

## ***Interactive comment on “Parameters sensitivity analysis for a crop growth model applied to winter wheat in the Huanghuaihai Plain in China” by M. Liu et al.***

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Received and published: 4 July 2014

Comments on “Parameters sensitivity analysis for a crop growth model applied to winter wheat in the Huanghuaihai Plain in China” by M. Liu et al.

Major concerns: 1. It is questionable whether the parameter sensitivity presented here represents the full parameter space. Because many crop models often show nonlinear responses against even a unit change in parameter value, the parameter sensitivity is subject to a range of the parameter perturbation. However, authors only perturbed parameter values within the range of 0.8 to 1.2 relative to the default value (the sources are unclear. Maybe these are derived from some sort of model documentations). The

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range is too narrow and the number of sampling (2000 times for each parameter) is too few to explore the full possible parameter space and their interactions if one considers the fact that the value of some parameters used in crop models can change by over 40% of the initial value after the calibration (see Iizumi et al., 2011, Table 1 & Fig. 2). 2. The use of the default parameter values cannot be justified without rationales. In the presented study, no result is presented to show the model performance in reproducing observed yields and phenology when using the default parameter values. Without rationales that the model can reproduce the characteristics of the real world using the default parameter values, the sensitivity analysis using the perturbation relative to the default values is invalid. 3. While authors claim that the proposed method for sensitivity analysis is useful to select parameters to be calibrated before regional crop simulation, no result is presented to support this statement. To say so, it is necessary to compare calibration results with and without the information from the sensitivity analysis. 4. Although authors suggest that the difference in soil type is a key to explain the parameter sensitivity, I have reservations. This statement is acceptable in general sense as soil types govern the hydrologic and biogeochemical characteristics of cropland and thus influence the crop's response to water and nitrogen stresses. However, results may change if the sensitivity analysis was performed for the full parameter space. 5. It is a bit of surprise that authors do not know a series of the following studies if they are interested in regional crop simulation or upscaling of a crop model: Iizumi, T., M. Yokozawa, and M. Nishimori, 2009: Parameter estimation and uncertainty analysis of a large-scale crop model for paddy rice: Application of a Bayesian approach. *Agricultural and Forest Meteorology*, 149, 333-348. Iizumi, T., M. Yokozawa, and M. Nishimori, 2011: Probabilistic evaluation of climate change impacts on paddy rice productivity in Japan. *Climatic Change*, 107, 391-415. Iizumi, T., G. Sakurai, and M. Yokozawa (2013) An ensemble approach to the representation of subgrid-scale heterogeneity of crop phenology and yield in coarse-resolution large-area crop models. *Journal of Agricultural Meteorology*, 69, 243-254. Iizumi, T., G. Sakurai, and M. Yokozawa (2014) Contributions of historical changes in sowing date

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and climate to U.S. maize yield trend: An evaluation using large-area crop modeling and data assimilation. *Journal of Agricultural Meteorology*, 70, 73-90. <sup>1</sup>Œd Sakurai, G., T. Iizumi, M. Nishimori and M. Yokozawa (2014) How much has the increase in atmospheric CO<sub>2</sub> directly affected past soybean production? *Scientific Reports* 4, Article number: 4978 doi:10.1038/srep04978. <sup>2</sup>Œd Iizumi, T., Y. Tanaka, G. Sakurai, Y. Ishigooka, and M. Yokozawa (2014) Dependency of parameter values of a crop model on the spatial scale of simulation, *Journal of Advances in Modeling Earth Systems*, available at: <http://onlinelibrary.wiley.com/doi/10.1002/2014MS000311/abstract>

Specific comments: 1. P3874L2: "genetic coefficient". Although it is true a few parameters could possibly link to some sort of genetic characteristics of a crop plant, I would suggest calling these parameters "crop-specific" parameters or something else. 2. P3875L4: "Tan and Ryosuke" would be "Tan and Shibasaki" 3. P3875L26: "uniformly-distributed". These sites distribute geographically, but not uniformly. 4. P3877L8: "grain". What is the difference between grain and (wheat, rice and maize)? 5. P3878L21. "environmental factors". I do not think BP1, BN2, BN3 describe environmental factors. It would be more appropriate to say that these parameters describe the crop's biochemical characteristics.

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Interactive comment on *Geosci. Model Dev. Discuss.*, 7, 3867, 2014.