

Early insight into the implications of the new UKCP09 projections to water resource planning

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Plan Design Enable

Introduction

- UK Climate Projections 2009 (UKCP09) released in July 2009
- Water industry preparing for PR09
 - Good risk management
 - Statutory duty to consider climate change in WRMPs
- Reflect on relationship between climate and water resources planning
- Early insights into use of UKCP09: challenges and opportunities

Contents

- UKCP09 and benefits
- Climate in water resources planning
- Experience of PR09
- Comparison of UKCP09 with water industry scenarios
- Issues of using UKCP09 in water resources planning
- Look forward

UK climate projections 2009 (UKCP09)

Jenkins *et al.* (2009). See: <http://ukclimateprojections.defra.gov.uk>

Figure 5: A schematic diagram showing the progression from UKCIP02 to UKCP09, using temperature as an example. The single estimate of change in temperature from UKCIP02 (left, for a given emissions scenario, location, time period, etc.) gives no information about uncertainty. A range of changes in temperature from different climate models (centre) gives no information about which model to use, and only partly reflects uncertainties. The PDF given in UKCP09 (right) shows the probability of different outcomes, that is, different amounts of change in temperature.



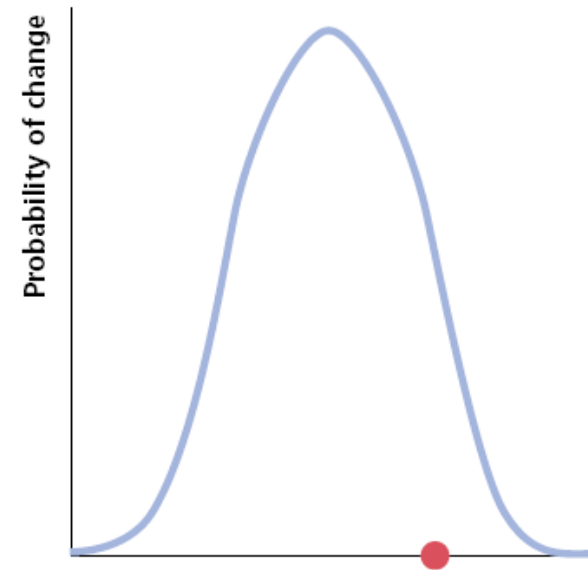
Change in temperature

UKCIP02 gave a single estimate of change in temperature



Change in temperature

Using many models would give a range of different changes in temperature, but no information on which to use



Change in temperature

UKCP09 gives the probability of different amounts of change in temperature

Benefits of UKCP09

- Explicitly represents critical uncertainties associated with greenhouse gas emissions and climate models
- Probabilities help in risk management
- Flexible future 'timeslices'
- Available for whole of UK at 25 sq km resolution
- National standard; Climate Change Act
- Extras such as weather generator

Climate in water resources planning

Supply = demand + headroom

Supply (dry year) = demand (dry year + peak conditions) +
uncertainties

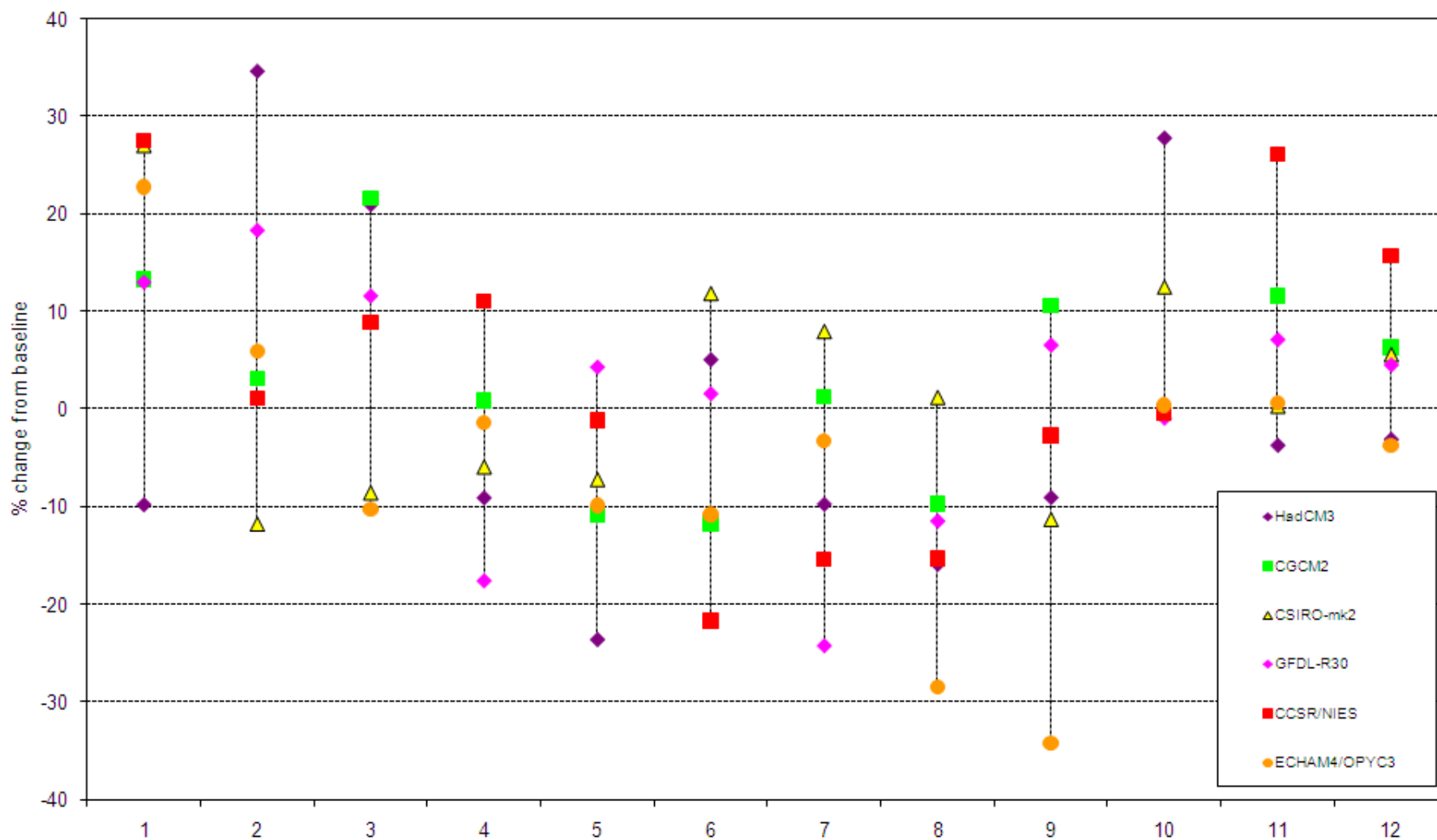
Supply (dry year + mean CC impact) = demand (dry year +
mean CC impact + peak conditions) + uncertainties (inc.
climate change)

PR09: preparation and UKWIR06

- Focus on supply-side (biggest impact and uncertainties)
 1. Extending historical record e.g. dry period in 1920s
 2. Climate change scenarios: UKWIR06
- UKWIR06 deterministic but based on several climate models

UKWIR06 scenarios

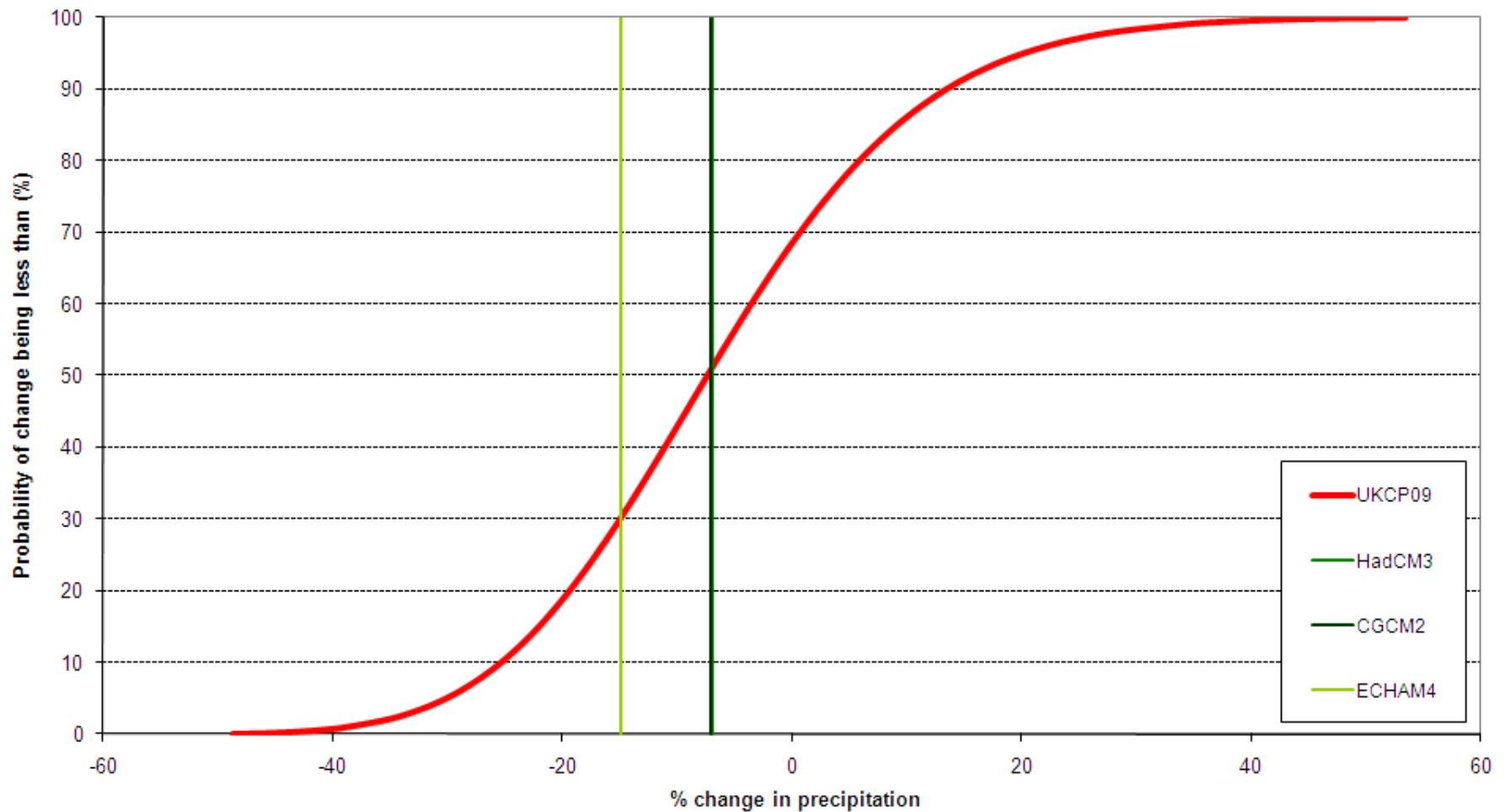
Precipitation change factors for 2020s (example analysis)



Comparison of UKCP09 with UKWIR06

Example: Thames basin

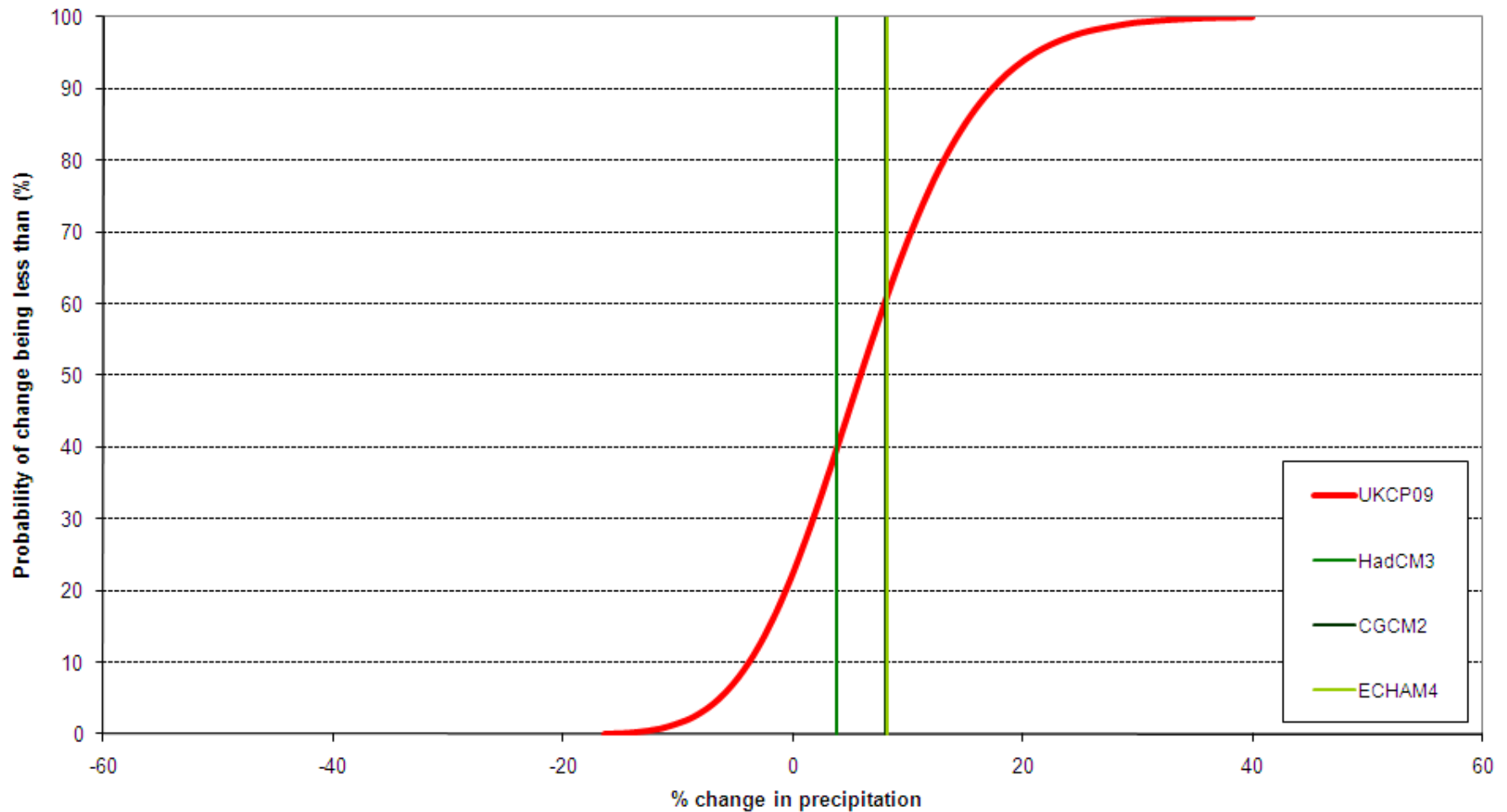
Summer



Comparison of UKCP09 with UKWIR06

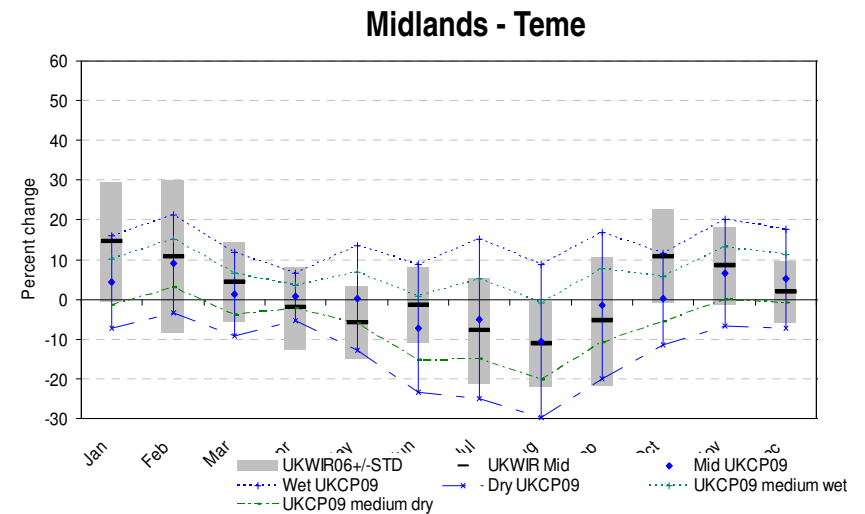
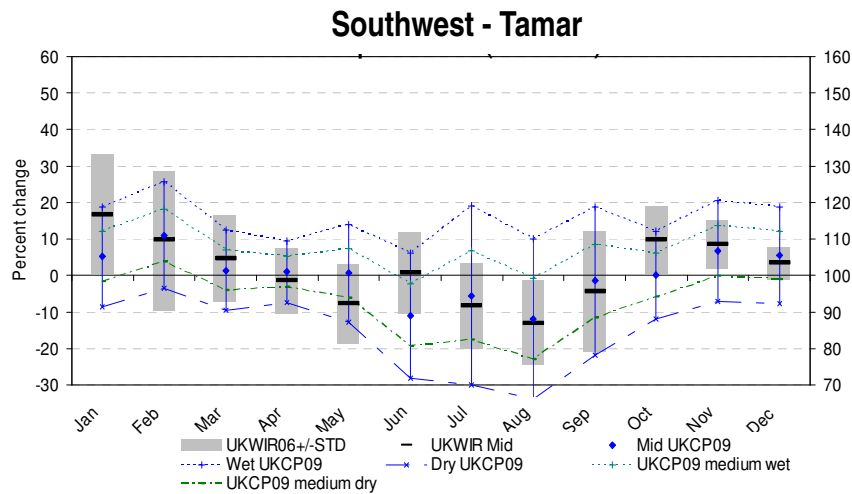
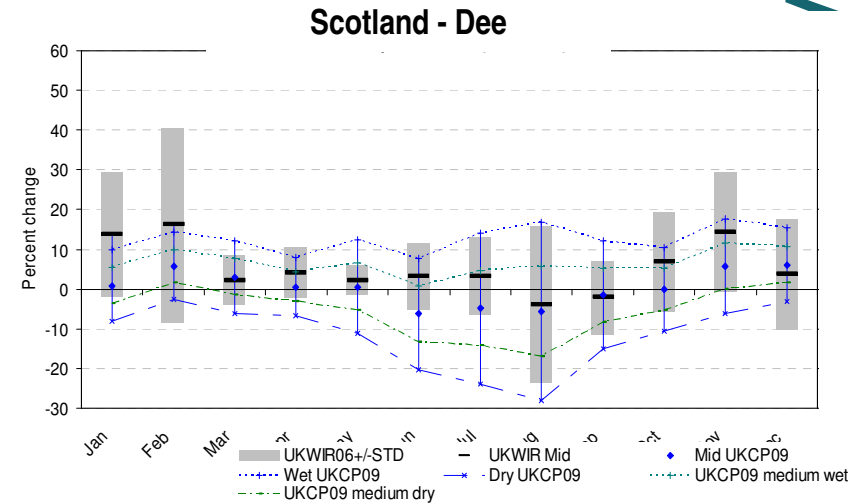
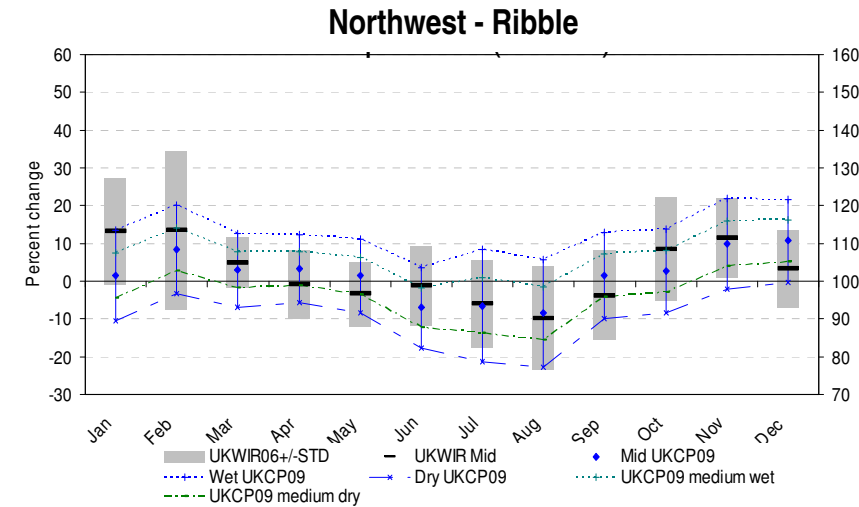
Example: Thames basin

Winter



Comparison of UKCP09 with UKWIR06

Monthly changes in rainfall for different catchments



From Rapid Assessment (UKWIR research completed by HR Wallingford)

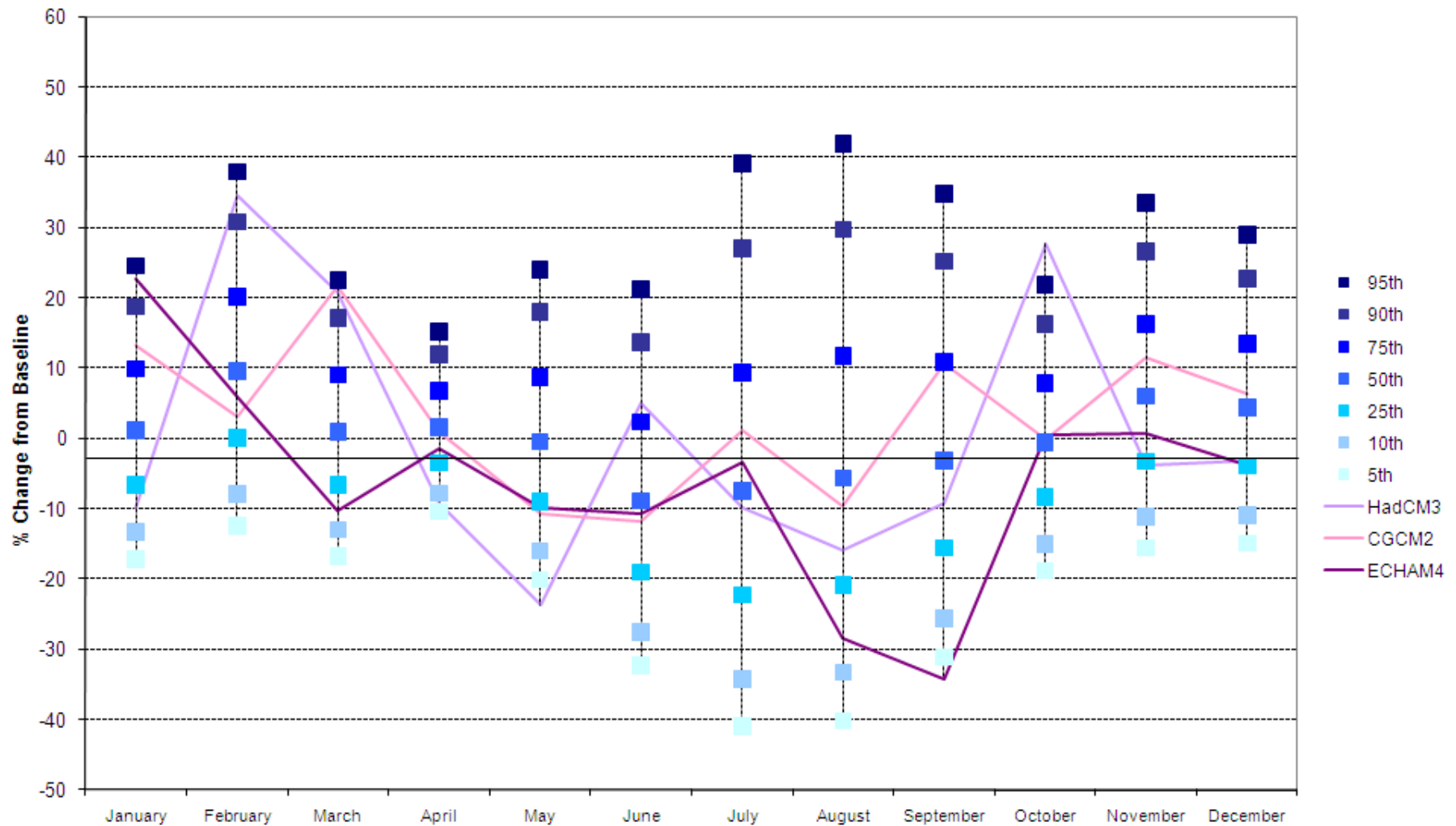
Comparison of UKCP09 with UKWIR06

- Overall message remains: wetter winters, drier summers
- Winter and autumn drier under central estimate of UKCP09 compared with UKWIR06
- Summer and spring about the same
- But pattern varies geographically
- Greater uncertainty in UKCP09, especially in summer

Comparison of UKCP09 with UKWIR06

UKCP09 probabilistic projection has 10,000 members

Impractical to run all through impact models, so sample



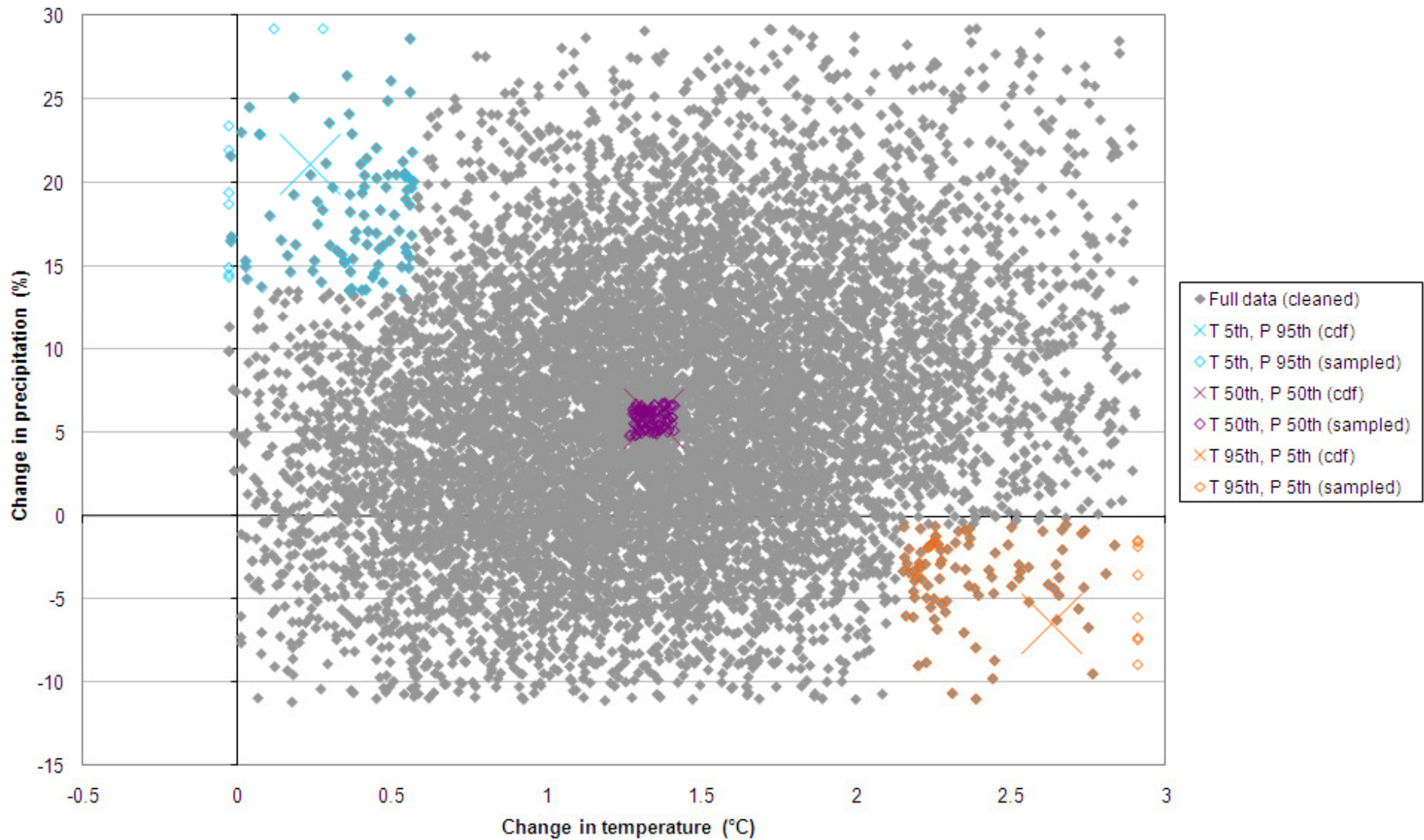
Covariance and sampling

- Not simple case of matching a given percentile for one climate variable or time period with another to give the same percentile for overall 'climate' or year, e.g.
 - 5th percentile of rainfall not necessarily = 5th percentile of temperature
 - 5th percentile of winter rainfall will not necessarily correspond with the 5th percentile for other seasons

Covariance and sampling

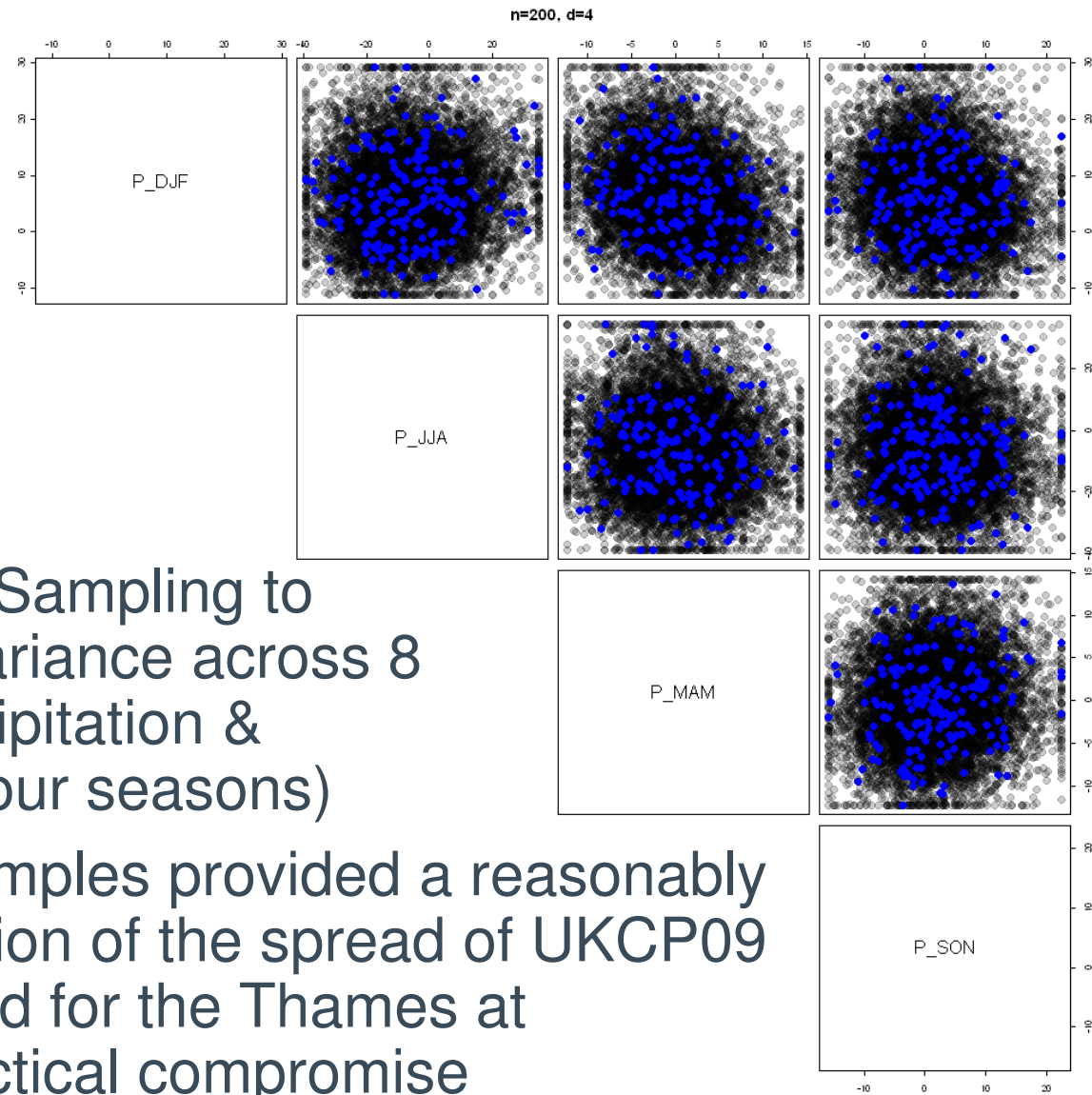
Example: Thames basin

Winter



UKWIR Rapid Assessment

UKWIR
research
completed by
HR Wallingford



- Latin Hypercube Sampling to examine the covariance across 8 dimensions (precipitation & temperature for four seasons)
- Found that 20 samples provided a reasonably good representation of the spread of UKCP09 uncertainty (tested for the Thames at Kingston) - a practical compromise

Issues with UKCP09 in WRP

- Interdependence of variables and sampling
 - ‘Final’ approaches to be determined
- Requirement for lots of impact model runs
- Spatial coherence limited to pre-set areas
- Does not offer any new insight into summer convective events or inter annual variability

Towards PR14... and UKCP14?

- Learning how best to use UKCP09
- Avoid distraction of precision; instead focus on understanding sensitivity of system
- Improve approaches to dealing with uncertainty: in modelling process, in investment optimisation
- A more sophisticated approach to including climate and climate change e.g. change in extremes, stochastic approach?
- Recognise geography of risk: companies, investors, customers, climate ...and regulate accordingly
- Collaborative approach: in step and on time

Acknowledgements

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Data from UKCP09 and UKWIR06 scenarios

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