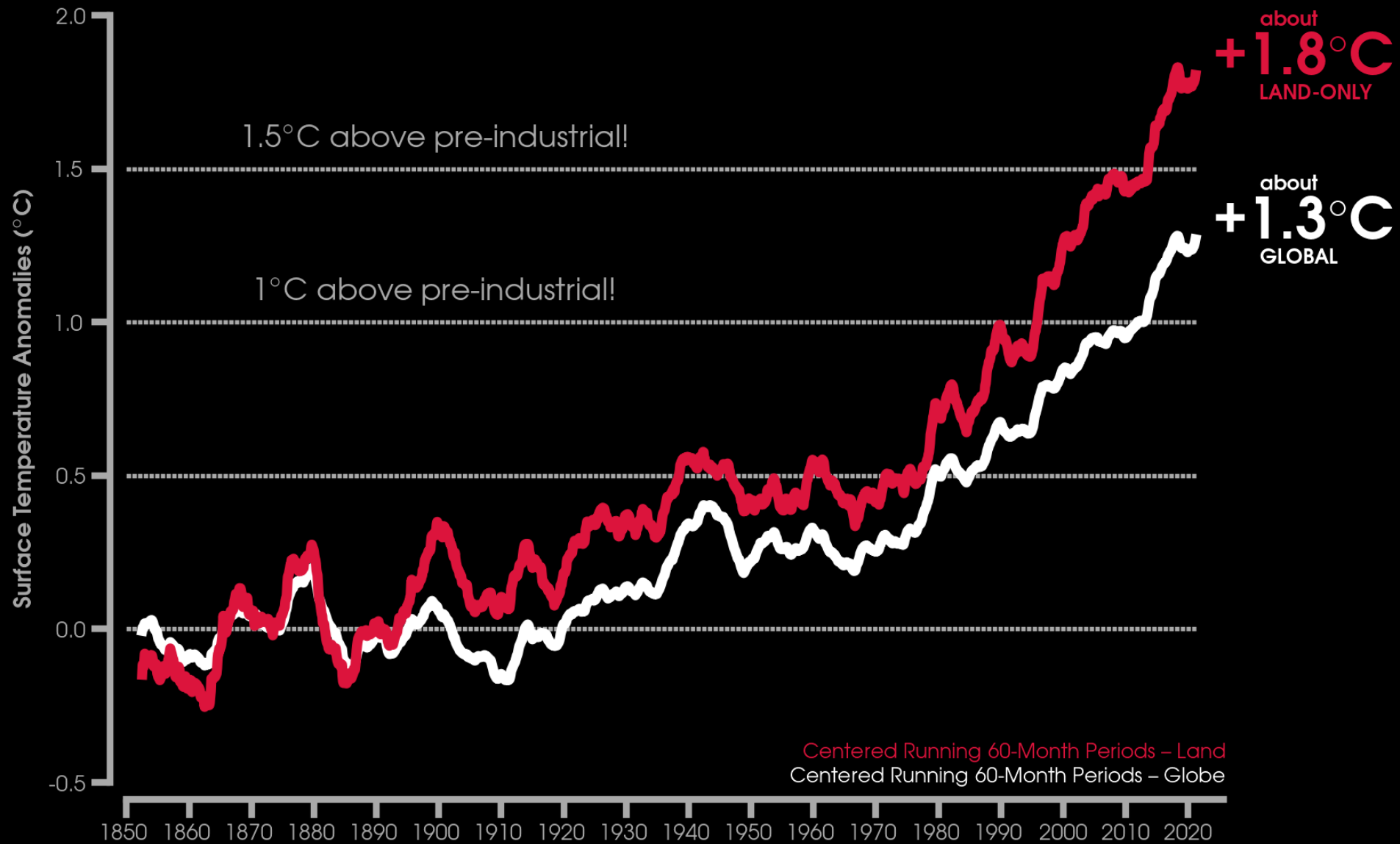
*National Center for Atmospheric Research, US
and Willis Senior Academic Fellow*



Key Takeaways

1. A new era of climate risk
2. Some changes in high-impact weather have already been observed. Further changes are expected.
3. The value of partnerships to inspire new science and produce usable information.

GLOBAL AVERAGE SURFACE TEMPERATURE CHANGE FROM PRE-INDUSTRIAL

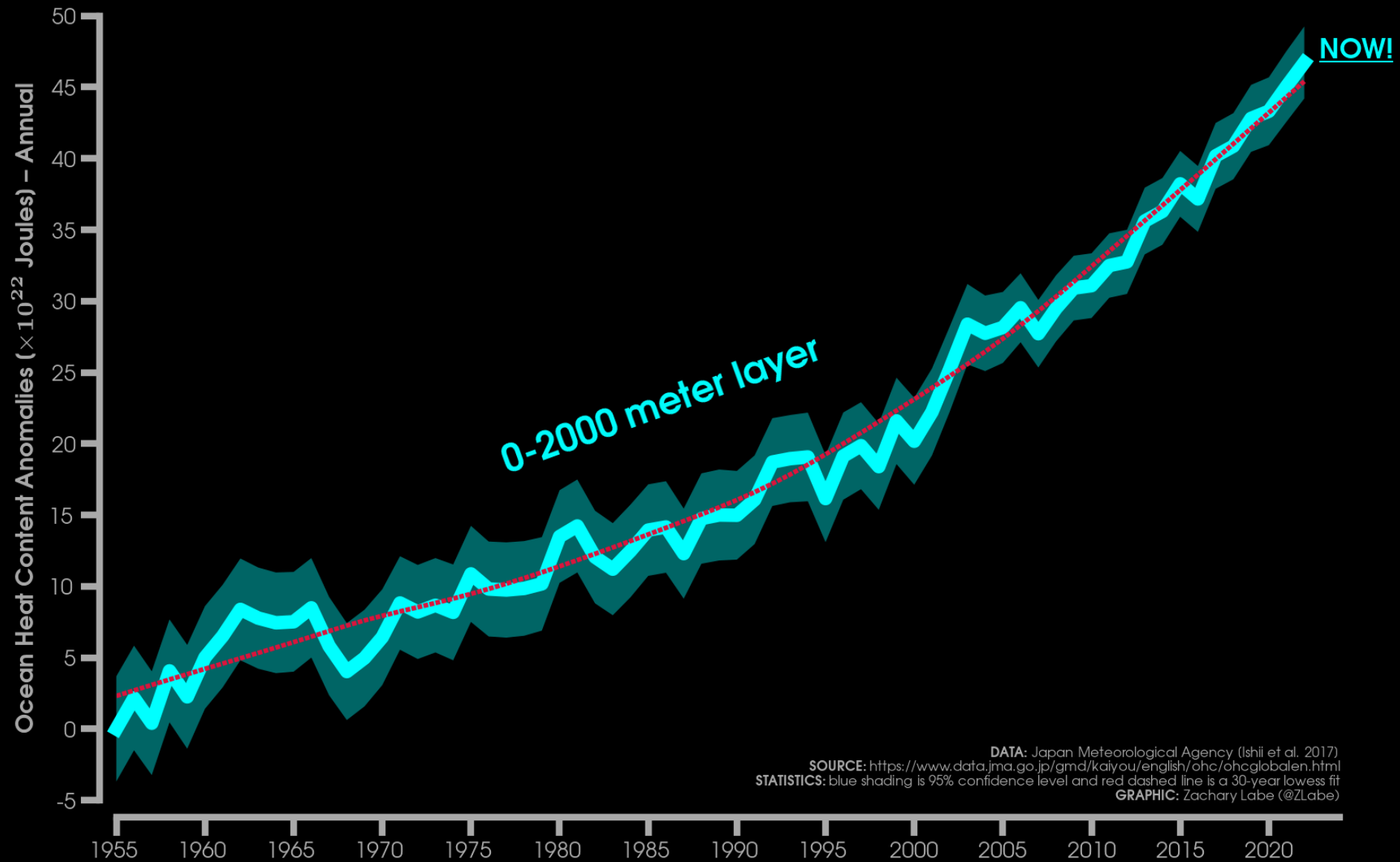


DATA: NOAA/ESRL Physical Sciences Division (WRIT Tool) – updated through August 2023
SOURCE: <https://psl.noaa.gov/data/atmoswrit/timeseries/index.html>
GRAPHIC: Zachary Labe (@ZLabe)

DATA SET: Berkeley Earth
BASELINE: 1850-1900

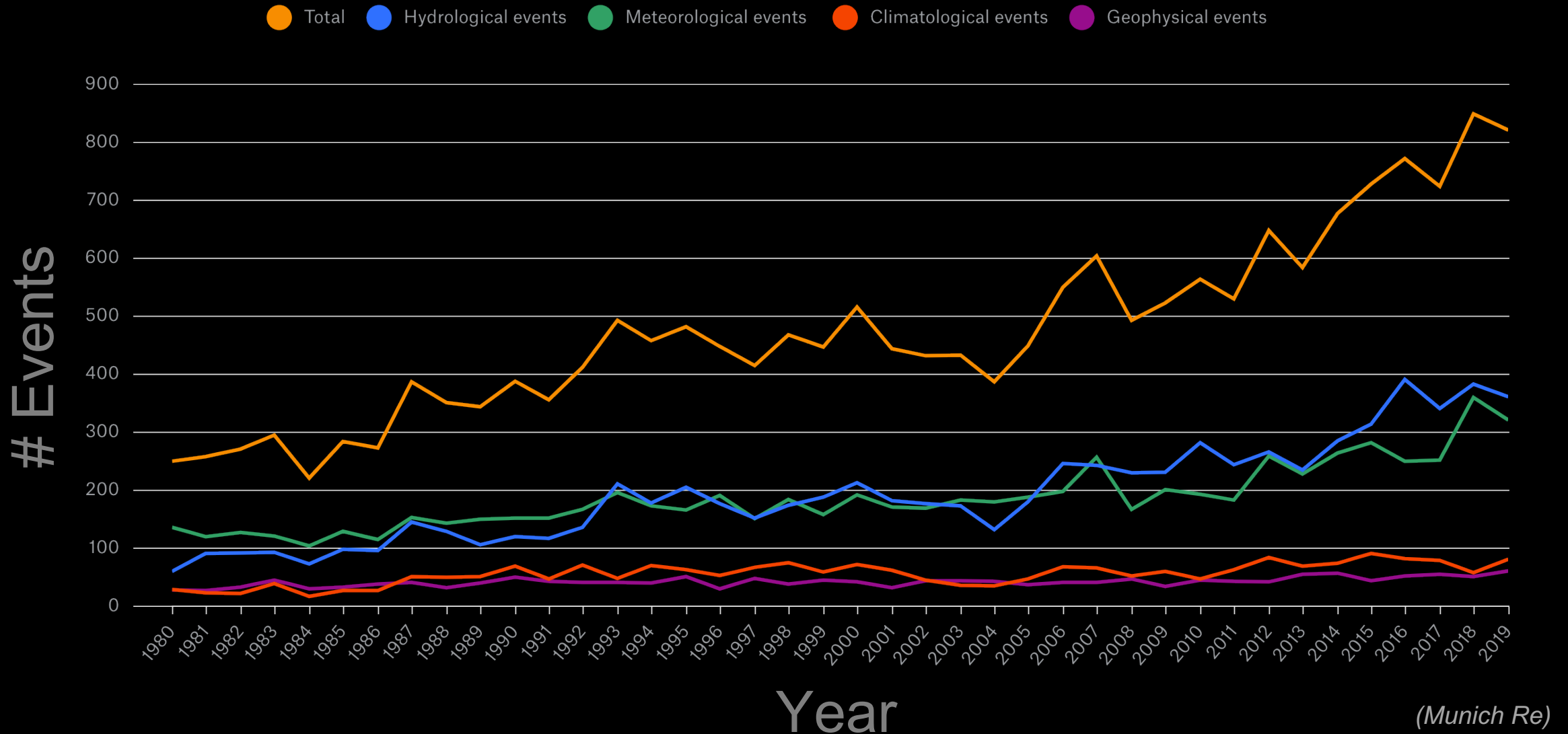
<https://zacklabe.com/>

CHANGE IN GLOBAL OCEAN HEAT CONTENT SINCE 1955

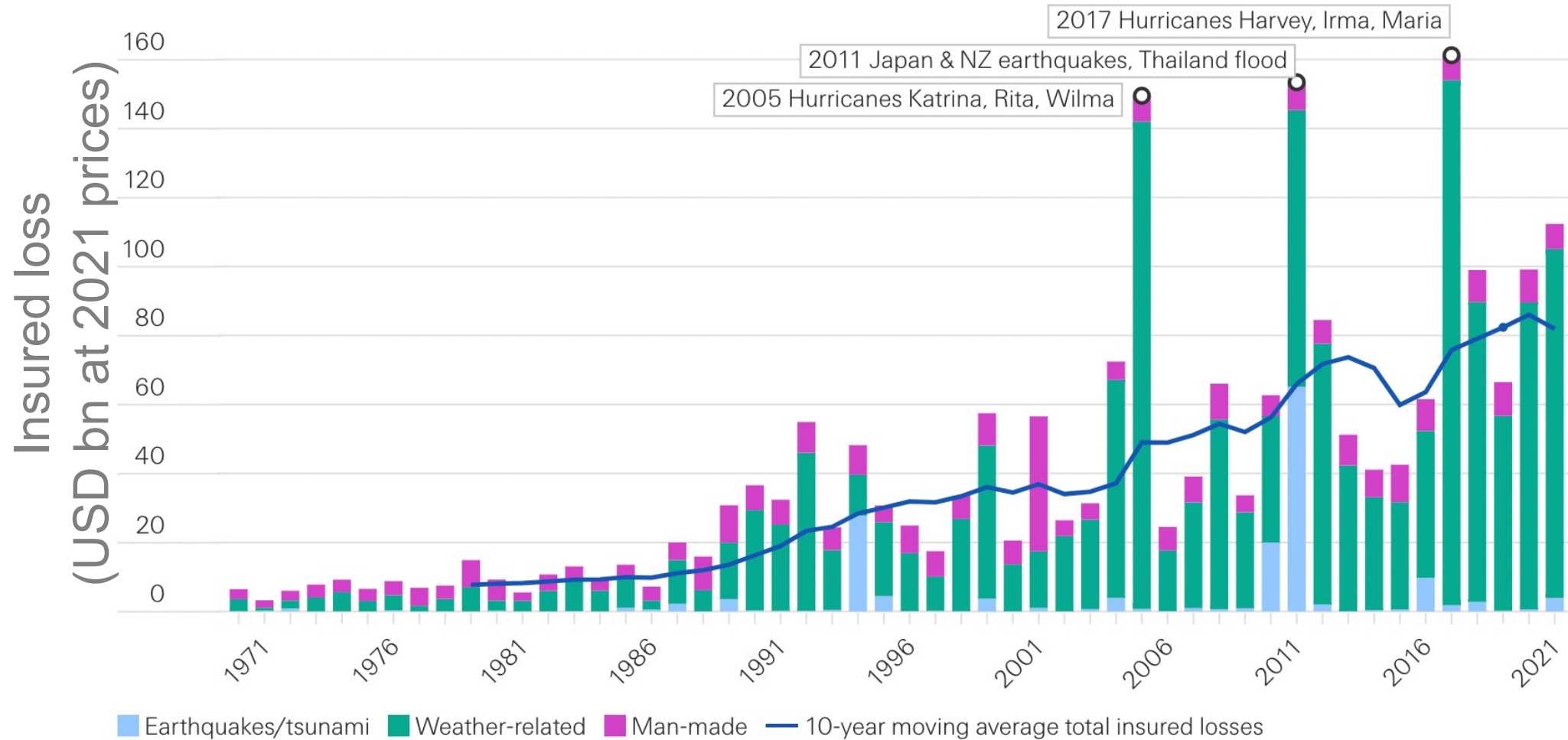


<https://zacklabe.com/>

More high-impact weather events



Rising costs of weather events



Source: Swiss Re Institute

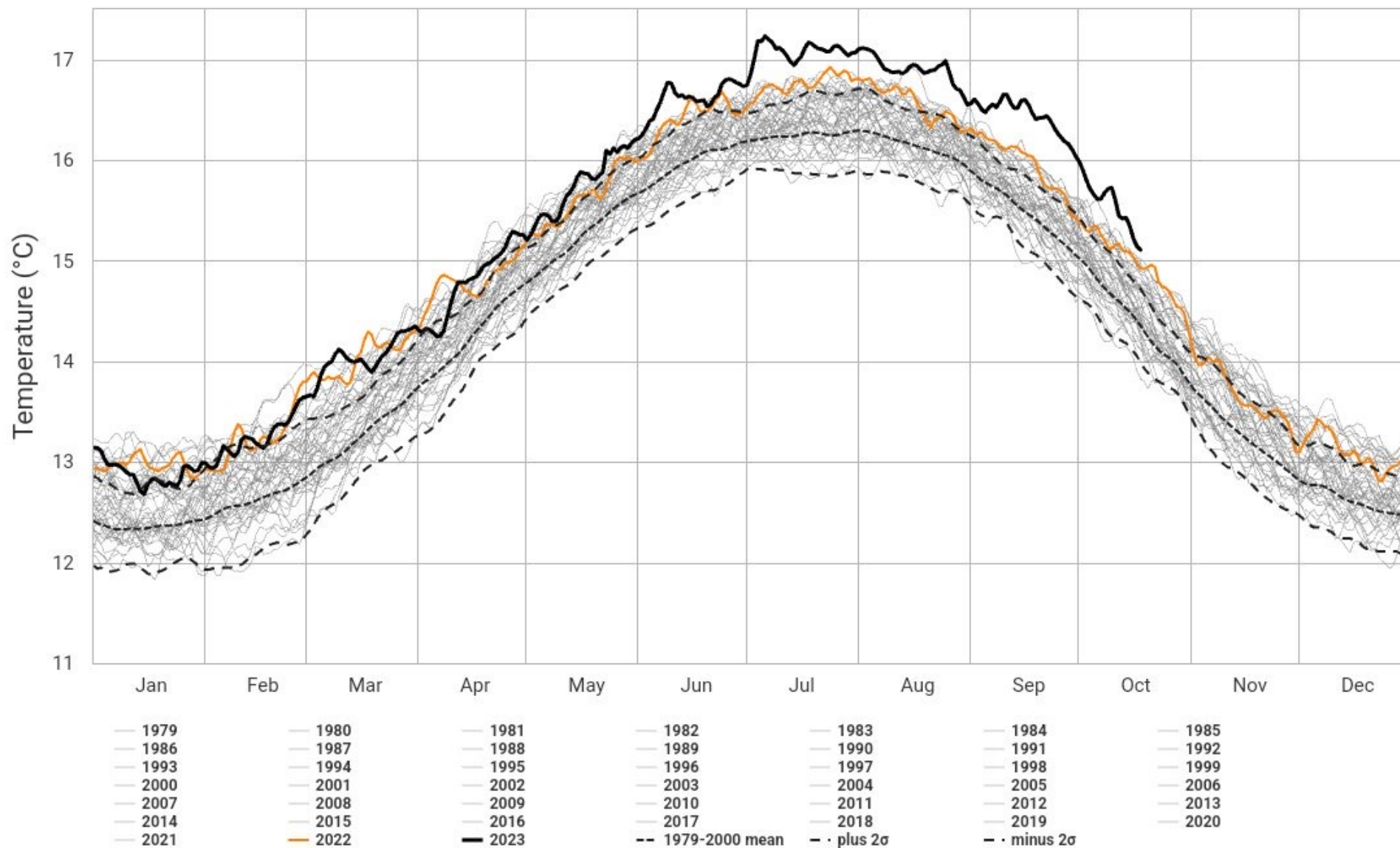
A new era of extreme weather impacts

A satellite image of a large storm system over the Gulf of Mexico. The storm is characterized by a bright, dense core and swirling cloud patterns. White outlines of the United States and its states are overlaid on the image, showing the storm's position relative to the coastline. The text is overlaid on the central part of the image.

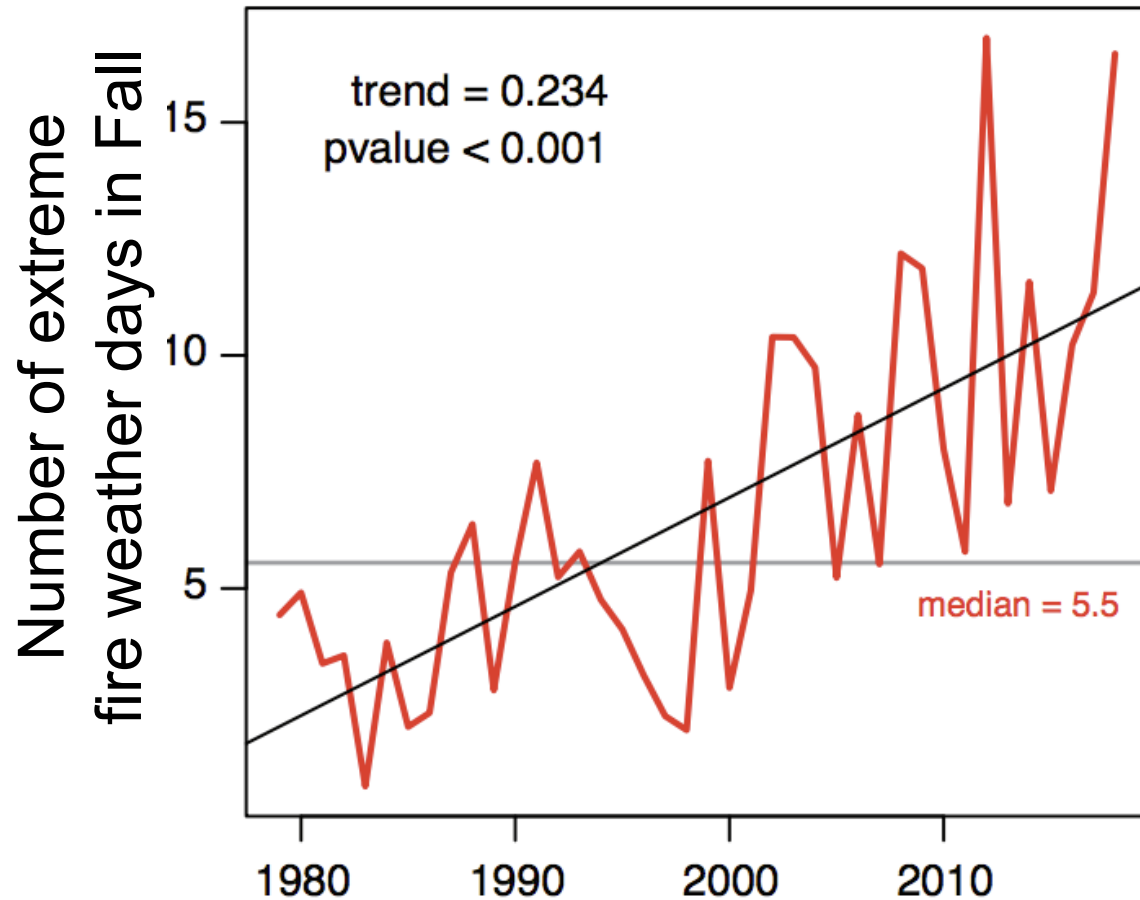
Climate Change is a
Pervasive and Growing
Risk Multiplier

Daily Surface Air Temperature, World (90°S-90°N, 0-360°E)

Dataset: NCEP Climate Forecast System | Image Credit: ClimateReanalyzer.org, Climate Change Institute, University of Maine

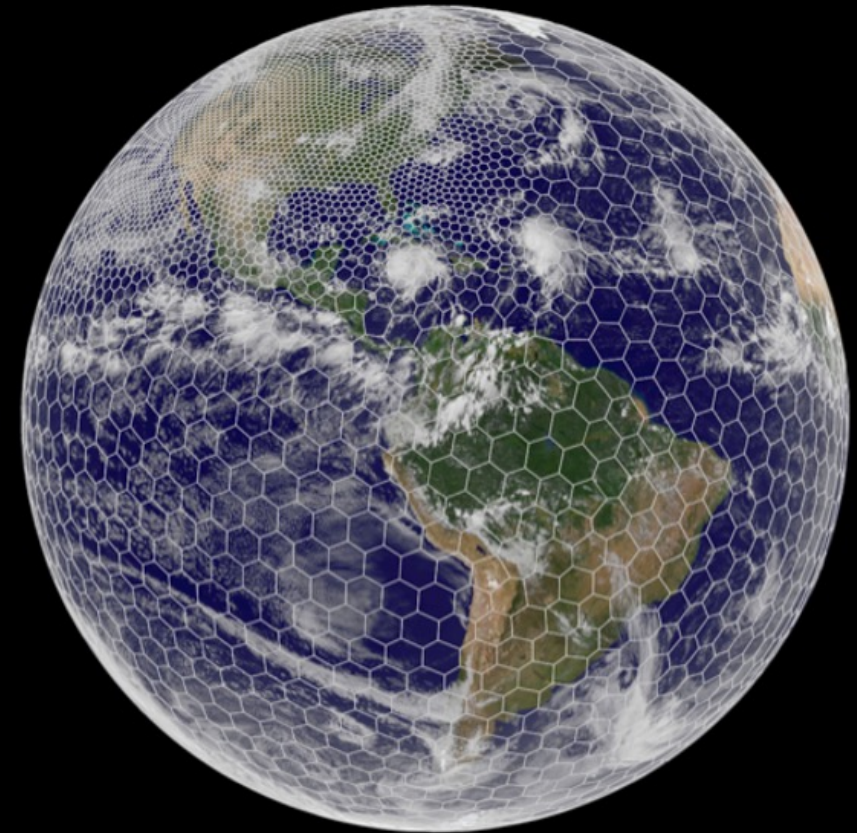
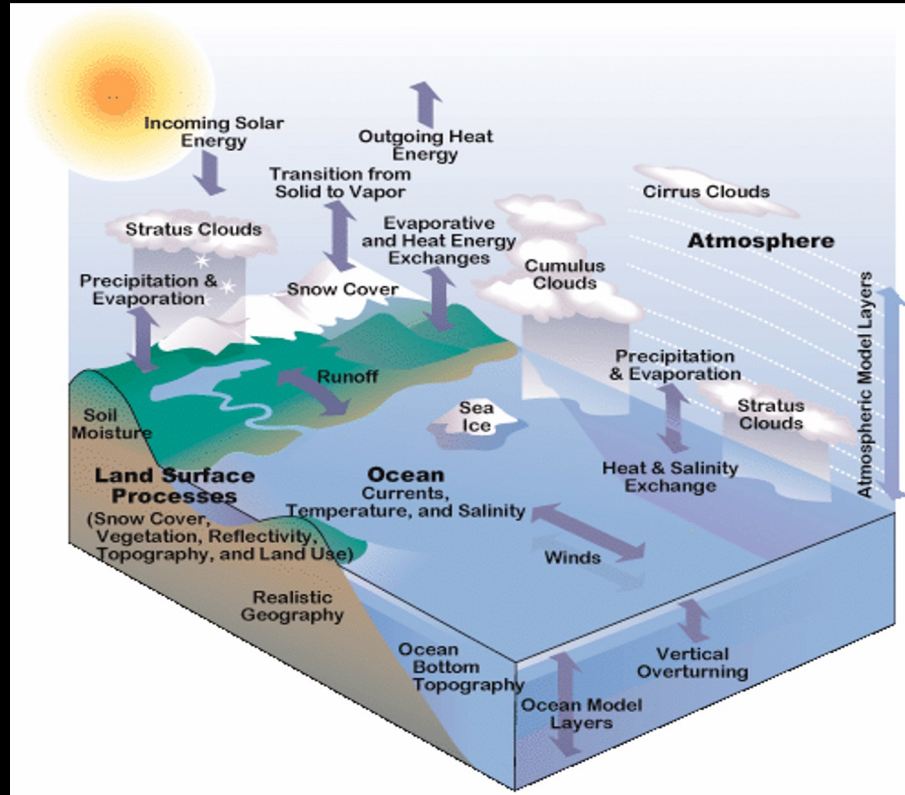


Climate Change has already doubled the likelihood of extreme fire



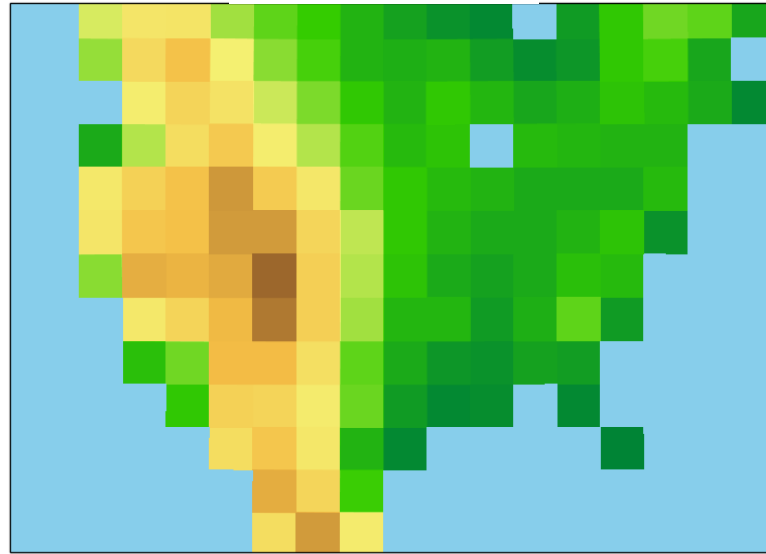
Swain et al. (2020)

Simulating the Future



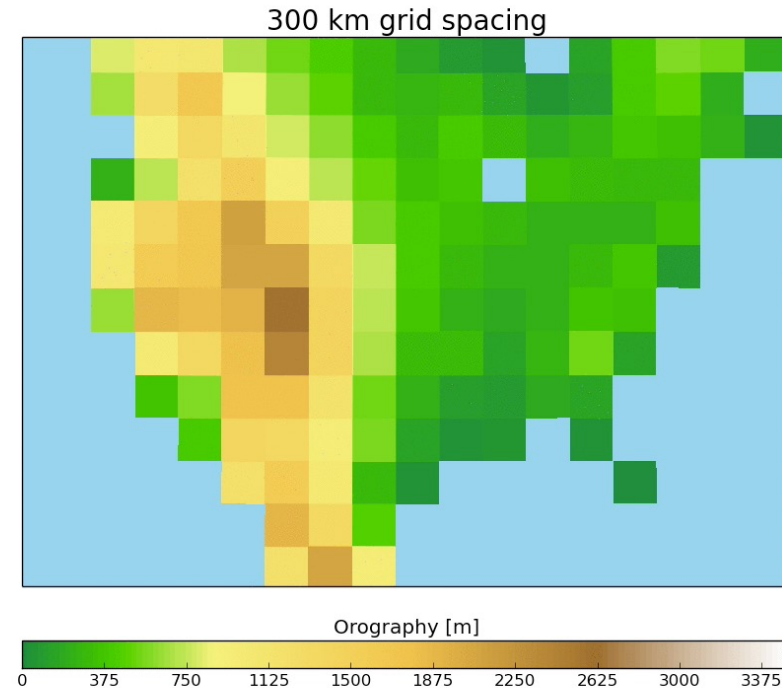
Climate models are designed to understand the climate

Resolution of Climate Models



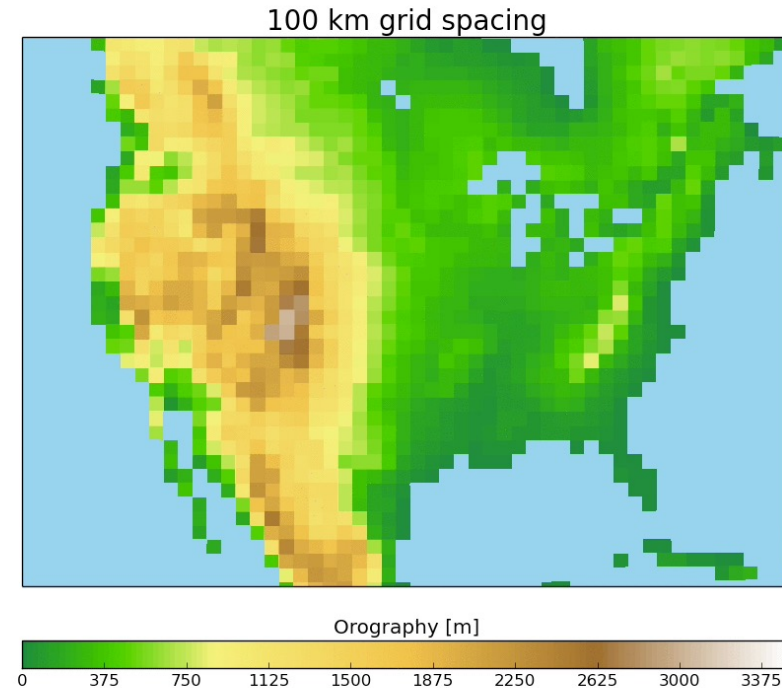
A. Prein (NCAR)

Resolution of Climate Models



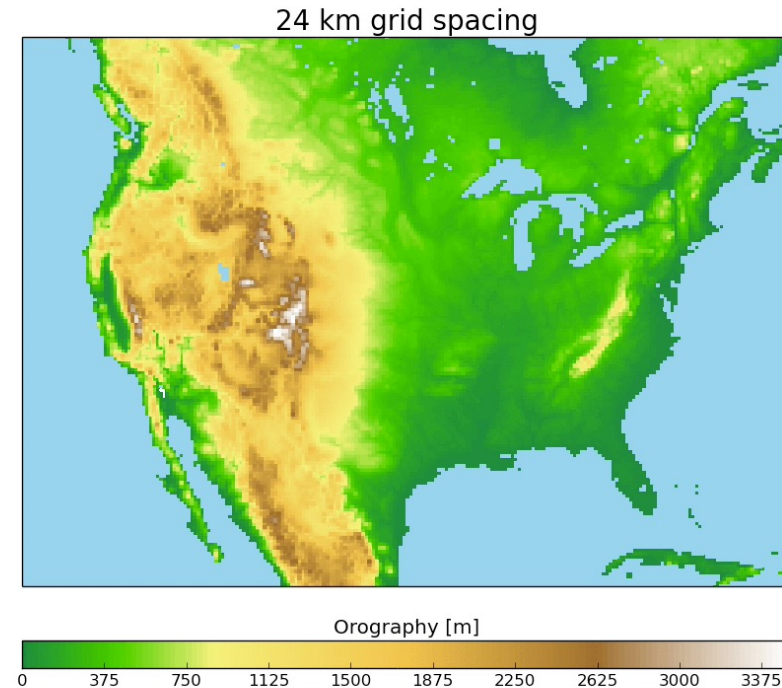
A. Prein (NCAR)

Resolution of Climate Models



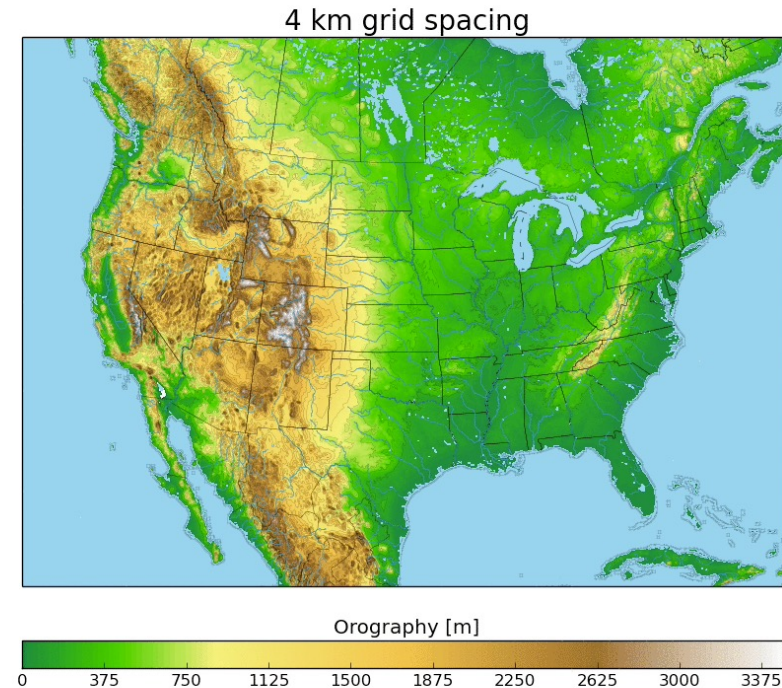
A. Prein (NCAR)

Resolution of Climate Models



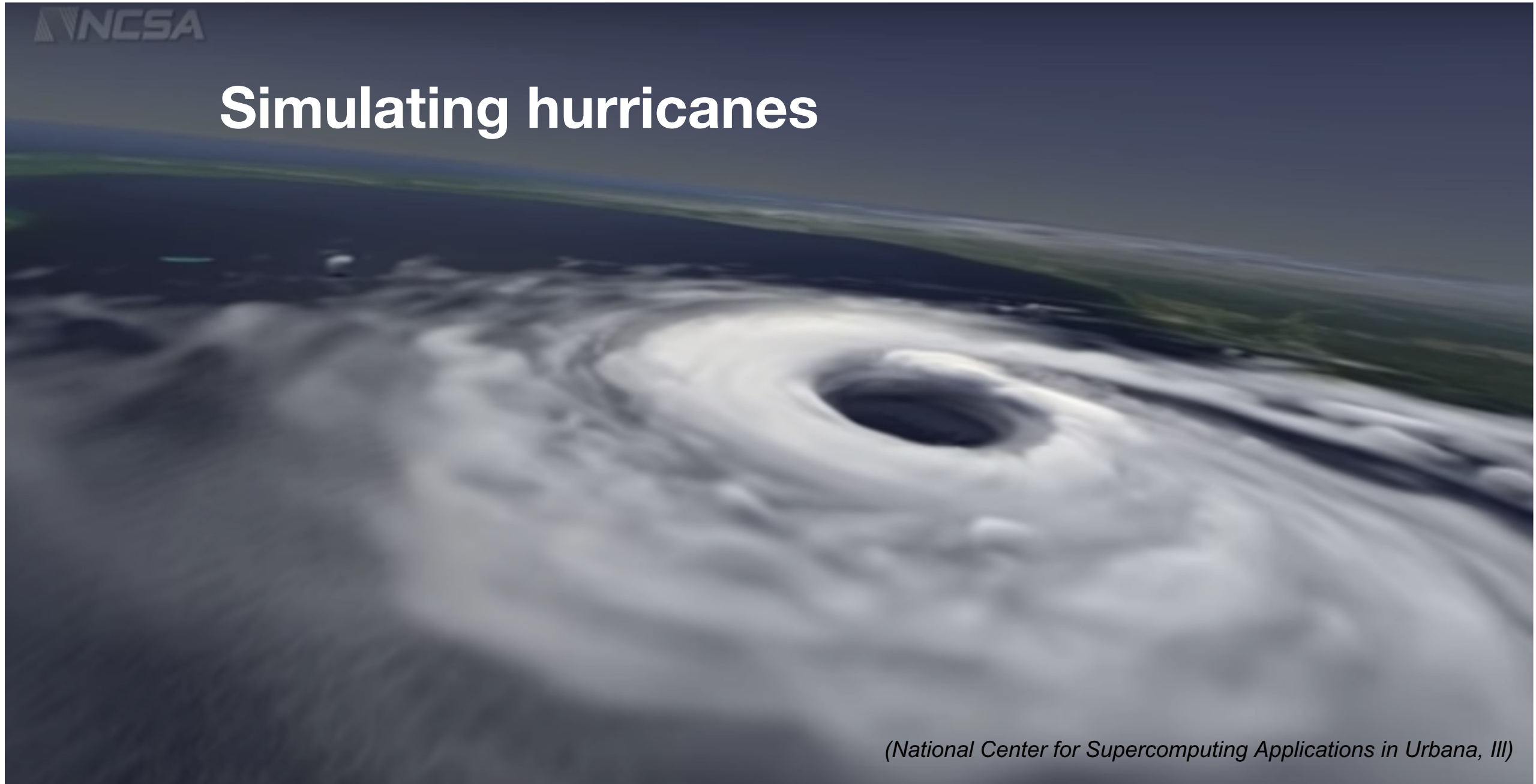
A. Prein (NCAR)

Resolution of Climate Models

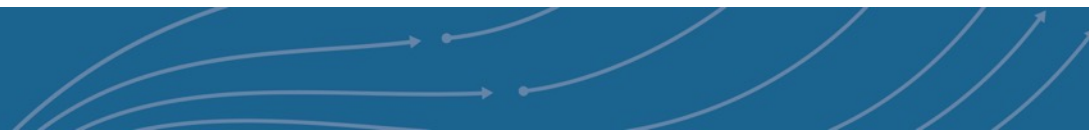


A. Prein (NCAR)

Simulating hurricanes



(National Center for Supercomputing Applications in Urbana, Ill)



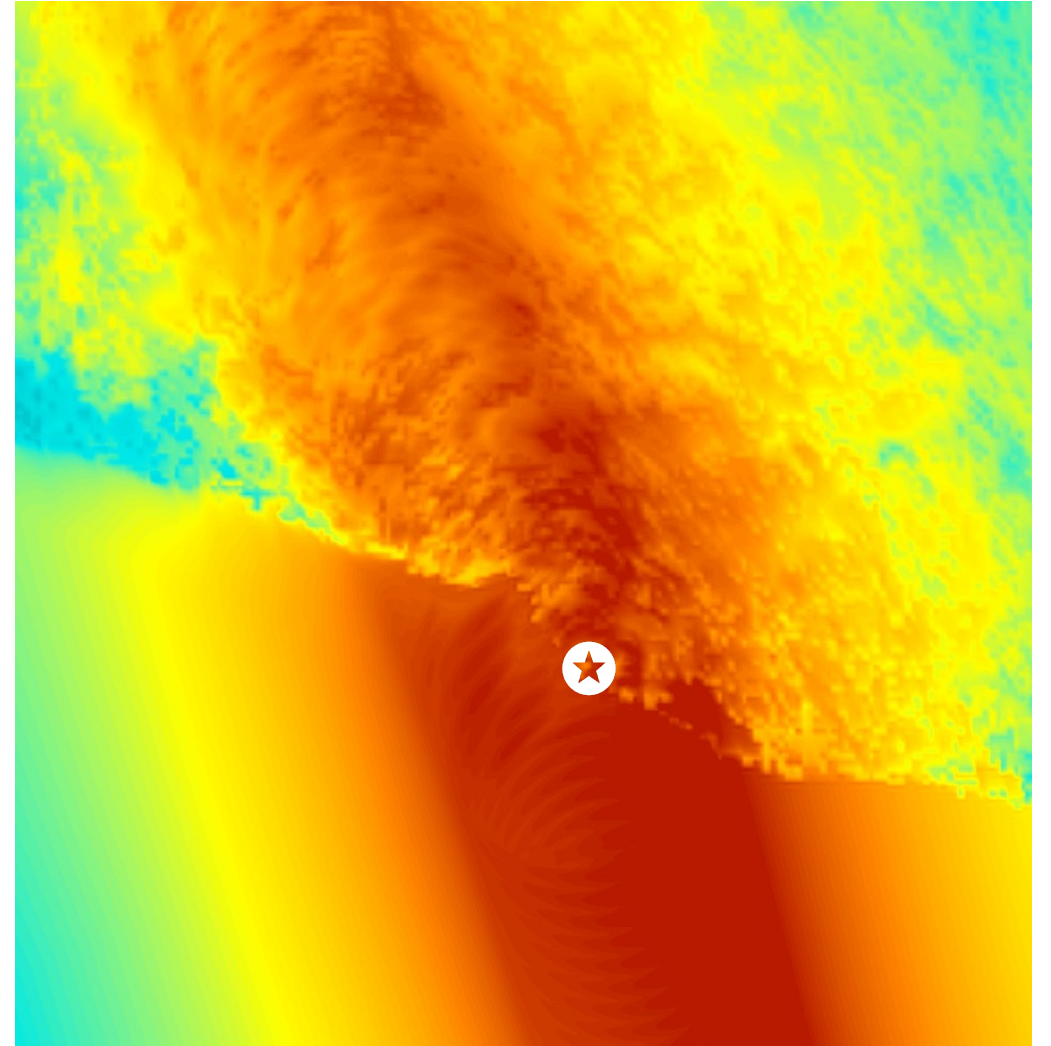
Heavier rainfall

A photograph showing a yellow school bus driving through a deep flood on a residential street. The water is dark and reflects the bus's headlights. In the background, other cars are visible, some partially submerged. Houses and trees line the street under an overcast sky. A semi-transparent white box with blue text is overlaid on the middle of the image.

Houston's risk of extreme rainfall has quadrupled

Thomas B. Shea/Getty Images.

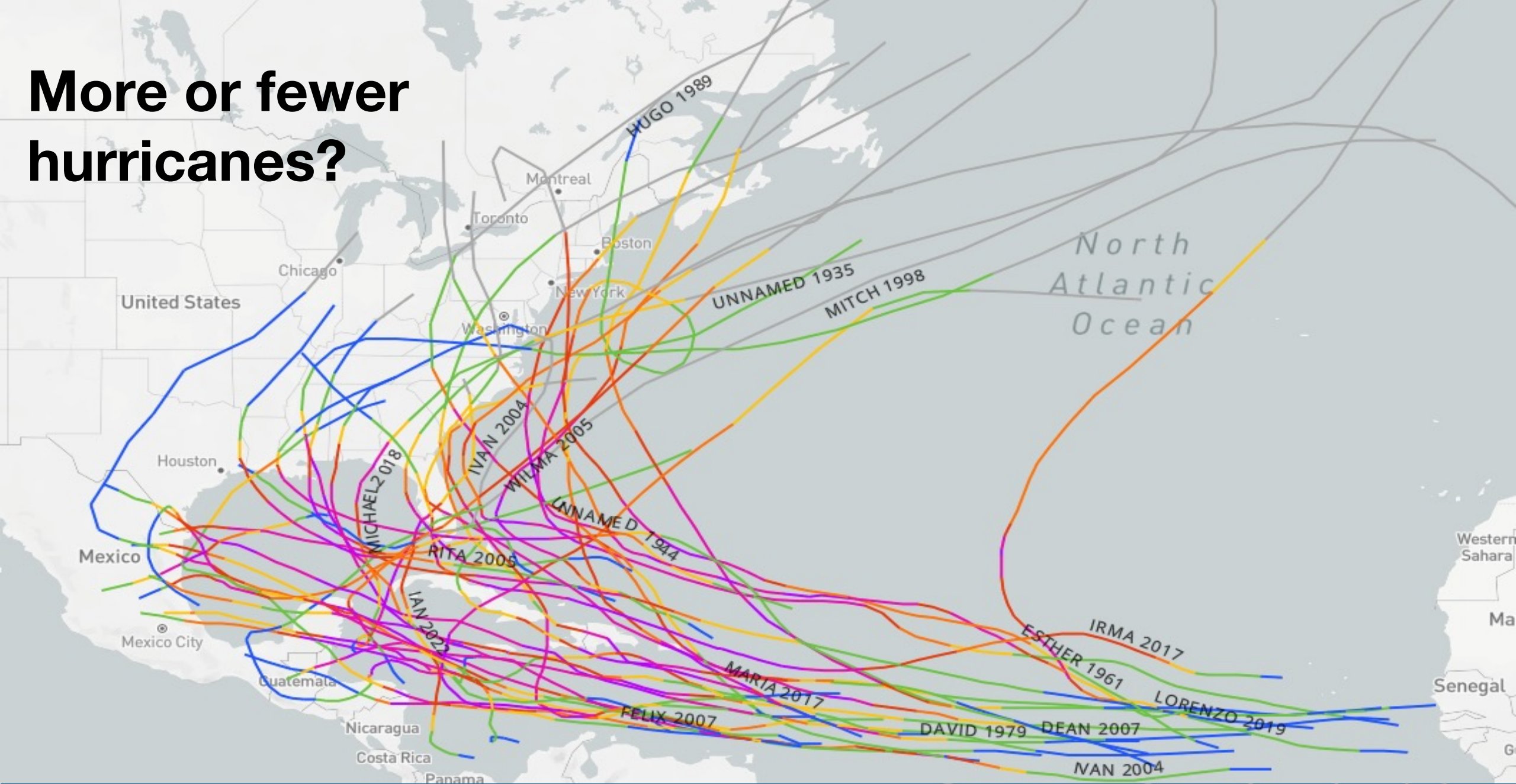
Stronger winds



Higher storm surge

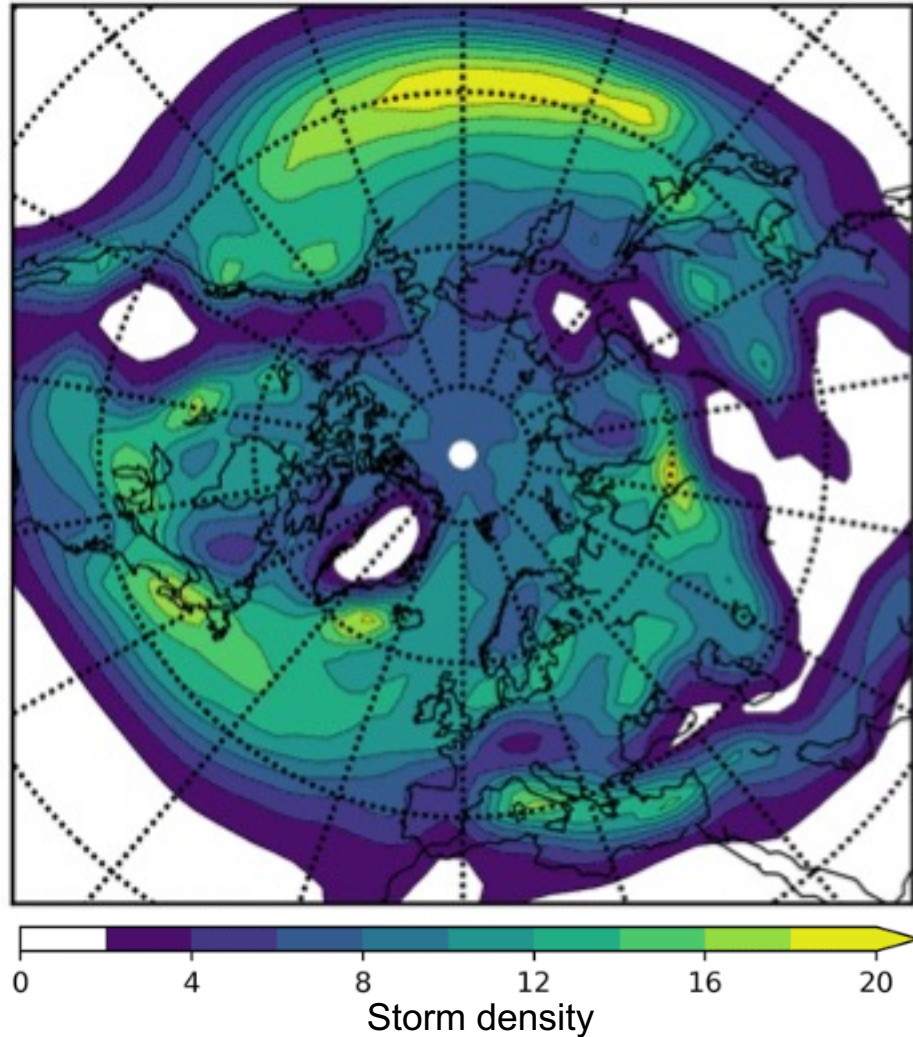


More or fewer hurricanes?

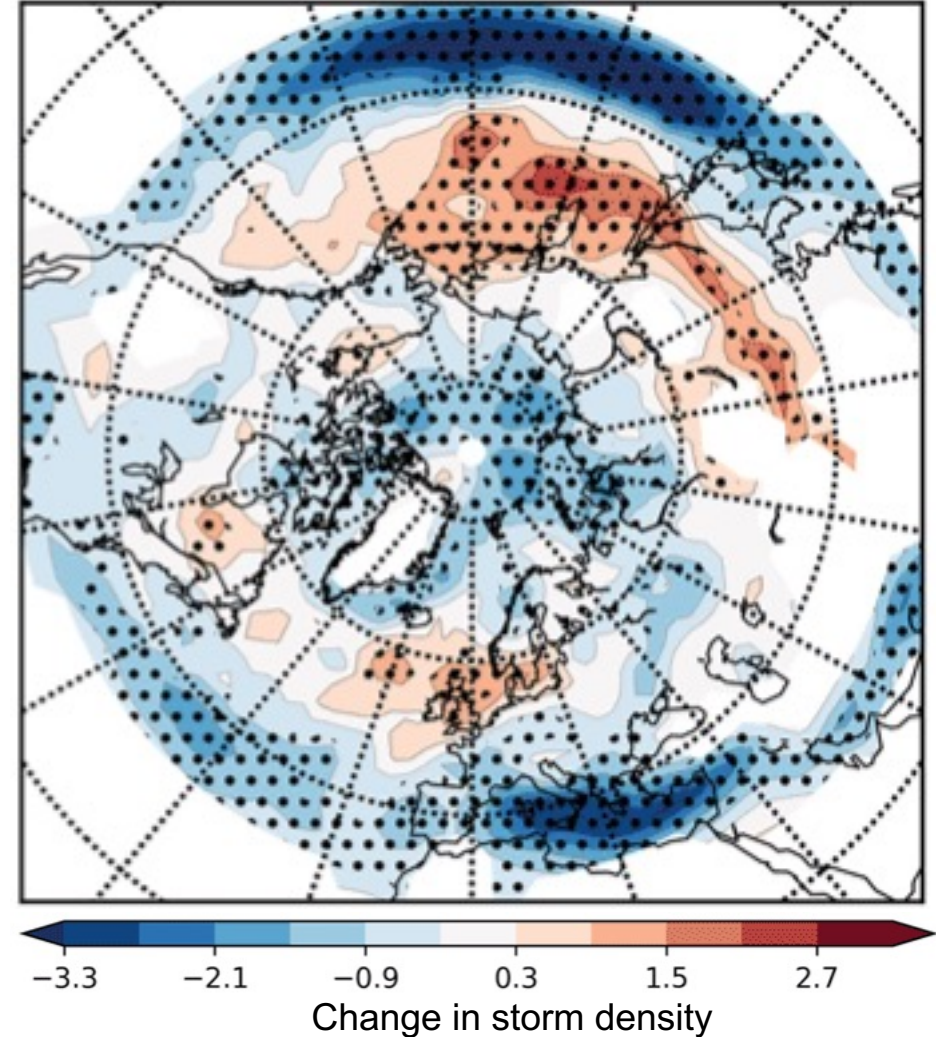


Changing Storm Tracks

Historical storm tracks

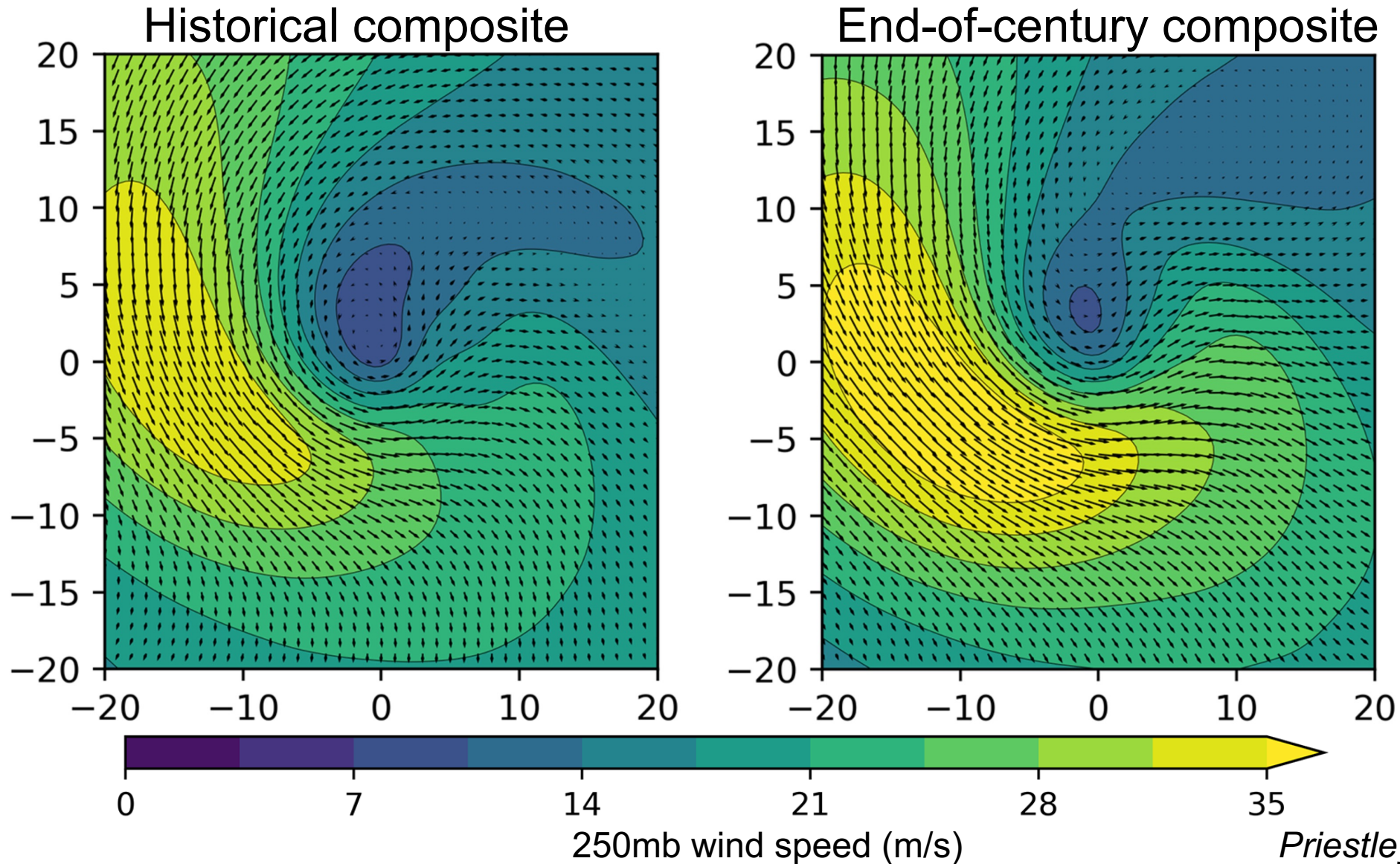


End-of-century change

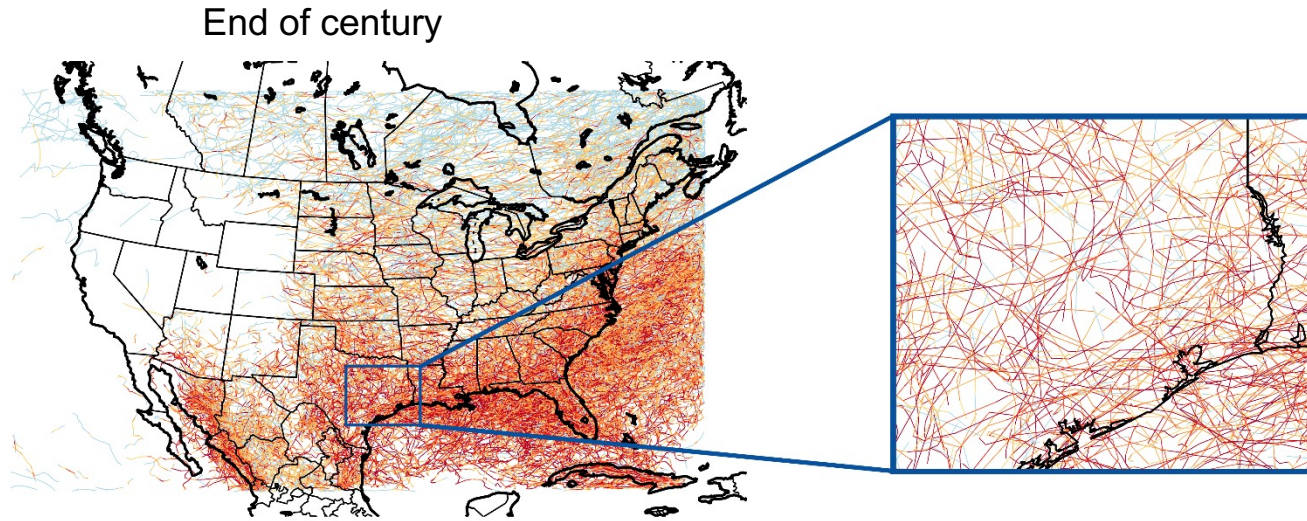


Preistley and Catto (2022)

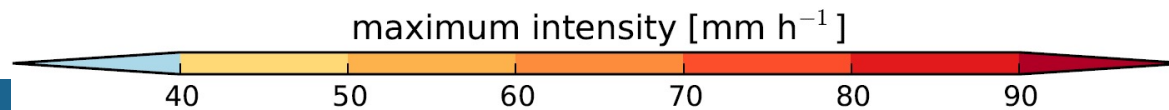
Stronger Extratropical Cyclones



More strong thunderstorms

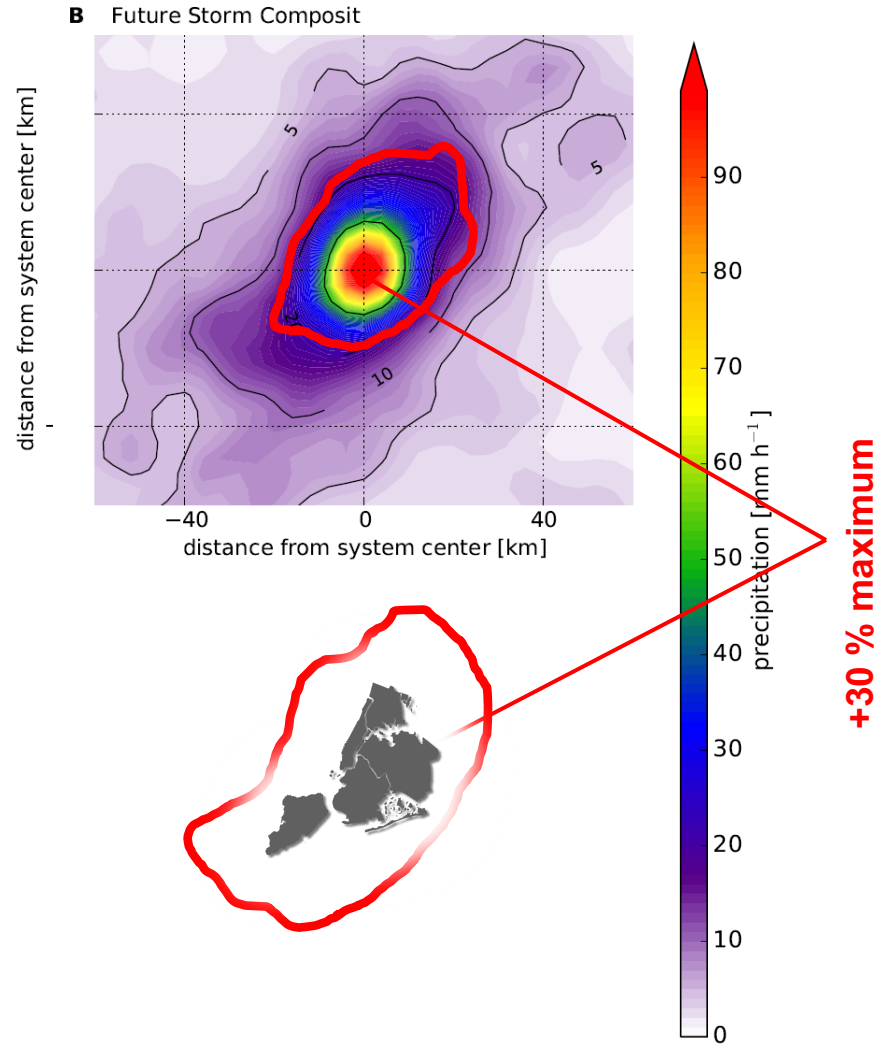


**4-times the
number of
strong storms**



A. Prein (NCAR)

Larger, wetter thunderstorms



Maximum rain rate

+30 %

Area

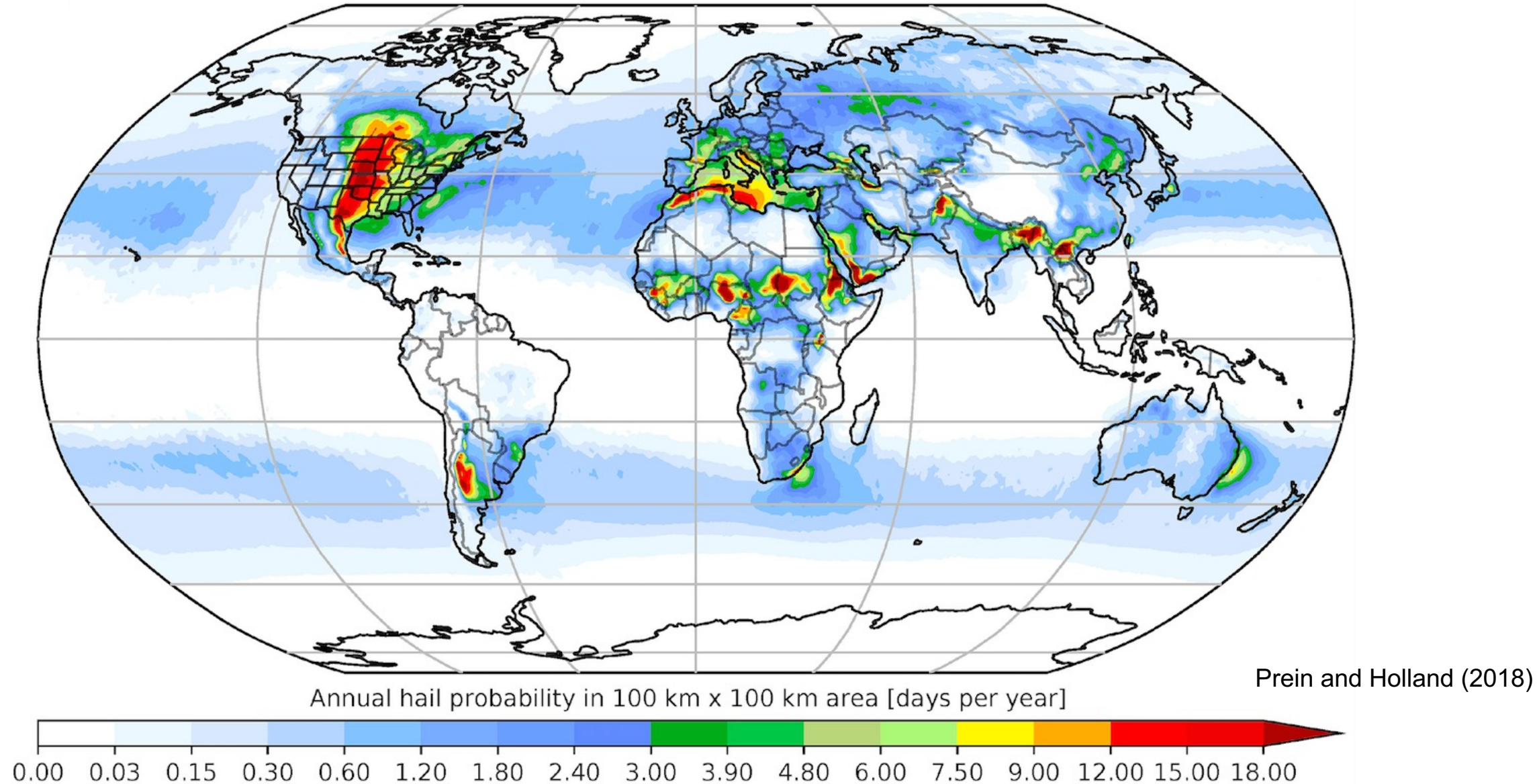
+88 %

Rainfall Volume

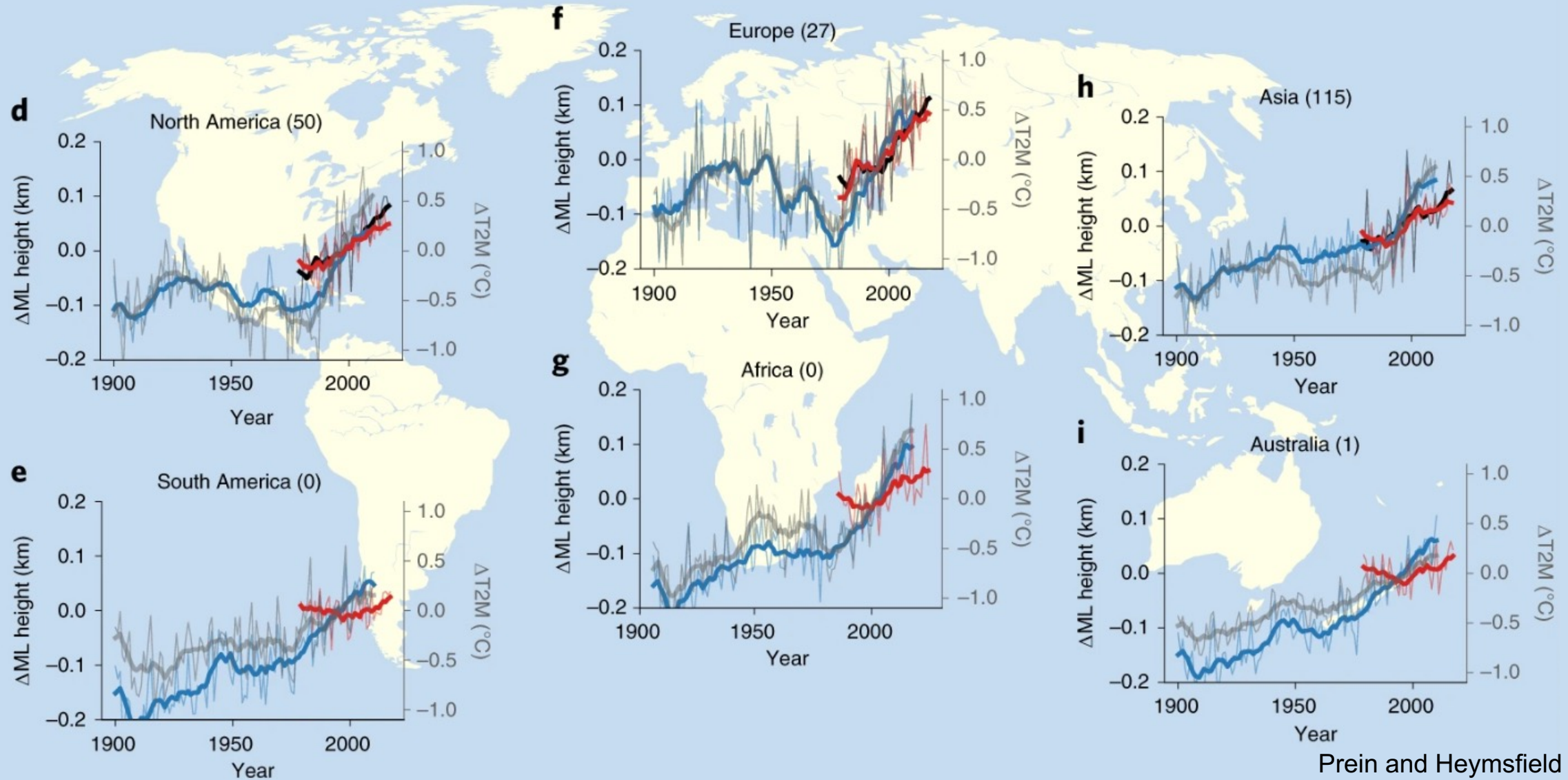
+105 %

A. Prein (NCAR)

The Central US is a global hotspot of large hail

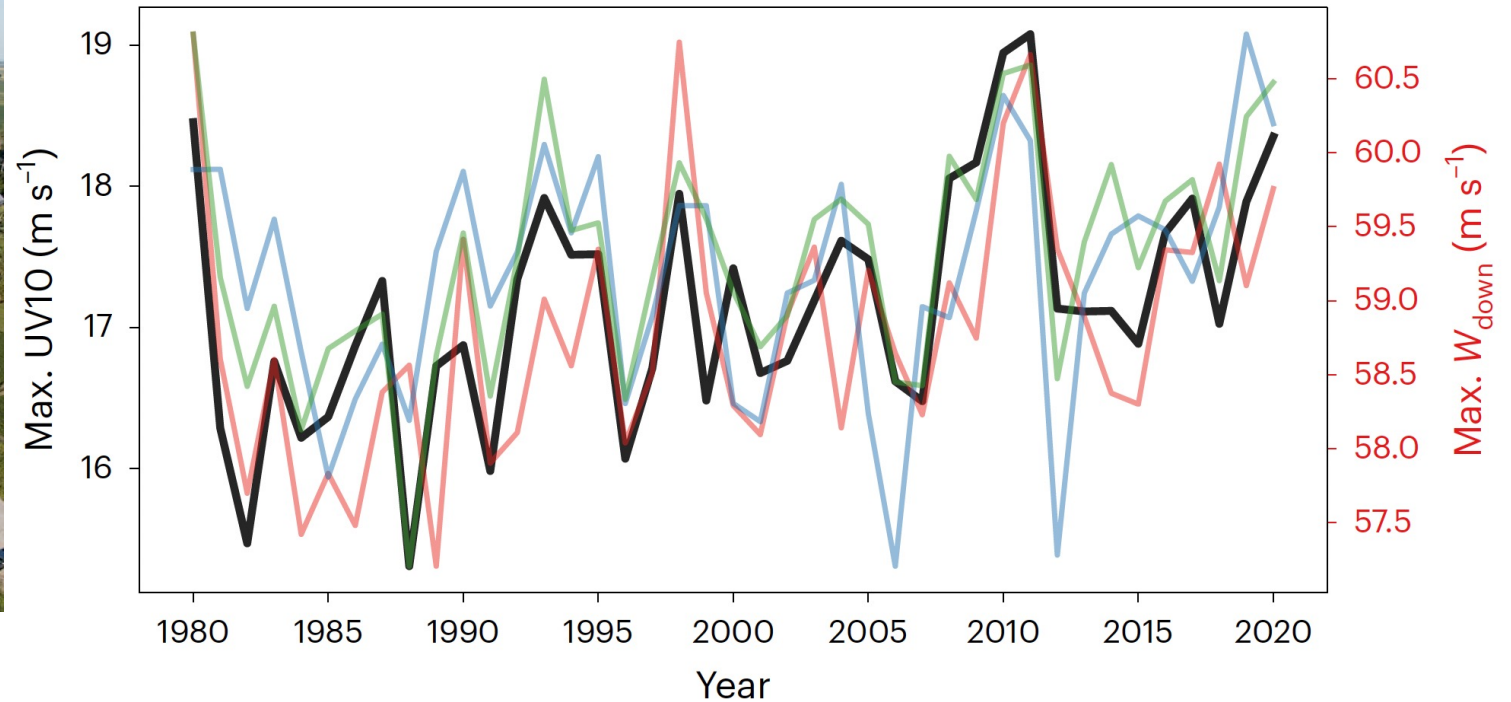


The melting level is rising



Prein and Heymsfield (2020)

The intensity, frequency and coverage of damaging straight-line winds are increasing

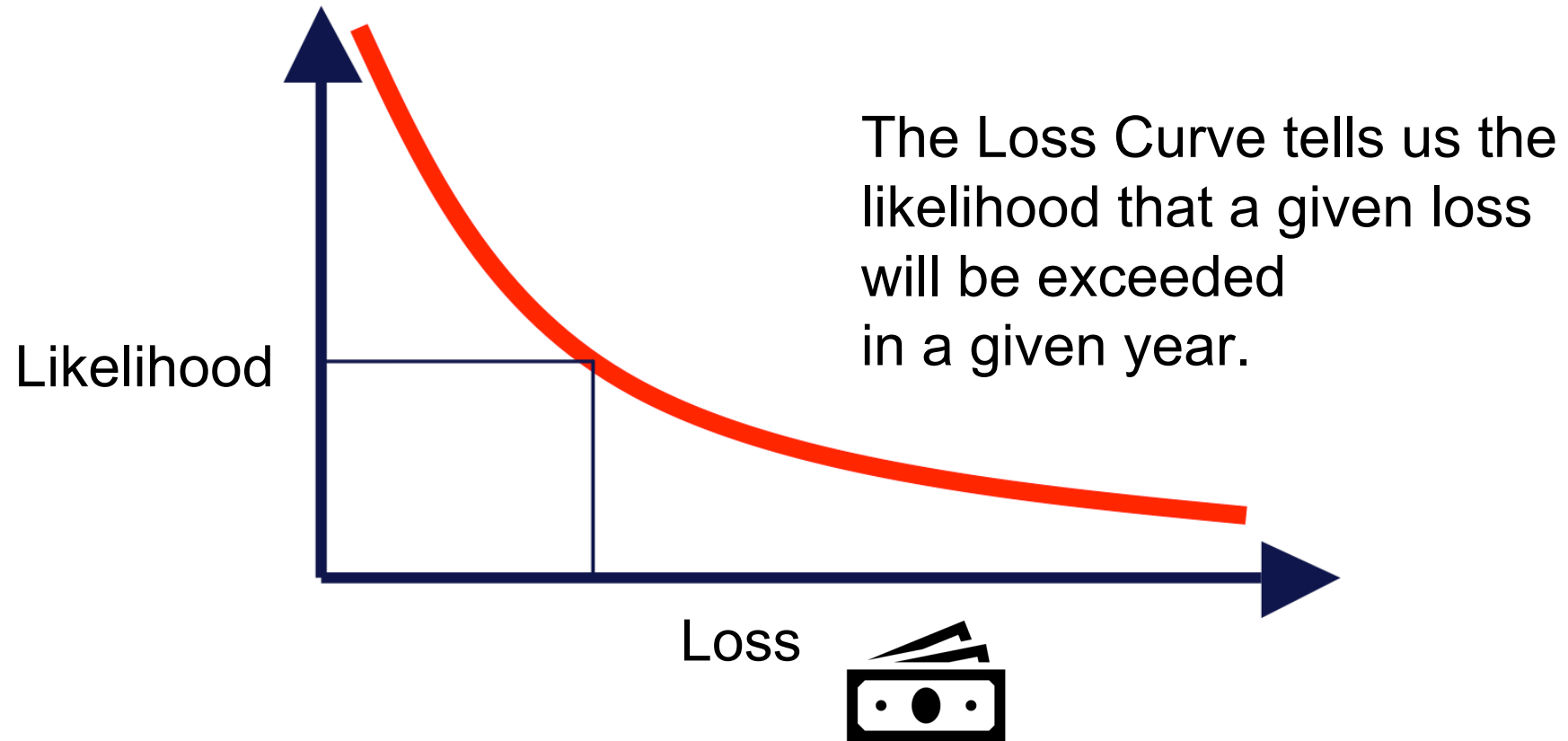


Prein (2023)

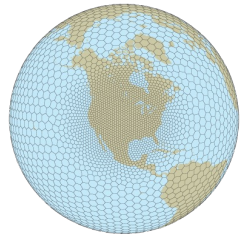
Connecting Climate Science with Risk: The Insurance Perspective



Your insurance premiums are informed by ***The Loss Curve***



Catastrophe models calculate the loss curve



A role for climate
modeling and
observations

Weather
'event set'



Exposure



Vulnerability



Traditionally
based on short,
incomplete
historical records



What keep insurers up at night?



1. Are these climate excursions temporary or permanent?

Climate change is the highest priority across the re/insurance sector.

4. Correlations between hazards and locations.

Key Takeaways

1. A new era of climate risk
2. Some changes in high-impact weather have already been observed. Further changes are expected.
3. The value of partnerships to inspire new science and produce usable information.