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Hydrology and Earth System Sciences
Discussions
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Interactive comment on "Joint assimilation of soil moisture retrieved from multiple passive microwave frequencies increases robustness and quality of soil moisture state estimation" *by* A. I. Gevaert et al.

Anonymous Referee #1

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OVERVIEW

The manuscript investigates the potential of assimilating passive microwave soil moisture observations in land surface modelling for improving surface and root-zone soil moisture simulation. Specifically, the assimilation of L-, C-, and X-band observations obtained by SMOS and AMSR2 satellites into the AWRA-L model in Australia is carried out. In situ observations at surface and root-zone are used for assessing the impact of

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Discussion paper

satellite soil moisture assimilation.

GENERAL COMMENTS

The manuscript is well written and clear. The topic is surely of interest for the readership of HESS as the availability of multiple soil moisture products from satellite sensors poses the question on how to fully exploit their combination/integration for improving hydrological applications. The study investigates this aspect by using passive-based microwave retrievals at L-, C-, and X-band. Therefore, I believe the paper deserves to be published. The paper reads well and I have only a couple of suggestions that can be implemented to improve further, in my opinion, the significance of the paper.

1) Two precipitation products are considered to assess the influence of their quality on soil moisture assimilation. It was recently done also in Massari et al. (2018, doi: 10.3390/rs10020292), and I believe it is a very interesting approach. However, a gauge-corrected product (research version of TRMM) and a gauge-based product are considered. I would suggest to consider also the real-time version of TRMM, better of TMPA, that is only satellite-based and would provide information of the impact of soil moisture assimilation in areas of the world in which raingauge are not present. I believe that it would not be too much work to be done, and the corresponding results would be of strong interest (at least for me).

2) The analysis has split the assimilation in wet and dry periods, as in wet conditions AWRA-L model is not performing well. However, in many previous studies it was obtained that the higher impact of soil moisture assimilation is obtained in the transition periods between dry and wet conditions (and viceversa between wet and dry condi-

tions). I would suggest including these periods in the analysis (again, it should be easy to be added).

SPECIFIC COMMENTS

Page 10, figure 3: The performance of the Open Loop simulation for root-zone soil moisture simulation should be added

Page 11, line 9: “no difference”. I suggest changing with “a small difference” or equivalent, as some differences are present also for root-zone soil moisture.

Page 16, Discussion section: I suggest adding a paragraph of comparison with studies that have considered the joint assimilation of active and passive soil moisture products, to highlight the similarities and the differences.

RECCOMMENDATION

On this basis, I found the topic of the paper relevant and interesting. Therefore, I suggest a minor revision before the publication in Hydrology and Earth System Sciences.

REFERENCES

Massari, C., Camici, S., Ciabatta, L., Brocca, L. (2018). Exploiting satellite-based surface soil moisture for flood forecasting in the Mediterranean area: state update versus rainfall correction. Remote Sensing, 10(2), 292, doi: 10.3390/rs10020292. http://dx.doi.org/10.3390/rs10020292.

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