POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH

ISIMIP
Inter-Sectoral Impact Model Intercomparison Project

News from ISIMIP

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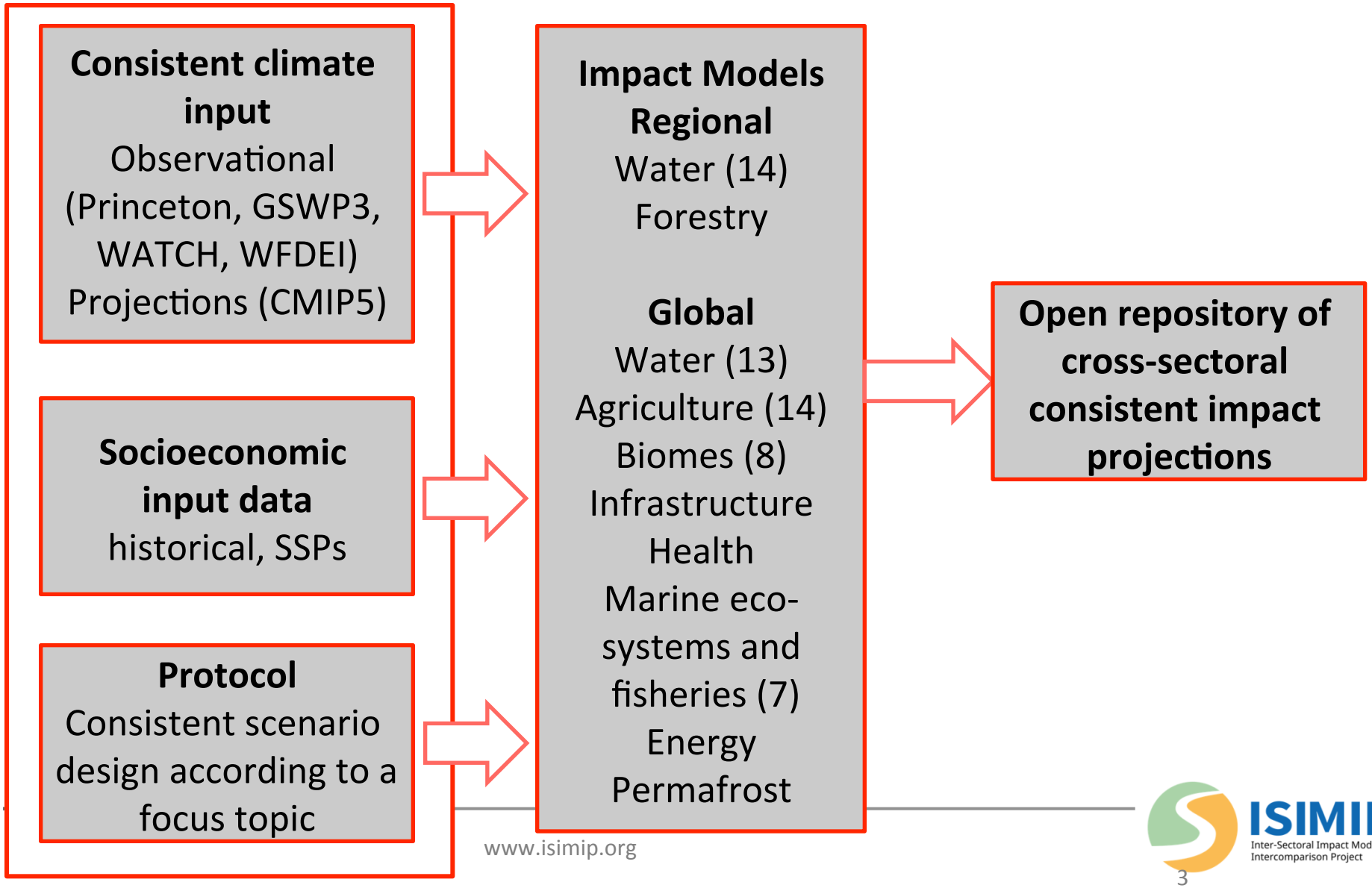
July 25 2016

Leibniz Association

Outline

- What is ISIMIP?
- Current activities: ISIMIP 2a
- Next step: contribution to 1.5° report (ISIMIP 2b)
- Economic integration
- Links to other communities
- Conclusion: what do we have to offer?

ISIMIP in a nutshell



What ISIMIP can provide now:

- **Basic data:**
  - **Crop yields, irrigation water withdrawal (annual)**
  - **Monthly carbon fluxes and pools, net primary production**
  - **Daily runoff, discharge, irrigation water demand, actual irrigation water withdrawal and consumption**
  - **Total catch of fish, total ocean biomass density**
  - **Malaria – climate suitability, lenght of potential transmission season, population at risk**
  - **Coastal infrastructure – costs, people affected, adaptation costs**

What ISIMIP can provide in the near future:

Process based models

- Flooded areas, flood depths
- Reductions in capital stocks due to extreme events (e.g. flood events, tropical cyclones)
- Number of people affected by floods and tropical cyclones
- Changes in agricultural production
- (National) water scarcity indicators, droughts
- Inundation areas due to sea level rise (+ storm surges)

Based on empirical approaches

- Changes in heating and cooling demands
- Changes in Labor productivity due to heat
- Heat and cold related mortality

→ What are useful indicators for IAMs? How to aggregate them?

What can be done with this?

- Impact model uncertainty (many papers)
- Cross-sectoral analyses:
  - Impact hotspots (Piontek et al. 2014)
  - Feedbacks/links between sectors (Elliott et al. 2014, Frieler et al. 2015
- Differential impacts of global warming (Schleussner et al. 2016)
- Efforts under way include links between agriculture and health (malnutrition) or agriculture and fisheries (fish availability for food)
- Input for derivation of socio-economic impacts

Current phase – ISIMIP2a: Model validation regarding extreme events and variability

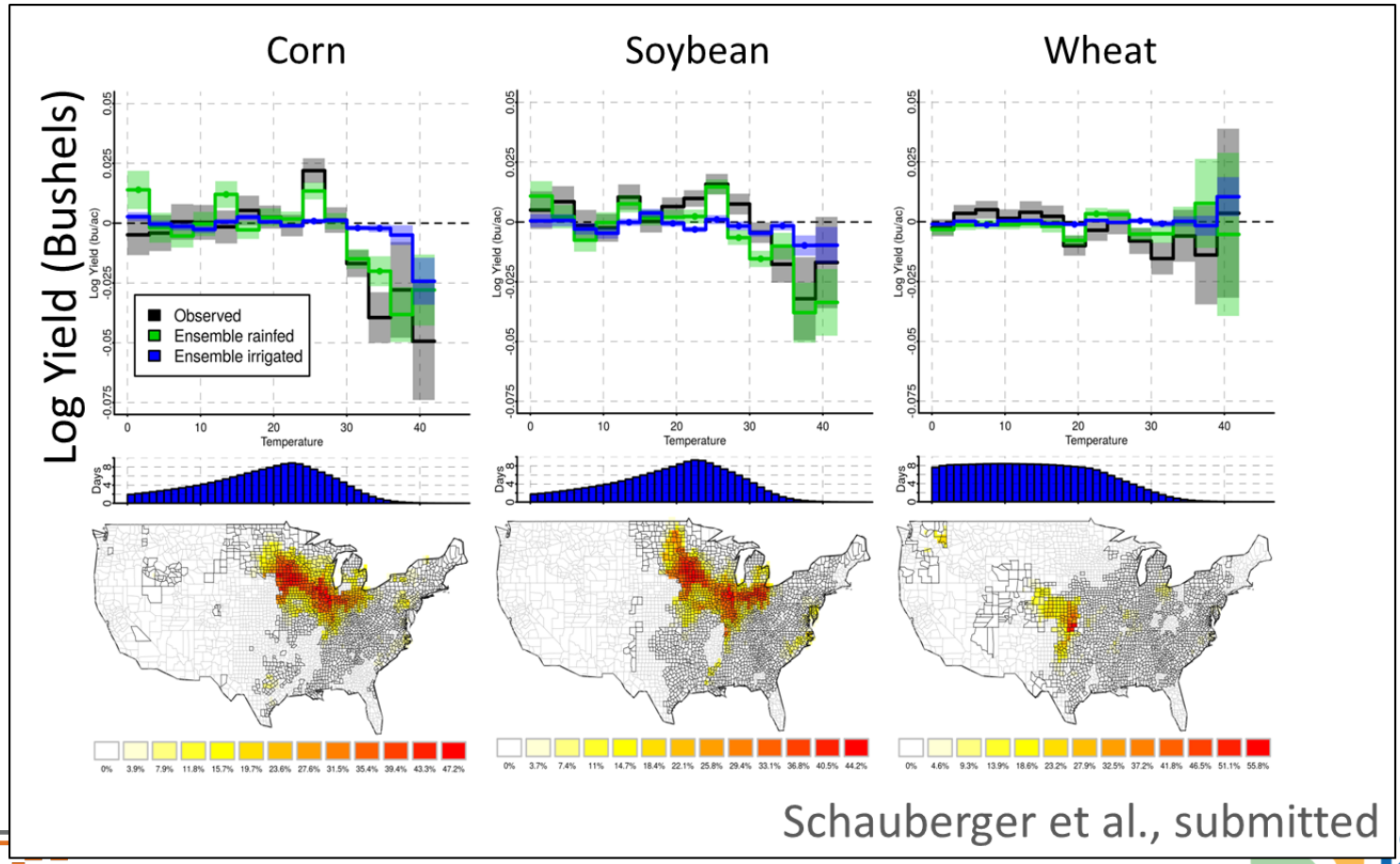
- **Goal: understand ability of models to reproduce observed features, identify key areas of improvement**
- **Data input:**
  - **Climate: PGMFD v.2 (Princeton), GSWP3, WATCH (WFD), WFDEI.GPCC**
  - **Land use: historical cropland patterns and historical area covered by natural vegetation from HYDE3.1 and MIRCA, soil map**
- **Simulation time frame: 1971-2012**
- **0.5°resolution**

Key analyses (ERL Open Special Issue)

- **Water: Machine-learning approach to create a multi-model combination estimate as an ensemble summary indicator of hydrology models informed by model performance and weighting – more robust than simple ensemble mean (Zaherpour et al.)**
- **Biomes: (Francois et al.): ecosystem productivities under droughts and heat waves in Europe sensitive to model but less to land use change or historical climate data set**
- **First FISH-MIP results (Eddy et al.)**
- **Cross-sectoral: impacts of the 2003 European heat wave (Schewe et al.)**

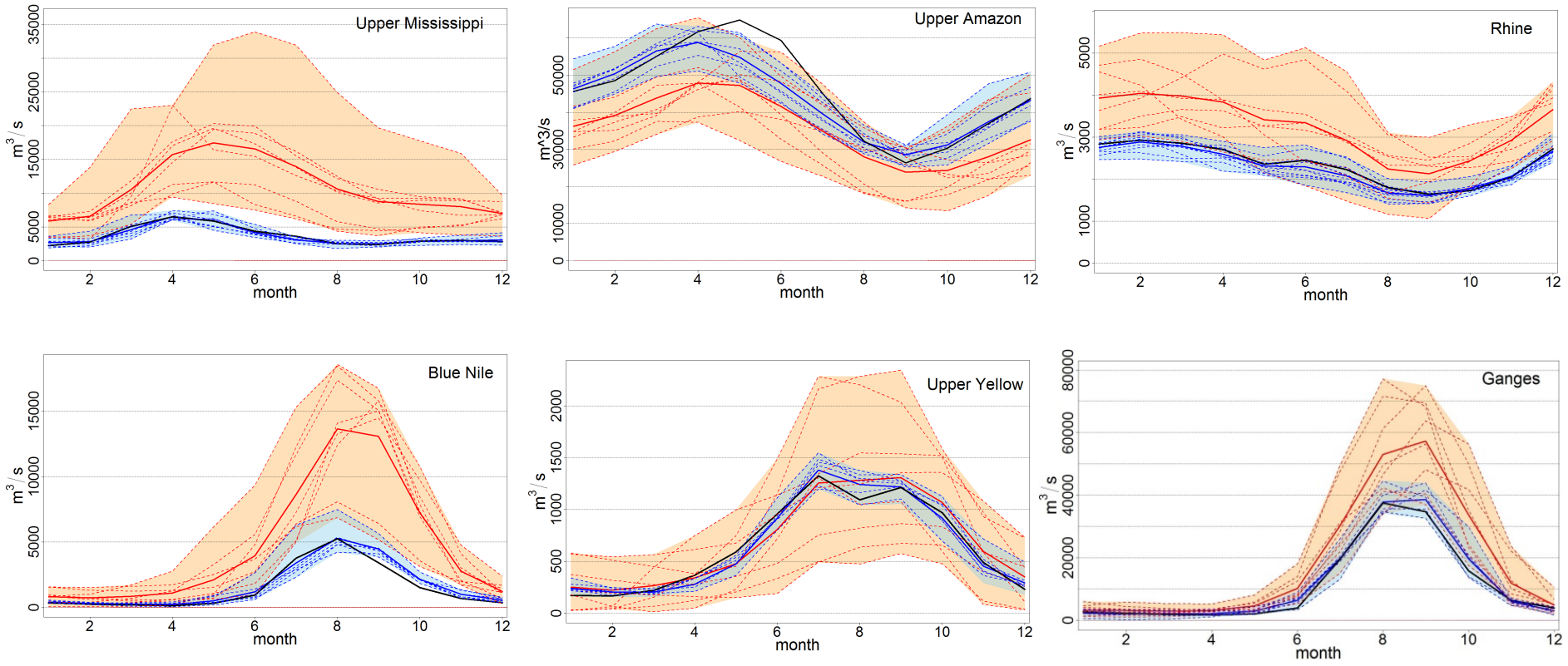
Key analyses (ctd.)

Agriculture: reproduction of statistical results on temperature dependency of crop yields using crop models (Schauberger et al., under review)



Key analyses (ctd.)

Cross-scale: cross-scale comparison of regional and global hydrologcail models for 12 river basins (Hattermann et al., under review)



River discharge

Next step: ISIMIP 2b – input for 1.5°Special Report

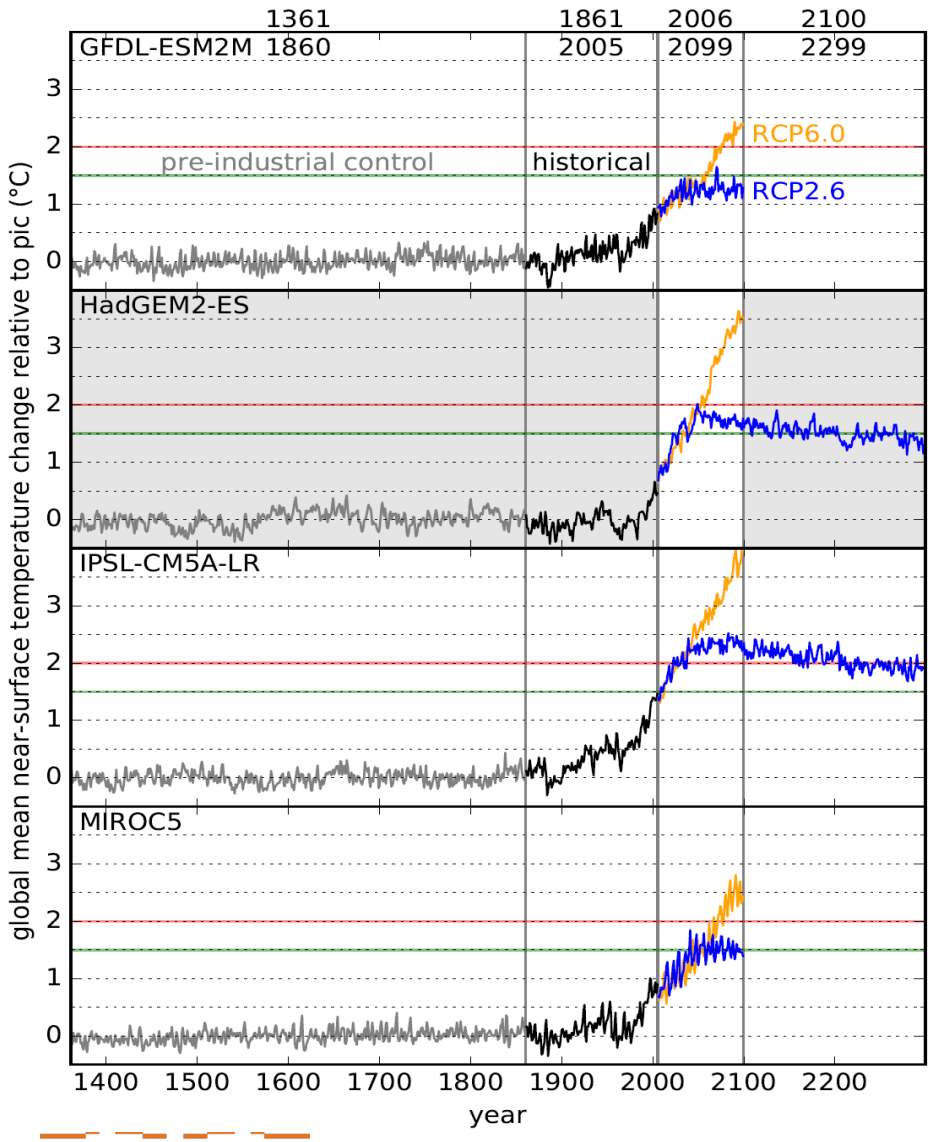
Key goals:

- **Separate impacts of historical warming starting from pre-industrial conditions from other human drivers (e.g. historical land use changes)**
- **Quantification of additional warming to 1.5° including potential overshoot and long-term effects up to 2300**
- **Quantification of pure climate effect with fixed socio-economic conditions**

Timeline:

- **Bias correction of GCM data and land use patterns under way → data provision by late summer**
- **Impact results available December 2016/January 2017**
- **Paper submission deadline September 2017?**

Input data



Other input data:

- **Historical land use: Hurtt**
- **Future land use: patterns from MAgPIE (and others?)**

  → Includes total crop land (irrigated/ non-irrigated), grass land, area for 2nd generation biomass, forest (managed/ non-managed), natural other vegetation
- **Historic population: Hyde3.2**
- **Future population: SSP2**
- **GDP: World Bank/SSP2 (country-level)**
- **Nitrogen deposition**
- **Sea-level rise projections**

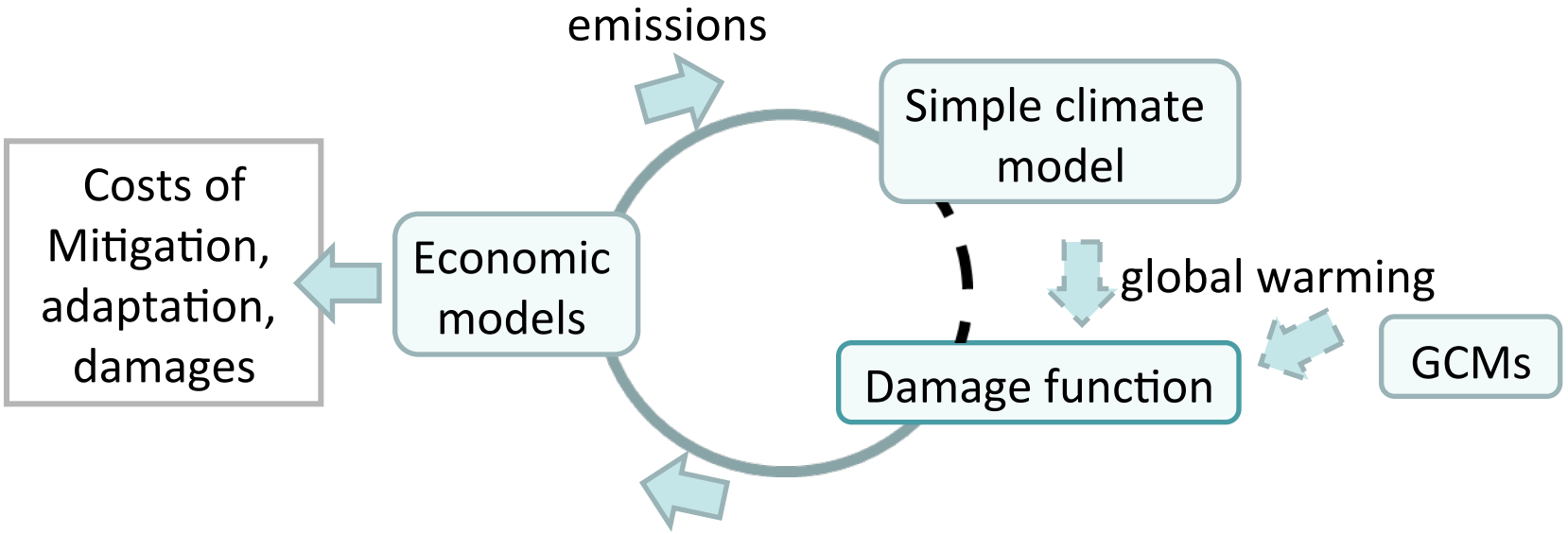
Long-term plans

- **Broader stakeholder involvement in ISIMIP process (e.g. ISIMIP3 focus topic)**
- **ISIpedia – online platform providing overview of available ISIMIP data, visualization of key indicators, access to the database, information on performance and uncertainties**

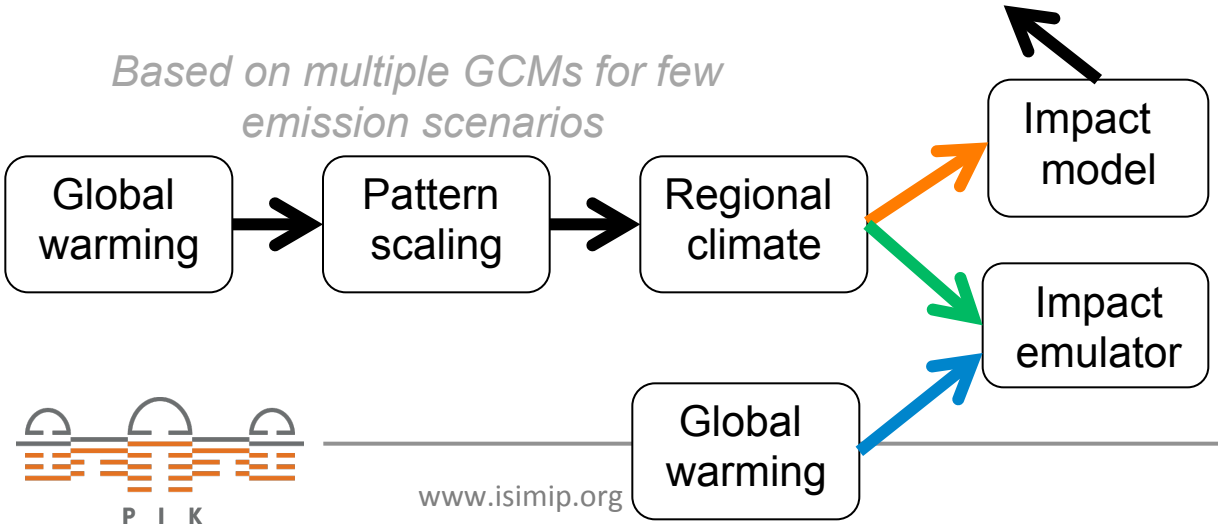
Challenges:

- **New approaches to include other sectors (health, infrastructure)**
- **More cross-sectoral analyses**
- **Economic integration**

Economic integration



Based on multiple GCMs for few emission scenarios

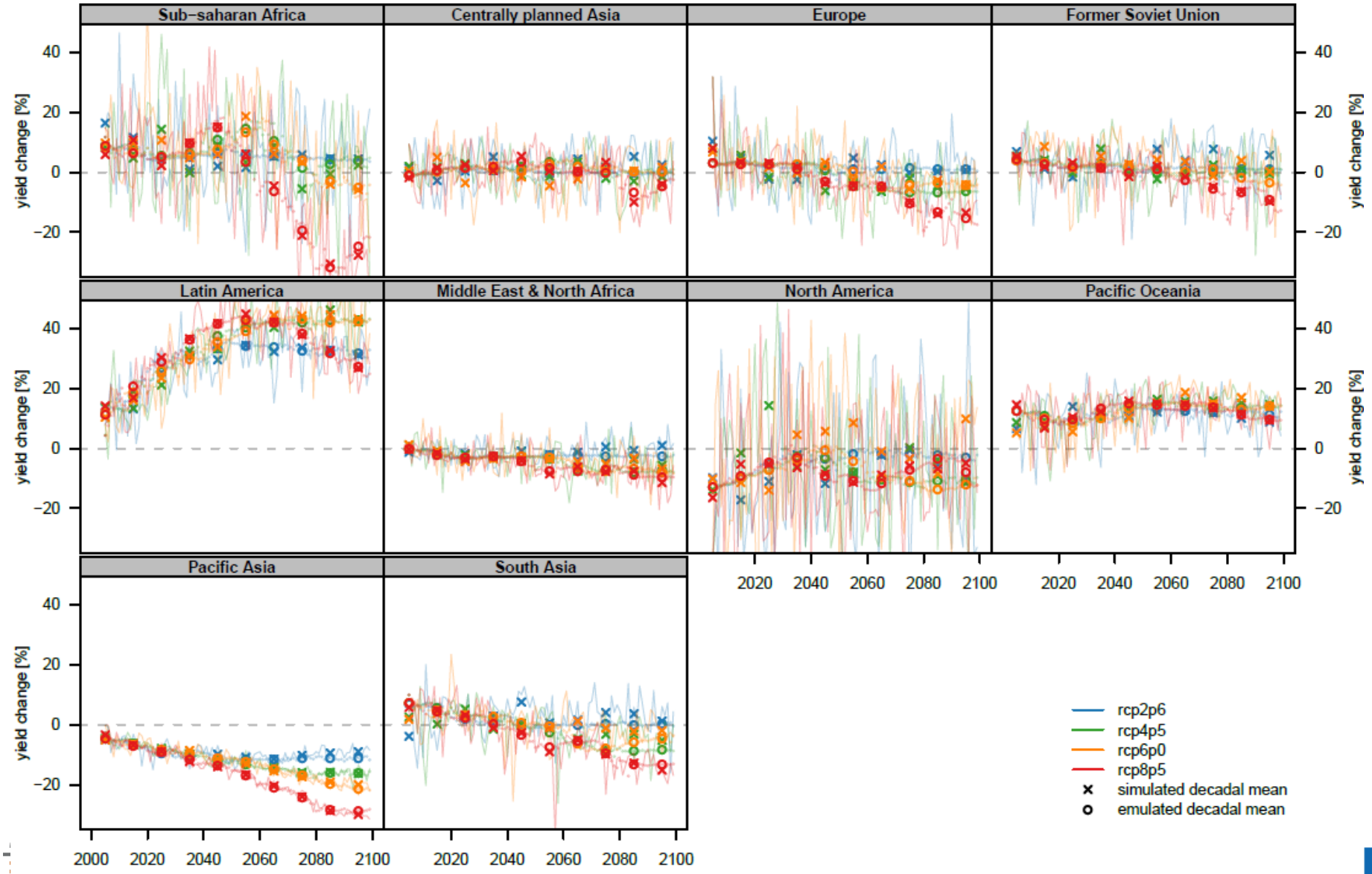


High flexibility but no coverage of impact model uncertainty, potentially slow

Maximum flexibility, fast, difficult development

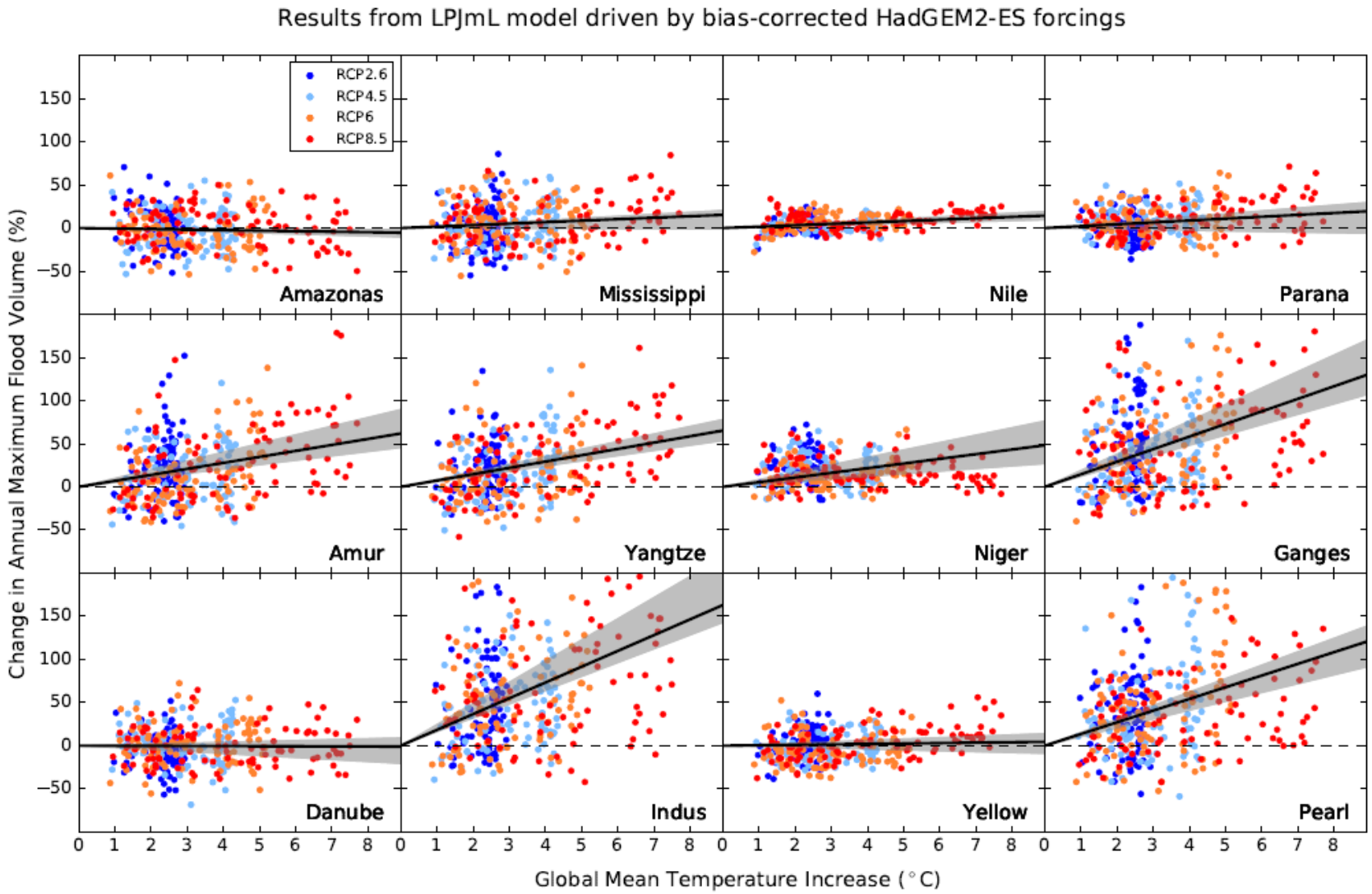
Some flexibility (limited to ISIMIP), fast, easy development

Examples for emulators in progress: crop yields

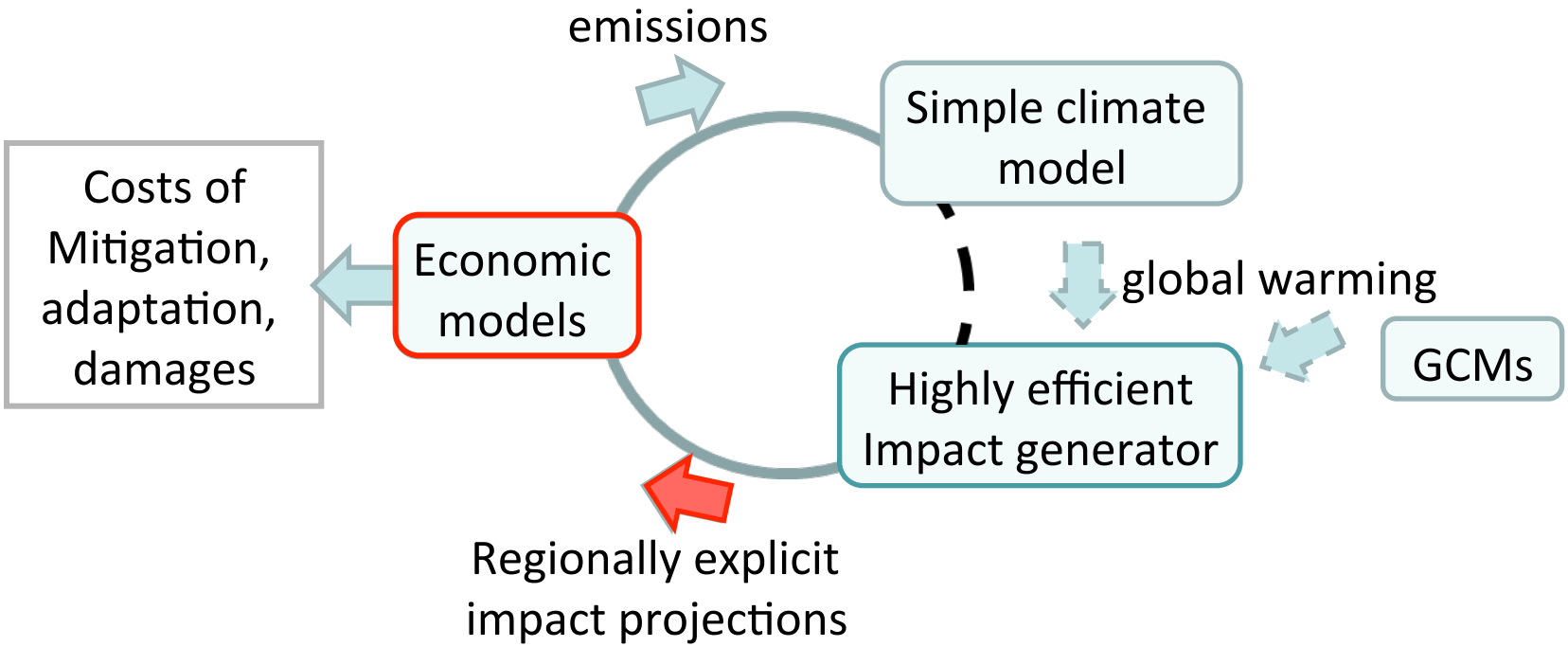


Emulated LPJmL Maize yield changes with CO2 effect for climate model HadGEM2−ES and emulator method 2

Examples for emulators in progress: flood volume

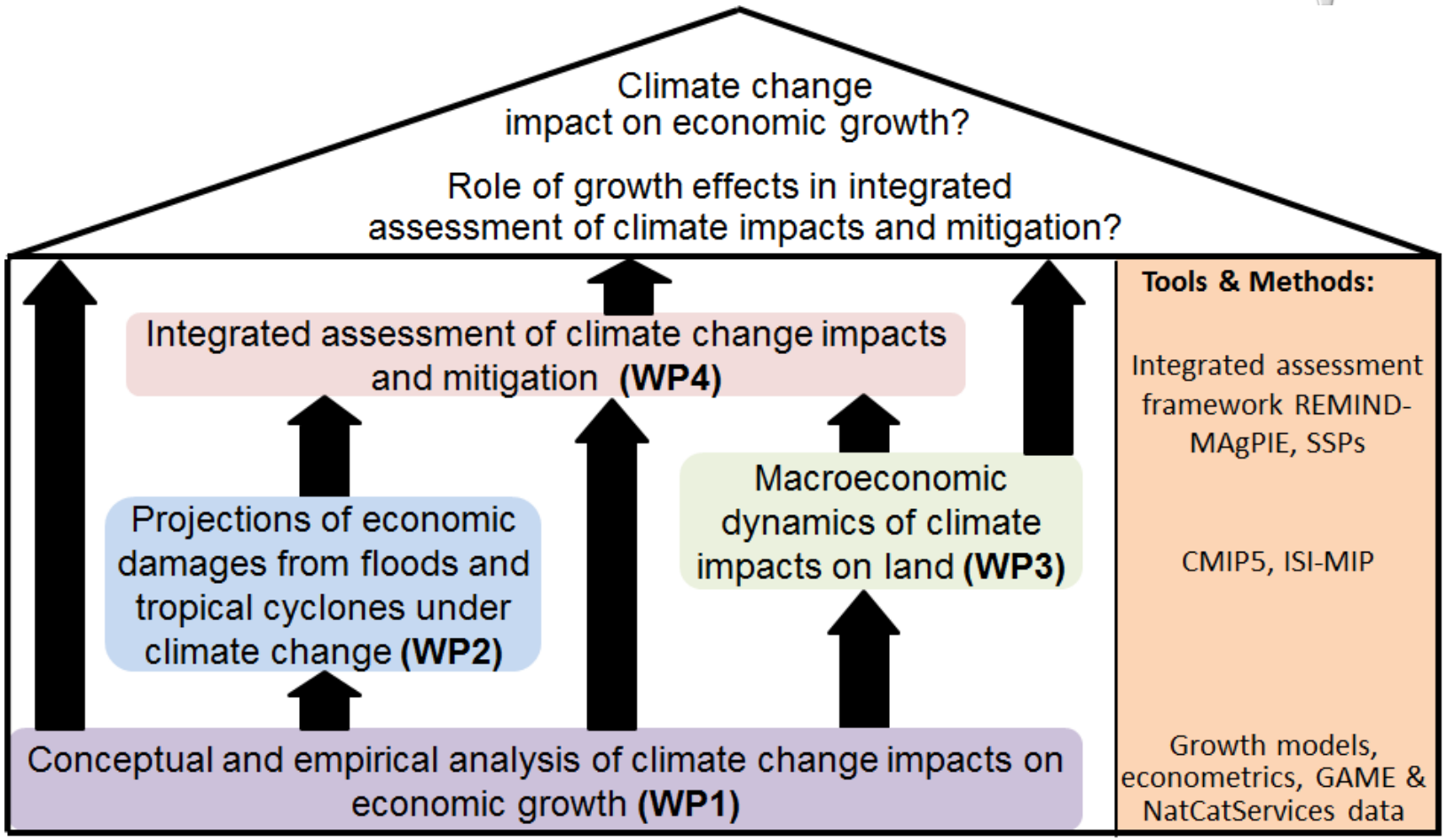


Economic integration



- **Need for increased economic process understanding:**
  - **What are critical impact channels, what is their dynamics?**
  - **Are there effects on economic growth?**
- **Other relevant metrics beyond costs!!**

Economic growth impacts of climate change (ENGAGE)



https://www.pik-potsdam.de/engage

Workshop with empirical and numerical modelers on growth impacts

- More process understanding needed: what shock from what type of impact affects what type of capital in what type of household with what type of loss?
- Mechanisms for growth impacts: human capital effects, permanent destruction of natural resources, lack of capital for reconstruction/ adaptation, poverty traps, weak institutions, repressed investments due to high risk aversion
- Need a mix of macro- and micro-level indicators beyond the SCC
- Need to take into account distributional impacts across sectors, households and countries
- Adaptation (high income, macroeconomic dynamics, double counting)

ISIMIP links with other communities

ESMs:

- **List of required variables provided to CMIP6**
- **Special requirements e.g. from energy sector (wind speed at hub height) or FISH-MIP**
- **ISIMIP3 – test effect of higher resolution input data set**

→ Sectors with little experience in dealing with climate data (e.g. health)

→ More critical than climate data is detailed representation of human management (e.g. fertilizer input, dams, …)

IAMs:

- **ENGAGE**
- **Economic session at last ISIMIP workshop – to be continued at Impacts World 2017 (October 2017, Potsdam)**
- **Future coordinator of emulator work: Detlef van Vuuren**

What ISIMIP has to offer:

ABOUT ISIMIP | GETTING STARTED | IMPACT MODELS | OUTPUT DATA | OUTCOMES | FAQ

Homepage › Impact Models › Impact Model: LPJmL

Impact Model: LPJmL

LPJmL | admin edit

Basic information

Sector: *Water (global)*

Region: *global*

Contact Person:

- *Dieter Gerten (gerten@pik-potsdam.de) Potsdam Institute for Climate Impact Research*

Simulation Round: *ISIMIP2a*

Reference Paper: Main Reference: ***Evaluation of ecosystem dynamics, plant geography and terrestrial carbon cycling in the LPJ dynamic global vegetation model.***

Reference Paper: Other References:

- ***Contribution of permafrost soils to the global carbon budget.***

Resolution

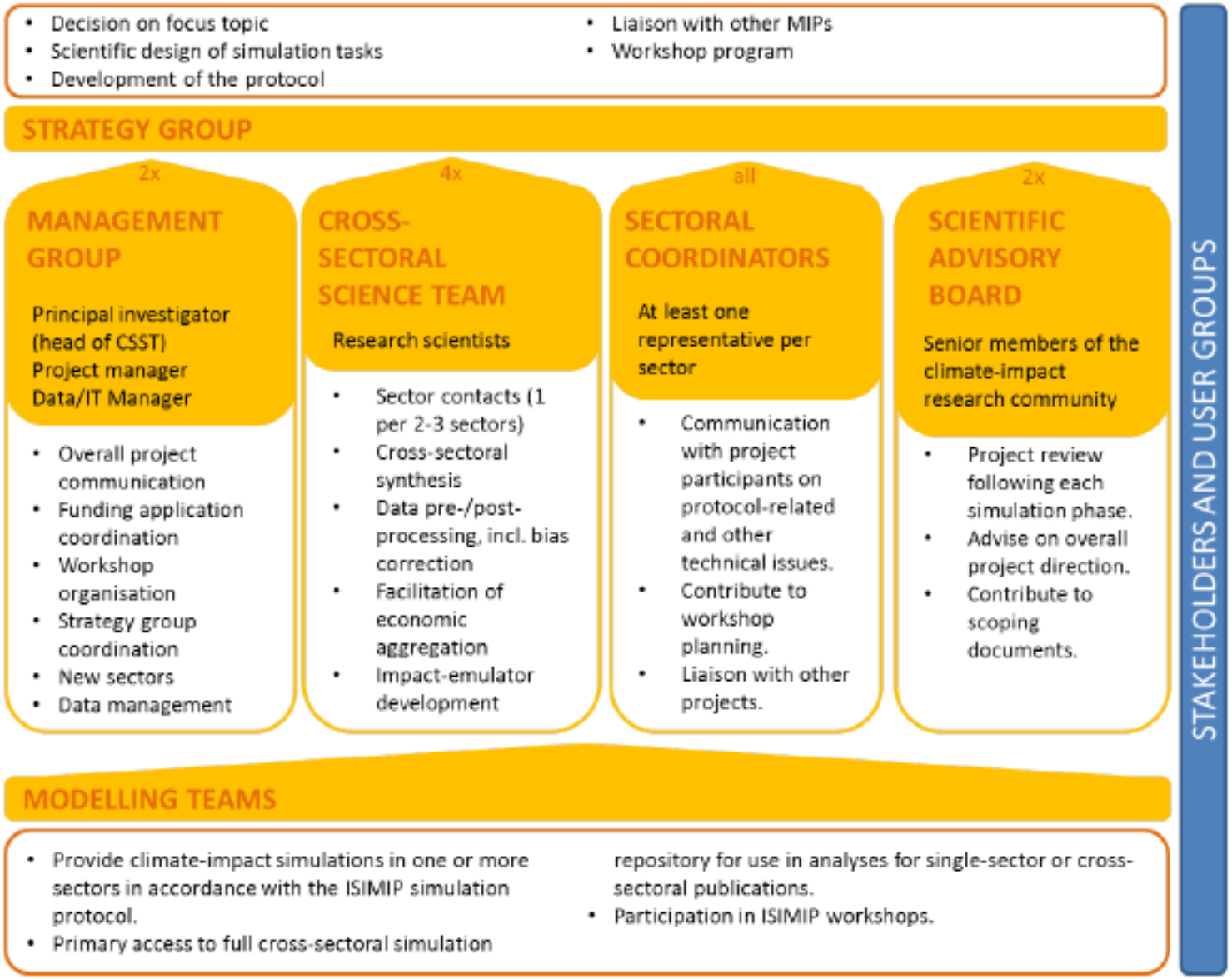
Input Data

What ISIMIP has to offer:

- **Consistent multi GCM, multi impact model data for historical and future periods from a number of sectors**
- **New website with impact model database**
- **Public data archive with input and output data: https://esg.pik-potsdam.de/projects/isimip-ft/**
- **Bias corrected climate input**
- **Support with data processing**
- **Development of impact emulators**
- **Access to a multisectoral impacts community**

Thank you!

Full organizational structure



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SIMIP
-Sectoral Impact Model
comparison Project

Sectoral coordinators

Sector	Coordinator for global simulations	Coordinator for regional simulations
Agriculture	Joshua Elliott jelliott@ci.uchicago.edu	
Water	Simon Gosling Simon.Gosling@nottingham.ac.uk Rutger Dankers rutger.dankers@metoffice.gov.uk	Fred Hattermann hattermann@pik-potsdam.de Valentina Krysanova Krysanova@pik-potsdam.de
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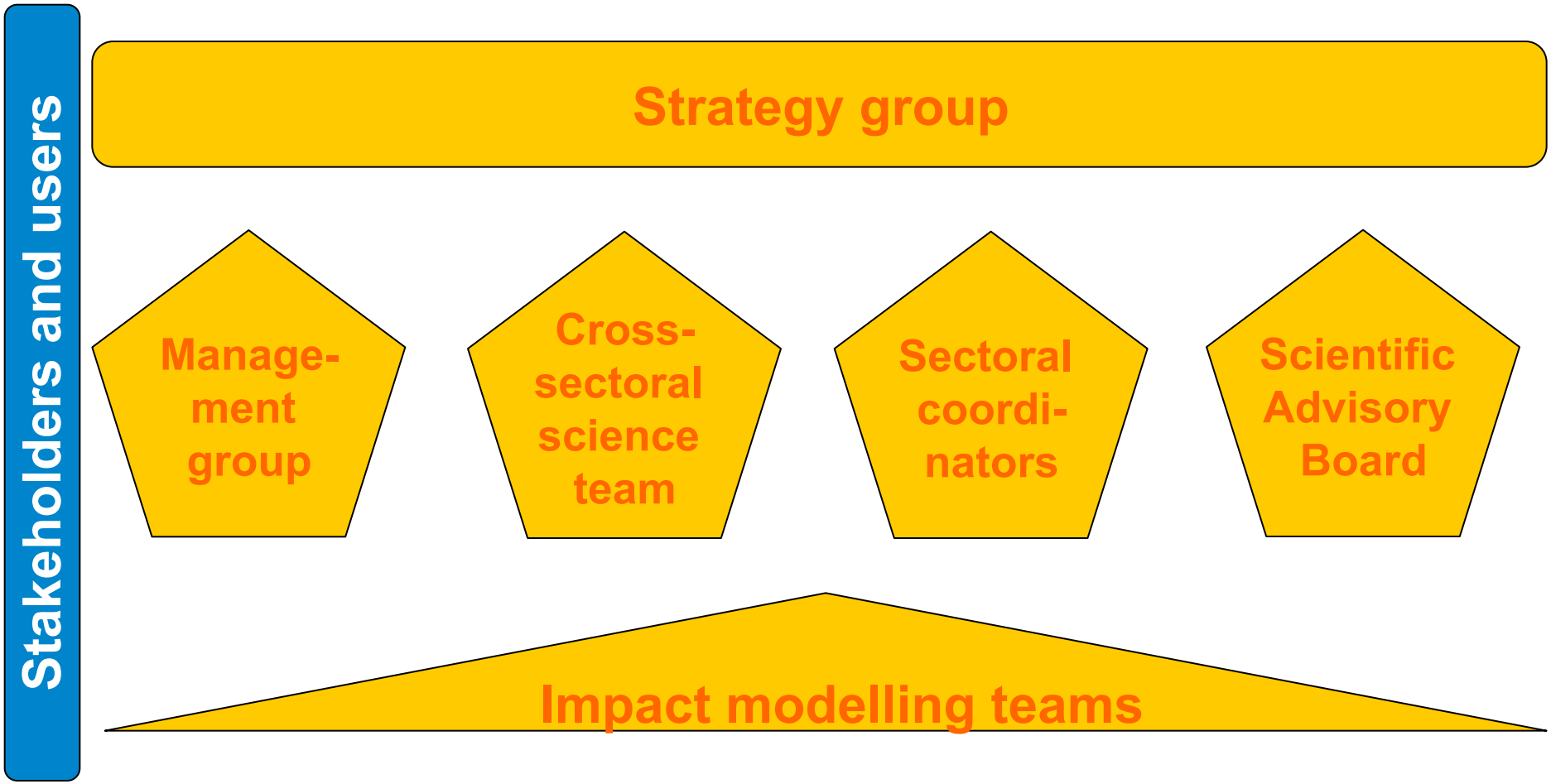
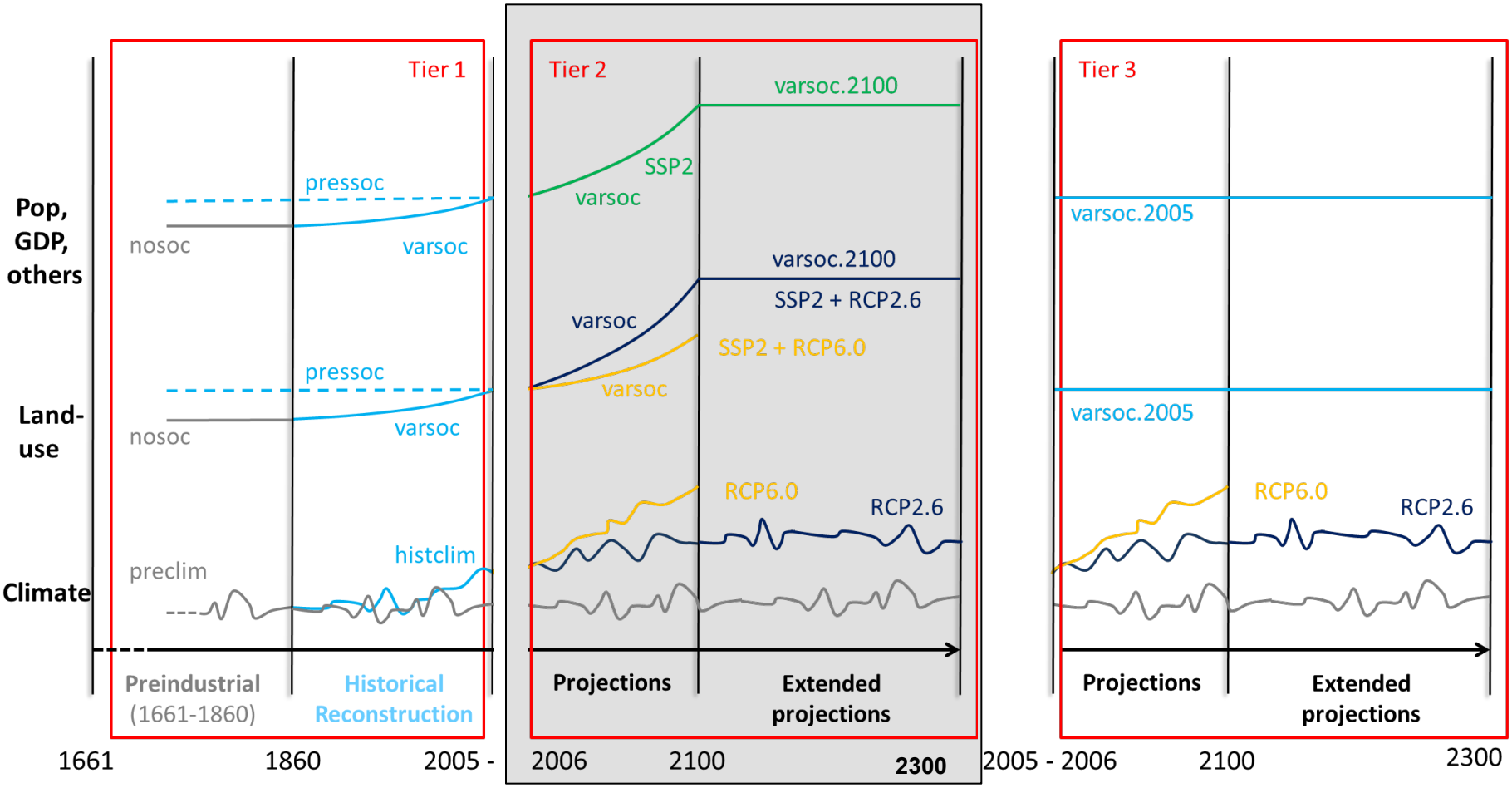
Cross-sectoral	Katja Frieler, Veronika Huber, Sebastian Ostberg, Franziska Piontek, Christopher Reyer, Jacob Schewe, Lila Warszawski; isi-mip@pik-potsdam.de	

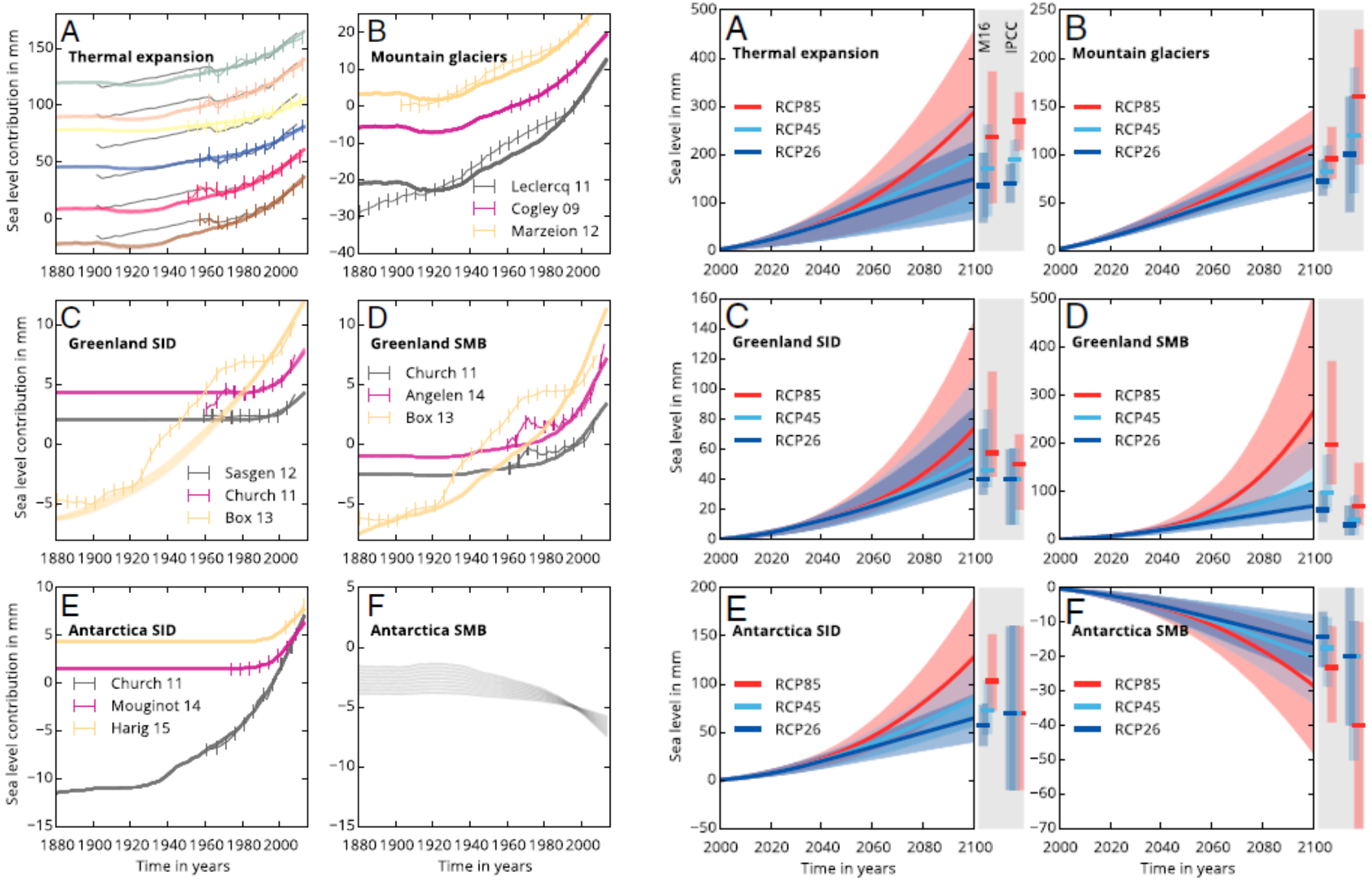
Organizational structure



Setup of runs



Sea level rise needs another approach



Mengel et al., 2016