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Discussions

Interactive comment on "Evaluation of root water uptake in the ISBA-A-gs land surface model using agricultural yield statistics over France" *by* N. Canal et al.

Anonymous Referee #3

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In the manuscript presented by Canal et al. it is examined how different alternatives for the simulation of root water uptake and soil water dynamics can improve the performance of the land-surface model ISBA-A-gs. To test this, aggregated yield data from the agricultural statistics in France are used. In principal, this question of whether a new process formulation improves the performance of a land-surface model or not could be of general interest to readers of HESS, as already mentioned by the other referees. However, the presented method is, in my opinion, hardly suitable to rigorously test the appropriateness of the different modeling approaches. This is due to the nature of the data set used in the study and also because of the fact that the alternative model con-

figurations are solely tested with respect to their potential to improve the simulation of the inter-annual variability of grain yields of cereals and dry matter yields of grasslands. Others (no less important) model predictions are not considered in this study. As the ISBA-A-gs model, initially developed to simulate energy and water fluxes at the land surface, is not a crop growth or grassland model, it is not surprising that the agreement of the model with the observed data is rather low. For crops, in the best case, the model can reproduce inter-annual yield variability of yields only at 13 out of 45 sites with an Rˆ2 > 0.366, even after optimization of the two most relevant parameters. In other words, Rˆ2 is lower than 0.366 in 32 of 45 cases. A validation of the model predictions with an independent data set not used for model calibration was not performed. For grasslands the match between simulations and observations is markedly better, which is due to the fact that the model simulates biomass and does not distinguish between 'vegetative biomass' and 'generative biomass' (grains). This indicates that aggregated grain yields are not really suited for the evaluation of the performance of the model. Beside of radiation, precipitation and temperature, crop yields depend also on many local conditions such as soil properties, nutrient availability and farm management. However, all these features are not included in the model (which typically is the case in LSM designed for global and regional studies). Probably, other data sets such as leaf area index (LAI) or green vegetation index (GVI) from remote sensing should be better suited for the evaluation of the vegetation component of the model at regional scale. For testing the adequacy of the coupling between soil hydrology and root water uptake, field scale data including soil moisture and evapotranspiration would be a useful complementation. Moreover, given the rather low performance of the model in relation to the data from agricultural statistics, the impact of alternative root water uptake models on simulated yields has only little informative value about the performance of the model. In my opinion it is questionable, to seek the improvement of an isolated process in a complex LSM while ignoring the impact on others (such as soil moisture, latent heat and sensible heat). This is because it is not clear a priori whether improving (or worsening) the representation of a single process will also improve (or worsen) the overall performance of a LSM. Unforeseen interactions of parameters in a new scheme with ones in existing schemes of the LSM may occur (e.g. Rosero et al., 2010; Niu et al., 2011). Even if there is no improvement (or even worsening) in the model predictions for biomass, other state variables such as soil moisture or the fluxes of sensible and latent heat could be greatly improved. And vice versa, improvements in one process can be accompanied by decrease in the overall model performance (e.g. Gayler et al., 2014). However, this was not investigated in this work and so the question of what the most appropriate approach for root water uptake is in other applications than yield predictions remains unanswered. In its present form the paper can be more or less reduced to the question if the vegetation component of ISBA-A-gs can be used for predicting the variability of yields over a period of 17 years (partially discussed in Section 4.3.). This seems to be the case on a rather low level (at least compared to more detailed models, which are designed for this purpose) and some of the tested root water uptake schemes perform better than others. However, the study does not allow conclusions about the suitability of the alternative approaches in applications of the models in hydrological simulations (e.g. regional or global scale), because the relevant observables were not considered. I therefore recommend to extend the study to further data sets which include those state variables, such as soil moisture and evapotranspiration.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 5421, 2014.