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Hydrology and Earth System Sciences Discussions

Interactive comment on "Assimilation of ASCAT near-surface soil moisture into the French SIM hydrological model" *by* C. Draper et al.

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We appreciate the referee's comments on our manuscript. These comments are reproduced below, with our response to each provided as a bullet point.

With pleasure I have read this paper, which I found to be very interesting and very complete. It is very interesting to see how the authors demonstrate that a modelling and data assimilation exercise can allow for evaluating remote sensing products. The paper definitely falls within the scope of HESS.

I only have some minor remarks:

1. page 5436, line 6: there are two formulae which are probably wrong. If the standard deviation on is 0.04, then one can calculate from 0.5 x (wfc $-$ wwilt) that there would only be a possible soil moisture range (i.e. w_fc - w_wilt) of 8 vol%. A standard deviation of 0.02 for would then result in a difference between field capacity and wilting point of 4 vol%. Something is thus wrong, and also I expect the range of soil moisture contents to be much larger.

- These formula are correct, and the reviewer is correct that this implies a very narrow range between w_fc and w_wilt: the mean difference between these two terms is 0.086 . We agree that this is very small, as is discussed in Draper et al (2011) in detail (from which the error specifications were taken).

2. page 5437, lines 12 to 19: here you find a bias in the soil moisture: the paper should better address how this can be taken into account through data assimilation (different options exist (pdf matching, correcting for bias when assimilating, ...) , maybe the paper can briefly address these and better explain how they accounted for it.

- The paper has been substantially rewritten to better deal with the implications for data assimilation of i) the biases between the SIM_NRT and SIM_DEL soil moisture, and ii) the finding that a bias-blind assimilation of CDF-matched (unbiased relative to the model) soil moisture influenced the model biases. Please see the response to Wade Crow's comments.

3. page 5440, line 3 and 4: here you state that the data assimilation "adds" 38.5 mm yr-1 . However this seems to contradict what is stated on page 5444, lines 10 to 18, where it is stated that the impact of the assimilation on the soil moisture is about 0.1 mm month-1 . If there is a net addition of 38.5 mm yr$-$1 , then the average per month should be larger...

- On page 5444 it is noted that the assimilation affects the *change in* surface moisture storage by 0.1 mm month^{-1}. This small net change in the gradient is evident in Figure 6 - note that the final and initial mean soil moisture for the assimilation experiment is very similar for SIM_NRT and SIM_ASCAT. The reason that this occurs, despite the large volume of moisture added to the model by the assimilation, is that most of the added moisture is lost from the model due to increased drainage and evapotranspiration (see Figures 7c and 7d).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 5427, 2011.