FACCE-MACSUR

Model intercomparison for calibrated models

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Abstract

The study ROTATIONEFFECT aims to compare the output of different models simulating field data sets with multi-year crop rotations including different treatments.
Within the first Step (1a2a) data sets (comprising a total of 301 crop growth seasons) for 5 locations in Europe were distributed to 15 interested modeller groups.
For this step only minimal information for calibration were provided to the modellers. In total 15 modelling teams sent their "uncalibrated" results as single-year calculations and/or continuous calculations of rotation depending on the capability of the model. Results have been evaluated and the paper submitted (European Journal of Agronomy).

Now, within the 2nd step (1b2b) modellers were provided with more information on the crop for the calibration of models. Again, results of calibrated runs were collected.
6 models were capable to run the rotations as continuous runs and another set of 6 models provided single year simulations.
A first overview of the improvement of predictions due to calibration has been produced. Result files have been uploaded to the web platform for CropM results at Aarhus University (WP2 – data management).

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Introduction

Crop model testing and validation is regularly done in a two-step process. Firstly, modelling teams are requested to simulate crop growth given limited calibration data. Secondly, modellers are provided with sufficient data for calibration of one of the treatments and again, modelling results are collected (see for instance Asseng, 2013). In the modelling exercise ROTATIONEFFECT we now approach this second step.

Apart, we learned from the first step of the exercise, that the advantage of modelling in mode rotation will likely become more visible under extreme growing conditions, e.g. when water or nutrients are scarce and not being filled to field capacity at the beginning of the growth period after winter. Thus, we selected an additional dataset from Italy to be included in the study, which has so far only be simulated by 7 models for the uncalibrated step.

Methods

Following the protocol for model inter-comparison in CropM (see M-C1.1), firstly **objectives and hypothesis to be tested** have been developed.

Secondly, **the selection of the datasets** has been performed.

Thirdly, the **blind application** was conducted. For this, **basic minimum data sets** derived from the 5 datasets were provided in a pre-defined format to modellers (see Deliverable C1.3).

Fourth, results of the blind application have been condensed and let to a paper that was submitted to *European Journal of Agronomy* (title: Crop rotation modelling - a European model intercomparison).

Fifth, calibration data of selected treatments for all datasets was sent to the modellers and, like in the blind application, modelling teams were asked to provide results in the same daily and yearly pre-defined output format (see deliverable D.C.1.3.) and pre-defined file names. Other treatments were used for validation. Again, simulations of the given rotations should be calculated in two separate runs: (1) as single year simulations and (2) as a continuous rotation. However, due to the diverse model architectures, it was not possible for all models to provide model results neither for both variants nor for all crops.

In parallel, an additional dataset (Foggia, Italy) was sent to interested modellers. The dataset was selected to reflect Mediterranean conditions that have not been integrated in ROTATIONEFFECT so far and it is assumed that here the advantages of continuously modelling a rotation will become more visible.

Results

In total, 6 modelling teams provided results of rotation runs and a partly overlapping set of 6 modelling teams provided results of single-year simulations (Tab. 1).

All files of calibrated modelling results (and un-calibrated results for Foggia dataset) were stored at the site of the main investigators of this study (C. Kollas, K.C. Kersebaum) and in process of storing at the site of the Arhus University data platform. That data platform serves as a storing facility, geo-network and visualisation platform (responsible: Jorgen Olesen, Jens Gronbach Hansen, Sanmohan Baby, see Task C2.2: Database development and management and Task C2.6. Visualisation of Data). The complete dataset of calibrated results encompasses 1720 files. In total 8 modelling teams participated in this second step of the study.

Results of modelling the Foggia dataset (un-calibrated) were provided by 8 modelling teams (rotations) and 7 teams (single-year).

A first overview of the comparison between un-calibrated and calibrated results was shown at the MACSUR1 final scientific meeting, Reading 8-10.4.15. They indicate slightly better results of calibrated results, compared to uncalibrated results. Again, continuous runs provide more accurate yield predictions compared to the single year runs (Fig.1), but the differences are more pronounced and significant in most cases.

Table 1: Delivery of un-calibrated and calibrated results per model for single year runs (S) and continous (R) runs.

Model	Un-calibrated		Calibrated	
	R	S	R	S
Cropsyst	X	X	X	X
Daisy	X	X	O	O
Fasset	X	X	X	O
Hermes	X	X	X	X
Lintul	X	X	X	X
Monica	X	X	O	O
Stics	X	X	X	X
Swim	X	O	X	O
Theseus	X	O	O	O
DSSAT (Tr)	O	X	O	O
Wofost	O	X	O	O
DSSAT (Ve)	O	X	O	X
LPJguess	O	X	O	X
Spacsys	X	X	O	O
Σ	10	12	6	6

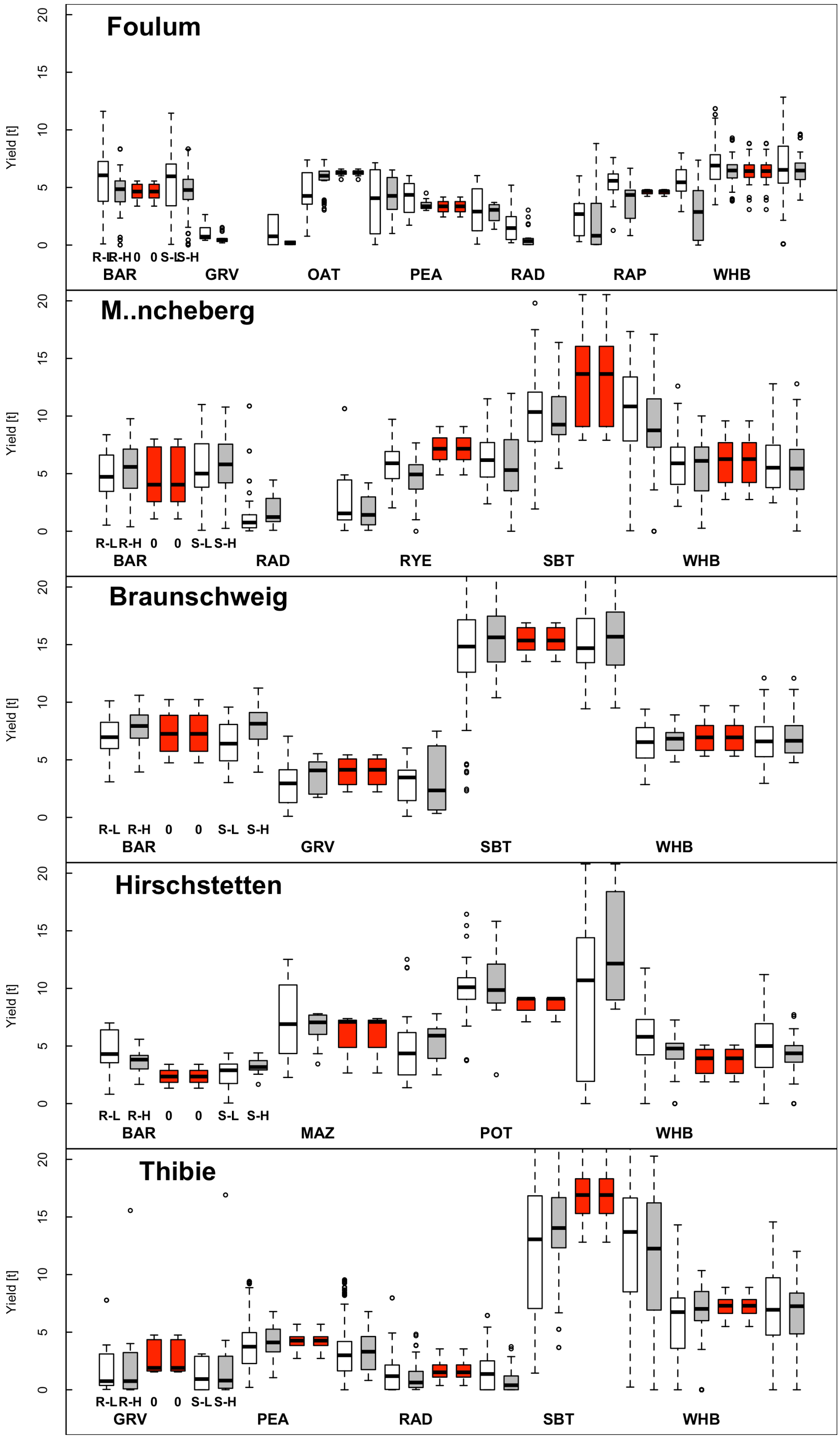

Fig. 1: Preliminary results: Yield predictions (R-ROTATION, S-SINGLE, L-low information/un-calibrated, H-high information/calibrated) of 15 models (L) and 8 models (H) and observation (O) of all treatments of the five datasets.

Discussion

The result files of calibrated runs provided by the various modelling teams have been checked for formatting and consistency. Results are condensed into two files that are ready for an in-depth analysis of the data.

Further development

In May 2015, Dr. C. Kollas will leave the CropM project. The work/data is handed over to Dr. Marcos Lana (ZALF), who will prepare a MS on the comparison of un-calibrated and calibrated model runs.

Acknowledgements

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References

Submitted manuscripts

Kollas C, Kersebaum KC, Nendel C (…): Crop rotation modelling - a European model intercomparison. European Journal of Agronomy

Kersebaum KC, Boote KJ, (…), Kollas C, (…): Analysis and classification of data sets for calibration and validation of agro-ecosystem models. Environmental Modelling & Software