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Hydrology and Earth System Sciences
Discussions

Interactive comment on "On the use of high resolution satellite imagery to estimate irrigation volumes and its impact in land surface modeling" *by* Jordi Etchanchu et al.

Anonymous Referee #1

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The paper proposes the development of an irrigation module in LSM that better reflects the reality of decisions that depend on the crop, its phenological stage and irrigation techniques. The study found that current models are either too simplistic with the impossibility of representing real practices or too complex with the impossibility of providing large-scale information on the parameters needed to characterize the irrigation schedule. The idea is to improve the irrigation scheme present in the ISBA model by using remote sensing imagery to characterize phenology (actually 3 stages: the 8-leaf stage with an LAI of 0.4, flowering with an LAI max and harvesting with an LAI <0.4) and a finer calendar of the irrigation constraints based on expert opinion. The article is limited to the case of irrigated maize in the hills of Gascony. The article clearly

presents the approach and an improvement is observed, mainly on irrigation volumes, but this at the cost of determining 3 parameters based on the phenology of corn and 2 on the equipment (dose provided and minimum return time). The model is also very sensitive to soil characteristics such as AWCmax which is linked to soil depth. Finally, we are quite close to deterministic situations considered too complex and genericity in parameter determination is far to be clear (the authors must give 2 sets of parameters according to the plots studied, all located in the same sector). Moreover, if the improvement is clear in 2013, it is much less obvious in 2014. The article lacks a real discussion on the method to be used to generalize the approach in a context where there is a diversity of crops, cultivars for a given crop, soils, regional contexts and a diversity of equipment. That is a lot and this point should be the subject of much deeper discussion on what sources can be mobilized at the regional level and how they can be exploited. For example, information at the level of that provided by the FAO could ultimately be appropriate as it is a level at which we can synthetize knowledge and compile data. I suggest to consider in the discussion the following points :

- How to collect expert data on irrigation strategies and technical data. The authors suggest that the model might be calibrated on irrigation records. What would be the data sources then? Such an approach, which will probably be necessary, could have been tested on the data sets used by the authors.

- The quality of phenology determination is insufficiently discussed. What would be the impact of the absence of satellite data on phenological accuracy and the resulting impact on irrigation estimation? This can be addressed by a sensitivity analysis.

- AWCmax is an important factor in the proposed model. This one will never be known with certainty. Therefore, would it be possible to propose a single value (or a limited number if it appeared that the soil properties were a proven fact for the irrigation decision). What impact would this have on the estimation of irrigation?

- The accuracy with which the model simulates the soil water content at the beginning

of the irrigation period is not discussed. However, mistakes of several tens of mm can quickly be made.

- The model seems to be designed to run at a mesh resolution of 1 km. At this scale there will surely be similar crops with phenological stage differences. How will these discrepancies be managed?

- To properly cover a territory, how many types of crops will have to be considered?

To feed a model that should work on a 1km scale, it is as important to address these issues as to develop an algorithm that is flexible but whose parameters seem to be case dependent. As a result, we find ourselves in the same situation as explicit models (such as STICS as mentioned in the introduction and criticized). I therefore propose to give a much larger room to discussion and give concrete and argued suggestions for generalization. From a more specific point of view, here are some remarks on the text, which is generally very well read.

P2 L27-32 I am not sure that the proposed approach overcome such limitations P3 L15-20 I am not sure that the proposed approach is simpler. The cost of the flexibility is the number of parameters and thus it raises the problem of their determination. P3 L23-25 : it could be the appropriate level to determine parameters over large territories. P6 L28 contrarily to of all (spelling?) P7 L7 : is plot refer to field used in the study? P7L18 : I am surprised by the LAI definition. In general it the whole green area and in Bvnet I think that the training data set is related to whole leaf area. P9L20 in order to optimize the water resources availability (in order to optimize irrigation rate according to water resource availability?). P10L15 : 8 h looks very long. In general farmer use irrigation equipment which is a moving system where a unitary surface "see" irrigation during a much shorter time (30-45'). Setting an 8 hours irrigation will lead to a very small irrigation flux. If such a flux has importance in ISBA, I suggest to reduce it accordingly, even 8 hours is needed to irrigated the whole field.

P10 L28 : I am not sure to fully understand on which timr period Min and max are

established (at the annuel level LAImin=0) P12L28-29 : what consistent means here? Figure 2 : it is difficult to identify irrigation since the lines barely reach the threshold line..

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