

The future of the UK's water supply

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Bristol Geographical Association

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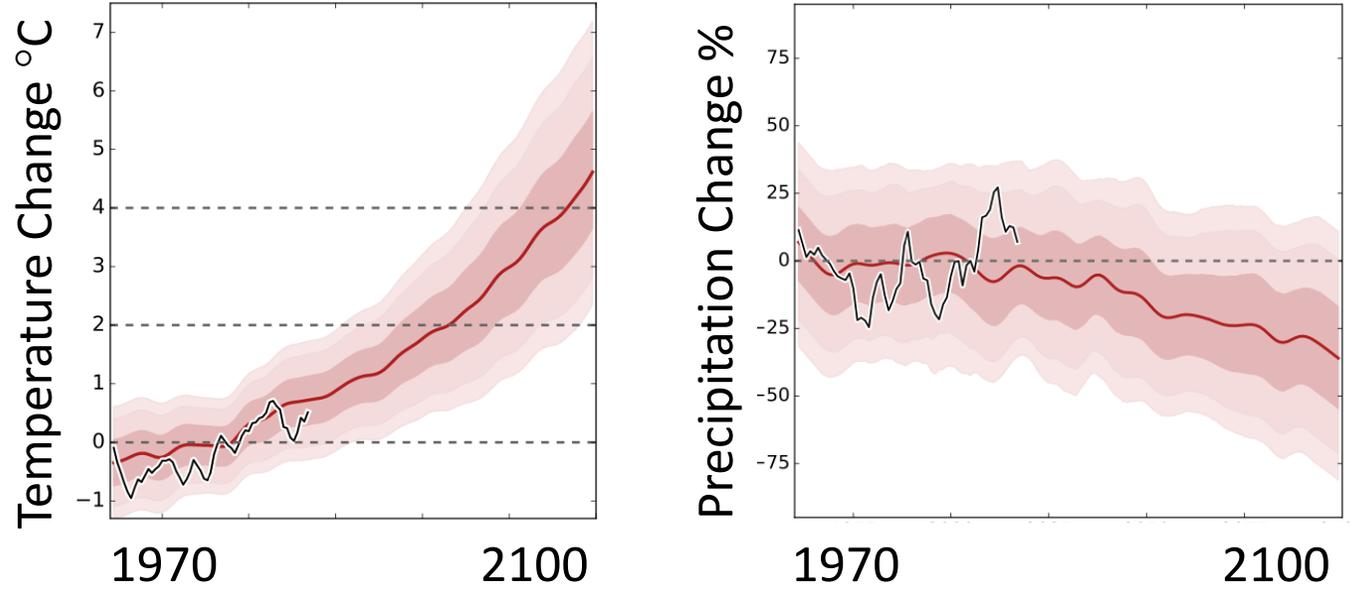


Frequent UK droughts and water shortages are projected by 2050...



© Sentinel 3, ESA

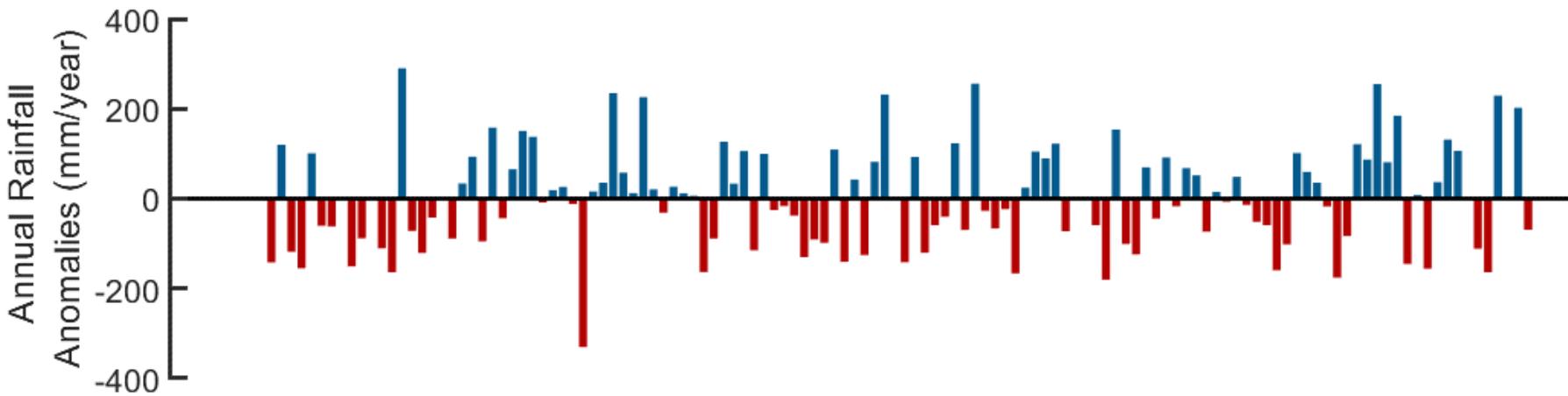
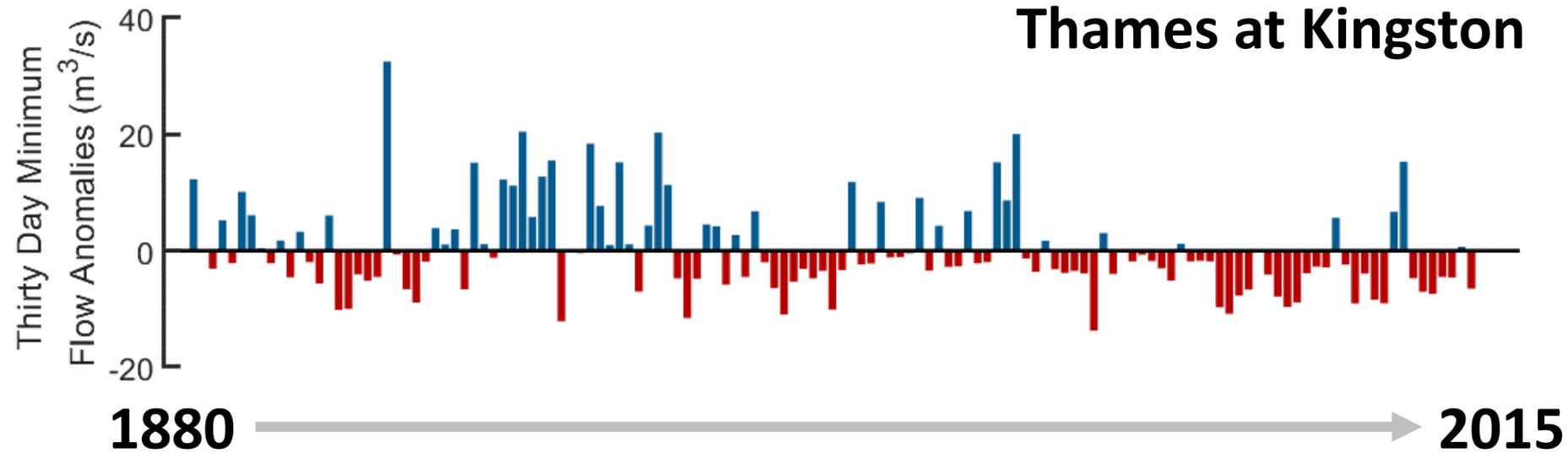
UK Climate Projections 2018



↓ Water Supply

Lowe et al (2018)

...not only due to climate change...



Decreasing trend in low flows -> Seven-fold increase in abstractions



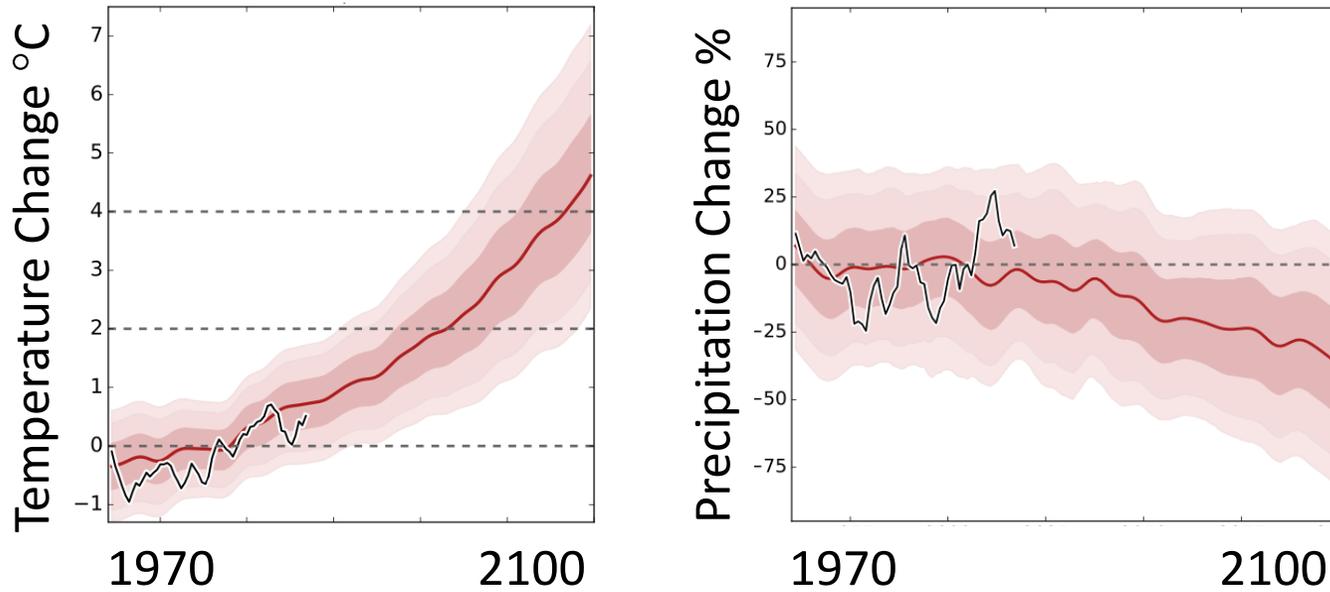
3.8 million m^3/day



~11.5 billion

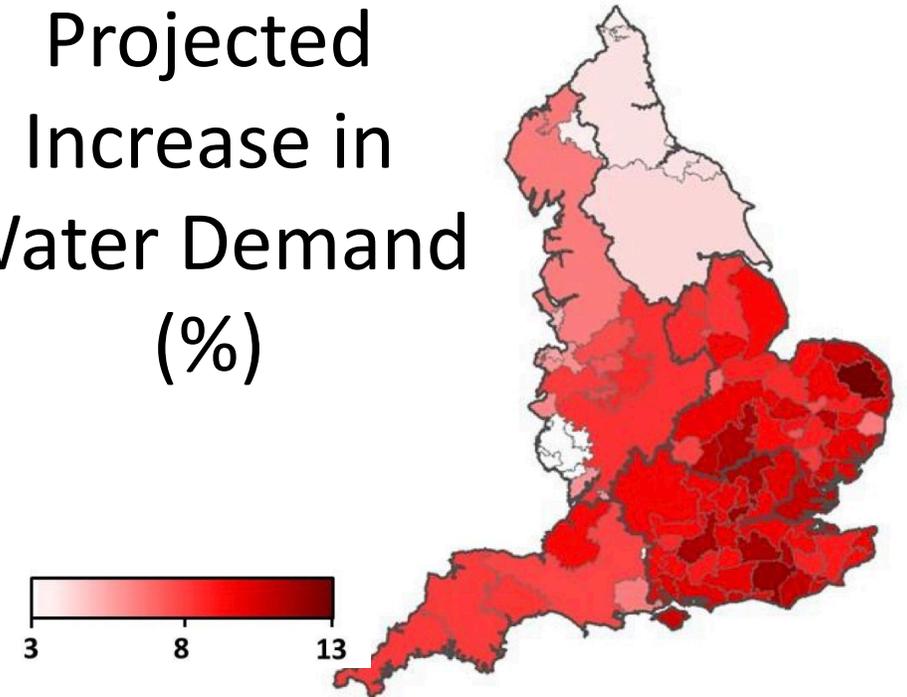
...but also due to increases in water demand...

UK Climate Projections 2018



↓ Water Supply

Projected Increase in Water Demand (%)



↑ Water Demand

...with **severe impacts** on food-energy-water systems

A recent National Infrastructure Commission report estimated costs of £40billion on emergency water supply measures over the next 30 years.



A recent Environment Agency report concluded that we will need around 3.4 billion extra litres of water a day to meet the needs of people, industry and agriculture

UK's future water challenges

How will freshwater resources respond to future changes in water supply and water demand?

What is the resilience of our water system to extreme droughts?

How can we ensure the UK's future water supplies?



England sees driest spring in a century as drought hits UK

With fields left parched and rivers at record lows, government officials and experts meet to discuss the drought across the UK

● [Interactive: drought-hit Britain](#)



📷 The River Derwent was bone dry at Seathwaite on 3 May 2011. England has had its driest May in a century. Photograph: Paul Kingston/NNP

A poster from Thames Water with a cracked earth background. The text reads: "AFTER TWO YEARS OF EXCEPTIONALLY LOW RAINFALL WE ARE IN DROUGHT NONE OF US CAN MAKE IT RAIN BUT WE CAN ALL USE LESS WATER PLEASE START NOW". It includes a "Top tip" about saving water and a website link.

Thames Water

AFTER TWO YEARS OF EXCEPTIONALLY LOW RAINFALL

WE ARE IN DROUGHT

NONE OF US CAN MAKE IT RAIN BUT WE CAN ALL USE LESS WATER

PLEASE START NOW

RIVER KENNET - WEST OVERTON, WILTSHIRE
MARCH 2012

PLEASE USE WATER WISELY

Top tip: Please turn off the tap when washing vegetables or dishes, and save 6 litres of water a minute!

To find out more about how the drought will affect you, visit: www.thameswater.co.uk/drought

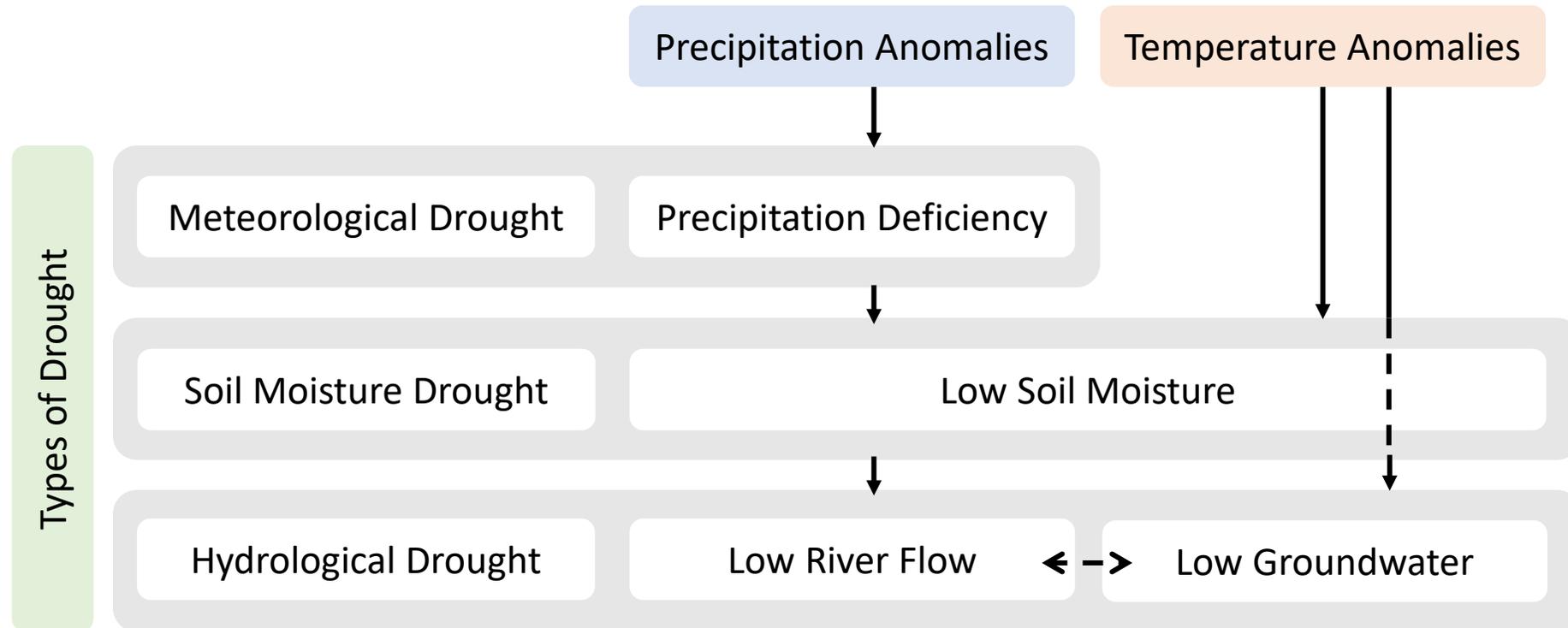
Today's talk

- Hydrological droughts explained
- UK Droughts – but isn't the UK really wet!?
- How can we ensure the future of the UK's water supply?

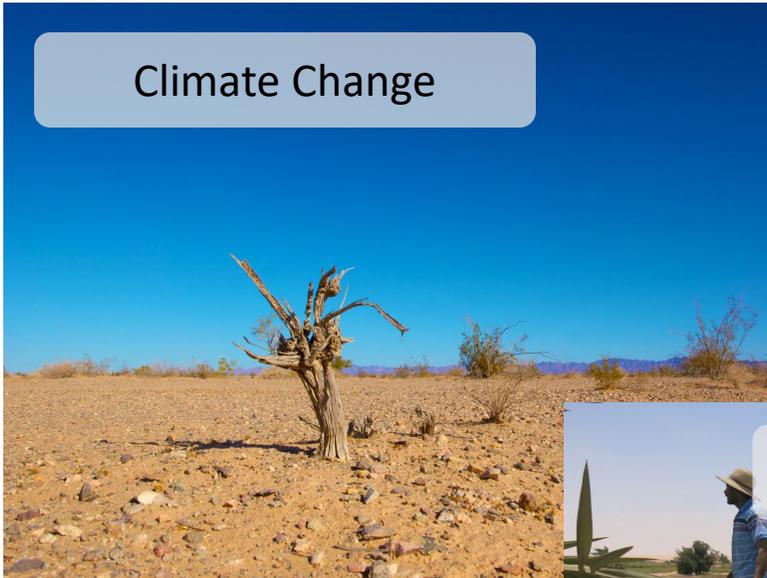
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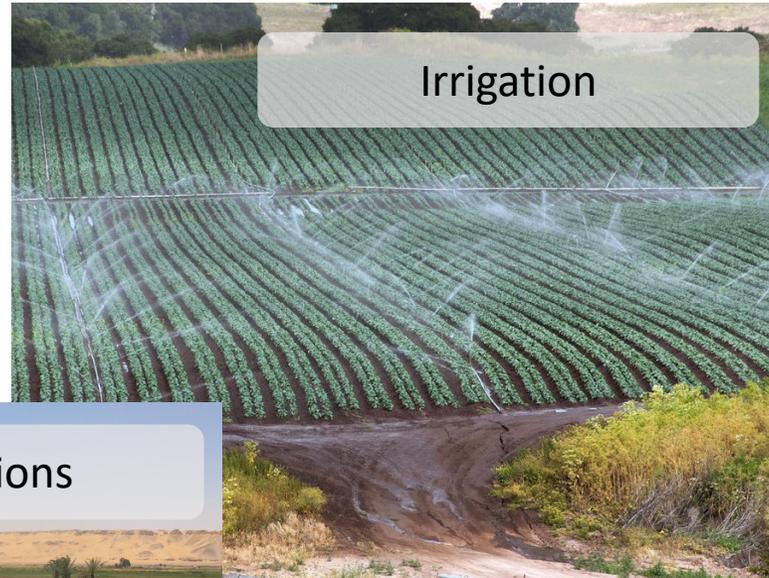
Drought is defined as a lack of water compared to normal conditions which can occur in **different components of the hydrological cycle**



Climate Change



Irrigation



Abstractions



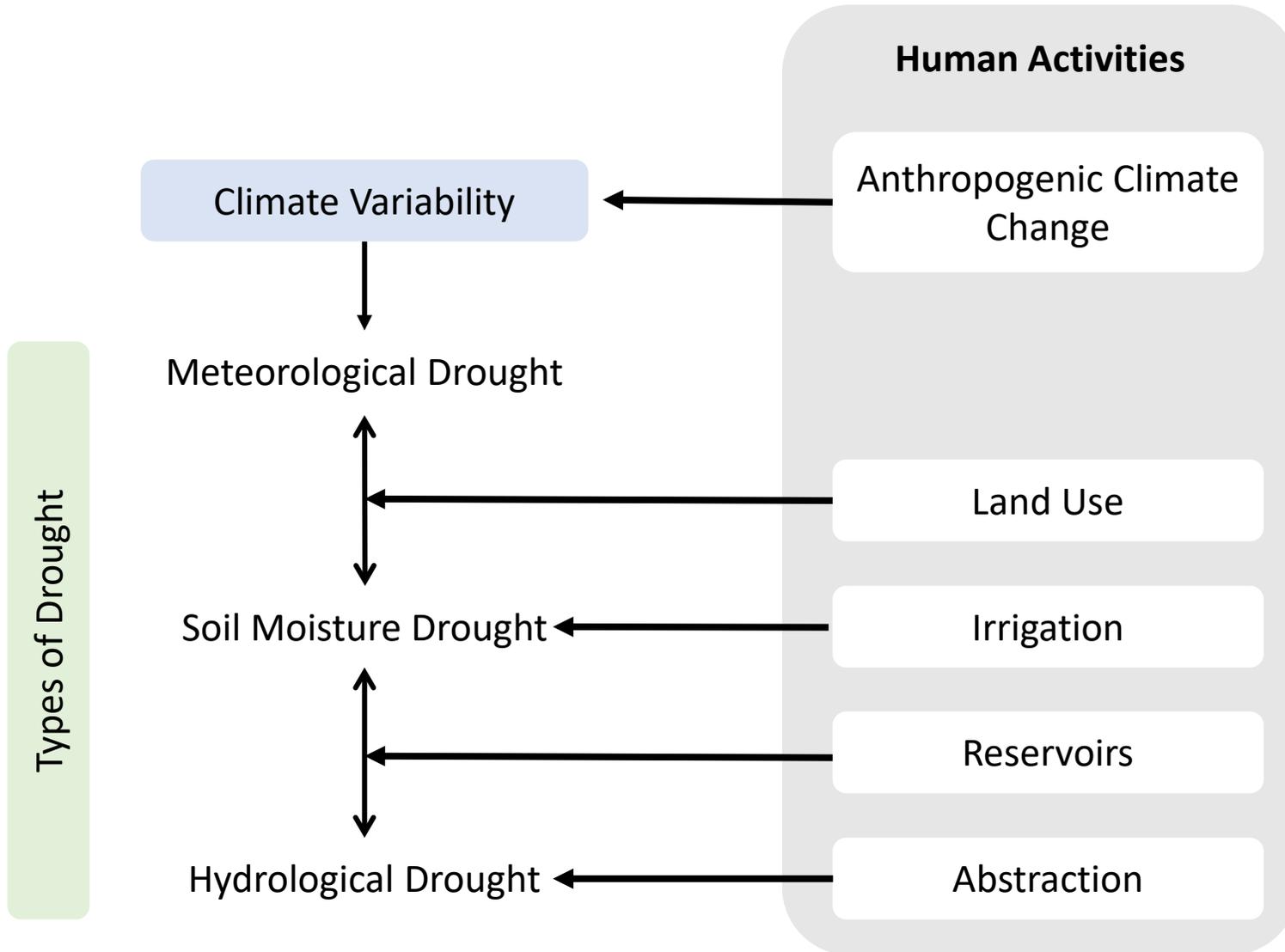
Land Use Change



Reservoirs



Human activities drive and modify droughts

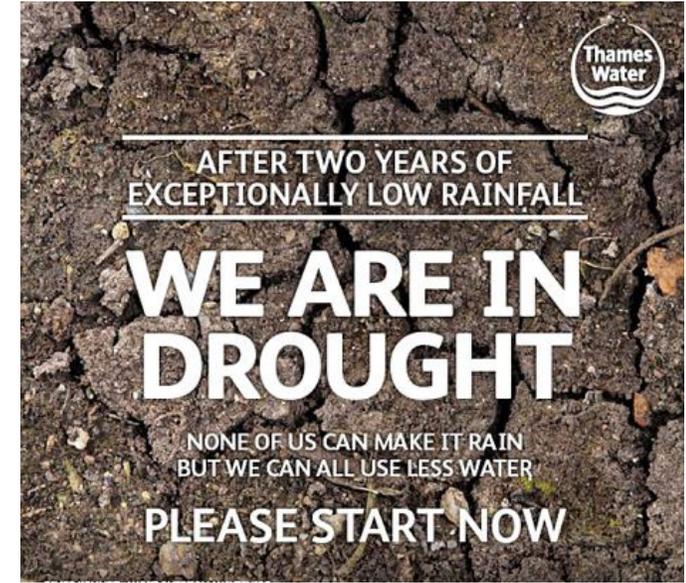
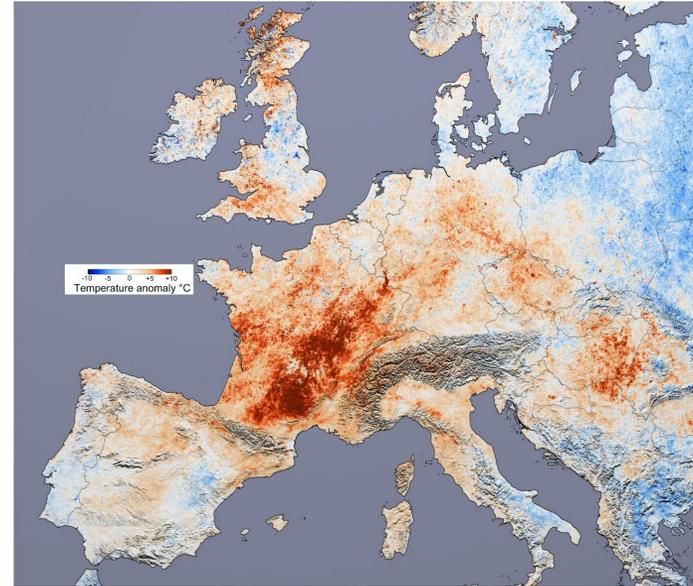


Adapted from Van Loon et al (2017)
<https://doi.org/10.5194/hess-20-3631-2016>

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UK Droughts....but isn't the UK really wet!?



The standpipe drought

Hot summer drought

From droughts to floods

1976

1983

1988-
1993

1995-
1998

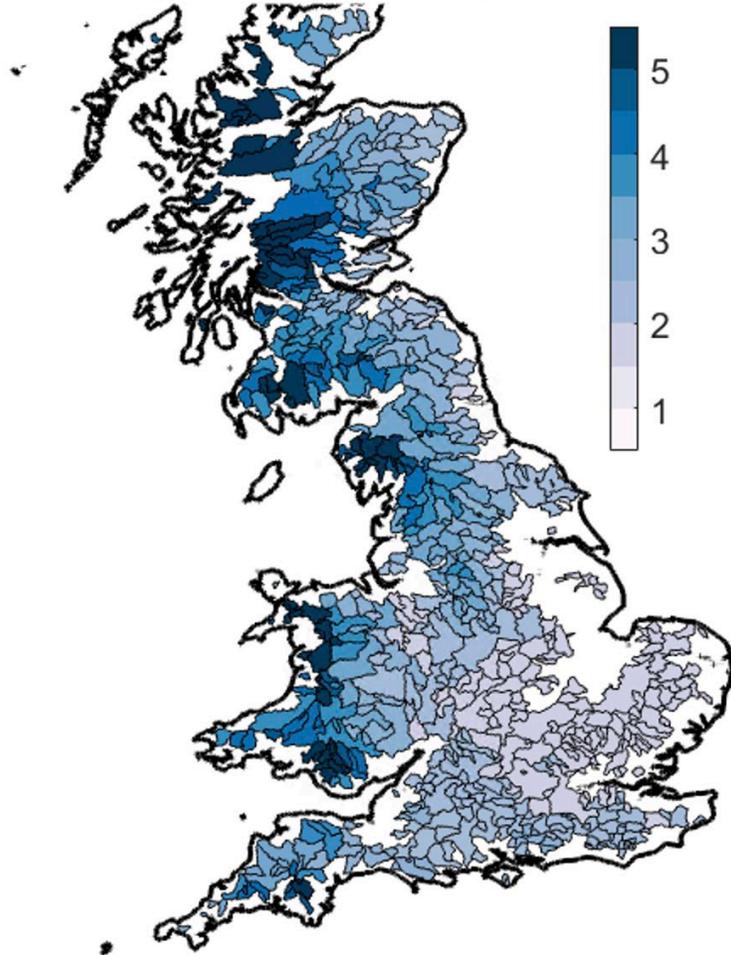
2003

2004-
2006

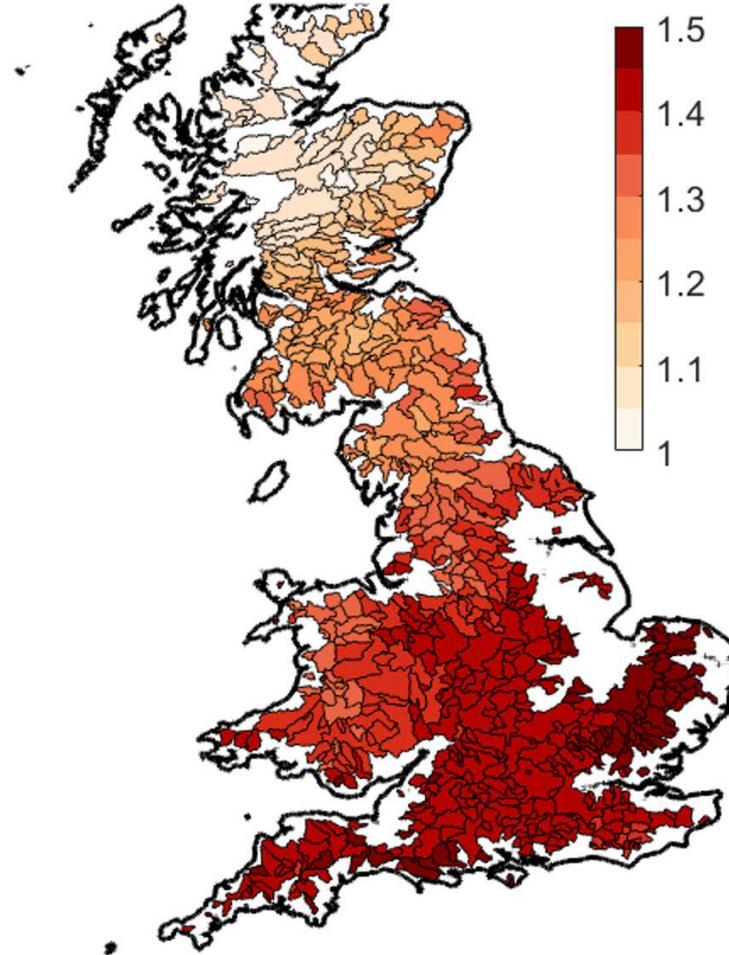
2010-
2012

Climate is the primary control on mean hydrological response across GB...

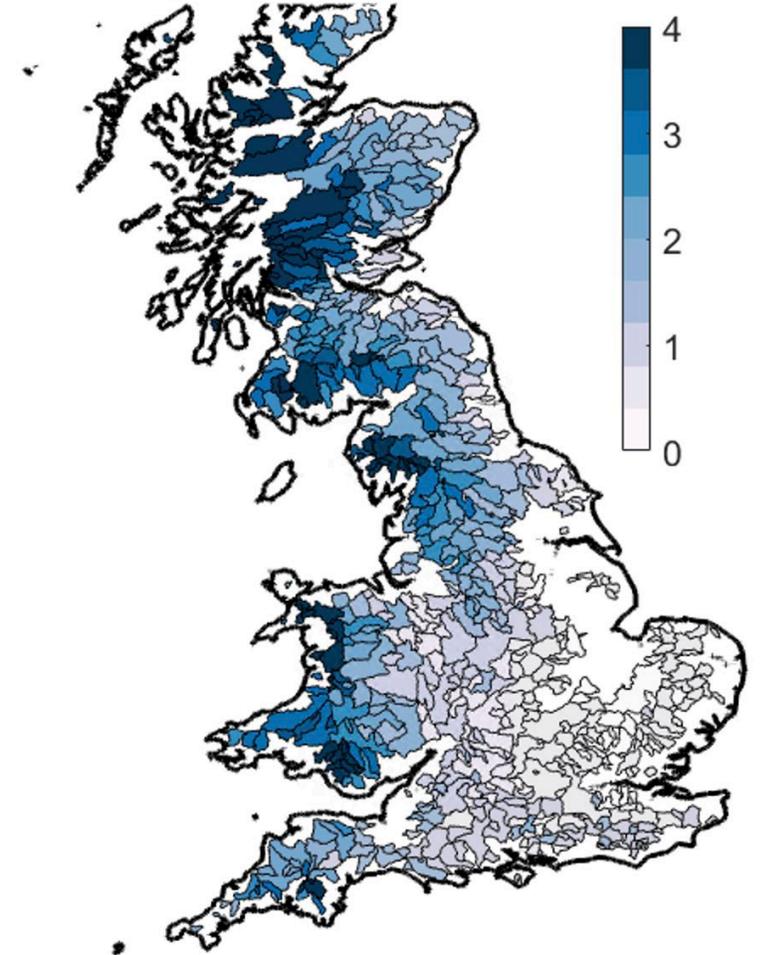
Average Daily Precipitation



Average Daily PET

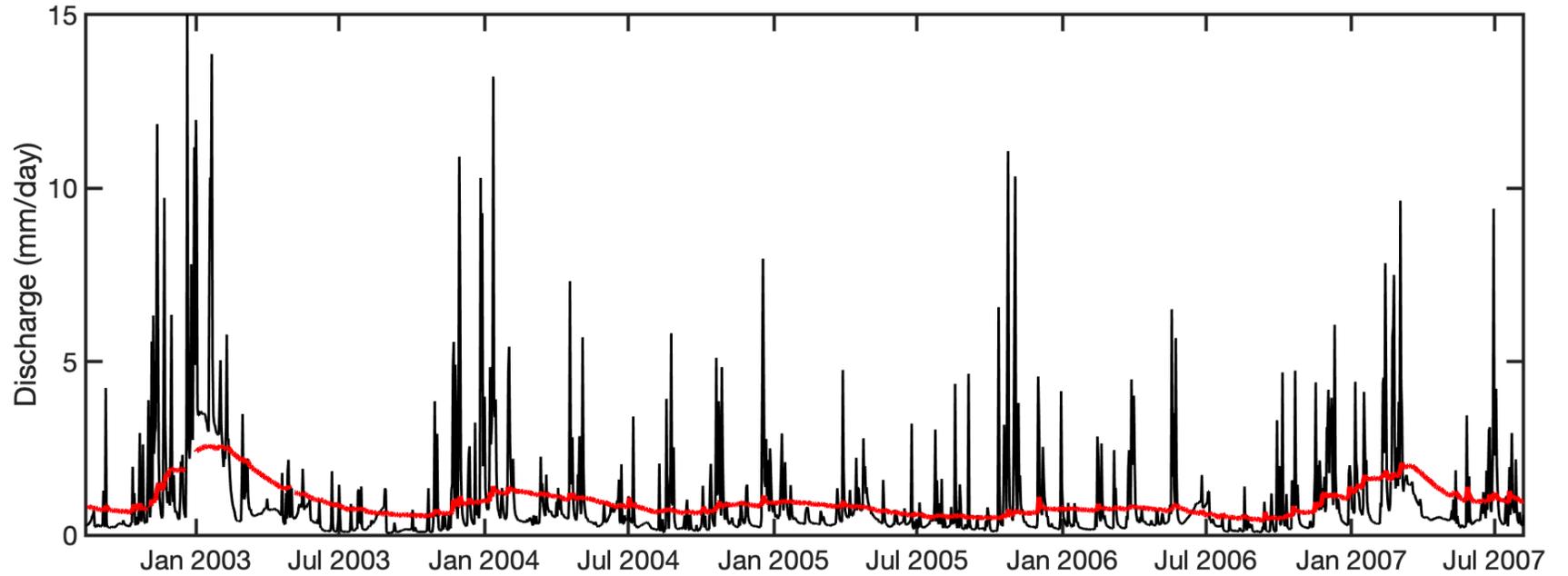
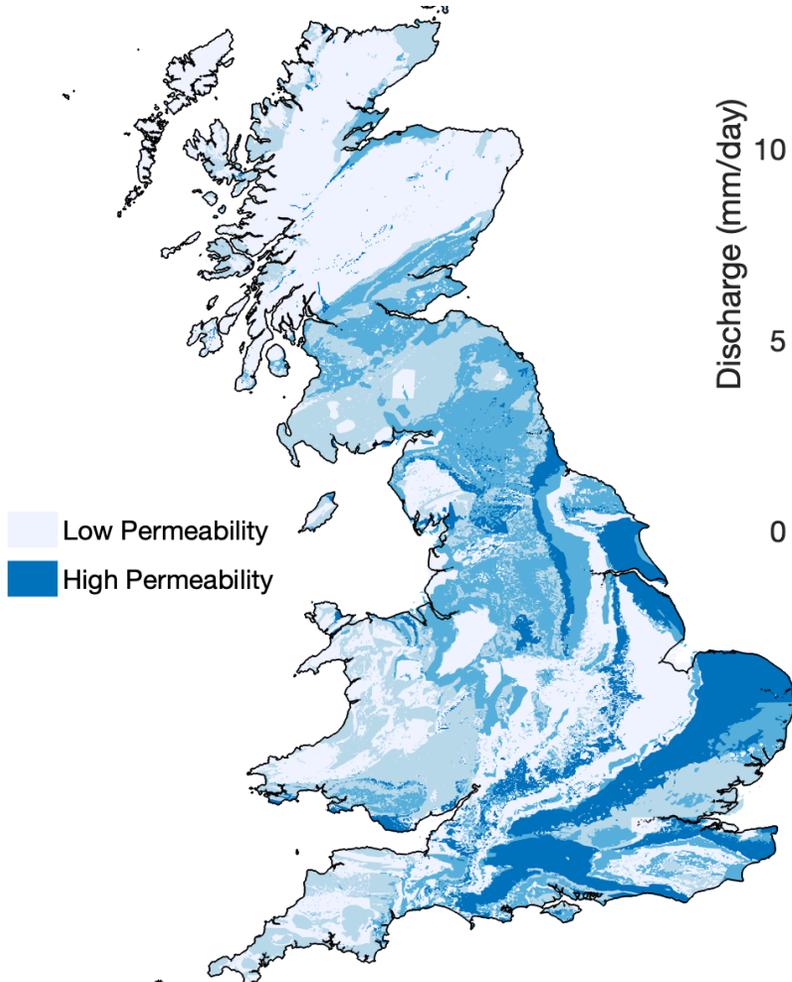


Average Daily River Flow



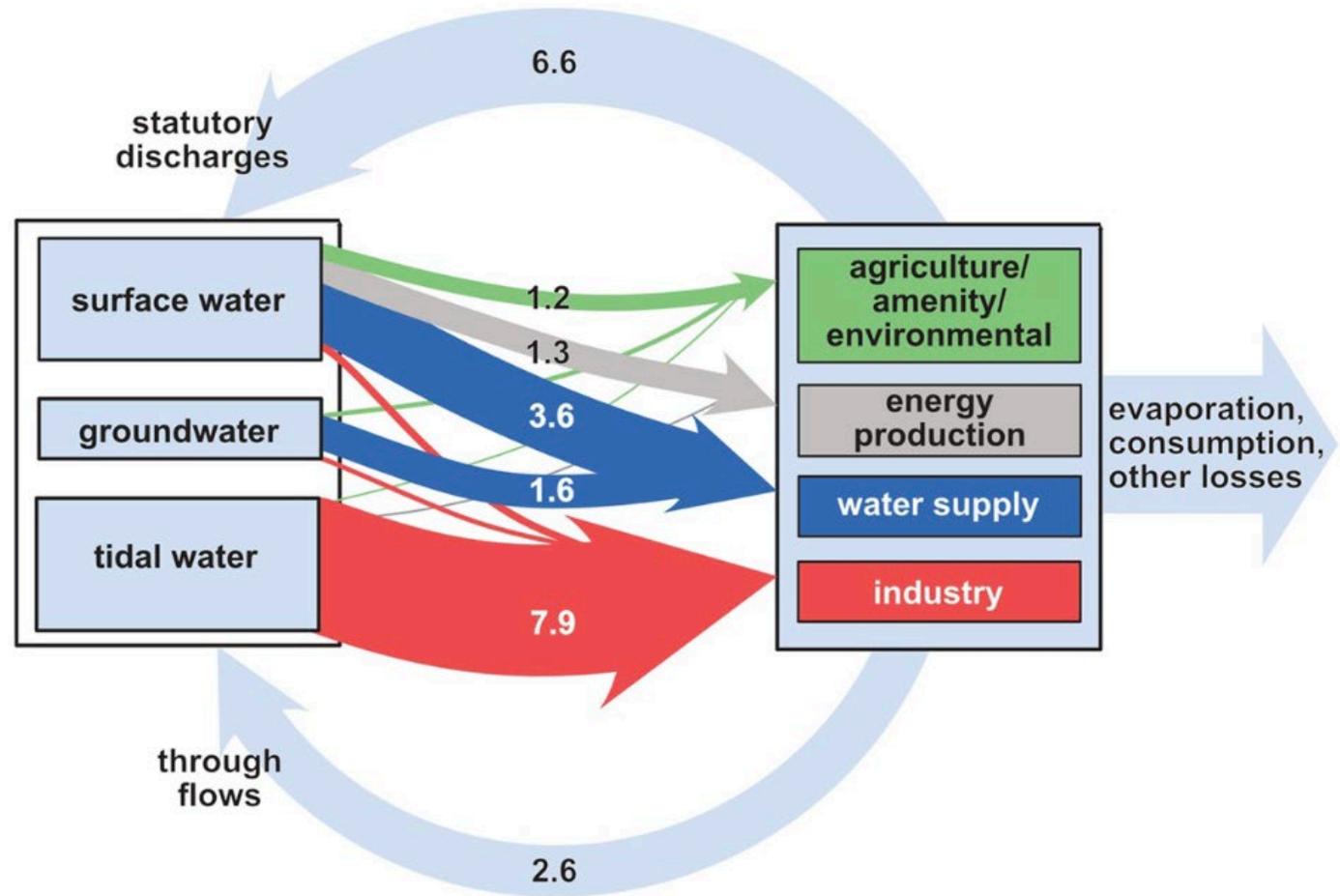
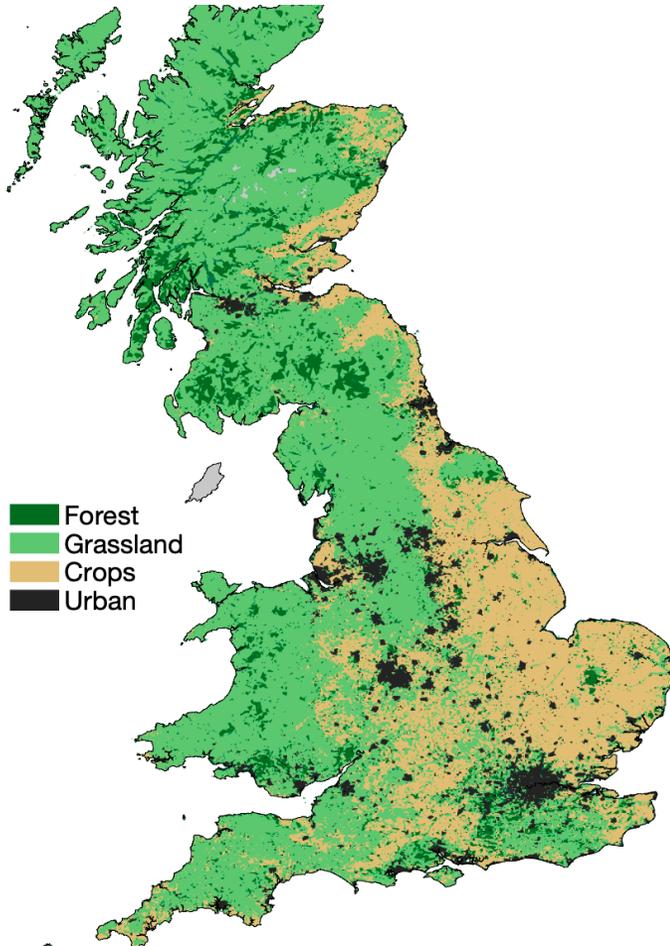
...but geology and land cover are also important

Geology



...but geology and land cover are also important

Land Cover

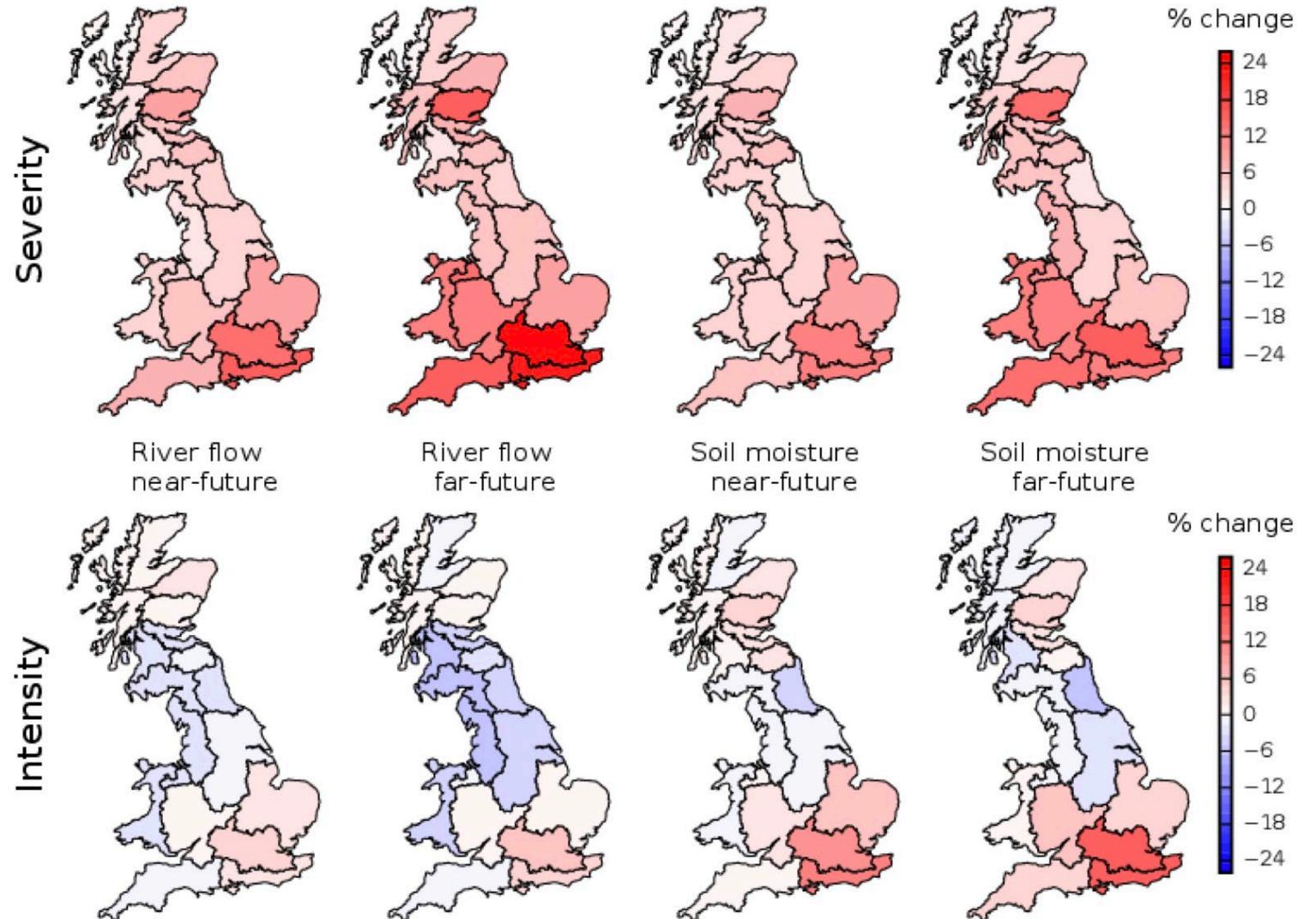


Units: billion cubic metres per year

Looking ahead..the South-East as a drought hot-spot

- Future reductions in low flows, particularly in the south-east
- Longer duration and peak intensity

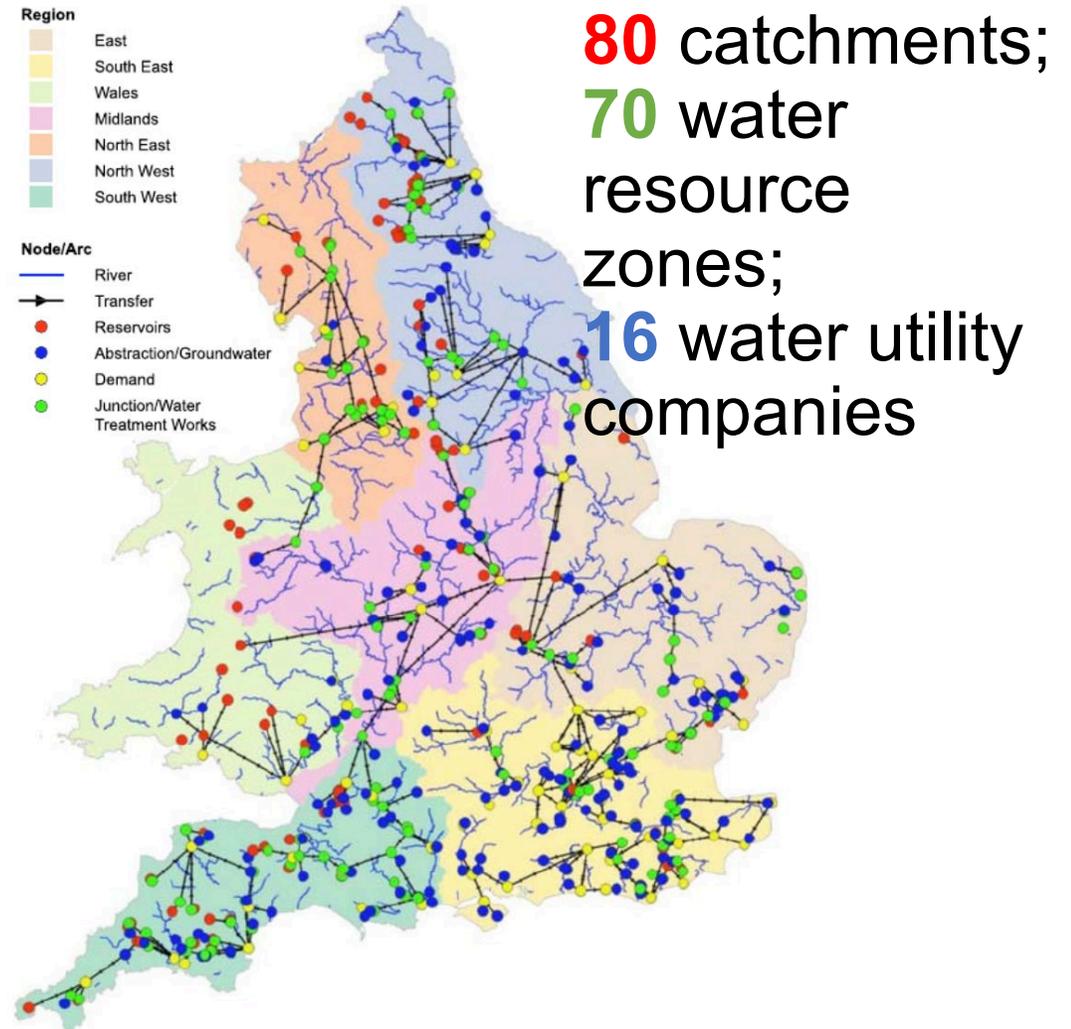
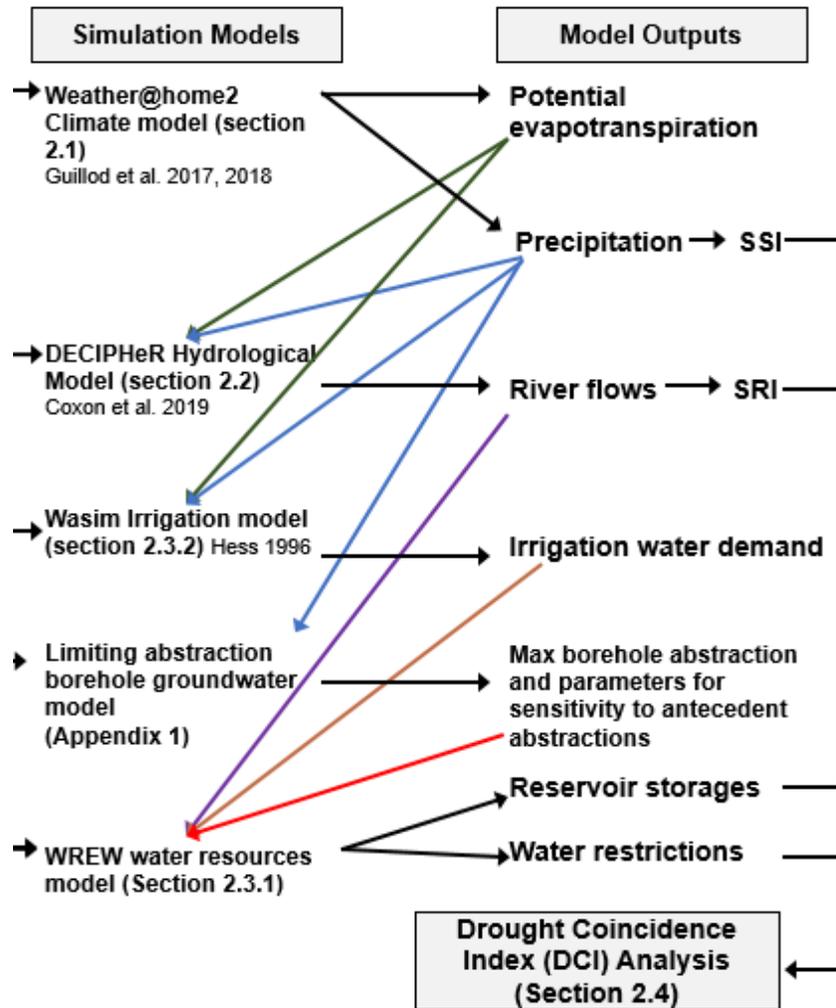
Rudd et al (2019)



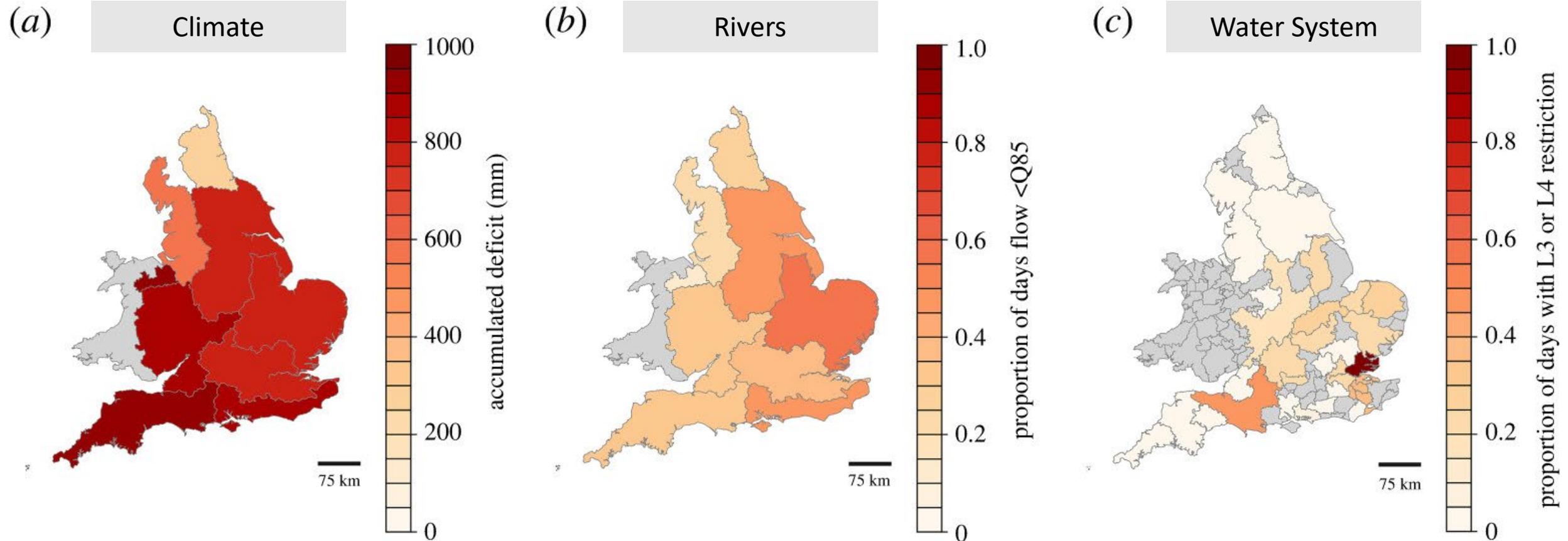
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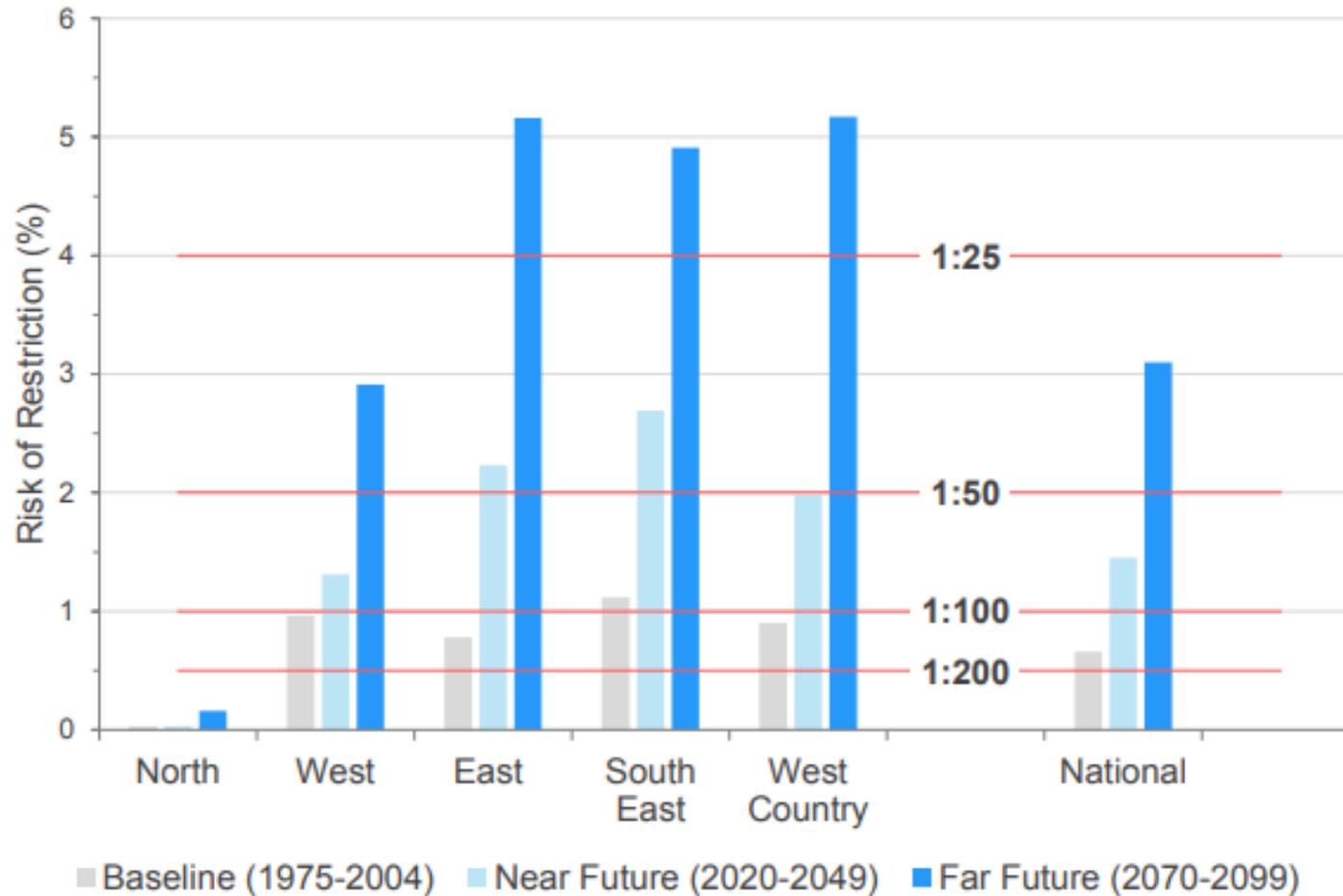
A modelling framework that represents the water supply of over 50 million people



Complex interactions between climate, hydrology and water systems



Climate change makes years with water restrictions **twice as likely in 2050** (1.5% risk) and **four times as likely by 2100** (3.1% risk) at a national scale



Environment Agency

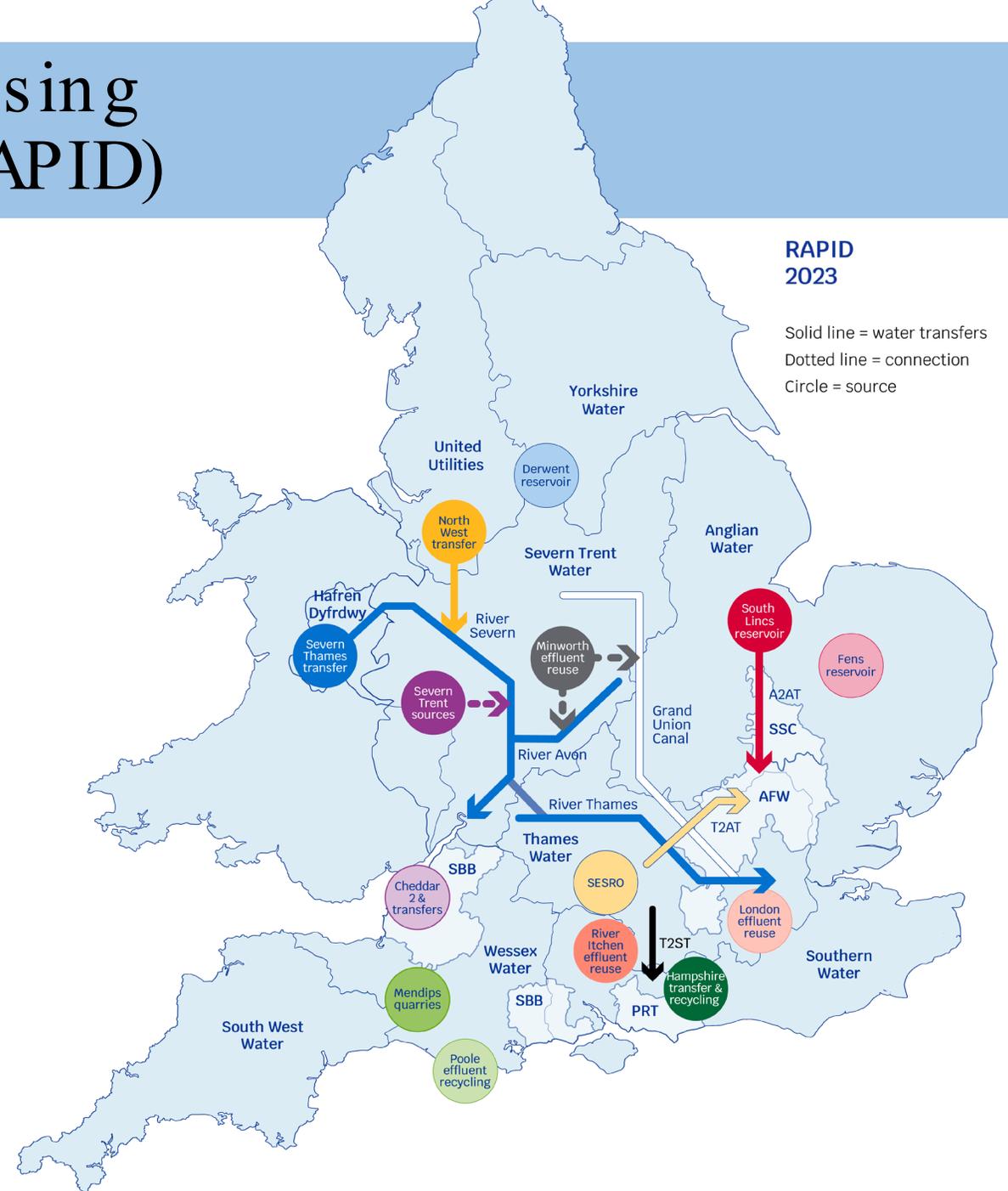


Meeting our future water needs: a national framework for water resources

Restriction: Level 3 (ban on non-essential use) and Level 4 (standpipes)

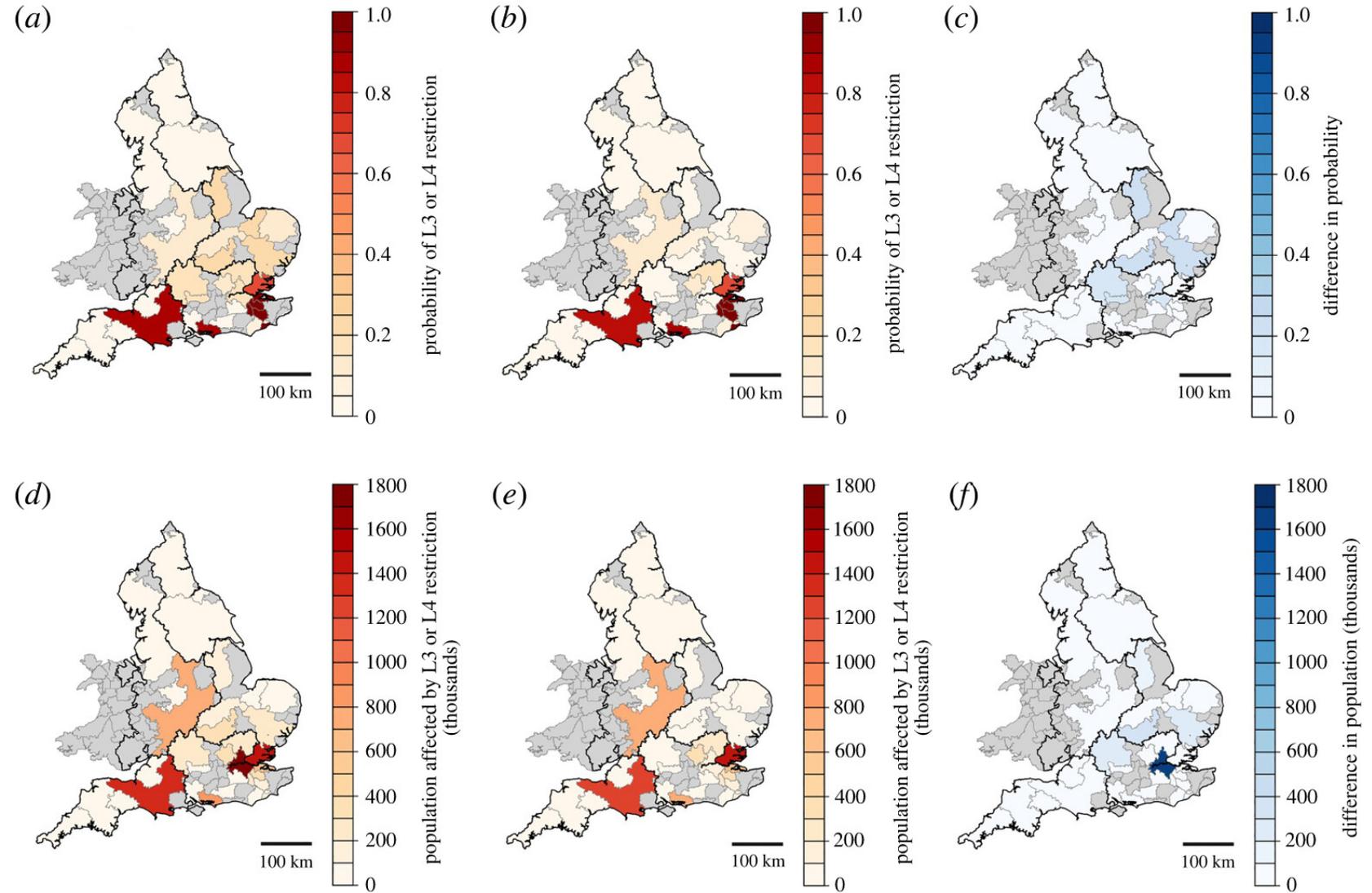
Regulators' Alliance for Progressing Infrastructure Development (RAPID)

- Ofwat, Environment Agency and Drinking Water Inspectorate project
- Aim is to analyse the feasibility of nationally strategic water supply schemes
- 18 schemes proposed including new reservoirs, water transfers and water recycling



Assessed these strategic resource options in national water system model

- Reduction in both the probability of water restrictions and the total population affected by restrictions in key water-stressed urban areas in the South and East.
- The greatest benefit of the SROs, in terms of population affected by restrictions, is observed in the London WRZ.



No straightforward answers..

- New reservoirs can have negative environmental impacts and are controversial
- Water transfers are expensive and won't always be effective in severe droughts
- We need to consider future water supply options in conjunction with leakage and water demand reductions



Summary

- Frequent UK droughts and water shortages are projected by 2050 due to changes in climate and water demand
- These will have severe impacts on food, energy and water systems.
- We use models to better understand how new water infrastructure can help to mitigate these impacts BUT solutions are complex and often controversial!
- Informing adaptation is a transdisciplinary challenge – geographers are well placed to help answer these questions

Thanks to the awesome PhD and post-docs!



Thank you for listening. Any questions?