Reviewer #2:

We thank reviewer #2 for taking the time to review our manuscript and the helpful comments which will improve the quality of the manuscript. In the following section we will reply to all comments of reviewer #2 by numbering reviewer comments starting with R2-1 (i.e. reviewer 2, comment 1) and our response with A2-1 (i.e. author response to R2-1).

R2-1: MAJOR: A large number of simulations have been carried out. It is difficult to make a summary of the results obtained and to clearly understand the more important scientific understanding that has been gained by carrying out the study. For example, when looking at the figures, it seems that no configuration gives satisfactory results, especially in terms of soil moisture dynamics. A RMSE lower than 0.06 cm^3/cm^3 is not very representative and depends on the dynamic range of the soil moisture data. I would strongly suggest reducing the number of simulations and focusing on more relevant results.

A2-1: We are thankful about this comment and this leads into the same direction compared to what reviewer #1 mentioned in his/her comments. As also suggested by reviewer #1, we will remove the scenarios with hourly data, a first layer depth of 35 cm and all scenarios in which we calibrated all soil physical parameters. This will help to streamline our analyses and make the main points in our manuscript clearer.

R2-1: MAJOR: Why are the results not as good as expected? Does it depend on the SMAR model, or on the CRNS data, or on the soil moisture benchmark? This should be clarified. For example, a simulation with surface and deeper layers from the Soil Moisture Benchmark data can give insight into the performance of SMAR. Some additional analysis in this direction should be done.

A2-2: This is again a very similar comment to what has been mentioned by reviewer #1. We are glad to see that the improvements which need to be made on this manuscript are clear.
In addition to removing a large part of the scenarios as mentioned in A2-1, we will perform the remaining scenarios of SMAR also based on the in-situ point-scale soil moisture sensors, only. This means that we will use the surface soil moisture time series of the in-situ soil moisture sensors and apply all SMAR scenarios for two selected soil

moisture sensor profiles. Furthermore, we will then perform the analyses based on depth averages from the entire soil moisture sensor network.

This will give us a better, site-specific benchmark to evaluate the original and modified version of the SMAR model by testing it on in-situ profile scale and in-situ network scale before testing the influence of a CRNS-derived soil moisture time series as the input. This way, we may be also able to get more clues on the performance of the original SMAR model and our modified version.

R2-3: MODERATE: Other methods have been proposed to extrapolate soil moisture data from the surface to deeper layers. The exponential filter is the most commonly used approach. I would suggest a comparison with such an approach, again to provide additional information on the performance of the SMAR model.

A2-3: The reviewer is right. The exponential filter method (also referred to as the Soil Moisture Index) is a famous and often used approach to derive soil moisture time series in deeper layers from a surface soil moisture time series. We initially decided not to add this approach to our manuscript as its only bulk fitting parameter T is not directly linked to a single specific physical quantity and is difficult to predict for individual observation sites (e.g. Zhang et al. 2017, Wang et al. 2017). Hence, it always requires calibration against reference soil moisture information in the depth of interest. However, finding an approach which can be used without reference information in the depth of interest was the initial objective of this study.

Nevertheless, as also pointed out by reviewer #1, the exponential filter is a standard approach and comparing the original SMAR with calibrated water loss parameter V_2 and the completely uncalibrated modified SMAR with the exponential filter with calibrated T parameter can provide some additional insights into the performance of either SMAR version at our study site.

Following the response to the comments of reviewer #1, we will repeat all analyses also with the exponential filter and add the results to a modified version of our manuscript.

Additional references:

Wang, T., Franz, T. E., You, J., Shulski, M. D., and Ray, C.: Evaluating controls of soil properties and climatic conditions on the use of an exponential filter for converting near surface to root zone soil moisture contents, Journal of Hydrology, 548, 683-696, http://dx.doi.org/10.1016/j.jhydrol.2017.03.055, 2017.