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Droughts of the future – scenarios and prospects

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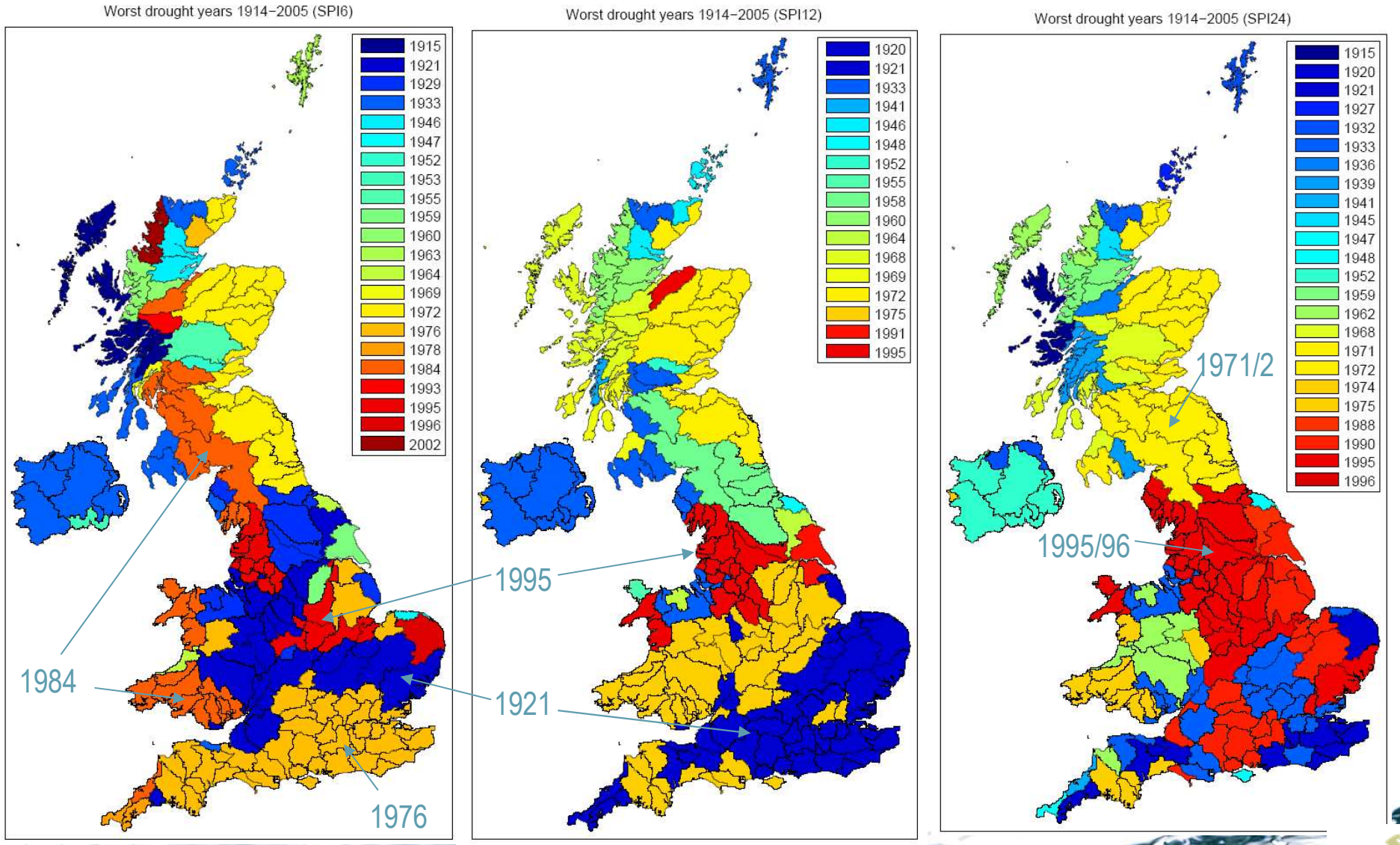
Acknowledgements

- Effects of climate change on river flows and groundwater recharge – CL04
- Climate change and sewerage systems – CL10
- Defra Cross-Regional Research Programme
- EA Severe Droughts project
- Business Risks of climate change (SNIFFER)
- EEA CC indicators
- EC COP12 negotiations
- EC-India CC research collaboration
- HRW company research

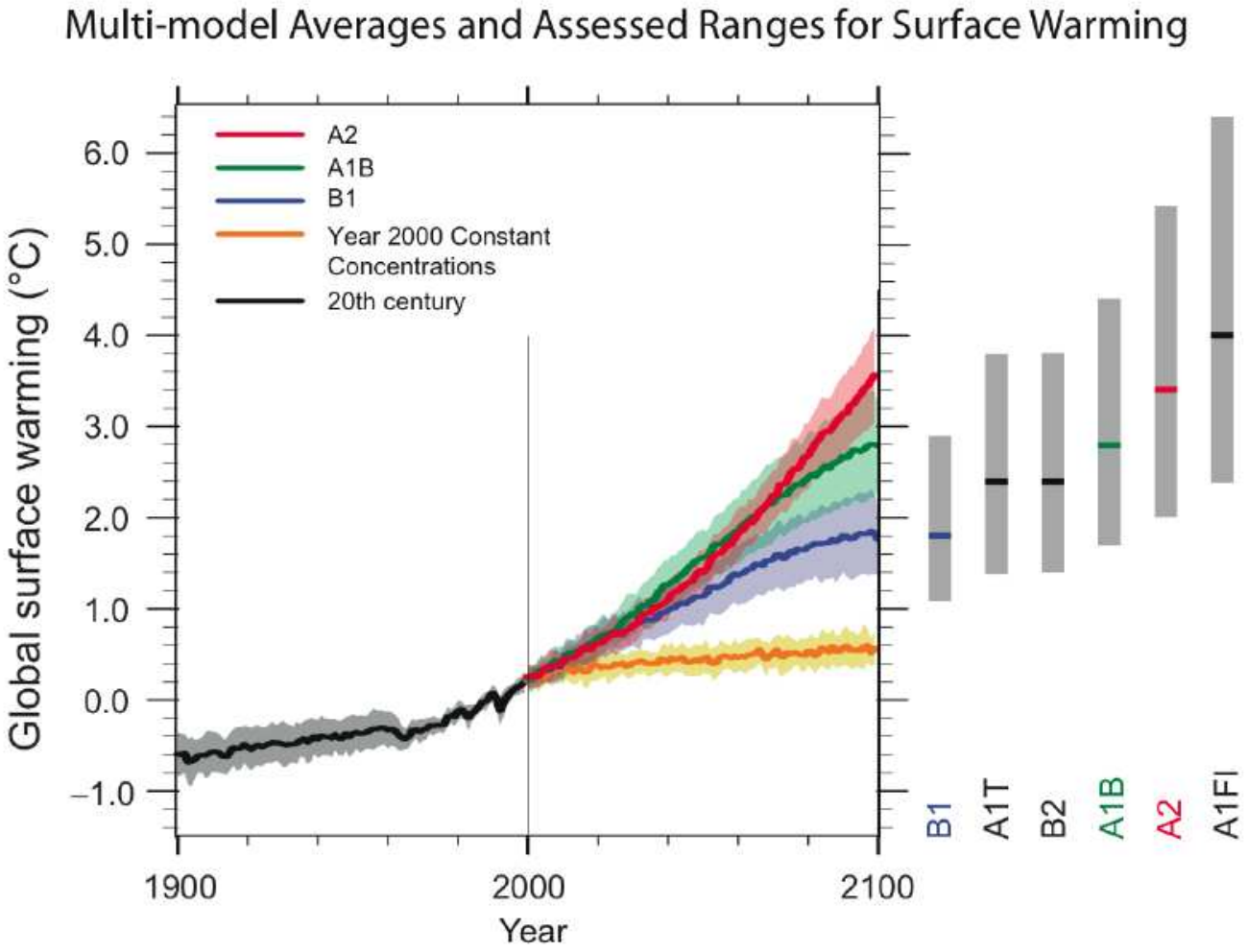
Worst UK rainfall droughts (Vidal and Wade, forthcoming)



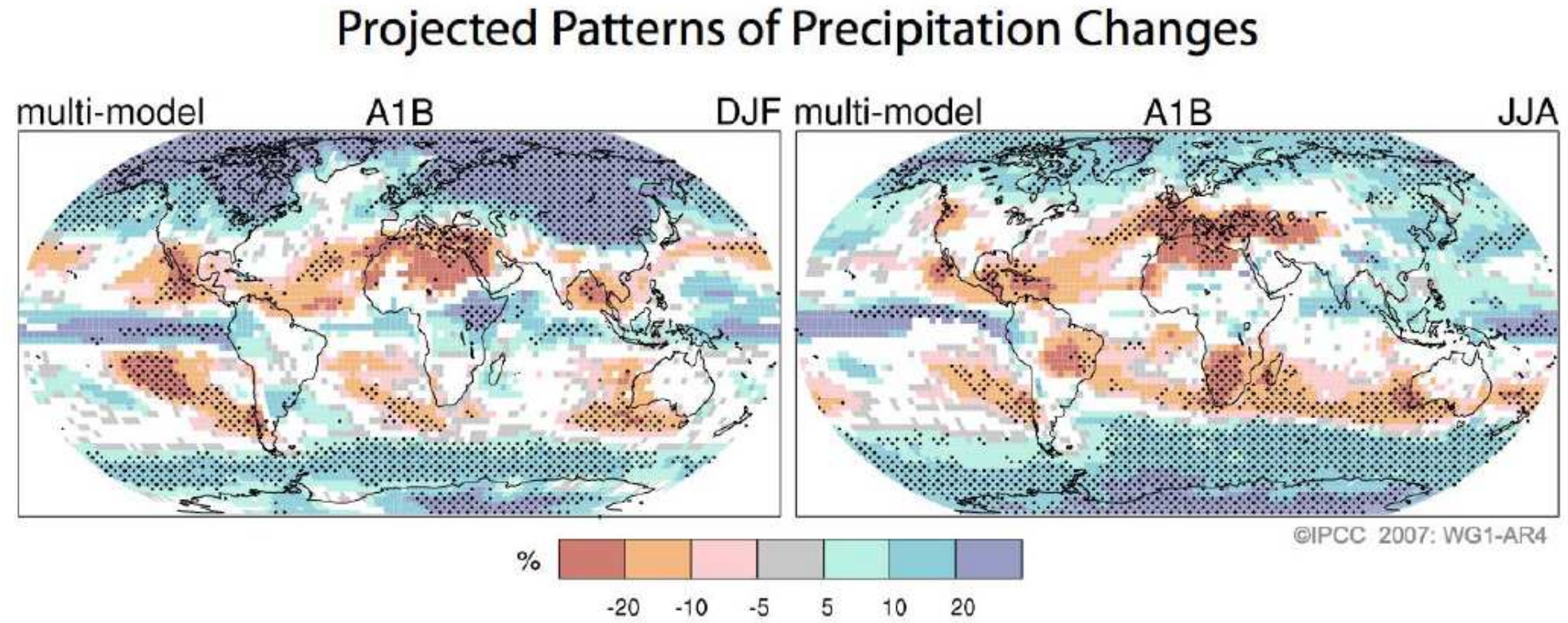
Scenarios and prospects – too little or too much?

- Future Scenarios
  - HadRM3/UKCIP02
  - UKWIR/EA research
  - Changes to population & demand
- Prospects for rainfall drought
- Prospects for changes in river flow and recharge
- Prospects for water resources drought

Global warming (Forth Assessment Report, 2007)



Global warming (Forth Assessment Report, 2007)



Changes in precipitation patterns based on HadRM3 (Wade et al., 2006)

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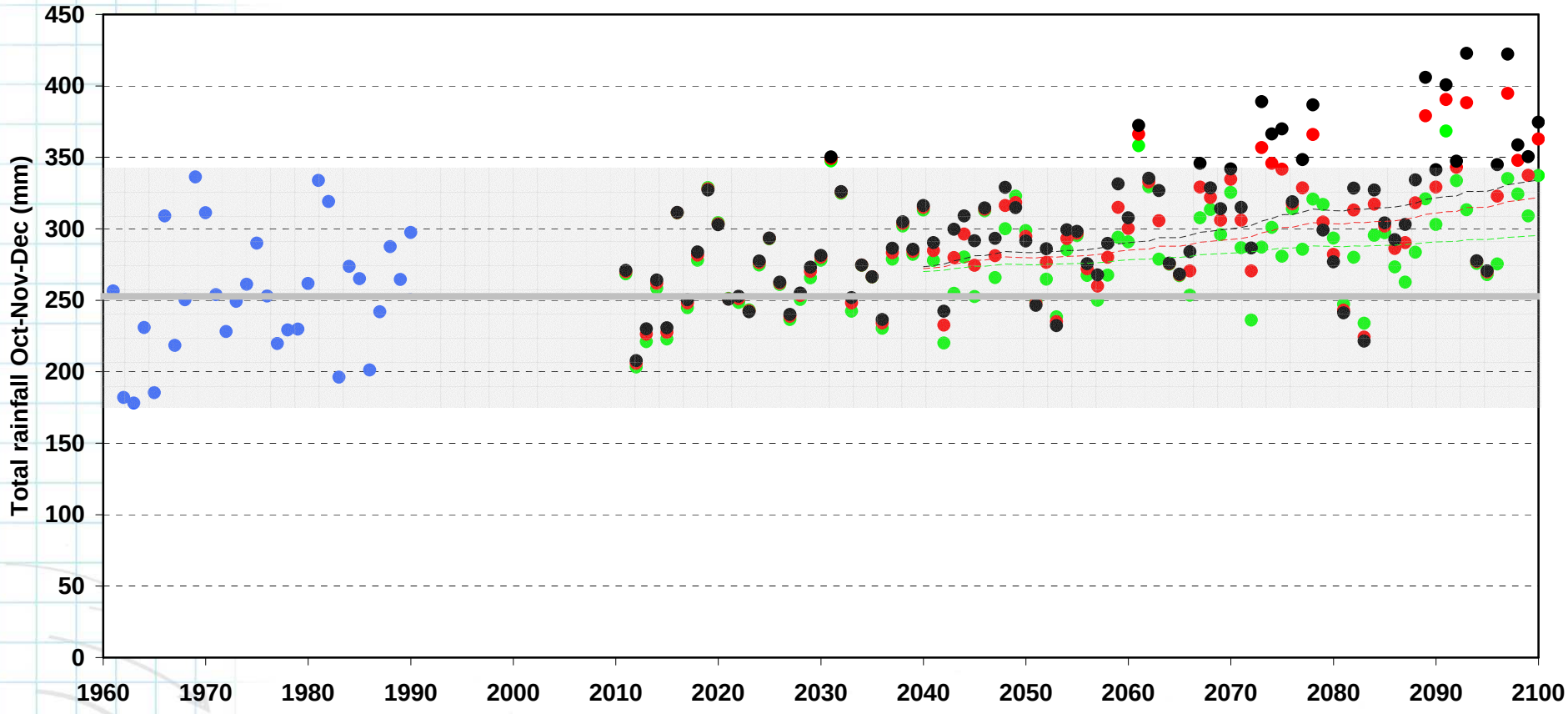
South East of England
Possible changes in precipitation 3 winter months (OND)



Changes in precipitation patterns based on HadRM3 (Wade et al., 2006)

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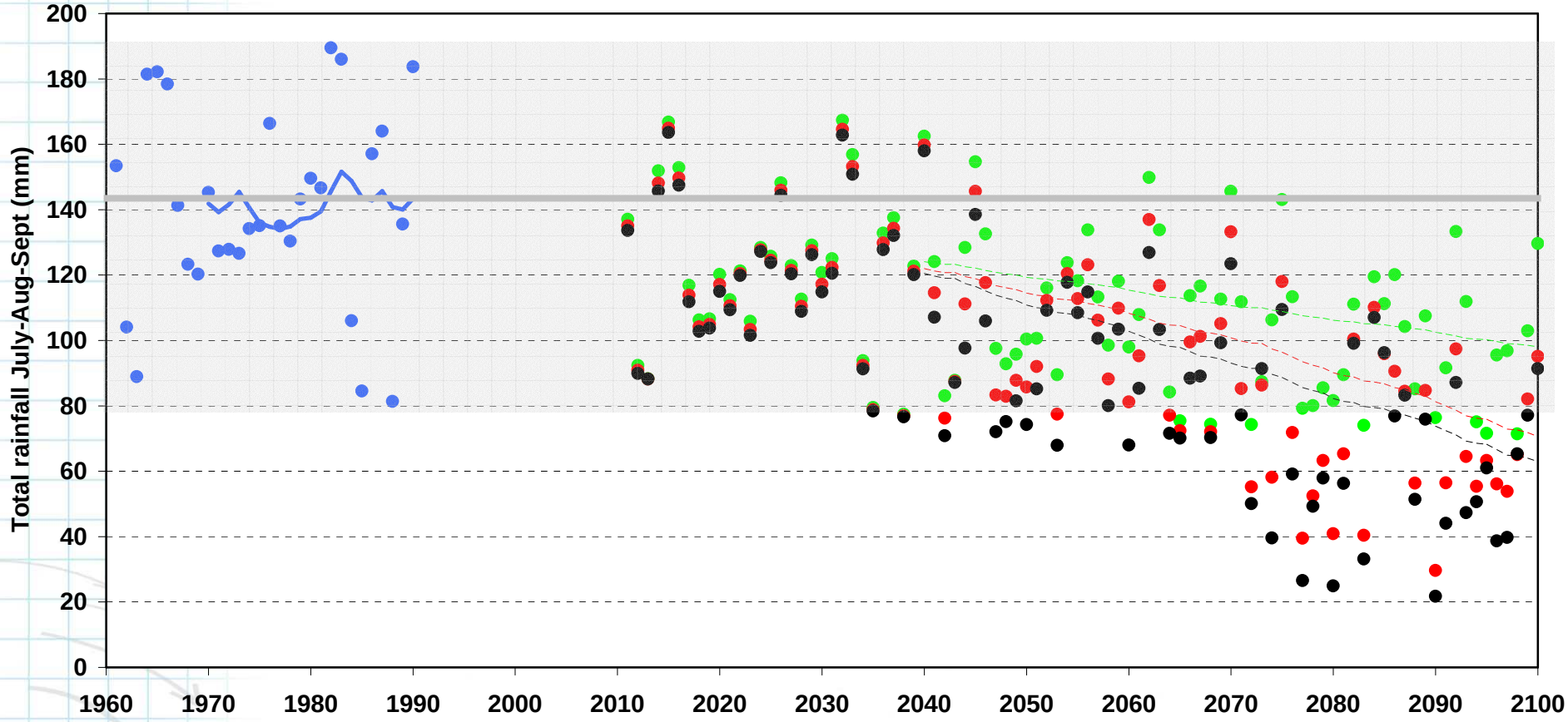
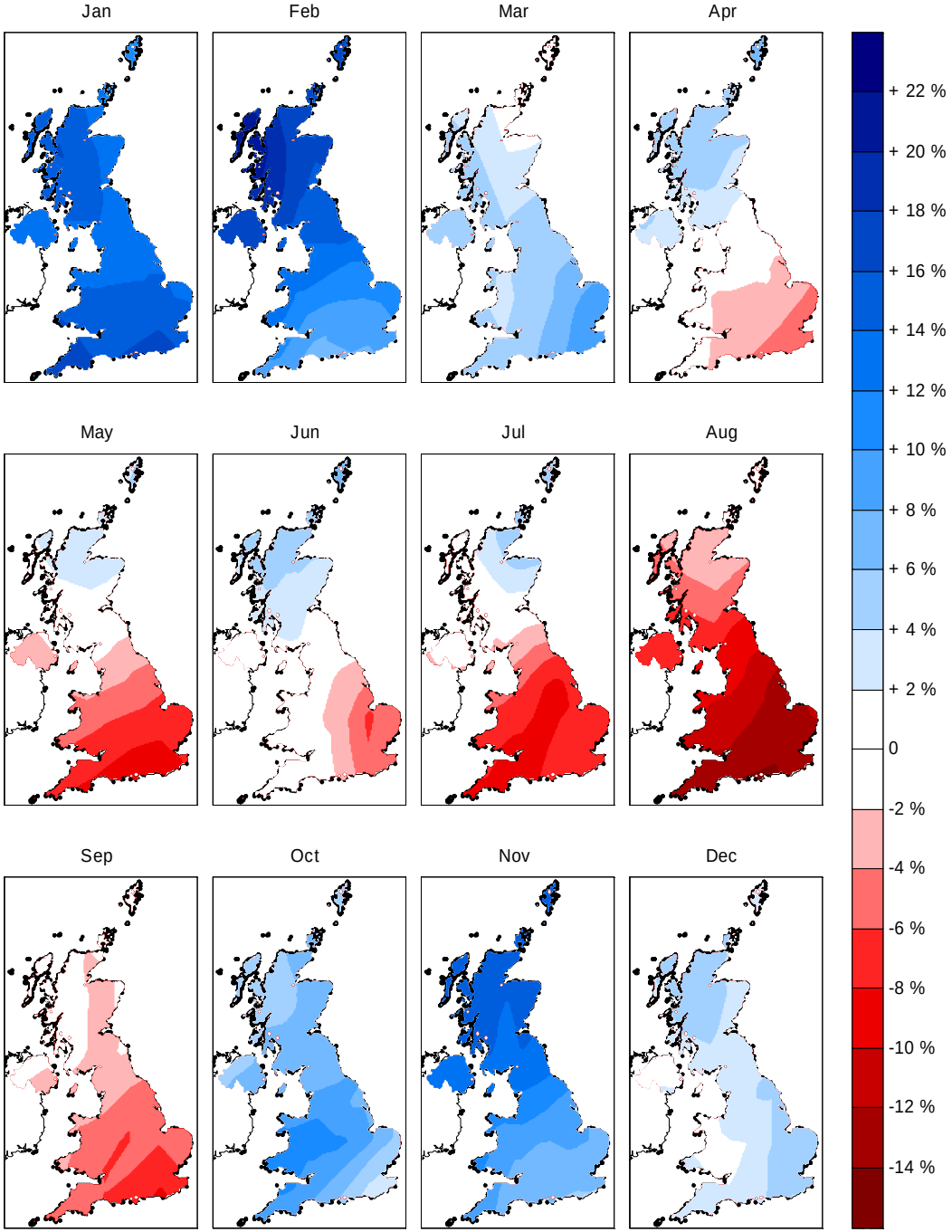
Defra Cross-Regional Climate change programme

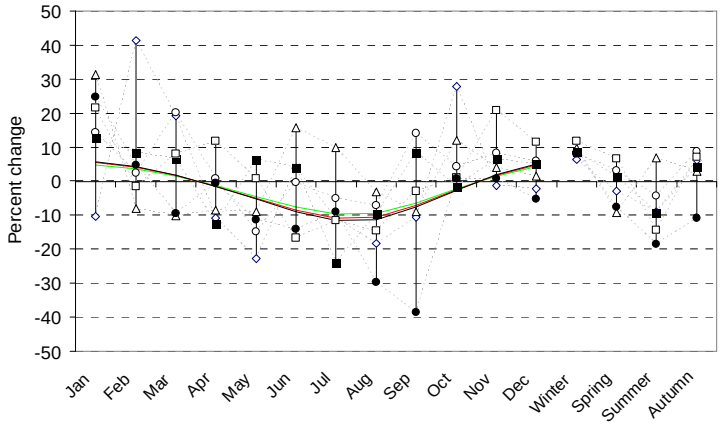
South East of England
Possible changes in precipitation 3 summer months (JAS)



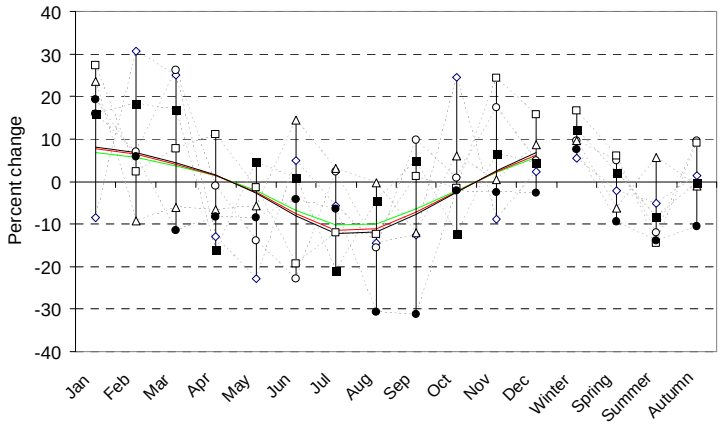
Changes in rainfall, 2020s
A2 scenario (UKWIR, 2007)



Mersey, NW England

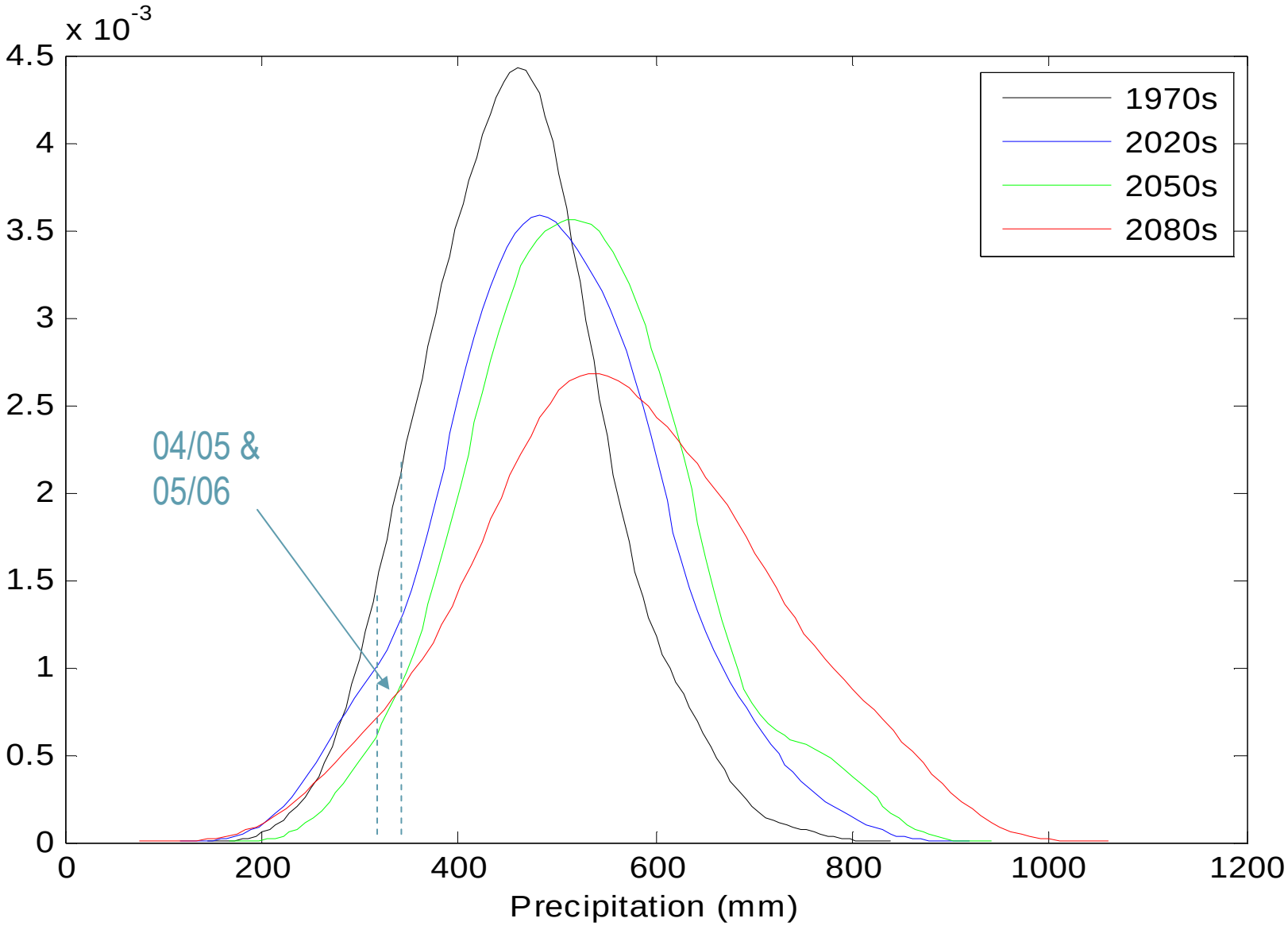


Stour, SE England

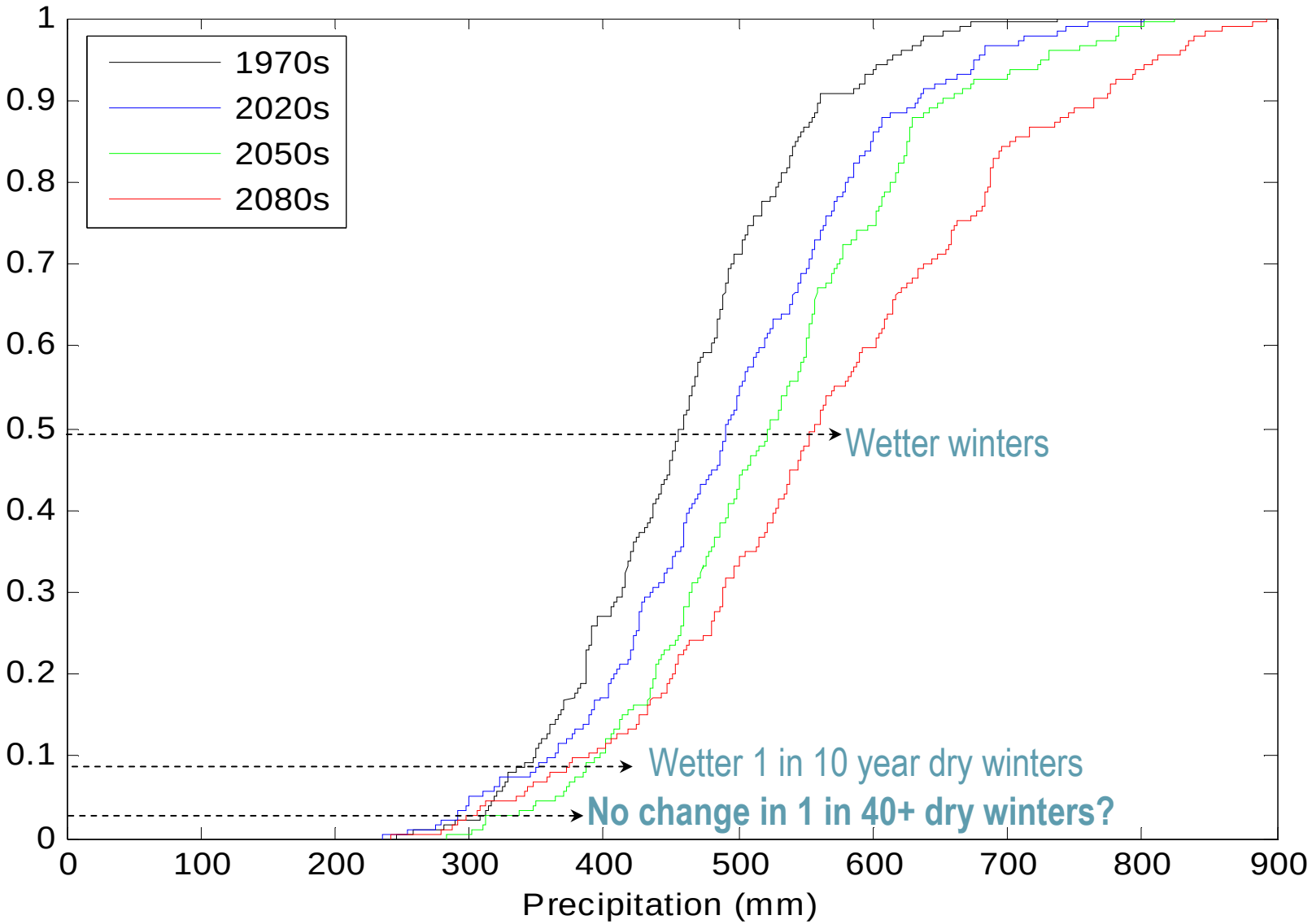


UKWIR, 2007

The chance of a dry winter: Test & Itchen rainfall pdf

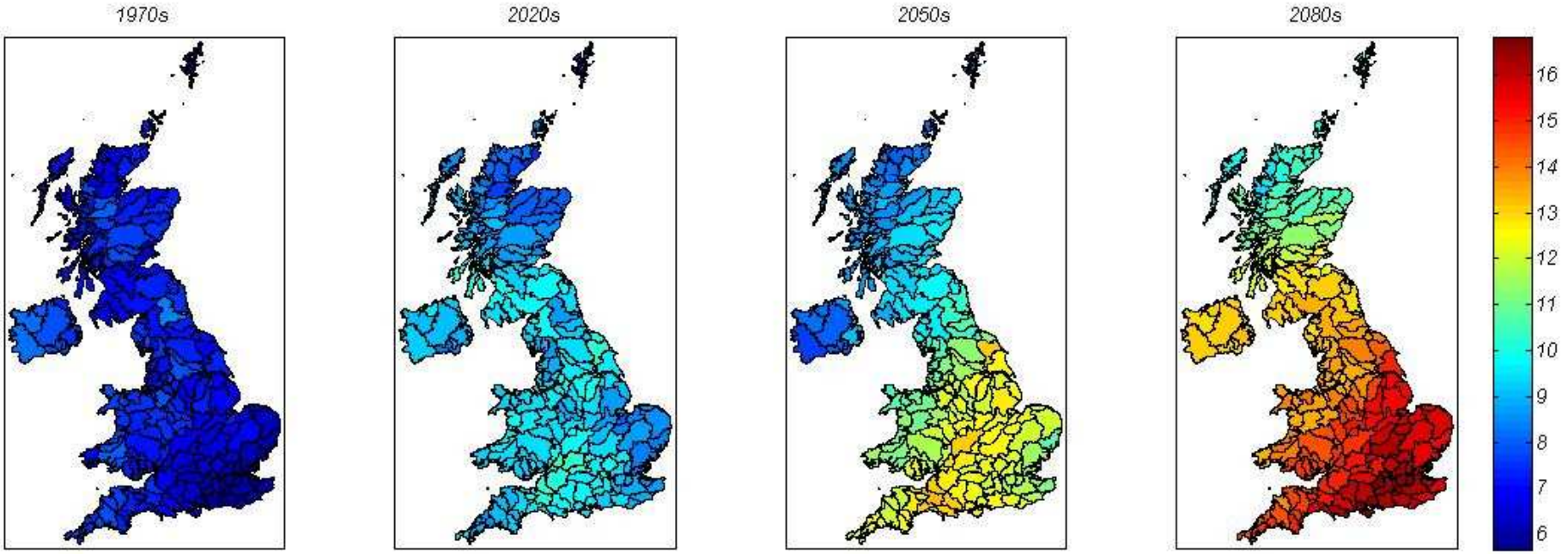


The chance of a dry winter: Test & Itchen cdf



Future rainfall drought (Vidal and Wade, forthcoming)

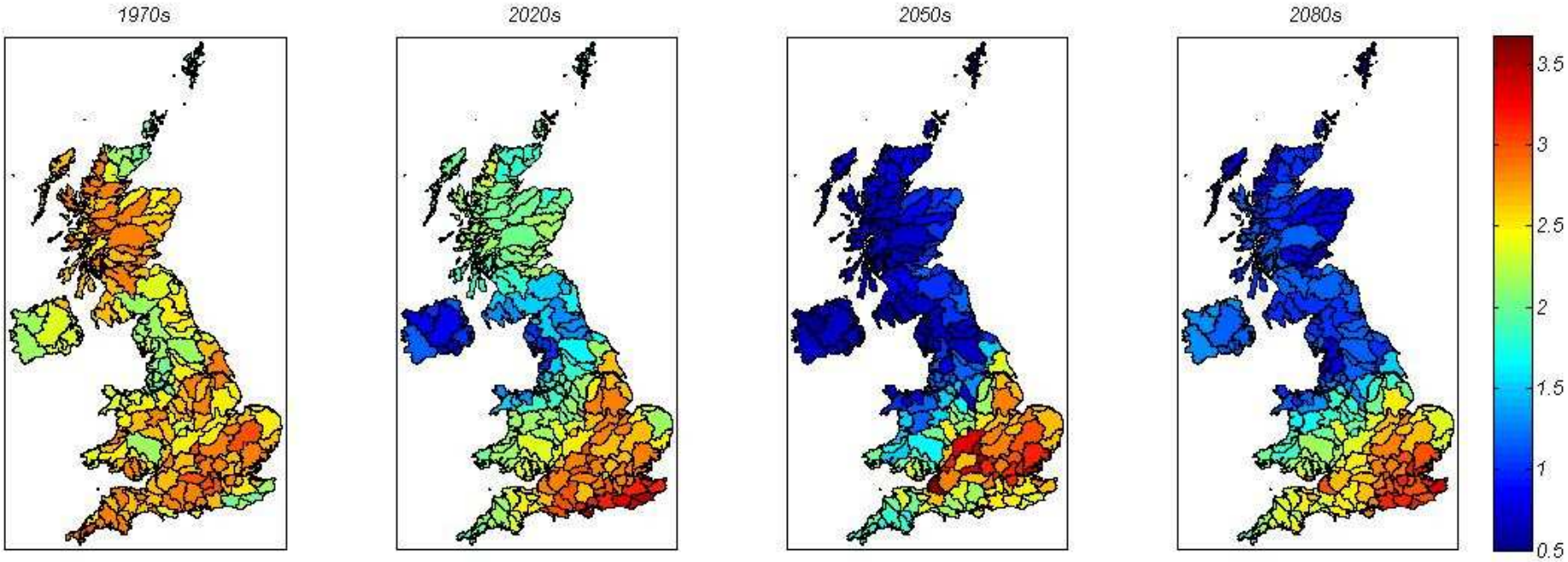
The number of three month extreme rainfall droughts (SPI3 indicator)



- ‘Short’ rainfall droughts likely to increase three-fold

Future rainfall drought (Vidal and Wade, forthcoming)

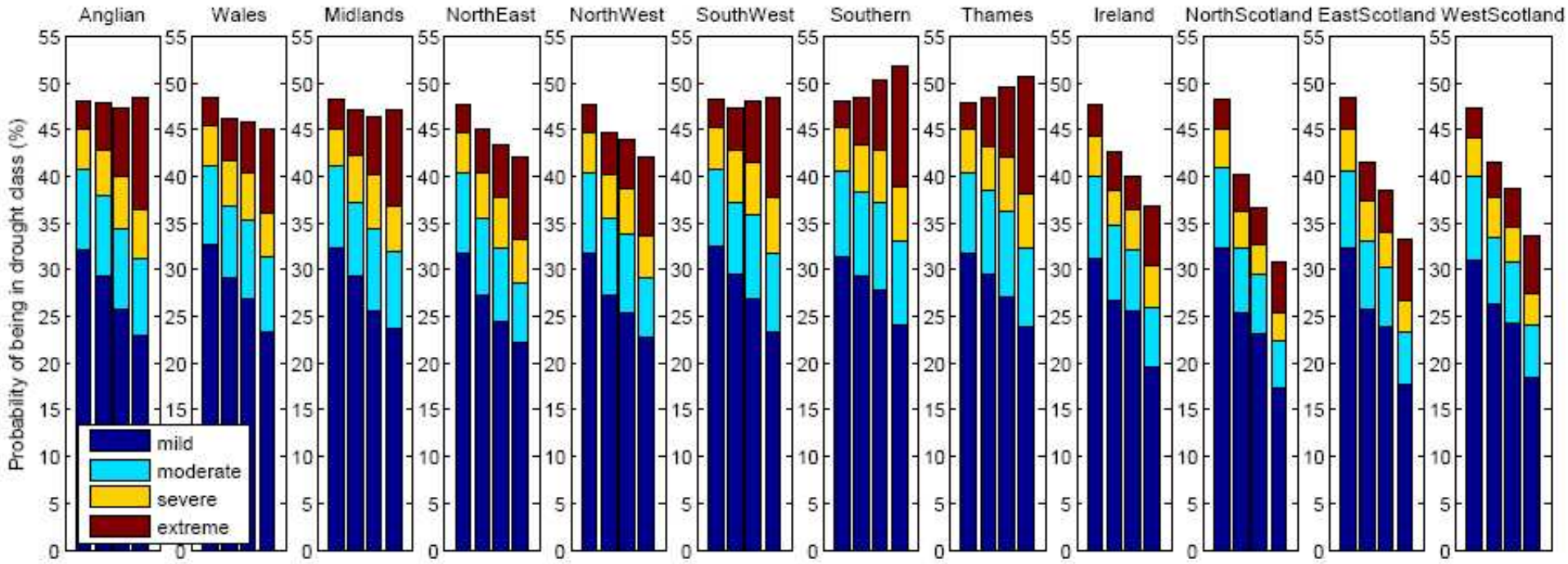
The number of twelve month extreme rainfall droughts (SPI12 indicator)



- Little change in longer droughts
- Reduction in 12 month rainfall droughts in the North, Scotland and Northern Ireland

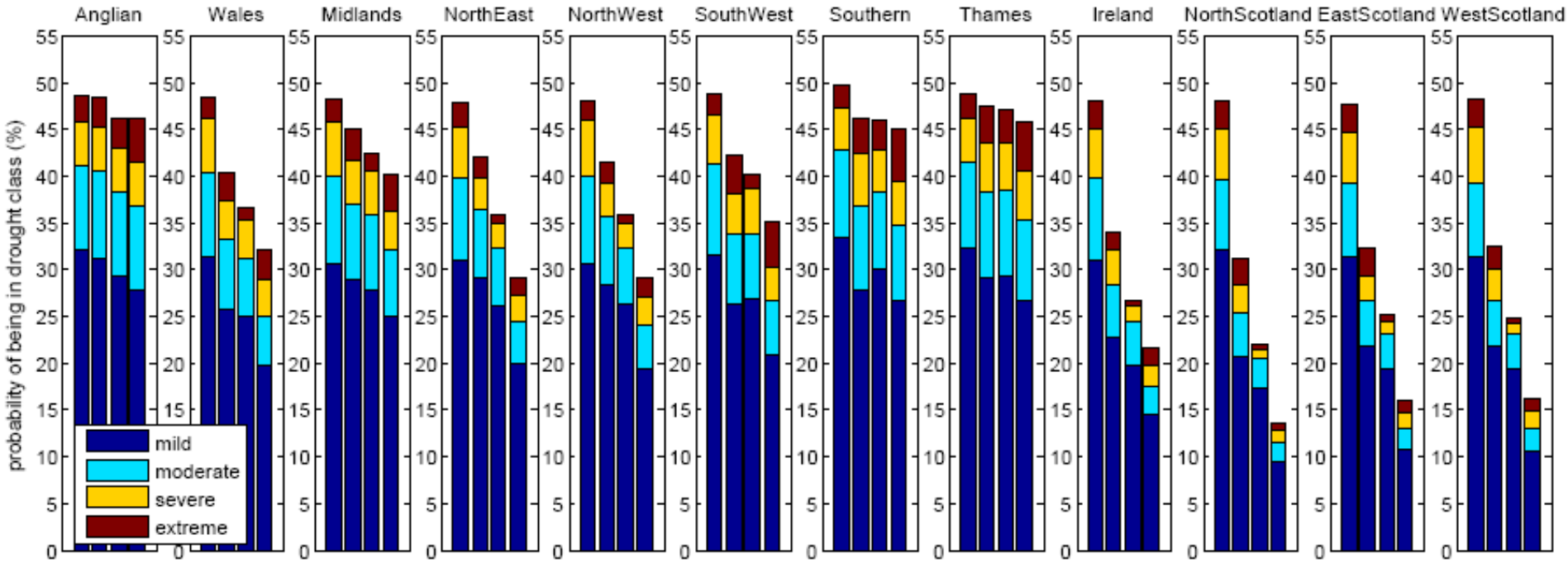
Future rainfall drought (Vidal and Wade, forthcoming)

The time spent in each drought class for the SPI3 indicator



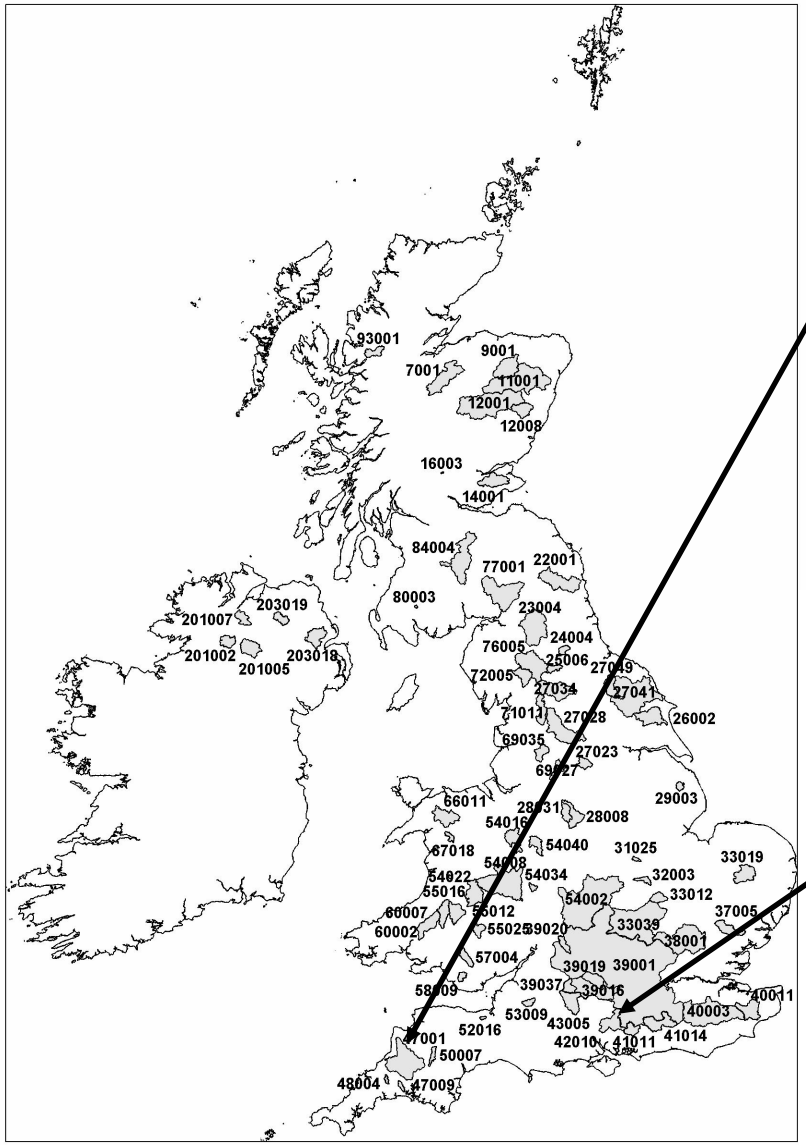
Future rainfall drought (Vidal and Wade, forthcoming)

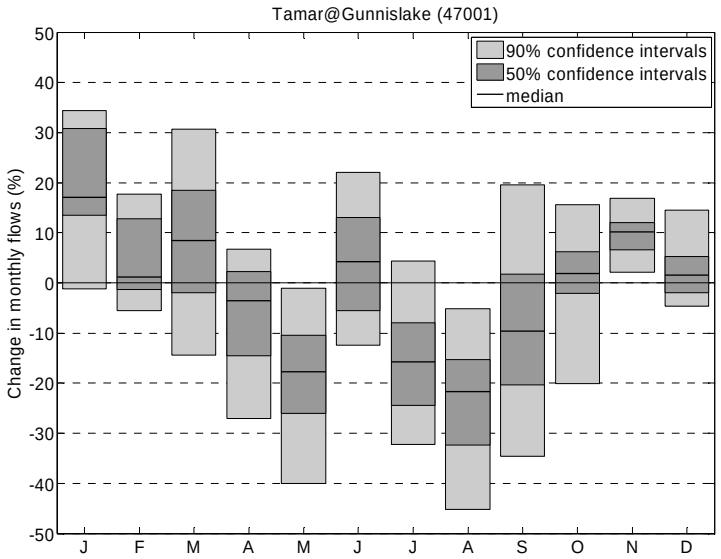
The time spent in each drought class for the SPI12 indicator



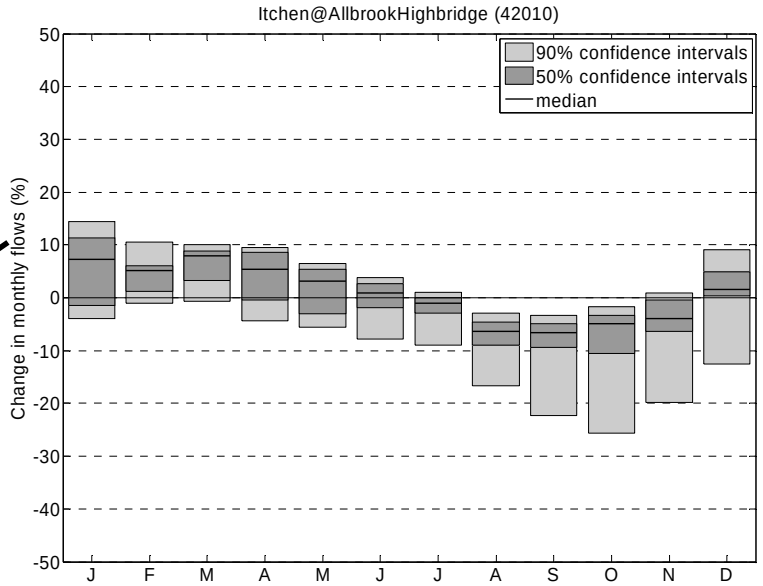
Prospects for river flows – role of storage

Multi-model, A2 scenario, 2020s (UKWIR, 2006)





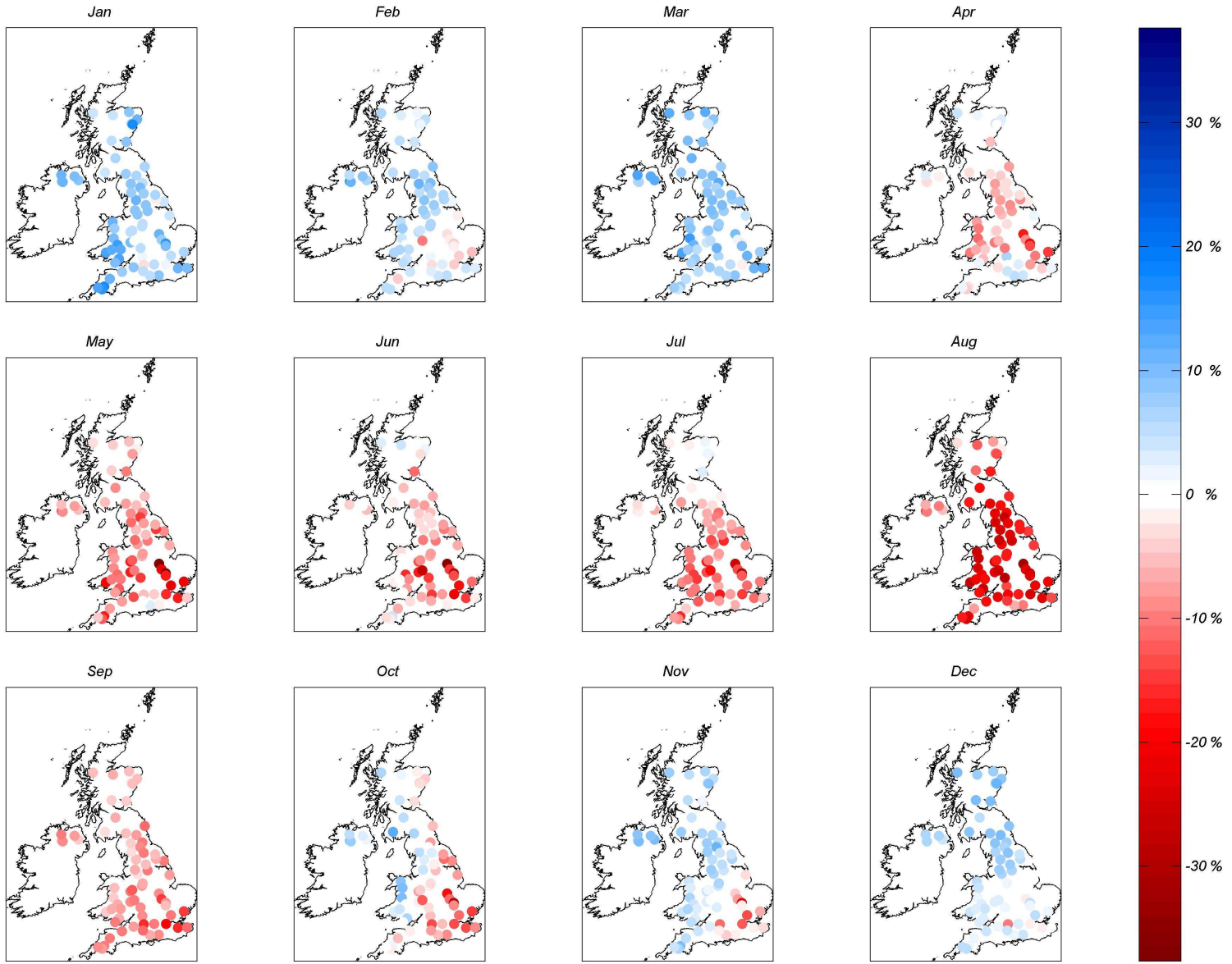
BFI=46%



BFI=96%

Average changes in monthly flow for 70 catchments

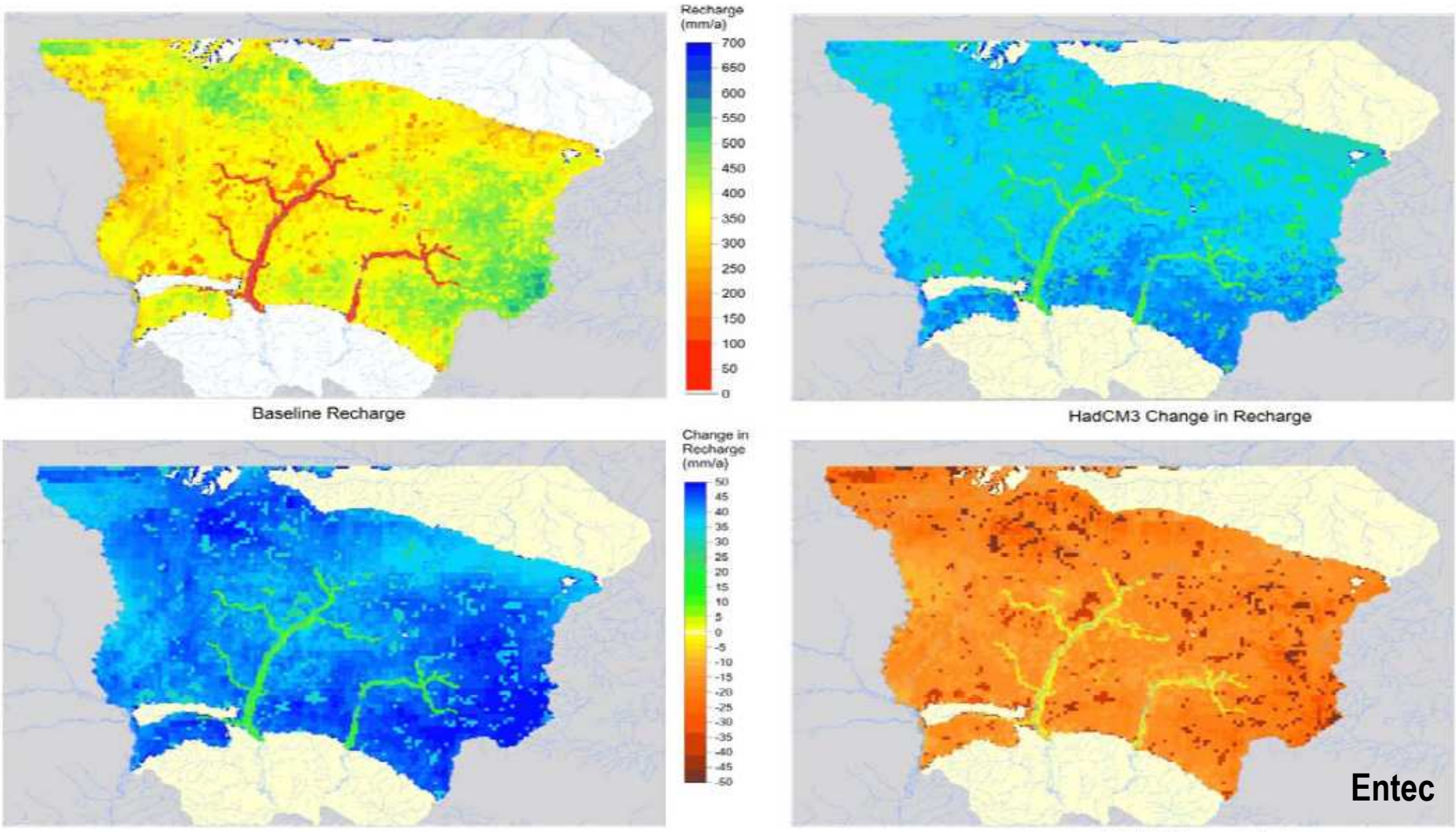
Multi-model, A2 scenario, 2020s (UKWIR, 2007)



Prospects for recharge – little change but longer groundwater recession

Multi-model. A2 scenario. 2020s (UKWIR. 2007)

Figure 3.10 – Differences in Long Term Average Recharge in the Test Catchment using Alternative GCMs

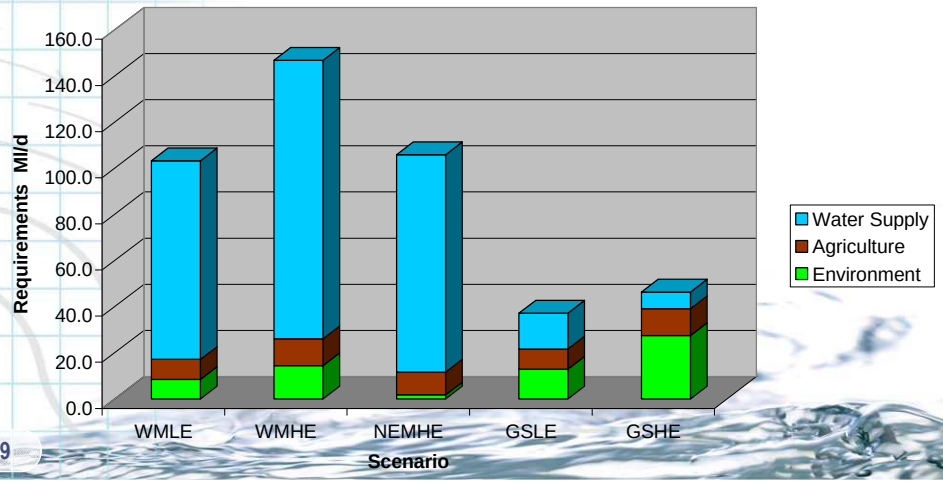


Prospects for water resources drought

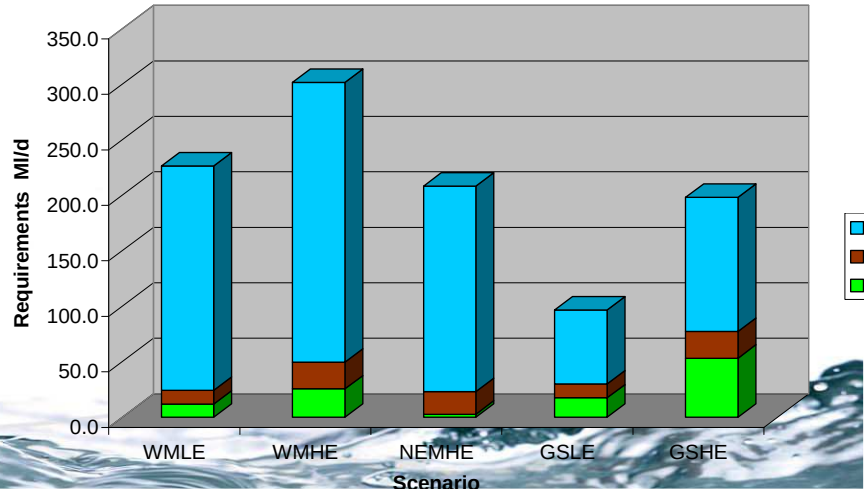
Water futures for the South East (Wade et al., 2006)

2020s	2050s	2080s
Small increase in the demand (2%) for water due to climate change Large increases in demand for water in 'growth areas' due to increasing population/households Potential supply-demand deficits of 4 to 15% in the SE. Potential for additional investment ca. £50M per water resources zone in development 'hot-spots.'	Increase in demand (4%) due to climate change Increases in demand depending on socio-economic scenario Potential supply-demand deficits of 7 to 32 % in SE	Further increases in demand due to climate change Overall increases depending on socio-economic scenario Potential supply-demand deficits of 16 to 46% in SE

Water Futures: 2050s resource requirements =f(climate change, socio-economic change)



Water Futures: 2080s resource requirements =f(climate change, socio-economic change)



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Conclusions

- The drought 2004/5 to 2006 was the result of several dry winters and low winter recharge
- In a warmer climate winters will be wetter and summers drier - dry winters will still occur
- Short droughts will increase three-fold (Aut/Sum/Spr)
- River flows affected by change in seasonal climate and catchment characteristics – higher flows and recharge will be 'squeezed' into a shorter period – longer recessions
- Water resources drought affected by WRZ characteristics (storage/licence), changes in demand and **how we choose to adapt to climate change**

Example project reports & research papers

Vidal, J.P. and Wade, S.D. (2007). ***A framework for developing high-resolution multi-model climate projections: 21st century scenarios for the UK***. Int. J. Climatology (accepted).

Vidal, J.P. and Wade, S.D. (2007). ***Multimodel projections of catchment-scale precipitation regime***. J. Hydrology (submitted).

Vidal, J.P. and Wade, S.D. (2007) ***Effects of climate change of river flows and groundwater recharge: Guidelines for resources assessments and UKWIR06 scenarios.*** UKWIR Report 05/CL/04/*

Wade, S.D., Barnett, C. and Fenn, T. (2006). ***Climate change and water resources.*** Defra Cross-Regional Climate Change Impacts and Adaptation Research Programme: Topic C – Water.

Wade, S.D., Jones, P.D. and Osborn, T. (2006). ***The impacts of climate change on severe droughts. Implications for decision making.*** Environment Agency Science Report: SC040068/SR3.