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Hydrology and Earth System Sciences Discussions

Interactive comment on "Estimation of surface soil moisture and roughness from multi-angular ASAR imagery in the Watershed Allied Telemetry Experimental Research (WATER)" *by* S. G. Wang et al.

Anonymous Referee #2

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Overview

The study investigates the possibility to directly obtain both surface roughness and soil moisture estimates from multi-angular ASAR images. The authors employed two semi-empirical relations to retrieve surface roughness information from two ASAR images acquired with different incidence angles. Then, by using the AIEM model, soil moisture can be obtained. A grassland site located in an arid region of northwestern China was used as case study. The research is part of the WATER research experiment.

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Interactive Discussion
Discussion Paper

General Comments

The paper is well written and structured and the topic can be relevant for the HESS reader. However, if I am not mistaken, in the paper the authors simply applied a methodology already proposed by Zribe and Dechambre (2002) together with Baghdadi et al. (2006a; 2006b) to field and satellite data collected during the WATER experiment. Therefore, no new methodology was developed by the authors, as it can be supposed reading the abstract and the purposes of the paper. I have not understood if the novelty of this paper is in the determination of equation (11). If so, it should be better highlighted in the corresponding section.

Moreover, in my opinion, several aspects should be enhanced before its publication.

The presentation of the results in terms of soil moisture retrieval is very short. For instance, why was the validation performed for only sites D and E if measurements were conducted at five sites (A-E)? The comparison was made for each measurement point. How many soil moisture measurements were carried out? Which is the spatial resolution of ASAR images?

By reading section 3.1, it seems that surface roughness measurements are not needed because the standard deviation and the correlation length of surface roughness can be obtained only by the knowledge of the difference in backscattering coefficient of two images acquired with different incidence angle. Are in situ surface roughness measurements used for the calibration of equation (13)?

Moreover, why is the vegetation effect corrected only using parameter values taken from literature? I suppose that these parameters have a strong influence on the retrieved soil moisture therefore, why an attempt to calibrate these parameters was not carried out by using as benchmark the in situ observed soil moisture values?

All these aspects should be better specified in the revised manuscript allowing the reader to better understand the methodology employed by the authors for soil moisture

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retrieval.

Another important drawback of the paper is related to the total absence of a comparison of the obtained results with those previously published in the scientific literature. If SAR images should be used to retrieve soil moisture operationally, a better assessment of their performance over different regions and by using different algorithms should be clearly assessed. In fact, the accuracy obtained in this study (RMSE<0.06 cm^3cm^{-3}) could be not sufficient for many applications.

In the specific comments, I report only few changes that should be required because much of them are already reported by referee 1.

On this basis, the paper can be recommended for publication in HESS journal, provided the comments and suggestions given above are addressed.

Specific Comments/ Technical Corrections (P: page, L: line or lines)

P3366, L9-14: The sentence is not clear at this point because the terminology is not yet been defined (roughness slope, roughness parameters). Please modify the sentence.

P3367, L2-4: I disagree with the authors about the fact that coarse resolution satellite sensor can not be employed at the catchment scale. Several contributions using these type of information for rainfall-runoff model calibration (Parajka et al., 2006, 2009), for the assessment of the reliability of modeled soil moisture (Sinclair and Pegram, 2010) and to improve runoff prediction (Crow et al., 2005; Brocca et al., 2010) were already published in the scientific literature.

P3368, L5-9: The expressions of the two linear relations can be also removed from the Introduction section.

P3371, L10: "... and more applicable..." to modify with "... and applicable...".

P3371, L12: In equation (7) the symbol F_{pq} is not defined.

P3372, L15-18: The sentence is not clear and should be revised.

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P3375, L12: What does it mean "after calibration". Please specify if different filters or different size were used.

P3376, L1: "..., it was found..." By who? Please add a reference.

P3376, L6-8: Again, it was found by who? Does it refer to in situ measurements carried out in this study?

P3376, L21: The relationship provided by Baghdadi et al. (2006b) was obtained from simulated data or from in situ observations? Please specify. How this relationship behaves considering in situ observation of surface roughness conducted in this study?

P3377, L9-10: Please add a land use map to visualize the pattern of vegetated areas.

P3378, L22: Please specify the characteristics of the TDR probes used in the study. It is quite strange to have portable TDR measurements for a layer depth of only 5 cm.

P3379, L1-7: I have not understood if the coefficients in equation (12) were taken from Baghdadi et al. (2006b) or from in situ measurements performed in this study.

P3379, L23: Results are reported only for sites D and E whereas strong salinization is present only on sites A, B and C, for which no result is shown.

Additional References

Brocca, L., Melone, F., Moramarco, T., Wagner, W., Naeimi, V., Bartalis, Z., and Hasenauer, S.: Improving runoff prediction through the assimilation of the ASCAT soil moisture product. Hydrol. Earth Syst. Sci. Discuss., 7, 4113-4144, doi:10.5194/hessd-7-1-2010, 2010.

Crow,W. T., Bindlish, R., and Jackson, T. J.: The added value of spaceborne passive microwave soil moisture retrievals for forecasting rainfall-runoff ratio partitioning, Geophys. Res. Lett., 32, L18401, doi:10.1029/2005GL023543, 2005.

Parajka, J., Naeimi, V., Bloschl, G., and Komma, J.: Matching ERS scatterometer

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based soil moisture patterns with simulations of a conceptual dual layer hydrologic model over Austria, Hydrol. Earth Syst. Sci., 13, 259–271, doi:10.5194/hess-13-259-2009, 2009.

Parajka, J., Naeimi, V., Bloschl, G., Wagner, W., Merz, R., and Scipal, K.: Assimilating scatterometer soil moisture data into conceptual hydrologic models at the regional scale, Hydrol. Earth Syst. Sci., 10, 353–368, doi:10.5194/hess-10-353-2006, 2006.

Sinclair, S. and Pegram, G. G. S.: A comparison of ASCAT and modelled soil moisture over South Africa, using TOPKAPI in land surface mode, Hydrol. Earth Syst. Sci., 14, 613–626, 20 doi:10.5194/hess-14-613-2010, 2010.

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