## Referee #1

### General comments:

**This paper is very interesting and very well written. It compares different soil moisture (SM) satellite products from a hydrological point of view. In particular, it tries to asses if these products could be useful in real time, as part of future flood warning system in Morocco. I think the paper could be published, after some minor changes.**

*First of all, we would like to thank the reviewer for his time to critically review our manuscript and to provide additional suggestions to improve the paper. In this document, we respond to the received comments point by point and also we show the changes suggested in the paper according to the line numbers in the revised document. Our responses are in italics.*

### Main remarks:

1. **The methods and data are globally well described, but sometimes a bit difficult to follow due to the huge amount of information provided. I would see 2 tables: a table summarizing the different available SM products, and another one concerning the punctual measurements in each catchments**

*Thanks for this comment. We will follow your suggestion and we added a table that summarizes the different rain gauges used in the paper and also the hydrometric stations with different information (Time step, monitoring period, altitude…).*

*Concerning the second table, that presents the different available SM products, we added a table so the reader can have a clear view of the soil moisture products considered.*

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2. **I would also remove the Extended collocation analysis: it takes time to read and understand the method (3.2), while the results are presented in only few lines (4.4), confirming previous findings**

*We added the Extended Collocation analysis to verify if the two types of comparisons give the same results. But we will follow your suggestion and this part has been removed in the revised manuscript. We added this evaluation as supplementary material.*

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3. **I agree with the authors concerning the usefulness of the SM satellite products. However, I don't think that they could totally replace a Soil Moisture Accounting (SMA) scheme, especially for real time flood forecasting. First, as mentioned by the authors, the latency of those satellite products could be an issue as well their coarse spatial resolution. My opinion is that an interesting perspective to mention is to assimilate SM satellite products into continuous models in order to correct the state of its production function. I am not sure that**

**using an event-based hydrological model is a good option for (flash) flood forecasting. But I agree, this question is far beyond the scope of this paper**

*We agree with the reviewer, we cannot replace easily SMA model which is based on observed data with satellite products especially for real time flood forecasting. However the accuracy of the SMA model depends on the quality of rainfall data. As the reviewer mentioned, we can mention in the perspective the contribution of SM product assimilation in order to correct the data [Line: 615 to 620). Another option would be to calibrate the SMA product with satellite data (as in Tramblay et al. 2012).*

*About the use of a continuous model, its application can be hampered by the lack of long-term good quality data. In particular rainfall but also runoff, since stage/discharge relationship may change over time due the changes in the river channel in this type of mountainous basins. This is why we implemented an event-based approach.*

**Minor remarks:**

4. **P02L68: no date in Western and Bloschl**

*Done.*

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5. **P04L132: A table could summarize the punctual hydro-meteo data (type, number, starting date, ending date, time step, catchment, . . .)**

*Done.*

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6. **P04L139: I think that with a such short observation period (1 year for Rheraya and 6 years for Issyl) you also have strong uncertainties on high flow, because of the rating curve. How the discharge were calculated? Are gauging during floods available?**

*The discharge was calculated using the radar sensor installed in each basin's outlet with a time step of 10min. The radar observes the height of the flow and then the discharge is calculated from the rating curve by the Hydraulic Agency of Tensift. The rating curves have been elaborated on much longer records than 1 and 6 years, but due to data quality issues, some events did not have paired rainfall and runoff, or some floods were obviously erroneous, we performed a conservative selection of flood events to ensure the quality of the data.*

*We don't know in detail the gauging strategy of the Hydraulic agency, but due to the presence of a bridge at the location of the gauge, it is possible to measure river speed event at relatively high discharge rates.*

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7. **P05L153: I don't know if the Oudin's formula has been tested before in Africa.**

*The Oudin formula was previously applied tested in Morocco (Tramblay et al., 2013, Marchane et al., 2017) and in Tunisia (Dakhlaoui et al., 2020). We added this sentence from line 163 to 165.*

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**8. P06L187: "Hargreaves-Samani equation" => you said you were using the Oudin formula?**

*Yes, we made a mistake there. We corrected it.*

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**9. P05L189: A table could summarise these data (type, starting date, ending, time resolution, spatial resolution, latence,missing values. . .)**

*We added this new table as table 3*

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**10. P07L252: replace "ranging between 1 and 1000" to "ranging from 1 to 1000mm"**

*Done.*

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**11. P08L278: you must finish this paragraph by explaining the criteria r and RMSD (with in_situ and SMA as 'reference'**

*Done, we completed the paragraph that explains the r and RMSD criteria. From line 299 to 300 "With $SM_{In-situ}$ is the in-situ measurements of soil moisture or SMA model which are considered as reference, $SM_{sat}$ is the soil moisture from satellite or reanalysis and N is the number of values."*

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**12. P08L279: remove this paragraph**

*Done.*

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**13. P10L348: how is CN (and S) calibrated? On which criteria?**

*The parameter CN is first calibrated both automatically in the HEC-HMS software and manually; to obtain the correct shape of the hydrograph, and then we calibrate the other parameters that condition the transfer (Sc and Tc), that mean that the calibration is made separately between the Production and Transfer functions. The main criterion is Nash-Sutcliffe efficiency coefficient.*

*These explanations have been added from line 374-384.*

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14. **P11L355: same question for Sc and Tc**

*The answer is mentioned in the previous point*

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15. **P11L368: I assume that Sc and Tc are also calculated using the leave-one-out procedure (as for S)**

*Yes. In the leave-one-out procedure, the model is recalibrated with the N-1 events, then the mean Sc and Tc values are used in validation. However, there is a difference between the calculation of the S parameter and the other two. The difference is that the calculation of S is based on a linear equation that links it with SM data.*

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16. **P11 equation (9) and (10): is N the number of time step, or the number of event? I think that here, this is the number of event, while previously (see remark 11), it is the number of time step**

*The displacement of those equations as you suggested in the point 11 resolve this problem.*

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17. **P12 equation (12): express le bias correctly (with sums)**

Done.

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18. **P12L381: N => number of event or time step? + be coherent you also have 'n' in 10 and 11 (see rq 16)**

*Done.*

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19. **P12L395: replace "from between 0,59 and 0,64" by "from 0,59 to 0,64"**

*Done*.

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20. **P12L398-401: mention the % in the data table (see remark 9). But maybe, it is better to calculate the 'continues' r and RMSD, over a same time 'common' period, whatever the product you consider. Indeed, I think that the discrepancy in time period could have an impact on the scores.**

*We added the % in the table. We calculate the r and RMSD over the same period. But in the figure presentation we showed the whole period.*

21. **P13L424: same remark**

*Done.*

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22. **P14L457: delete 4.4 paragraph**

*Done.*

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23. **P14L474: replace "table 3" by "table 4"**

*Done.*

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24. **P16L537: this sentence should be in the introduction**

Done.

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25. **P17L583: maybe replace "Javelle et al 2010", by "Javelle et al 2016: Setting up a French national flash flood warning system for ungauged catchments based on the AIGA method, DOI: 10.1051/e3sconf/20160718010**

*We replaced it. Thank you.*

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26. **P17L587: additionally to the latency issue, there is also the spatial resolution issue. On this subject, see for instance this product: https://www.theia-land.fr/humidite-du-sola-thrs-cinq-series-mises-a-jour/**

*We totally agree with the reviewer, the spatial resolution is an issue in this type of products. We added page 18, line 618 to 620: "With the issue of the latency to obtain some products, it should be noted also that the mismatch of spatial resolution between large scale remote sensing products and very local small scale applications could be an additional issue".*

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27. **P17L579-590: see my remark 3. I think that in the future, we must investigate assimilating SM satellite data into continuous hydrological models.**

*Yes we added this point.*

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**28. P30 Table6: "-1938.07" should be on one line**

*Done.*

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**29. Figure 2 to Figure 5: time scale with dash every 1rst January (to better see the seasonality)**

*We changed the time scale to show every 1st January and 1st June of each year.*

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**30. Figure 7: replace in the legend "Q_SM_obs" by "Qobs"**

*Done.*

## References:


Marchane A., Tramblay Y., Hanich L., Ruelland D., Jarlan L., 2017. Climate change impacts on surface water resources in the Rheraya catchment (High-Atlas, Morocco). Hydrological Sciences Journal 62(6), 979-995. http://dx.doi.org/10.1080/02626667.2017.1283042

Dakhlaoui, H., Seibert, J. & Hakala, K. Sensitivity of discharge projections to potential evapotranspiration estimation in Northern Tunisia. Reg Environ Change 20, 34 (2020). https://doi.org/10.1007/s10113-020-01615-8

Tramblay, Y., Ruelland, D., Somot, S., Bouaicha, R. and Servat, E.: High-resolution Med-CORDEX regional climate model simulations for hydrological impact studies: A first evaluation of the ALADIN-Climate model in Morocco, Hydrol. Earth Syst. Sci., 17(10), 3721–3739, doi:10.5194/hess-17-3721-2013, 2013.