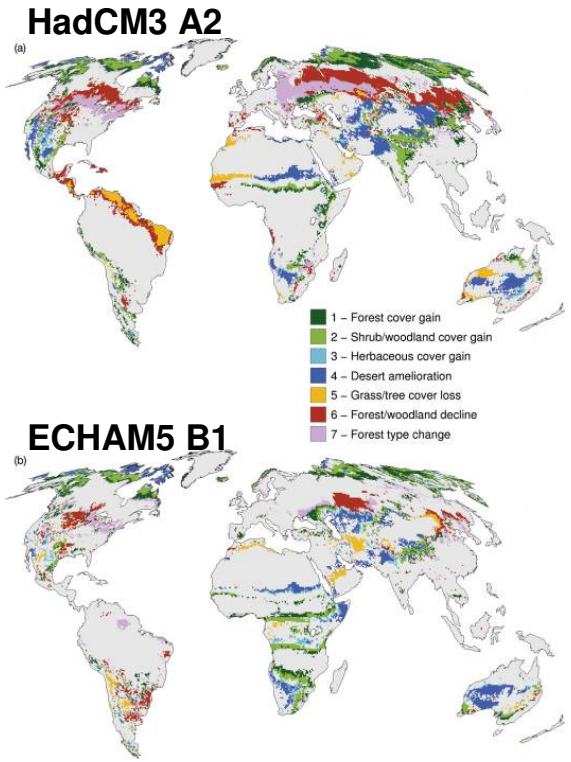
Met Office
Hadley Centre

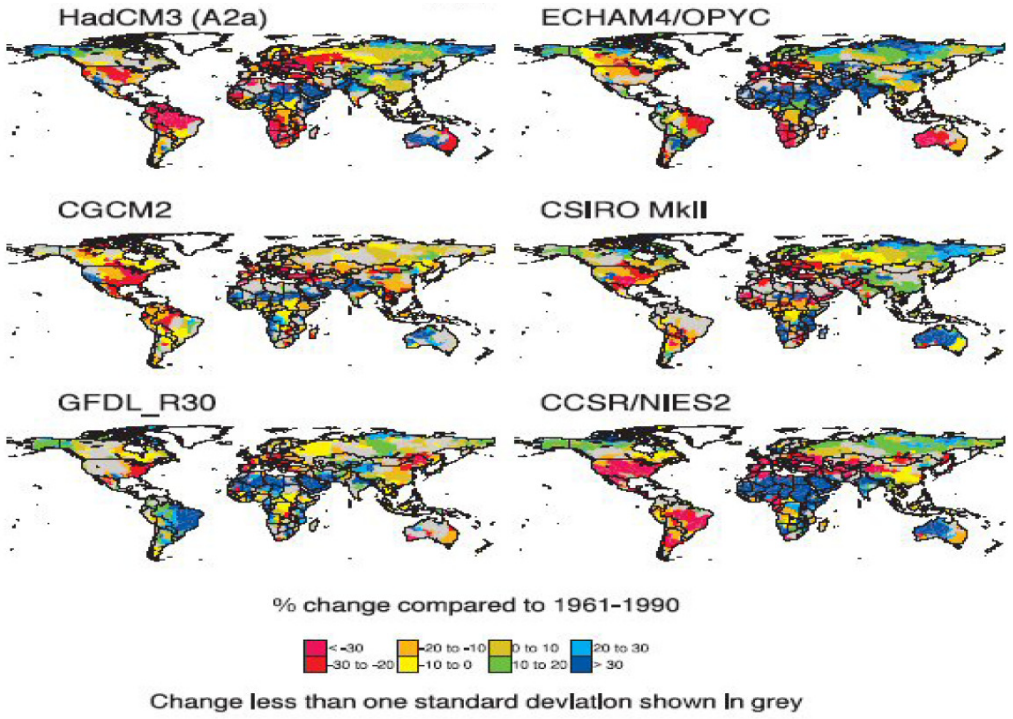
JULES in ISI-MIP

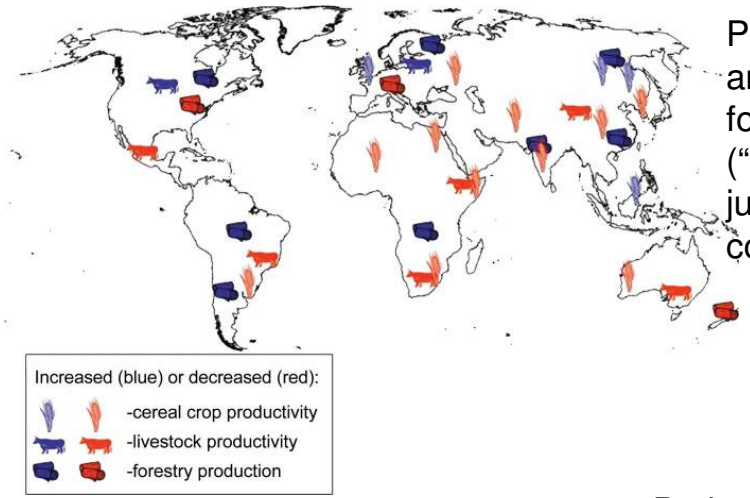
Rutger Dankers, Doug Clark, Jemma Davie, Pete Falloon, Ron Kahana, …



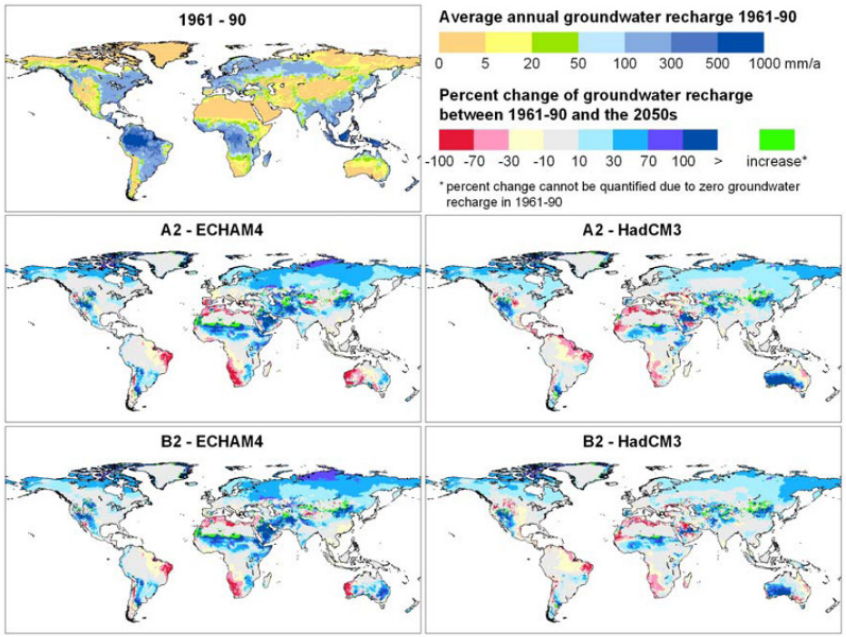
Projected changes in terrestrial ecosystems
(LPJ: 2100 compared to 2000)

Projected changes in runoff
(MacPDM(?): 2050s compared to 1961-90, A2 only)





Projected changes in crop and livestock yields, and forestry production ("literature and expert judgement": 2050s compared to present day)



Projected changes in GW recharge
(WGHM: 2050s compared to 1961-90)

Consistency of impacts projections

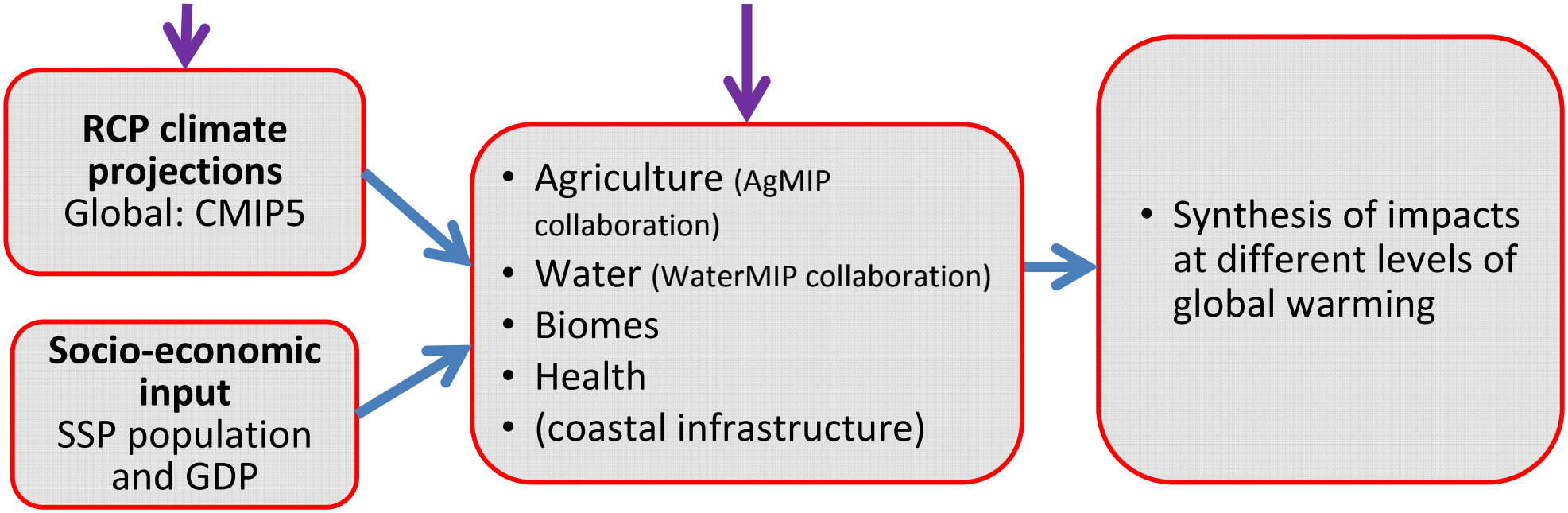
- Different models used for different impacts
- But often rely on same processes (eg: land surface hydrology)
- Are the impacts assessments physically consistent with each other?
  - Eg: do runoff / groundwater recharge projections take account of ecosystem / crop changes?
- Food and Water Systems and Ecosystems are closely linked and can't really be considered independently.

ISI-MIP

InterSectoral Impacts Model Intercomparison Project

What is ISI-MIP?

Multiple climate models + Multiple global impact models per sector = Fast track contribution to AR5



- What is the difference between a 2°, 3° and 4°C world?
- How good are we at telling this difference?
- Are there essential deficiencies in our process understanding or the way proccesses are represented in impact models?
- Are these deficiences persistent across different impact models?

Participating models: 5 sectors, more than 30 models, 11 countries

- 9 **water** models: VIC, H08, WaterGAP, MacPDM, WBM, MPI-HM, PCR-GLOBWB, DBH, MATSIRO
- 5 **biomes** models: Hybrid, Sheffield DGVM, JeDi, ANTHRO-BGC, VISIT
- 9 **agriculture** models: GEPIC, EPIC, pDSSAT, DAYCENT, IMAGE, PEGASUS, MAgPIE, LPJ-GUESS, MCWLA
- **Cross-sectoral**: LPJmL, ORCHIDEE, JULES,
- 5 **health** = malaria models: MIASMA, MARA, VECTRI, WHO CCRA Malaria, LMM 2005
- **Infrastructure**: DIVA
- Collaboration with

AgMIP The Agricultural Model Intercomparison and Improvement Project

WATCH Water and Global Change

JULES runs for ISI-MIP

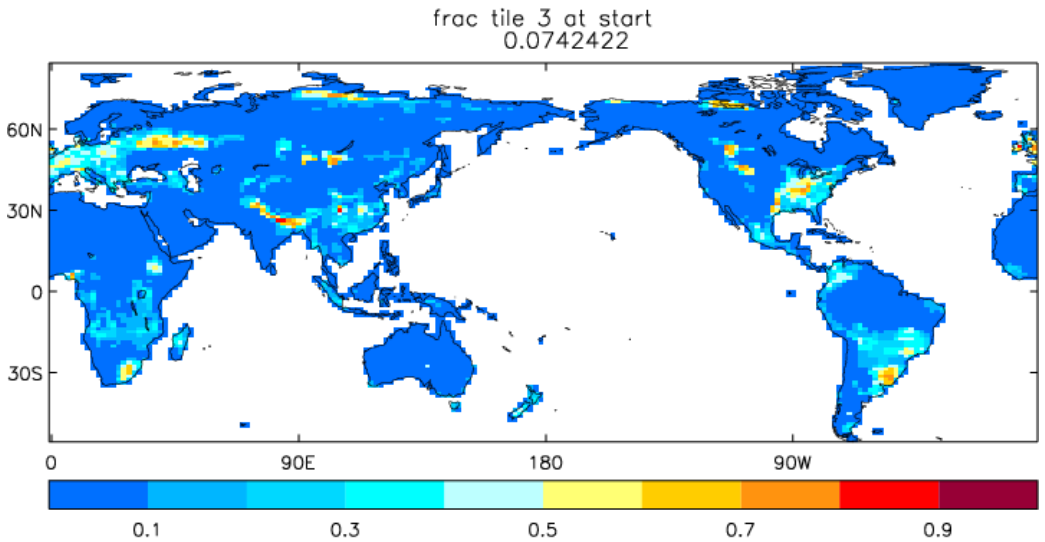
InterSectoral Impacts Model Intercomparison Project

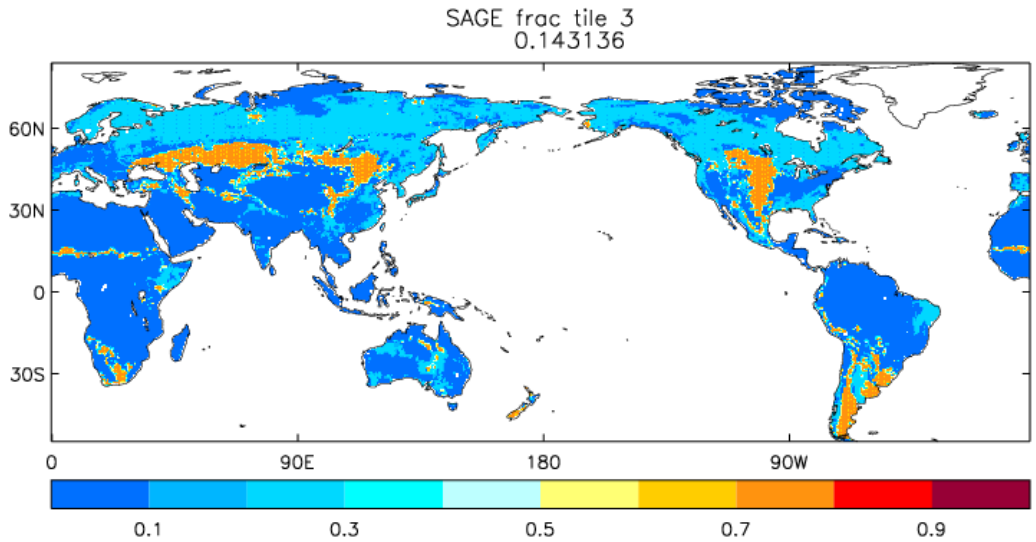
JULES runs for ISI-MIP

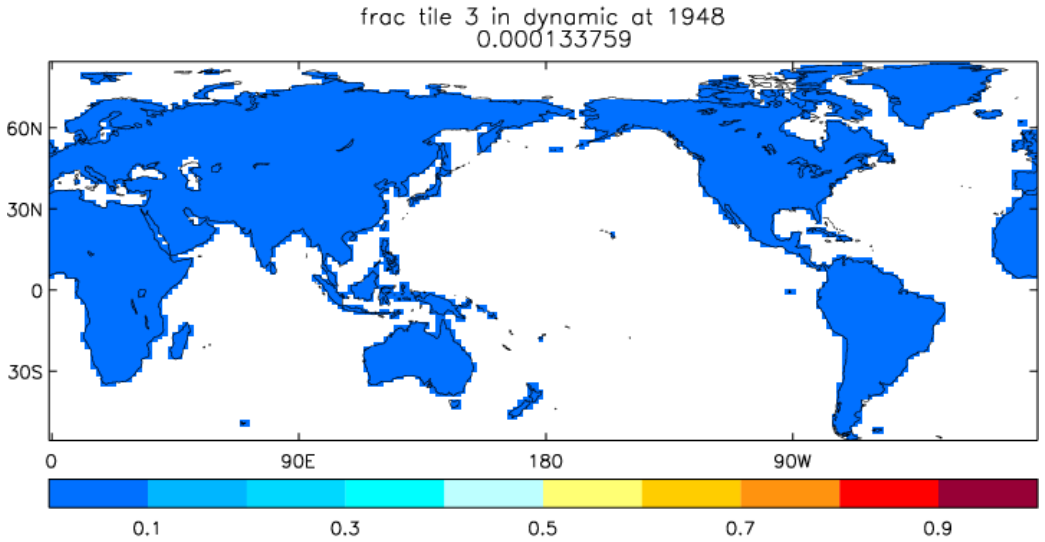
- JULES contributing to **water** and **biomes** sectors
  - 5 GCMs, 4 RCPs
  - Additional runs with static CO2, veg.
  - >20 sector-specific output variables
- JULES 3.0 + “added” functionality
  - Ability to disaggregate daily forcing data
  - Time-varying CO2 concentrations
  - ISI-MIP relevant diagnostics
- Runs shared between CEH and MO

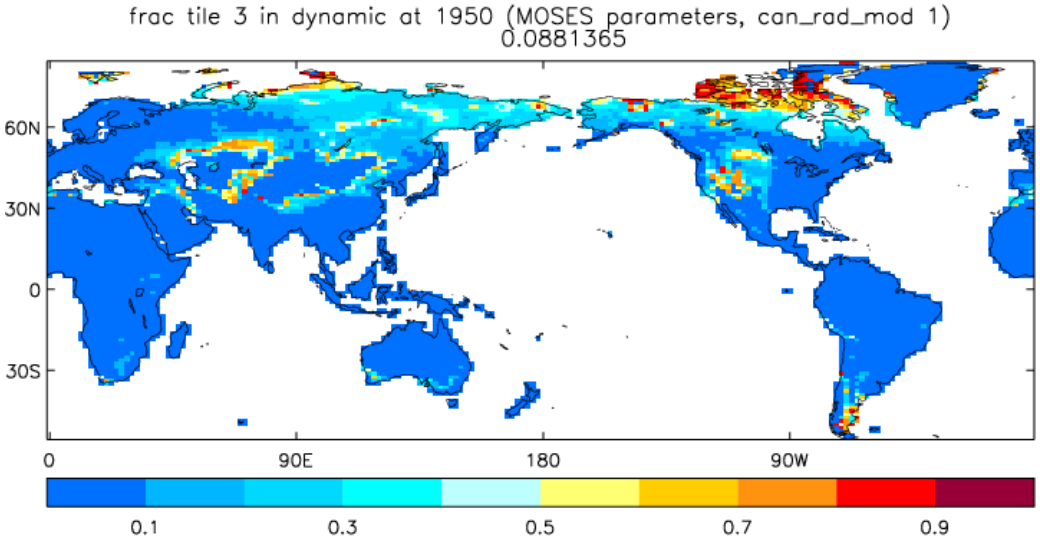
JULES setup for ISI-MIP

- No pre-existing standard global configuration
- N96 (1.875º x 1.25º) with dynamic vegetation (TRIFFID) and river routing (TRIP)
- Ancillaries based on HadGEM2-ES
- TRIFFID parameters based on HadCM3(C)
  - Modified parameters for BT and NT (thanks to Chris Huntingford!)
  - can_rad_mod=1
- Spinup as specified by ISI-MIP
  - 1950s climate, constant / transient CO2, 150 / 185 y



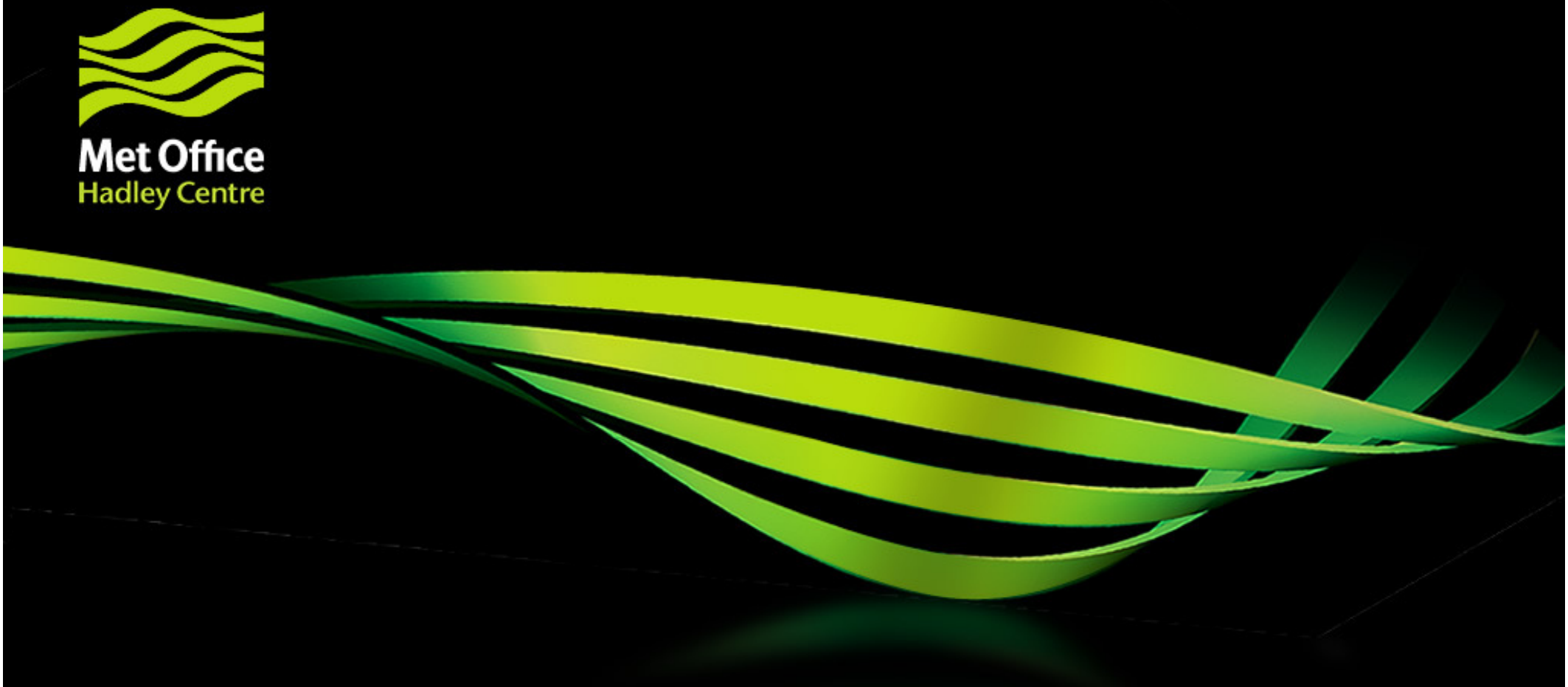






C3 grass fraction after spinup: HG2 parameters + can_rad_mod 5

C3 grass fraction after spinup: MOSES parameters + can_rad_mod 1

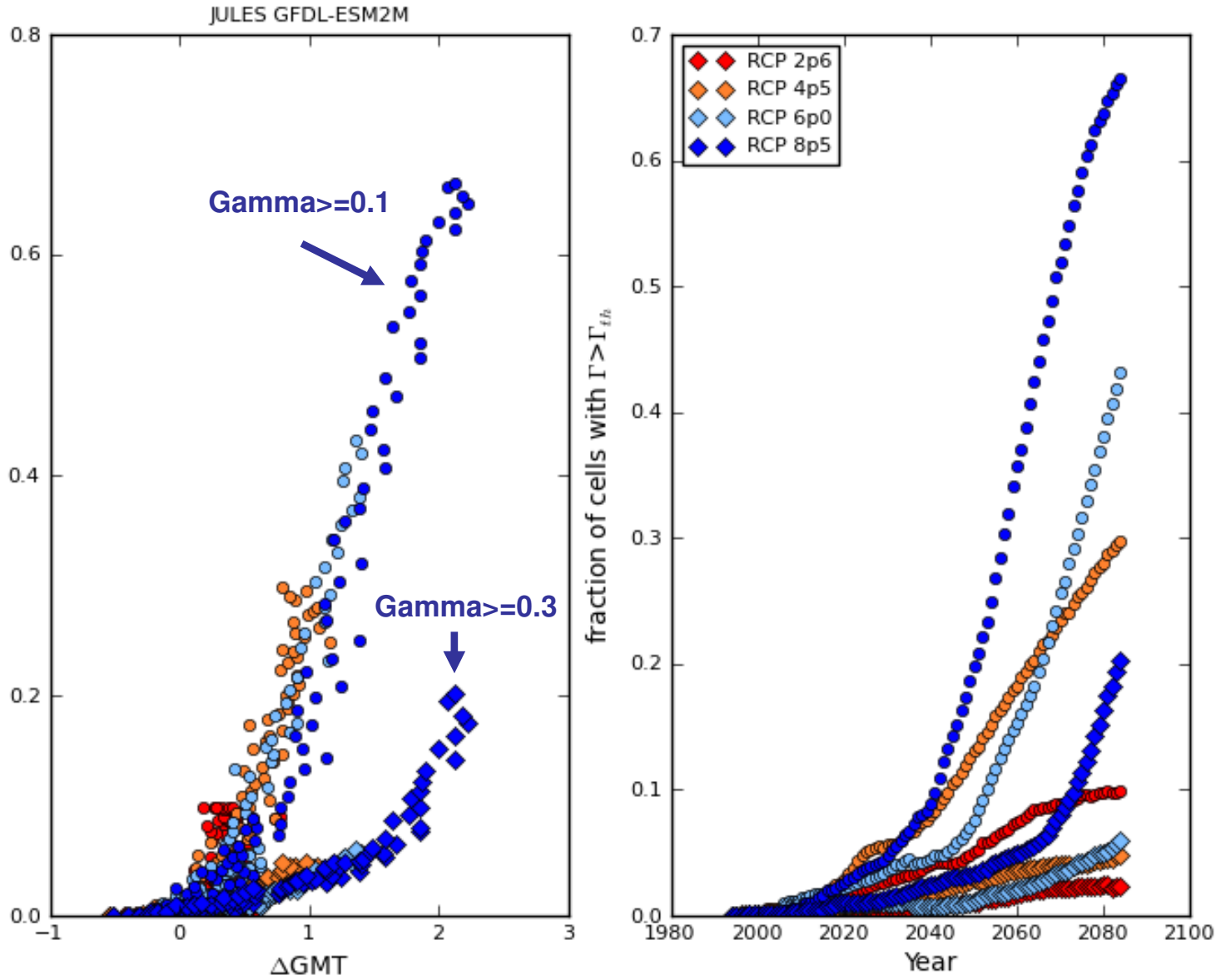


Preliminary (!) results

Biomes sector (draft) results

Quantify biomes shift using Γ-metric (Heyder et al. 2011):

combines changes in vegetation, carbon and water to assess risk of ecosystem shift.



Plot courtesy of L. Warszawski (PIK)

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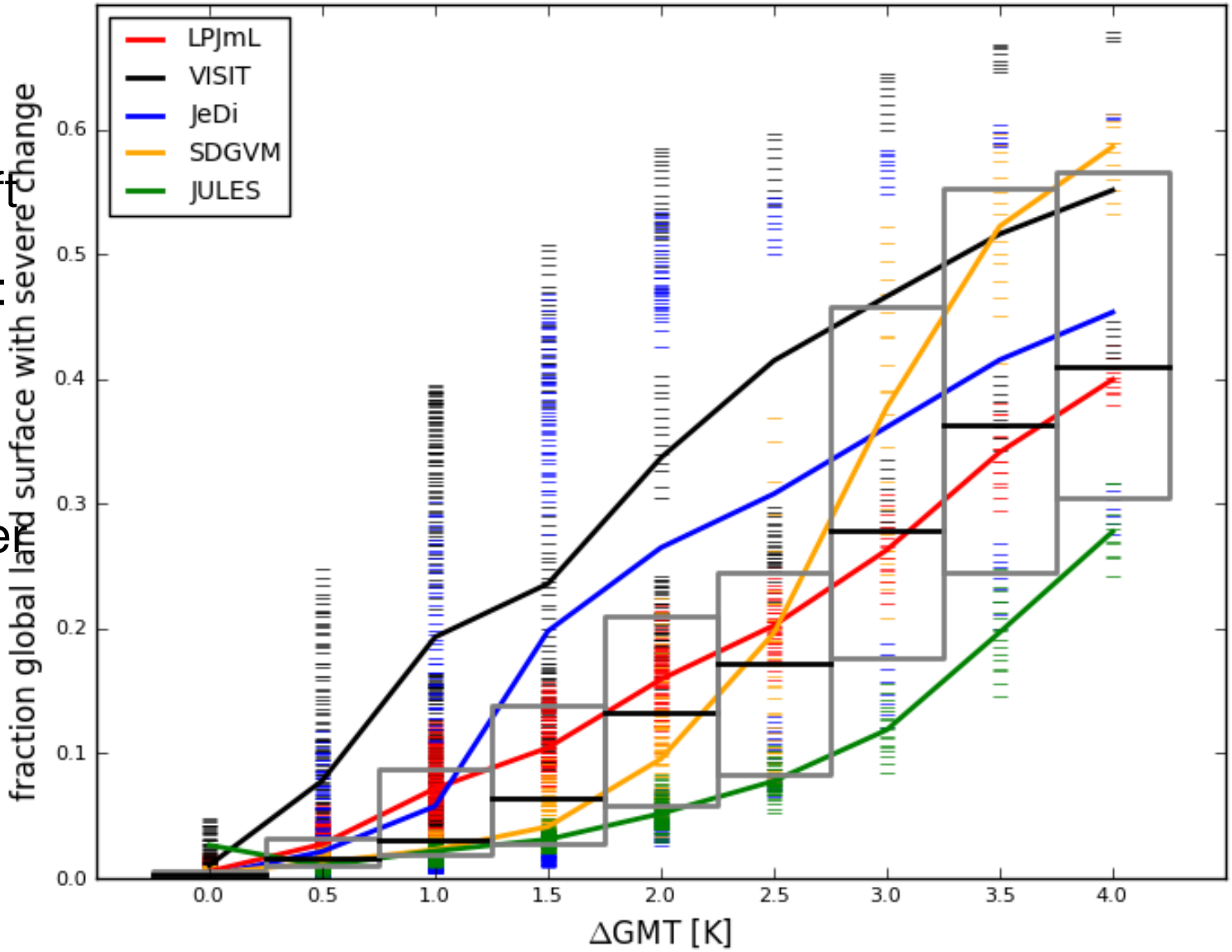

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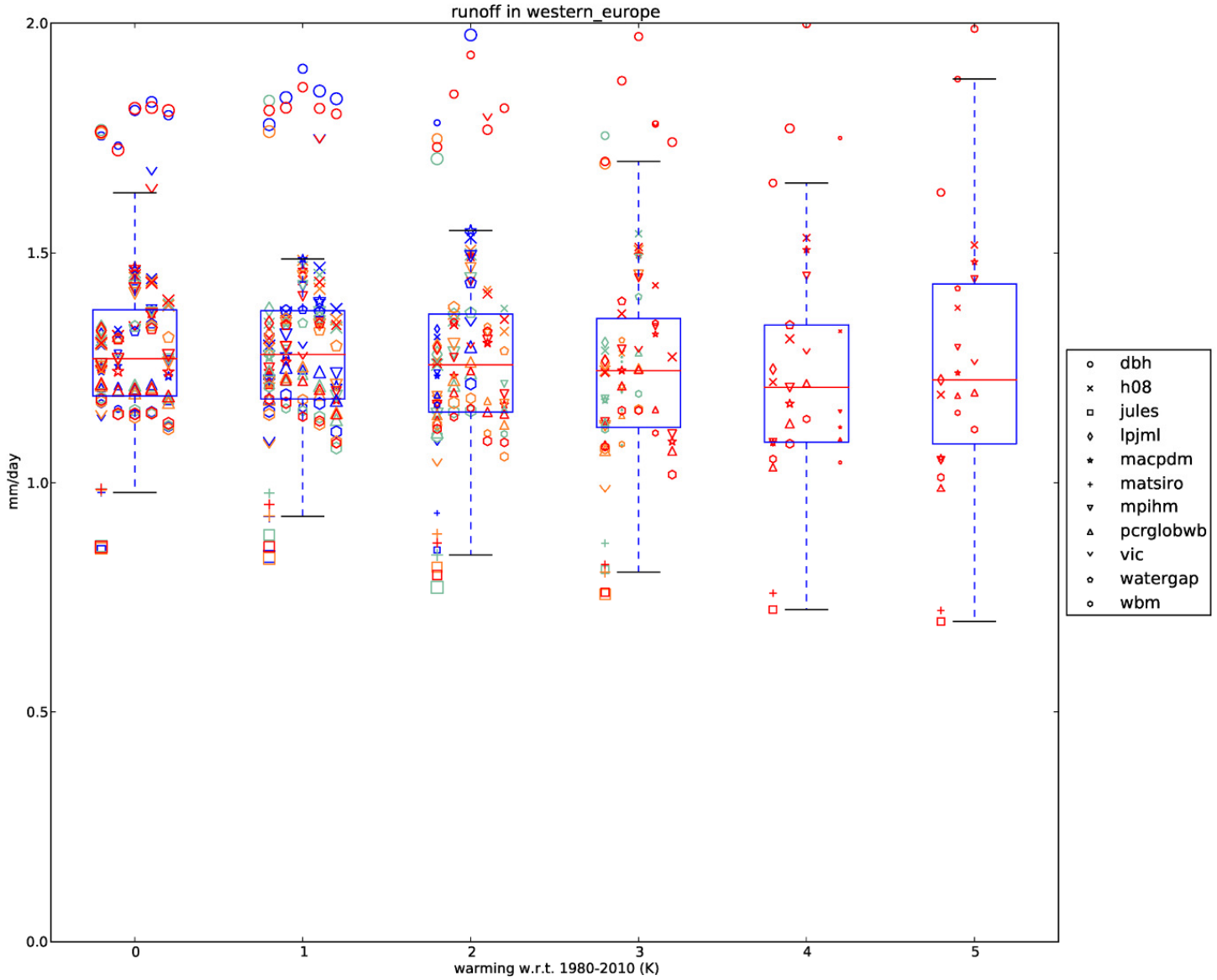
Water sector (draft) results



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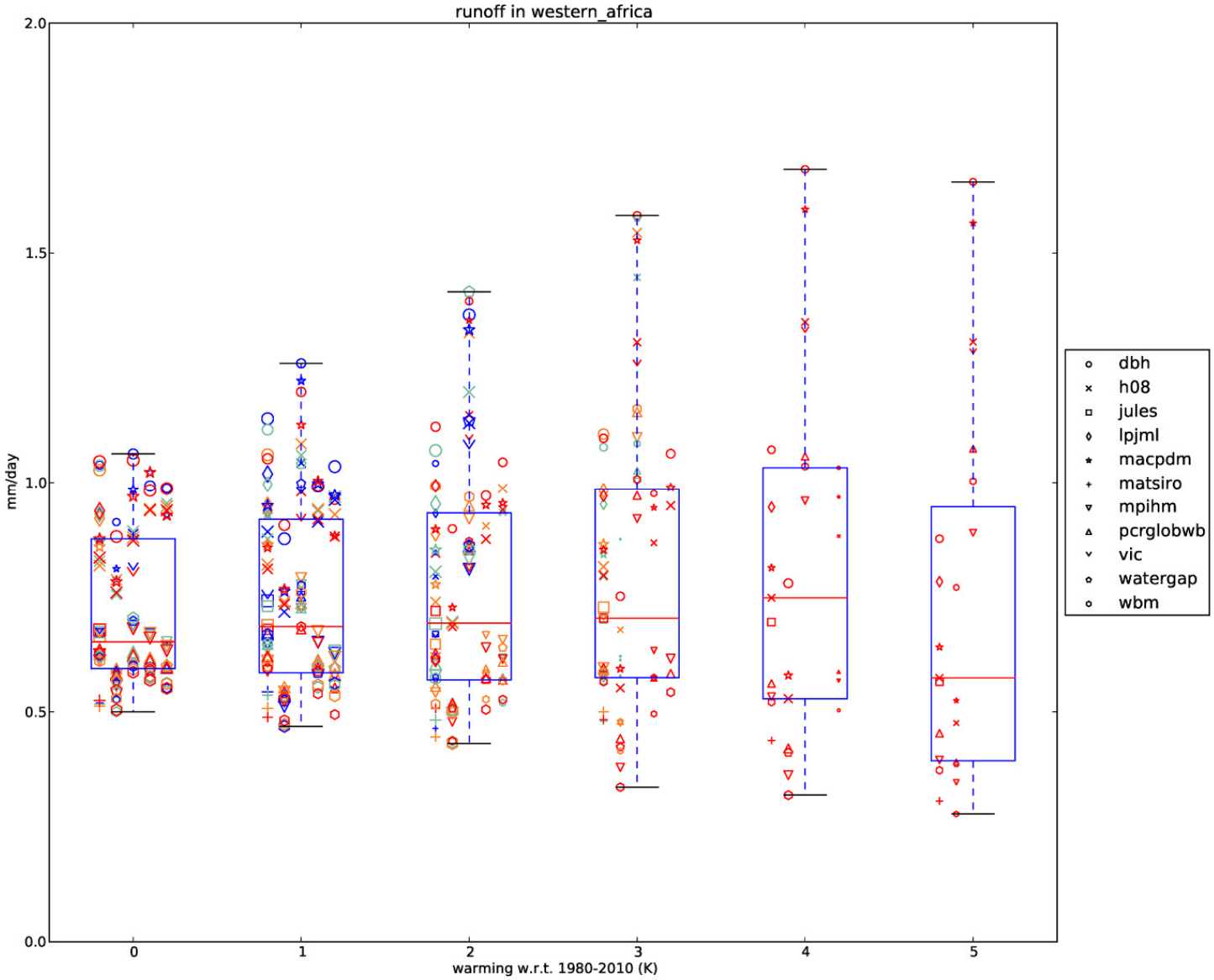

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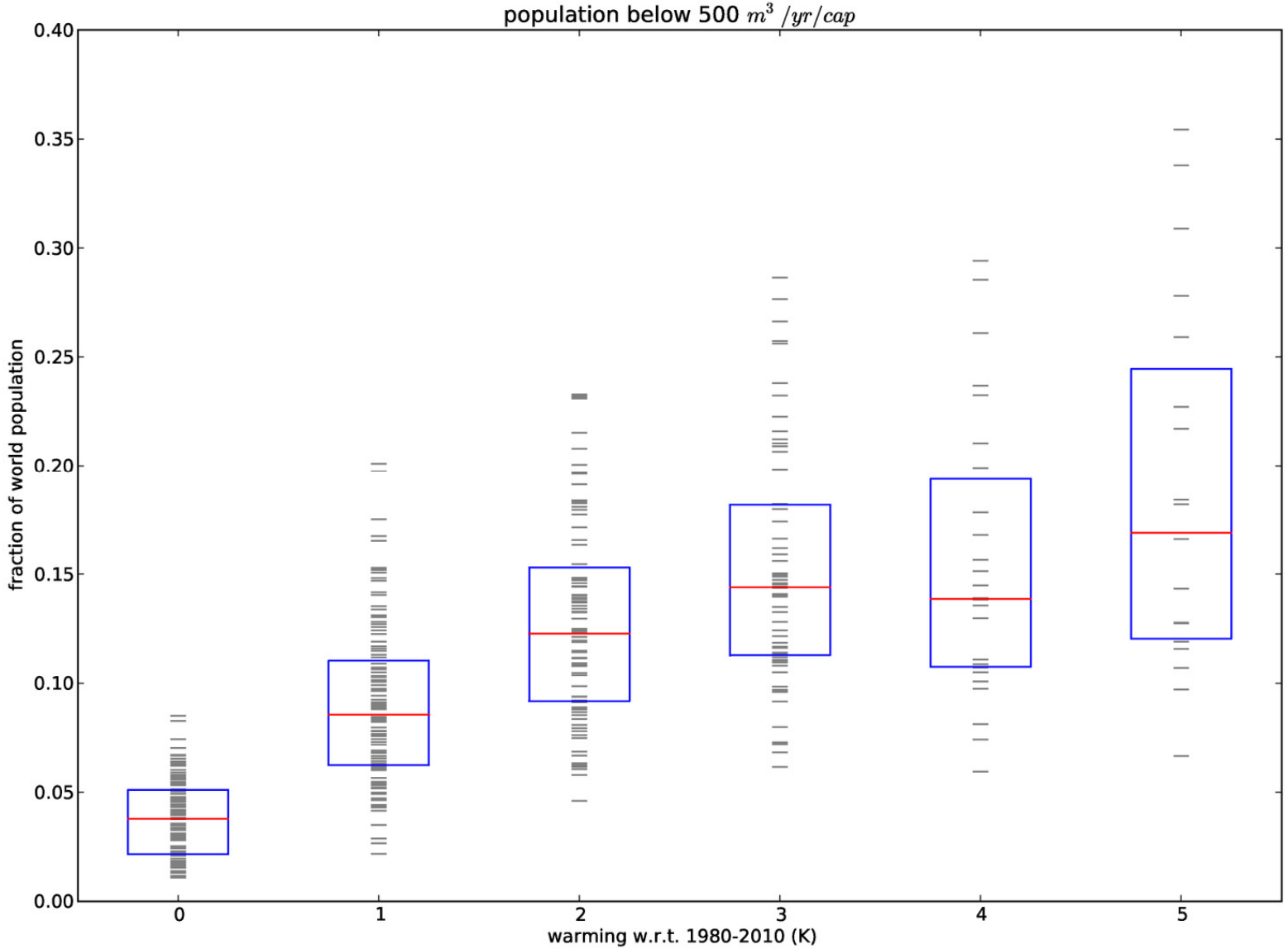

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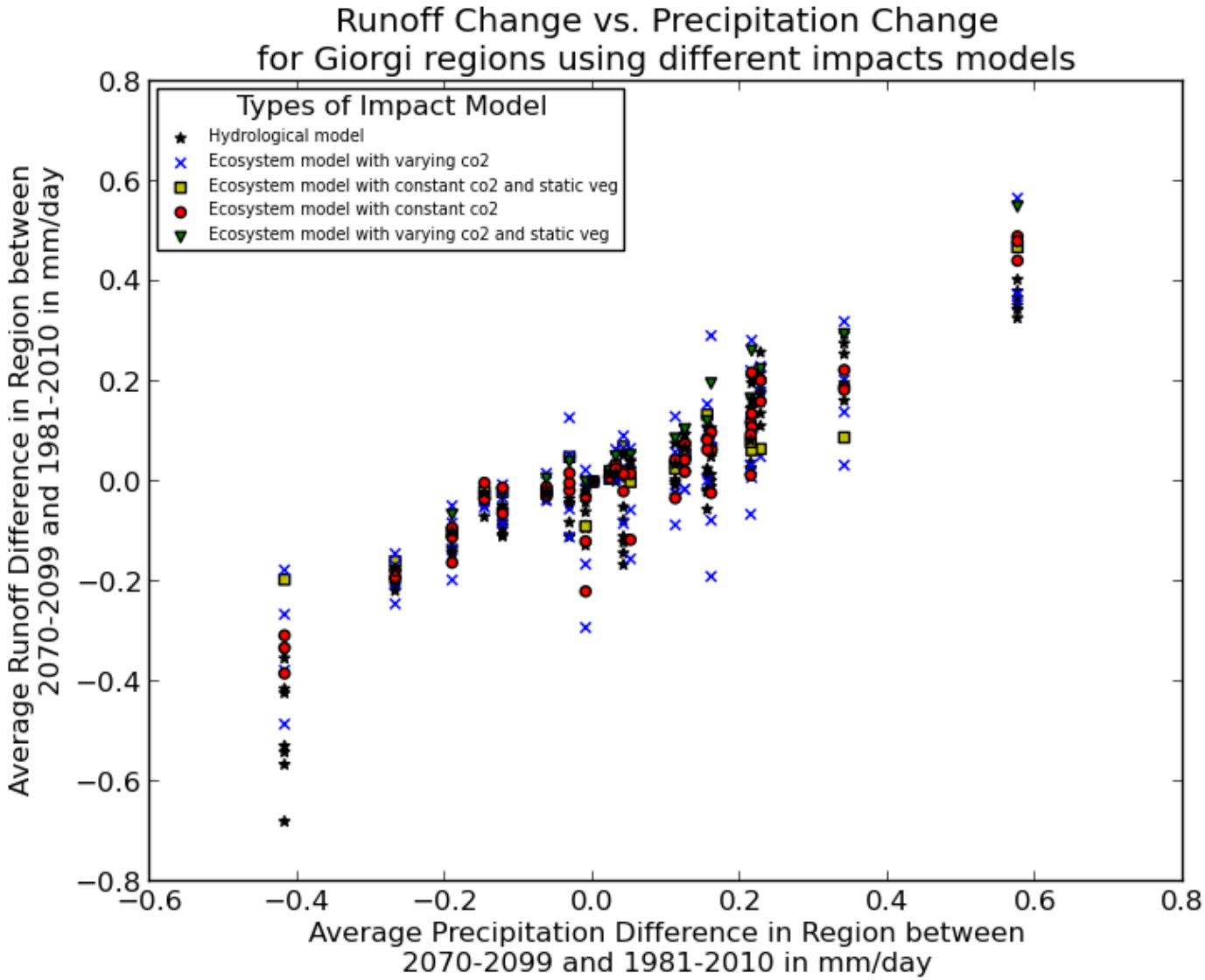
Runoff projections from water / ecosystem models

Jemma Davie et al.



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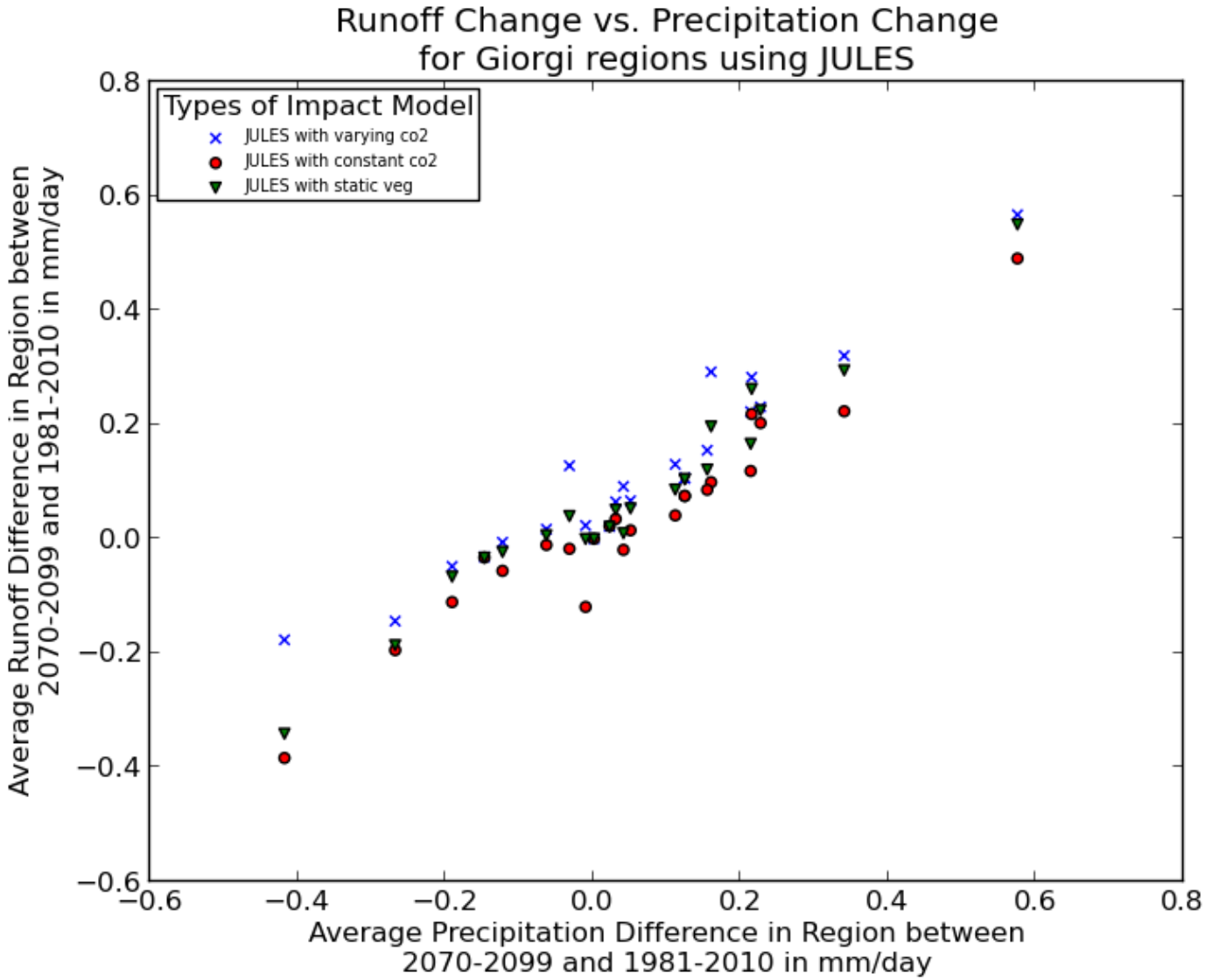
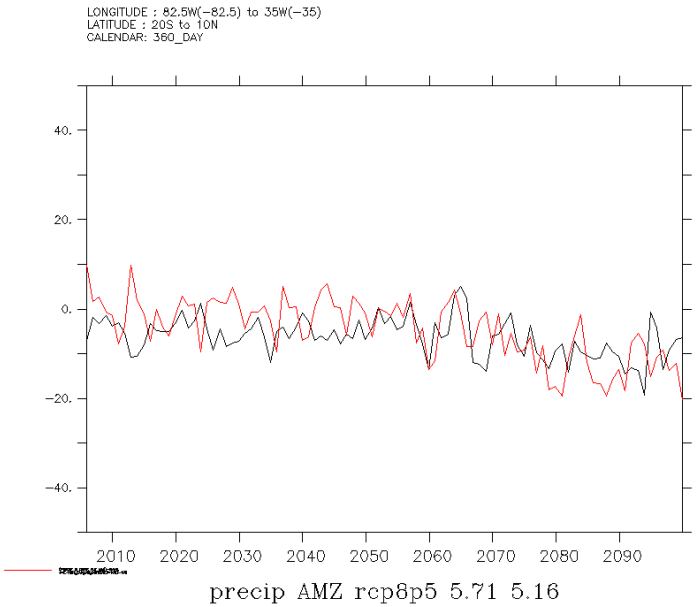


Impact of bias correction

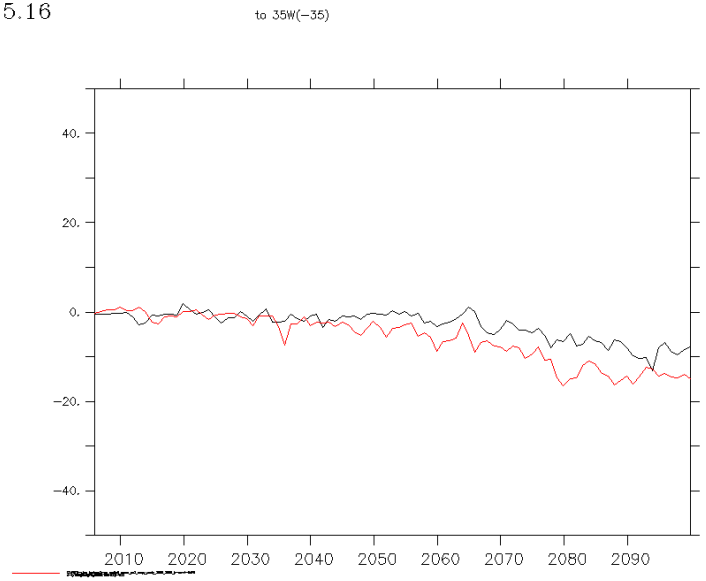
Ron Kahana et al.

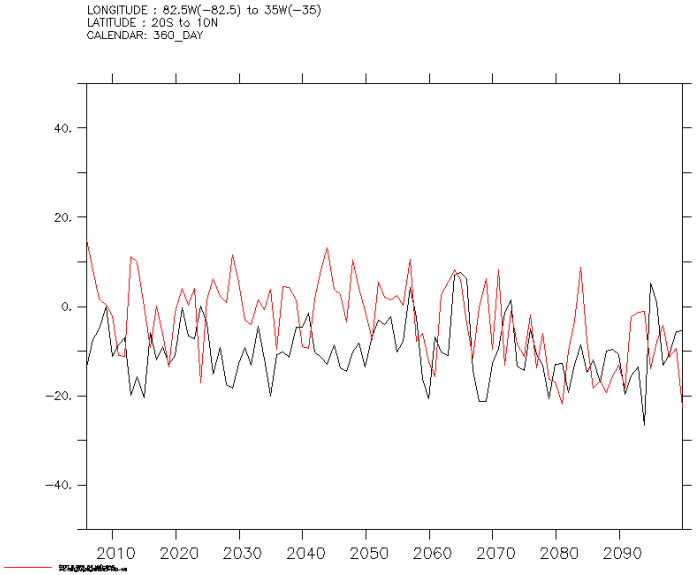


Amazon Basin Precip, evapotranspiration and runoff. RCP 8.5

--------- bias corrected

--------- original run





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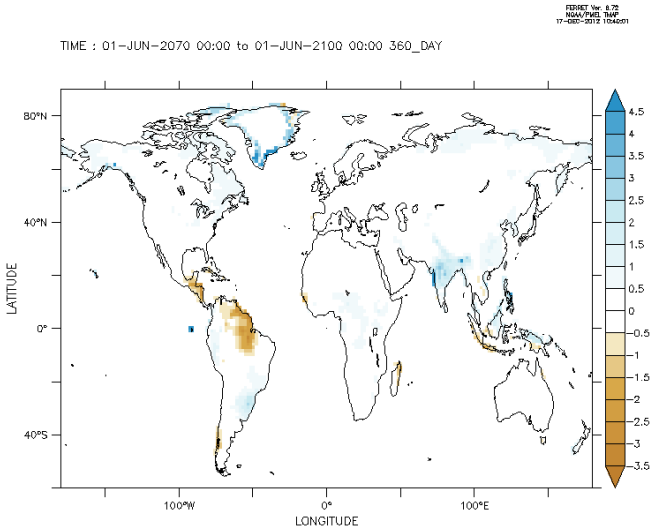
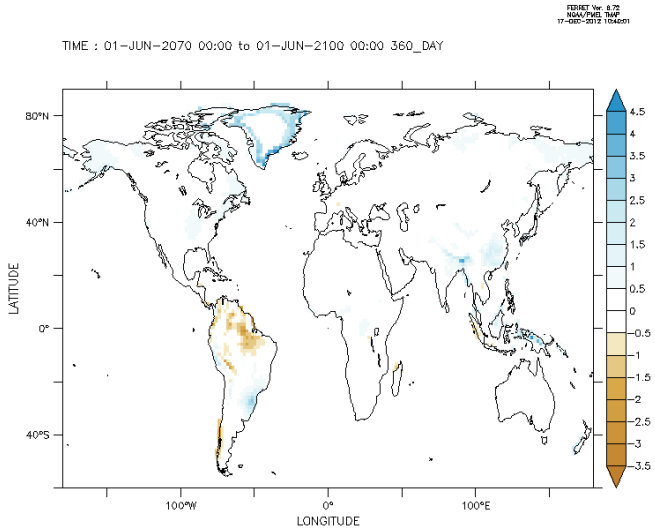
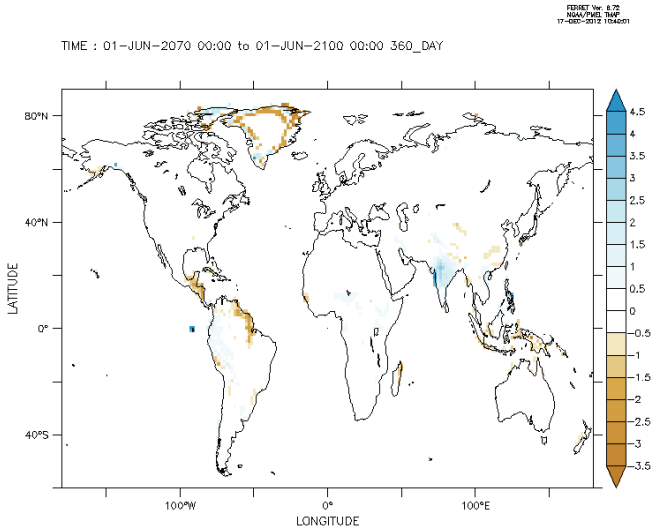
Changes in runoff (mm/d) RCP8.5 Bias corrected vs. original run



bias corrected 2100−2000



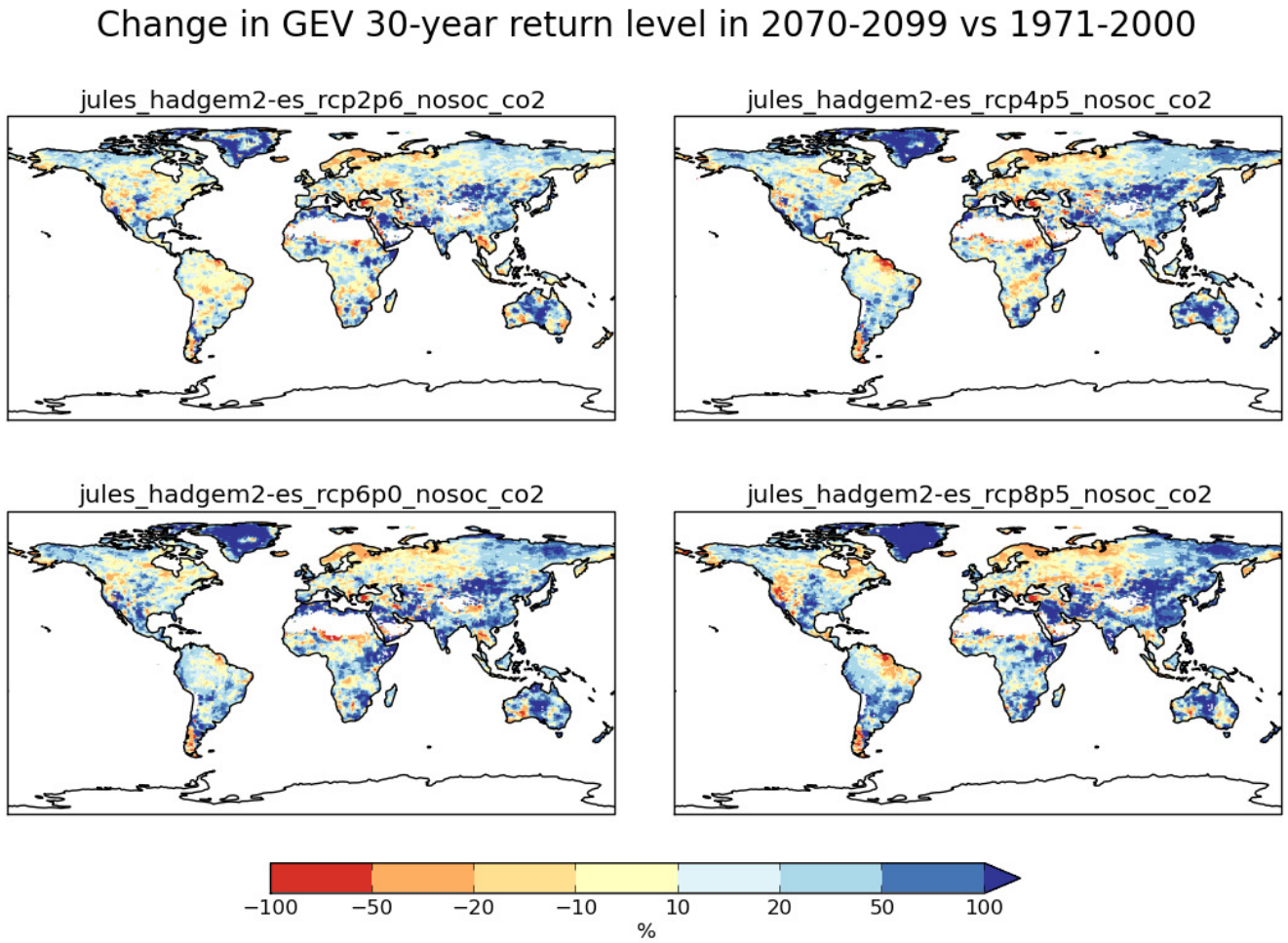
no bias correction 2100−2000



bias corrected − no bias correction

Changes in flood hazard

Rutger Dankers et al.



Changes in drought hazard

Doug Clark, Christel Prudhomme, et al.

Concluding remarks

- Impacts modelling uncertainty should not be ignored
- MIPs can result in interesting science…
- … but also poses new challenges
- Technical issues ***will*** take time
- Need for standard configuration for global-scale applications
- Need to think about parameterisations

Thank you!

Runoff projections from water / ecosystem models

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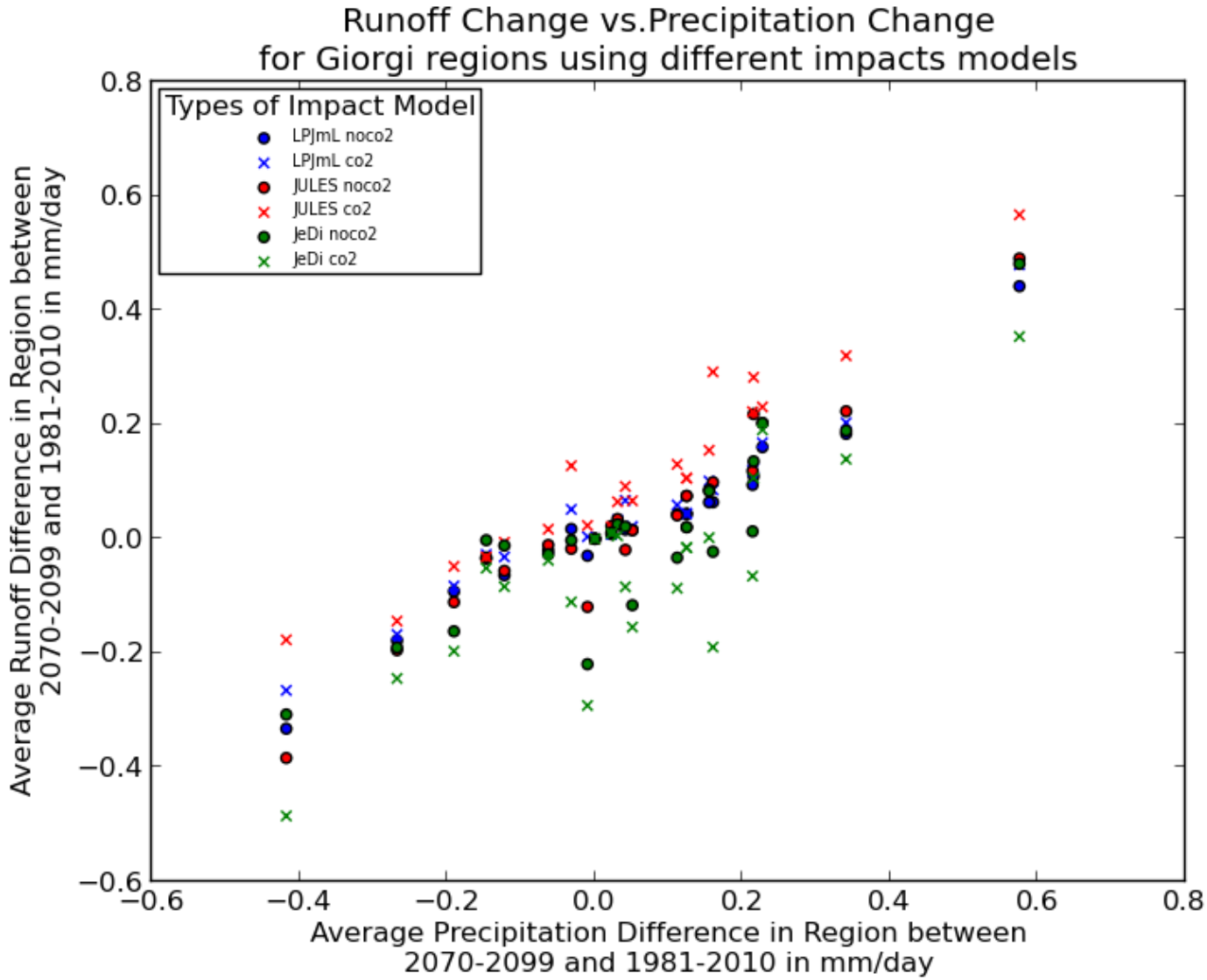

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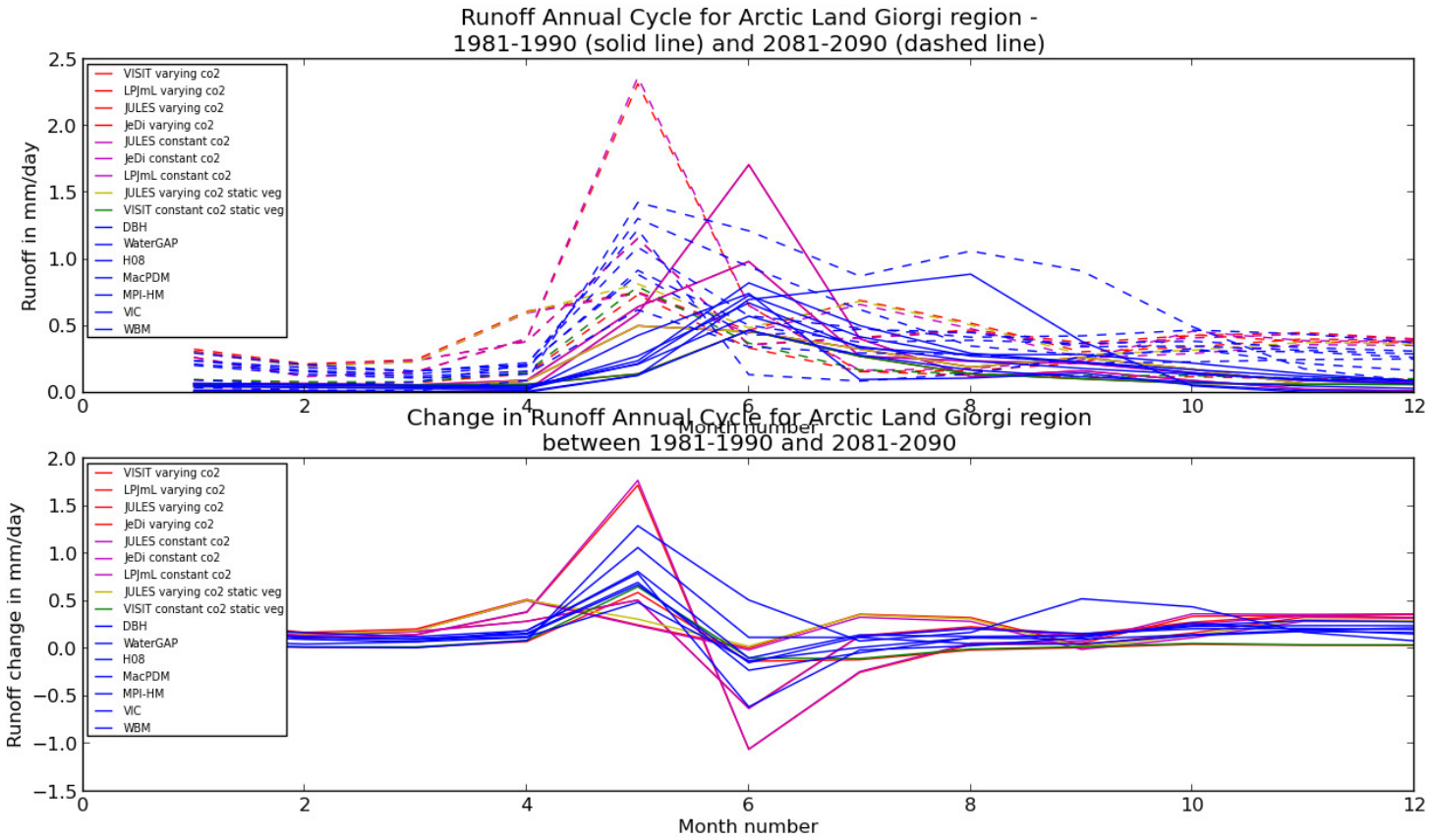

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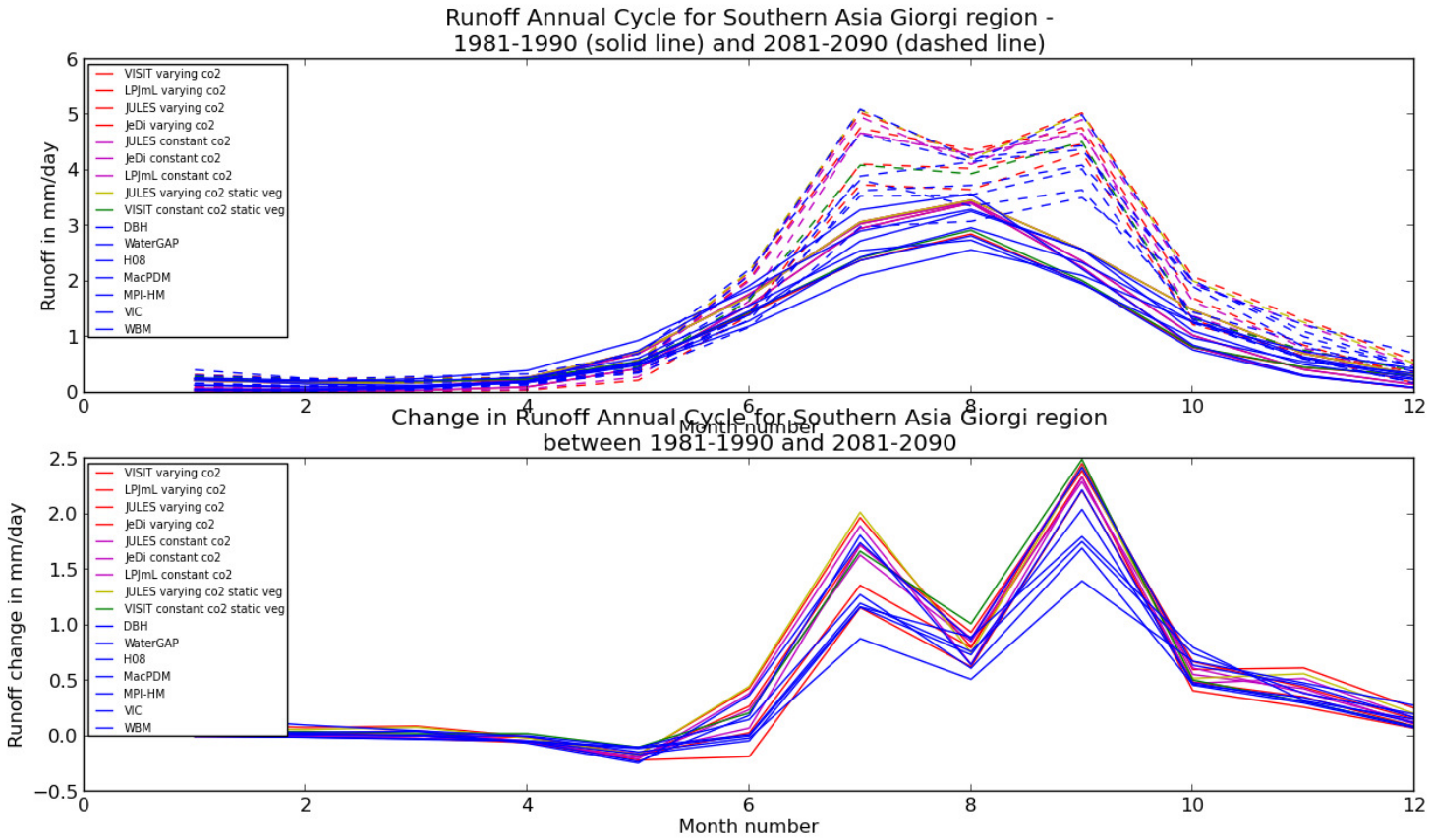

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