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ReBASE: Reanalysis-Based Attribution and Storylines of Extremes



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1. Introduction

How has climate change affected the intensity of recent extreme weather?

If extreme events from the past were to occur today, in a warmer and wetter world, would their impacts be different?

We use **reanalysis-based storylines** to answer these questions.

2. Reanalysis attribution

We reconstruct events using the 20th Century Reanalysis (20CRv3):

- Observed SST, sea ice, and CO₂;
- Assimilates only **surface pressure** observations.

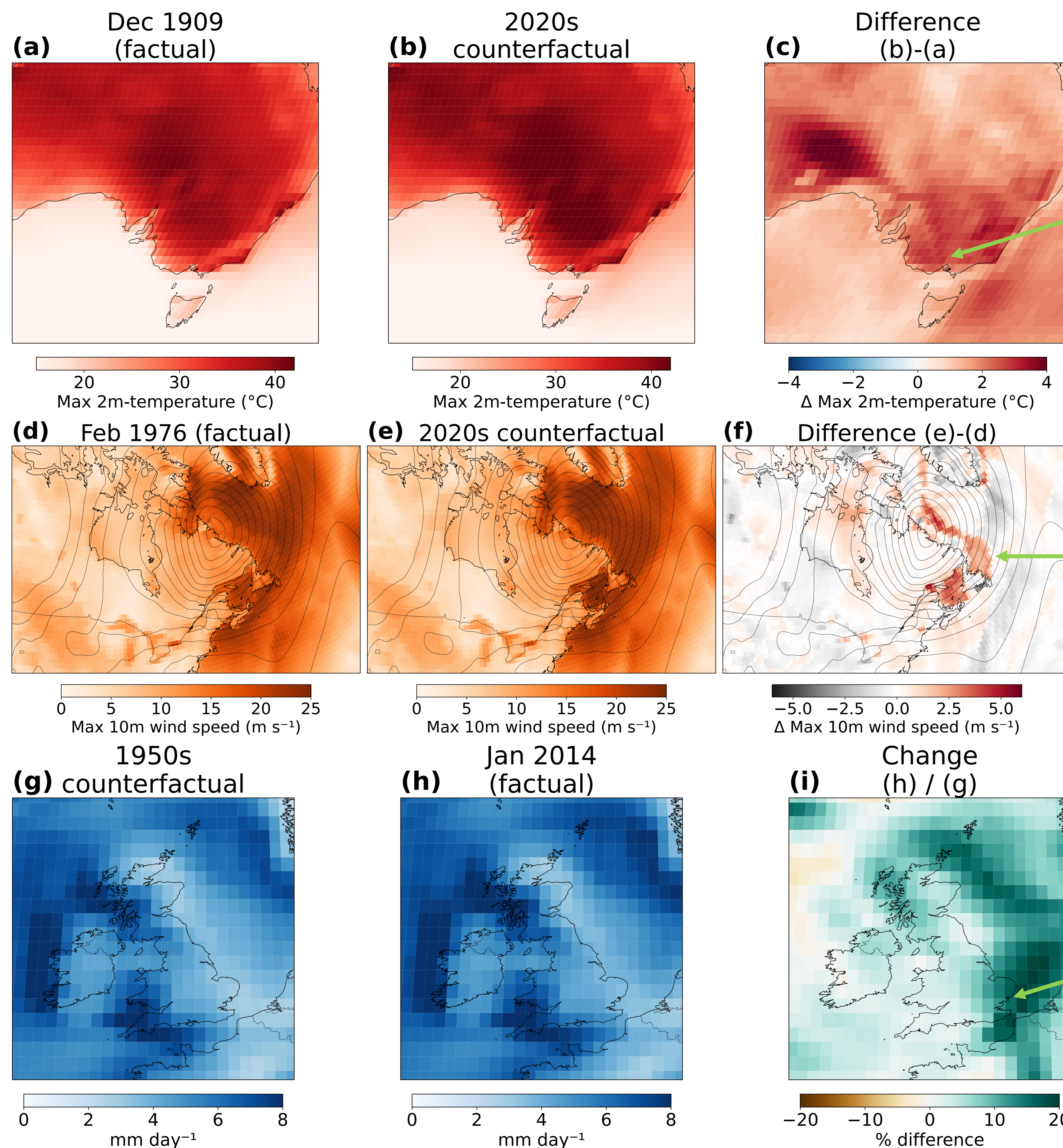
We then re-run the reanalysis with:

- perturbed SSTs**, sea ice, and atmospheric CO₂...
- ...while assimilating the **same pressure observations**.

This translates the impacts of extreme weather events into warmer or cooler climates.

All data will be made openly available.

Project website:



3. Australia heatwave (1909)

Temperatures in the shade reached 39.4°C in Melbourne.

The same weather patterns would lead to max temperatures **3°C hotter** in the current climate.

(a), (b): Maximum 3-hourly T2m between Dec 19th 12Z and Dec 20th 09Z, 1909.
 (c): T2m difference in the 2020s-climate counterfactual.

4. Groundhog Day Gale (1976)

Maximum 10m wind speed would be **up to 5ms⁻¹ higher** off the coasts of New Brunswick and Nova Scotia – among the worst affected regions by the Groundhog Day Gale.

(d), (e): Maximum 3-hourly 10m wind speed between 00Z and 21Z, Feb 3rd 1976.
 (f): Difference in maximum wind speed in the 2020s-climate counterfactual.

5. UK wet month (2014)

This was the **wettest month on record** in parts of southeast England.

Rainfall over East Anglia is **10-20% higher** in the 2014 reanalysis than in the 1950s-climate counterfactual.

(g), (h): Mean precipitation in January 2014.
 (i): Percentage increase in precipitation in the 2014 reanalysis compared to the 1950s-climate counterfactual.