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Effect of different levels of calibration in rotation schemes simulated in five European sites in a multi-model approach

Matijevic Lana, Kurt Christian Kersebaum, Chris Kollas, Xinyo Yin, Claas Nendel, Kiril Manevski, Chris Müller, Taru Palosuo, Cecilia Armas-Herrera, Nicolas Beaudoin, et al.

► To cite this version:

Matijevic Lana, Kurt Christian Kersebaum, Chris Kollas, Xinyo Yin, Claas Nendel, et al.. Effect of different levels of calibration in rotation schemes simulated in five European sites in a multi-model approach. iCROP 2016 International Crop Modelling Symposium "Crop Modelling for Agriculture and Food Security under Global Change", Mar 2016, Berlin, Germany. , 441 p., 2016, International Crop Modelling Symposium "Crop Modelling for Agriculture and Food Security under Global Change" 2016. hal-01608869

HAL Id: hal-01608869

<https://hal.science/hal-01608869>

Submitted on 3 Jun 2020

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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.

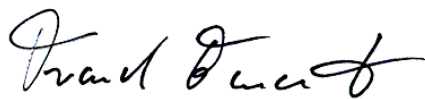
The overwhelming interest in participation in this symposium has exceeded original expectations. From the large number of submitted papers, it was possible to develop what we, the Symposium Chairs, hope is an exciting programme of oral and poster presentations combined with a range of internationally 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

Effect of different levels of calibration in rotation schemes simulated in five European sites in a multi-model approach

M. Lana^{a} – K. C. Kersebaum^a – C. Kollas^c – X. Yin^b – C. Nendel^a – K. Manevski^b – C. Müller^c – T. Palosuo^d – C. M. Armas-Herrera^e – N. Beaudoin^e – M. Bindl^f – M. Charfeddine^g – T. Conradt^c – J. Constantin^h – J. Eitzingerⁱ – F. Ewert^k – R. Ferrise^f – T. Gaiser^k – I. G. de Cortazar-Atauri^l – L. Giglio^g – P. Hlavinka^{m,u} – H. Hoffmann^k – M. P. Hoffmannⁿ – M. Launay^l – R. Manderscheid^o – B. Mary^e – W. Mirschel^a – M. Moriondo^s – J. E. Olesen^b – I. Öztürk^b – A. Pacholski^{j,o} – D. Ripoche-Wachter^l – P. P. Roggero^f – S. Roncossek^b – R. P. Rötter^d – F. Ruget^p – B. Sharif^b – M. Trnka^{m,u} – D. Ventrella^g – K. Waha^{c,t} – M. Wegehenkel^o – H.-J. Weigel^o – L. Wu^q*

* Corresponding author: lana@zalf.de

Introduction

Diversification of crop rotations is considered a basic agronomic practice recommended to reduce the incidence of pests, diseases, as well as to increase the resilience of agroecosystems, especially in a context of climate change and variation. The majority of crop simulation studies have focused in simulating single crops during single years. In a long term perspective, it makes more sense to simulate rotations than single crops because they can also characterize the carry-over effects of the previous crop, providing much better arguments for impact and adaptation studies. The aim of this study is to evaluate the effect of minimally versus calibrated data on the projections of crop yields using nine different crop models in five sites and different rotation schemes.

Materials and Methods

Experimental data

Data sets from five sites in Europe covering 10 crops under different crop rotation schemes were approached in this study. A comprehensive description of the sites and the crop rotation schemes can be found in Kollas et al (2015). The targeted variable was crop yield at harvest or maturity or final biomass, depending on the crop.

Crop models

Nine different crop models were used in this study. They can be initially divided in three different modes: ROTATION (when a crop model only performs continuous runs without reinitializing subroutines at the onset of the crop season - SWIM), SINGLE (when crop models only perform single crop growing seasons, not representing a true rotation scheme – DSSAT1 and DSSAT2) and ROTATION + SINGLE (when a crop model can provide results for both modes – DAISY, FASSET, HERMES, LINTUL2, MONICA, STICS).

Crop model calibration

The results observed in Kollas et al (2015) refer to crop models using a low level of calibration (defined as LOW), usually limited to information about initial values of soil

water content and soil mineral N (at a date close to sowing) for each treatment for the first year only. Additional data about key phenological observations, so as harvest dates or final biomass observations, were also provided. The high level of calibration (HIGH) contained detailed information about soil parameters, management, so as plant phenology and development.

Evaluation of crop models performance

As proposed by Bennett et al (2013), the performance of each model was evaluated by calculating complementary performance indicators. This procedure allows the quantification of error magnitude and the detection of bias. The performance indicators mean absolute error (MAE), index of agreement (IA), percent bias (PBIAS) and root mean square error (RMSE) were calculated for each site, crop, simulation mode and calibration level, and then averaged for each site.

Results and Discussion

The results of this study are structured in the following order:

- a) Evaluation of single crop model performance in simulating yields using LOW and HIGH levels of calibration for specific sites and crops;
- b) Comparison of crop multi-model ensemble using LOW and HIGH calibration levels for single crops;
- c) Comparison of the effect of LOW versus HIGH calibration on the simulation of yields in rotation schemes.

Conclusions

Initial results indicate that, for the majority of crops, the HIGH calibration does improve the model outputs for both ROTATION and SINGLE modes, when compared to the LOW calibration. The same tendency can be observed for multi-models ensemble, where HIGH calibration slightly reduced the difference between observations and simulation results. The effect of HIGH calibration is more evident in ROTATION schemes than in SINGLE, probably due the better projection of carry-over effect.

Acknowledgements

The present study was carried out in the context of CropM within the FACCE-MACSUR knowledge hub. We are thankful to all the colleagues that provided experimental and simulated data, so as advices to conduce this work.

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