ReBASE: Storylines of extreme weather events in alternative climates

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How would an extreme weather event of today have unfolded in the past climate?

What could it look like in a future, warmer world? How much wetter? How much hotter?

What do we need to prepare for?

ReBASE is a new reanalysis-based approach which will allow anyone to answer questions about the changing severity of observed extreme weather events in their own chosen region.

We are producing new reconstructions and counterfactuals for all extreme events globally in particular time periods.

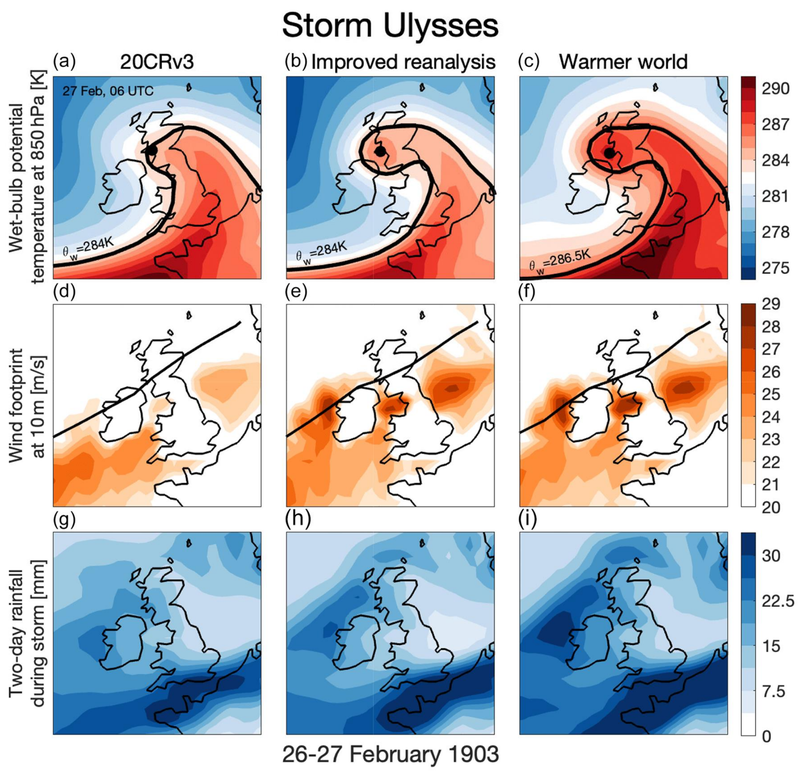
Importantly, the counterfactuals will be of the 'same' weather events occurring in a different climate.

For historical events, warmer counterfactuals will answer questions like "if that event reoccurred now or in the future, how extreme would it be?".

For modern events, cooler counterfactuals will enable answers to questions like "how much more damaging was that event than if it had occurred without climate change".

Future counterfactuals will explore how all these events would be different in a warmer future.

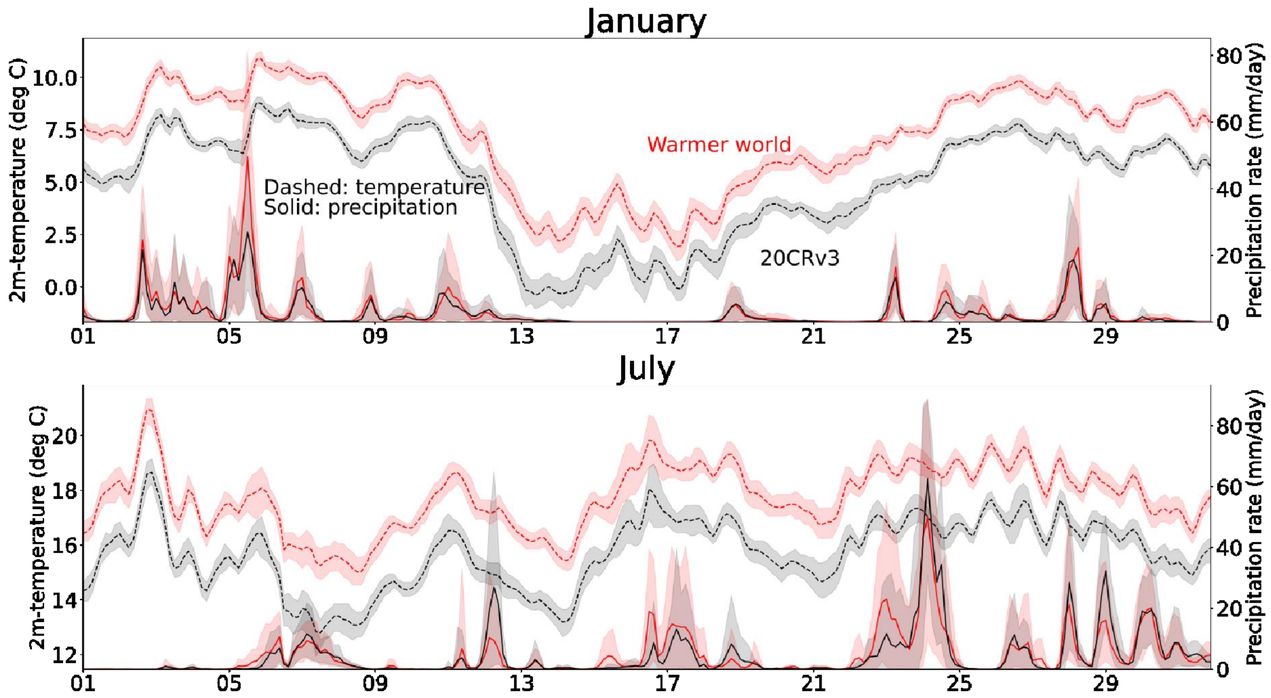
1903: Extreme Weather



Here we see rescued pressure observations lead to an improved reconstruction (Hawkins et al., 2023).

Simulating the event in a warmer climate, increased rain and stronger winds are shown.

1903: Everyday Weather



This approach allows us to not only investigate the extremes – we can also assess changes in the everyday weather.

These timeseries show the 2m temperature and rainfall for a single location in central England, for January and July. Black shows the 20CRv3 – the improved reanalysis – from 1903, and red shows the simulation with the same weather patterns in a world 2 °C warmer than 1903.

Comparing the reanalysis with the simulation in a warmer world we see that temperatures are higher and rainfall is more intense. For rainfall the signal is noisy – individual events do not all follow the consensus.

Future research questions

Multi-year drought:

What would the agricultural impacts be in a warmer world?

Wind storms:

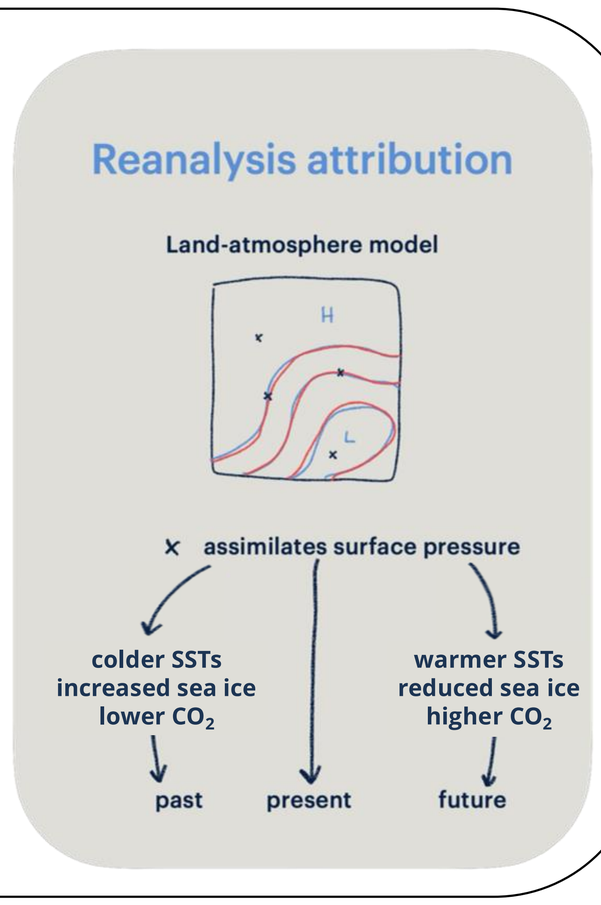
Can we better reconstruct historical events with newly available data?

Extreme rainfall:

If a past flood event occurred again, in the present climate, what would the flood extents look like?

Extreme heat:

How many days of heat alerts or extreme wildfire risk will we get in a future, warmer, climate?



References:
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