Marielle Gosset's short comment

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This is an interesting work, illustrating how satellite observation of rainfall and soil moisture can be complementary. However the objective of the work should be better explained and the choice of using only non-adjusted (or RT) satellite rainfall products should be better justified. If the objective of this work is to propose an alternative bias-correction method for RT satellite rainfall than the operationnal advantage of the proposed method should be developped. If the objective is to show how combining information on both rainfall and soil moisture can help a better understanding/modelling of hydrological processes, than the point would be strenghened by adding post-adjusted products (such as 3B42V7) in the study.

Thank you very much for your comment. Your remarks helped the authors to put this work in a different perspective. The operational point of view of this method is actually quite interesting and has been added to the study. The performances of the real-time precipitations, the assimilation of SMOS using the real-time precipitations, and the re-analyzed precipitations are compared. More specifically and as suggested, the following post-adjusted precipitations products have been used: PERSIANN-CDR, TRMM-v7 3B42, and CMORPH-v1 CRT. The study shows that SMOS assimilation can perform as good as the post-adjusted precipitation products (especially for PERSIANN, and a bit less for the other two products).

-is the SMOS based bias correction potentially available with better delay than what is currently done based on gauges (for instance to correct 3B42RT into 3B42v7) ? what are the current/future perspective on soil moisture monitoring and would the expected sampling allow for using soil moisture based bias correction to be used operationnally?

The version of the SMOS product that is used here is the Level 3 soil moisture, usually available under 8 days after the observations. SMOS observed brightness temperatures are made available in quasi real time (2 to 3 hours), which can allow an assimilation of the observations in quasi real time (cf. work of Nemesio J. Rodriguez-Fernandez, using neural network to retrieve soil moisture within one day). However, the post-adjusted precipitation products are only available weeks after the actual observation (up to a couple of months). SMOS would definitely be useful during the release of the real-time precipitation and the adjusted products.

-One of the tested product (PERSIANN) has been shown by many previous authors (cited in the present paper) to have a large and steady positive bias over the region. Simple method (like pdf matching based on gauges series used by Thiemig et al, among others) can remove such steady bias. What is the quantitative advantage of the SMOS based method compared to such simple methods ?

By assimilating SMOS soil moisture, a physical information is added into the process regarding the amount of soil moisture and also its spatial distribution (even at a coarse scale). A pdf matching is a statistical method that consists of matching certain statistics (such as the mean and the standard deviation) to those of in situ gauges. This statistic method can be extremely efficient and very fast if in situ gauges are available indeed, just like they are incorporated in the post-adjusted precipitation products. Since they are not always available everywhere, as opposed to satellite observations, SMOS has the advantage to adjust the soil *moisture quantity in regions where there is no other precipitation network.*

If the known/steady bias on rainfall was removed before assimilating soil moisture in the model, couldn't the complementarity between the high resolution rainfall information provided by the satellite products and the soil moisture information be better exploited?

It appears here that the bias is not steady since there can be precipitations seen in the real-time products during the dry season (spring mainly), whereas some of the rainfall events during the rainy season can be underestimated. Moreover, the bias or errors in the satellite precipitation products can only be identified if rain gauges are present on site, which is not always the case. The complementarity of the high resolution of the rainfall products and the soil moisture information is not properly addressed here, but it is one of the current subject under study at LTHE, Grenoble.

The improvement of the discharge simulation is very low in the case of TRMM based forcing (because the first order correction, i.e. strong bias removal, is not relevant in this case). In this case, what is the effect of moisture assimilation on other variables (ground water etc...) ; is the space/time distribution of water within the basin improved?

Regarding the impact of the assimilation on the groundwater simulations, they are shown on Figure 10 of the manuscript. They are all improved by the assimilation compared to the in situ measurements of groundwater (at one location). Unfortunately, there are not enough in situ locations to assess the quality of the spatial distribution of the water within the basin.

I believe this work would be more convincing if the post-adjusted version of TRMM 3B42v7 was also included and the questions above explored.
Note that bias corrected versions of PERSIANN (persiann-CDR) and Cmorph (v1) are also available for the study period and could be easily used in the present study for comparison.

The three post-adjusted versions of the precipitation products have been added to the manuscript. It allows this work to be more thorough and focused on the real advantage of SMOS. We would like to thank Marielle Gosset for her valuable comments which made this work more focused.