Hydrology and Earth System Sciences Discussions

Interactive
Comment

Interactive comment on "Assessment of soil moisture fields from imperfect climate models with uncertain satellite observations" *by* G. Schumann et al.

G. Schumann et al.

guy.schumann@bristol.ac.uk

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Reply to comments from Anonymous Referee #3

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General comments

The paper addresses the evaluation of seasonal soil moisture predictions of the LAM and GCM model against satellite observations, both averaged over a number of years. The fuzzy logic theory proposed in the paper is appealing as it explicitly accounts for uncertainty of satellite observations and as far as I know, it has not been used to eval-

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uate Land Surface Schemes (LSS) before. However, I agree with the other reviewers that the paper lacks an elaboration of the sources of uncertainty and how these are encompassed in the fuzzy framework that is proposed. For example, from the paper it is unclear why the accuracy of the satellite observations has not been included and why the variance of the observation has been taken as a measure of uncertainty instead. I also encourage including an elaboration and justification on the evaluation criterion that has been used, embedded in a discussion on the role of soil moisture in climate models, addressing issues such as: Why is the average soil moisture used and not e.g. the temporal variation of soil moisture? Are there other satellite products that may be included in the evaluation? And how important is the soil moisture content in the upper 5-10 cm of the soil column for the the LSS performance, as the main source of evaporation is the root water uptake of vegetation, taken from the entire soil column? Furthermore, as already stated by the other reviewers, some of the statements are not well justified or unclear. E.g. in Section 4.1 it is suggested that improved parameterization of runoff might improve the performance of LSS. In the model description, it is not explained which runoff parameterization is applied by MOSES and for the reader it is unclear, why the remark is made and how it fits in the overall aim of the paper.

Reply: most of the above comments have been replied to in the replies to comments of reviewer #1 and #2. To recall, we will qualitatively address some other uncertainty sources and possibly add the error in the observation to our acceptability scheme thereby making the trapezoidal shape wider. We will also greatly elaborate on the scheme and the methodology we applied. As already stated in the replies to reviewer #1, we will remove the reference to the runoff parameterisation and support some of the statements of our findings by additional figures in the result section.

Detailed comments:

I miss in the introduction a reference to other satellite products that may be used for LSS evaluation. See for example the SEBAL algorithm that derives turbulent heat fluxes from satellite images (e.g. Bastiaanssen et al., 2005).

Reply: we thank the reviewer for this note and will make more references to other satellite products that may be used for LSS assessment.

Fig 2: The figure 2 shows the statistics of the absolute difference between RS1 and RS2. It would be informative to include some statistics of RS1 and RS2 as well

Reply: we will add a figure reflecting distributions of soil moisture values for ERS as well as AMSR-E.

I agree with referee 2 that the improvement of the soil moisture simulation by LAM as compared to the GCM is not justified by the results presented in figure 5. Referee 1?

Reply: as stated in the replies to reviewer #1, we will include an additional figure in the results section of the revised manuscript that supports this statement.

Technical corrections:

Eq.(1): The equation should be revised as c_1 and c_2 can be either RS1+ sigma, RS2+sigma or RS1- sigma and RS2- sigma.

Reply: this will be revised. It is worth noting that RS1 is always situated on the left side of the scheme but can take the value of either ERS or AMSR-E depending on which gives the smaller value for that particular pixel. Therefore c_1 can only be RS1-sigma in our version of the adaptation of the scheme (see figure 3). The same applies for RS2 (on the right side of the scheme) for the larger values and so c_2 is RS2+sigma. However, this may not be clear in the way the equation is written at the moment and so this will be checked thoroughly.

I suggest reconsidering the title of the y-axis of figure 2.

Reply: as also stated by Referee #2, the expression 'fractional soil moisture' is indeed confusing and thus will be replaced (see 'Replies to comments of reviewer #2).

References: Bastiaanssen, W.G.M., E.J.M. Noordman, H. Pelgrum, G. Davids, B.P. Thoreson and R.G. Allen, 2005: SEBAL model with remotely sensed data to improve

water-resources management under actual field conditions. ASCE Journal of Irrigation and Drainage Engineering, 131, 85-93

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