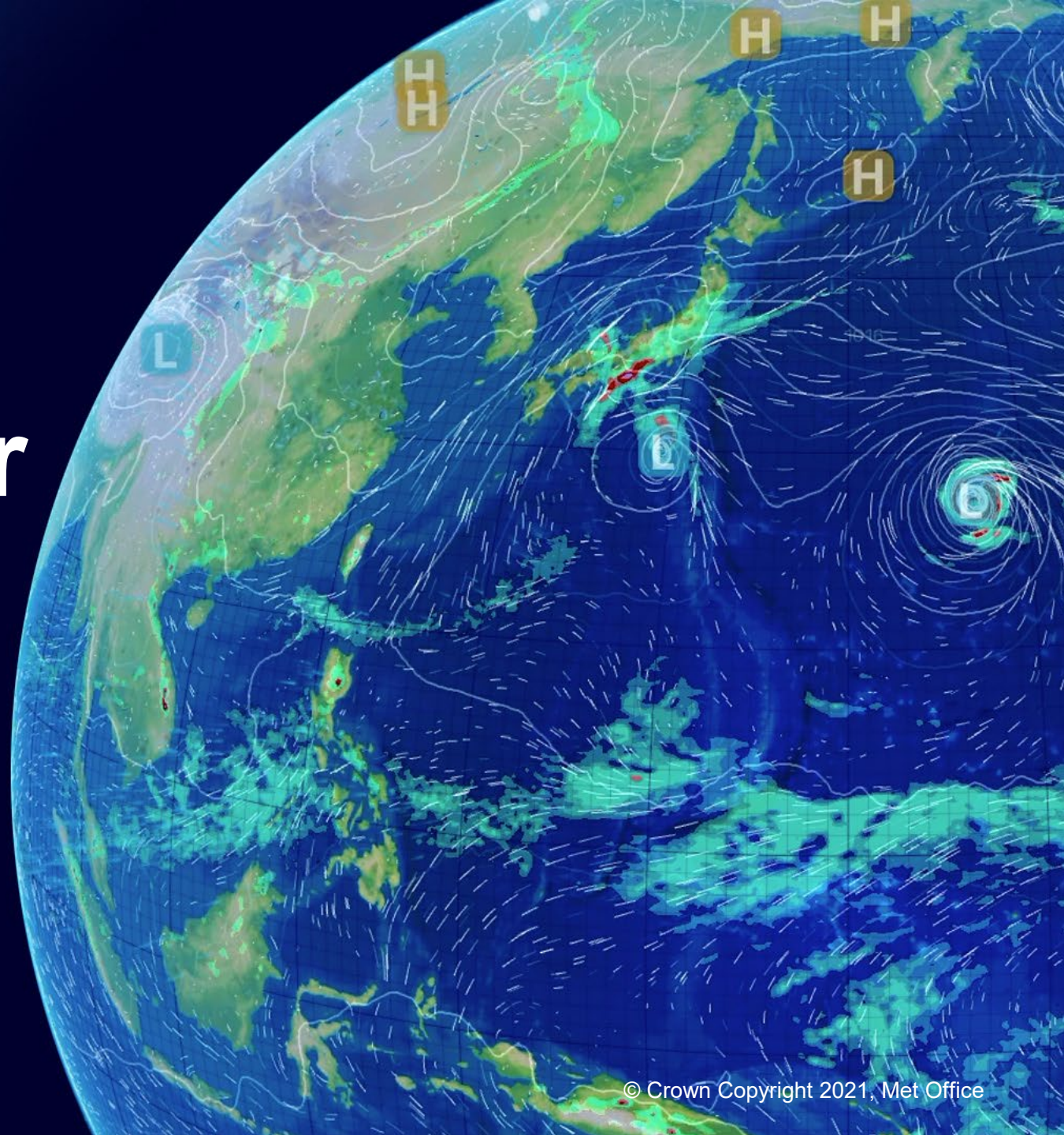


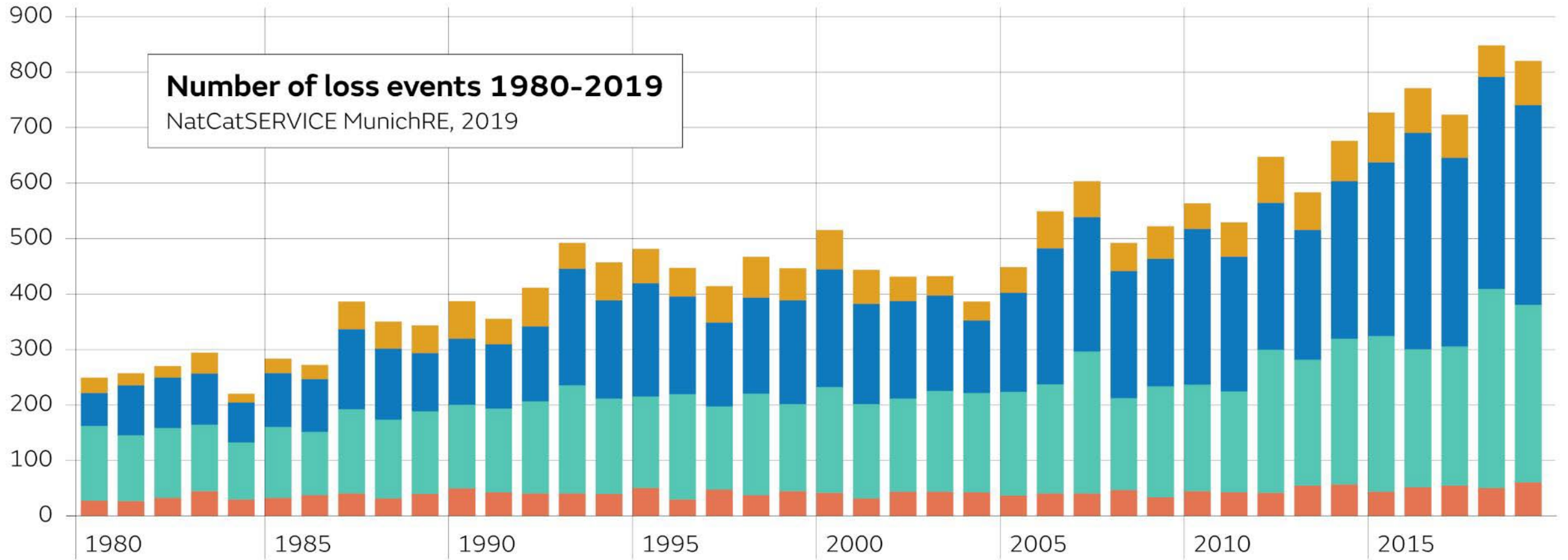
# Extreme Weather

15 June 2023

Paul Davies, Chief Meteorologist  
Principal Fellow, Meteorology



# Met Office Are extremes becoming more frequent?



**Geophysical events**

Earthquakes, tsunamis,  
volcanic activity

**Meteorological events**

Tropical storm, extratropical storm,  
convective storm, local storm.

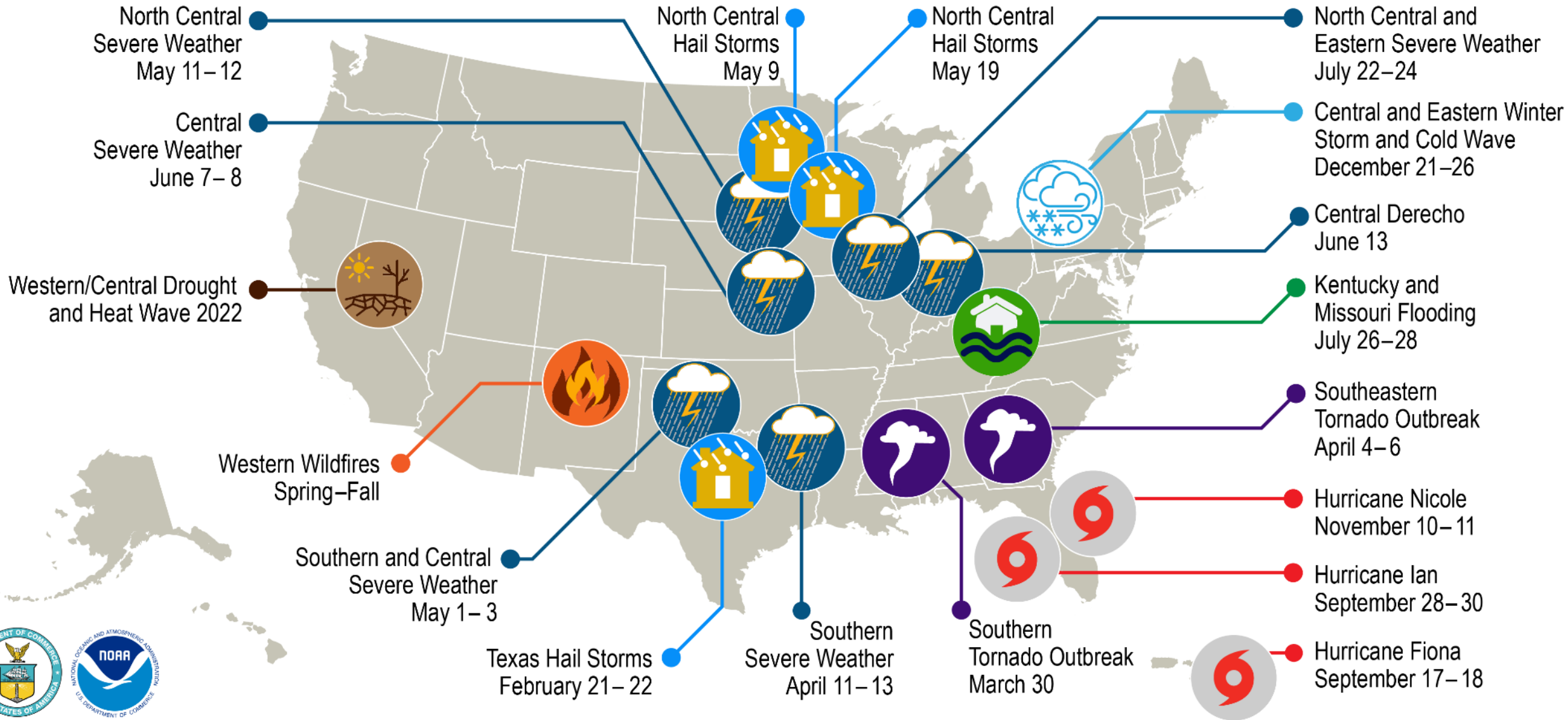
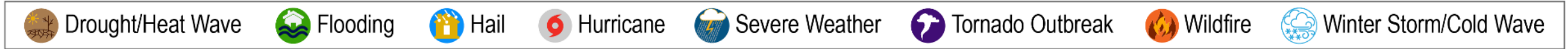
**Hydrological events**

Flood, mass movement.

**Climatological events**

Extreme temperature,  
drought, wildfire.

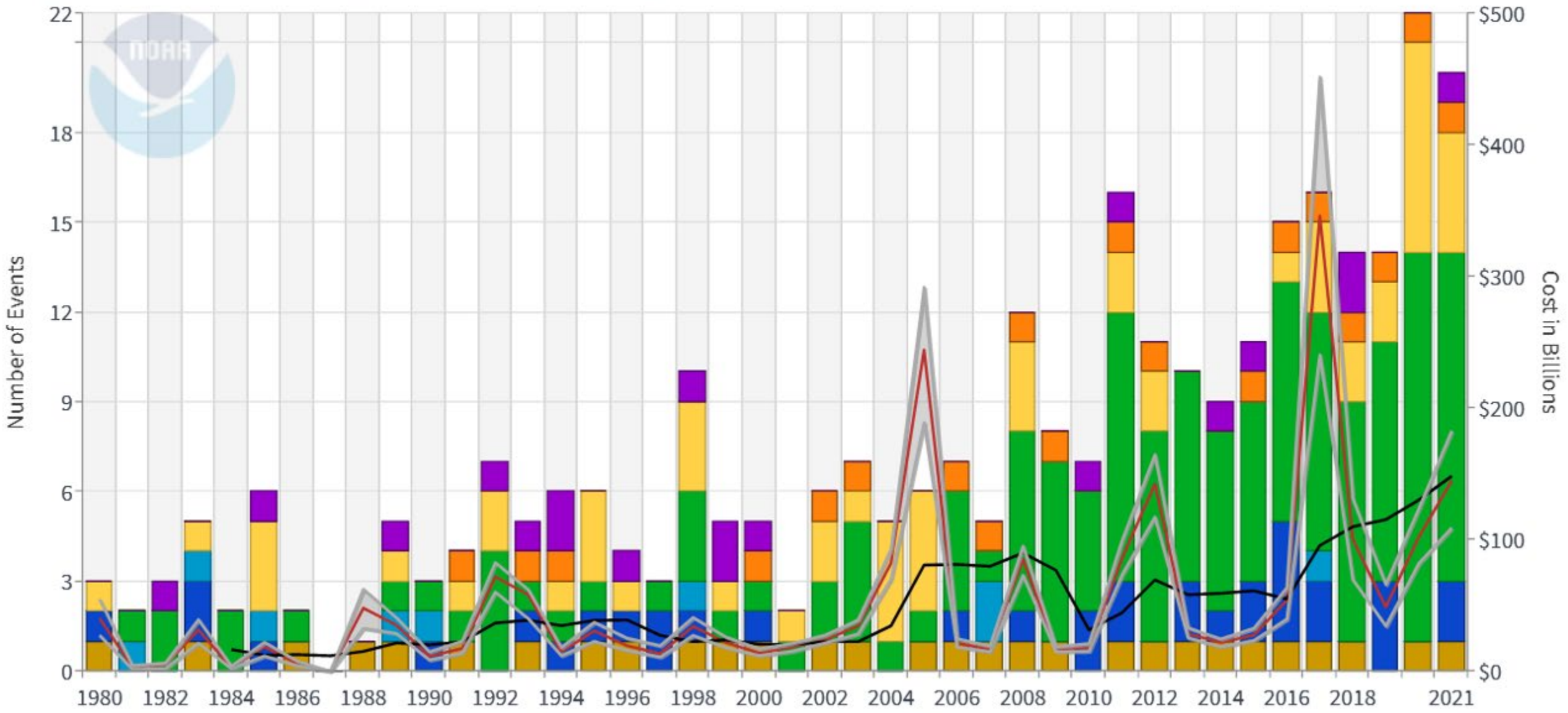
# U.S. 2022 Billion-Dollar Weather and Climate Disasters



*This map denotes the approximate location for each of the 18 separate billion-dollar weather and climate disasters that impacted the United States in 2022.*

# United States Billion-Dollar Disaster Events 1980-2021 (CPI-Adjusted)

- Drought Count
- Flooding Count
- Freeze Count
- Severe Storm Count
- Tropical Cyclone Count
- Wildfire Count
- Winter Storm Count
- Combined Disaster Cost
- Costs 95% CI
- 5-Year Avg Costs



# Severe Storms & Flash Flooding

# New York 2021



# London 2021



# Coverack

Shot across the Bows; if the storm had been further inland many people would have died.





# Inland Tsunami



An inland Tsunami is one the most powerful and destructive rainfall induced flooding events that can occur anywhere and at anytime.

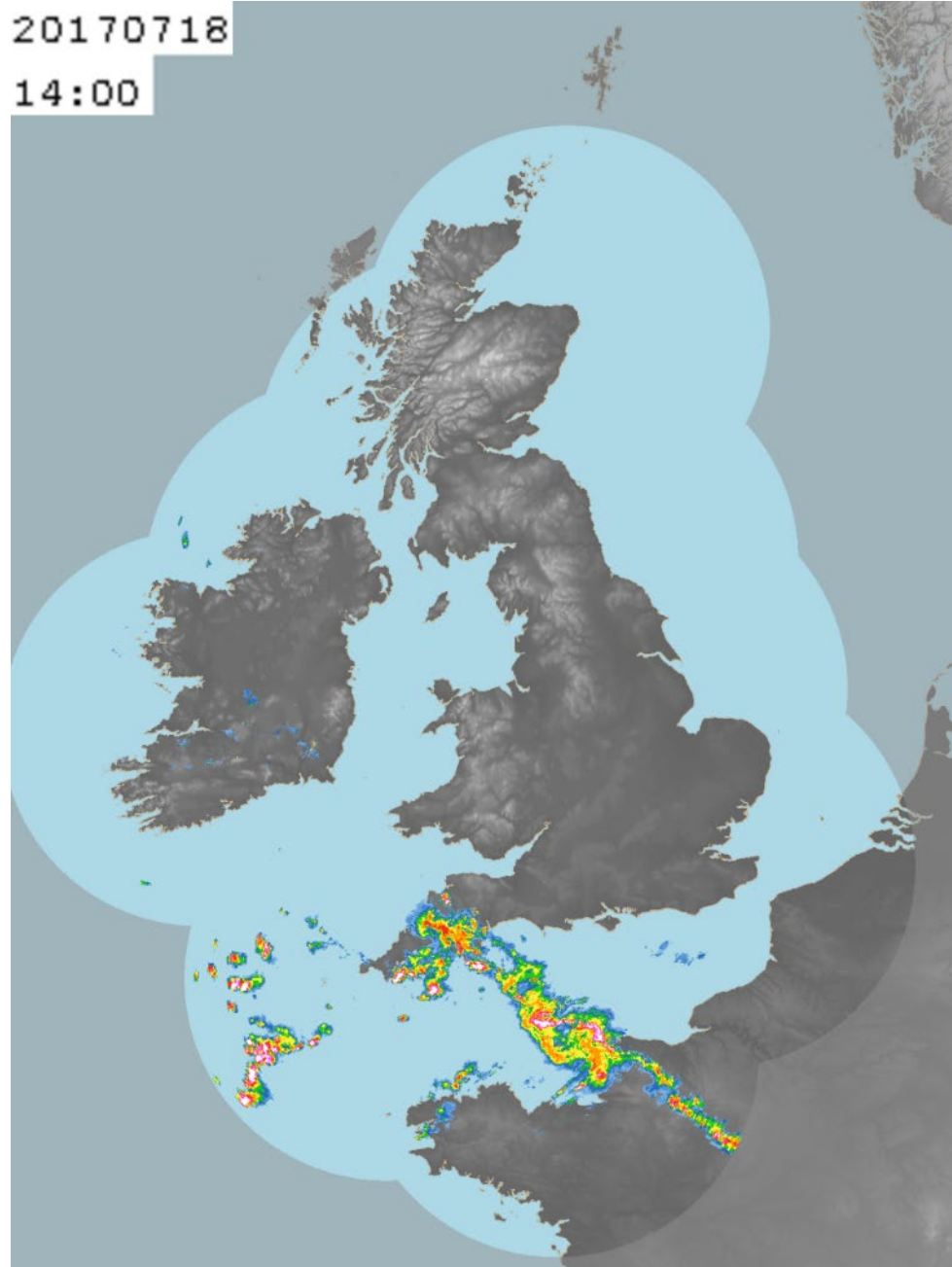
An inland Tsunami is caused by a sudden downpour of rainfall so heavy and intense that the ground on which it falls is unable to absorb the impact. Surface water maps provide limited guide to what can happen next.

The flow and force of the ensuing water and the debris it carries can destroy buildings, homes, vehicles, and livelihoods and other structures; cause injuries; and take lives as the tsunami moves fast and unexpected through villages and towns.

# Radar at that time

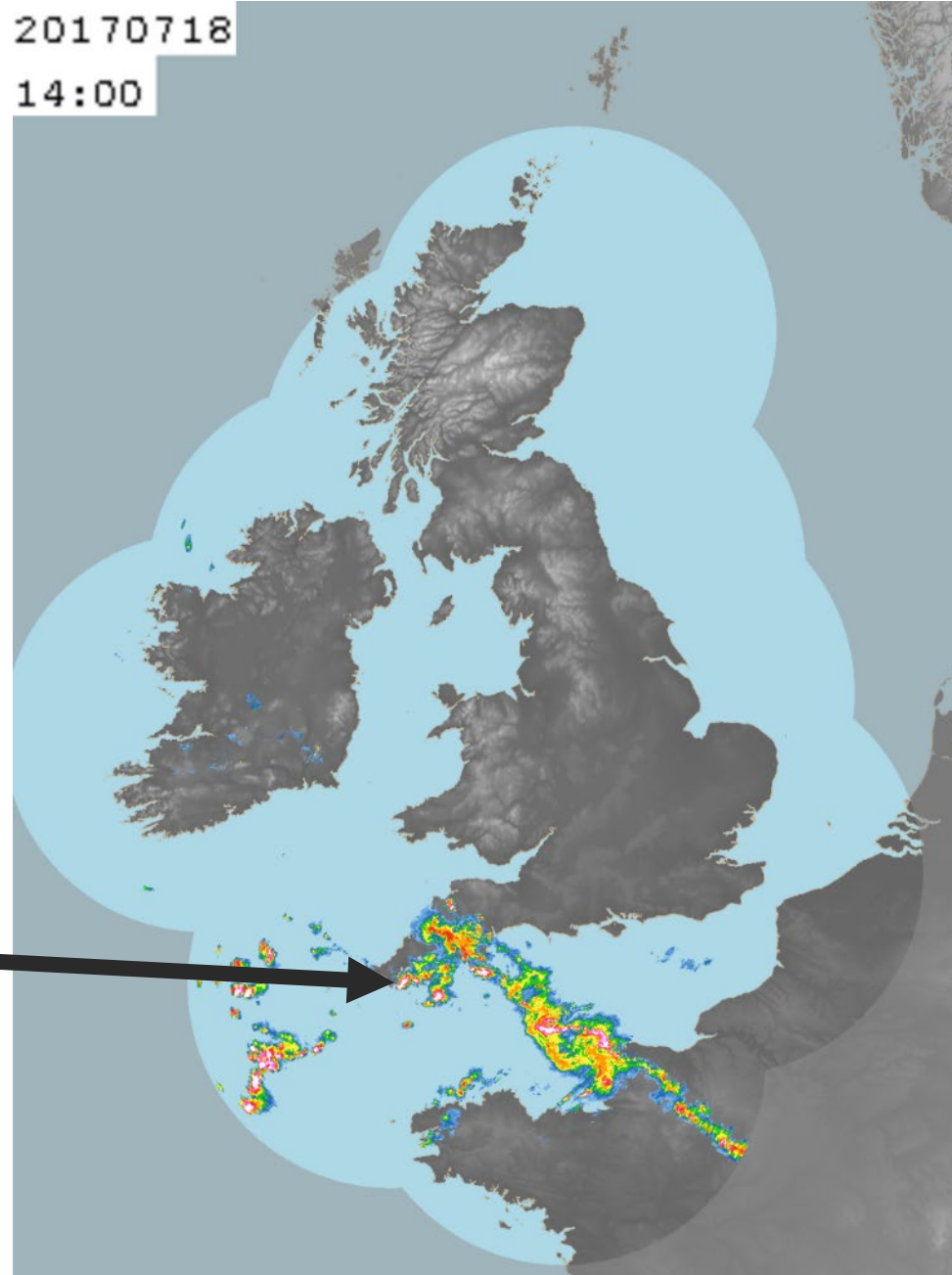
20170718

14:00



# Radar at that time

Coverack



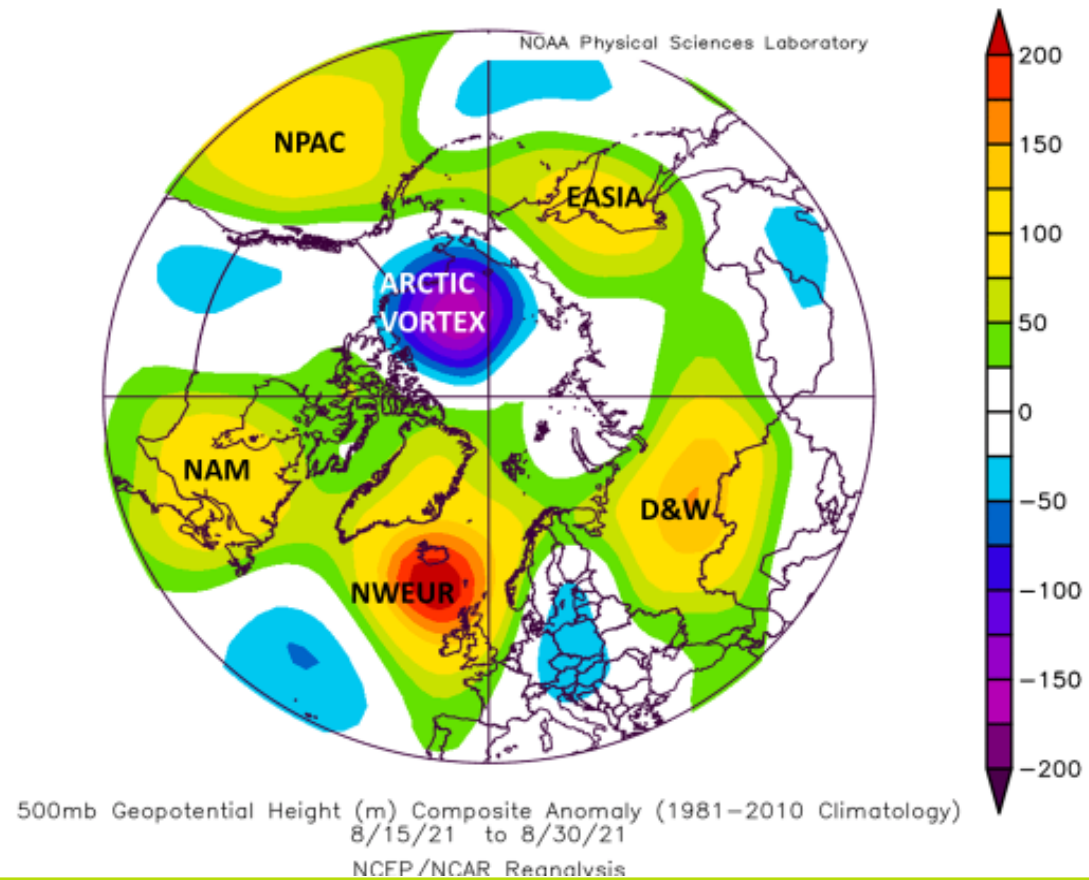
# Boscastle

How effective are our warnings; does it invoke the right action?. How do we prepare for life threatening, fast evolving extremes?

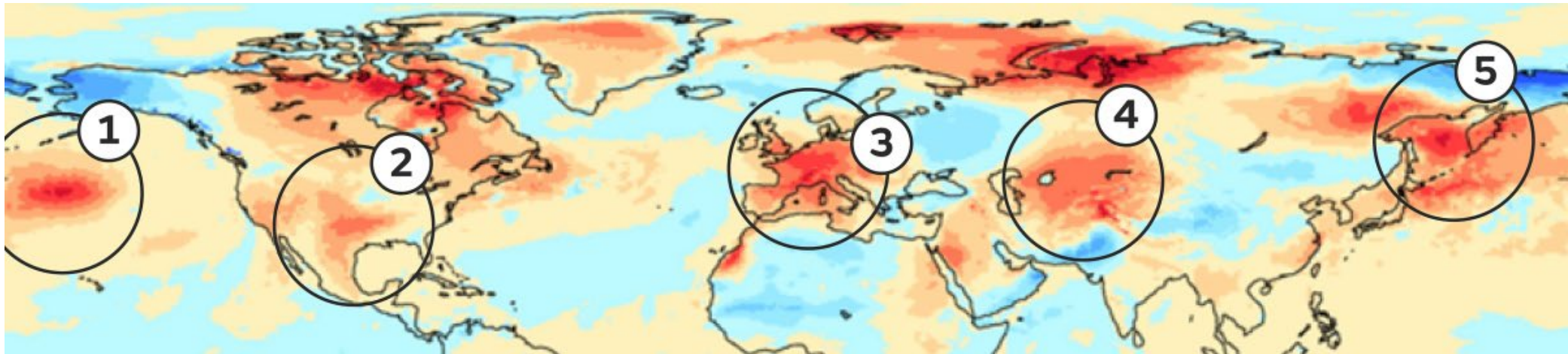


# Heat and Drought

# Heatwaves - global Teleconnections



# Summer 2022: a historic season for northern hemisphere heatwaves



**The wavenumber 5 pattern in surface temperature. The colours show the different from average of the near surface temperature for the week commencing 18<sup>th</sup> July. This graphic has been adapted from the Met Office long-range forecast system: GloSea.**

# Flash droughts

Flash droughts can develop and intensify in as little as **two or three weeks**.



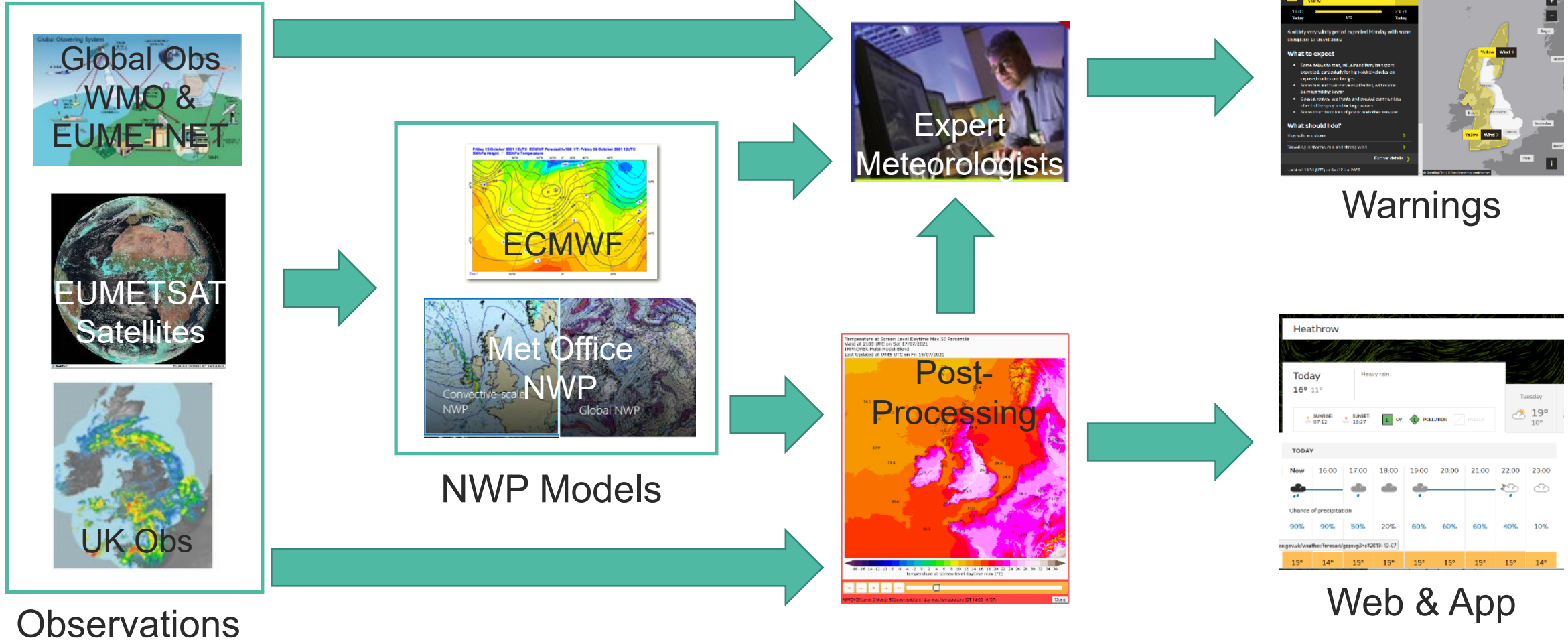
Flash drought events have become **more frequent** since the late 1950s in many regions, **including Europe**.



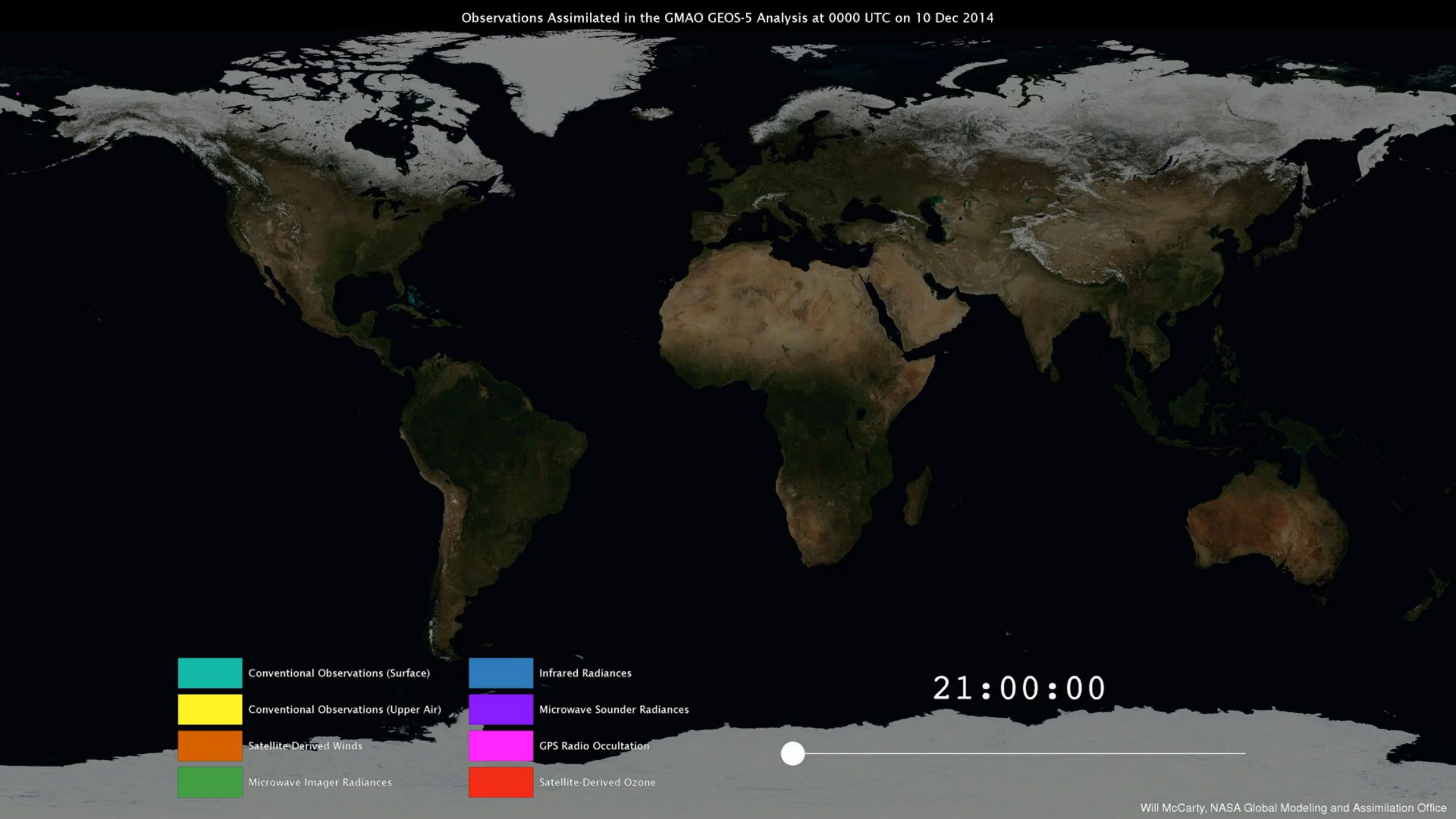
# The weather forecasting value chain

# The Value Chain

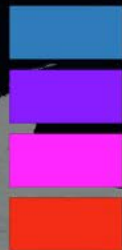
What it takes to produce our forecasts, 24x7, globally.



Forecast Quality: Actual Accuracy, Timeliness & Consistency



Conventional Observations (Surface)  
Conventional Observations (Upper Air)  
Satellite-Derived Winds  
Microwave Imager Radiances

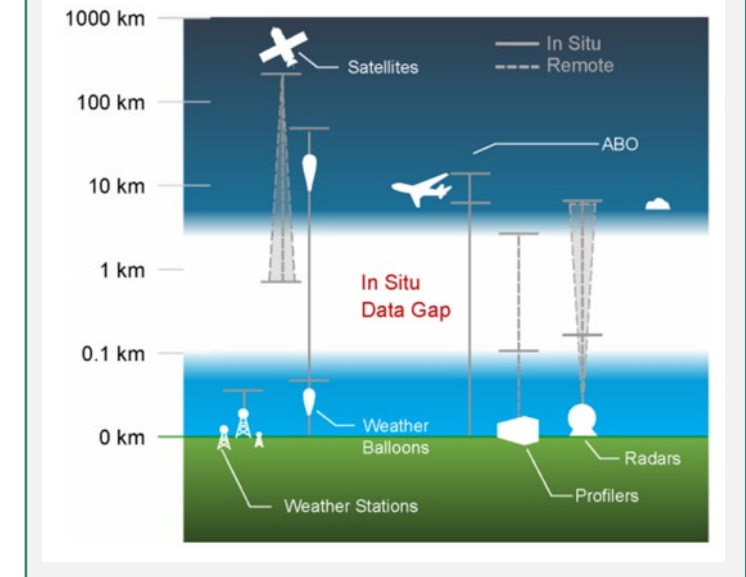
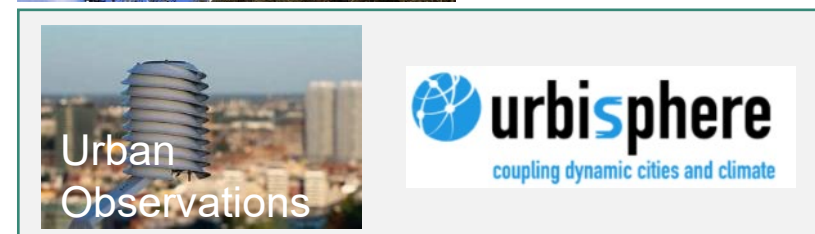
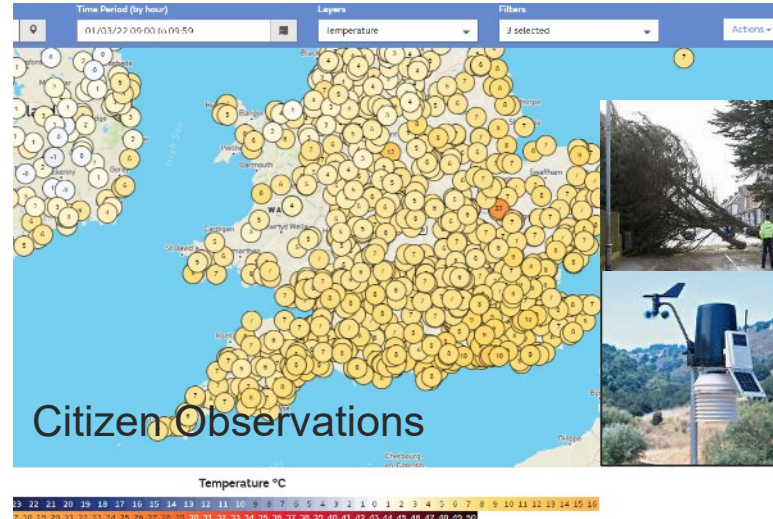
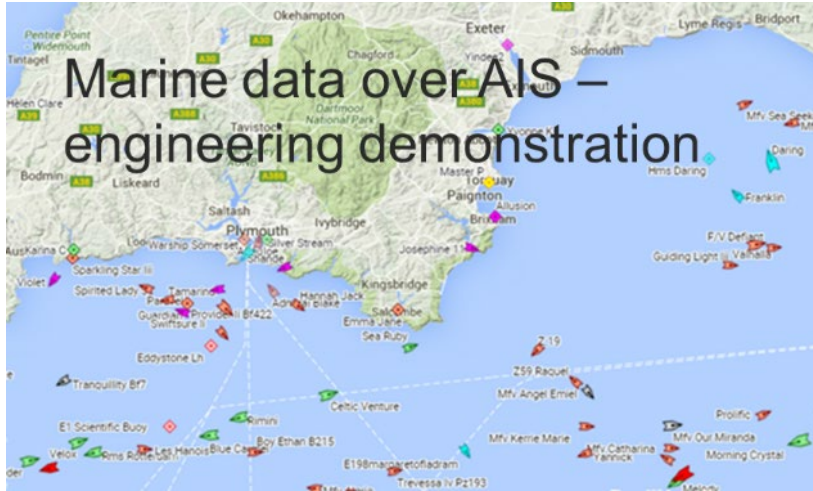


Infrared Radiances  
Microwave Sounder Radiances  
GPS Radio Occultation  
Satellite-Derived Ozone

21:00:00



# Met Office Examples of Opportunistic Observation Sources



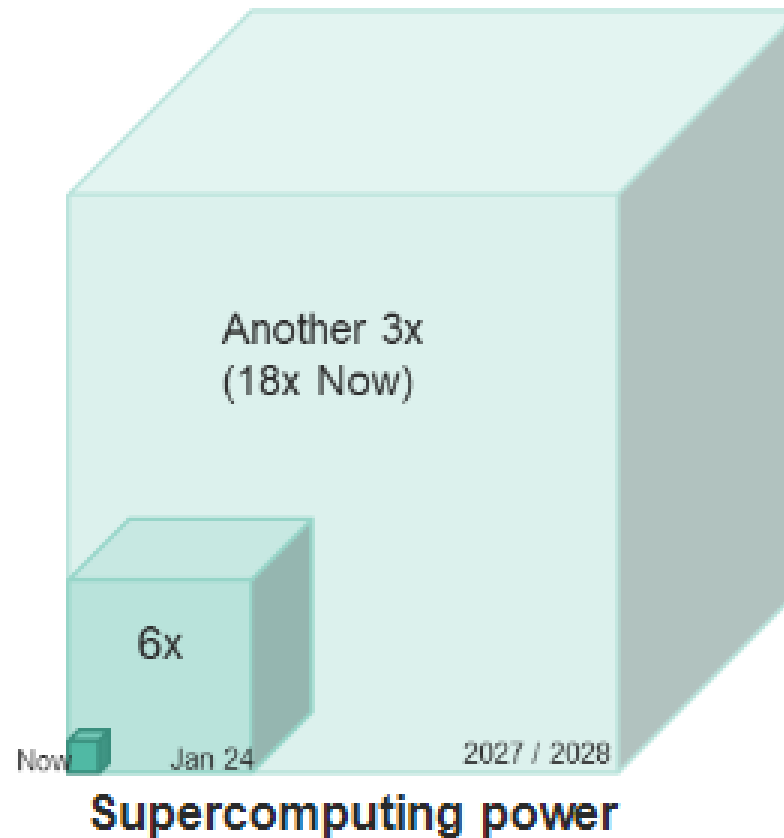
# Big Data

Capable of over 14,000 trillion arithmetic operations per second – that's more than 2 million calculation per second for every person on the planet



# Big Data

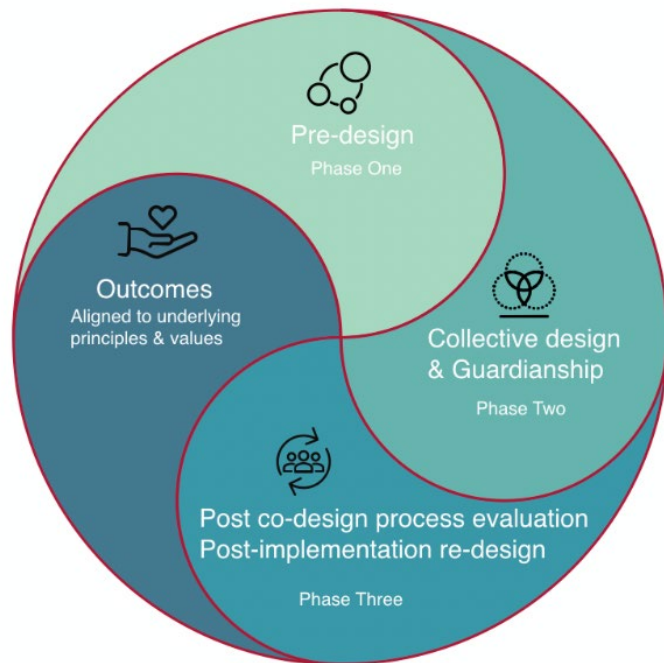
We are in the midst of unprecedented change; driven by the relentless exponential growth in data and being faced with incomplete or inaccurate diagnosis of risk and impact



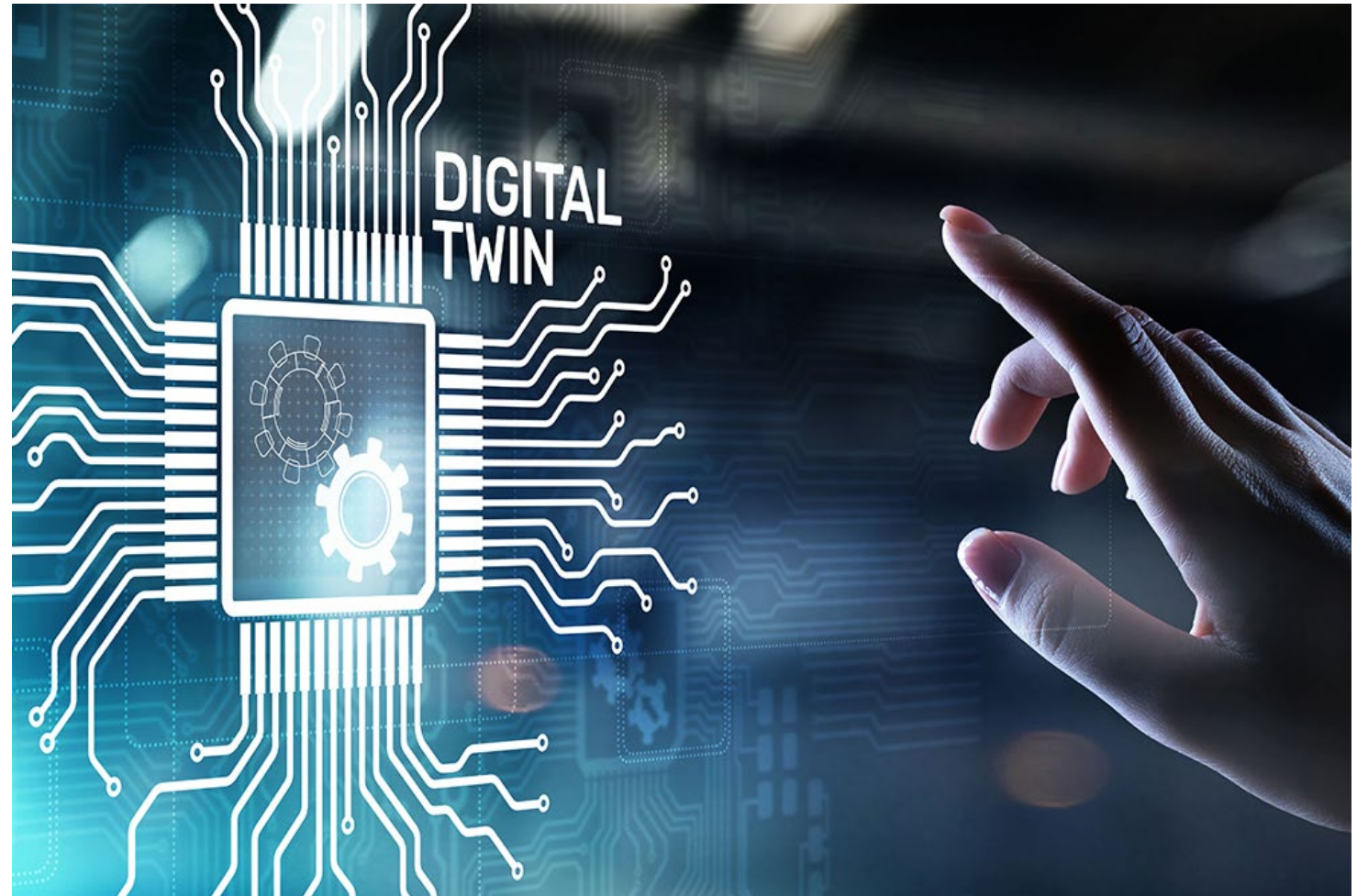
# Collaborations

## Co-design Process

Lived experience informed and designed



INTERNAL PROCESS EVALUATION & EXTERNAL EVALUATION OF OUTCOMES



# Transdisciplinary

