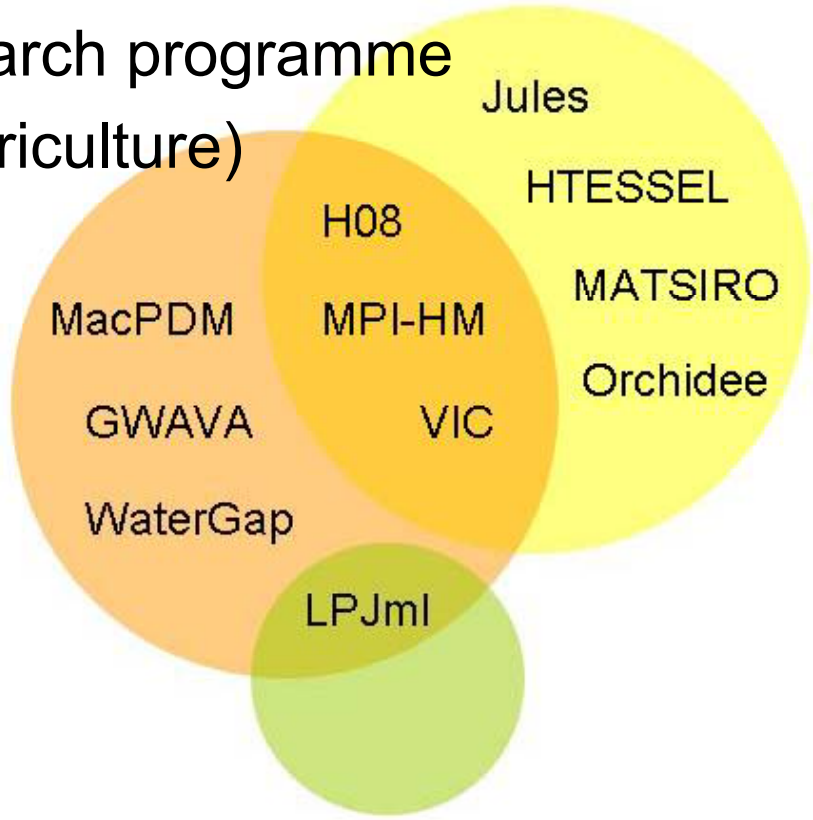
Global water use and availability: What might the future bring?

Ingjerd Haddeland, Hester Biemans, Stephanie Eisner, Martina Flörke, Naota Hanasaki, Jens Heinke, and Fulco Ludwig

Norwegian Water Resources and Energy Directorate, Oslo, Norway
Wageningen University and Research Centre, Wageningen, The Netherlands
University of Kassel, Kassel, Germany
Potsdam Institute for Climate Research, Potsdam, Germany
National Institute for Environmental Studies, Tsukuba, Japan

WaterMIP

- WaterMIP: Water Model Intercomparison Project
  - EU WATCH FP6 research programme
  - Water, (vegetation, agriculture)
  - 2007-2011
- 11 hydrologic models



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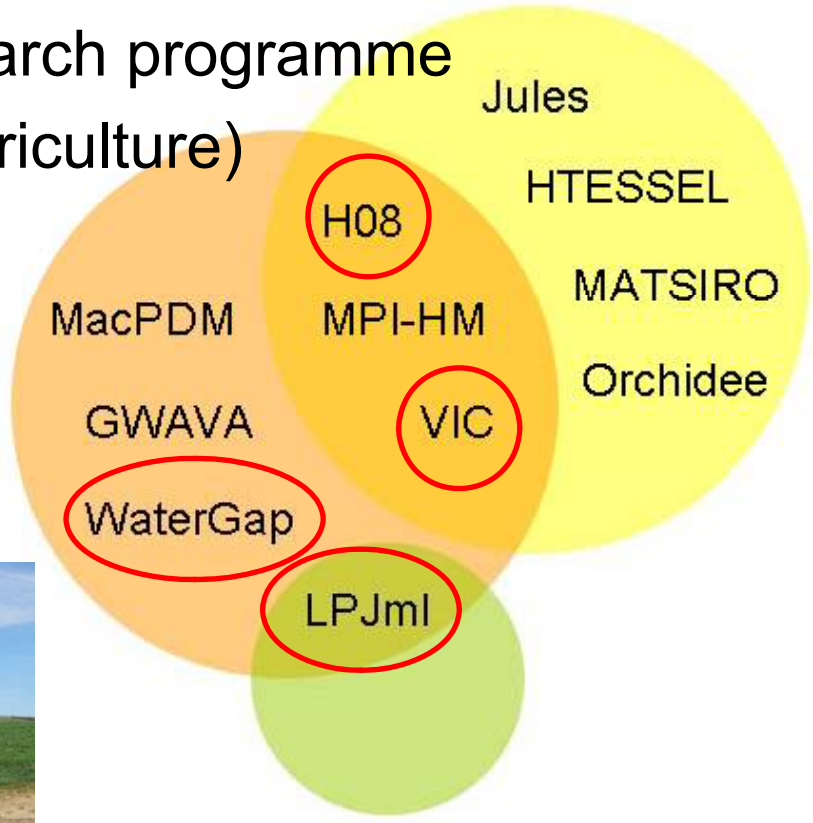
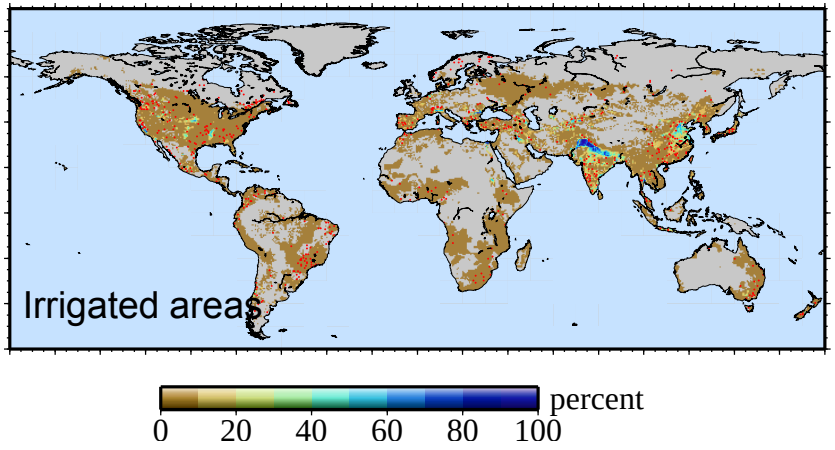


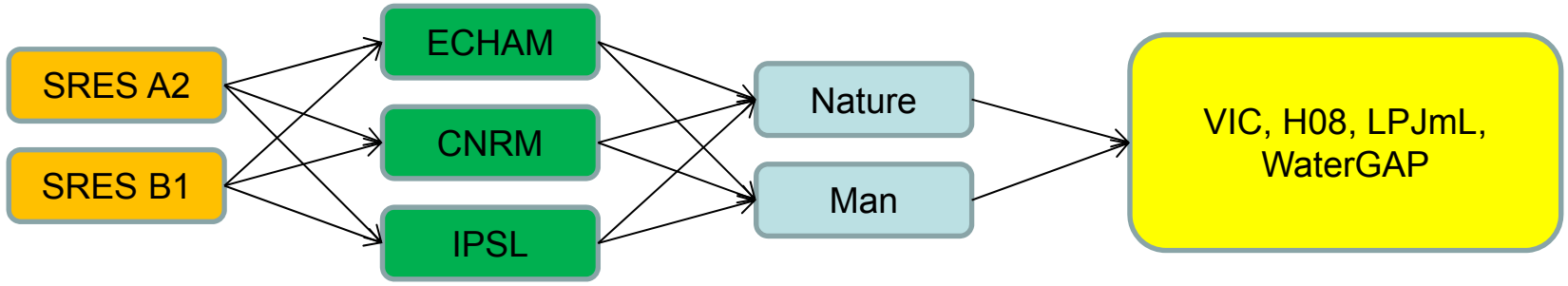
WATCH
Water and Global Change

What is done?



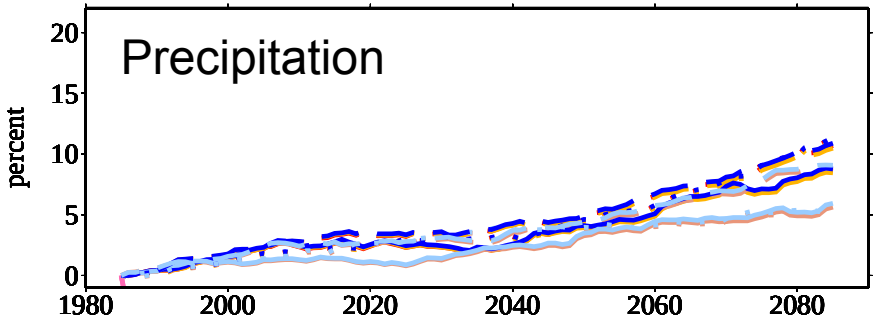
- Hydrological simulations for global terrestrial areas for the period 1960-2100 at 0.5 degrees spatial resolution
  - Naturalized
  - Including human impacts like dams and water withdrawals
- Effects of climate changes alone.

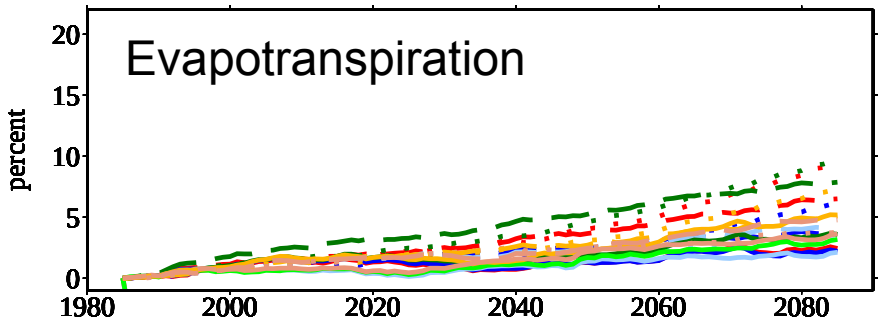
WaterMIP simulations:

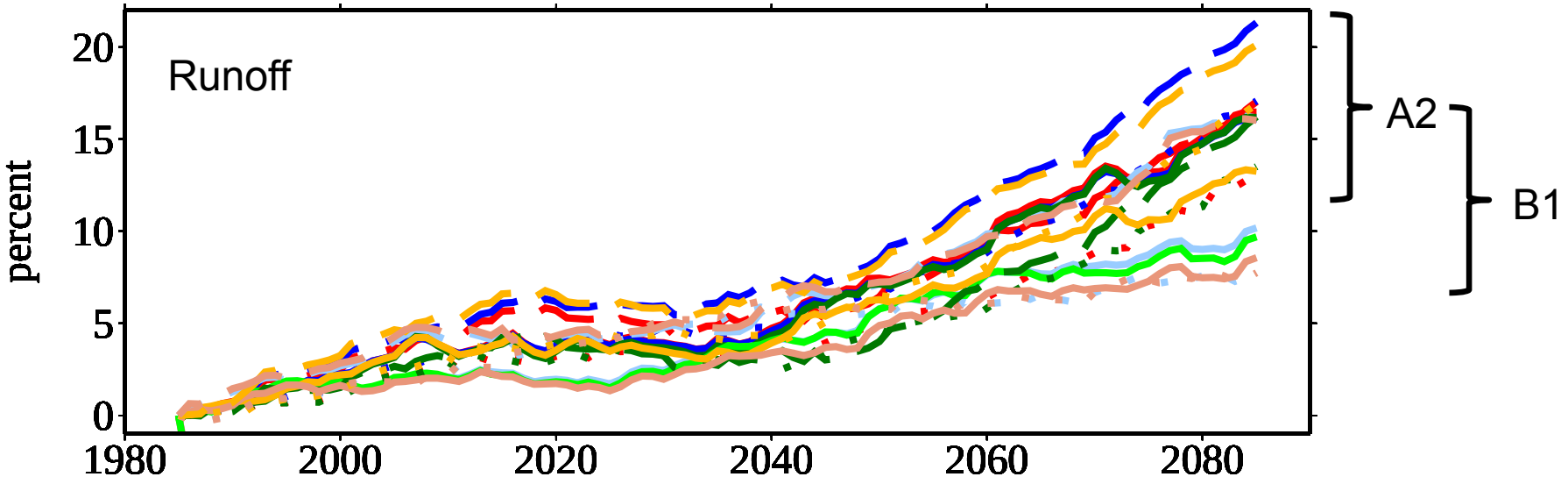


Global terrestrial hydrologic projections

Naturalized simulations
30 year moving averages, 1971-2100. ’0’ (1985) represents 1971-2000.

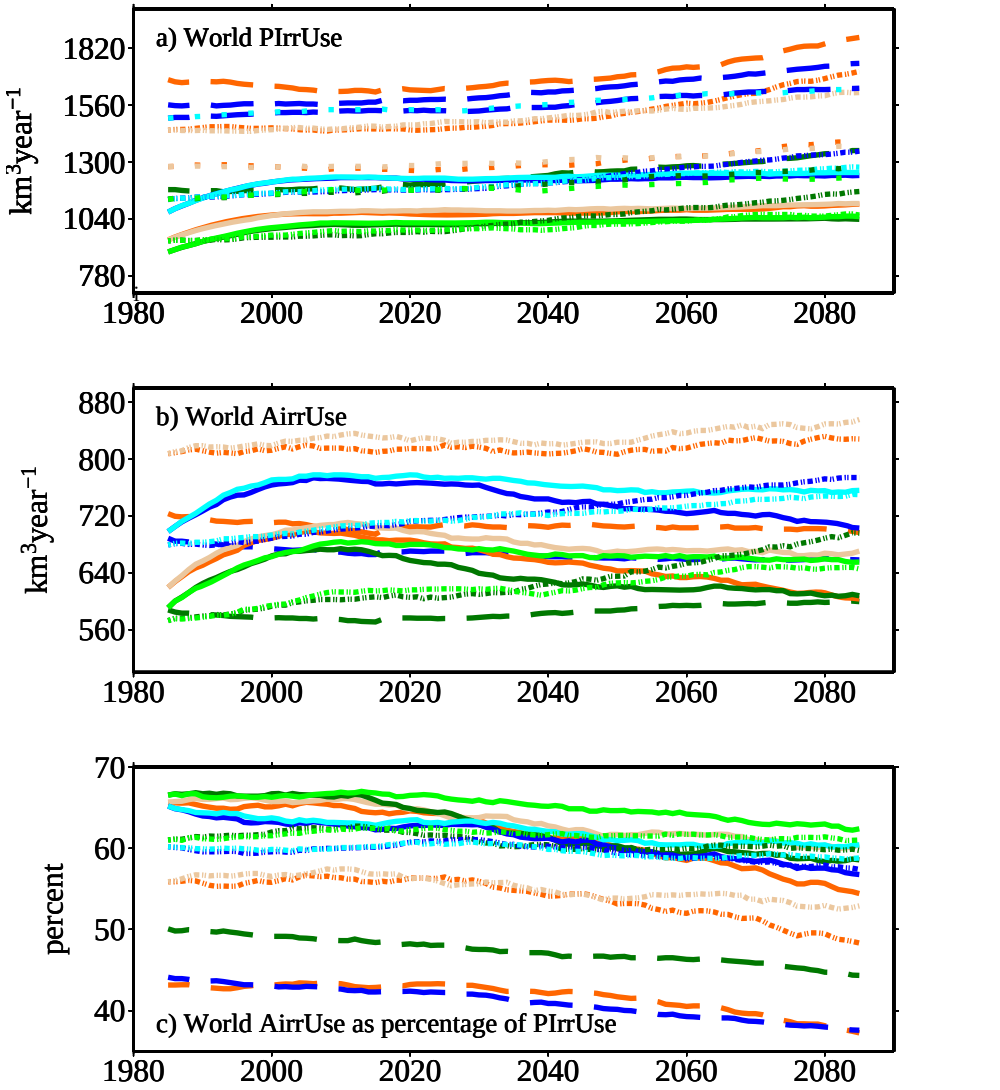






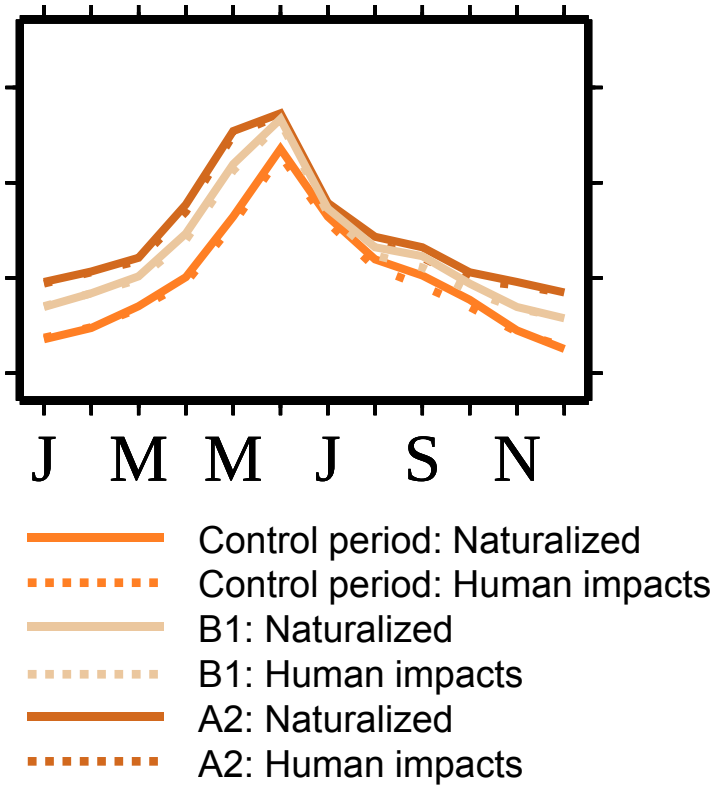
Irrigation water

- 90% of current total water consumption is irrigation water.
- Globally averaged 30-year running mean numbers, 1971-2100.
- a) Potential irrigation water consumption (PIrrUse).
- b) Middle panel: Actual irrigation water consumption (AIrrUse).
- c) Lower panel: AIrrUse/PIrrUse (percentage).



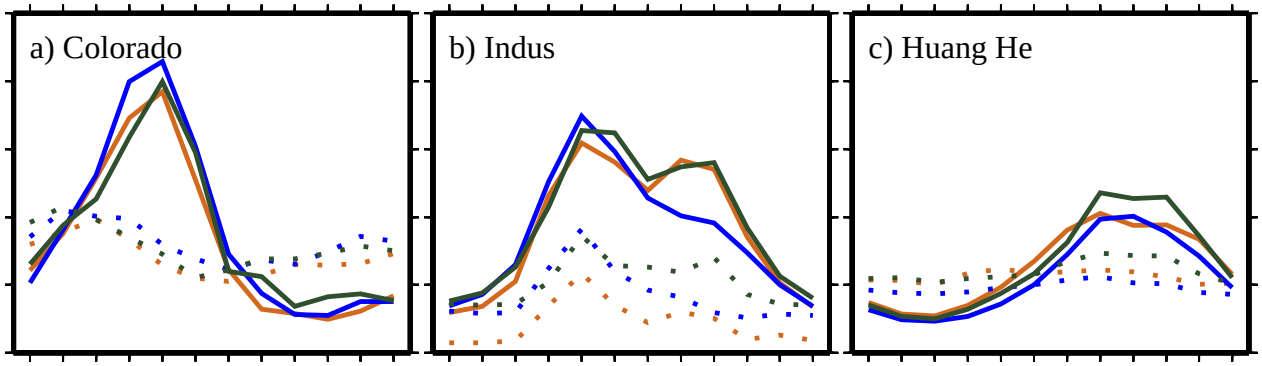
Global terrestrial discharge to oceans

- Forcings: ECHAM B1 & A2
- Hydrologic model: VIC
- Similar results for other forcings and hydrologic models

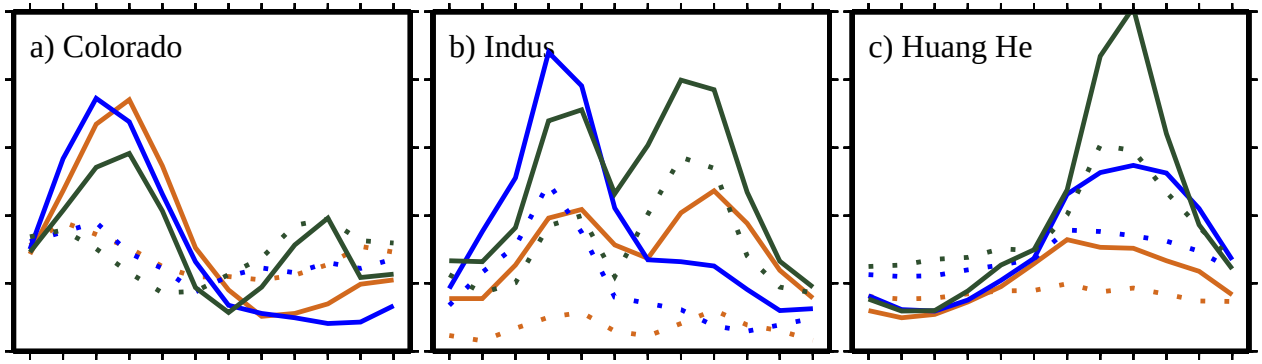


Basin discharge (VIC results)

Control period:
1971-2000

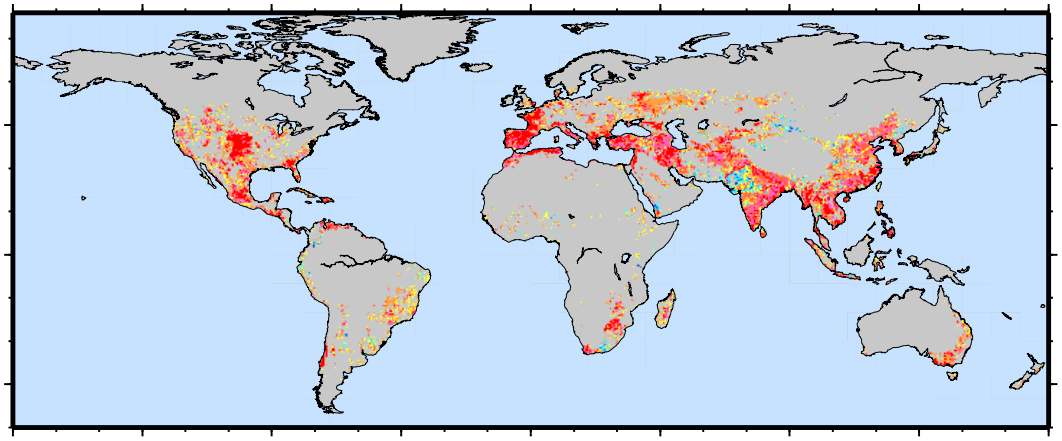


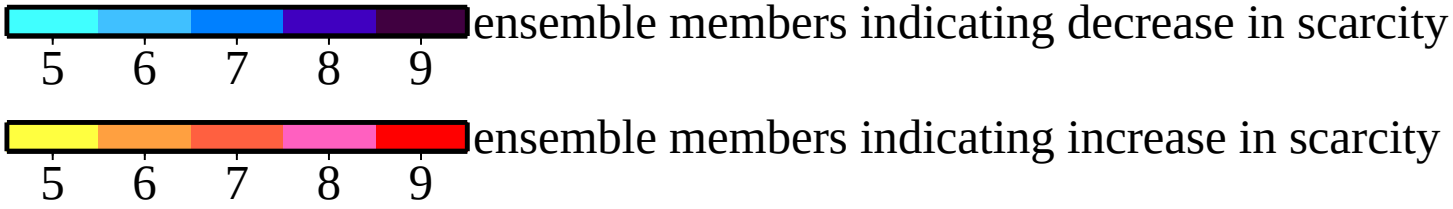
Projection period:
(2071-2100)



ECHAM, Naturalized
IPSL, Naturalized
CNRM, Naturalized
ECHAM, Human impacts
IPSL, Human impacts
CNRM, Human impacts

Water scarcity - agriculture





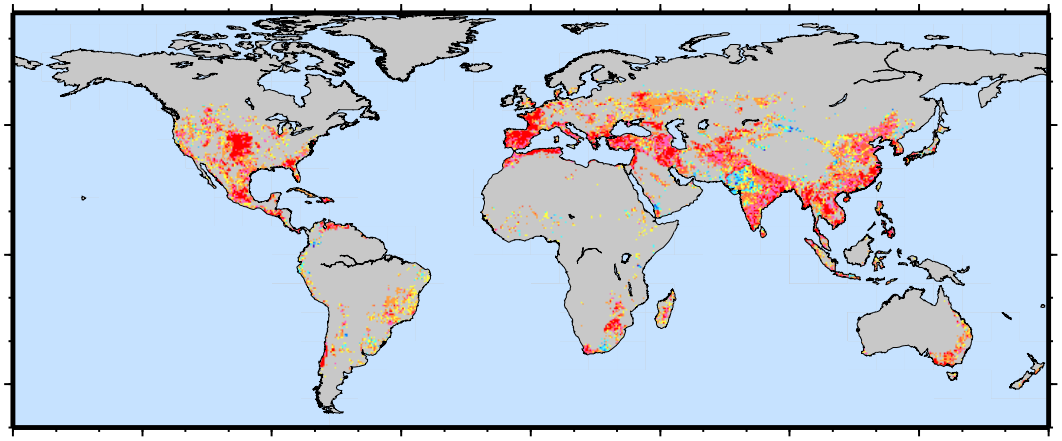
Areas where more than half (here: ≥5) ensemble members project increased /decreased water scarcity.

Emission scenario: A2
Climate models: Echam, IPSL, CNRM
Impact models: H08, LPJmL og VIC

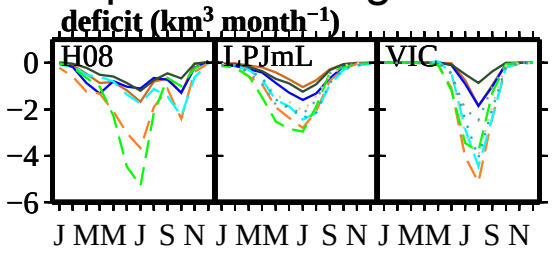
} 9 members

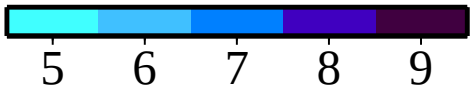
AIrrUse as percentage of PIrrUse

Water scarcity - agriculture

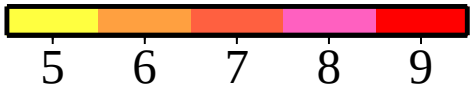


Spain + Portugal:





ensemble members indicating decrease in scarcity



ensemble members indicating increase in scarcity

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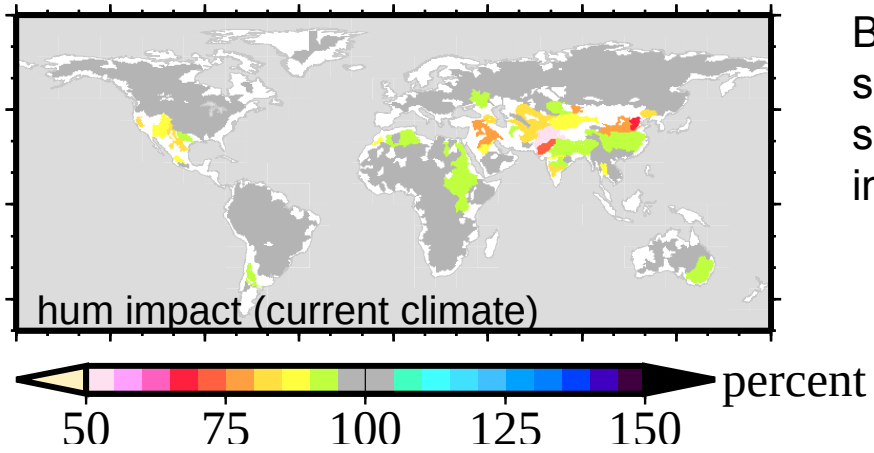
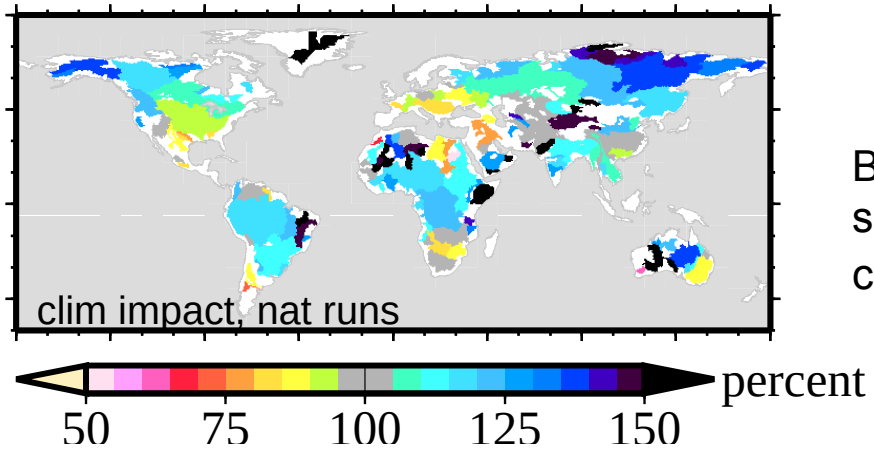
AIrrUse as percentage of PIrrUse

Naturalized compared to human impacts

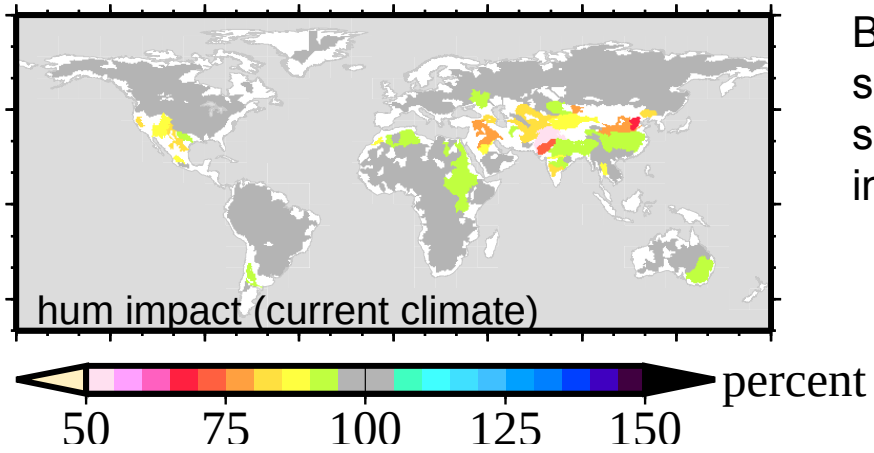


Basin averaged/total discharge, human impact simulations, compared to the naturalized simulations. NB! Only the large basins are included in the figure.



Basin averaged/total discharge, naturalized simulations. Projection period compared to control period.

Naturalized compared to human impacts



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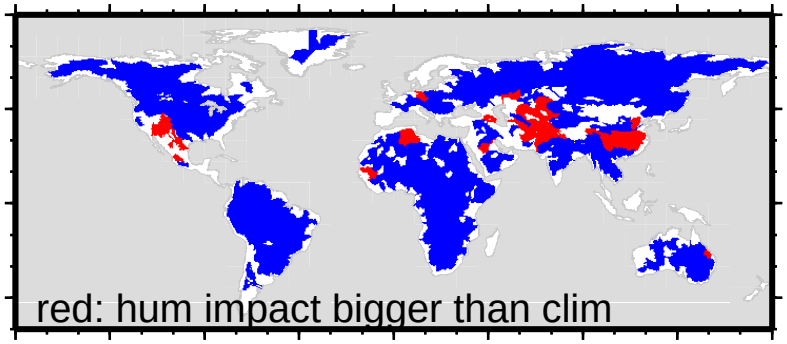
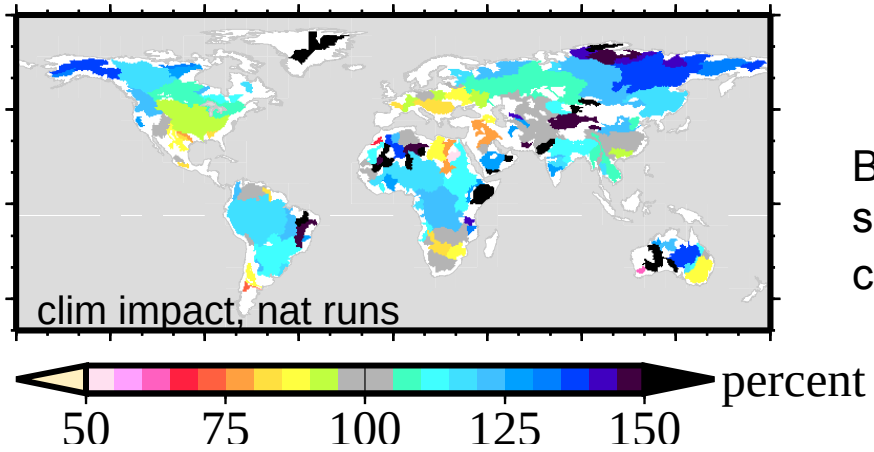
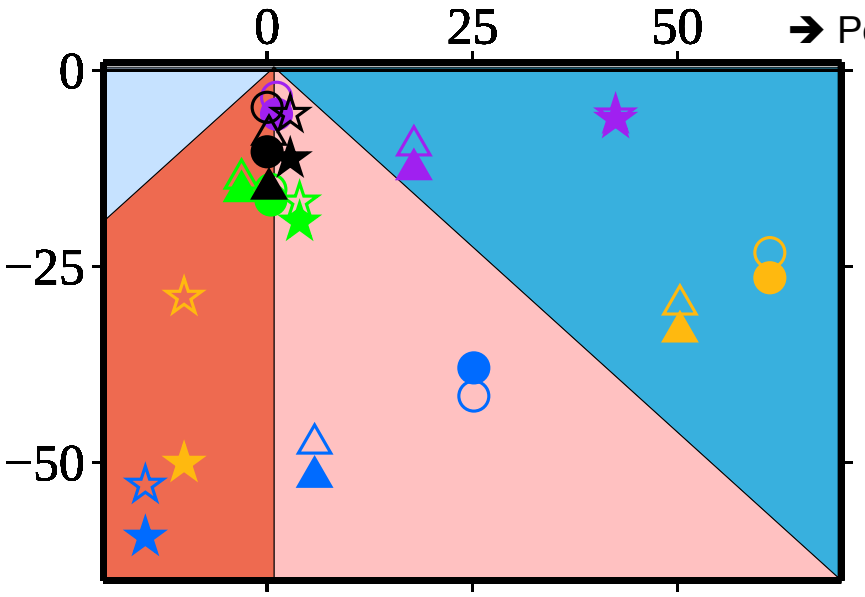




Basin averaged/total discharge, naturalized simulations. Projection period compared to control period.

Water consumption vs climate change effects

- Red/blue areas: Anthropogenic water consumption larger/smaller effects on runoff than climate change
- Mean of 4 impact models



➔ Percent increase in runoff (projected cp control), naturalized

➔ Percent decrease in runoff as a result of anthropogenic water consumption

Colorado
Nile
Indus
ChangJiang
HuangHe

○ CNRM
☆ ECHAM
△ IPSL

Open symbols: Control period human impacts compared to control period naturalized

Filled symbols: Projection period human impacts compared to projection period naturalized

Conclusions

- Irrigation water demands is expected to increase
- 55 percent of current global agricultural water demands can be met, decreasing to about 48 percent at the end of the century (mean results)
- In some areas direct human impacts have a larger effect on water fluxes than climate change is expected to have.
- Models generally agree on sign, but some differences in timing and amount.

- More information: www.eu-watch.org/watermip
- Ongoing project using CMIP5 data: ISI-MIP, www.isi-mip.org