



C4: Known unknowns and unknown unknowns: what are our models missing, and how much impact lies in the gaps?

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Summary of themes covered in workshop

How well are we doing to estimate the costs of climate change? Are we aware of most of the coming impacts, or are there major blind spots in our forward vision? Climate change impacts interact with technological development / socio-economic change, such as in fisheries. There are many known and unknown model issues in agricultural models, that could become major research issues in the future, e.g., surface ozone effects on plant growth as it could cancel the CO₂ fertilization effect, uncertainty in future cultivar technology. The workshop split up in discussion groups (sector specific, 5 sectors) to discuss uncertainties and confidence of each sector. We then reunited for a discussion of what potentially large climate impacts is ISIMIP totally missing. Finally, we developed a semi-quantitative 'expert assessment' of how confident we are assessing climate change impacts now and how by 2040.

Most controversial question that came up in this workshop?

Is ISIMIP covering enough of the total impacts of climate change?

Results of the discussion

Top 3 Uncertainties, and confidence per sector:

Sector: Marine ecosystems and fishery

Uncertainties:

- 1) coastal oceanographic processes
- 2) trophic efficiency
- 3) scenario uncertainty in the ocean - fishing mortality is as big as natural mortality

Confidence:

- biological principles are grounded with ecological observations
- reasonable confidence in overall biomass and catch but less so in meso-scale and fine scale

Sector: Biomes / Forestry

Uncertainties:

- 1) Disturbances ==>1% back ground mortality... hydraulic mortality... extreme events/disturbances
- 2) CO2 fertilization
- 3) Soil carbon and soils in general...

Confidence: not indicated

Sector: Agriculture

Uncertainties:

- 1) Co2
- 2) Ozone
- 3) extreme events

Confidence: not indicated

Sector: Water & Lakes

Uncertainties:

- 1) Water / nutrient fluxes: Uncertainty in PET equations (applicability of the current approaches under climate change conditions); Simulating river discharge; Simulating nutrient fluxes (e.g., into lakes)
- 2) Inclusion of human dimension into water models (+ projections of future water-related infrastructure)
- 3) Unavailability of data for (global) modeling studies: e.g., groundwater volumes, glacier volumes limits assessment of impacts of cc

Confidence: not agreed on (depending on scale, purpose etc.)

Sector: Health - heat stress

Uncertainties:

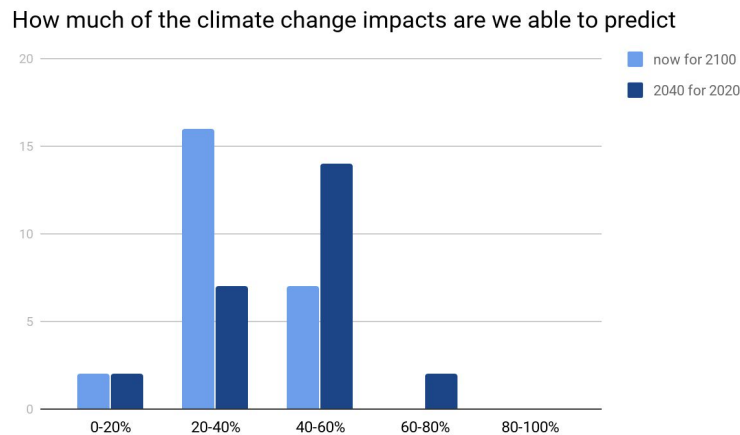
- 1) Unclear which metrics to use, view too narrow
- 2) Most thinking is in military
- 3) Adaptation and acclimation is unknown

Confidence: not indicated

Further discussion points: creation of “supermodels” (e.g. combined agricultural / hydrological model) and model interfaces (see also research gaps), cross sectoral catchy question (e.g. how will be the impact of cc to coffee)

Final vote among the workshop members (per hand sign)

- 1) How much (in %) of the total climate impacts expected for 2100 can we currently predict?
- 2) How much of the 2120 climate impacts will we be able to predict in 2040?



Number of participants (y-axis) that indicate how much (x-axis) of the cc impacts are we able to predict.

Research gaps identified

Integration of all components (into models) that sum up to total impacts (e.g., how emissions impact food production) is currently impossible with the models (complexity, interaction, methodology, data); Inclusion of CO2 effects in water models; changes in nutrient contents in agriculture/biomes models; ISIMIP sectors missing: “normal” infrastructure (e.g., transport), tourism, livestock, mental health, cross-sectoral interactions, poverty; explain why ISIMIP models are different (not only show that they are different); develop interface tools for interactions between models; increase spatial resolution (to km scale); are tipping points systematically excluded from models during model development, in order to ensure model reproducibility/ numerical stability?

Next steps

Tipping point working group; build towards a unified interface to couple impact models

Other

NA

3-5 keywords that characterize the session

Unknowns , Missing impacts, Confidence assessments, Integrated multi-sector modeling approach, Cross-sectoral interactions, Tipping points