Sustainability and the environment

Rob Varley
Met Office Chief Executive

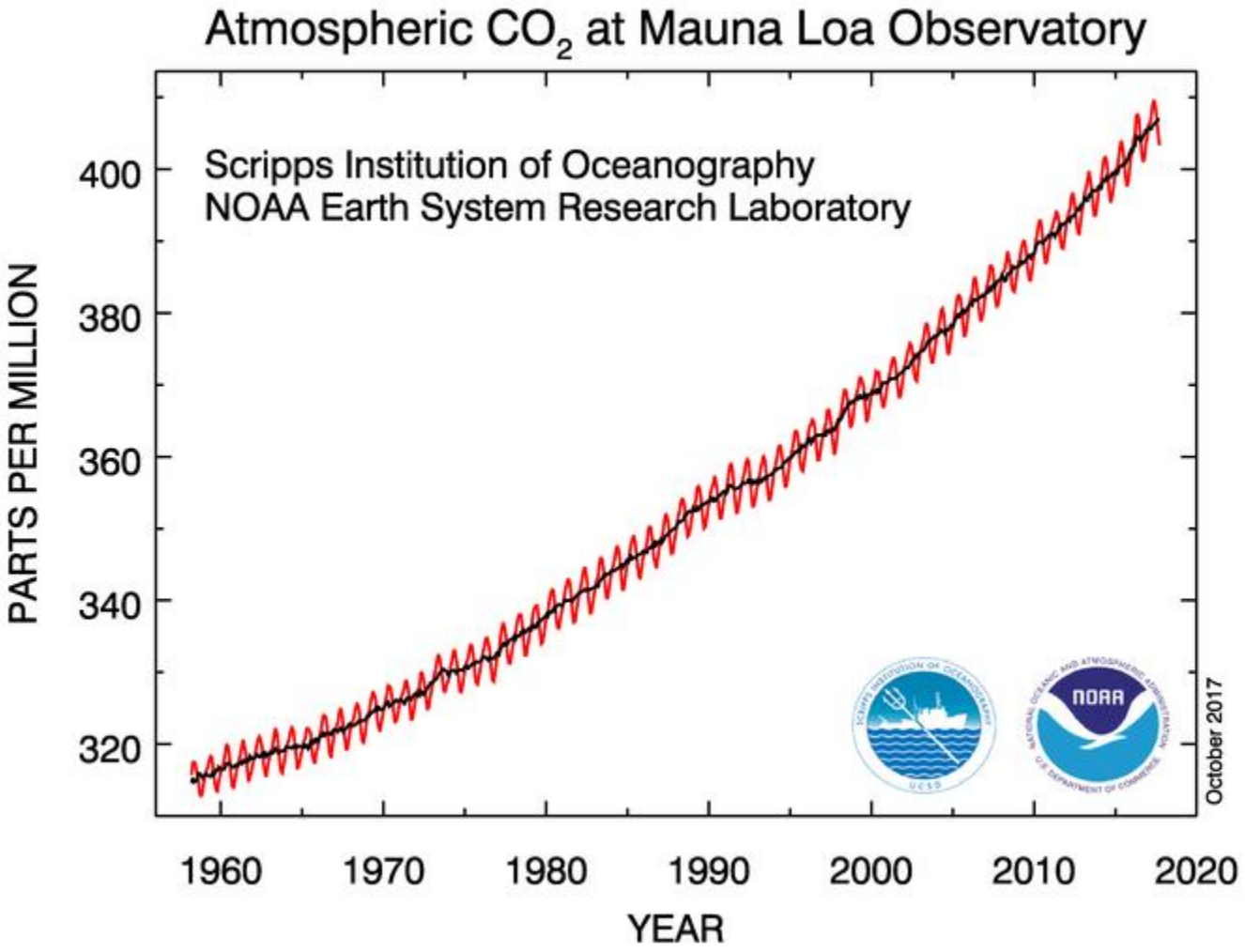
Sustainability and the environment

- Is climate changing?
- What about the UK?
  - Climate change Risk Assessment 2017
- How can science help sustainable planning?
  - the National Flood Resilience Review, 2016

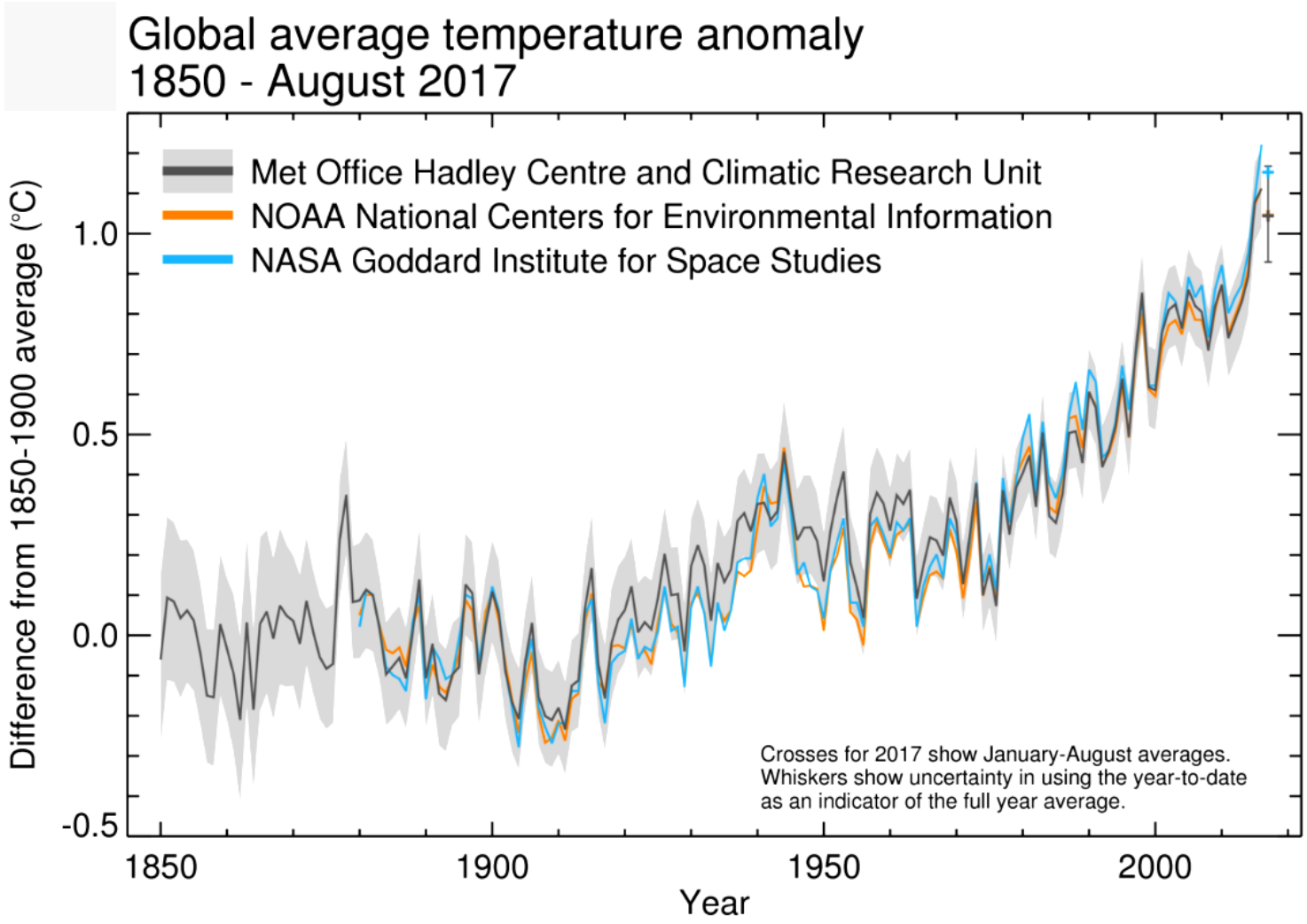
Source: bbc.co.uk/news

Is the climate changing?

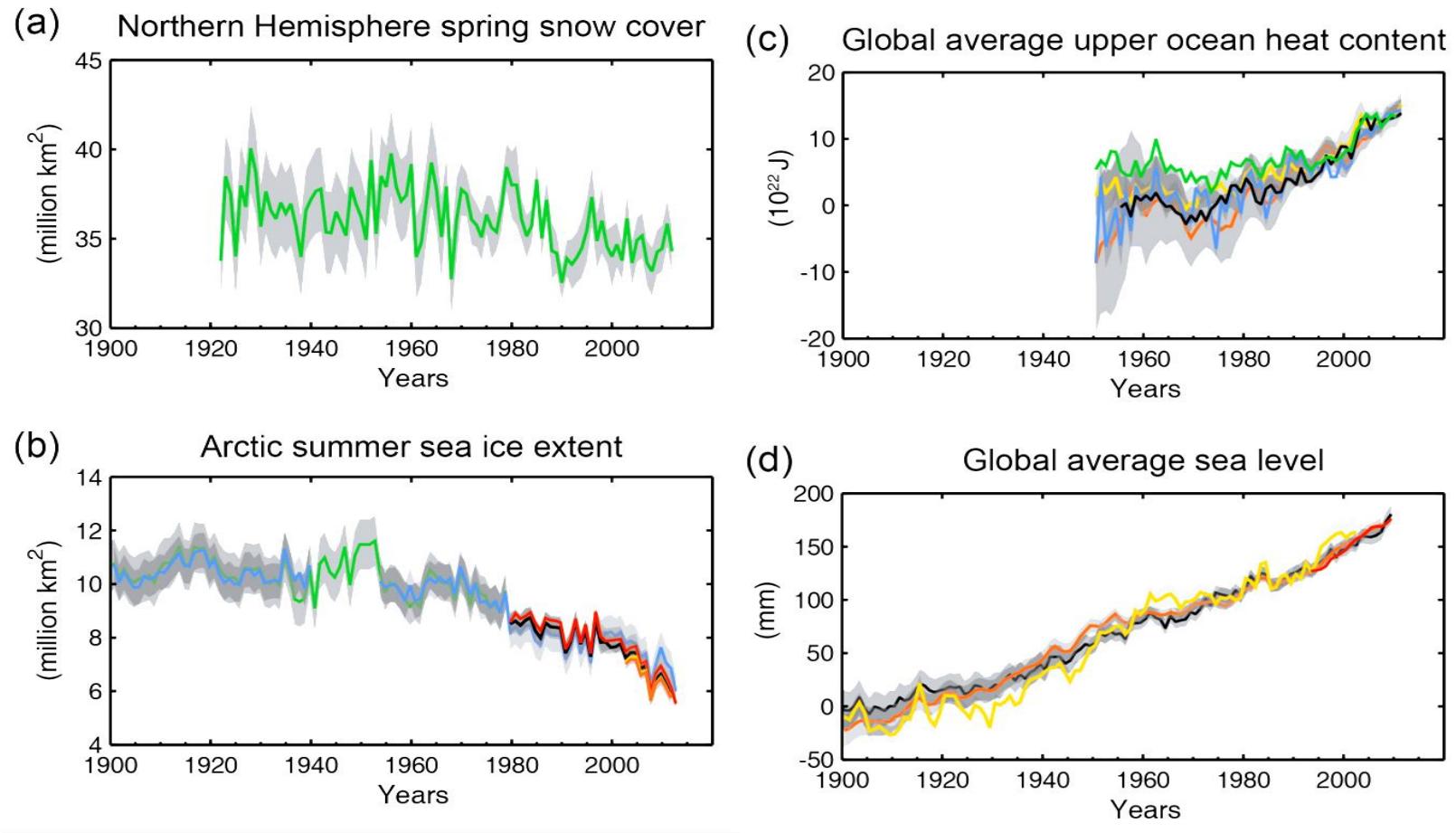
Global CO_2



Global temperatures



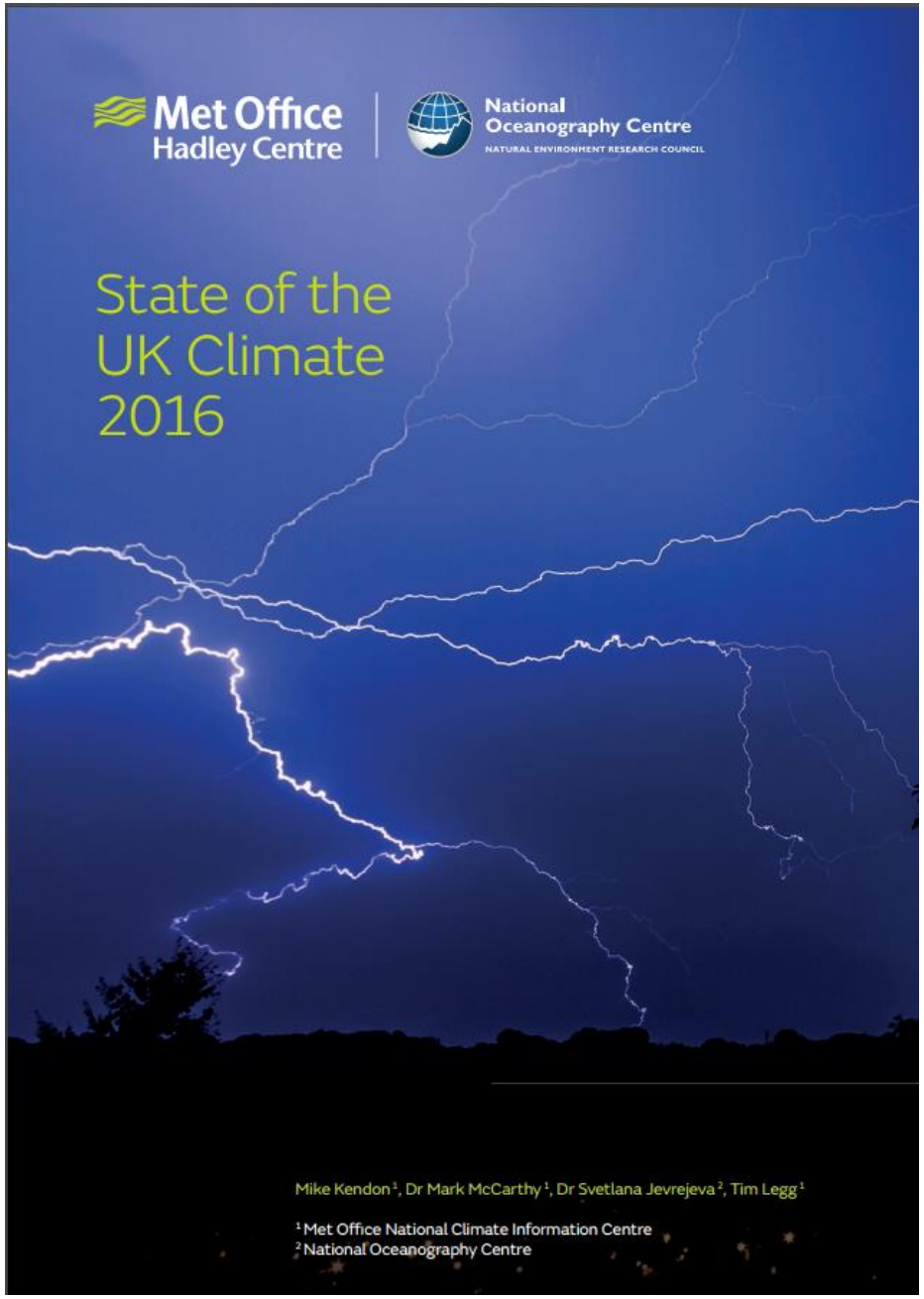
Global temperatures



What about the UK?

UK climate

- Eight of the ten warmest years have occurred since 2002
- Seven of the ten wettest years have occurred since 1998
- Winter 2015-16 (Dec -Feb) 2nd wettest in UK behind 2013-14



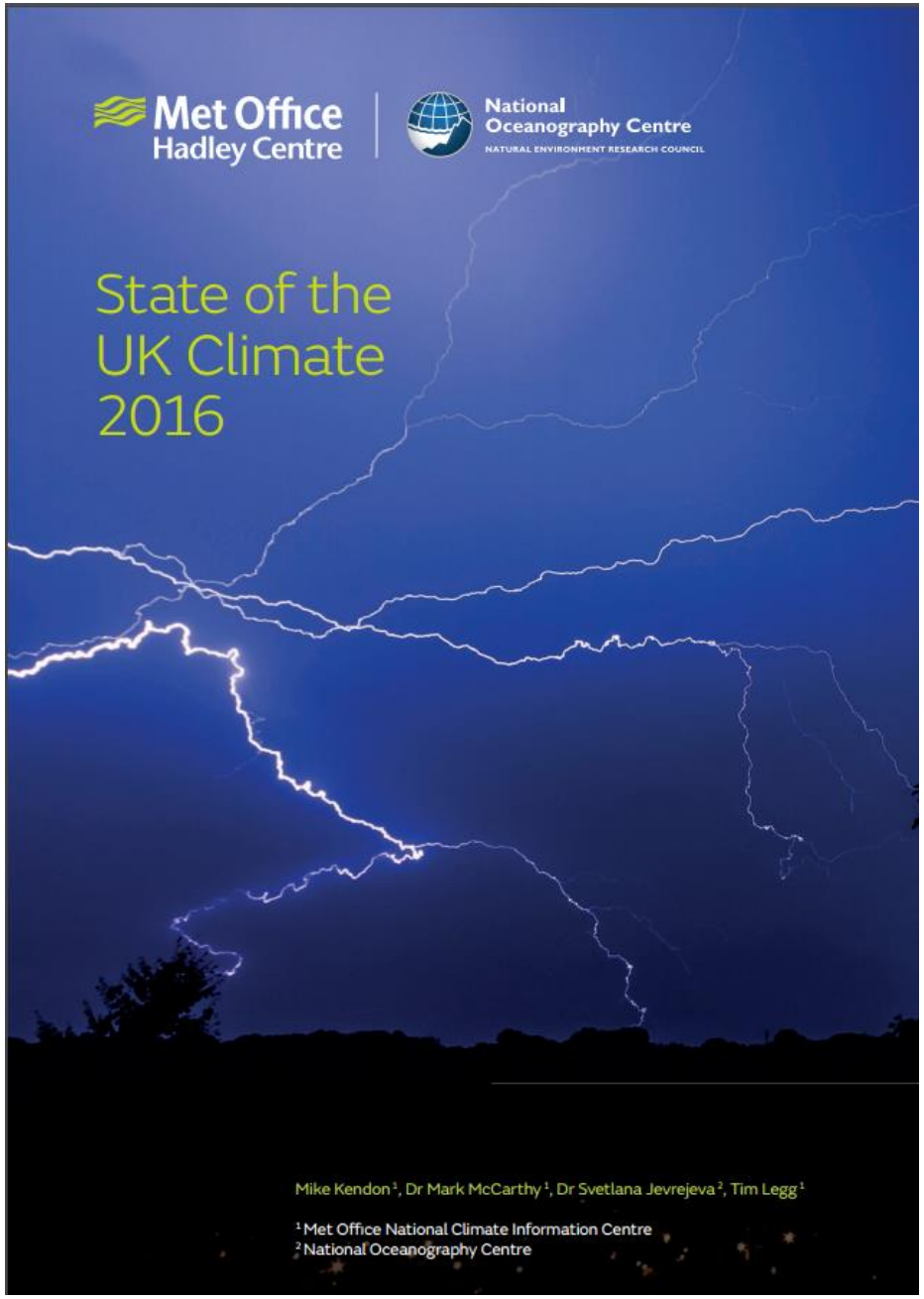
Available at https://www.metoffice.gov.uk/news/releases/2017/state-of-the-uk-climate-report-2016

UK climate

- The 2007-16 plant growing season increased by a month compared to the 1980s average, due to warmer temperatures

- Average number of frost days decreased by 16% since the 1980s

- Heavy rainfall events increased in winter in all UK regions over past 45 years



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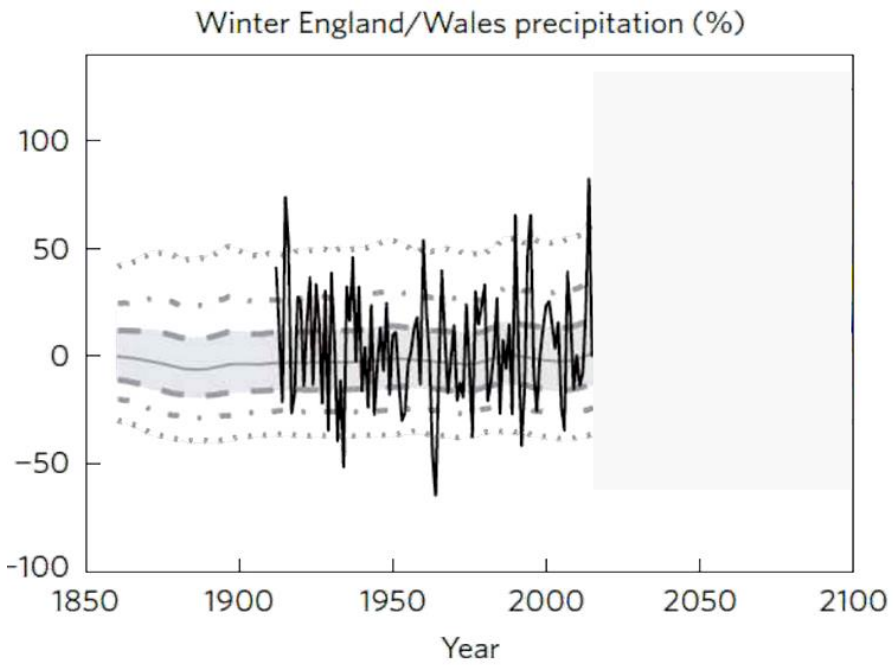
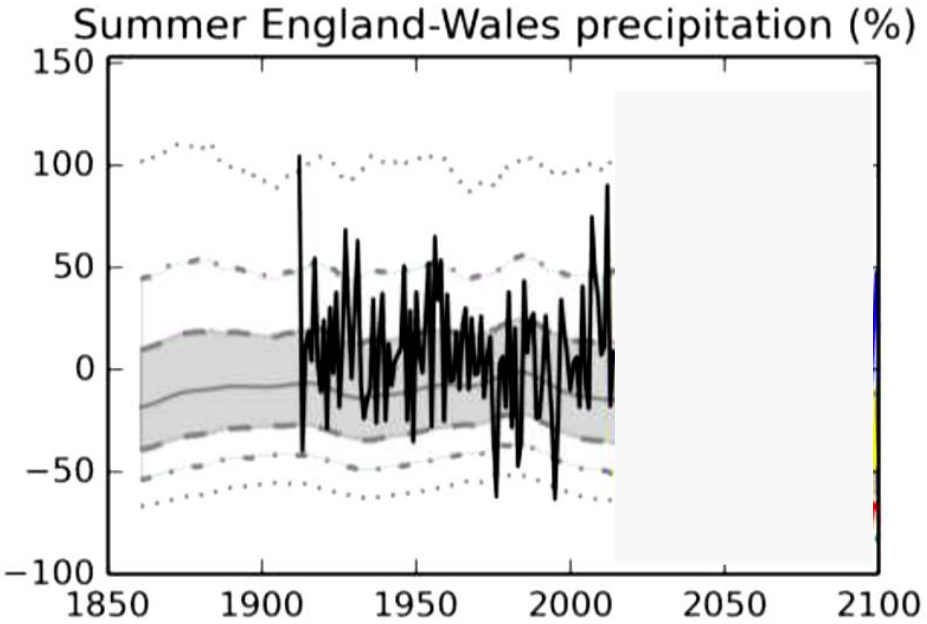
UK Climate Change Risk Assessment 2017

Top six areas of inter-related climate change risks for the United Kingdom. Source: UK Climate Change Risk Assessment 2017 Synthesis report, Committee on Climate Change.

Is our climate changing?





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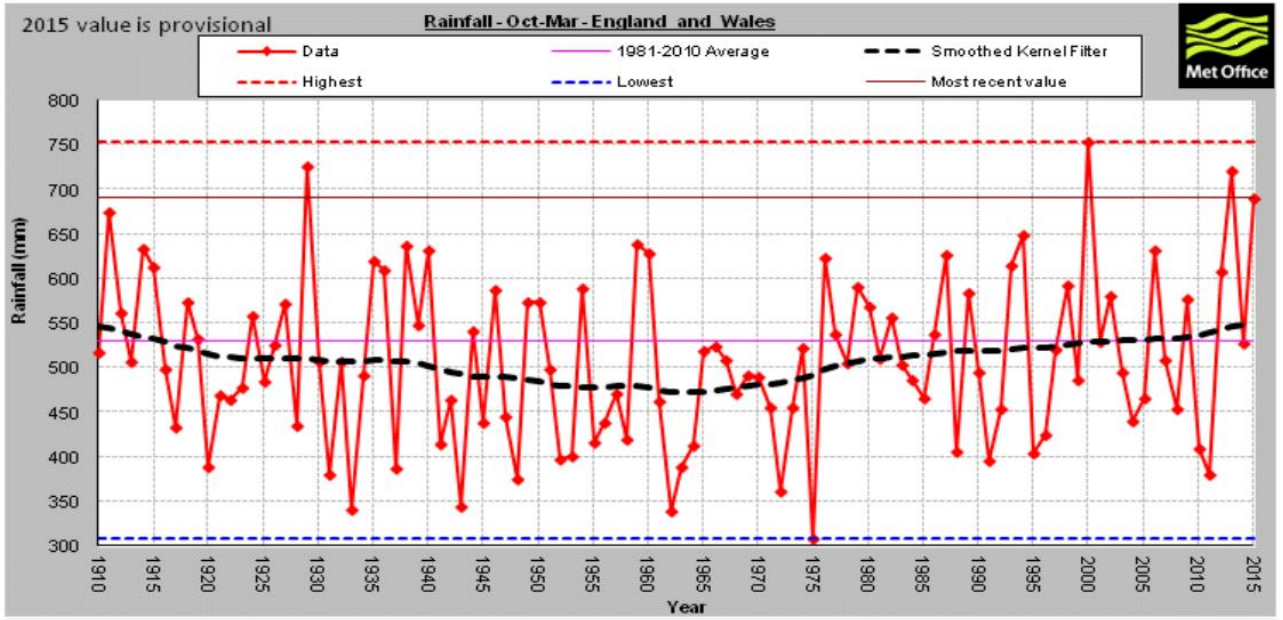

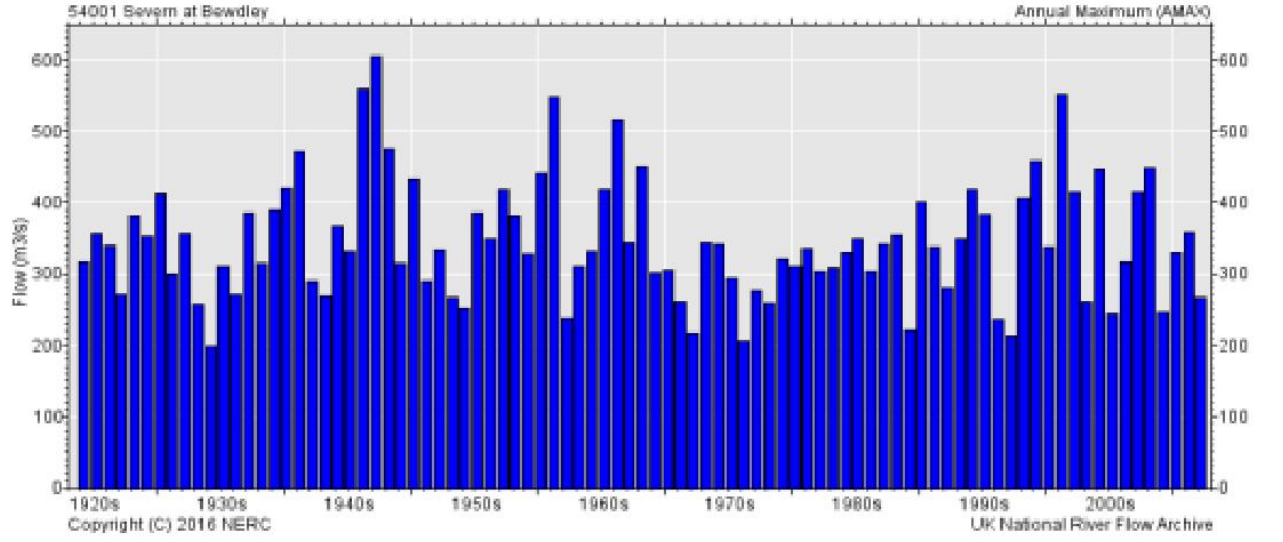

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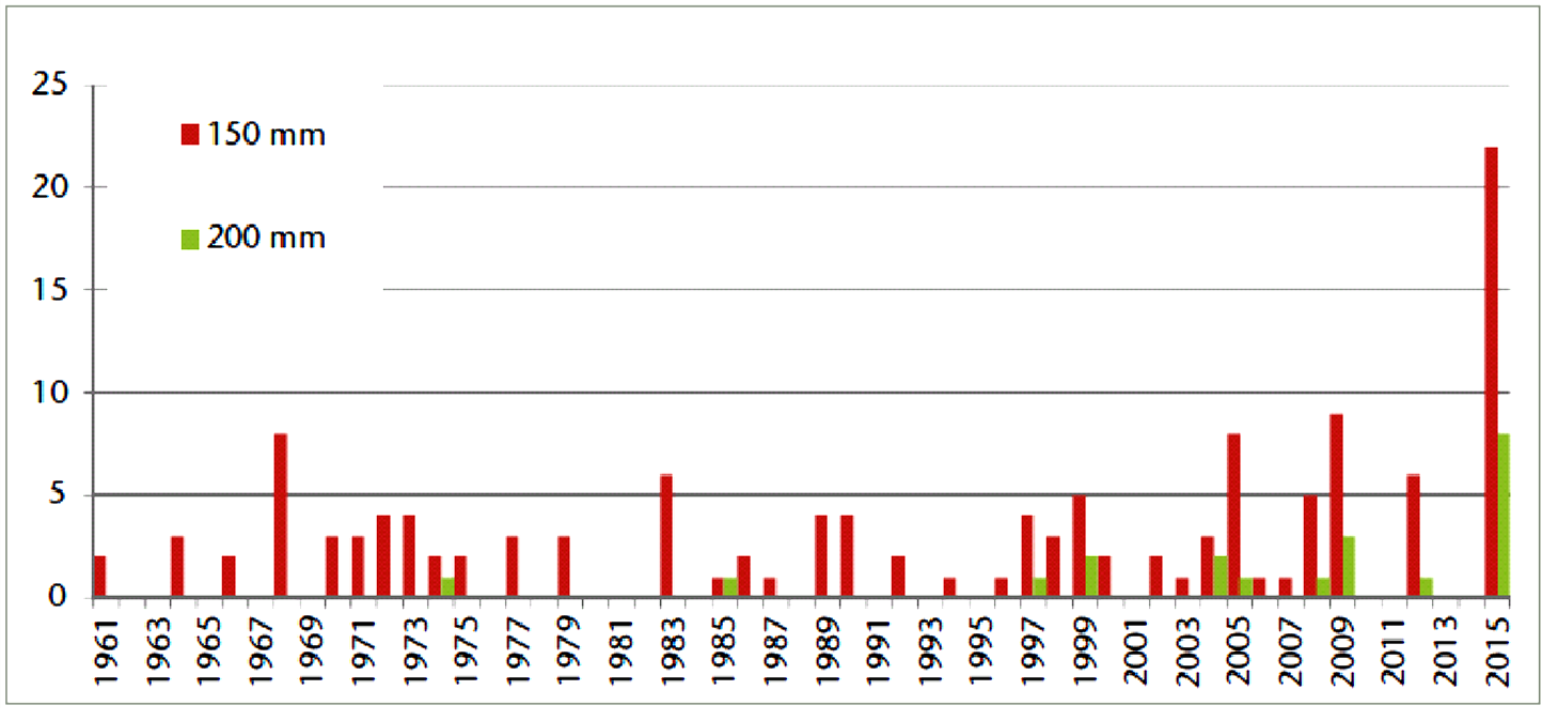

The number of UK daily rainfall station totals by year which have exceeded 150 mm (in red) and 200 mm (in green)

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Flooding

Cumbria floods: at least one killed as 45,000 homes remain without power

A man in his 70s reportedly died in Cumbrian village of Staveley as thousands of homes are flooded following record levels of rainfall

Flood water surrounds a damaged road sign as it covers a road at the northern end of Ullswater, near Pooley Bridge. Photograph: Paul Ellis/AFP/Getty Images

225 431

This article is 1 year old

Helen Pidd North of England editor, Josh Halliday Rowena Mason

Monday 7 December 2015 19.55 GMT

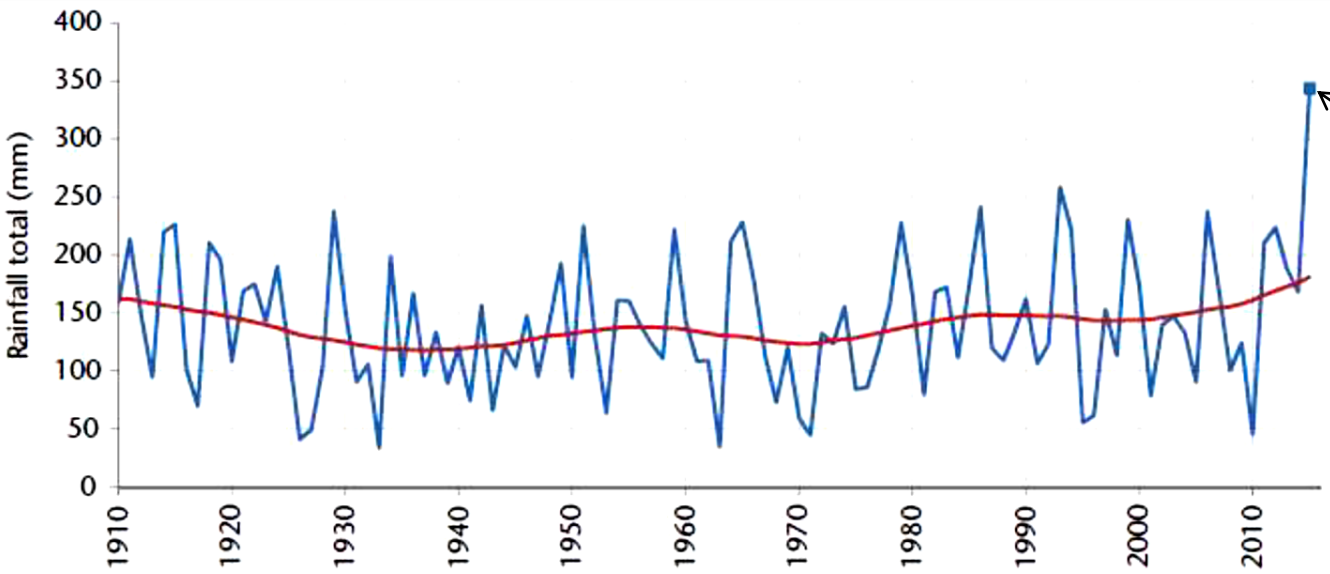
One person has been found dead and 45,000 properties are without electricity following the flooding that has hit north-west England.

Met Office

Storm Desmond
5-6 December 2015
Record 24-hr rainfall
341.4 mm*
at Honister Pass

* Previous record
316.4 mm at
Seathwaite,
Cumbria, 2009

Is our climate changing?



December rainfall totals from 1910 to 2015 for the climate district of North-West England and North Wales.

The December 2015 rainfall total was 343mm, **237%** of the 1981-2010 long-term average and exceeded the next wettest December by a margin of 85mm.

Just how bad could it be?

After the flooding events during December 2015 the National Flood Resilience Review was set up.

It aimed to assess how the country can be better protected from future flooding and extreme weather events.

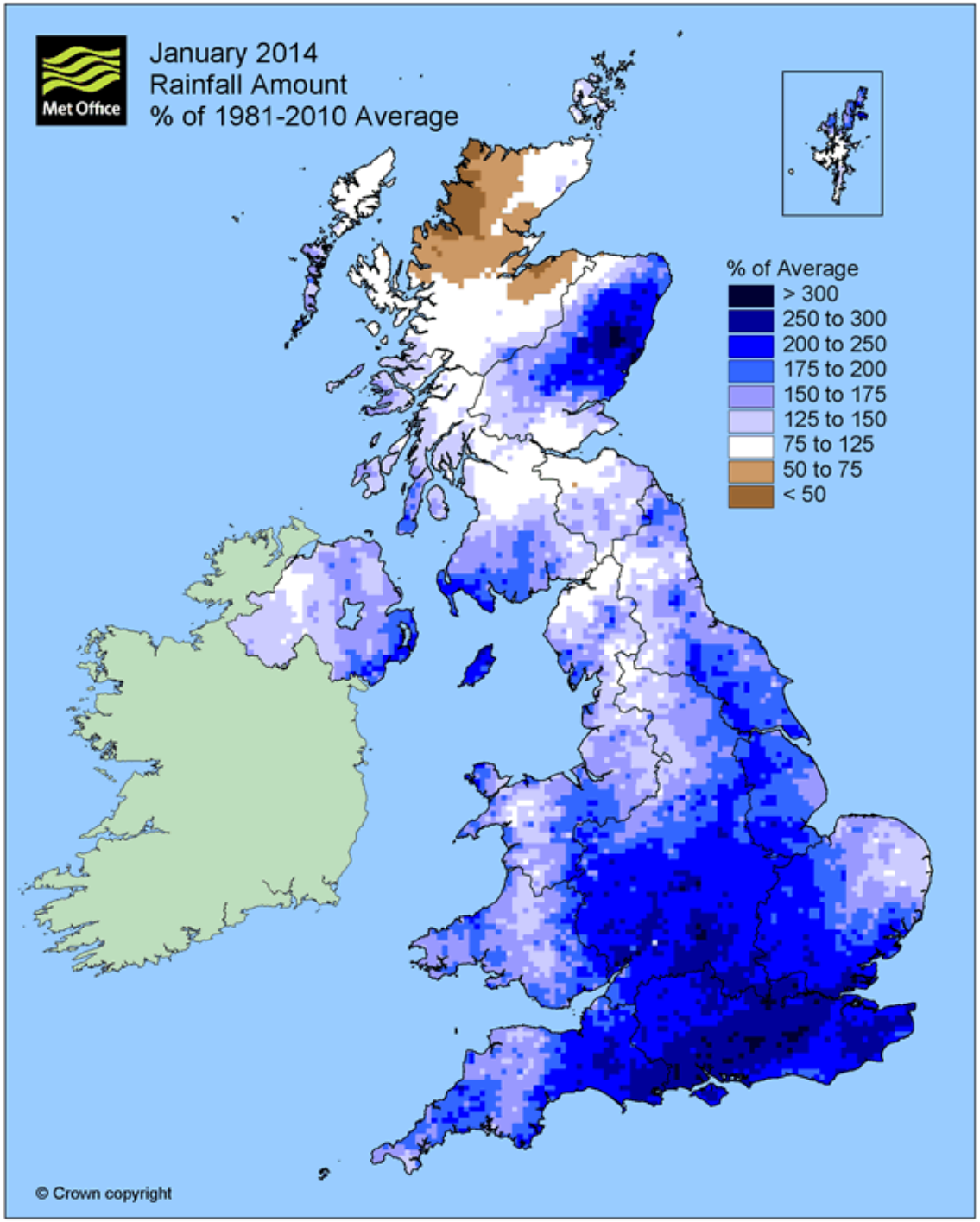
The team included the Cabinet Office, Defra, the Environment Agency, the Met Office, and the government's Chief Scientist.

We were asked to provide a **worst case scenario**.

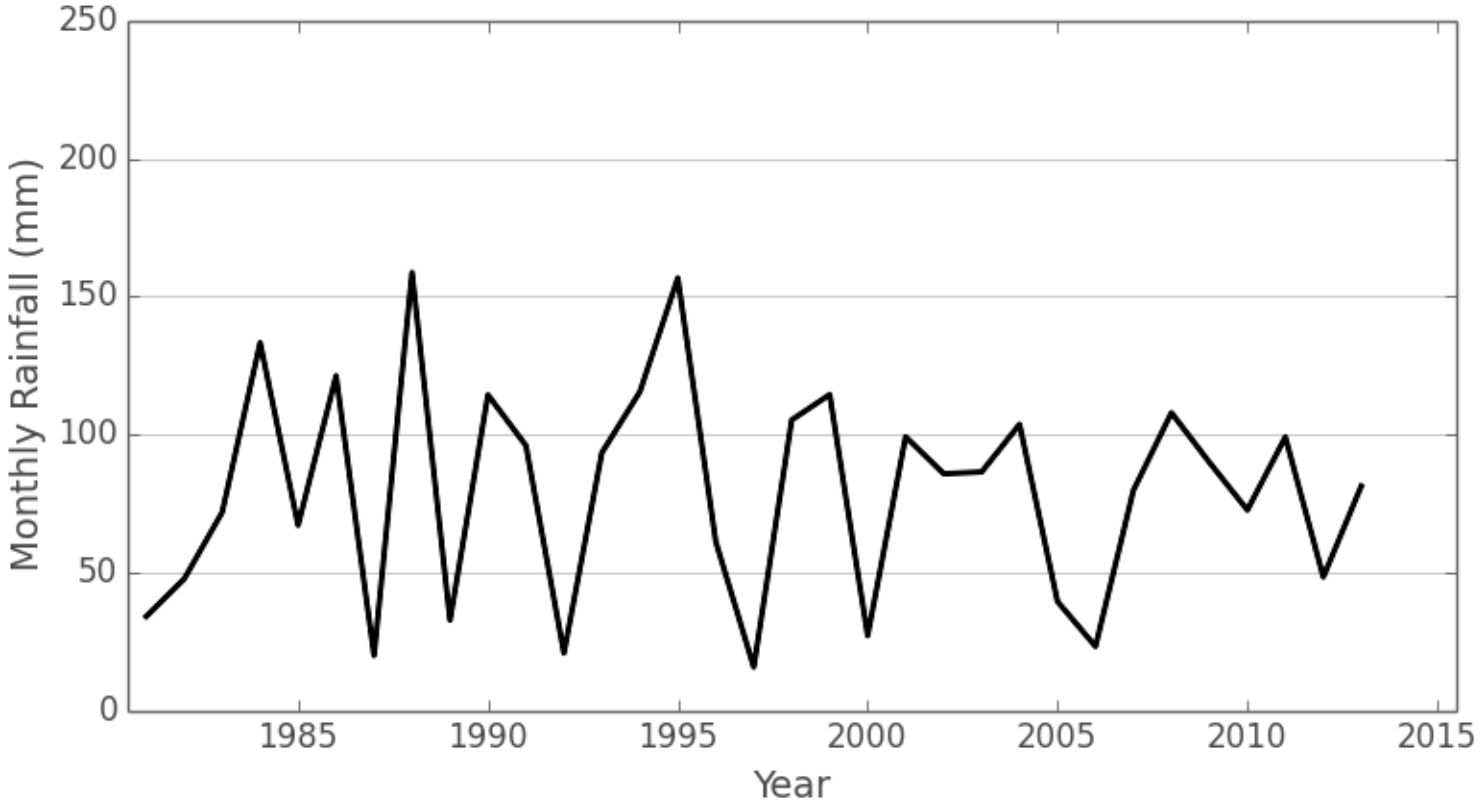
Met Office

January 2014

South east England experienced its wettest month since at least 1880, when records began



South east England
January Rainfall Record



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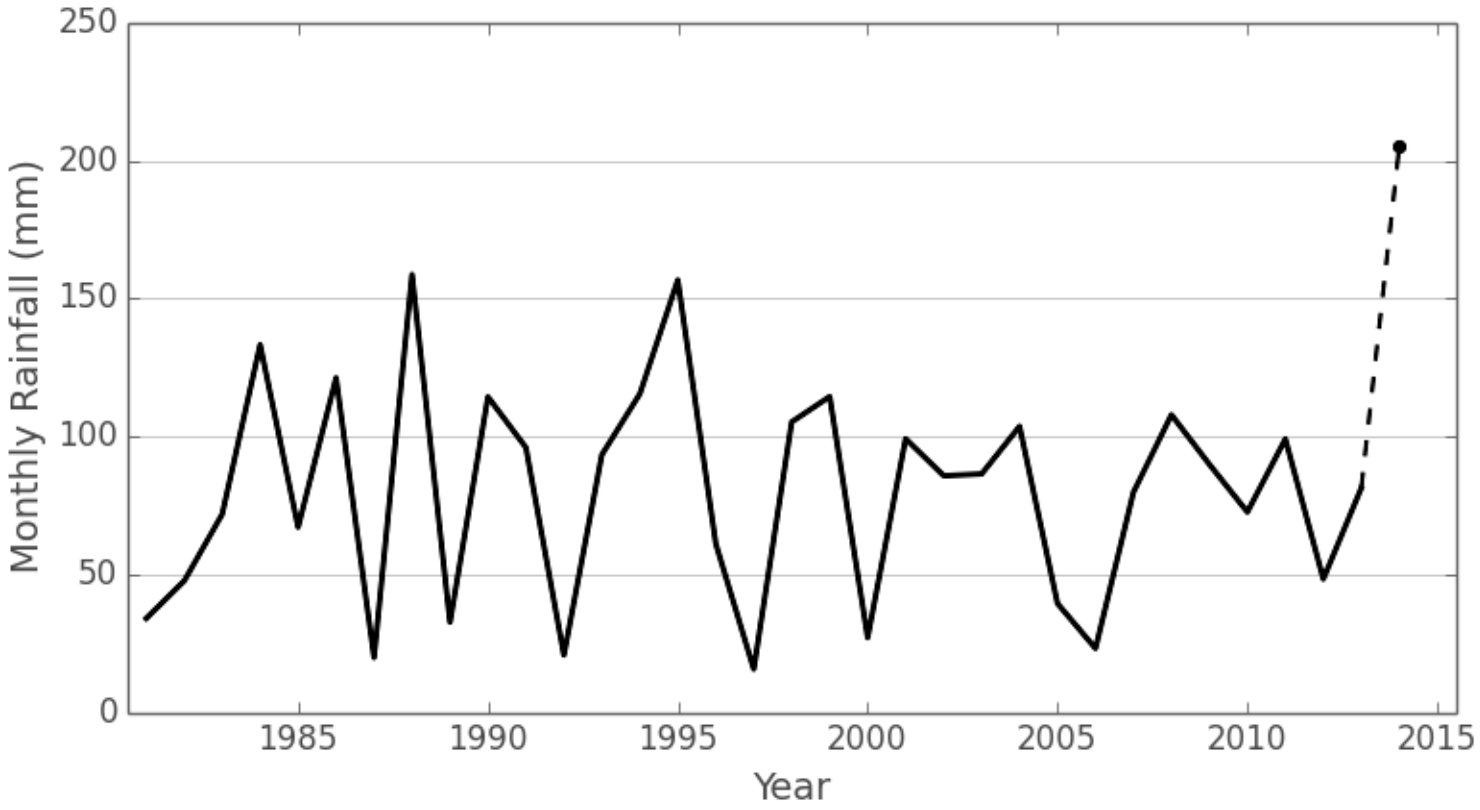
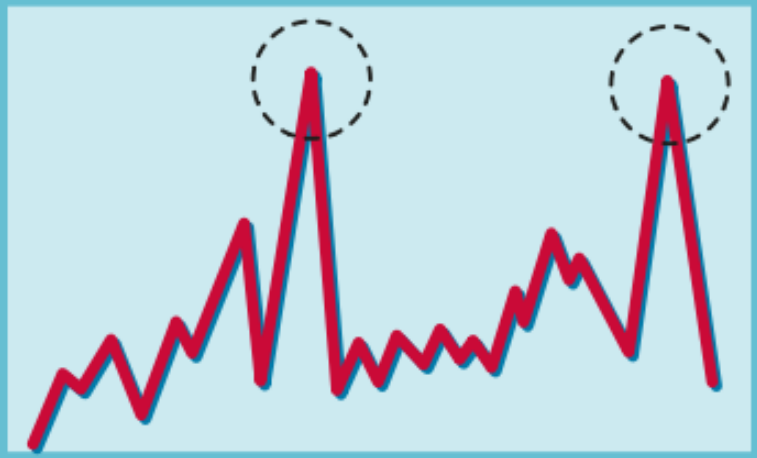


Met Office

THE PROBLEM

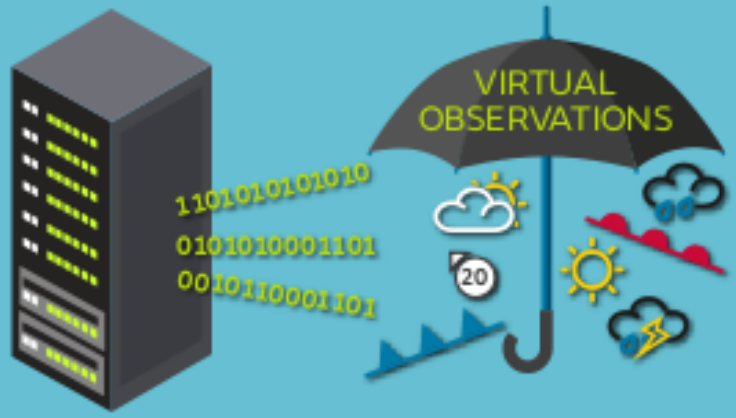


Extreme rainfall events are rare, so we have relatively few observations of them.

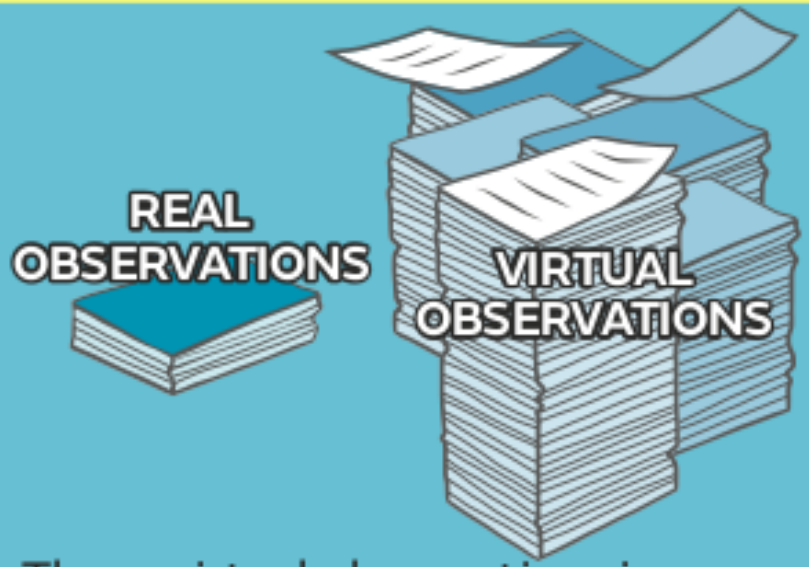
Our climate has also changed, so older observations may no longer be so relevant.

Met Office

THE SOLUTION

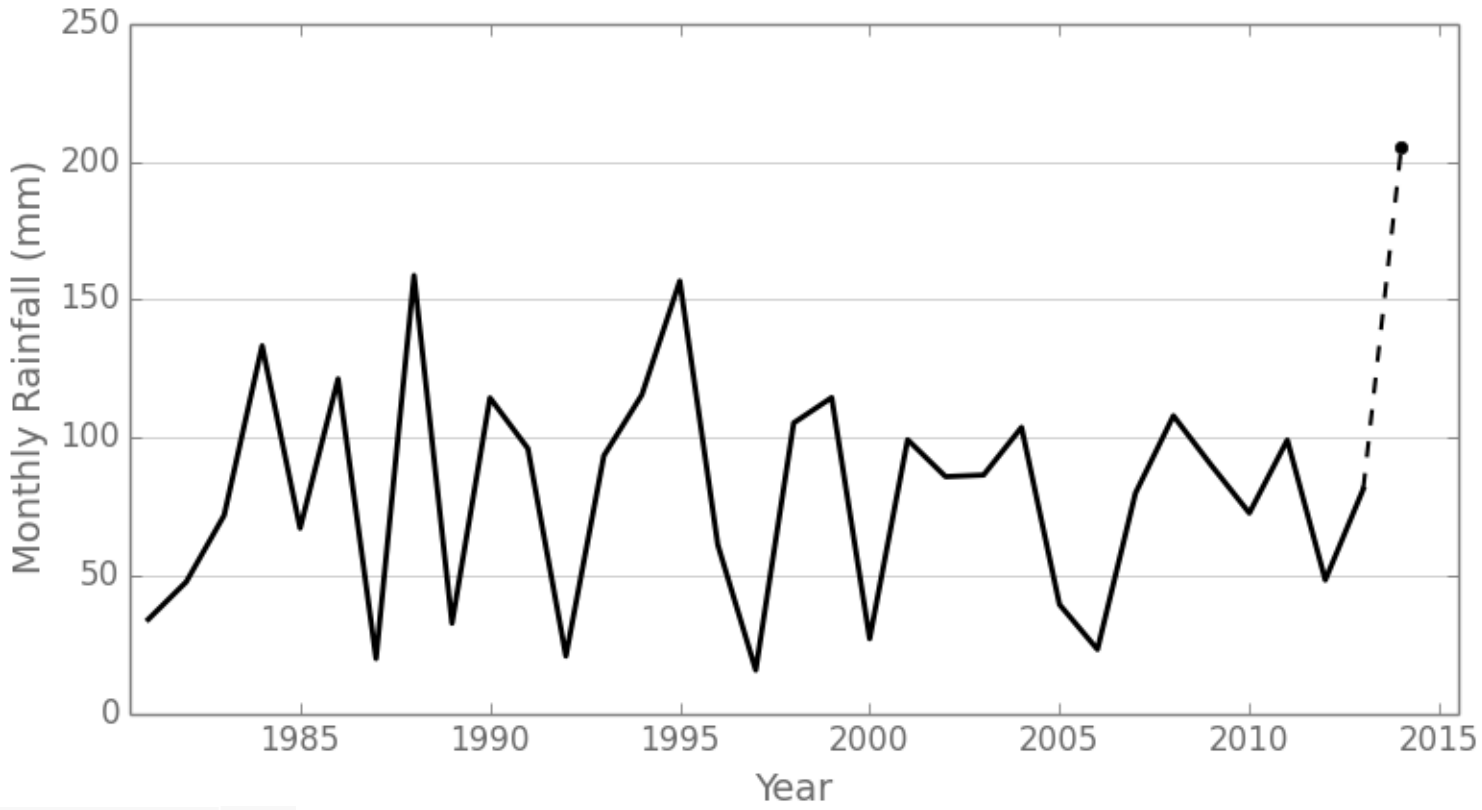


Our new supercomputer simulates the atmosphere, generating many possible versions of the weather.



These virtual observations increase available relevant data from 35 to 3,500 years of winters.

South east England
January Rainfall Record



Observations
Simulation

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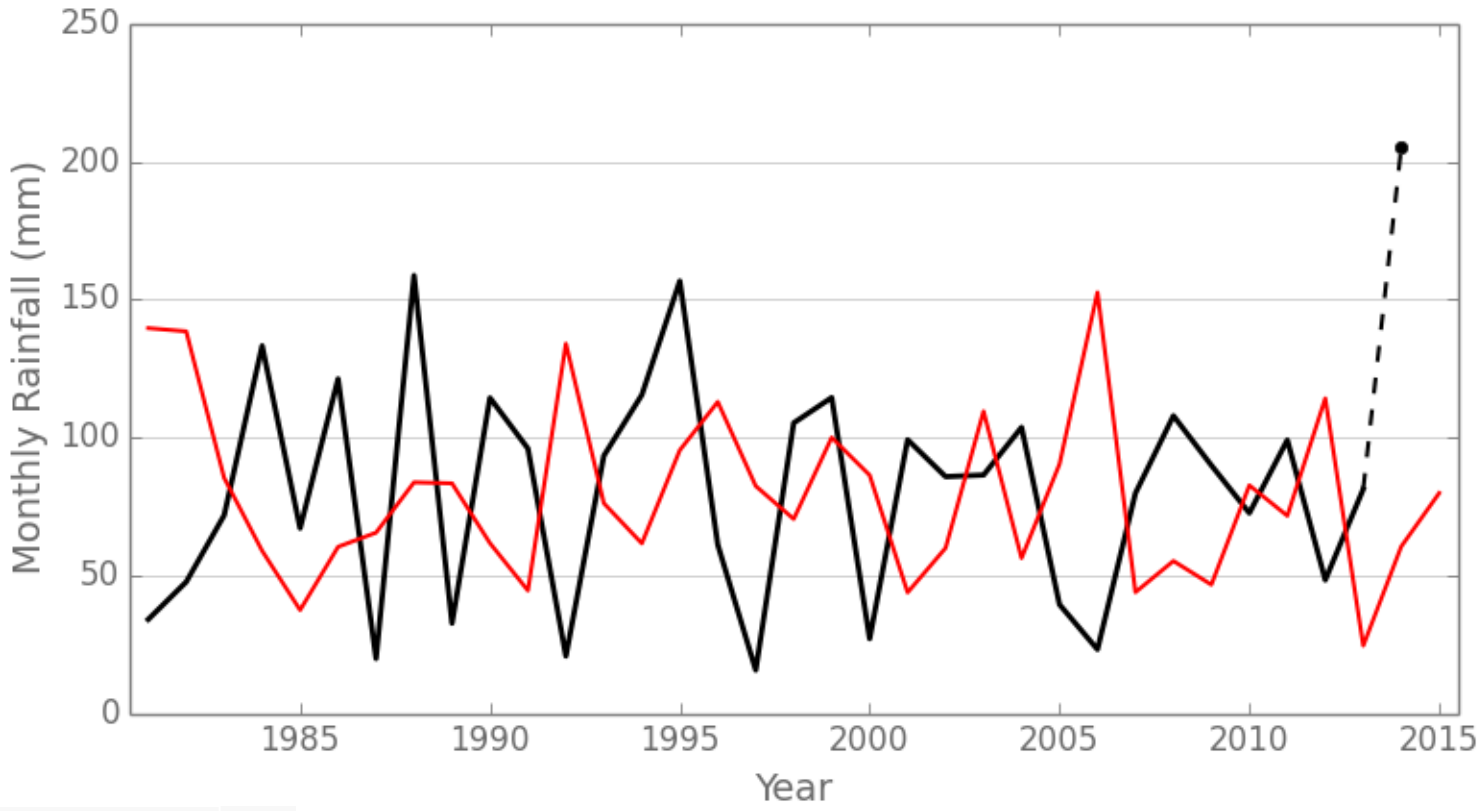
January Rainfall Record



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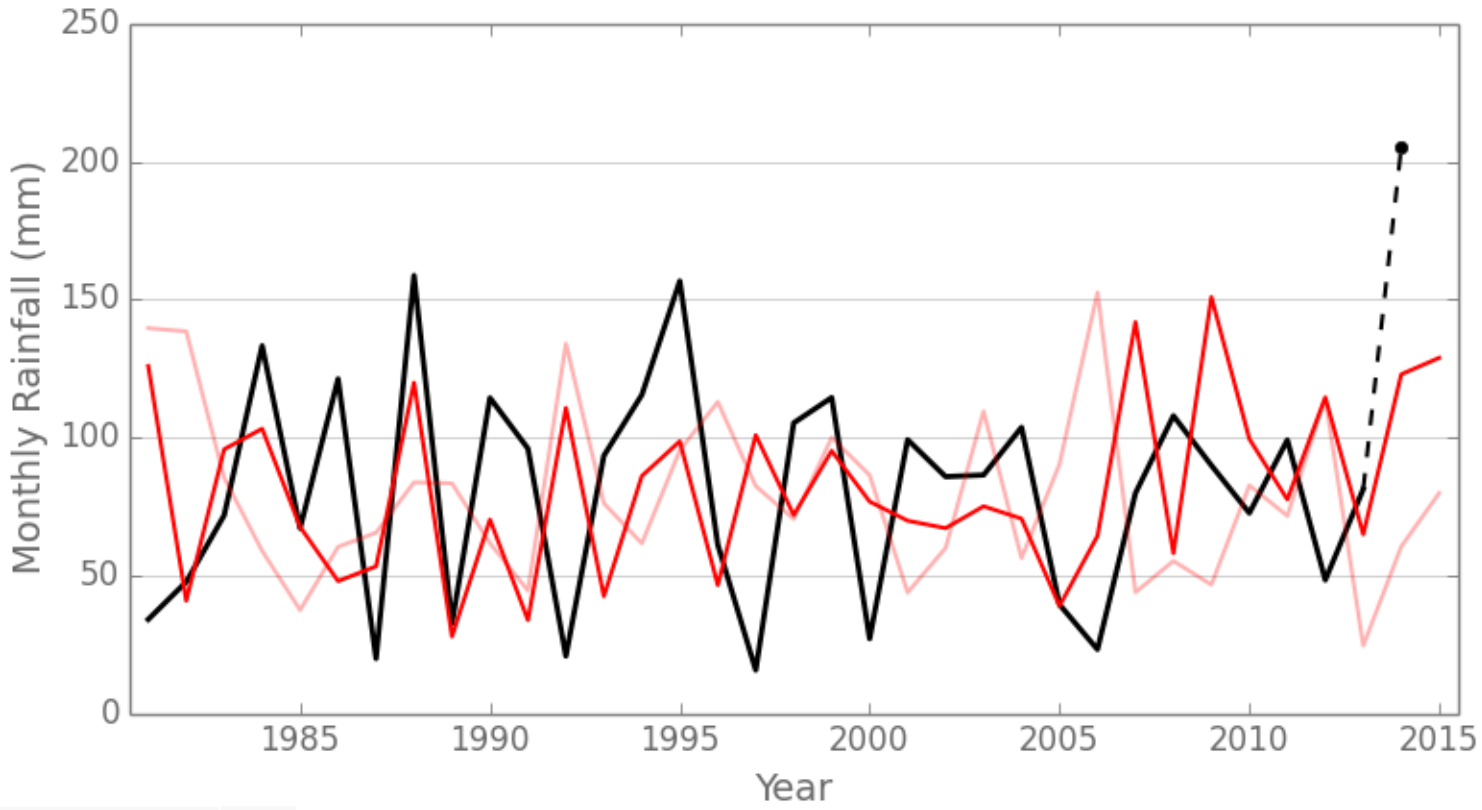

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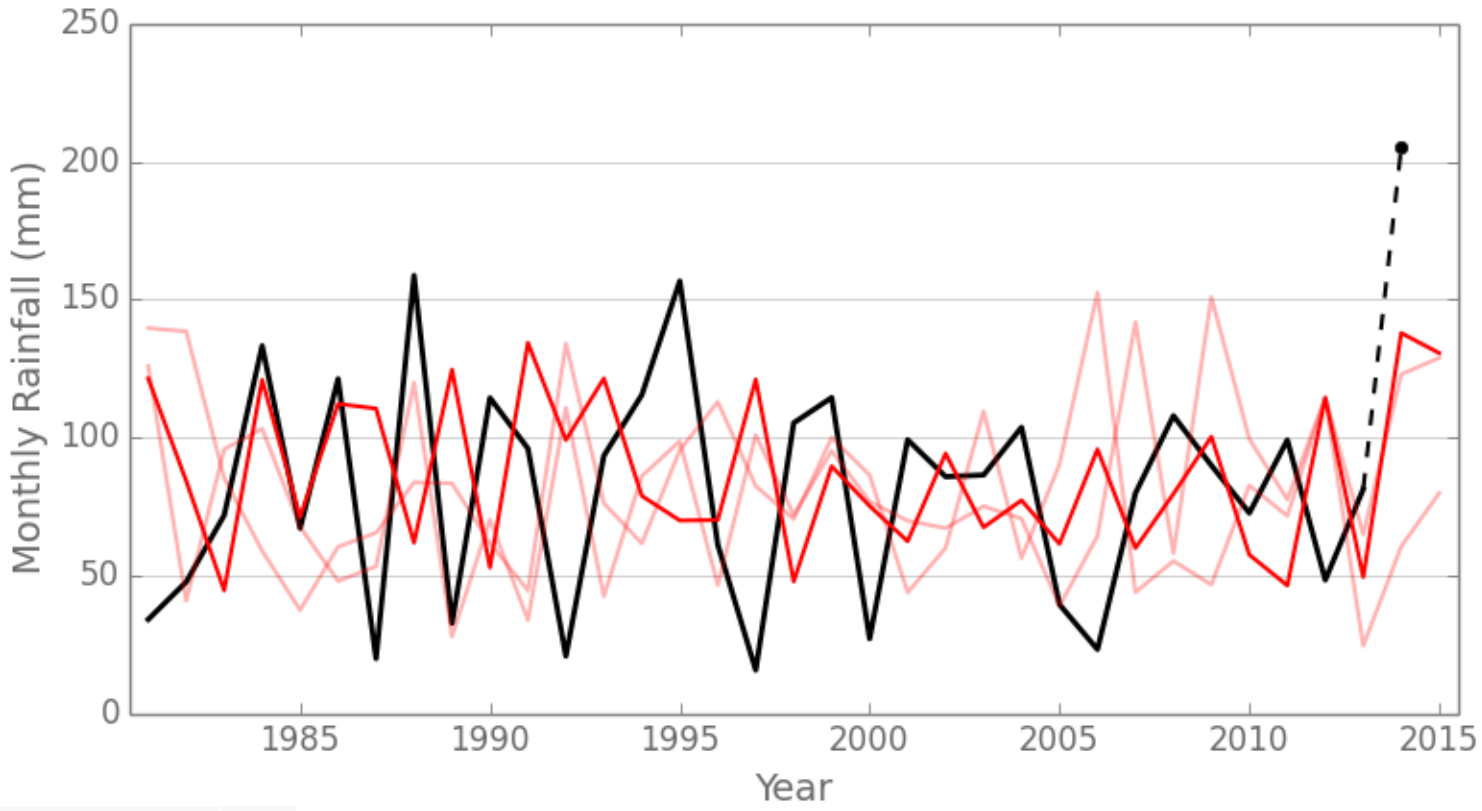

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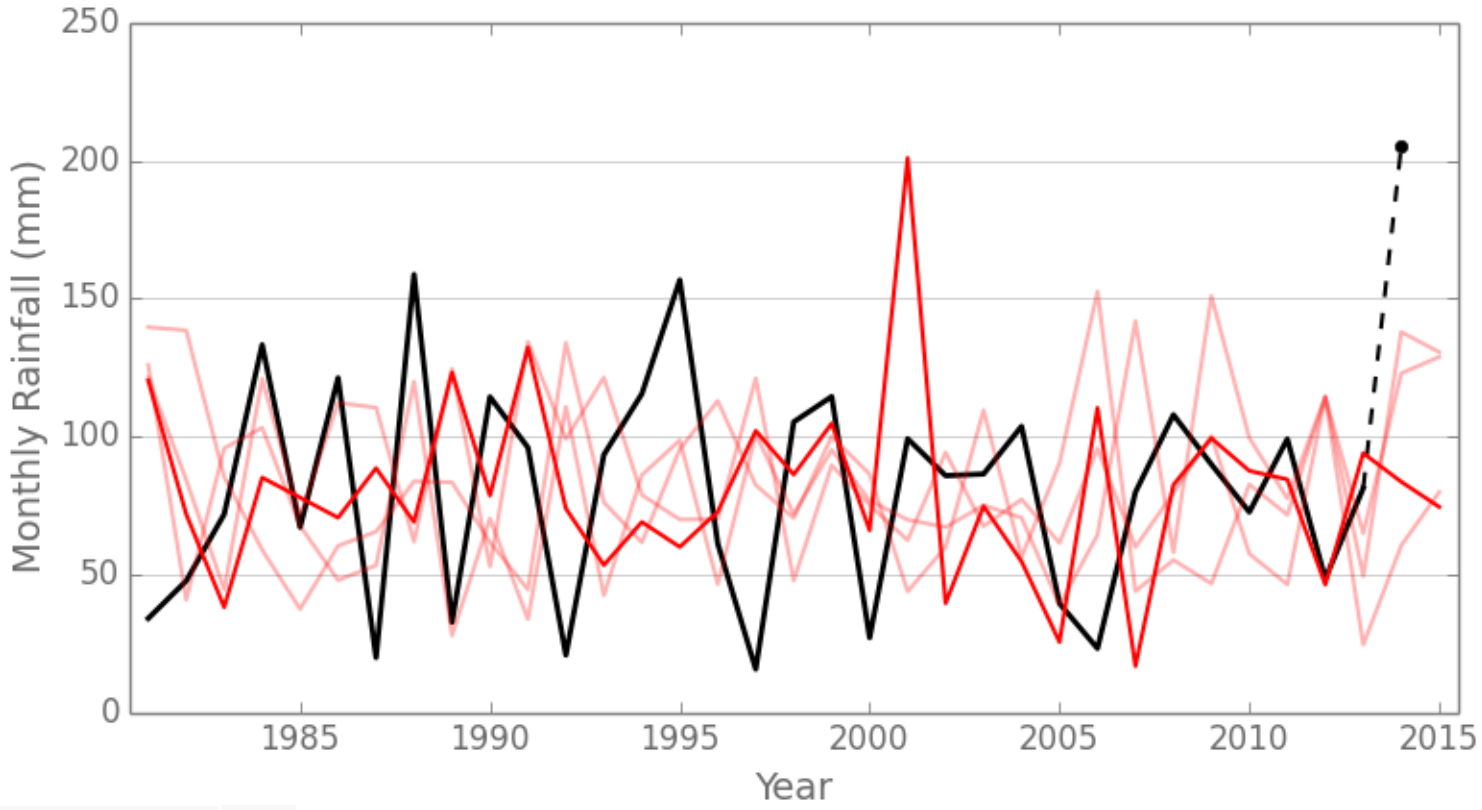

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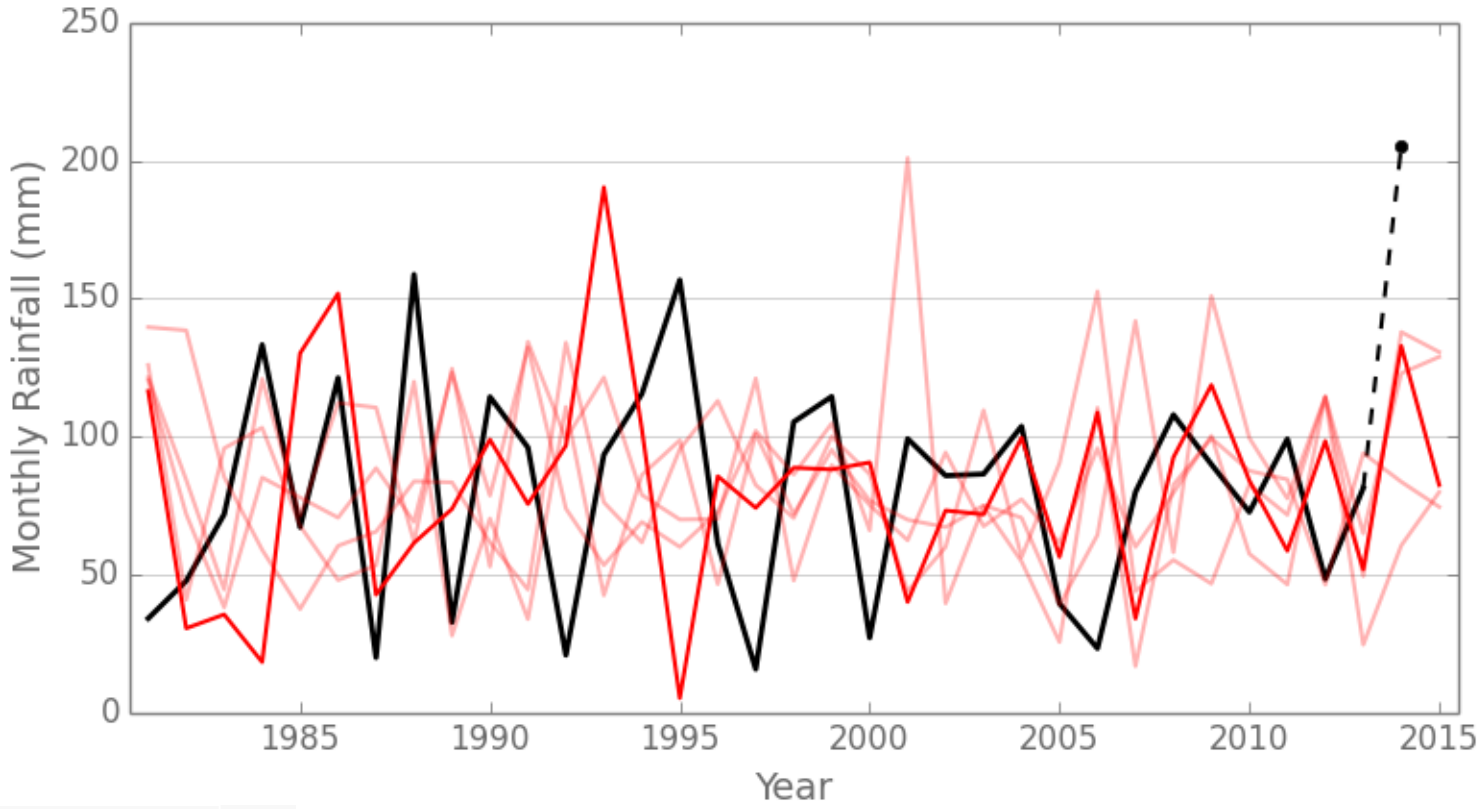

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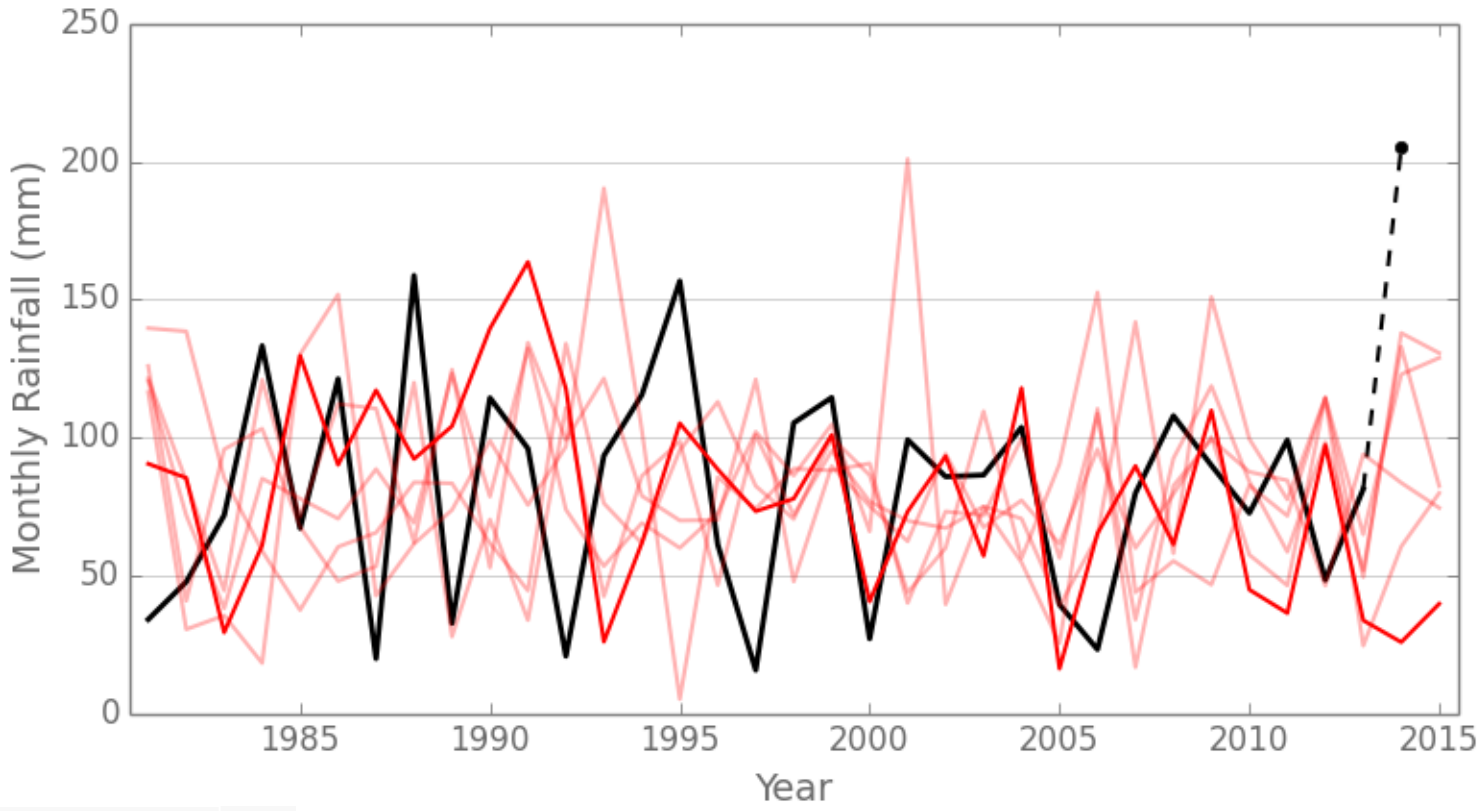

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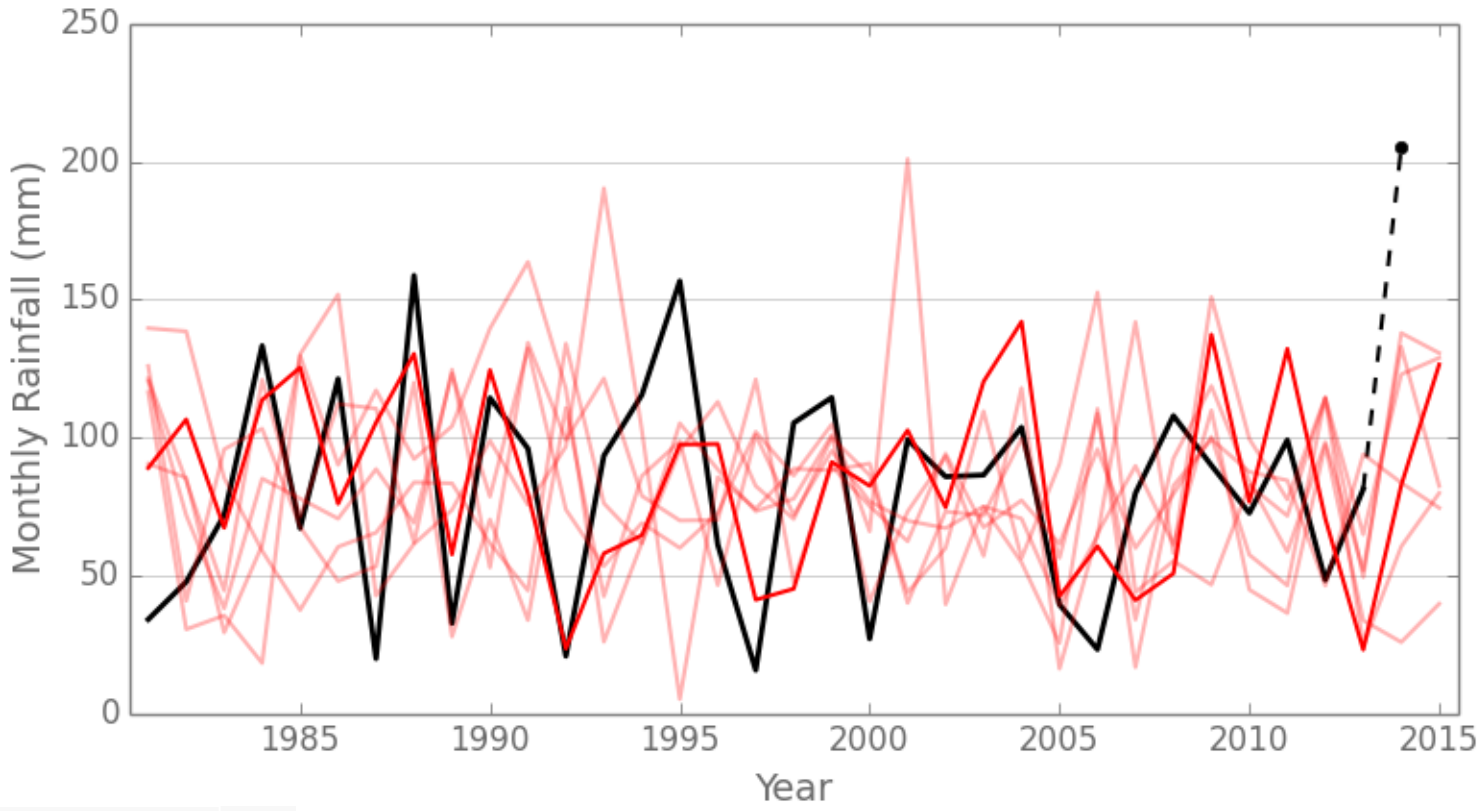

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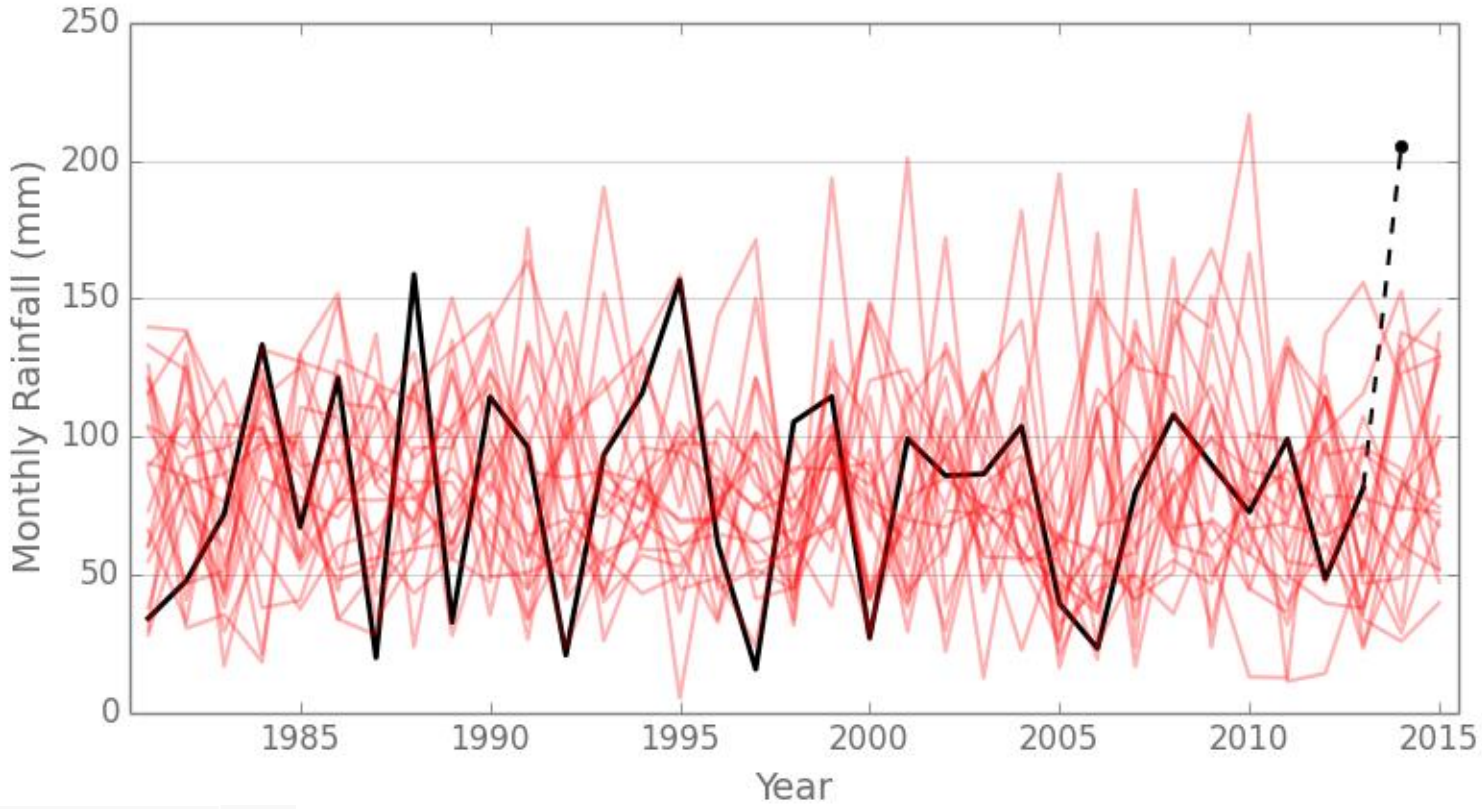

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Simulation

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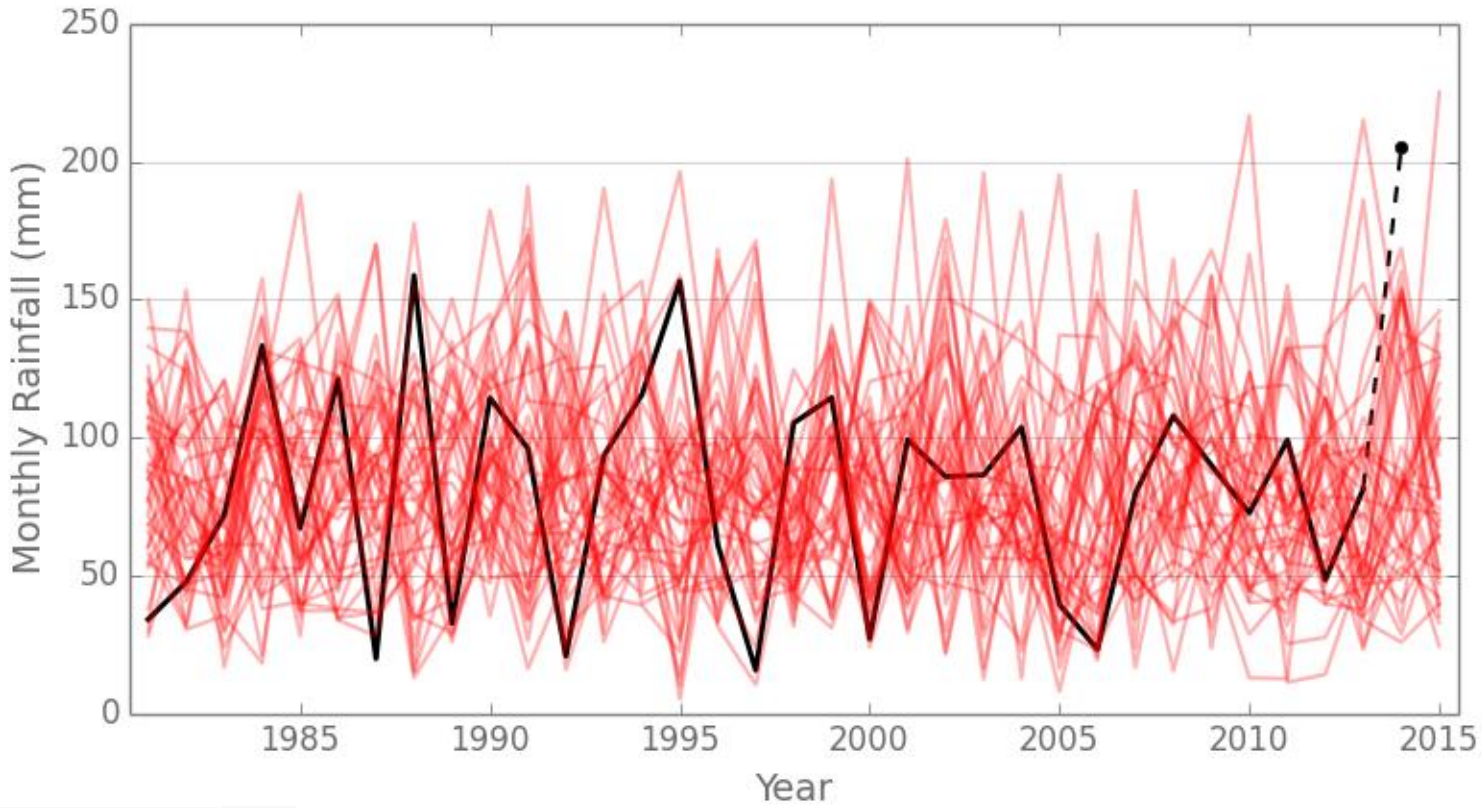


Observations
Simulation

THE OUTCOME

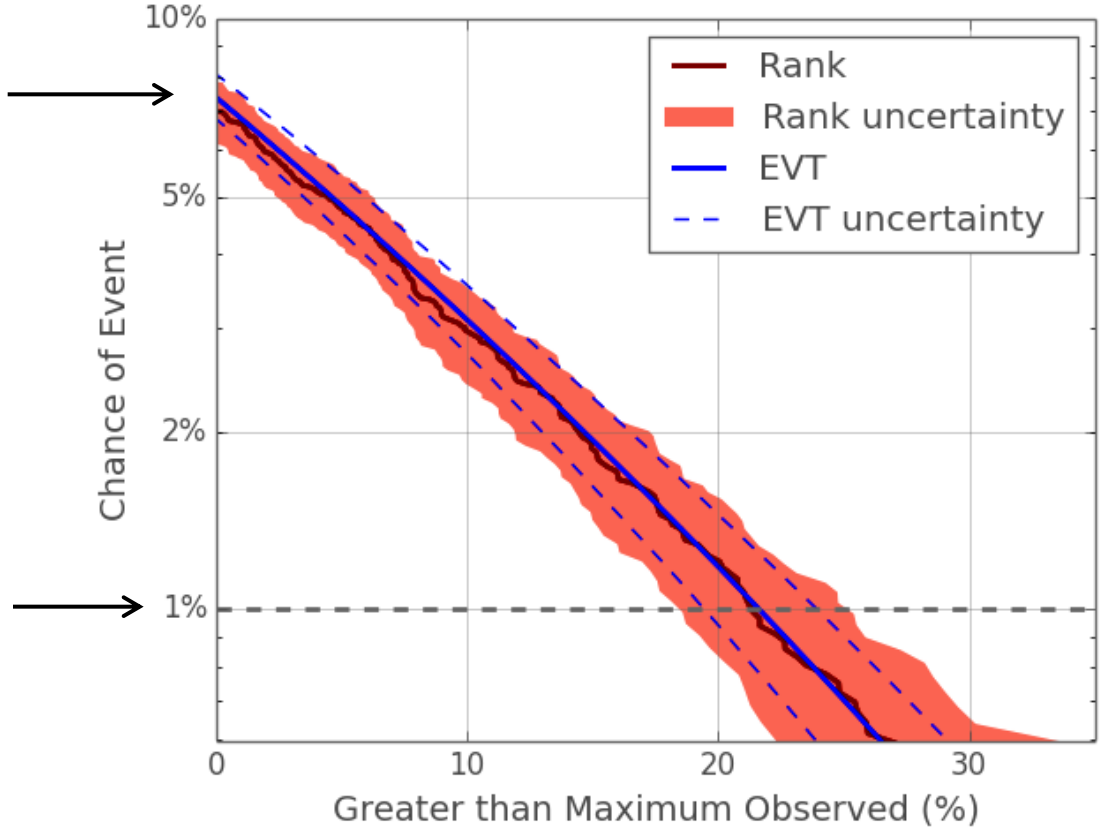
We analyse these to understand more about possible rainfall extremes.

This is used to estimate the risk of record-breaking rainfall in the real world.

And the same approach can be applied to other types of weather risk

Risk of an extreme

- 7-8% chance of a new rainfall record in south east England each winter
- 1% chance of a month with 15-30% more rainfall than the current record



Summary

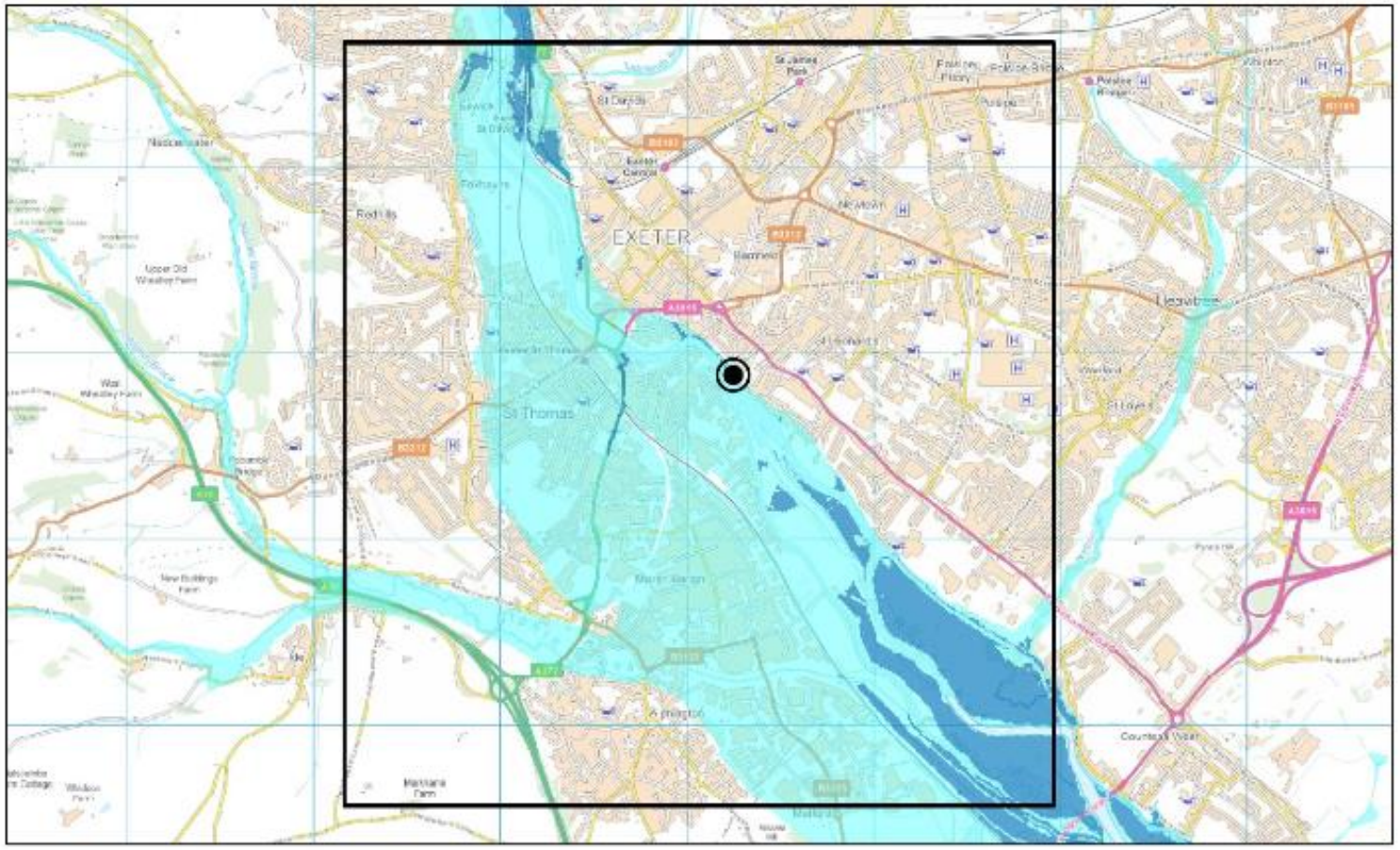
- The climate is changing
  - Very likely due to human action
  - In UK regions natural variability dominates
- Risks are increasing
  - Flooding and coastal inundation, high temperatures
  - Water supply, ecosystems, food production, trade
  - Human, animal and plant pests and diseases
- Quantifying weather-related risks
  - 1 in 3 chance of record monthly rainfall each winter somewhere in England and Wales
  - In SE England 7-8% risk of rainfall greater than the current records in at least one month of a given winter

Met Office

Questions?

Exeter, October 1960

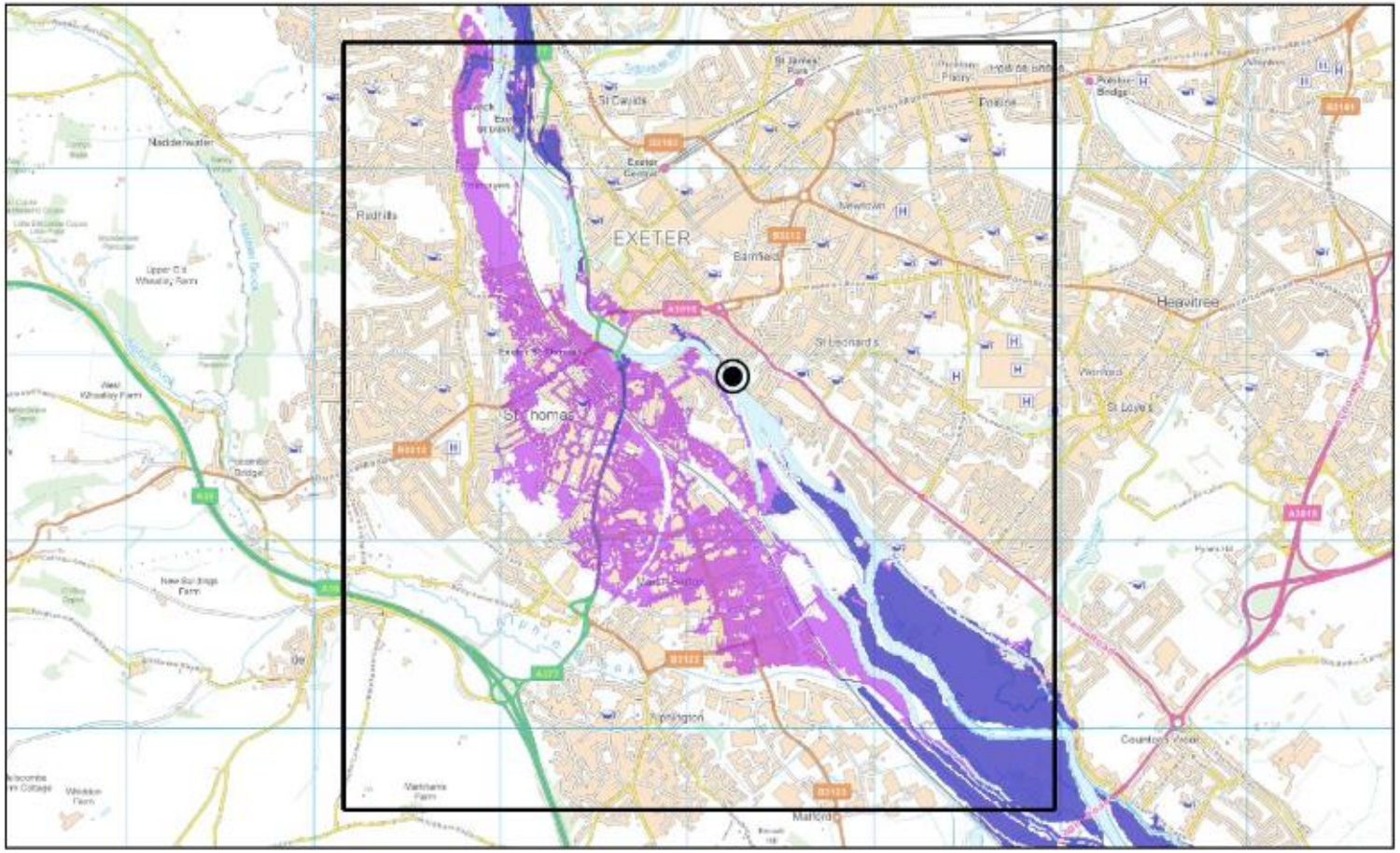
Exeter, October 1960



1960 flood extent

1960 flood extent with today's flood defences

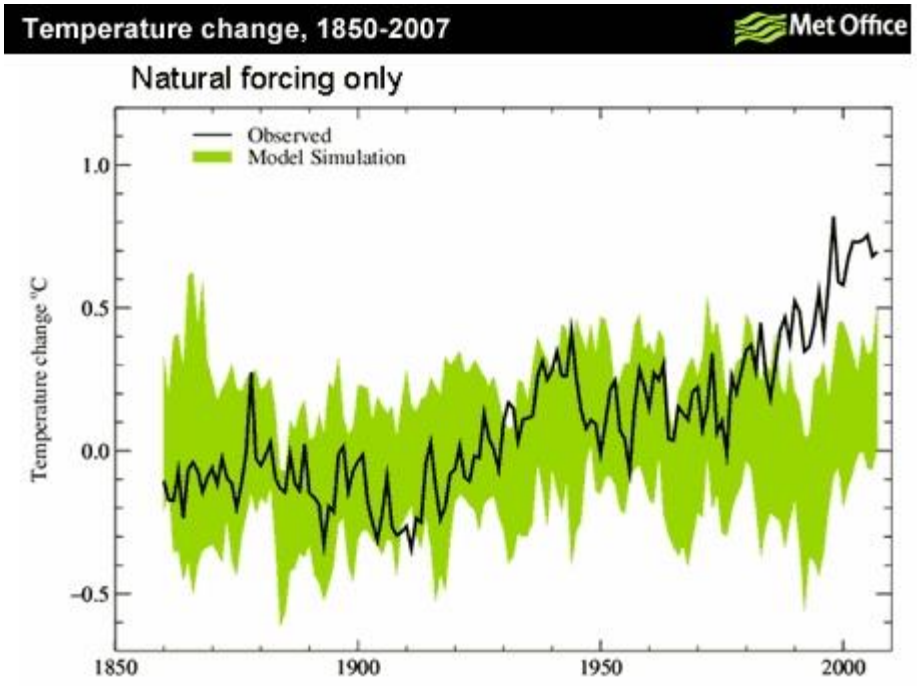
Exeter, October 1960

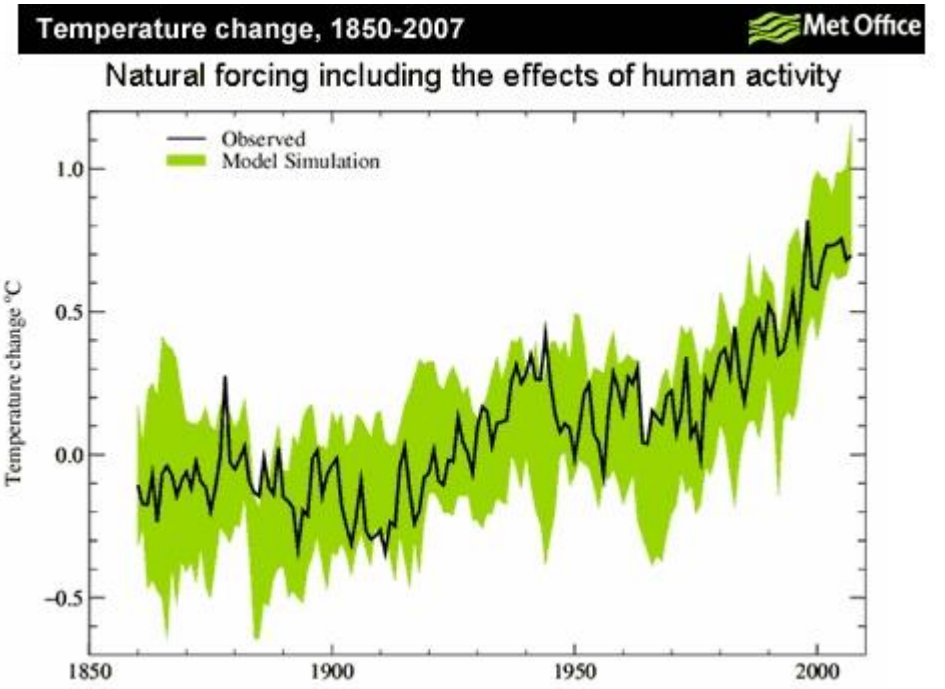


1960 flood extent with today's flood defences

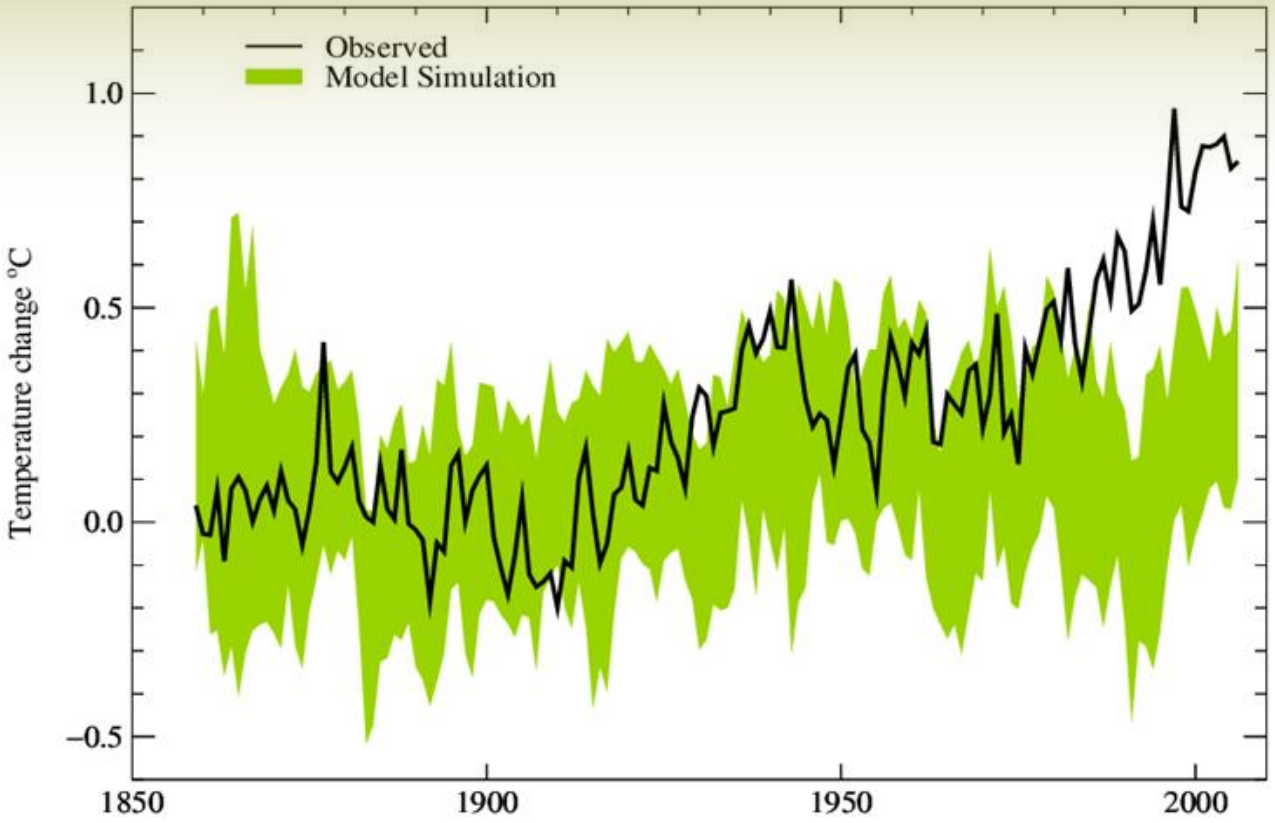
30% more rainfall

What is causing climate change ?

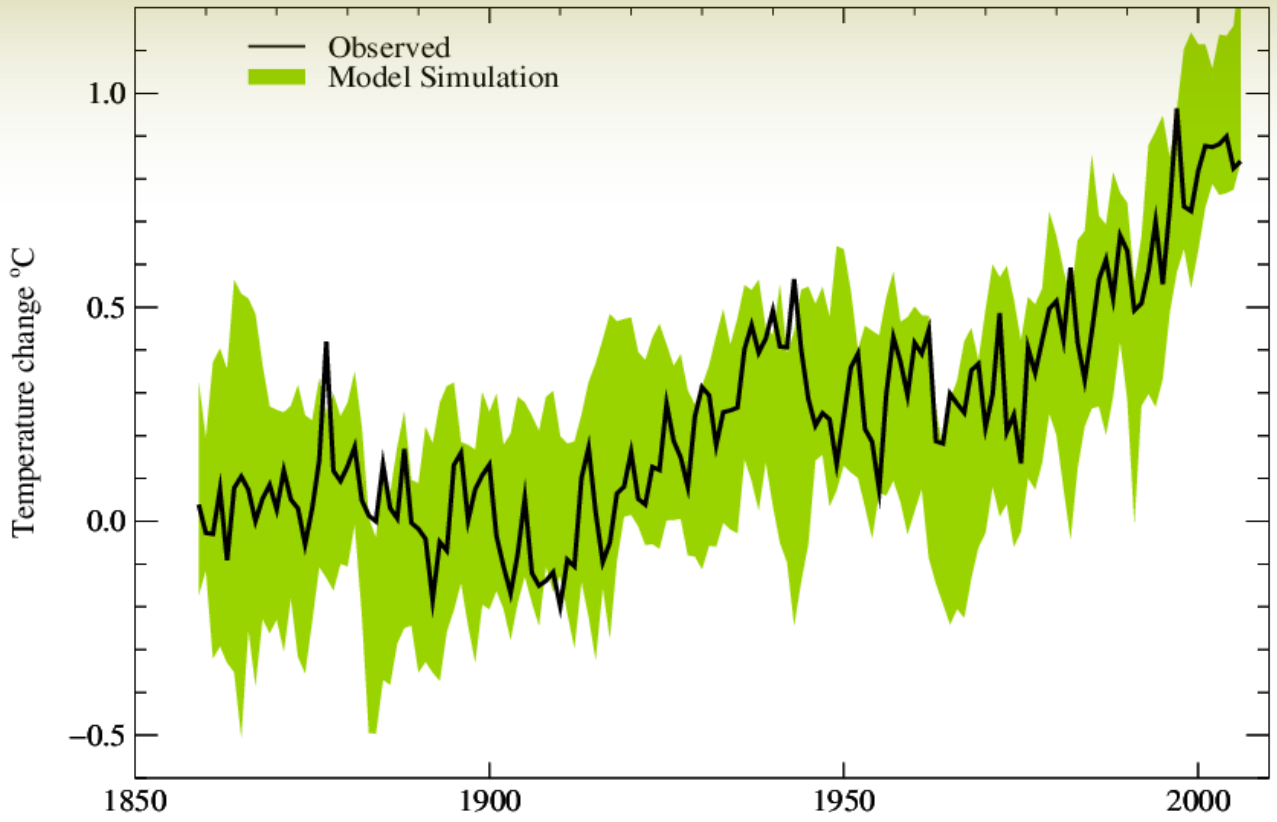


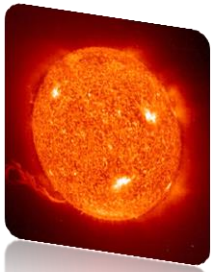


Natural influence alone

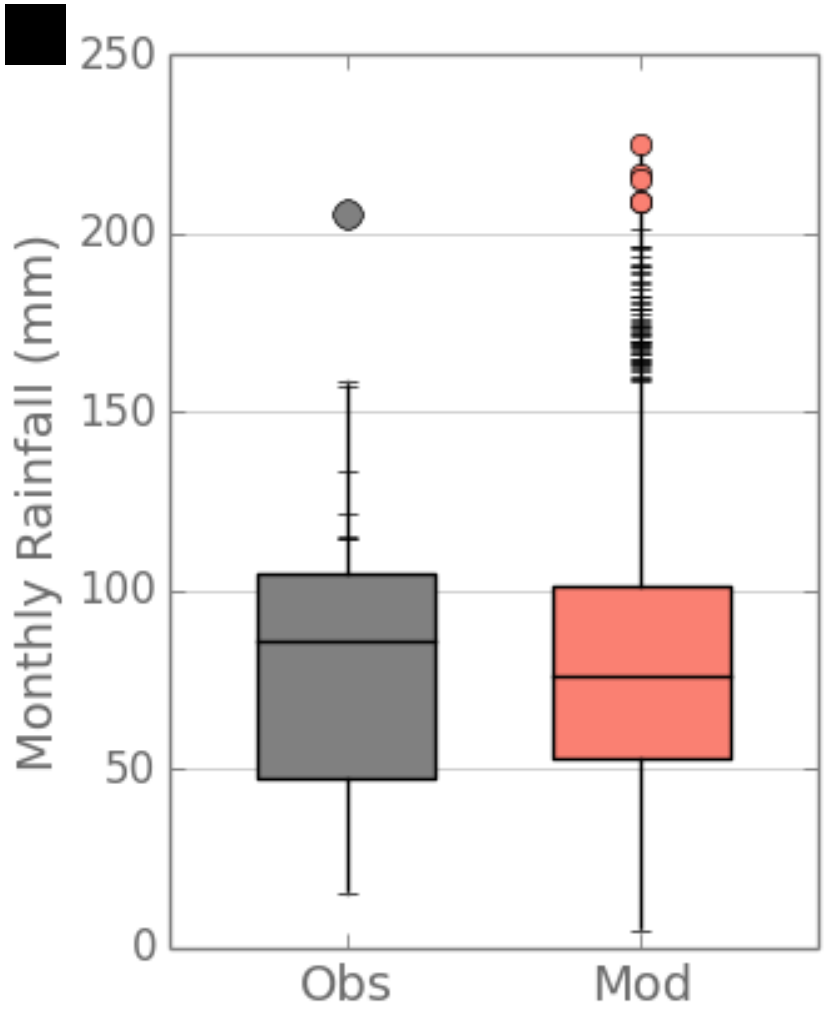


Human and natural influence combined

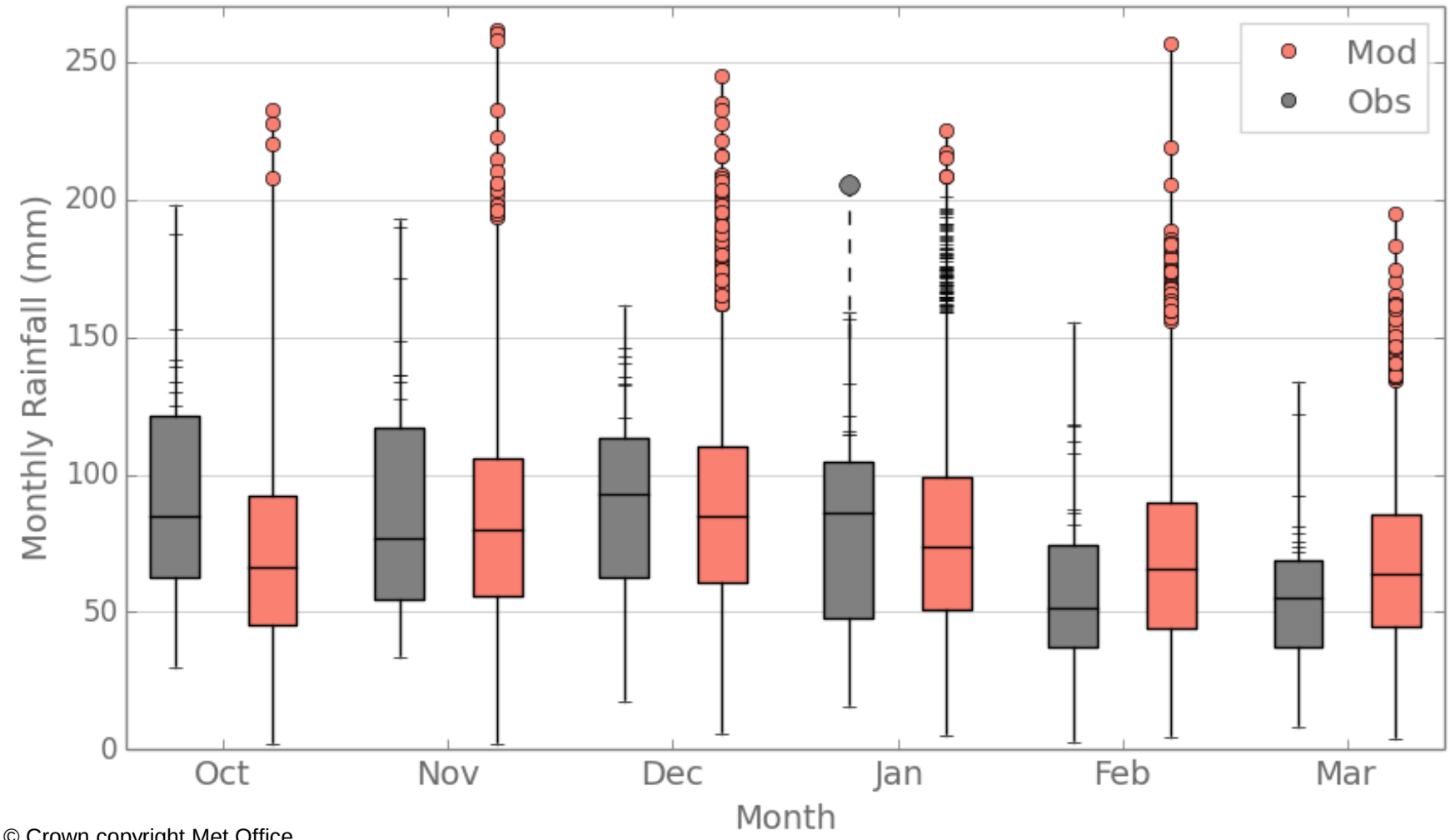




January rainfall



October to March rainfall



In a given winter, there is an **7%** risk of a month wetter than has been previously observed in south east England