Outcomes of the ISIMIP Strategy Group Meeting 2018

On September 24-26, 2018, the ISIMIP Sectoral Coordinators, Cross-Sectoral Science and management team, as well as members of the Scientific Advisory Board, met in Potsdam to discuss the modeling strategy that ISIMIP should pursue over the coming three years. The meeting had been preceded by online and personal discussions within and between the sectors and the Cross-Sectoral Science team, to elicit the most pertinent research questions that ISIMIP should address. At the meeting, it was acknowledged that not all possible research areas can be addressed by ISIMIP, but that the ISIMIP simulations should be chosen in a way to enable a wide range of studies that will be of interest both to ISIMIP modelers and to the wider climate impact research and policy communities.

With this in mind, and given a number of practical considerations, the ISIMIP Strategy Group[1] has decided on a set of scenarios, rather than a specific focus topic, (a: based on observed climate forcing, b: based on GCM climate forcing) to be included into the ISIMIP protocol (extensions of ISIMIP2a/b and new protocol for ISIMIP3a/b) and whose simulations will be supported by the provision of the associated climate and socio-economic forcing data. In particular, there was agreement that these scenarios would be useful to address questions around adaptation, high-end climate change, and attribution of climate impacts, which were all discussed as highly relevant topics. Below we provide a summary of the agreed scenarios (as far as they have been defined at the meeting) and information on the associated input data and timelines. This is NOT the simulation protocol itself; the Cross-sectoral Science Team is currently working on updating the ISIMIP2a/b simulation protocols and preparing the necessary input data for the new simulations. In a next step step the ISIMIP3a protocol and forcing data will be generated followed by the ISIMIP3b protocol and data.

1. Decision about the scenario design for the current (ISIMIP2a/2b) and upcoming simulation round (ISIMIP3a/3b)

It was discussed how ISIMIP could best serve to provide research for the IPCC 6th assessment report. Given the time constraints (WGII submission deadline for AR6: July 1, 2020) and the expected delayed availability of the CMIP6 climate simulations (larger set of ScenarioMIP runs probably available in March 2019) the ISIMIP Strategy Group has agreed on the following procedure:

- to make an extended version of the **ISIMIP2a/2b** simulations the main ISIMIP contribution to AR6; but also
- to do a set of historical simulations based on EWEMBI or ERA5 observational climate forcing (**ISIMIP3a**); and
- to provide the opportunity to do a first set of future projections using CMIP6 based climate forcing and constant present day socio-economic conditions to determine the

pure effect of climate change on considered impact indicators (2015soc, **ISIMIP3b, phase 1**).

While these simulations should be finished in time for the AR6, we additionally agreed on

- starting a second simulation phase later (**ISIMIP3b, phase 2**) where socio-economic conditions change according to specific SSPs and assumptions about adaptation. The preparation of the associated forcing data will happen while the other simulations described above are being run.

Note: One important difference between ISIMIP2 and ISIMIP3 are the impact model versions! So even if the set-up of the historical runs based on observational climate data is similar in ISIMIP2a and ISIMIP3a, the runs may differ due to progress in impact model development. As an important basis for the model evaluation, there should be ISIMIP2a runs from those impact models versions used within ISIMIP2b; and there should be ISIMIP3a runs from those impact model versions used within ISIMIP3b.

Detailed simulation set-up:

Naming conventions climate forcing:
histclim = observed (ISIMIP2a and ISIMIP3a) or simulated (ISIMIP2b and ISIMIP3b group 1 simulations) historical climate
noclim = detrended version of observed historical climate
rcp26, rcp60, rcp85 = RCP2.6, RCP6.0, and RCP8.5 respectively

Naming conventions socio-economic forcing:
histsoc = varying socio-economic forcing (e.g. land use changes, agricultural and water management, population patterns etc.) according to historical observations
2000soc = fixed year 2000 socio-economic conditions
2005soc = fixed year 2005 socio-economic conditions
2015soc = fixed year 2015 socio-economic conditions
rcp85ssp5soc = socio-economic drivers (such as land use patterns etc.) follow an RCP8.5-SSP5 storyline e.g. food demand has to be fulfilled for SSP5 population projections and accounting for RCP8.5 climate impacts on crop yields
rcp26ssp1soc = socio-economic drivers (such as land use patterns etc.) follow an RCP2.6-SSP1 storyline e.g. food and bioenergy demands have to be fulfilled for SSP1 population projections, accounting for RCP2.6 climate impacts on crop yields etc.

Planned runs in time for the AR6

1. To allow for model evaluation and potential attribution of observed impacts for the very recent period particularly including a wider range of extreme events and best covered by observations **ISIMIP2a** will be extended **to cover 1979-2016[2]** and include a **new "no climate change" reference run:** historical simulations based on EWEMBI observational climate data, using the same impact model versions as used within ISIMIP2b:
   - **histclim + histsoc** (Model evaluation runs as close as possible to historical conditions)

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[2] WFDEI (and hence EWEMBI) will be available until 2016 only

- **histclim + 2000soc** (Pure effect of climate change against year 2000 socio-economic background: Attribution)
- **noclim + histsoc** (Difference between first run and this one allows for the quantification of the pure effect of climate change against historical changes in socio-economic conditions: Attribution)

The ISIMIP coordination team will try to work out a proper method for de-trending observed climate, in order to construct the noclim data. E.g. account for changes in higher moments

2. To address the **quantification of high-end impacts** and allow for a quantification of the **effects of the new bias-correction method** that will be used within ISIMIP3 we agreed on the extension of **ISIMIP2b, group 2** simulations: Impact simulations forced by CMIP5 climate simulations assuming fixed socio-economic conditions
- **rcp85 + 2005soc** (Impacts of high end climate change scenario against year 2005 socio-economic background)
- optional: **rcp60 (improved bias correction) + 2005soc** (sensitivity run to quantify the effects of the improved bias correction and the statistical downscaling to 0.5°x 0.5° to be used in ISIMIP3)

3. Completing **ISIMIP2b group3** simulations: Impact simulations forced by CMIP5 climate simulations assuming varying socio-economic conditions (SSP2)
- **rcp60 + rcp60soc**
- **rcp26 + rcp26soc**
- And other "missing" ISIMIP2b runs (e.g. optional sector-specific simulations. This also provides an opportunity to individual modeling teams to submit any core runs that they had not been able to do so far.)

4. To allow for **model evaluation** and the **attribution of observed impacts to weather related forcing** instead of direct human influences we agreed on a new set of **ISIMIP3a (1979-2017)** simulations: historical simulations based on EWEMBI or ERA5[3] observational climate data, using those (potentially improved) impact model versions that would also be used within ISIMIP3b):
- **histclim + histsoc** (Model evaluation runs as close to possible to historical conditions)
- **histclim + nosoc** (Difference between first run and this one allows for the quantification of the pure effect of socio-economic drivers against historical changes in climate: Attribution)
- **noclim + histsoc** (Difference between first run and this one allows for the quantification of the pure effect of climate change against historical changes in socio-economic conditions: Attribution)

5. Phase 1 of ISIMIP3b: (1850-2100): Impact simulations forced by CMIP6 climate simulations assuming fixed socio-economic conditions
- **picontrol** [**+ 1850soc** + histsoc + 2015soc] (1661/1850-2100) (red part is optional)
- **histclim + histsoc** (1850-2014)

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[3] A decision will be taken based test runs by individual impact model runs evaluating the agreement between observed and simulated impacts.

- **rcp85 + 2015soc** (2015-2100)
- **rcp26 + 2015soc** (2015-2100)

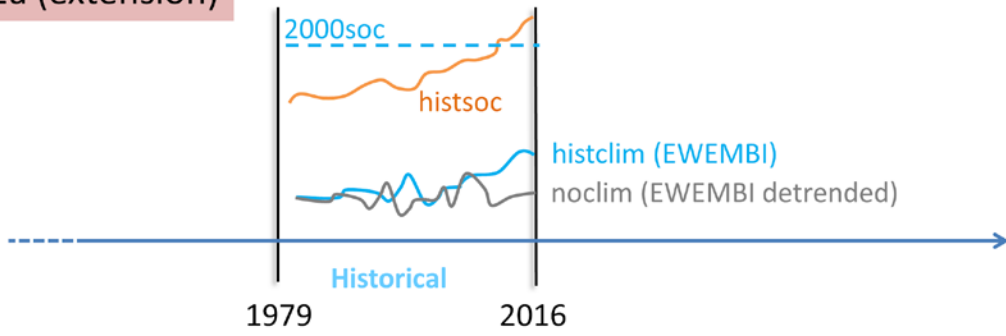Planned runs after the WGII submission deadline for the AR6

6. Phase 2 of ISIMIP3b: (1850-2100): Impact simulations forced by CMIP6 climate simulations assuming varying socio-economic conditions, in particular SSPs 1 and 5.

- **rcp85 + rcp85ssp5soc** (baseline implicit adaptation driven by with socio-economic development) (2015-2100)
- **rcp26 + rcp26ssp1soc** (2015-2100)
- **rcp85 + rcp85ssp5soc + explicit adaptation** in response to climate change (2015-2100)

ISIMIP2a (extension)

LU, Pop, …

2000soc
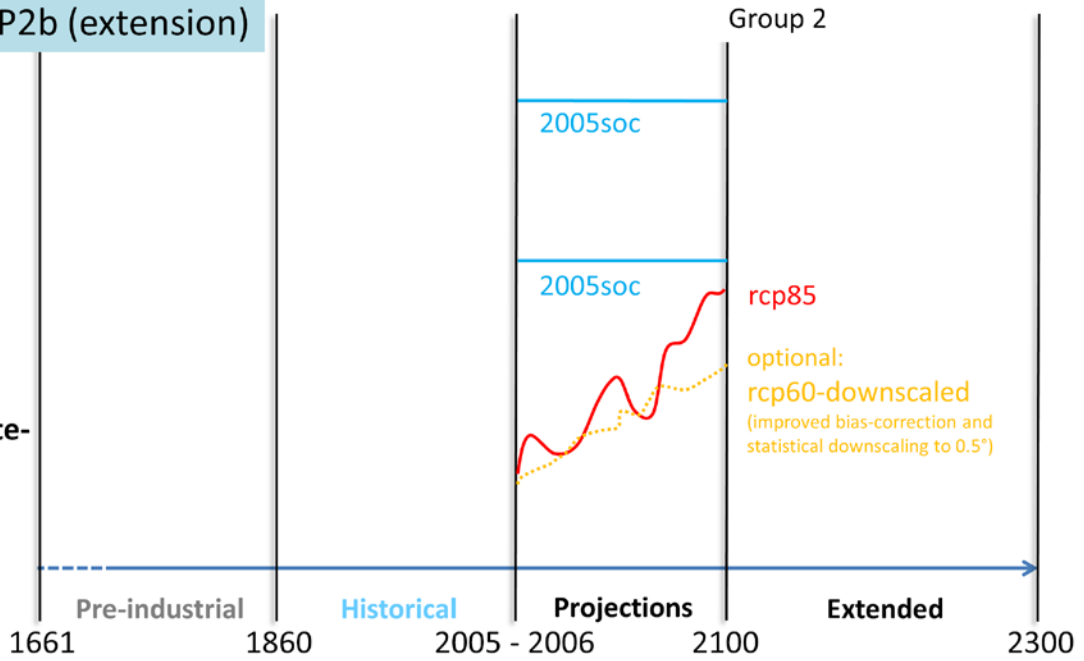
histsoc

Climate-obs

histclim (EWEMBI)

noclim (EWEMBI detrended)

Historical

1979

2016

ISIMIP2b (extension)

Group 2

Pop, GDP, other

2005soc

Land-use

2005soc

rcp85

optional:
rcp60-downscaled
(improved bias-correction and
statistical downscaling to 0.5°)

Climate-GCM

Pre-industrial

Historical

Projections

Extended

1661

1860

2005 - 2006

2100

2300

ISIMIP3a

LU, Pop, …

histsoc

nosoc

Climate-obs

histclim (EWEMBI or ERA5)

noclim (EWEMBI or ERA5 detrended)

Historical

1979   2017
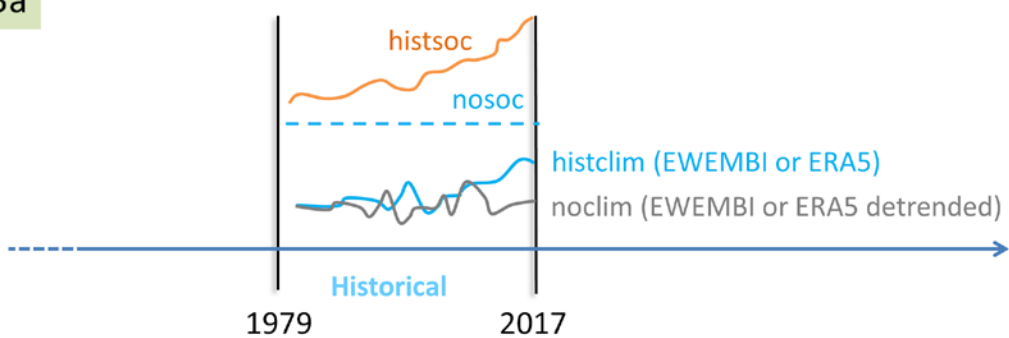
ISIMIP3b *phase 1*

Pop, GDP, other

1850soc

histsoc

2015soc

Land-use

1850soc

histsoc

2015soc

rcp85

rcp26

Climate-GCM

picontrol

histclim

Pre-industrial (optional)   Historical   Projections   Extended

1661   1850   2014 - 2015   2100   2300
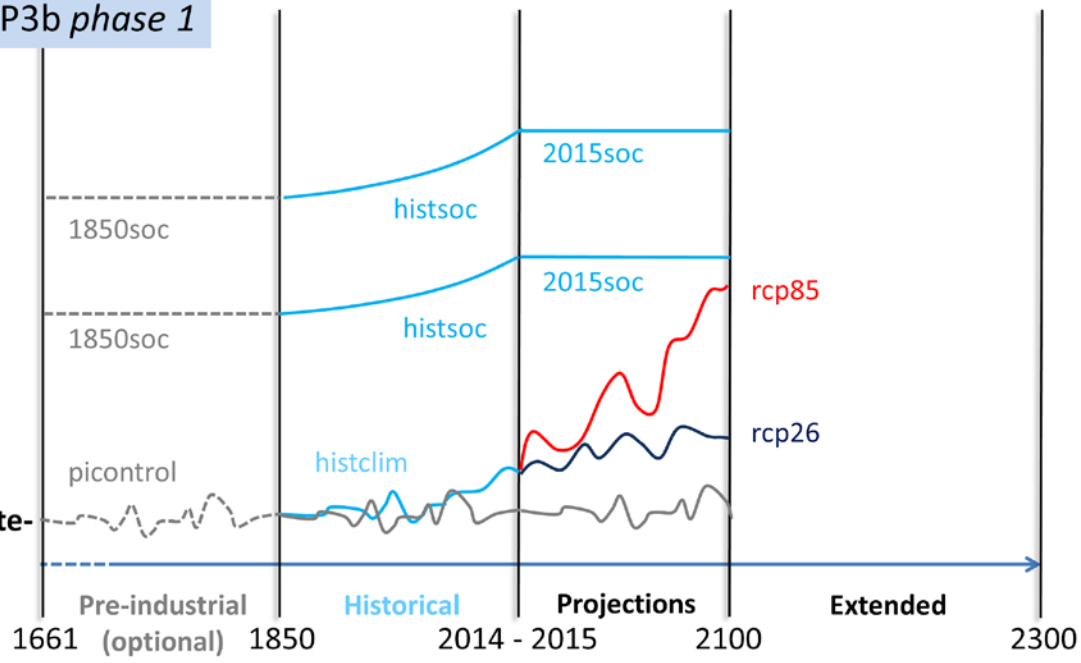
ISIMIP3b *phase 2*

Pop, GDP, other

ssp5 − explicit adapt.

ssp5

ssp1

rcp26ssp1soc

rcp85ssp5soc − explicit adapt.

rcp85ssp5soc

Land-use

rcp85

rcp26

Climate-GCM

Pre-industrial   Historical   Projections   Extended

1661   1850   2014 - 2015   2100   2300
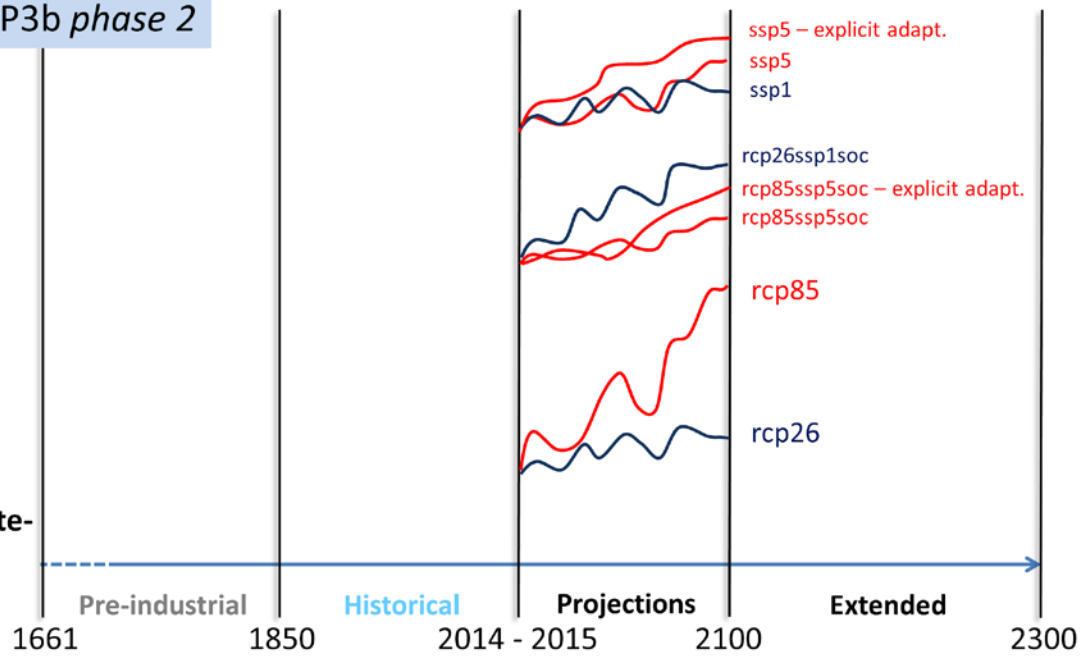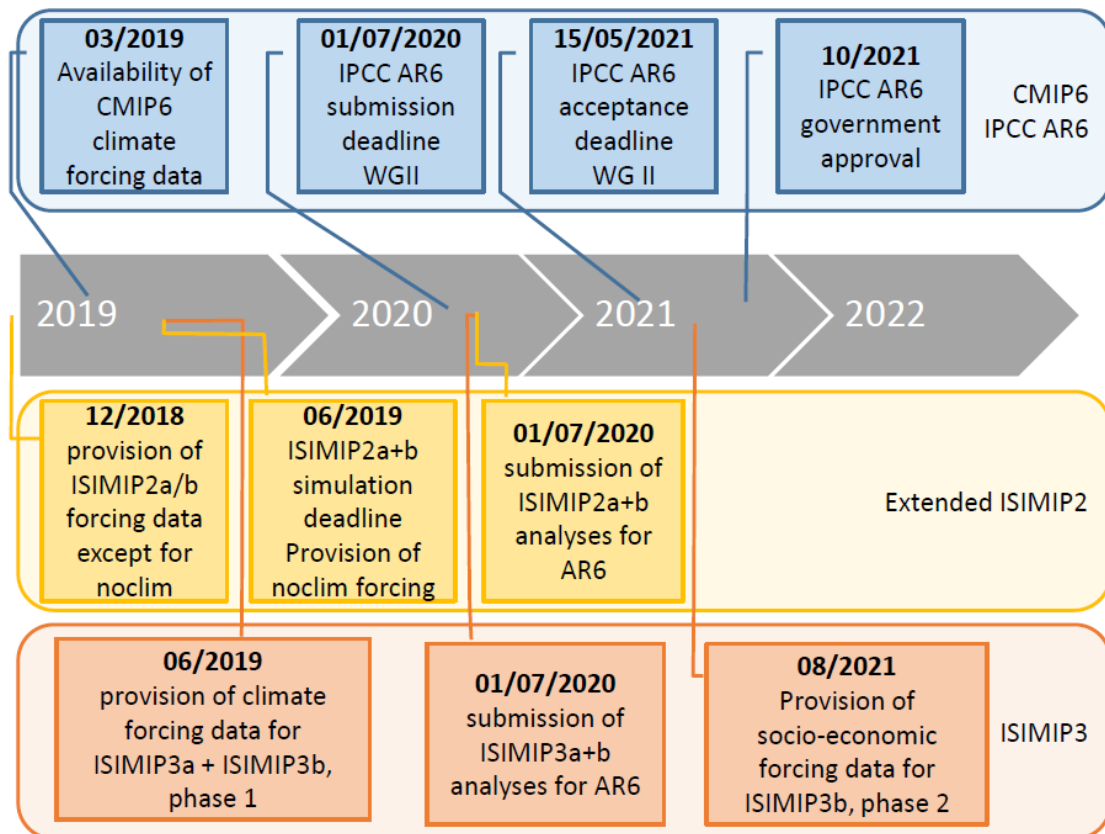
Timeline:

2. Additional outcomes of the strategy group meeting:

1. In particular from the biomes and biodiversity sector there was a request for quantifying the implications of using a range of land use projections not only based on Remind-MAgPIE but also representing the spread of projections induced by different modelling approaches. The ISIMIP Cross-Sectoral-Science- and Coordination Team at PIK will get in contact with other modelling groups (e.g. GLOBIOM from IIASA, IMAGE from PBL) to ask them whether they would contribute additional land use projections to ISIMIP3b, phase 2.

2. We discussed the potential for ISIMIP partners to apply for a COST Action, ITN Training Network and/or H2020 calls

3. We discussed whether to use the ILAMB benchmarking tool as part of the ISIMIP quality checks.

4. We discussed that, in order to include adaptation specifically in ISIMIP3 simulations, we need to define adaptation within the logic of the SSPs. Adaptation is to some degree part of the baseline scenarios (high/low adaptation challenges in SSP3/4 vs SSP1/5), but also part of the explicit Shared Policy Assumptions (SPAs) in response to climate change, which so far have not been quantified in terms of adaptation policies. Adaptation will have to be defined specifically for each sector.

3. Summary of the associated SAB Meeting

The SAB was overall very happy with the progress of ISIMIP but the following challenges were highlighted:
1. better motivate why ISIMIP is important. What are the technical challenges ISIMIP addresses and what are the scientific challenges
2. involve stakeholders (esp. political decision makers) early-on
3. establish stronger links to other communities/processes, e.g. IPBES, CBD, World2050
4. discussion about new SAB members