Future Changes in Rainfall

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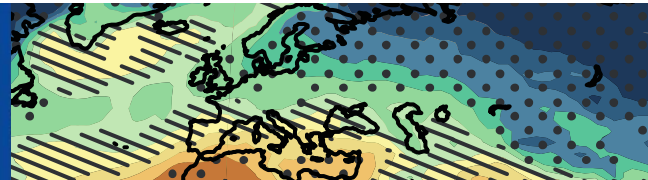
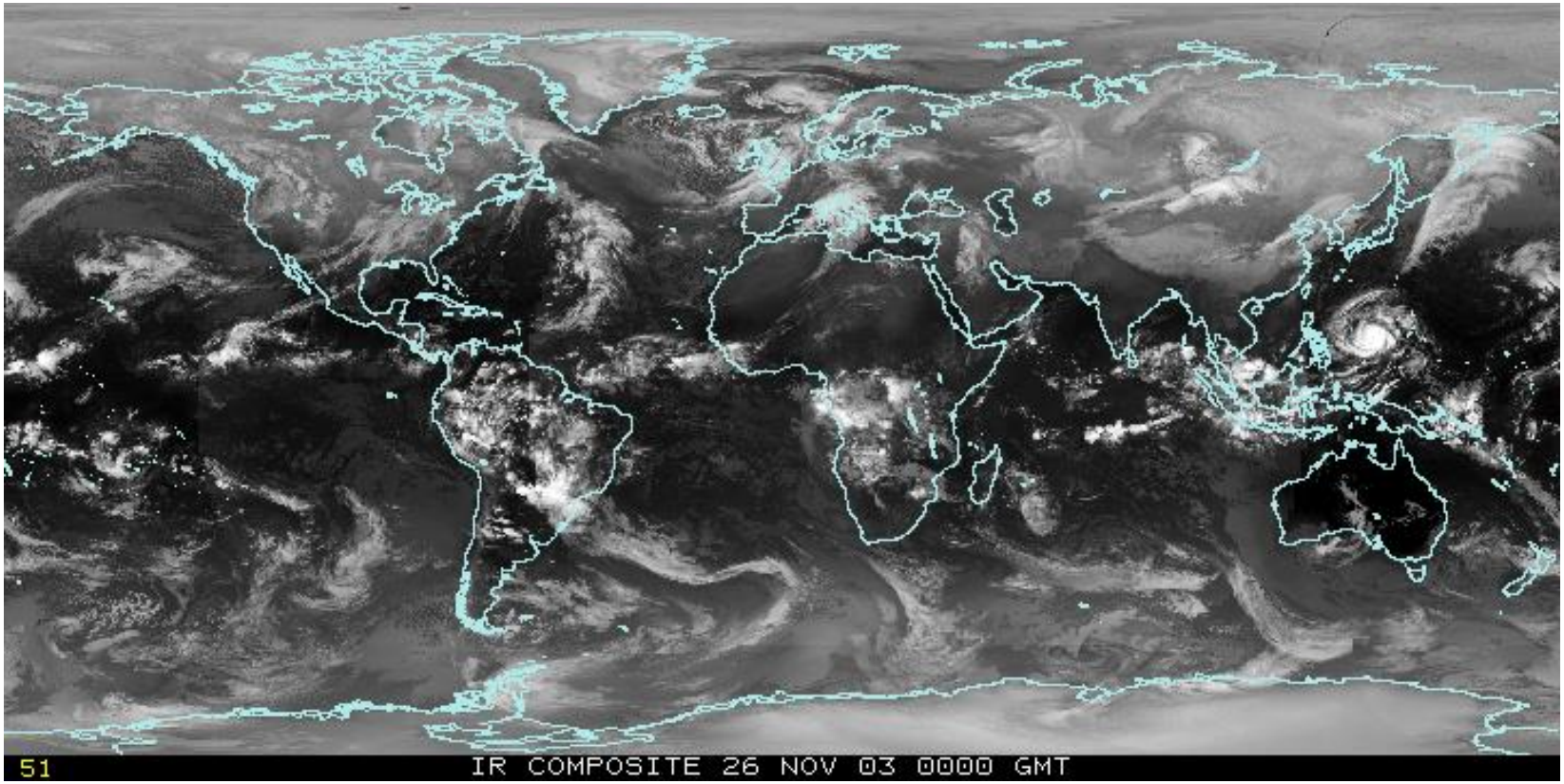
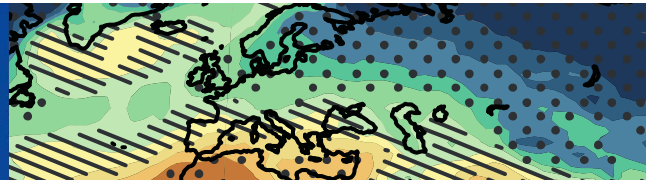


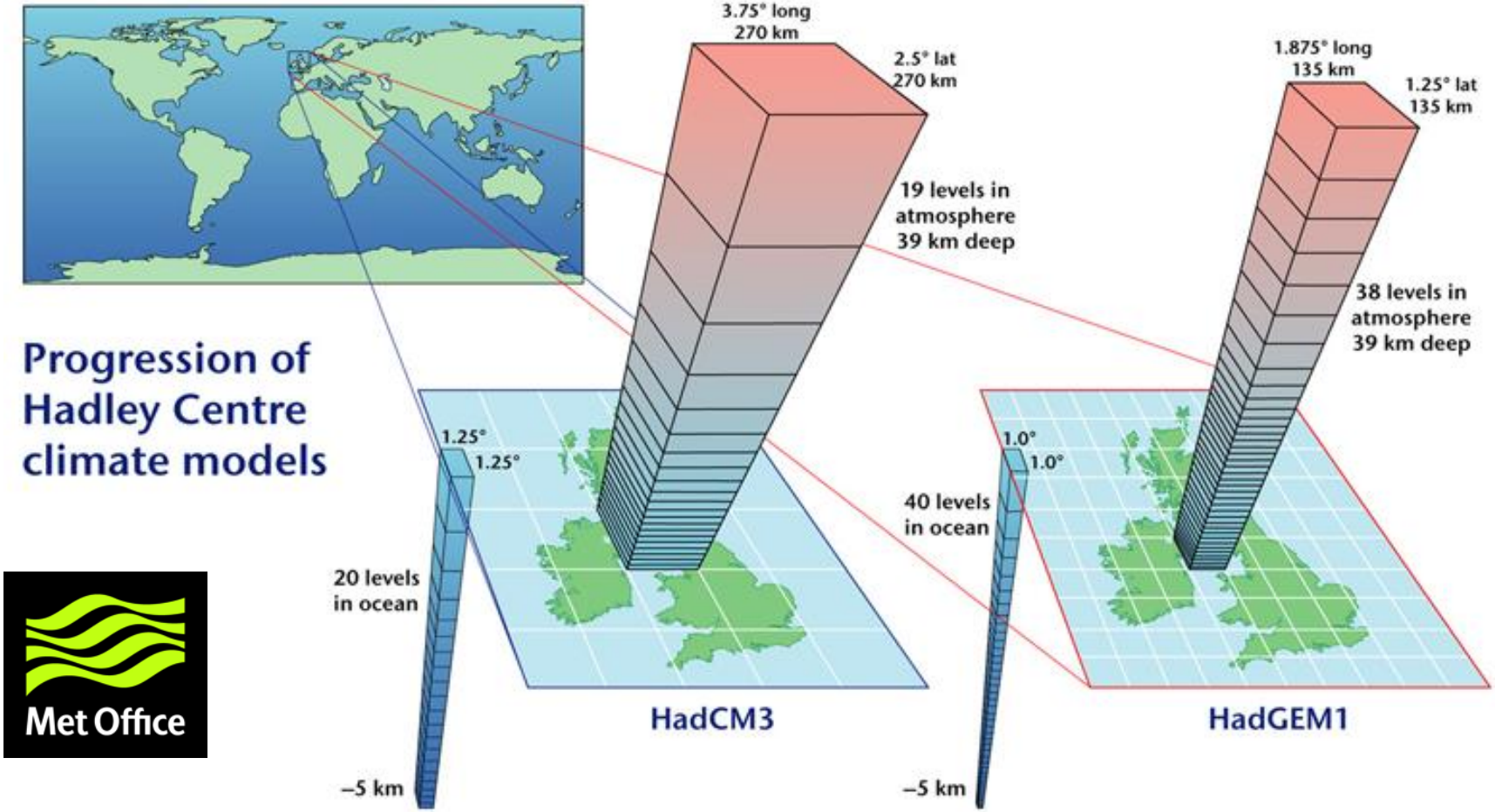
Rainfall Processes



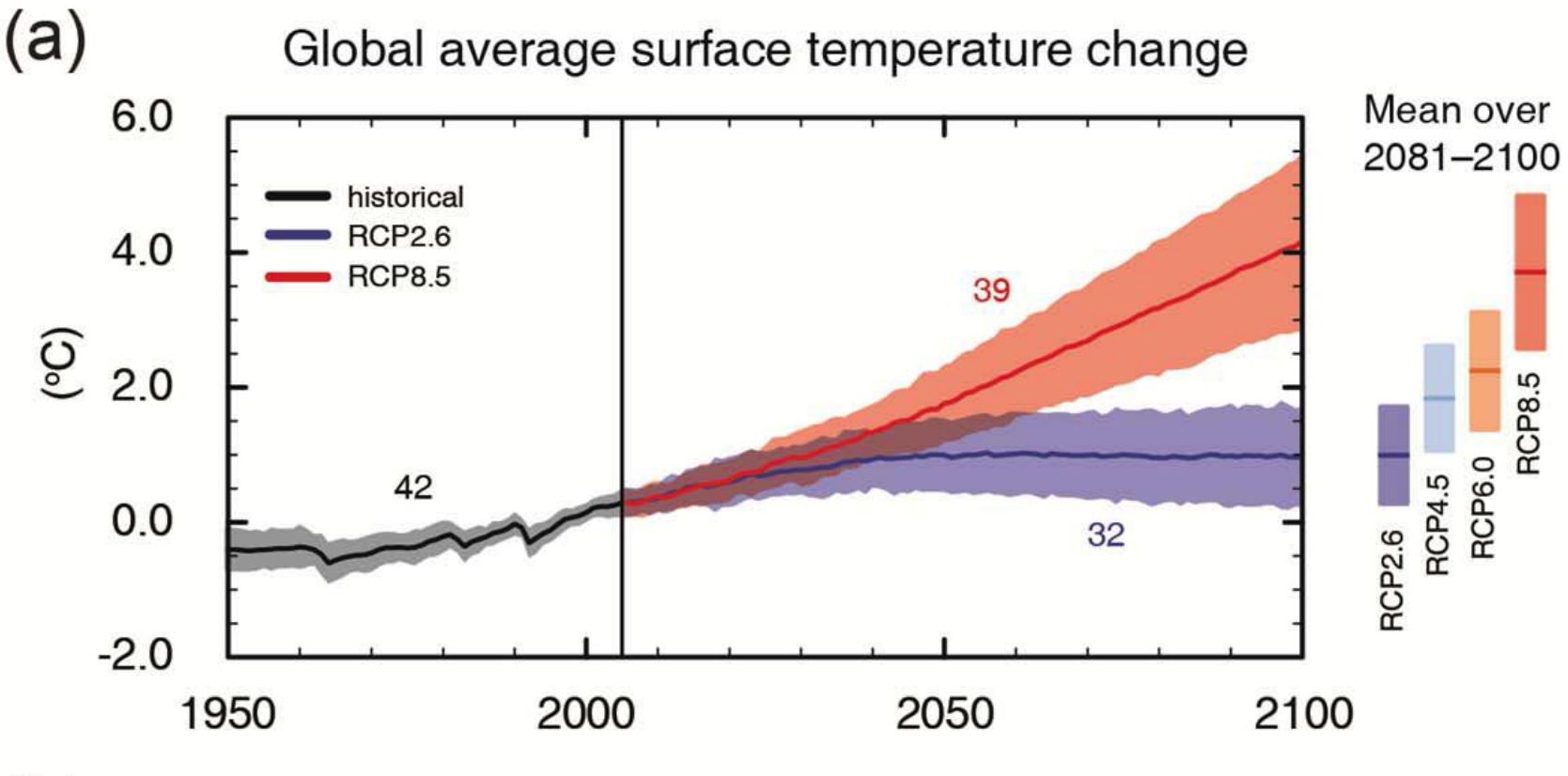
University of Wisconsin-Madison



Climate Models



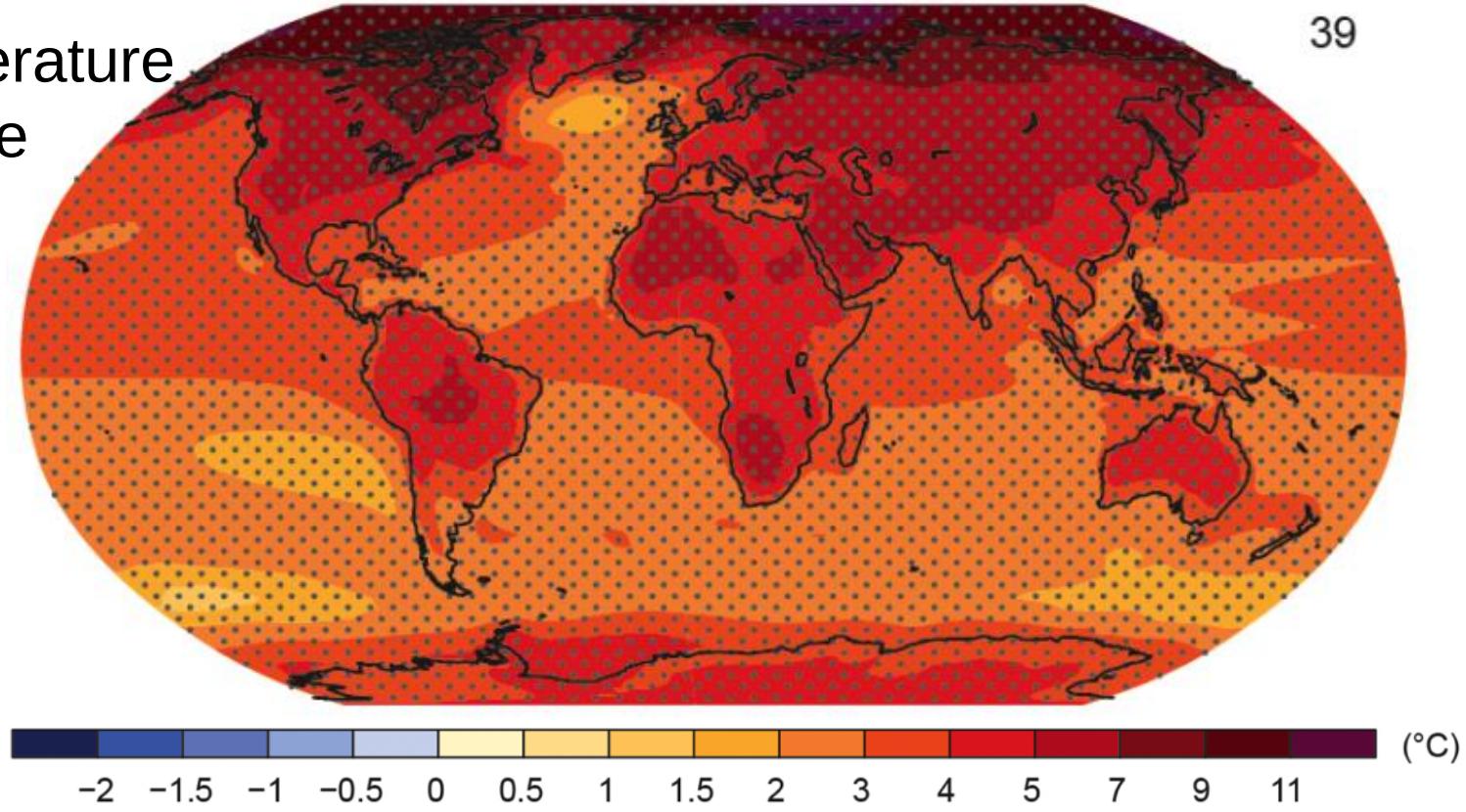
Global Mean Surface Air Temperature Change



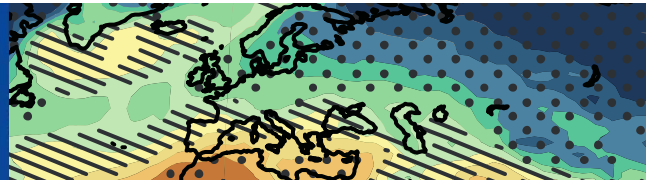
Source: Intergovernmental Panel on Climate Change 5th Assessment Report (IPCC AR5)

State-of-the-Art: IPCC AR5

Temperature change



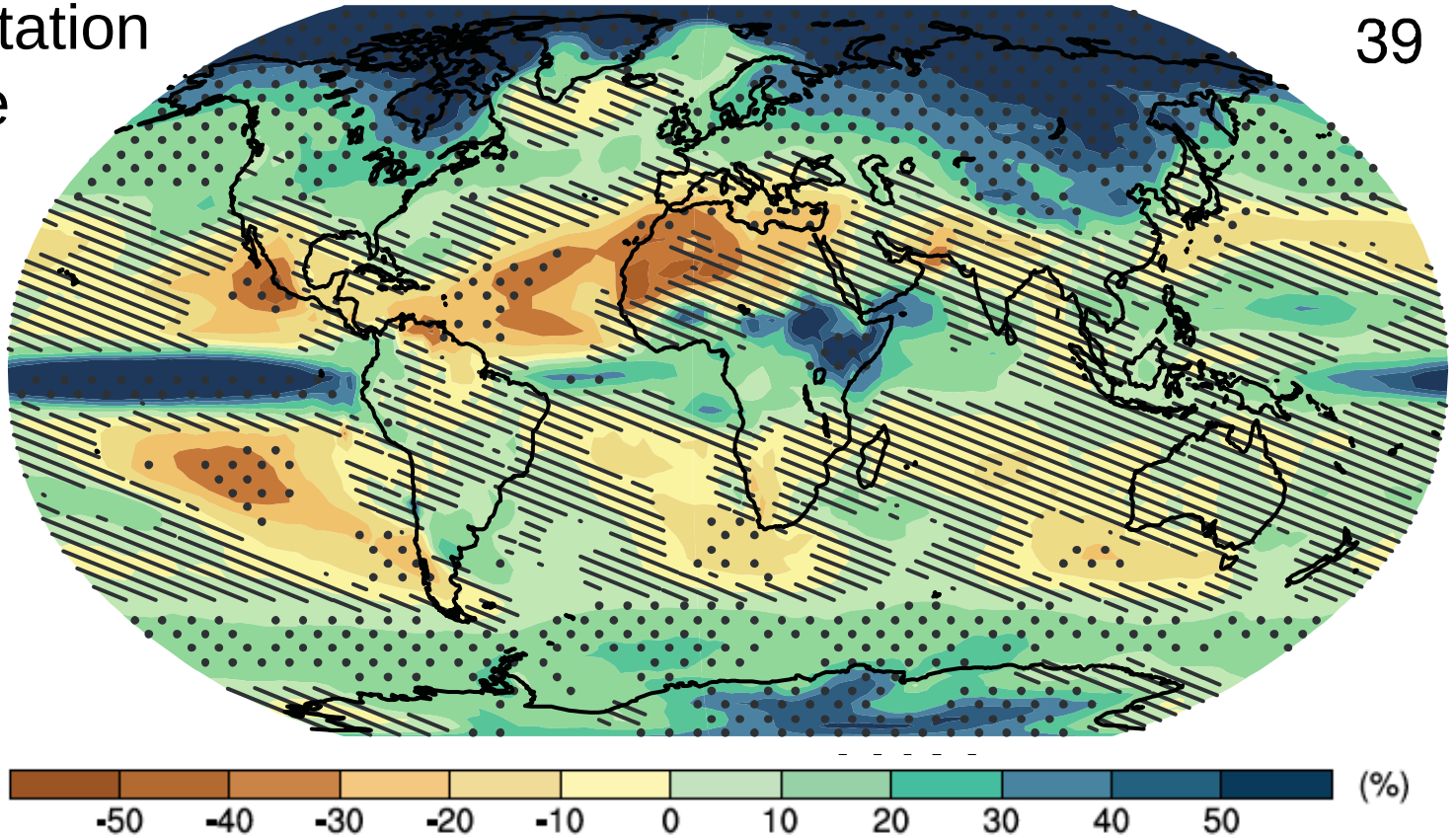
Stippling = model agreement
Hatching = low signal to noise



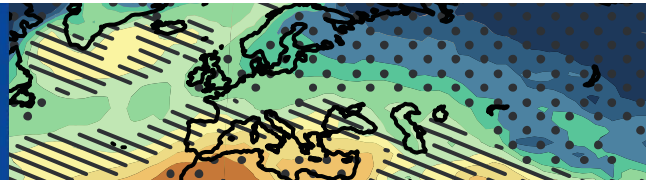
State-of-the-Art: IPCC AR5

2081-2100 - DJF

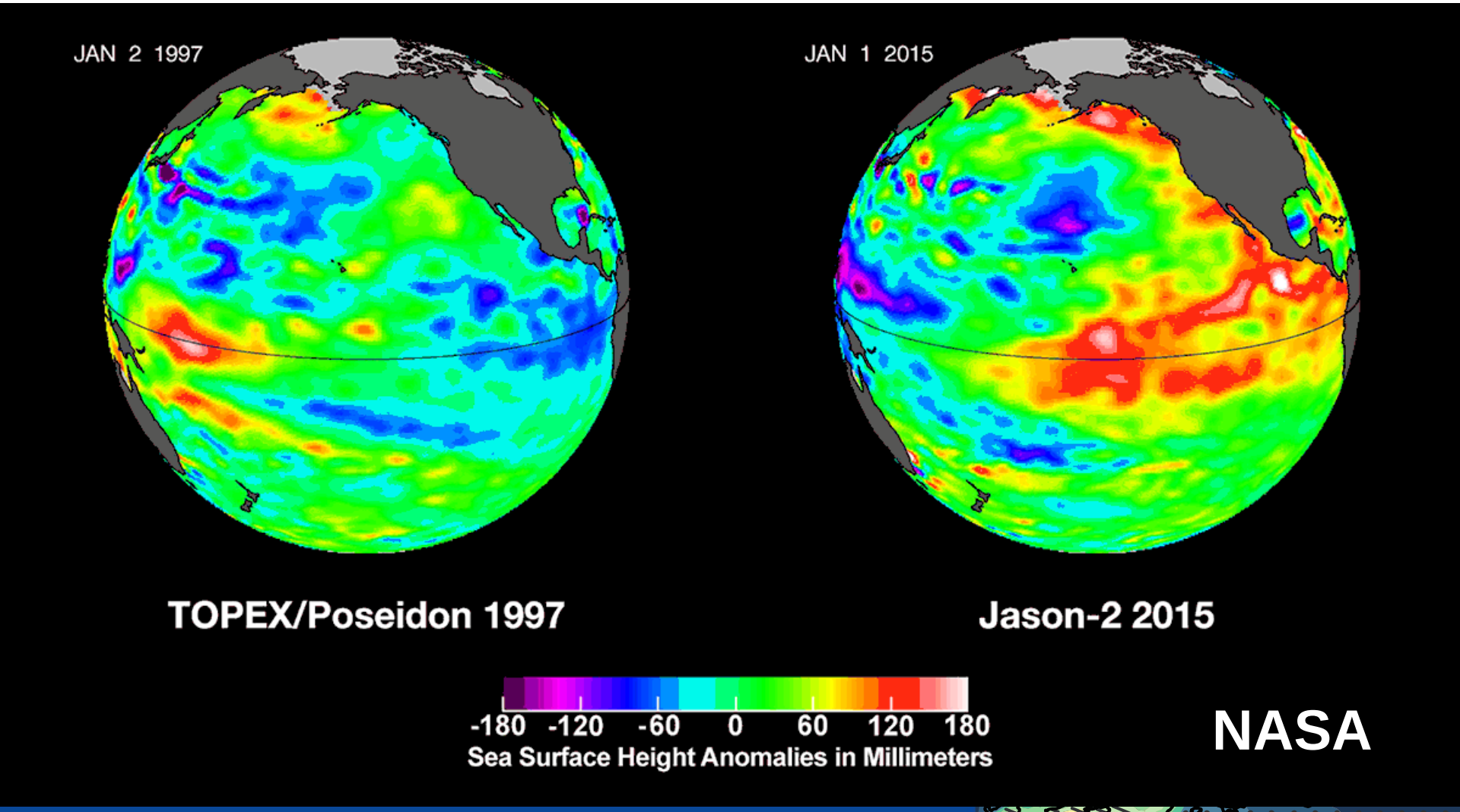
Precipitation change



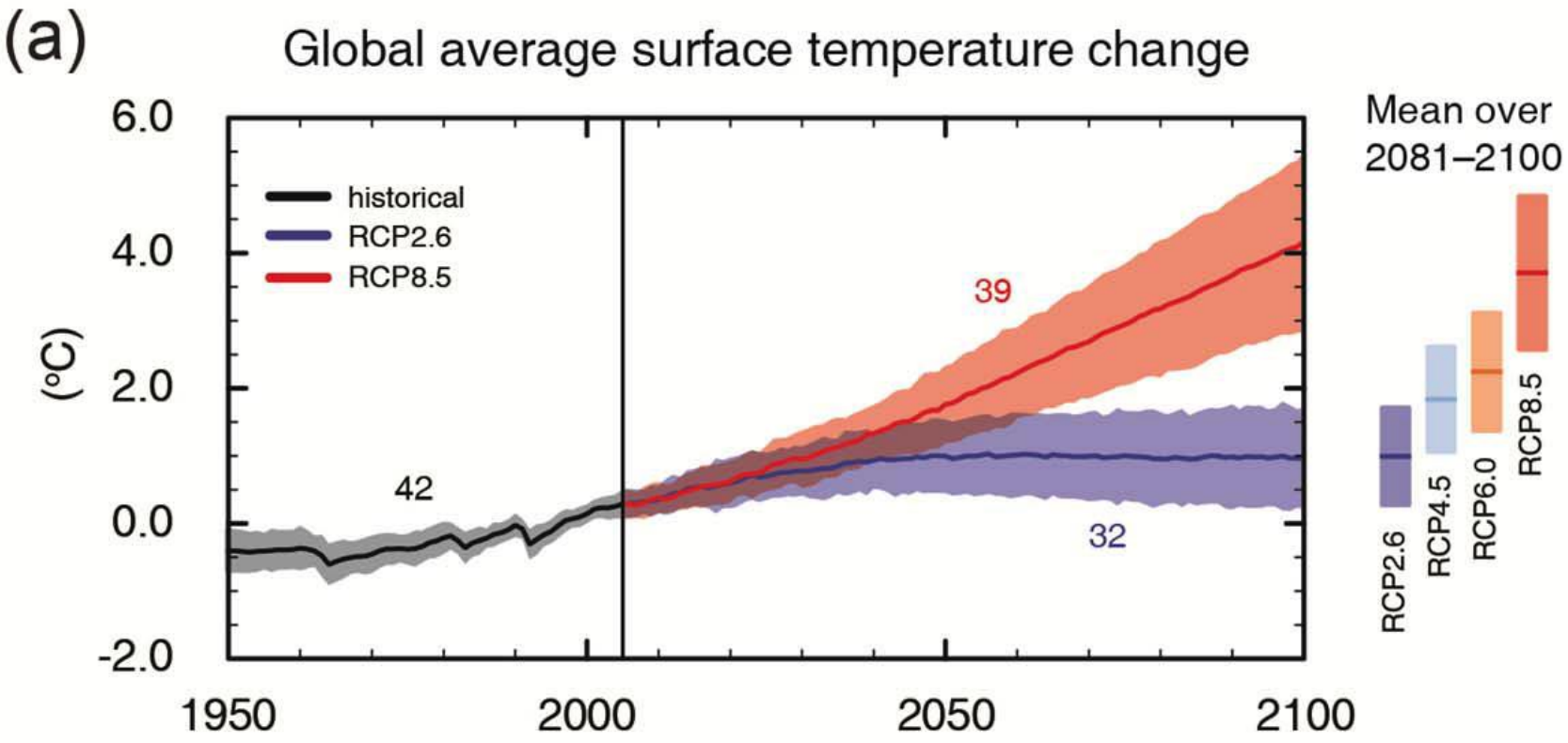
‘Some regions will experience increases, other regions will experience decreases and yet others will not experience significant changes at all’



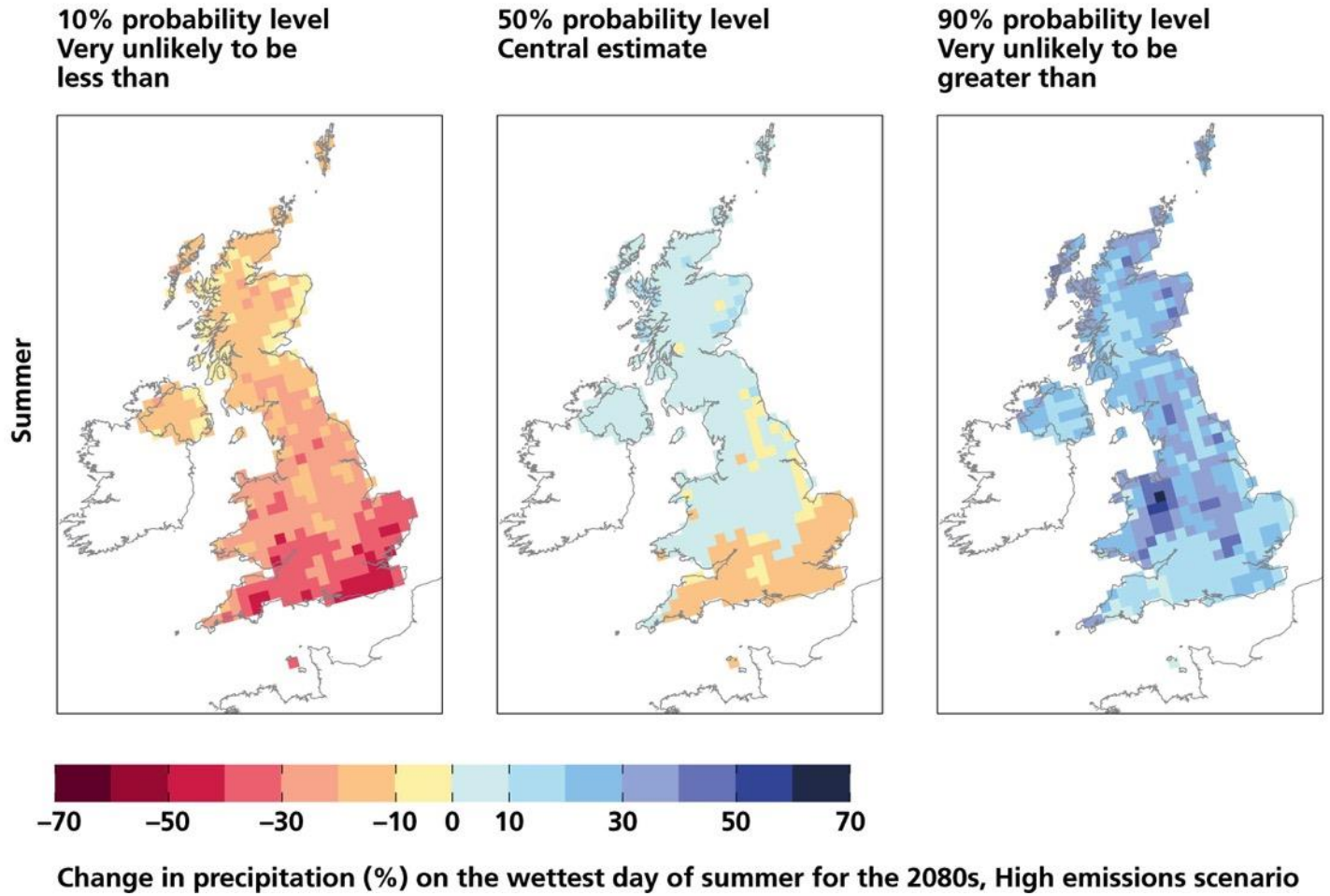
Sources of Uncertainty
1. Natural Variability



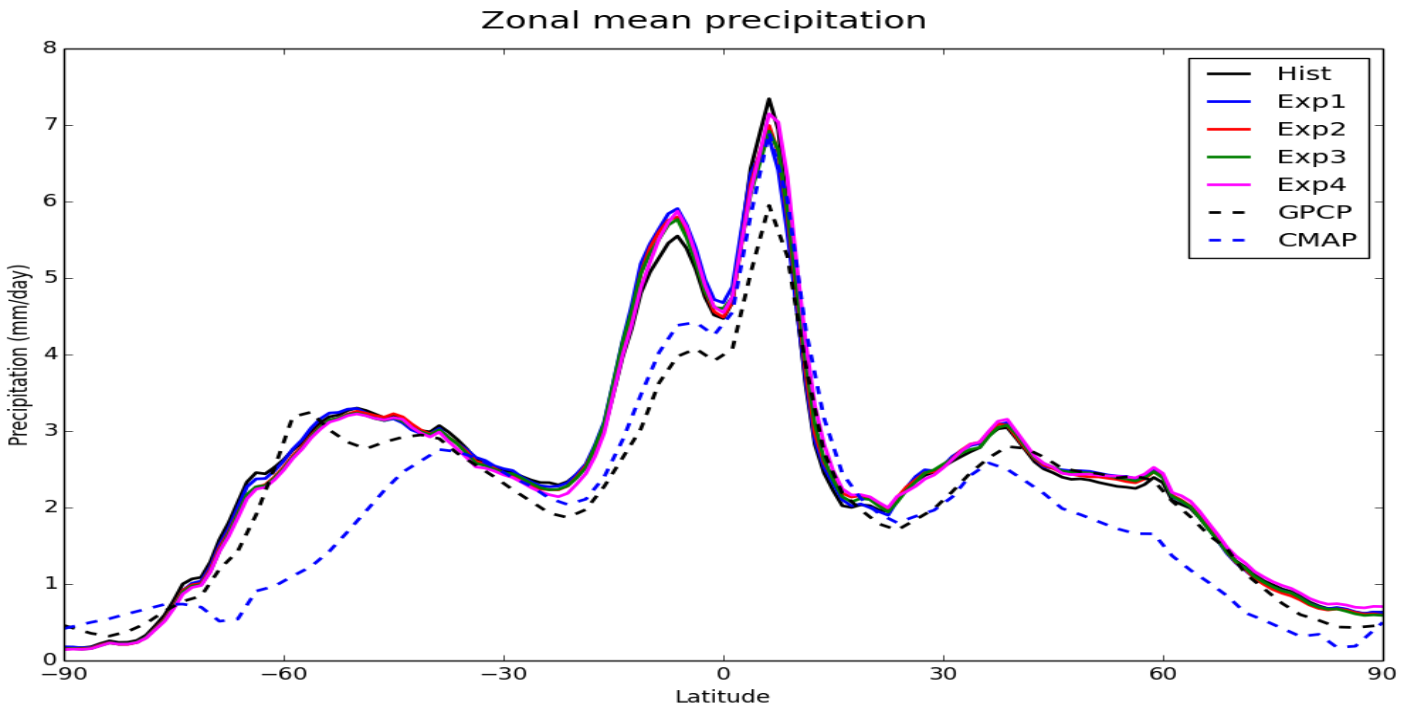
Sources of Uncertainty
2. Future Scenarios



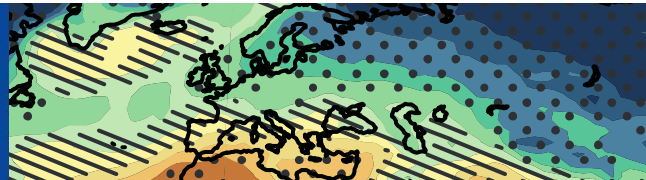
Sources of Uncertainty
3. Model Uncertainty



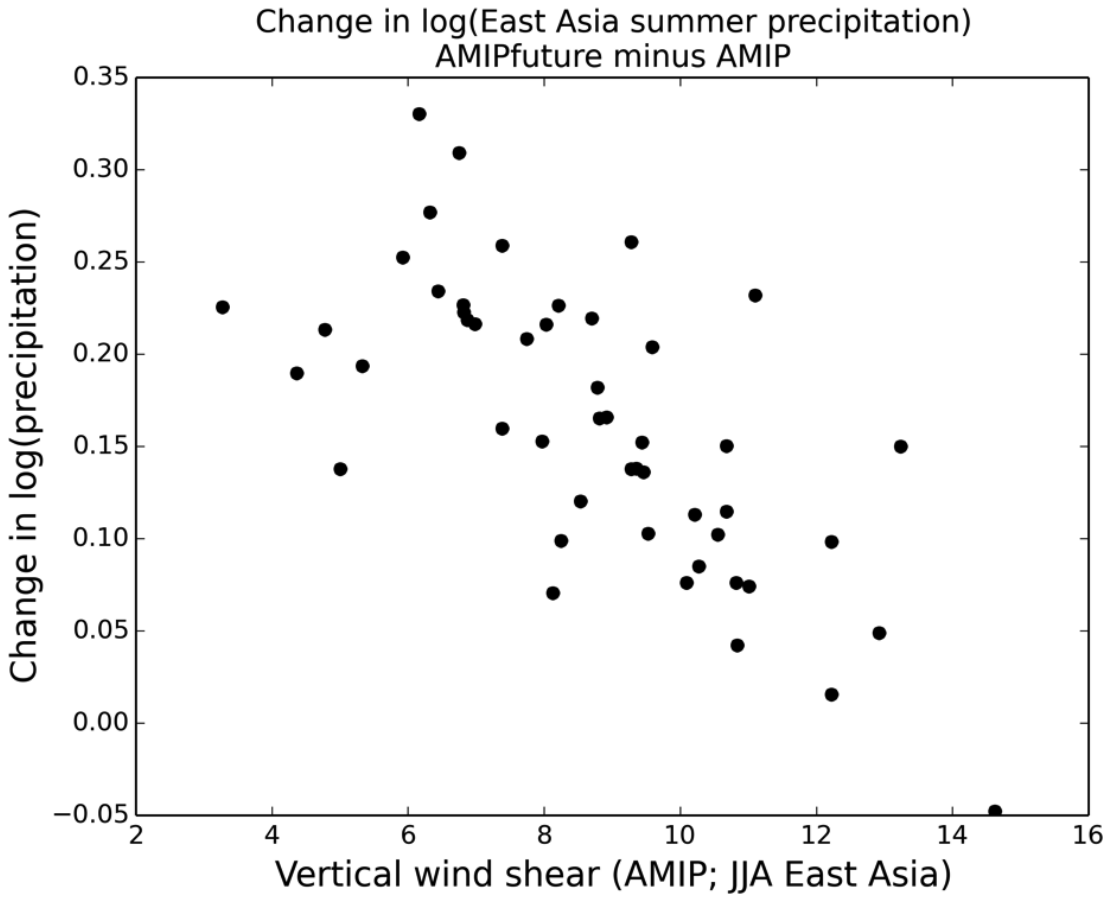
Model ‘Errors’



Hawcroft, M., J.M. Haywood, M. Collins, A. Jones, A.C. Jones, G. Stephens, Southern Ocean albedo, inter-hemispheric energy transports and the double ITCZ: global impacts of biases in a coupled model. *In press.*

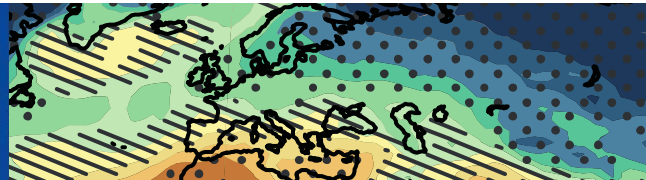


Emergent Constraints
E.g. East Asian Monsoon

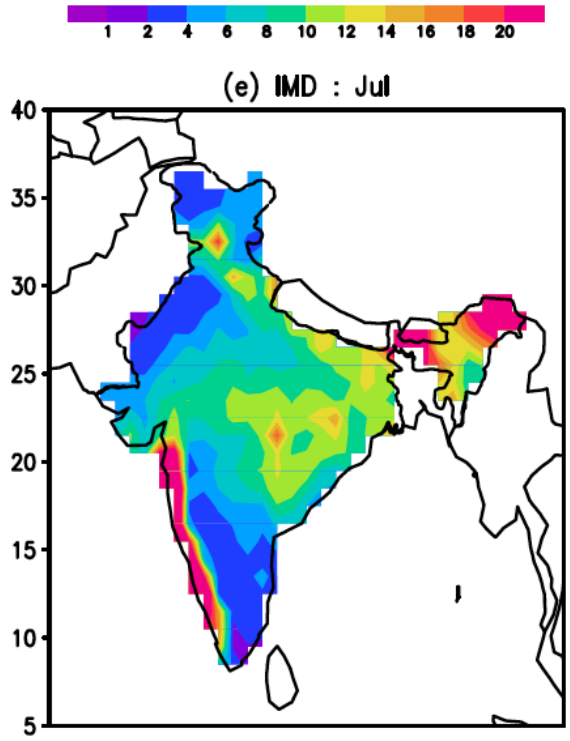


Early results from the new Met Office Perturbed Parameter Ensemble (PPE) indicating a possible emergent constraint (David Sexton)

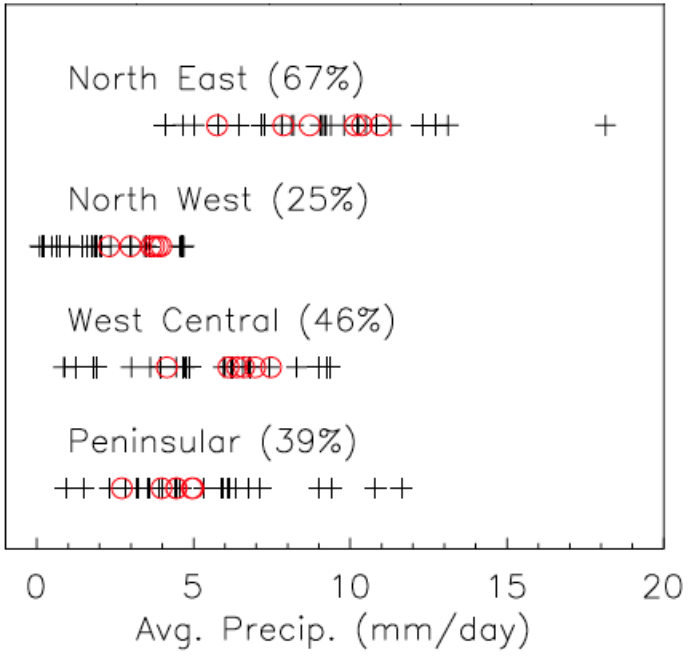
Physical explanation essential

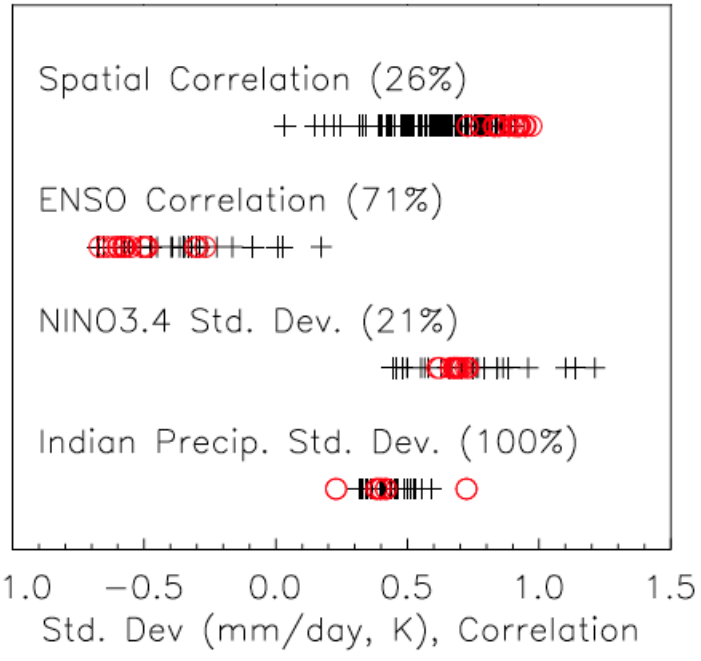


Observational Uncertainties

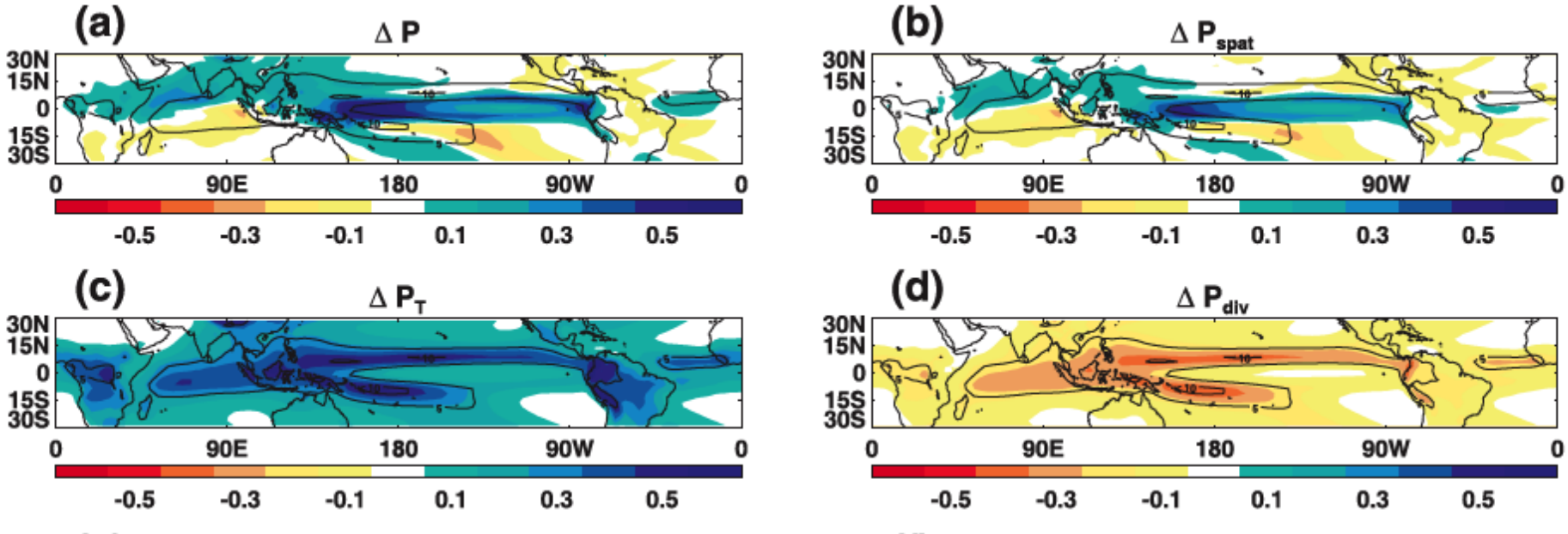


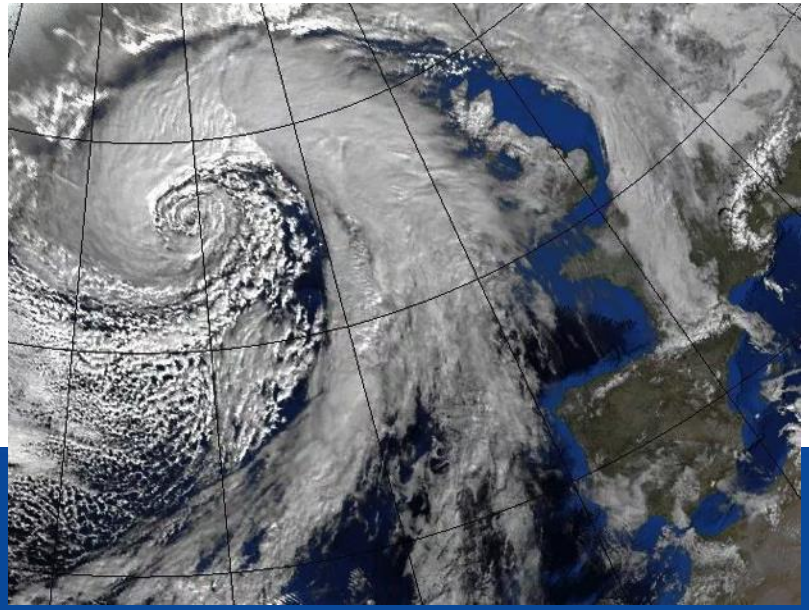
Collins et al. 2013,
Nature Climate Change



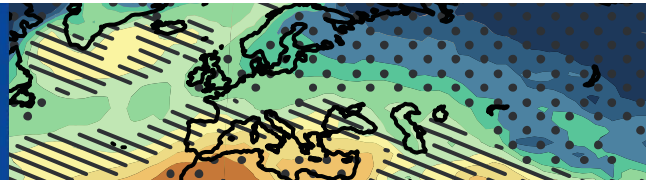


Processes Driving Changes in Rainfall





Chadwick et al. 2013



UNIVERSITY OF EXETER

Robust Projections of Real World Climate Change

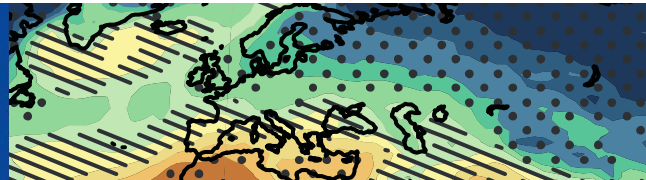
Model Hierarchy

- Full Complexity – CMIP/PPE
- Atmosphere-Slab
- Atmos. only – CMIP/PPE
- Simplified moist
- Simplified dry

Inference Techniques

- Full Bayesian MME/PPE
- Fast Bayesian
- Screening/history matching
- Process-based metrics
- Bias correction

NERC Funded



Future Changes in Rainfall

- Model uncertainty dominates in projections of future rainfall changes
- Can quantify uncertainties using statistical techniques
- Can also understand processes driving rainfall changes
- The challenge is to combine models, observations and understanding to make robust projections
- This all relates to large-scale changes, prior to any downscaling to smaller scales

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