Hydrol. Earth Syst. Sci. Discuss., 7, C3544–C3549, 2010
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Hydrology and Earth System Sciences Discussions

Interactive comment on "Mapping surface soil moisture over the Gourma mesoscale site (Mali) by using ENVISAT ASAR data" *by* F. Baup et al.

Anonymous Referee #3

Received and published: 22 November 2010

This manuscript assesses the quality of ASAR WS soil moisture retrieval over an arid region in western Africa. The paper first discusses the field site and the methodology and then presents a number of results. This paper may be published, pending major revisions, which I am outlining below.

Major comments:

The most important aspect of requesting major revisions to this paper is the fact that the authors need to make a stronger point as to why this paper is a significant advancement compared to their 2007 RSE paper. Currently it is a simple application of the work conducted there to a larger scale (which could/should have been done in the 2007 paper to start with, I would say). While the current results may be interesting from

various points of view (testing the retrieval algorithm, recalibration, scaling issues), no such point is really discussed.

Also, the reference list of this paper is a shortened version of the predecessor with just a few recently published AMMA references added (and significantly francophil), relevant papers like Pathe et al. (2009; TGRS, 47(2), 468-480) are not mentioned/discussed.

1. p. 7419, l. 4-8: what about more recent (international) campaigns such as SMEX or NAFE. All have been conducted at high resolution with C- and L-band instruments over similarly large domains and types of landscapes. Moreover, Mladenova et al. recently published ASAR studies along with NAFE data (2010; TGRS, 48(6), 2498-2507), comparing ASAR to high-resolution airborne soil moisture maps, what is the advantage of now comparing point measurements?

2. What is the actual objective of this paper. It is not entirely clear from the introduction. There is some background information on past campaigns and studies, but what is lacking here is a strong point as to what needs to be improved and how this paper is helping to solve this problem.

3. Is section 2.2 missing or should 2.3.1 be 2.2.1 etc.?

4. section 2.4: I am worried that only a such a small number of images were used. The AMMA project has been running for a long time now, surely there is the possibility to include some more images than just using the same ones as in Baup et al. 2007 to get statistically significant results. That way, the temporal cycles could also be captured.

5. You are comparing ASAR HH to ERS-Scat VV, could any of the differences between SCAT and ASAR stem from the difference in polarization?

6. You never discuss the accuracy of the EPSAT-SG data set over the area? and also, what is the ET rate in the area?

7. p. 7425, l. 13: Please explain where the NDVI=0.14 theshold comes from.

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8. p. 7428, l. 7: 2mm daily rainfall is small for such an arid area. Particularly, if the day had been hot, not much of those 2mm would eventually have end up in the soil. what is captured here is more likely the total of the preceding days. I think that you will also have to look carefully into the acquisition times of the satellite, compared to the predicted/observed precipitation.

9. p. 7428, l. 18-21: "On 4 August (DoY 216), the SSM map shows an overall good agreement with the daily rainfall EPSAT-SG map, especially in the Northern part (Fig. 8). Particularly, the SSM maps point out the high spatial heterogeneity of SSM and thus of the rainfall events that is not revealed by ESPSAT-SG data.". Isn't this a contradiction? First, it is stated that there is a good agreement, and then the EPSAT-SG data does not "reveal" the heterogeneity. Do yo mean the general large scale spatial trend, compared to the higher resolution variability of SSM?

10. p. 7429, l. 2-3: can you ellaborate why that may be the case?

11. p. 7429, l. 24-25: "In contrast, soil moisture patterns derived from WSC data are not in accordance with ASAR and EPSAT products." Is that a general conclusion or are you referring to that particular day?

12. p. 7430, l. 8: what do you mean with "the noise effect"?

13. p. 7430, l. 21/22: can you substantiate this statement? On what basis do you make it? what exactly is the reference of the "offset"? given that you compare two data sets, they can't both have an offset.

14. p. 7430, Fig 11a: how come that the coefficient of correlation of those data points is only 0.25? They almost all fall on a straight line, so I would expect a higher correlation. Are those therefore ranked correlations? Also, it would be preferable to include other statistical parameters, as well, such as bias and RMSD, as a good correlation by itself does not necessarily mean a good product representation.

15. p. 7430 section 4: there should be more data included here. How representative

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are those two dates, both in terms of the spatial and temporal dynamics of the sites? (see also an ASAR study on that topic: Wagner et al., 2008; Sensors, 8, 1174-1197).

16. p. 7430, Fig. 11a: on p. 7429, l. 2/3 you are saying that the "WSC products show a strong agreement with ASAR products but with much higher SSM values estimated over dry areas", which is not in line with the results of Fig. 11a (which in turn agrees with p. 7429, l. 24/25: "In contrast, soil moisture patterns derived from WSC data are not in accordance with ASAR and EPSAT products"). Given that those statements appear to be inconsistent, please discuss in more detail what you are referring to in those particular cases, or correct your statements.

17. p. 7430, Fig. 11a: as a general question: what are the units of the different products? The ERS-Scat data product ranges from 0-100, where 100 would be saturation, ie. ∼20 vol-% for a sand and ∼50 vol-% for a clay. However, you are comparing those data to ground measurements, which assumingly are in vol-%, as I assume your ASAR product is (see Baup et al., 2007). If this was not taken into account, it would actually explain away your bias. I would suggest to explicitly state which data products have which original units and then if units were converted (eg. for the Scat data from % to vol-%), it would have to be explained how this was achieved.

18. p. 7431, conclusions: the research questions posed in the introduction do not seem to be sufficiently covered, or answered here ("In the framework of the AMMA project, meso-scale sites have been instrumented in Mali, Niger and Benin, providing ground data along the latitudinal gradient between Sahelian and Sudanian bioclimatic regions [...]. The objective of the present study is to up-scale a local approach for estimating SSM (Baup et al., 2007a) to the Malian mesoscale site in the Gourma region by taking into account soil type and vegetation cover.") First, this is not a study about scaling effects, please rephrase the sentences accordingly. The authors are only applying a locally developed empirical model to other sites in the same region. Moreover, going to through the methodology section, I am still not entirely sure how the various soil types and vegetation covers were taken into account. What did you do to modify your model

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inputs/parameters. Also, if you are using a 150m-resolution product, why is the spatial variability at Ebang Mallam the reason for the low correlation? Is the site really that heterogeneous? I think a more thorough description in the methodology section and a bit more data analysis along those questions would greatly help this manuscript.

19. p. 7431, conclusions: another aspect here would also be a discussion in comparison to Pathe et al. 2009, which discusses the aggregation needs for ASAR GM data. What are the advantages of having the WS data aggregated to 1km, how much better is the performance compared to the GM data?

editorial comments:

- abstract : I would say "potential" rather than "potentialities"

- p. 7419, l. 26: unit for LAI?

- p. 7421, l. 26: "bulk" not "buck"

- p. 7422, l. 1: I don't think that the CSci manual is the correct reference, as it refers to only one or two clearly defined soil types. There are a number of recent studies covering the performance and calibration of CS615s and 616s that should be referenced here (published in AWR, J Hydrol and/or Soil Sci Am J), or the results of calibration undertaken by de Rosnay. But with the calibrations of CSci you wouldn't get those accuracies.

- p. 7423, l. 7: except

- p. 7423, l. 10: range

- p. 7425, l. 3: process steps

- p. 7426, l. 17: "created"/"produced", rather than "established"

- p. 7429, l. 14: "rain events"

- p. 7429, l. 20: Tin Tadeini (capital "T")

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- p. 7429, l. 21: "northern and central parts of the map"

- Fig, 7-9: why don't you use the same colour scale for the ASAR and ERS data? that would make a first visual comparison much easier.

- Fig. 11: increase font size

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 7417, 2010.