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Impacts of soil and weather data aggregation in spatial modelling of net primary production of croplands

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15-17 March 2016, Berlin, Germany

iCROP M₂₀₁₆



MACSUR and AgMIP jointly present the International Crop Modelling Symposium
**Crop Modelling for Agriculture and Food Security
under Global Change**



ABSTRACTS

Editors

Frank Ewert
Kenneth J. Boote
Reimund P. Rötter
Peter Thorburn
Claas Nendel

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Welcome

It is with pleasure that we welcome the international crop and agro-ecosystem modelling community and scientists from related disciplines to the International Crop Modelling Symposium 2016, in Berlin.

The past decade has seen a number of research initiatives launched to advance crop modelling and related research. Among these initiatives, The European Knowledge Hub MACSUR (Modelling European Agriculture with Climate Change for Food Security, <http://macsur.eu/>) and the international AgMIP project (Agricultural Model Intercomparison and Improvement Project, <http://www.agmip.org/>) stand out in terms of the breadth of their research scope. A large and important part of the activities in both projects is comprised of the improvement, comparison and application of crop models for climate change impact and risk assessment for food security in Europe (MACSUR) and further (AgMIP). These projects have brought together a large number of scientists from around the world and produced a substantial body of novel results. The international MACSUR symposium on crop modelling in Oslo in 2014 and the annual Global Workshops of AgMIP have provided forums to exchange some of these results and have been initial and important events towards this symposium. The increasing interest from within and beyond the crop modelling community for a more comprehensive forum for the exchange of results ultimately motivated representatives of MACSUR and AgMIP to organise this symposium, reflecting the successful and joint work of both projects including successful interaction with other international networks.

The overwhelming interest in participation in this symposium has exceeded original expectations. From the large number of submitted papers, it was possible to develop what we, the Symposium Chairs, hope is an exciting programme of oral and poster presentations combined with a range of internationally recognised keynote speakers. The workshop structure follows the main activities related to model improvement and model application, as well as anticipating improvements in genetics, and links between crop and related modelling fields such as grassland and vegetation modelling, and

functional structural plant modelling. Accordingly, four sessions have been organised:

- Session 1: Improvement of crop models and modelling approaches
- Session 2: Linking crop models and genetics
- Session 3: Crop modelling for risk/impact assessment
- Session 4: Expanding and supporting modelling activities

The organisation of this symposium was only possible due to the help of several people. Special thanks go to the Session Chairs and the Scientific Committee Members for supporting the development of the symposium programme. We are particularly grateful for the effort of the local host ZALF (Centre for Agricultural Landscape Research) for organising the venue, registration, website and logistics of the programme. The financial and in-kind support from the Research Council of Norway through MACSUR, CSIRO, AgMIP, University of Bonn, Luke and the University of Florida are likewise gratefully acknowledged.

We wish all participants a very fruitful and inspiring symposium and we look forward to the many interesting keynotes, oral and poster presentations. We also hope to have the chance to interact with many of you during the course of the symposium and that the symposium may help to support ongoing and initiate new collaborations to further advance research on crop modelling.



Frank Ewert

On behalf of the Symposium Chairs, Kenneth J Boote, Peter Thorburn and Reimund Rötter, and the local host at ZALF, Claas Nendel.

International Crop Modelling Symposium **iCROPM₂₀₁₆** 15-17 March 2016, Berlin

Abstracts of Keynote Presentations

Impacts of soil and weather data aggregation in spatial modelling of net primary production of croplands

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Introduction

Spatial modelling of net primary production (NPP) enables extrapolation of observations or predictions for future developments of ecosystems. Required input data, e.g. variables describing soil and weather, are often derived from different scales, which may affect simulation results. Literature is lacking on studies addressing the quantification of aggregation effect on NPP modelling. Thus, the objective of this study is to calculate differences between simulation results of five resolutions ranging from 1 to 100 km.

Materials and Methods

In a multi-model approach NPP is simulated by nine models for the German state North Rhine-Westphalia. The simulations consider croplands assuming wheat and maize monocultures with constant management.

Weather and soil input data are aggregated for five grid maps of 1, 10, 25, 50 and 100 km resolution, with the coarser resolutions based on data aggregation of the 1 km grid map. While the weather data are averaged for the coarser resolutions, the soil data are represented by the dominant soil type.

The impact of data aggregation on NPP is named the aggregation effect ($E_{aggregation}$) and represents the maximum difference between NPP averages for the five resolutions divided by mean NPP at 1km resolution:

$$E_{aggregation} = \frac{\max(NPP_{Res1}, \dots, NPP_{Res100}) - \min(NPP_{Res1}, \dots, NPP_{Res100})}{NPP_{Res1}}$$

Results and Discussion

The aggregation of both input data sets at the same time shows the lowest NPP average for the 100 km resolution, without a clear trend across the scales. For most models $E_{aggregation}$ is lowest for the climate aggregation and highest, if both input data sets are aggregated (Fig. 1). However, since the two aggregation approaches for soil and weather data are different and not comparable, it is not possible to detect the more divers parameter set. As both approaches represent the standard techniques for data aggregation, the aggregation of the climate shows a minor impact on the simulated NPP values in comparison to soil data aggregation. The aggregation of both, weather and soil data, cause an aggregation effect of 1 – 13 % depending on the model, with the strongest impact for the step from 50 to 100 km.

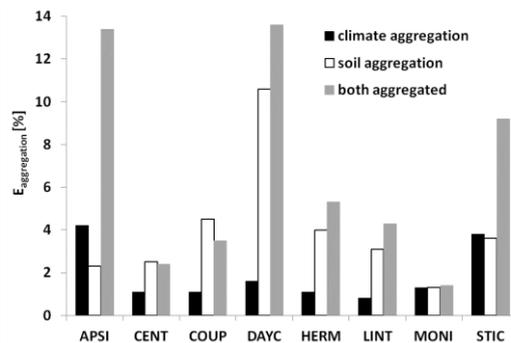


Figure 1. E aggregation for only climate data aggregation, only soil aggregation and both data sets aggregated.

Conclusions

Data aggregation leads to changes in NPP estimation of up to 13 % compared to the 1 km resolution with the strongest impacts for the 100 km resolution. Using the standard techniques for up-scaling, weather data aggregation shows a lower impact on simulated NPP than the aggregation of the soil data.

Acknowledgements

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