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Hydrology and Earth System Sciences Discussions

# *Interactive comment on* "Modelling soil moisture at SMOS scale by use of a SVAT model over the Valencia Anchor Station" *by* S. Juglea et al.

**Anonymous Referee #1**

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## 1 Summary

The manuscript is describing the set up of a land surface modeling system (SVAT) at the Valencia Anchor station (Spain). This anchor station is foreseen to be used as a reference soil moisture station for the validation of the Soil Moisture and Ocean Salinity (SMOS) soil moisture products. The paper describes the model setup and calibration of the ISBA land surface model. Comparisons of model simulated soil moisture with station data and three kinds of remote sensing information, a) AMSR-E soil moisture product, b) polarization ratio c) ERS scatterometer are made. The authors conclude that the paper presents the first necessary step for setting up a reference soil moisture data set at the Valencia Anchor station.



The evaluation of satellite soil moisture products is a very demanding task due to the high temporal and spatial heterogeneity of soil moisture fields. Sparse ground networks are limited in representing the soil moisture field as the variability of soil moisture in the footprint of a satellite sensor might be easily as high as envisaged accuracy benchmark of a mission (typically 4

## 2 Remarks

While this overall objective is recognized and very much appreciated, the present paper in its present form is not making a significant contribution to that subject. I will describe my major concerns with the paper in the following:

### 2.1 Majors

1.Lack of scientific originality: To my opinion, the paper is lacking scientific originality in the sense that it makes a new contribution to the above mentioned objective of soil moisture validation. The authors basically describe the set up and calibration of the ISBA land surface scheme over the VAS. They calibrate the soil module of the ISBA land surface model to ground measurements made at the VAS.

The set-up of a model over a new test site is not a scientific novelty as such. The ISBA land surface scheme is very well established and a lot of scientific papers exist which are using the ISBA scheme. The establishment of a modeling framework for a new test site and the calibration of the model is daily business in the hydrological community. I therefore miss the originality and novelty of the contribution of the paper here.

2.Representativeness of soil moisture fields: The authors re-calibrate the ISBA soil module using stations records of soil moisture. Soil hydraulic parameters are typically very sensitive model parameters that largely affect the partitioning of energy and water fluxes at the surface. On the other hand, it is difficult to obtain detailed information about soil properties, which makes site specific calibration often necessary. The authors perform this calibration at the local scale. It remains unclear, if this local calibration is in general applicable for the entire test site and other time periods. More specifically, I would like the authors to address at least the following questions: a)is the achieved calibration transferable? Can the calibration be evaluated using data from subsequent years? How is the accuracy of simulated for such an independent test period? b)Spatial representation: How representative is the achieved calibration for the entire test site? If the soil in the entire test site would be homogeneous, the local calibration certainly could be transferred, but it is not clear if this is the case. I would recommend the authors to address this point more consistently by providing additional information about the heterogeneity of soil texture distribution and discuss how they transferred the local soil calibration to the spatial scale.

3.Scaling and satellite intercomparison: The scaling of soil moisture fields is the most demanding task in the validation of satellite soil moisture products. The paper presents inter-comparisons of ISBA simulated soil moisture fields against three different soil moisture products. The intercomparison indicates very high uncertainties for the different remote sensing products. The ISBA soil moisture simulations are taken as the absolute truth in that intercomparison. The paper needs a further assessment of the uncertainties of the soil moisture product and the uncertainties of the reference soil moisture (see point above), to better quantify the actual accuracy of the soil moisture products.

4.Expected added value by remote sensing: The estimated errors of remote sensing data seem to be rather high. I would expect that partitioning the year in a wet and dry season just assign a climatological mean soil moisture dynamic will result in smaller errors than the observed ones. Please comment

In addition to the more general comments above, a few more detailed comments will be made in the following:



- p.651, l.29: what does 0.04 mean? This is the mission target of SMOS and not what will be achieved. It's exactly the objective of the SMOS cal/val activities to asses that accuracy. Further, the mission benchmark is a rms error of 0.04 and not an absolute error of a single measurement. Be more specific, as readers might not be aware of these differences.
- p. 652, l.2: the resolution of SMOS is varying with incidence angle. Nominal resolution is in the order of 40km. However for shallow angles like 55 degree, the resolution should be coarser than 50km, as provided by the authors. Please check and correct.
- Chapter 2.1: the description of the test site is lacking a description of the spatial heterogeneity of the soil. Please provide a map and further information about soil heterogeneity as this is very important for the evaluation of soil moisture heterogeneity in the test site.
- Chapter 2.1 and Figures 12: The spatial variability of the test site can not be identified from the information given. To accurately simulate soil moisture dynamics in a heterogeneous area, it is important that the measured forcing data, especially the precipitation data, is most representative for the area and that model parameters like land cover and soil hydraulic properties are known. It remains unclear how representative the data used, really is for the larger area provided in Figure 2. It is recommended to generate one Figure from Figure 1 and 2, containing three sub-figures, covering all the same spatial domain in the same geometry with the following content: subfigure a) topography and stations subfigure b) land cover and stations (probably not all) subfigure c) soil texture/types and stations (probably not all)
- p.658, l. 10: Authors use Meteosat data for the forcing of ISBA model. It remains unclear which kind of data they use. Do they use a data product like those provided from the LandSAF or do they make their own retrievals? Please clarify.

- Chapter 2.3.: perform an independent calibration and validation of ISBA soil module (see comments above)
- p.662, l.25: Authors state that IDW technique is "the most adapted method" for interpolation of meteorological data. This is not the case as there are a lot more sophisticated tools existing in geostatistics to interpolate data, like e.g. kriging techniques. IDW is not the most adapted, but the most simple technique. Why did authors choose IDW and how does the choice of the interpolation technique affect the uncertainties in the model simulations? Authors might conduct a sensitivity study, by doing cross-validation analysis (leave a single station out and recompute)
- p. 664, l. 13: How is the penetration depth considered?
- p.669, l. 17: "The value of 0.024 obtained ...": This statement is only valid if the authors could prove that the achieved calibration accuracy is applicable for the entire test site. Otherwise, one can not argue that the reference simulations have this high soil moisture accuracy. Again, authors need to more specifically address the scaling problem and uncertainties of the reference soil moisture simulations. It is also not clear, how the authors make the intercomparison between the ISBA model and the in situ data (Figures 34). Is this a comparison between a 10x10 $km^2$ ISEA grid cell and the local soil moisture measurements or a comparison between a "local" ISBA simulation at the point scale against the ground measurement. To more specifically address the scaling issue, authors should provide both, point like and 10x10 $km^2$ simulations against ground measurements. This would allow a better judgment of the uncertainties associated with the spatial averaging, which typically results in a reduction of the dynamical range of soil moisture.
- Table 3: Authors provide a table with the model parameters and data used. Model parameters are aggregated to 10x10 $km^2$ grid. It is assumed that authors do that



averaging by taking the spatial mean. However, for the parameter roughness length, a simple averaging is not valid due to the non-linear nature of this parameter. Please specify how the aggregation was done for the different parameters.

- Table 3: precipitation interpolation: the interpolation of meteorological parameters is highly dependent on topography. How do authors take into account topography in their interpolation approach? Neglecting topography effects in the interpolation might result in high uncertainties in the model simulations. Please clarify.
- Table 5: The intercomparison of ISBA and ground measurements are made at which temporal scale? Hourly, Daily ?
- Chapter 3: The statistical comparison with the in situ data is a bit confusing, as authors take relative saturation for the comparison. It is not clear, if the given RMSE values indicate absolute or relative values. We guess, these are relative values, but clarification is needed. Please provide units. In case of relative values write [-/-]
- Chapter 3: Time series intercomparison / added value of soil moisture observations: The results shown in in chapter 3 indicate rather high uncertainties of existing surface soil moisture products over the VAS. Beside the RMSE, other statistical measures, like e.g. the model efficiency are widely used for time series intercomparison. It is highly recommended to use the model efficiency as an additional score in the study.
- Table 4: The unit for Ksat is wrong!

### 2.2 Minors

- numbers in the paper should always come with a unit!

- The paper contains quite a lot of grammar and spelling errors. A native speaker should correct the proof before resubmission of the paper.
- Table 1: change “into” to “in”
- Figure 3,4,5: specify soil depth in the figure caption

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