Hydrological extremes and feedbacks – Wp1(a and b)

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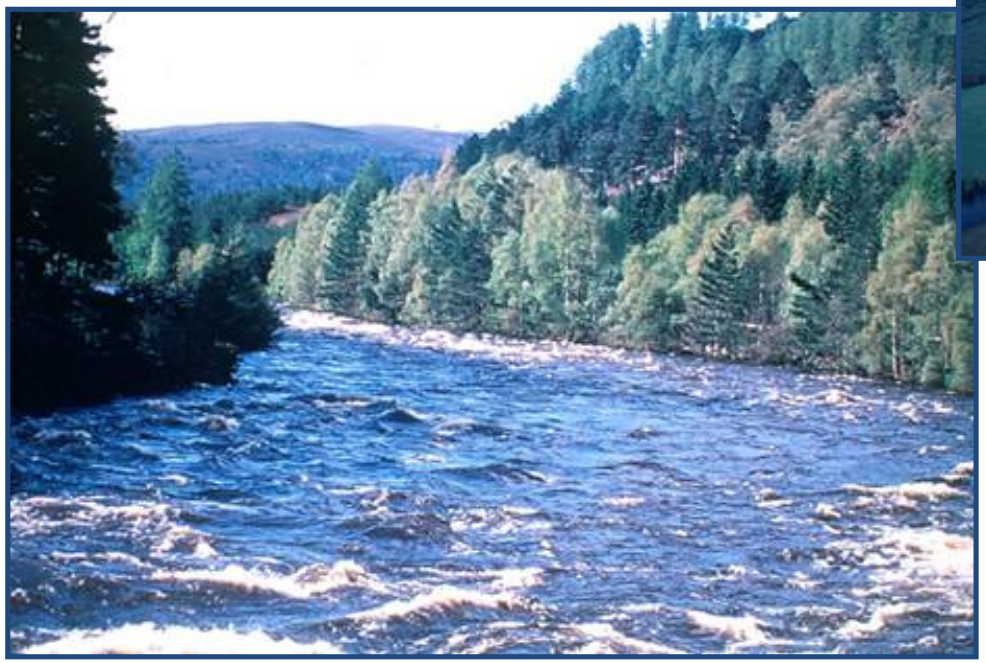
Outline

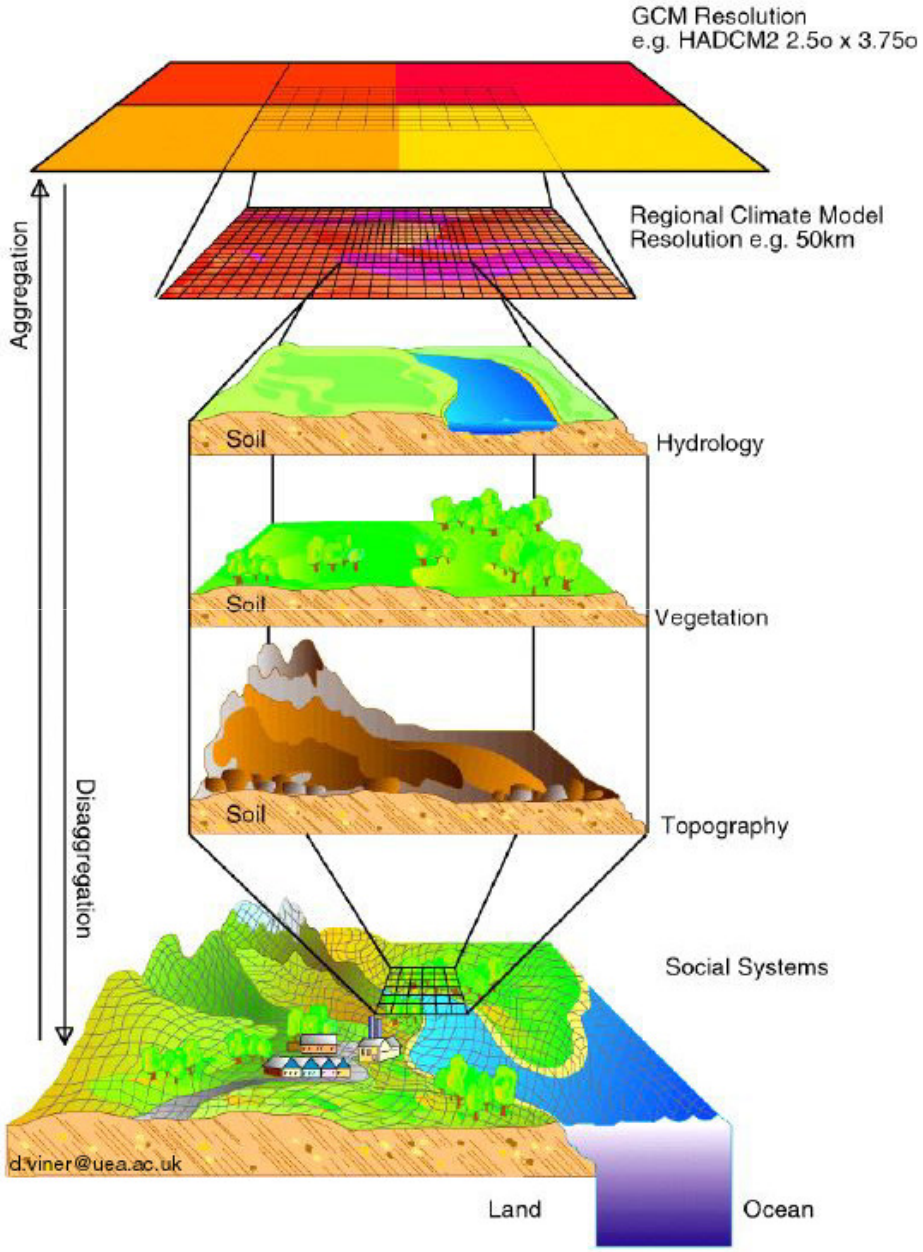
- Context
- Methodology for Wp1 (a and b)
- Progress
- Conclusions

Issues

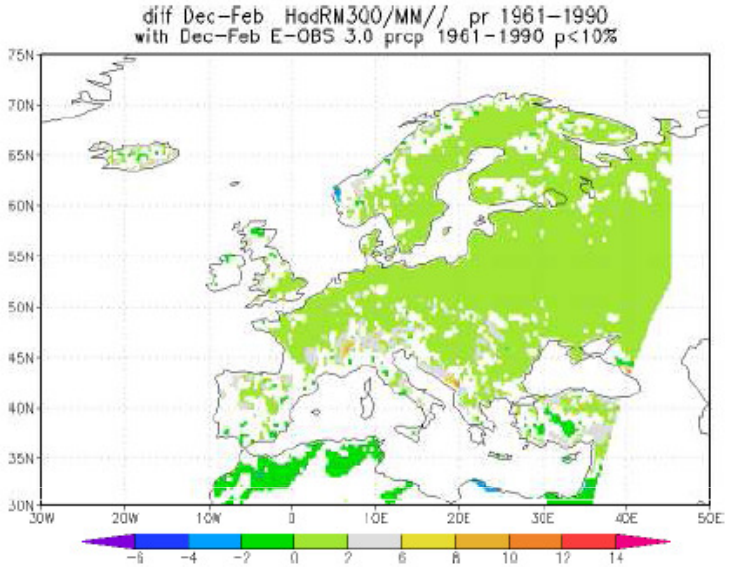


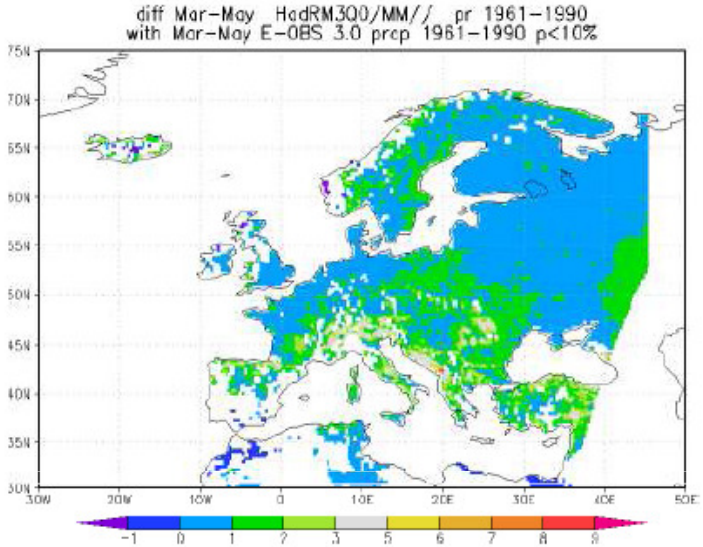
River Dee, Aberdeenshire

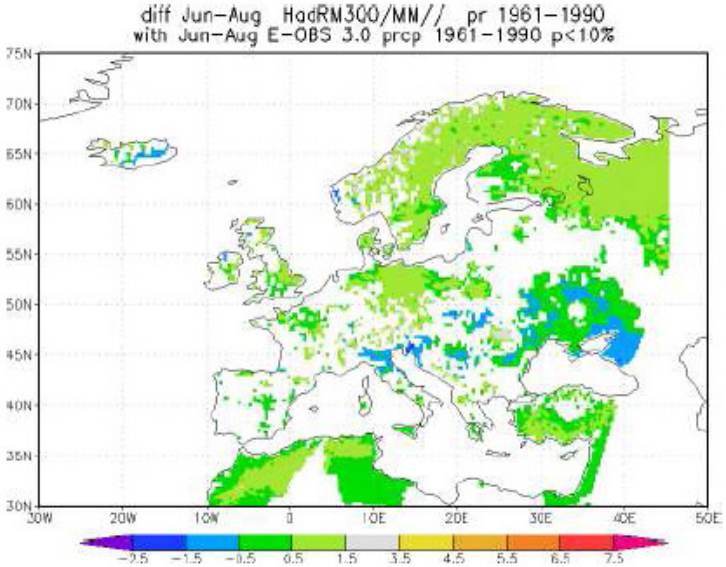
Scale problem

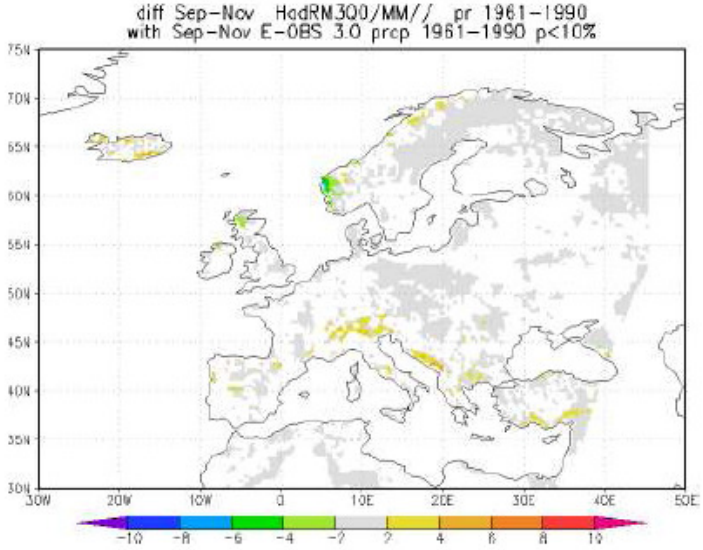


Monthly means of daily rainfall differences
HadRM3Q0 / HadCM3Q0



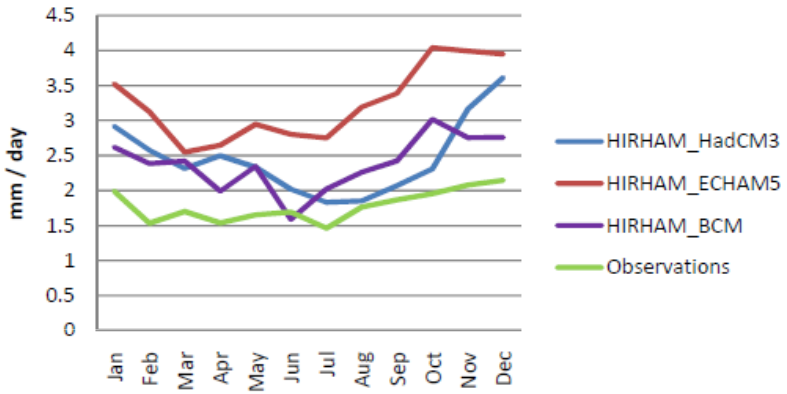




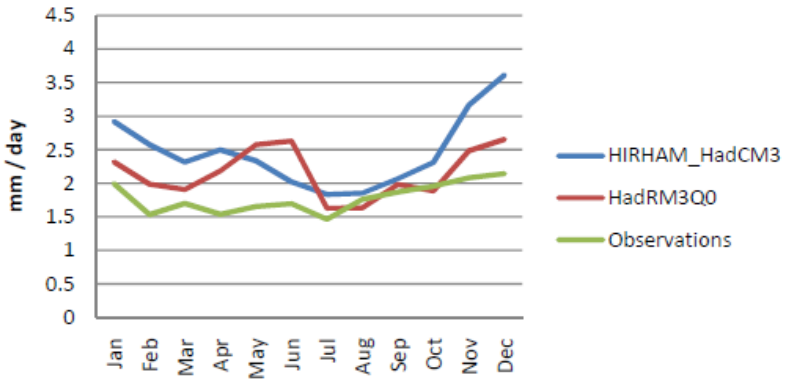


Examples of monthly averages of daily precipitation intensity: Baseline modelled data vs observations for the Thames catchment

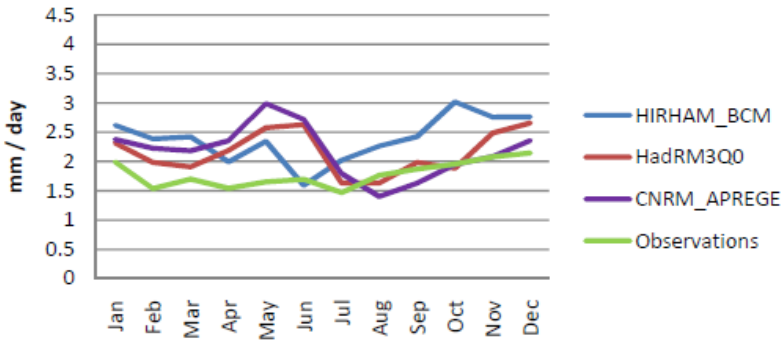
HIRHAM forced by different GCM



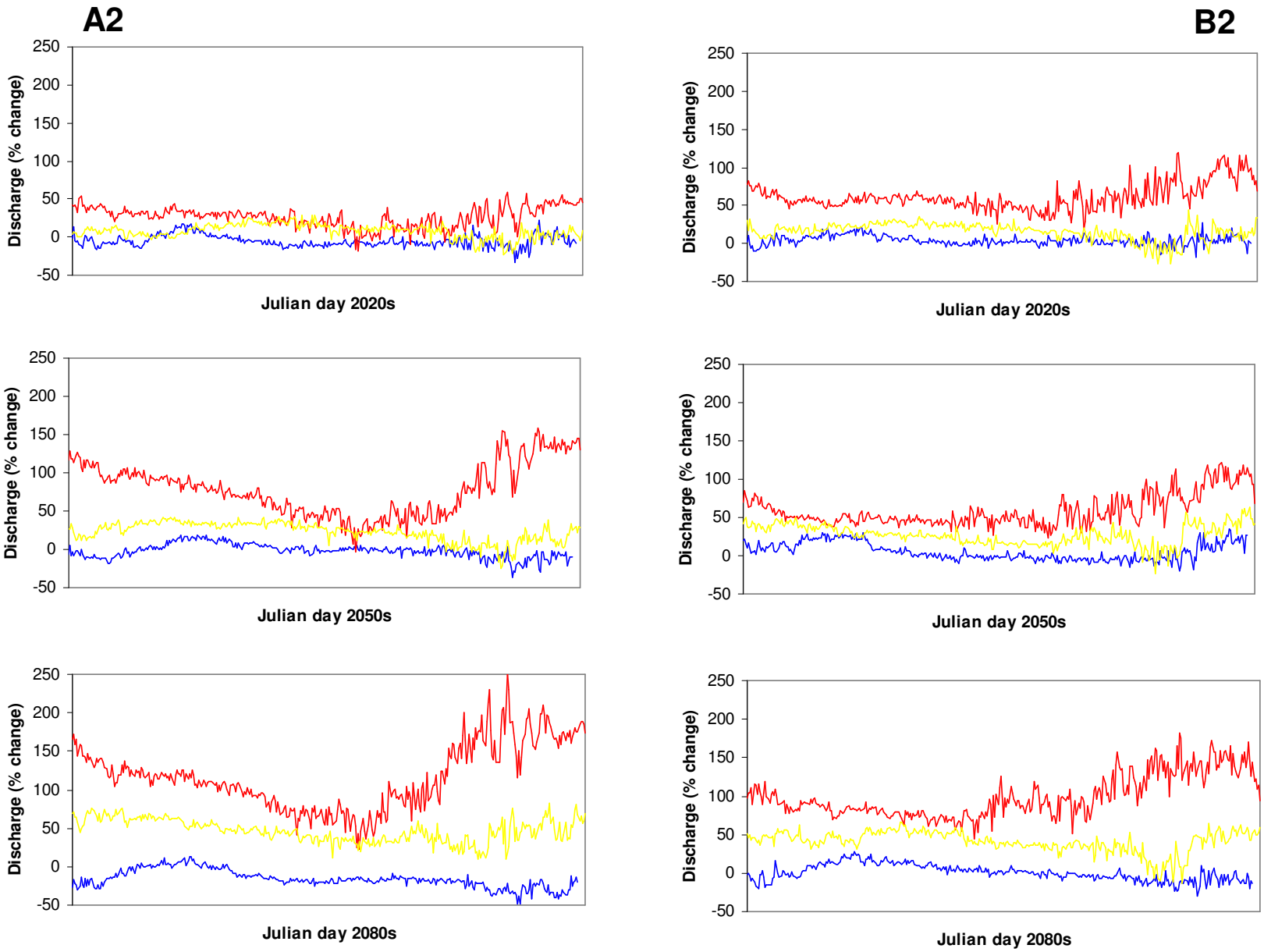
RCMs forced by HadRM3Q0



Different RCMs forced by different GCM



Percentage Change in Flows for 20s,50s and 80s for A2 and B2 Scenarios for 3 GCMs: Hadley CSIRO and CGCM2.



Key consideration

Not how to down-scale but

what to down-scale

Research questions

- What aspects of ‘hydrologically interesting weather’ do GCM/RCMs represent well (model proficiency)?

- What controlling climate processes at different spatial and temporal scales, in terms of ‘hydrologically interesting weather’, do GCM/RCMs represent well?

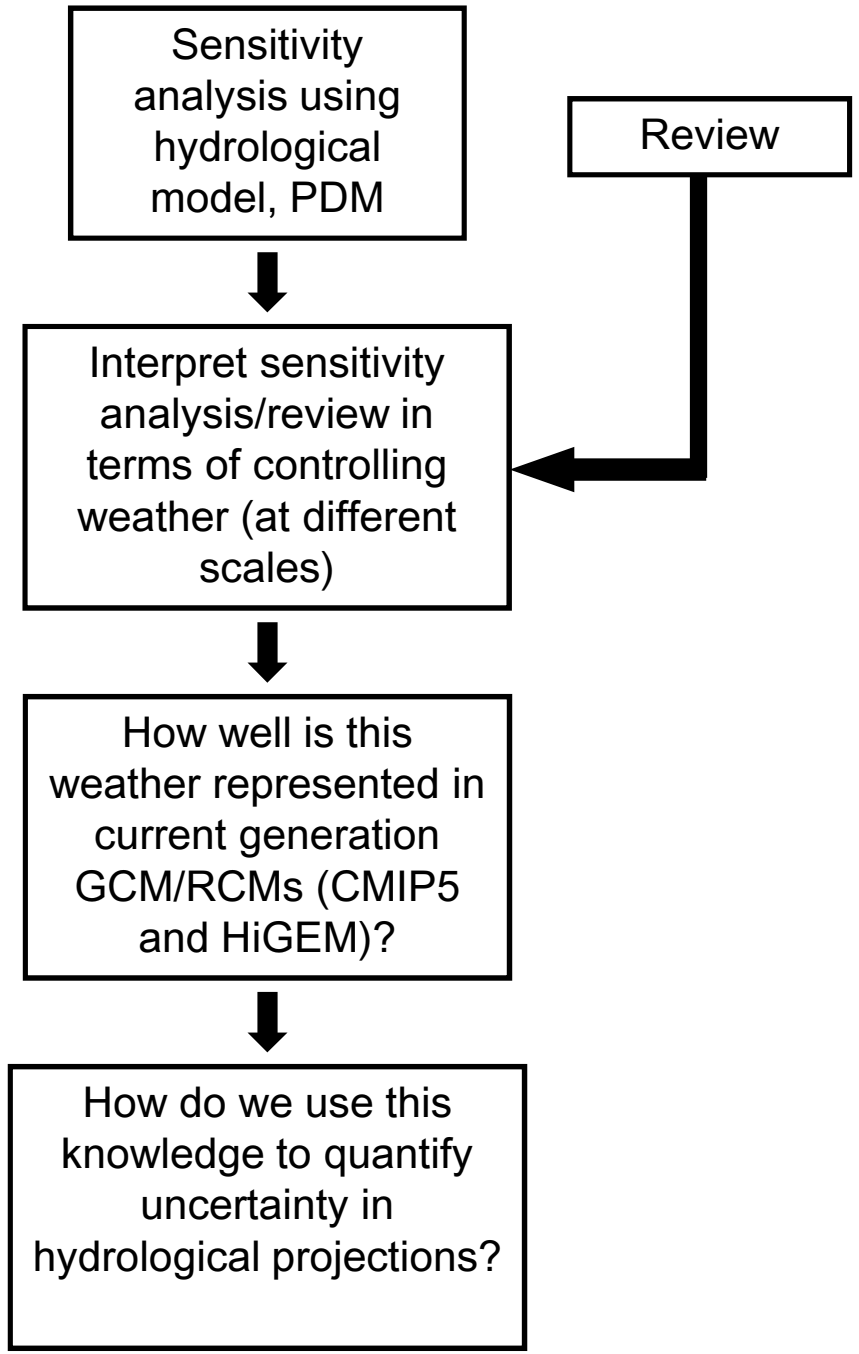
- How much uncertainty in hydrological forecasts does poor weather representation cause?

- How to use the evidence base for making more informed projections of hydrological extremes?

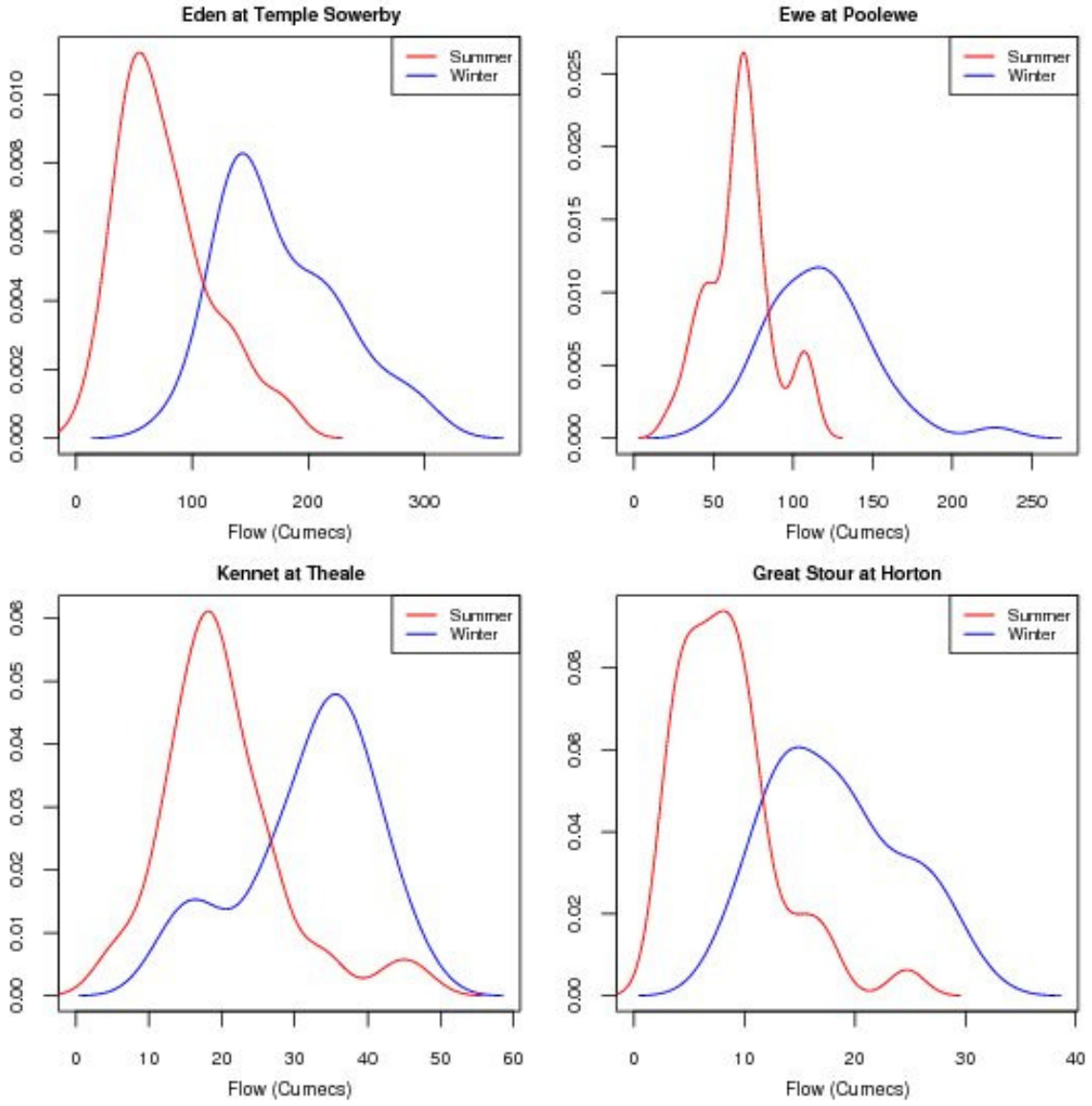
Methodology

issue driven

to begin assume hydrological model is truth



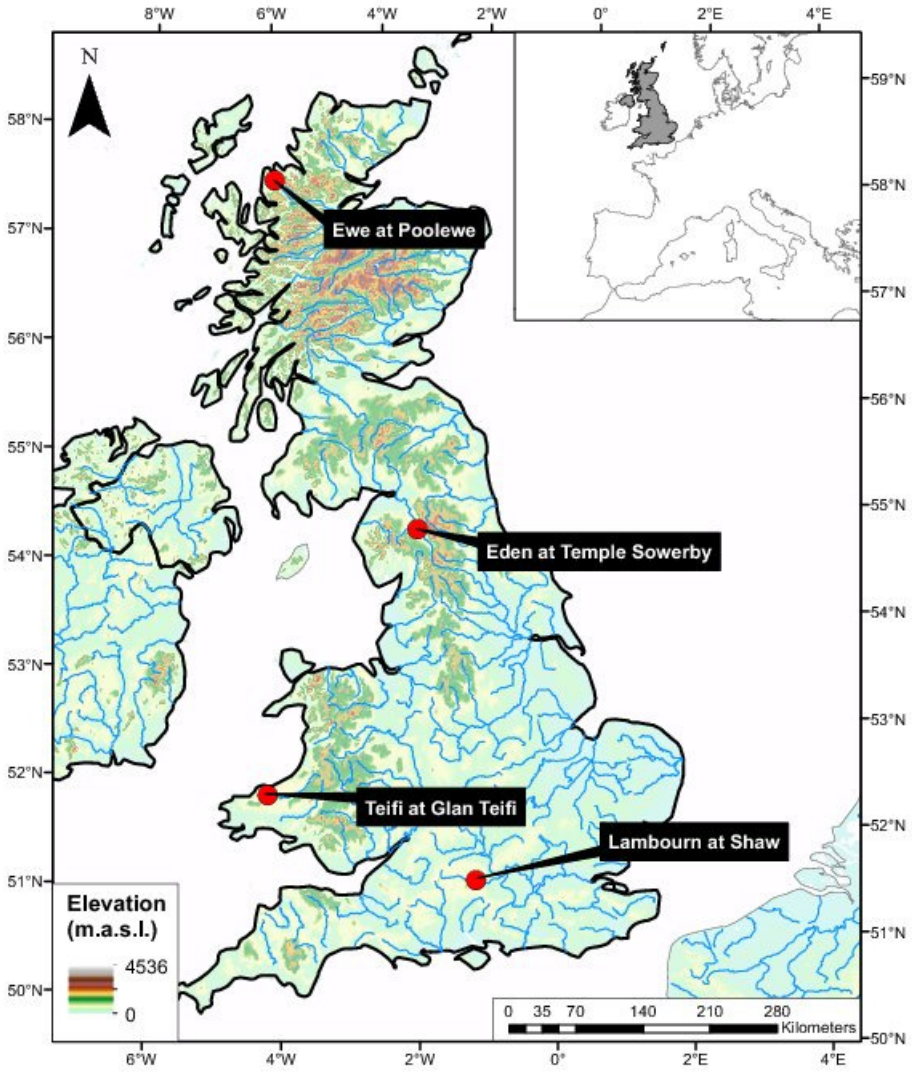
Winter and summer floods



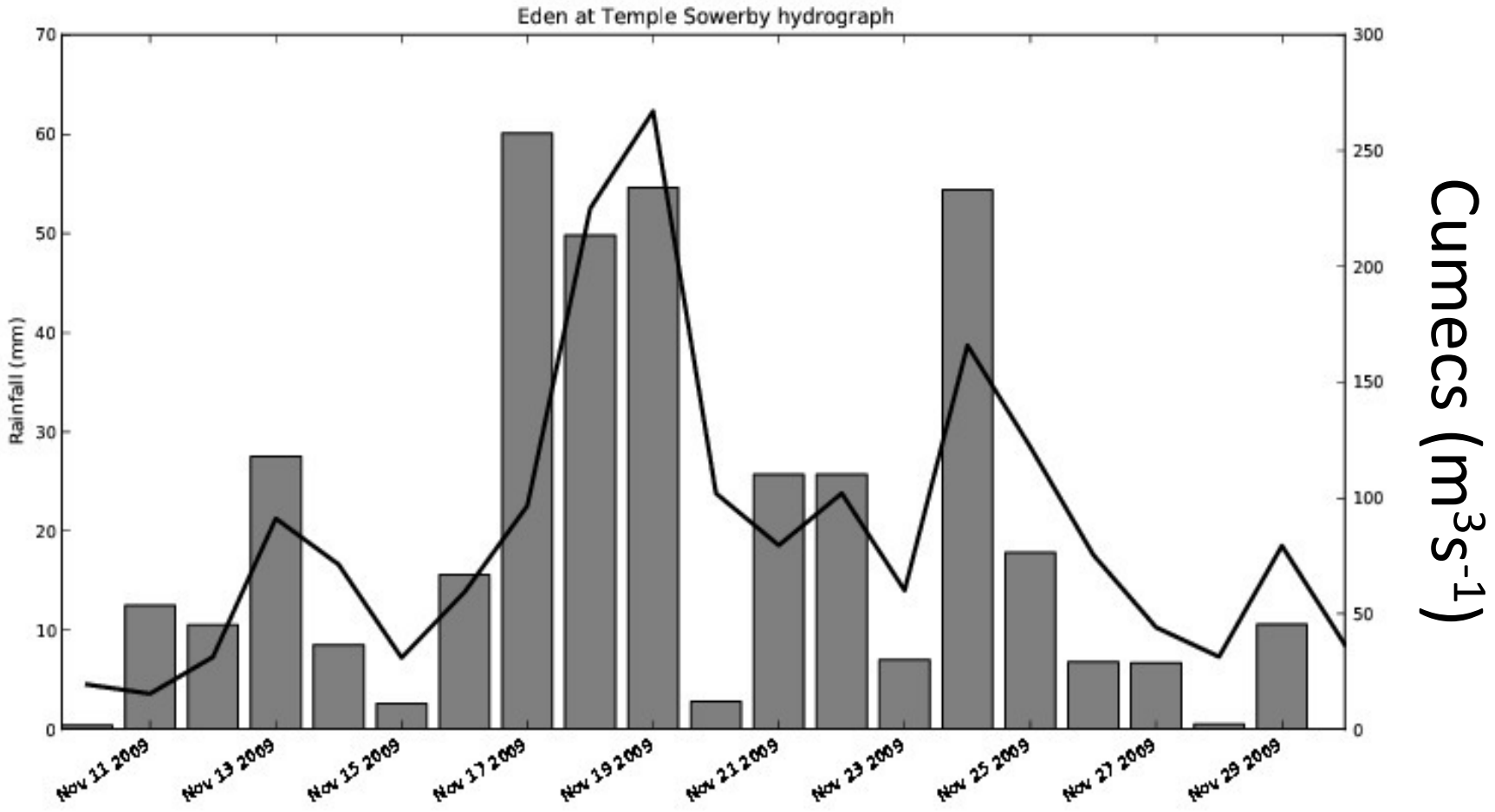
Atmospheric Rivers (ARs)

- ARs are regions where moisture travels from the subtropics to the mid-latitudes.
- Located within warm sector of extra-tropical cyclones.
- Most AR-flood research undertaken in western North America.

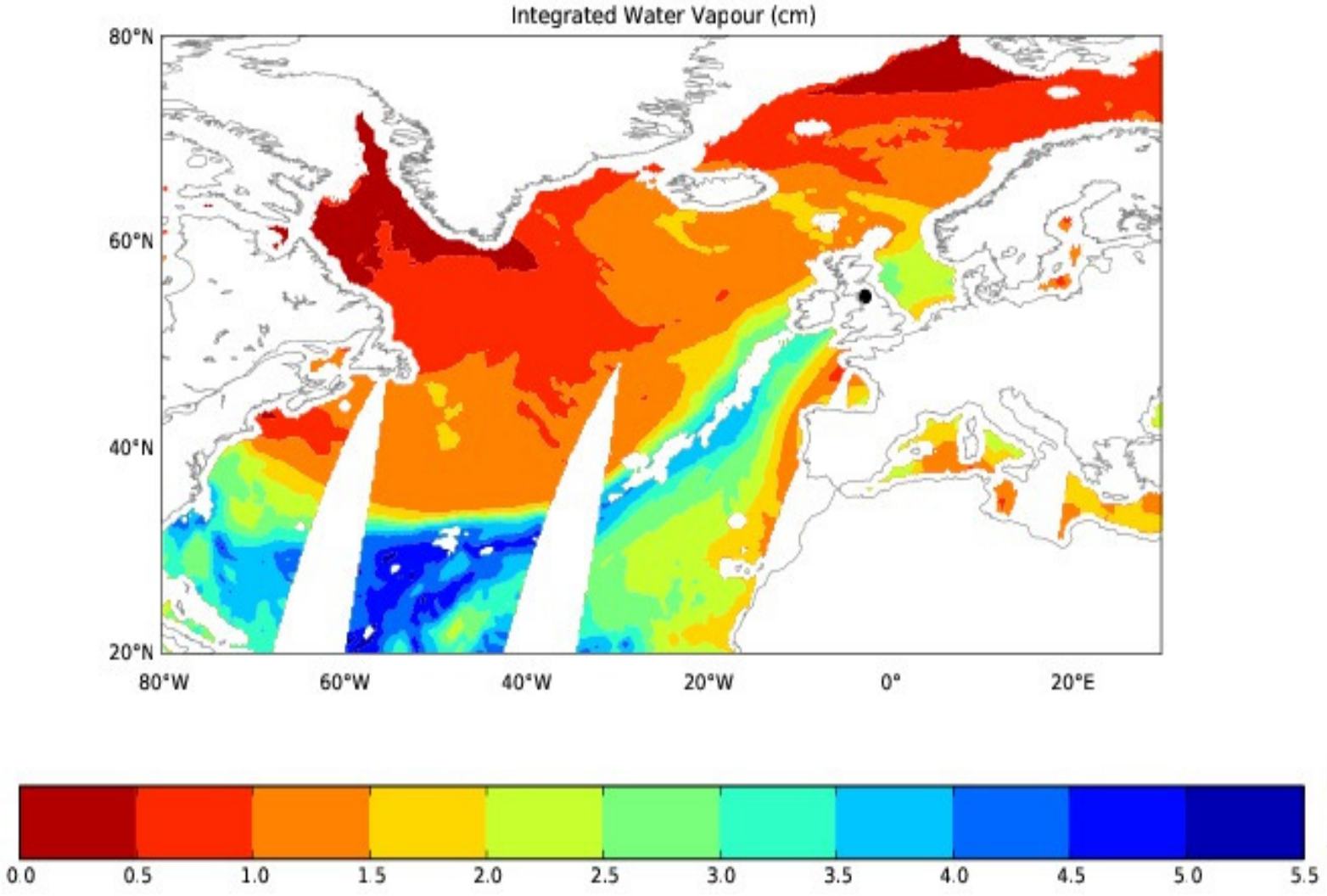
River basin locations



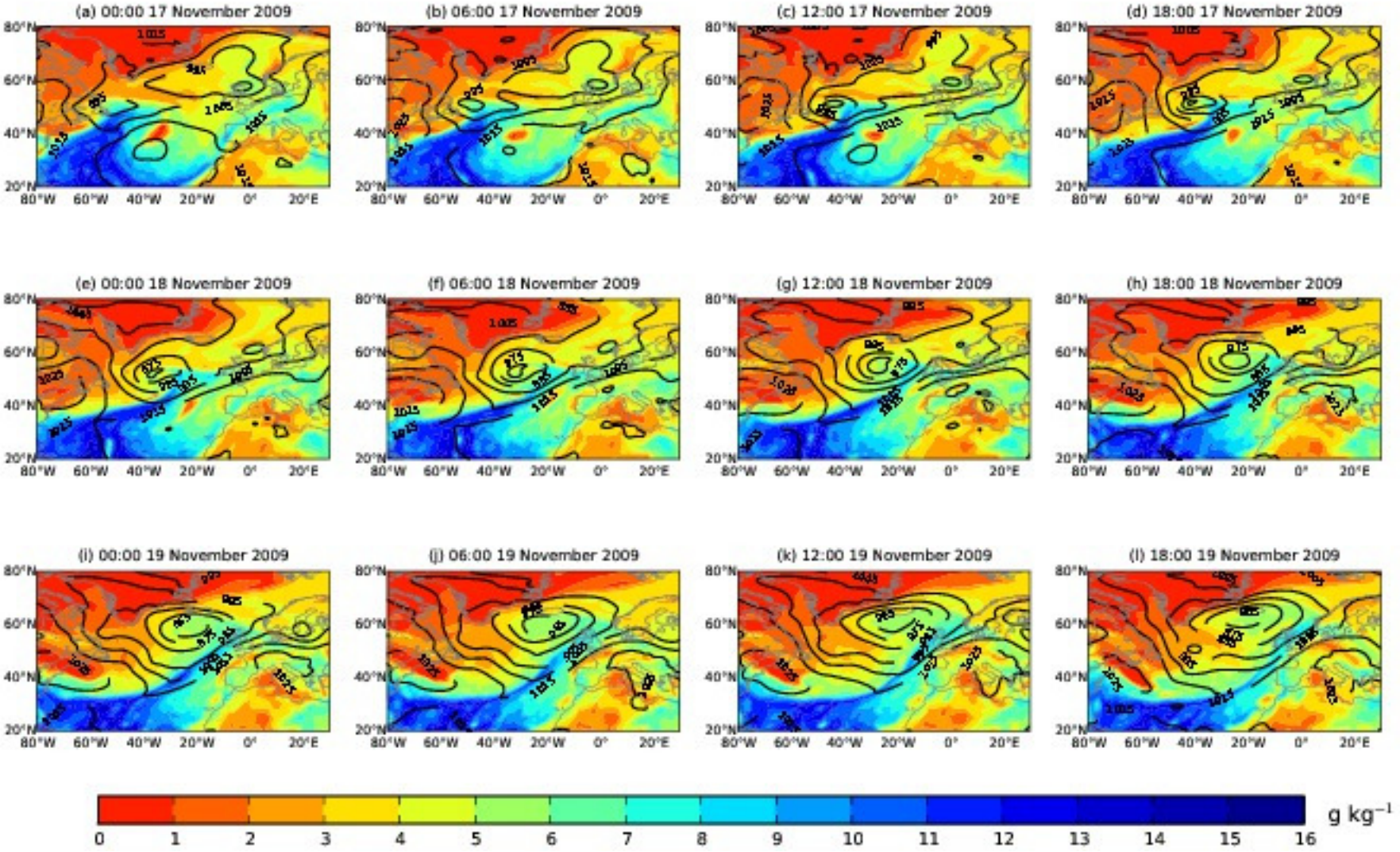
November 2009 Cumbrian flood



MSLP and specific humidity at 0600 UTC 19th Nov 2009

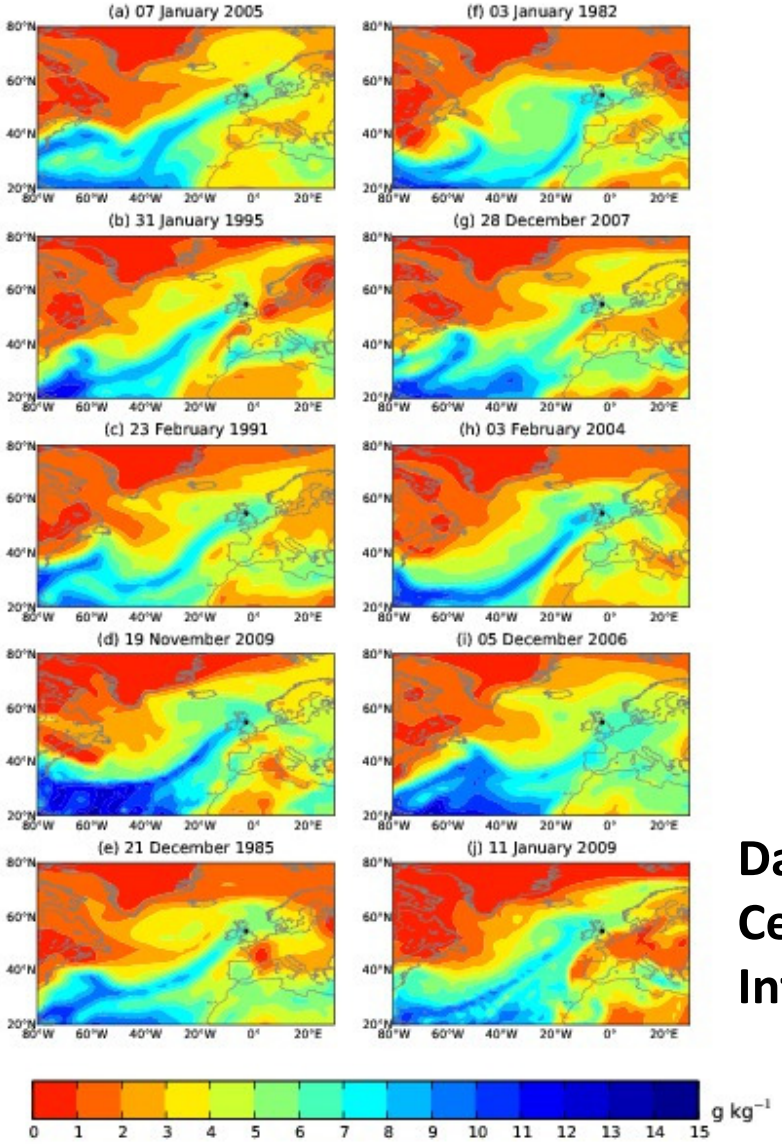


Evolution of 900 hPa specific humidity and MSLP



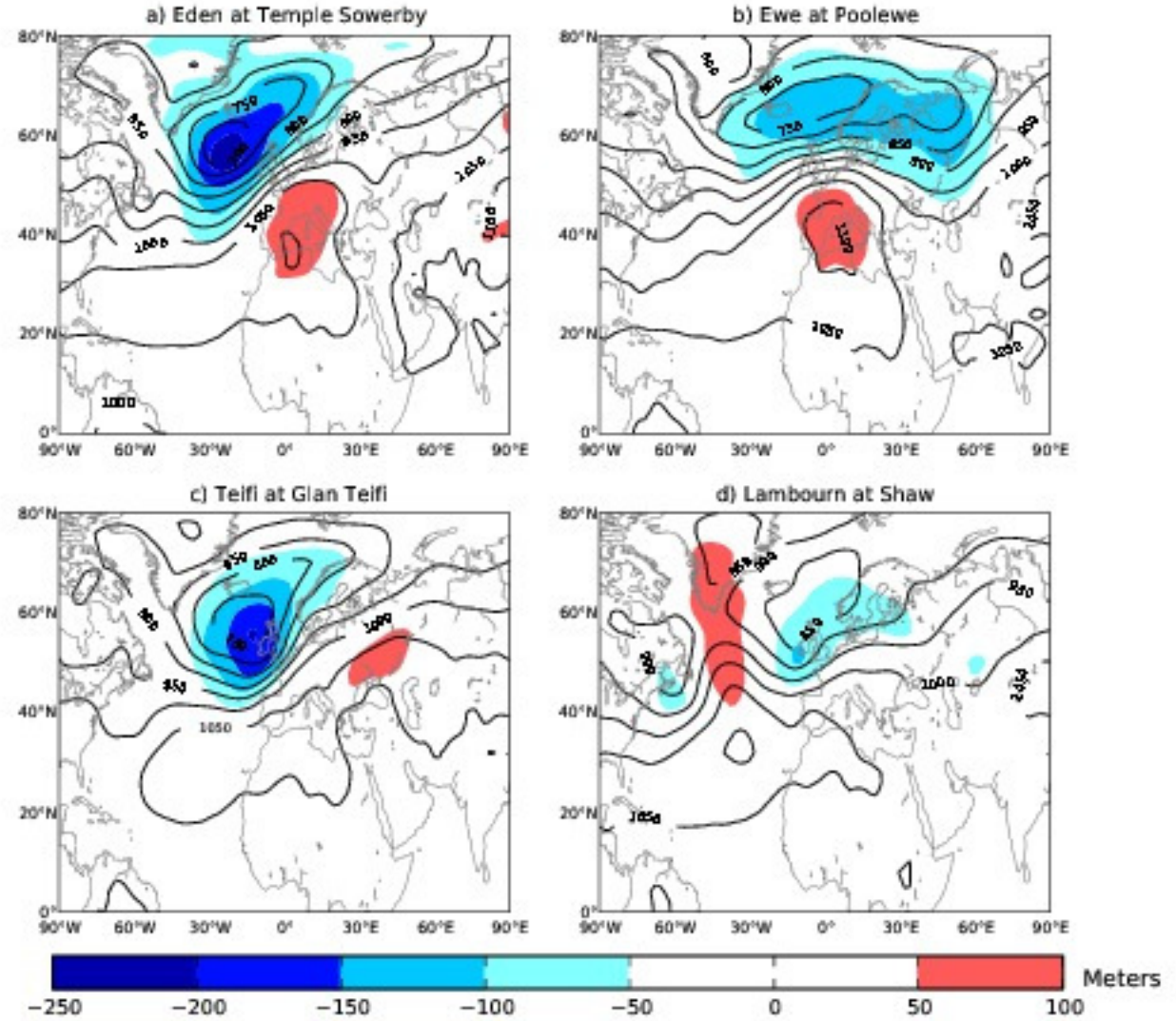
Data source: ECMWF ERA-Interim reanalysis.

Top 10 winter floods in Eden



Data source: 20th Century / ECMWF ERA-Interim reanalyses.

Atmospheric Circulation



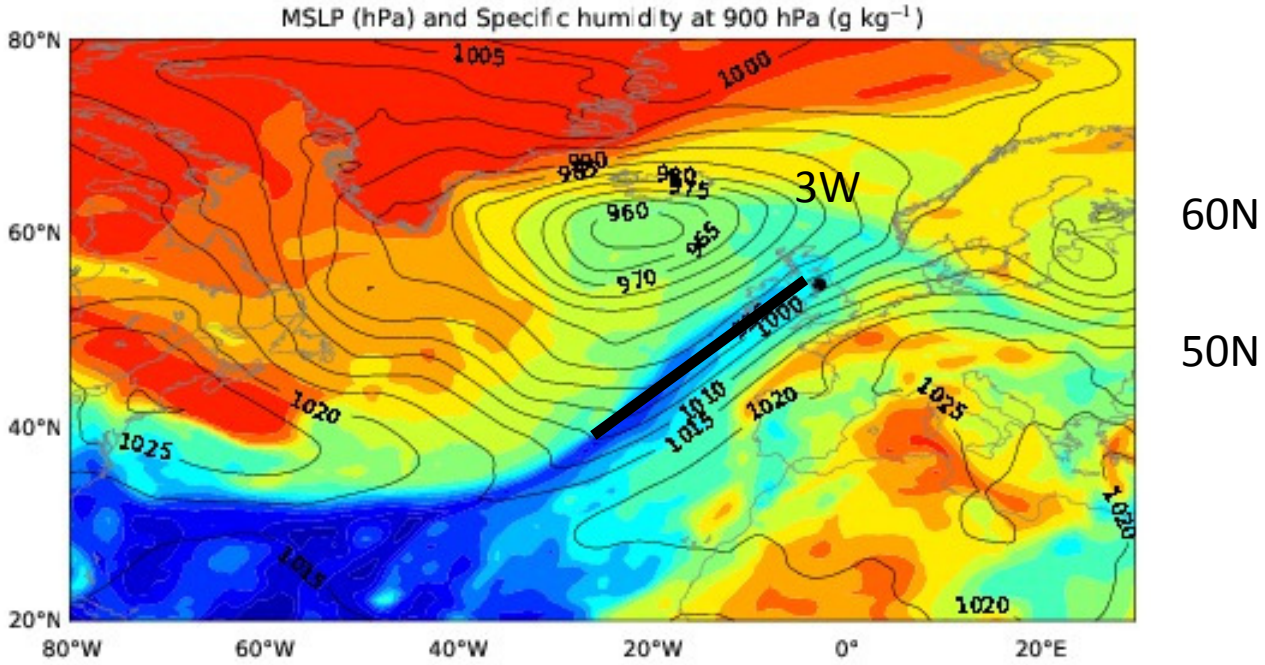
Data source: 20th Century / ECMWF ERA-Interim reanalyses.

AR screening in climate datasets

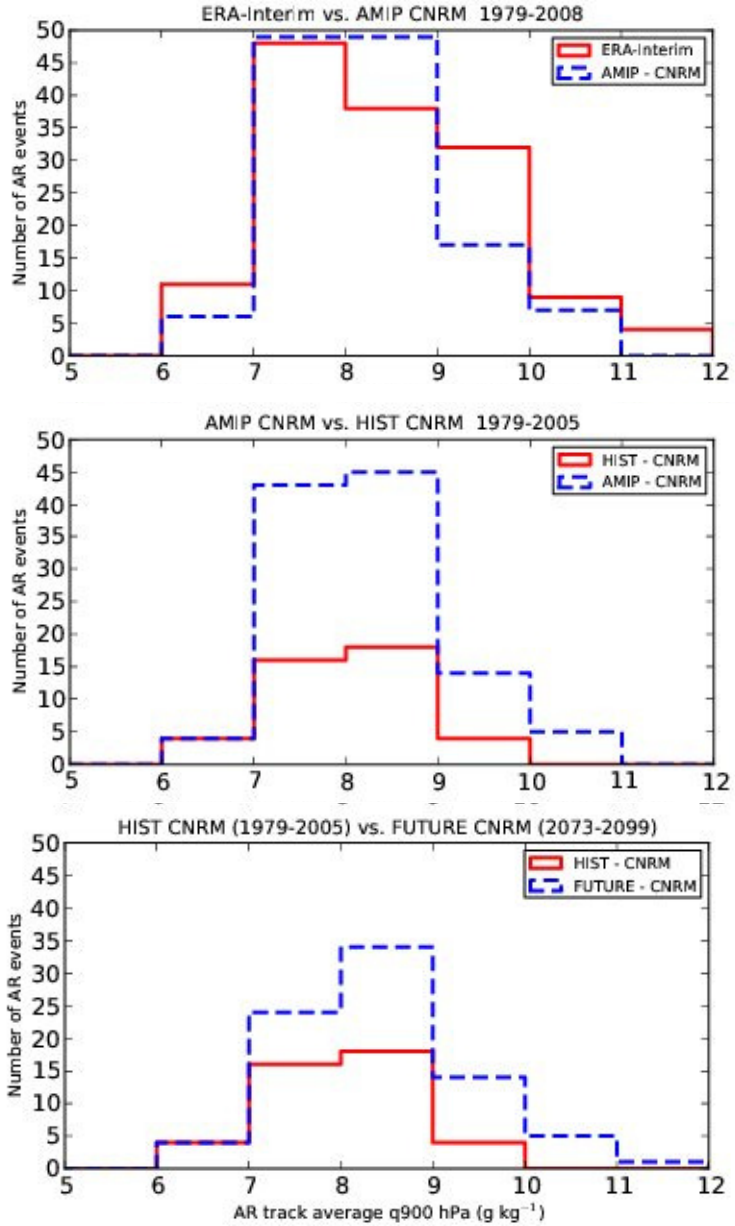
- **At 900 hPa search between 50N and 60N (between 4-5 W) for q > 5 g/kg and uv > 12.5 m/s; these criteria must exist for ~2000km across North Atlantic.**

- **If these conditions exist for 3 time steps over a *specific* region then a persistent AR is identified.**

- **7 out of top 10 Eden winter floods identified using this method.**



Preliminary CMIP5 results



Conclusions

- Identified ARs as a key control on UK winter flooding
- Developed an index
- Begun assess climate simulator proficiency
- Seems a useful conceptual framework
  - Droughts
  - Aquifer recharge