The WATCH project: the terrestrial water cycle

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Global Drivers of Change: interactions

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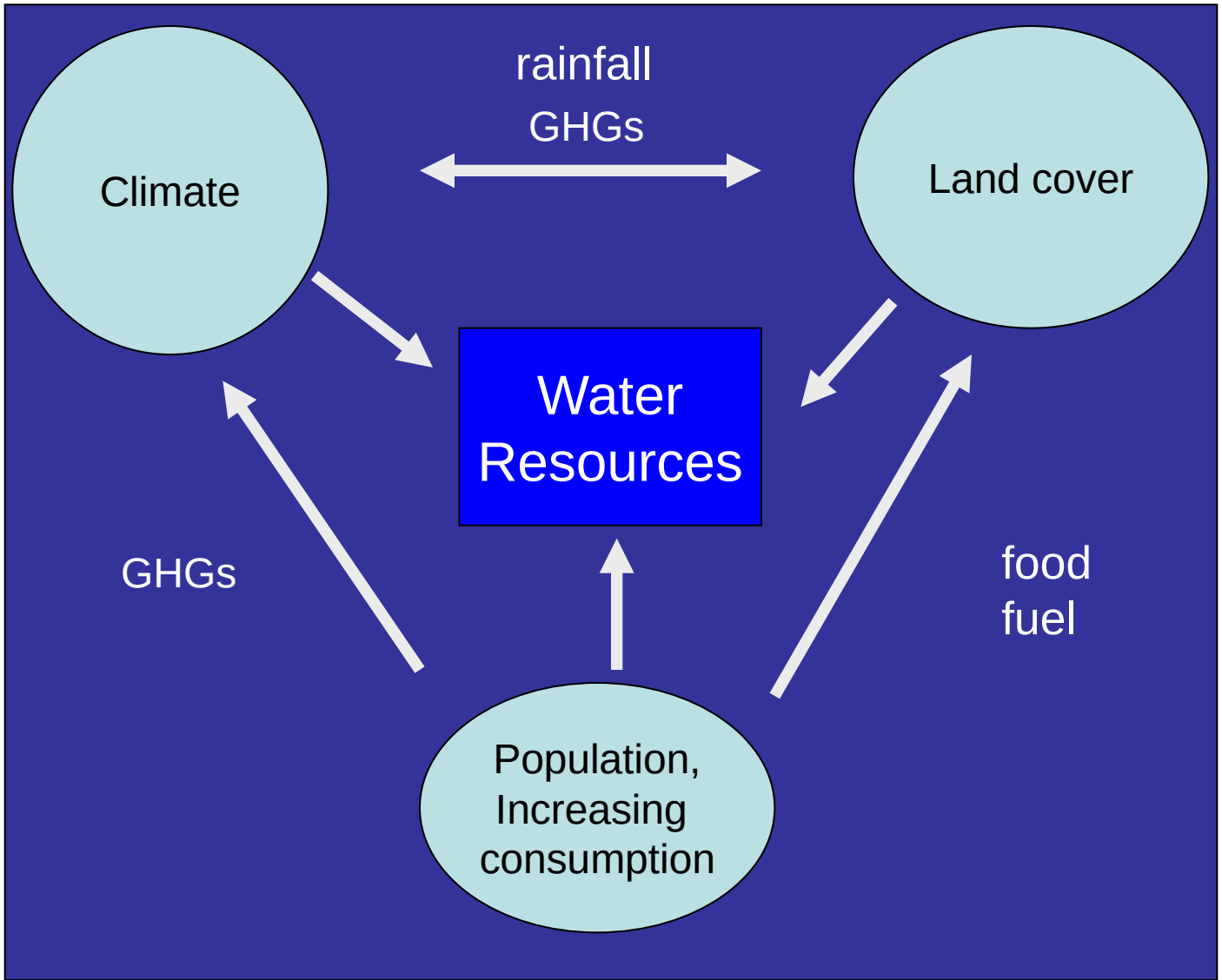
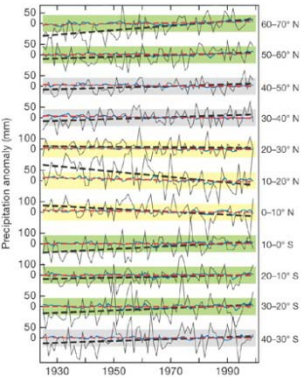


Global Changes in Hydrology

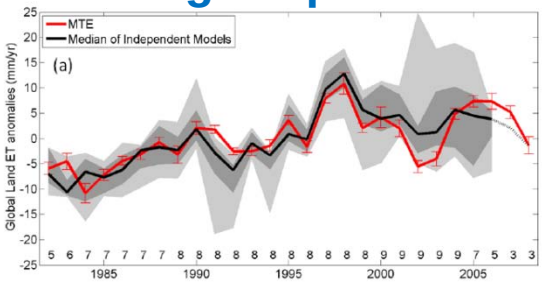
Changing drought severity

Changing zonal rainfall

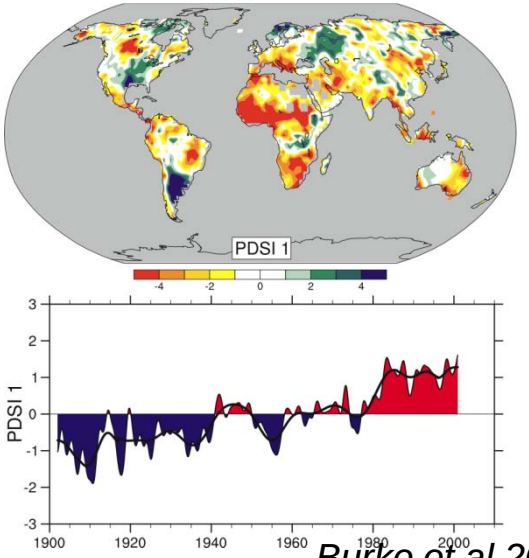


Zhang et al 2008

Increasing evaporation

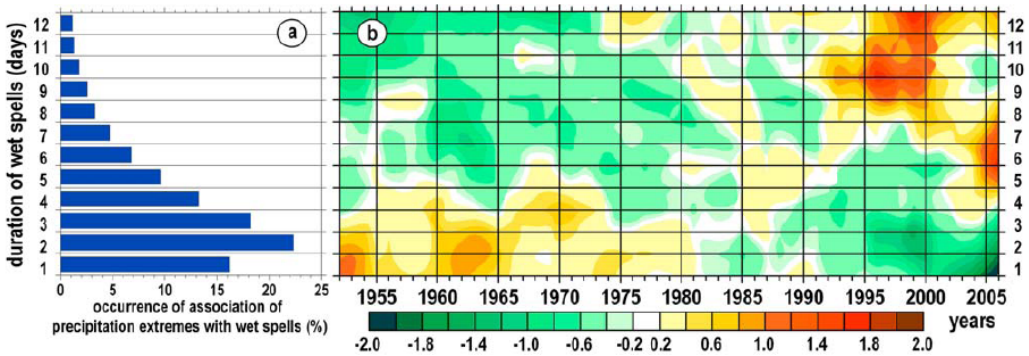


Jung et al 2010



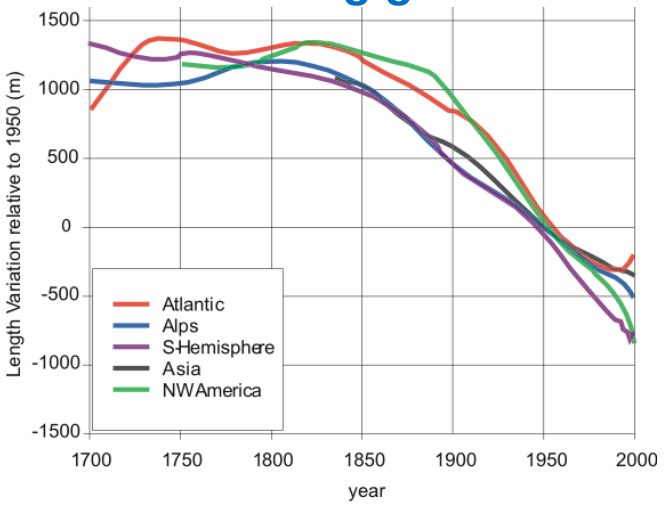
Burke et al 2007

Increasing heavy rainfall

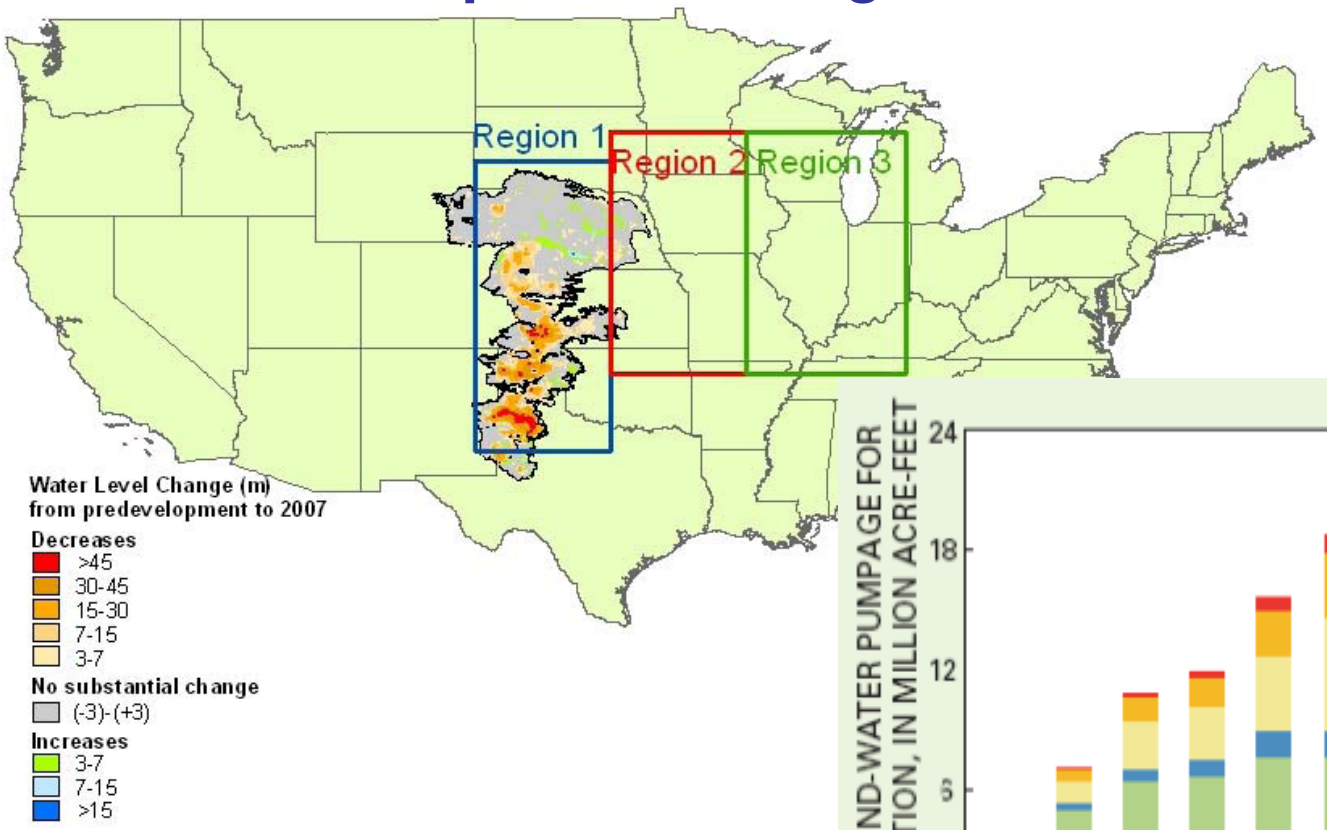


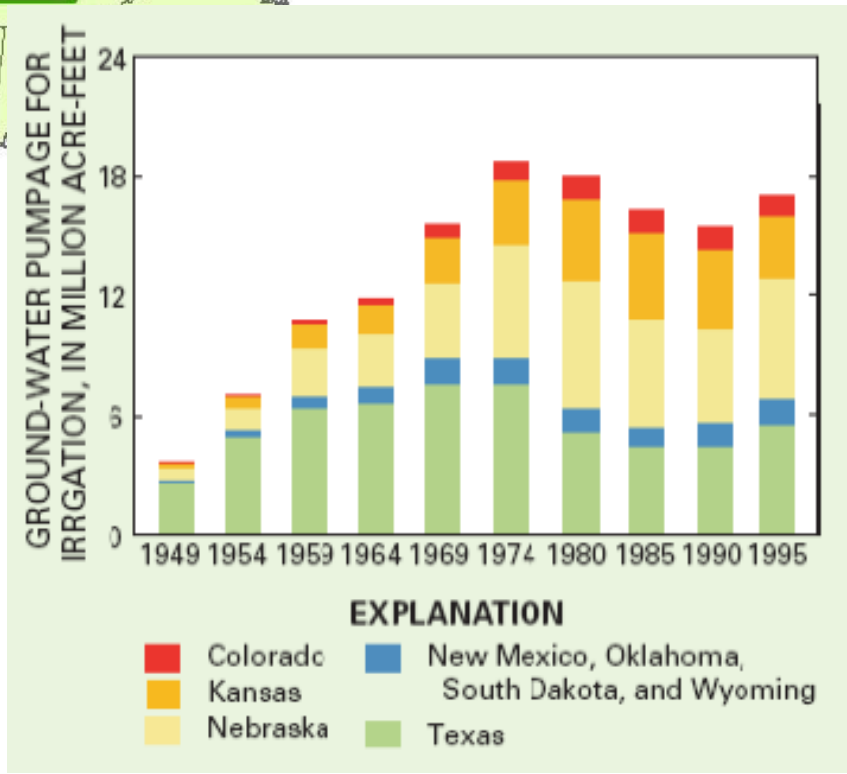
Zolinia et al 2010

Melting glaciers



Over-exploitation of groundwater





The Ogallala Aquifer and groundwater level changes from pre-development (pre 1950) to 2007 *(DeAngelis et al 2010),*

WATCH is a integrated project bringing together the hydrological, water resources and climate communities to analyse, quantify and predict the components of the current (20th C) and future (21st C) global water cycle.

The project aims to evaluate the uncertainties of, and clarify the overall vulnerability of, global water resources related to the main societal and economic sectors

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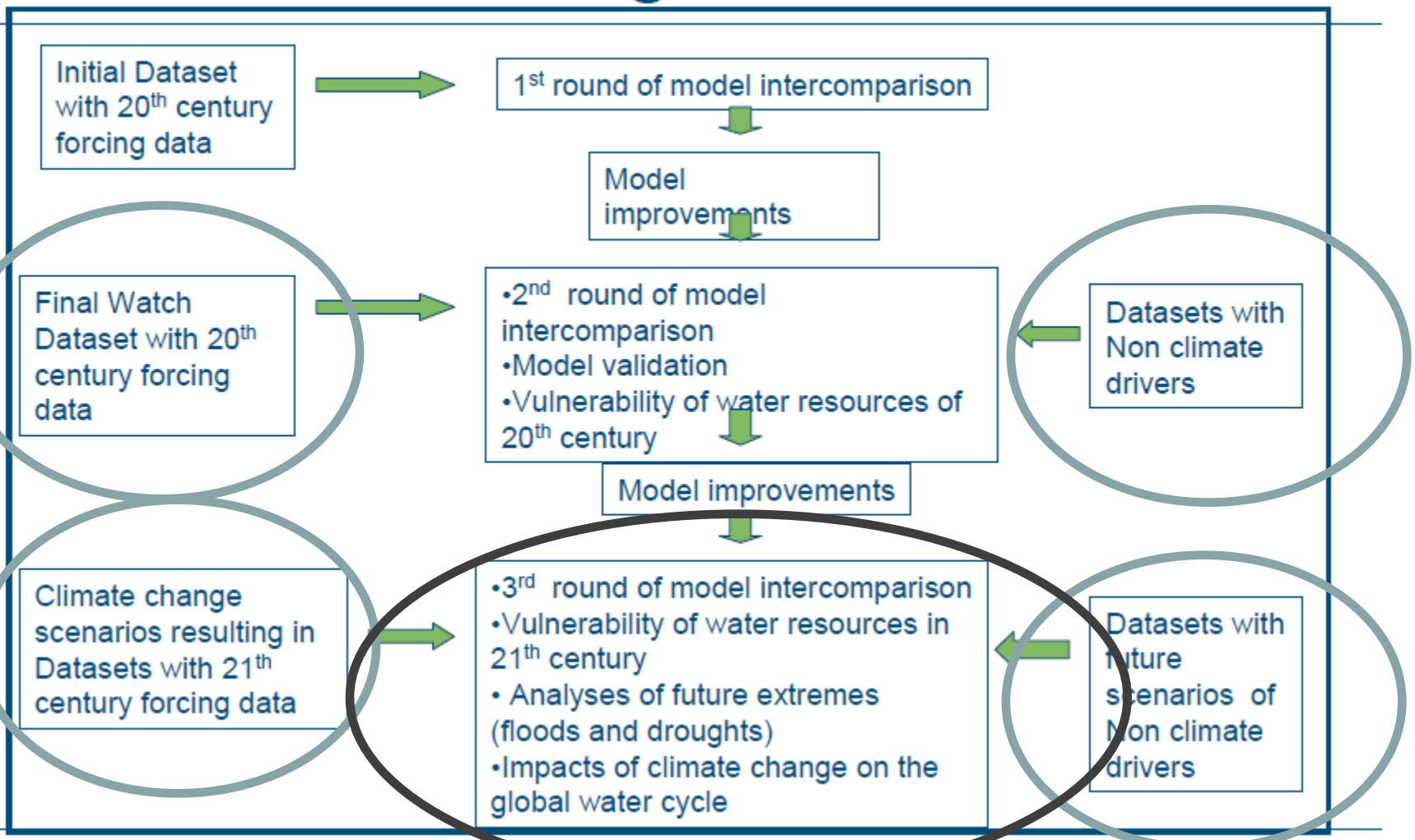
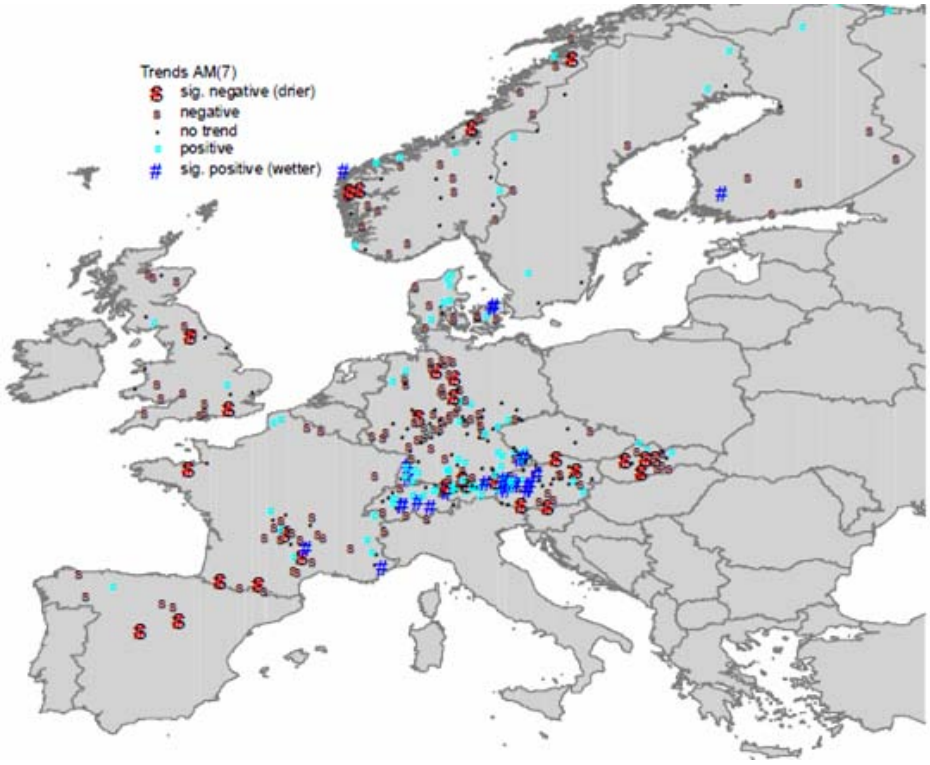
The use of the modeling framework



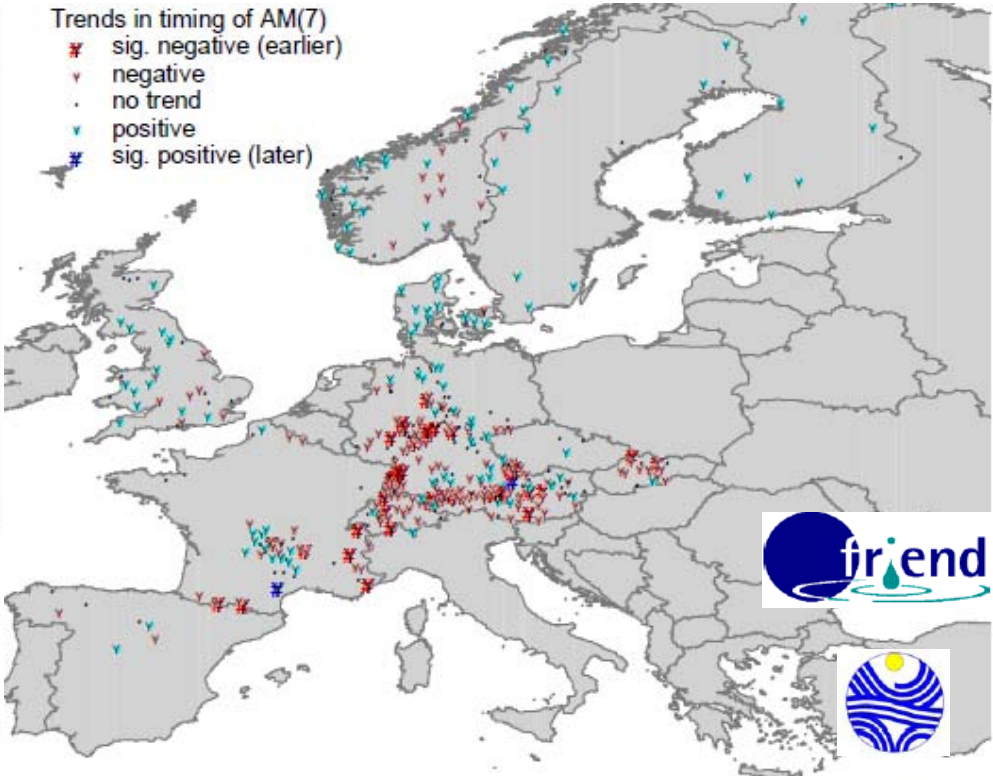
WATCH WB4 Extremes: are extremes becoming more common?

Trends for 1962-2005

Magnitude of 7-day Annual minima



Timing of 7-day Annual minima



Stahl et al, 2008, Trends in low flows from streamflow records of small headwater catchments across Europe, WATCH conf.

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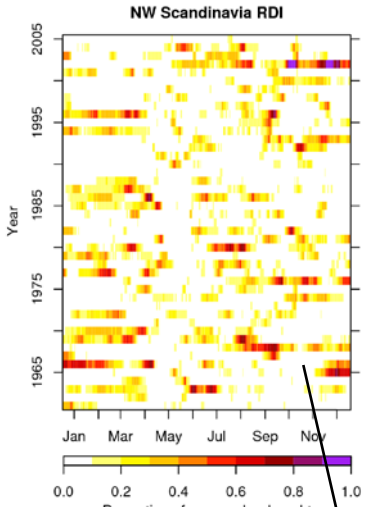
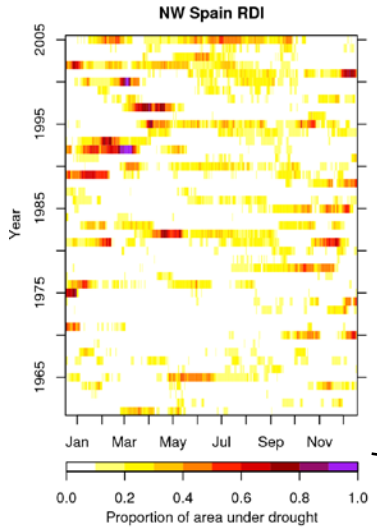
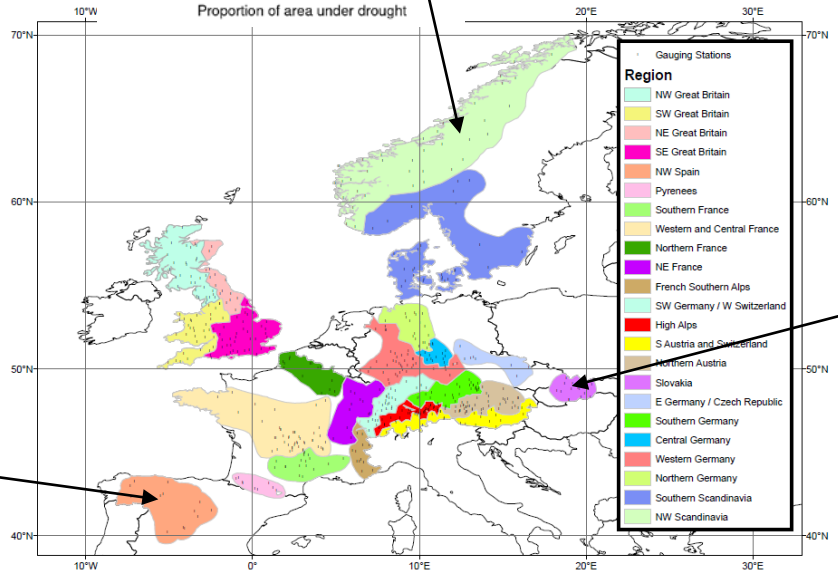
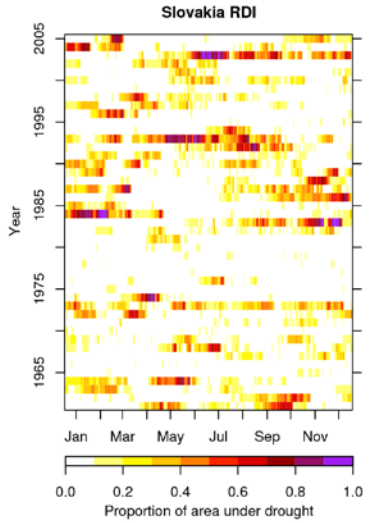
20th century drought catalogue

Norway, 2002









Hannaford et al., (in press) Hydrol. Process

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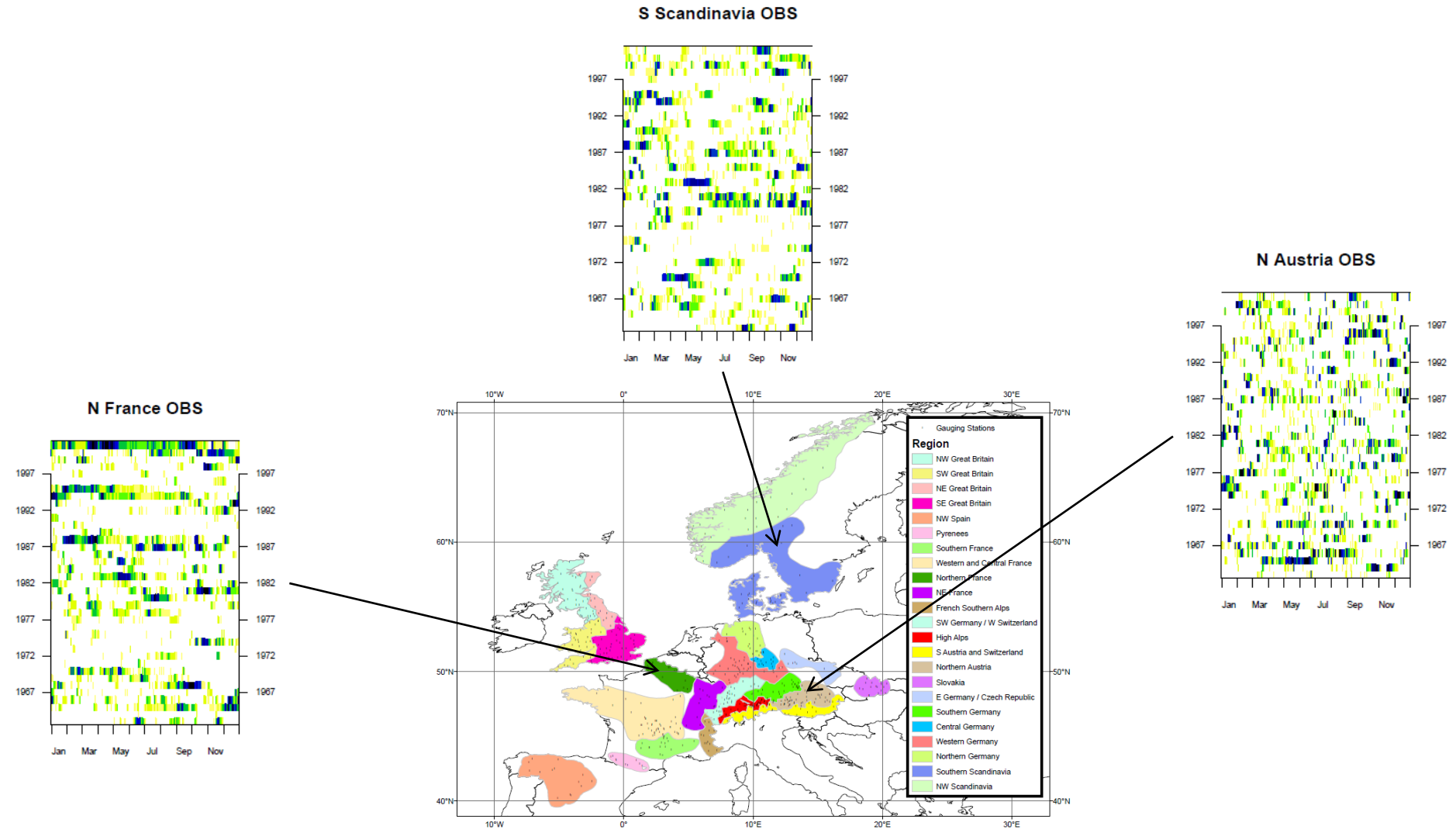
defra Department for Environment Food and Rural Affairs

Environment Agency

20th century 'observed' flood catalogue



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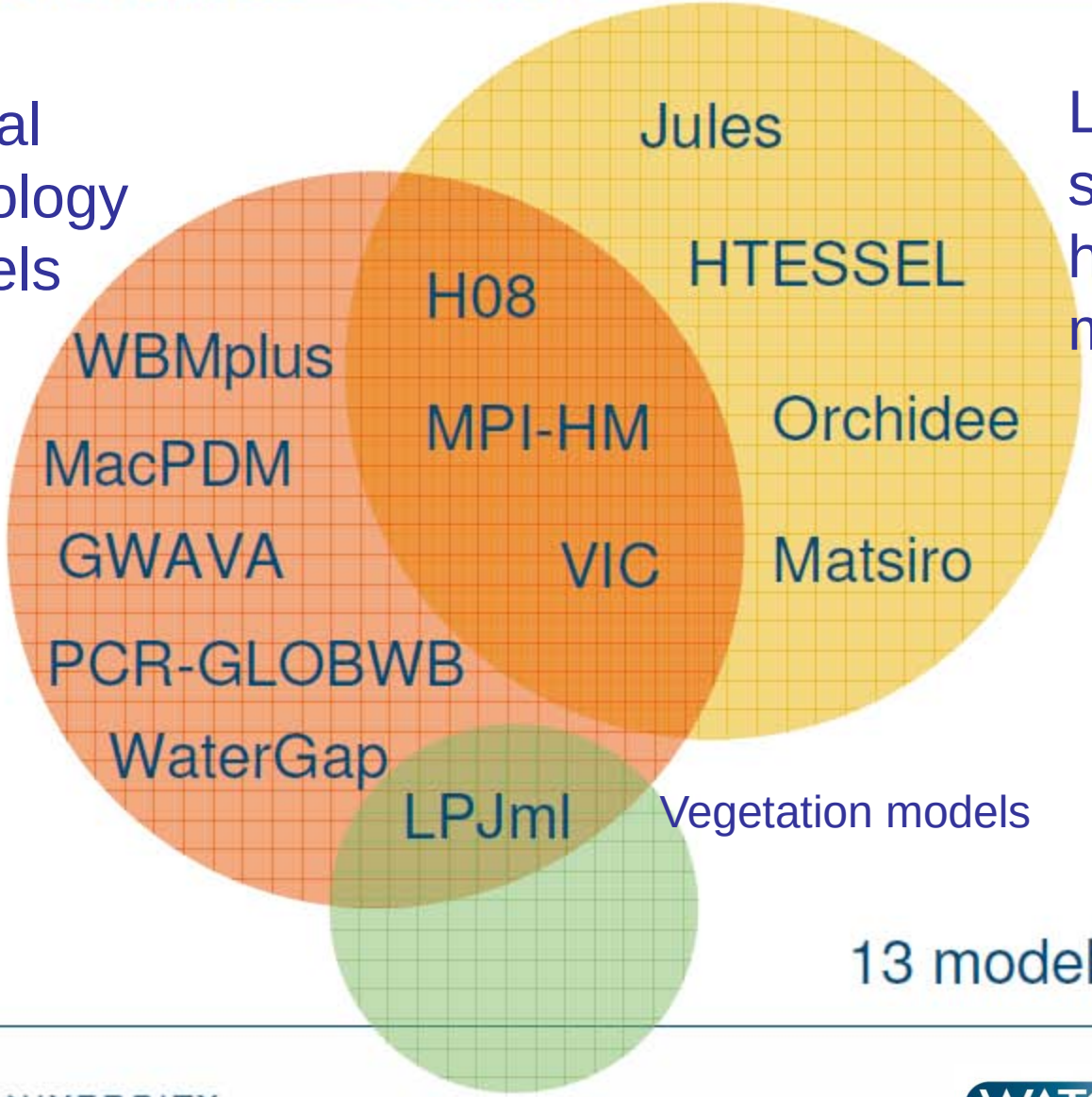
Participants: GHM - LSHM

Global hydrology models



Land surface hydrolog models

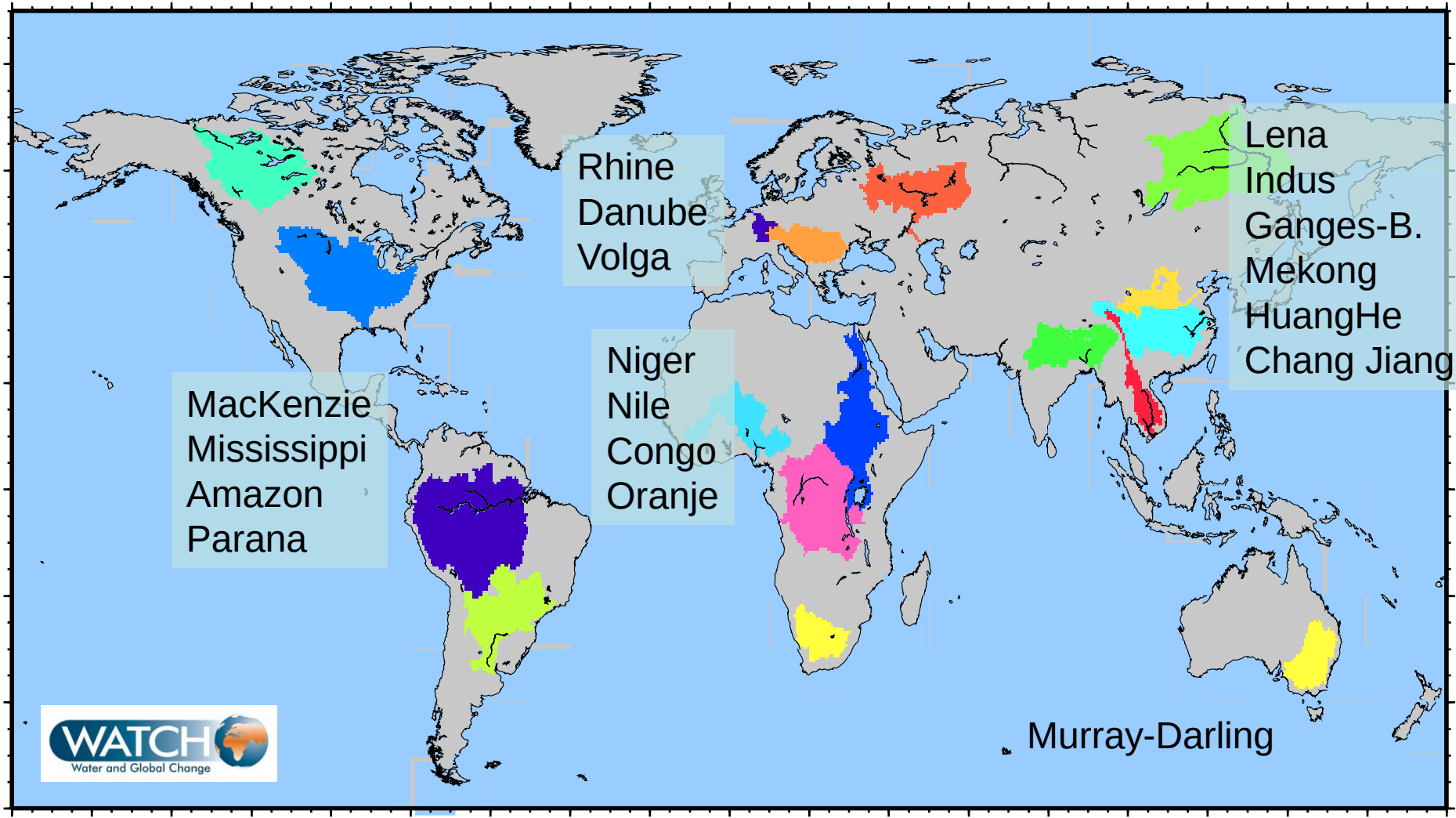
HBV
WATBAL
Bilan
FRIER

River basin Models

Vegetation models

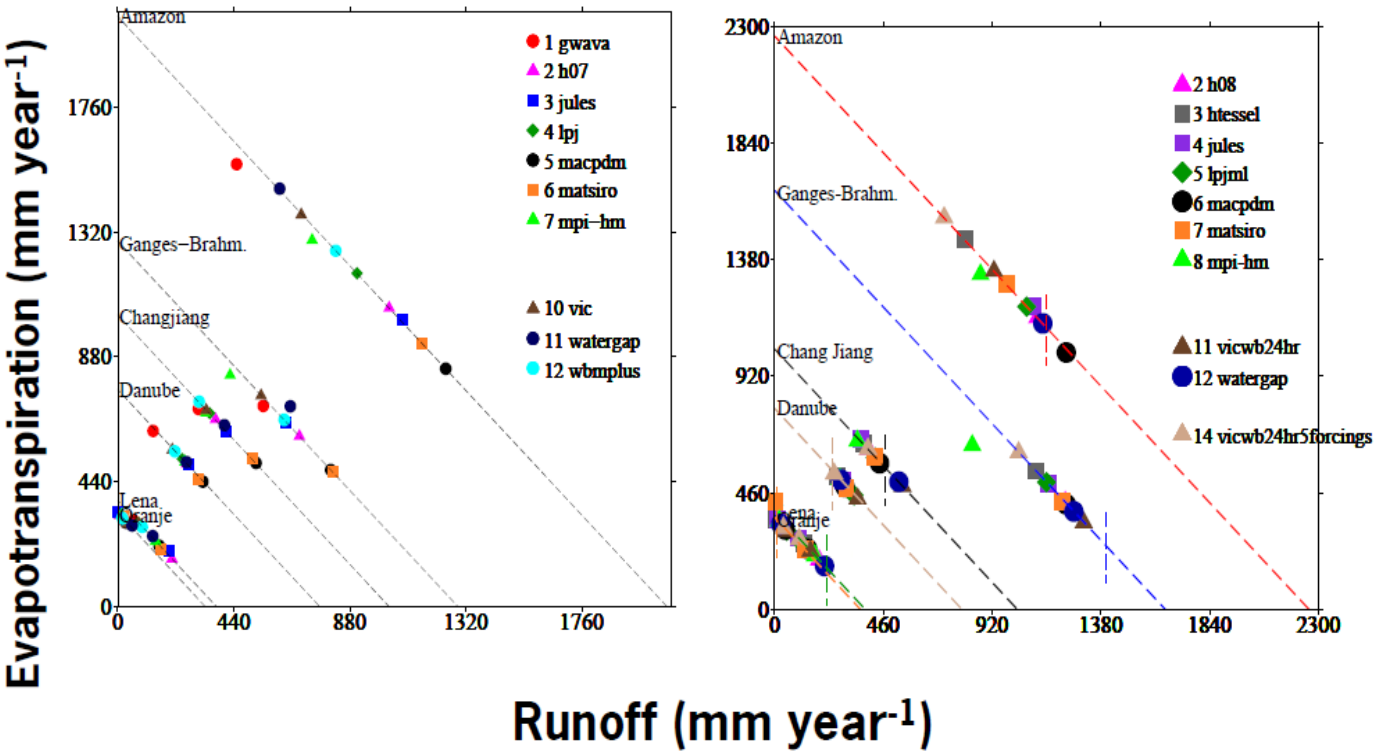
13 models in tot

River basins

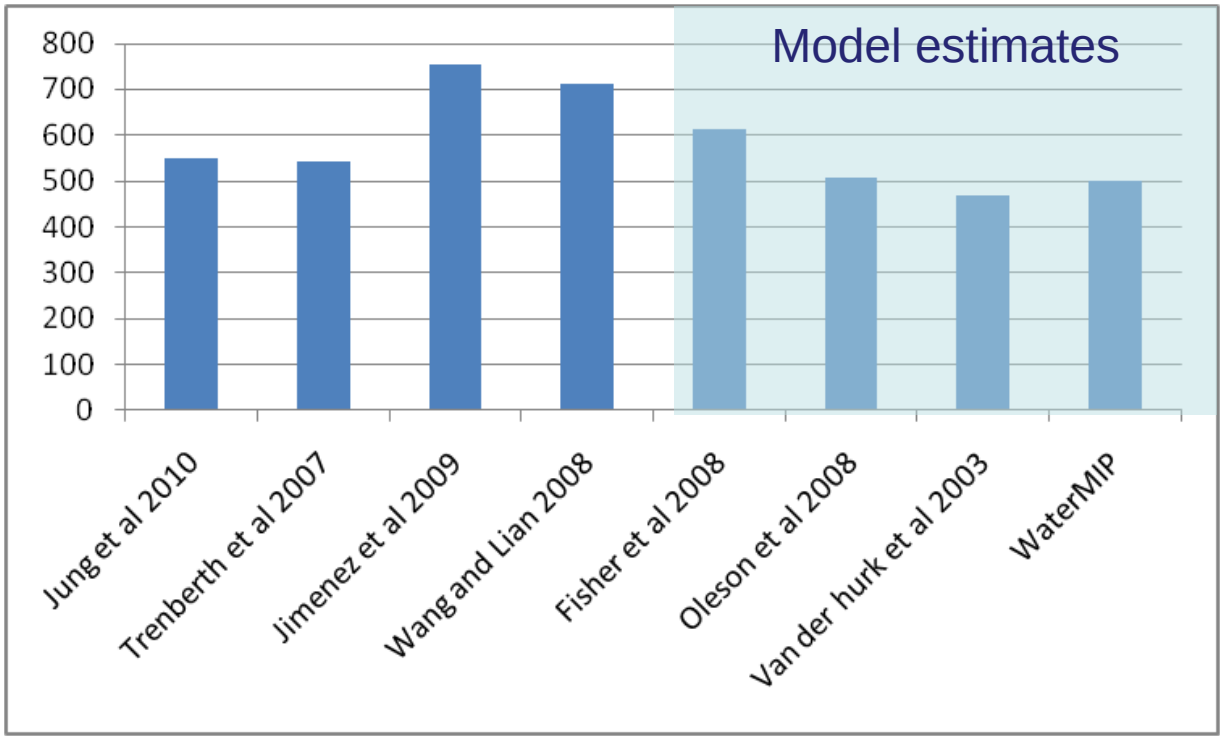


First round

Second round

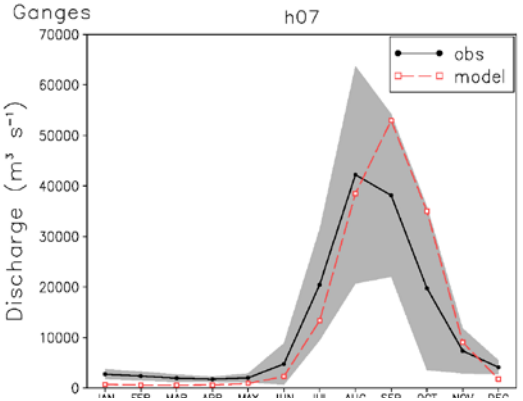


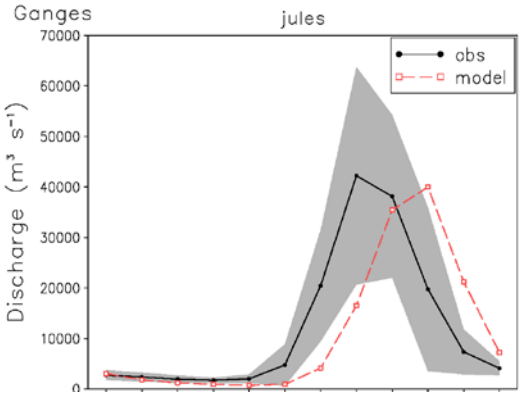
Global annual land evaporation derived from observations

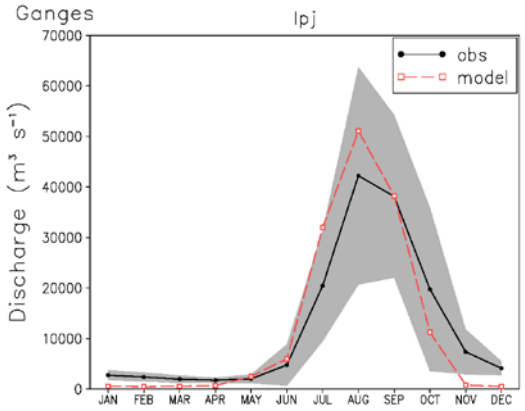


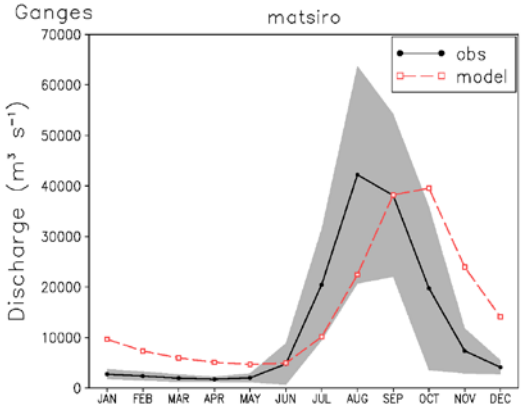
Reference	E(mm)	Method	Time period	Comment
Jung et al, 2010	549	AI+FLUXNET+RS	1982-2008	vegetated
Trenberth et al, 2007	541	P-Q	1979-2000	non-ice
Fisher et al. 2008	613	modified PT + RS	1986-1993	
Jimenez et al, 2009	754	RS calibrated on GSWP	1992-1999	
Wang and Lian, 2008	712	Statistical correlation	1986-1993	

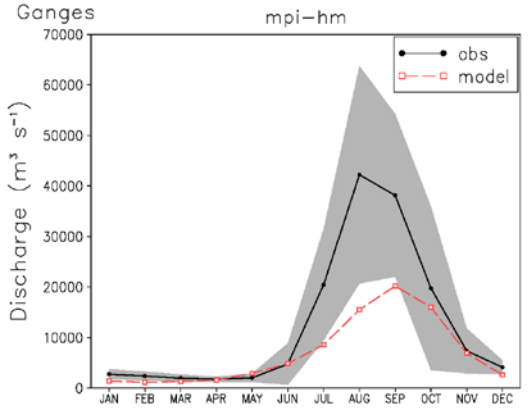
Simulations from 8 models for the Ganges basin (1985-1999)

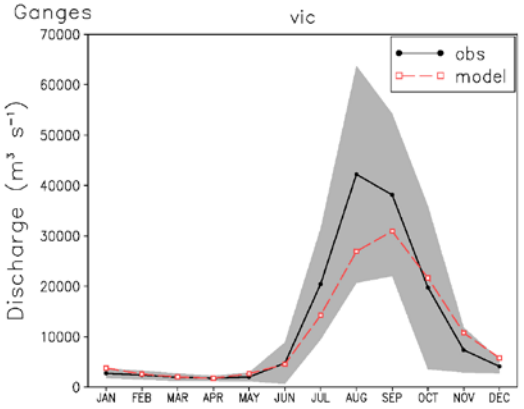


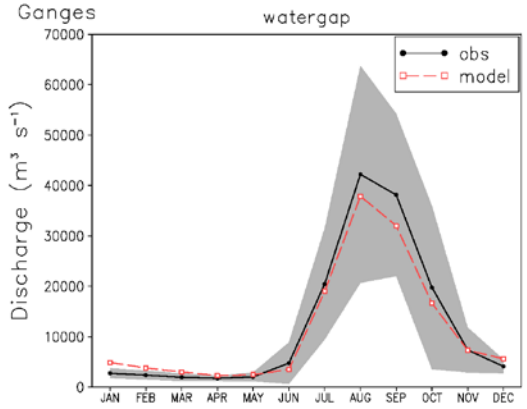


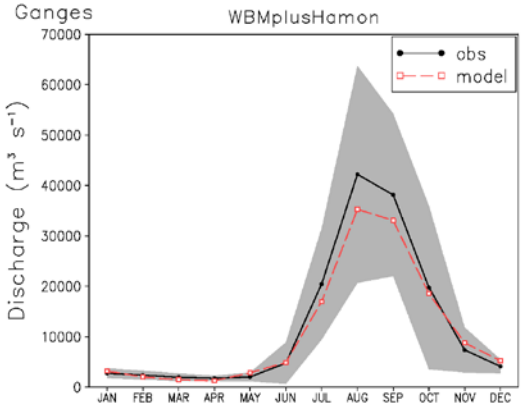




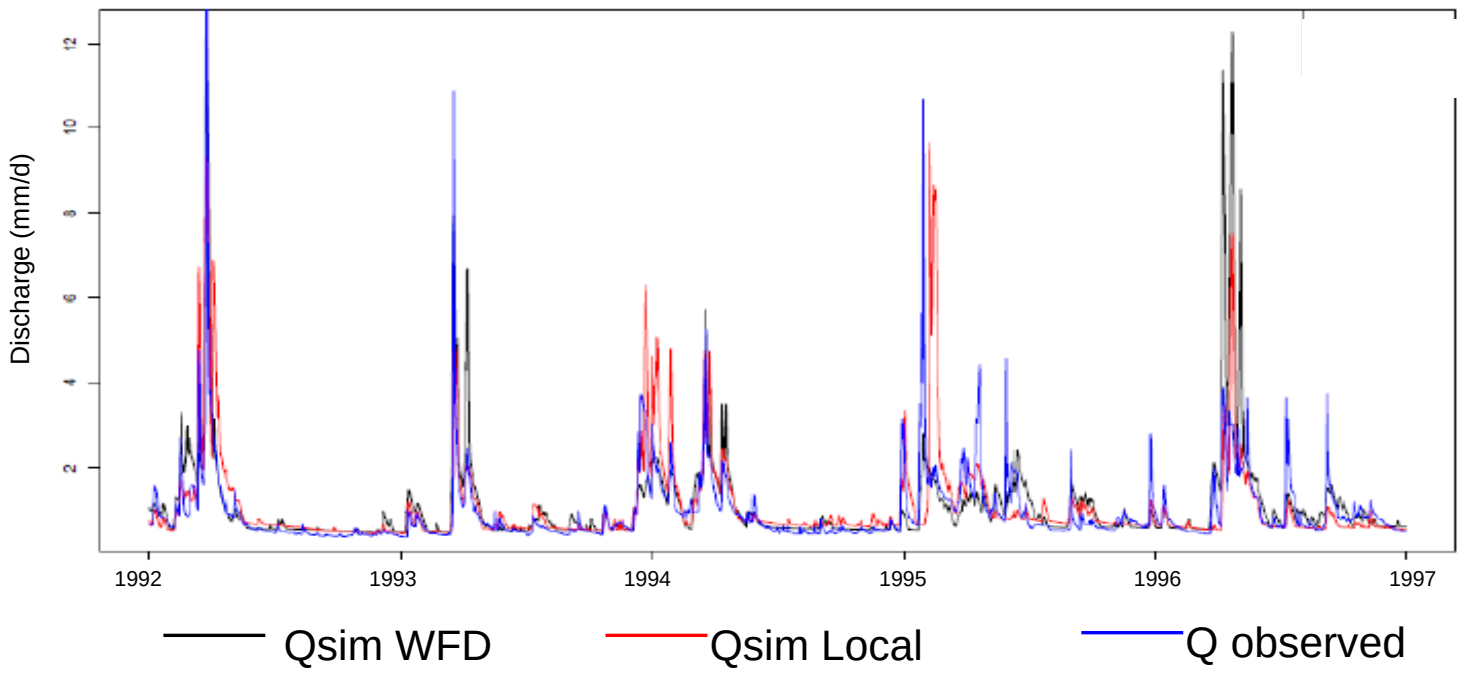








River Basin Scale: Metuje Catchment, comparison of stream flow WATCH Forcing Data vs. Local Observed Data



Low flows were better simulated with WFD that with the local forcing data. For simulated stream flow droughts WFD was closer to observed droughts than droughts simulated with local data Efficiency (lnQ): Local data 0.71 and WFD 0.60

Global Extremes Analysis

ERA40

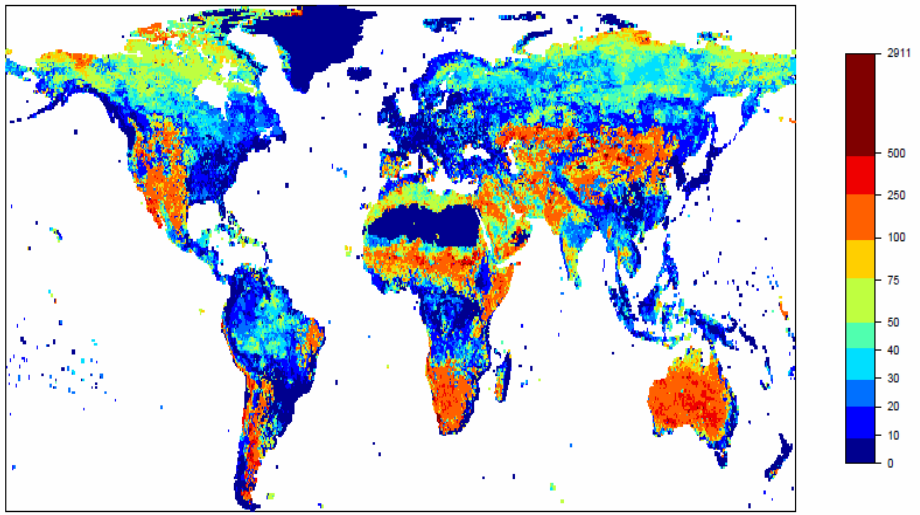
CRU

WATCH forcing data, 1958-2001

Multi-model runoff series (daily)

Drought and flood analysis

Runoff Drought:
Mean drought duration per cell (1963-2001)



MPI-HM

Van Huijgevoort *et al.* (ongoing)

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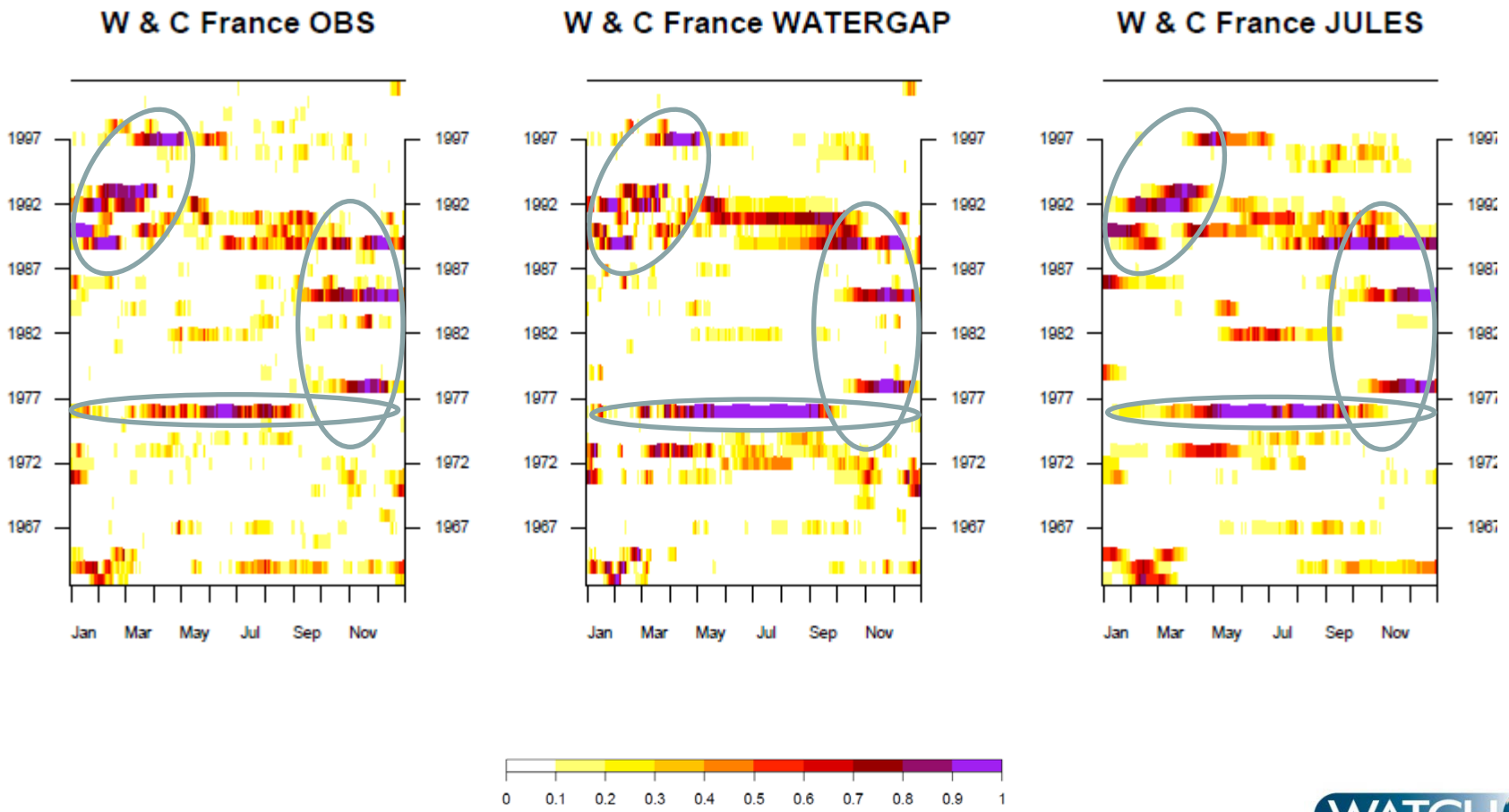
Analysis of droughts

Good reproduction of major drought events



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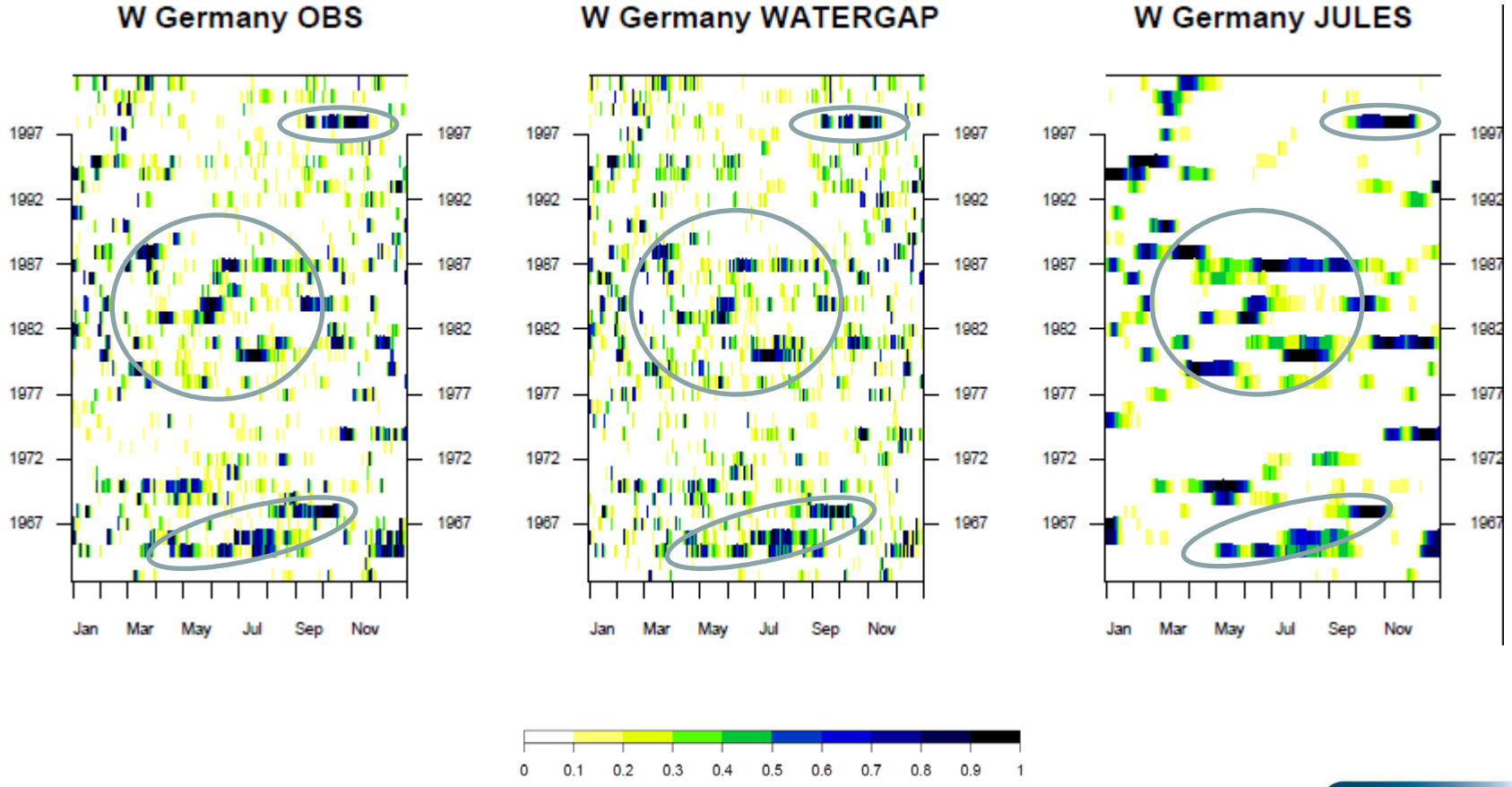
Analysis of floods

Good reproduction of major high flows/flood events



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Future research needs:

•maintain the existing river flow measurement networks and improve the free flow of data

•an improved global analysis of groundwater resource and changes,

•a better global analysis of extremes (floods and droughts) for the 20th and 21st centuries

•improved relevant human influence on the hydrological cycle with in Earth System Models

•higher resolution predictions from global (and regional) climate models to better represent local feedbacks and orographic effects

•to use multi-model ensembles for impact studies to better represent uncertainty in our predictions.

•How do we represent uncertainty to stakeholders? - Continuous stakeholder involvement.

Thank you

http://www.eu-watch.org

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