**Hydrology and
Earth System
Sciences
Discussions**

Interactive comment on "Influence of cracking clays on satellite observed and model simulated soil moisture" *by* Y. Y. Liu et al.

Anonymous Referee #2

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In my opinion the topic of this article is very interesting and relevant. As mentioned by the authors, the accuracy of soil moisture retrieved by satellite data and as well as simulated by land surface models over vertisols, in particular in the dry season and in presence of cracks, needs to be investigated before using these products for different applications. However, the objective of the article and the method to achieve it are not completely clear. According to the title, the abstract and the end of the introduction, the objective is to show the effects of soil cracks on soil moisture retrieved by satellite data and on soil moisture estimated by a land surface model and this is carried out by comparing the two soil moisture products. In the abstract is also stated that analyses are carried out, which prove the hypothesis. But, introduction (line 21-22 pp 909), method and results chapters address only the issue of the inaccuracy of remote sensed soil moisture over vertisoils by excluding the effect of others factors. The possible

inaccuracies of the model are, instead, shortly and only qualitatively explained in the discussion chapter, without any analyses (which are instead mentioned in the abstract). I think this is a bit confusing for the reader, as well as the general structure of the article, which can be improved. It should be clear for the reader since the beginning that this is a qualitative analysis. No analysis has been carried out to show the quantitative effect of soil cracks on remote sensed soil moisture accuracy. I agree with the conclusion of the article that the soil cracks of vertisols might affect the accuracy of AMSR-E VUA-NASA soil moisture products. However, a more quantitative analysis would be necessary to understand if this effect is higher than the product error, which has been estimated to be about 6%. Figure 5 shows an effect on soil moisture lower than this error. At least some comments about this issue should be included in the article. I recommend the publication of this article in HESS after a revision. Please find here below more detailed comments.

Abstract

1) Line 6-7: In the second sentence the authors state that both land surface models and passive microwave retrieval algorithms are not able to take into account of the effects of soil cracks for soil moisture estimation. However in the following sentence the authors state that to investigate the soil crack effect, the remote sensed and model soil moisture are compared. This is quite tricky. I mean, how can the authors evaluate the soil crack effect on soil moisture estimates if there is not an accurate soil moisture information as reference? Actually this sentence is misleading, because the aim of the article is achieved by excluding the effect of other factors on remote sensed soil moisture of vertisols and concluding that the unrealistic behaviour during dry season is due to soil cracks.

2) In the abstract should be specified that AMSR-E VUA-NASA soil moisture products are used, as there also other AMSR-E soil moisture products available for the scientific community.

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3) Line 12-14: A part from the analyses and results described in the previous sentence (line 10-12), no further analysis were carried out on the retrieval model. The conclusion about the effect of soil porosity and surface roughness on soil moisture retrieval is just a consequence of the analysis described in line 10-12 and not the result of further analyses.

4) Line 16: "Analyses show..." No analyses were carried out over the CLM model, but just qualitative considerations.

Introduction

1) Line 26 pp 908 - line 1 pp 909: There are only references referring to passive microwave retrieval of soil moisture. Please include also references referring to active microwave retrieval and soil moisture estimation by land surface models.

2) Line 1-6 pp 909: The comparison of remote sensed soil moisture with other products helps to understand the satellite sensitivity to soil moisture and not the processes causing the soil moisture variability. At least, this is not what is presented in Wagner et al. 2003.

3) Line 21-22 pp 909: The authors should be more consistent in presenting the aim of this study in the whole article. The aim written here is a bit different from what it is written at the end of the introduction and in other parts of the article.

4) In my opinion it is not a good idea to present Figure 1 in the introduction, as the description of the data used for this figure is given only in the following paragraphs. I suggest to present it in the results.

5) The black lines surrounding the vertisols areas in Figure 1, as well as in the other figures, are not very clear. I suggest to include in the article also a soil map, to help the reader to identify the vertisols location.

Data and methods

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1) The title should be changed in "Data", as the methods are presented in chapter 3.

2) Line 21 pp 910: The authors refer to local time for AMSR-E ascending and descending acquisitions. It should be clarified to which location they are referring.

3) Line 22 pp 911: As far as I know, it has been not demonstrated yet that AMSR-E VUA-NASA soil moisture retrieval represents the top 1.5 cm soil layer. Anyway the depth sensitivity depends on the soil moisture itself (i.e. wet or dry conditions) and on the soil texture. It would be better to mention some references, if known, about the depth of the soil moisture retrieved from passive microwave (C-band), as the same depth is taken in to account in the CLM model.

Methods

1) In my opinion, in this chapter the authors should mentioned that the effect of some factors on AMSR-E soil moisture retrieval is investigated in order to support the hypothesis (about the sensitivity to soil cracks), but the hypothesis itself is not directly proved to be true. Excluding all the other possible factors leads the authors to the conclusion that the only factor affecting the anomalous soil moisture trend over dry vertisols are the soil cracks.

2) As the method consists of proving that all the possible factors affecting the AMSR-E soil moisture retrieval, except the soil cracks, over dry vertisols are not the cause of the observed anomalous behaviour, the authors should be careful to check all the affecting factors. Topography and land cover are important factor affecting the soil moisture, which in my opinion should be taken into account in the analysis.

Results

1) I agree with the authors that a lower NDVI over vertisols with respect to the surrounding areas is an index of a lower vegetation density and therefore of a lower vegetation effect on the sol moisture retrieval. However it is also an indicator of a different vegetation cover over the two areas. I think the authors should add some comments about

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this point.

Discussion

1) In my opinion, this chapter looks in several points as an introduction, description of previous studies to support this. Moreover, further qualitative analyses are introduced. Instead, the discussion should further comment the presented results and link them with previous studies.

2) Line 22 pp 914: it would be very important to quantify how much the retrieved soil moisture is underestimated, when the increased soil porosity is not considered, and then compare this effect with the AMSR-E soil moisture product error due to LPRM model error propagation, which is estimated to be about 6%.

3) Figure 6 is interesting but also confusing. Unexpectedly, a different model and additional data, not mentioned before, are used to show a new result, which is certainly interesting, but only partially support your study (a different model has been used and a different parameter, than soil moisture, is shown to be affected by craking clay soils). The figure needs more detailed description and explanation. Therefore I suggested to remove it or to move it.

Conclusions

1) I agree with comment number 6 of W. Crow.

2) Line 18 pp 917: it is not clear how the differences between CLM and AMSR-E soil moisture can indicate the period of crack formation. Only two monthly averages were shown in the article, therefore it is not possible to conclude that CLM and AMSR-E soil moisture always agree over vertisols, except when there are soil cracks. Is it really possible to conclude that when the two products disagree over vertisol area, then soil cracks are present?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 907, 2010.