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Hydrology and Earth System Sciences Discussions

Interactive comment on "Soil moisture active and passive microwave products: intercomparison and evaluation over a Sahelian site" *by* C. Gruhier et al.

Anonymous Referee #1

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GENERAL COMMENTS

This paper presents an interesting piece of research where moisture products obtained from several microwave sensors are compared. A very large dataset is used with detailed in situ measurements as well as extensive satellite observations. The issues analyzed are of relevance for the scientific community and the paper is well structured and written. However, the paper can be improved in some aspects. In particular: - The discussion and interpretation of results can be deepened. In particular, the role of sensor frequency, type of sensor (active/passive), acquisition time, etc. should be

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commented in more detail. - Some more details on the retrieval approaches (just brief descriptions) could be helpful for the understanding and interpretation of results. - Your study area is very particular in terms of climate, vegetation, etc. But based on your results some recommendations for the utilization of those products in other parts of the world could be very interesting. For instance, the ERS/CETP method performs well here, but since it is a locally calibrated method is it easily applicable elsewhere? - The conclusions should be more focused and much shorter.

SPECIFIC COMMENTS

1. Introduction:

-page 5305, line 5: 'good spatial consistency' It is not clear to me what you mean here.

-page 5306, first paragraph: It is important to include here a brief description on the methods and techniques for retrieving soil moisture from the sensors mentioned in the previous paragraph. In particular, some comments on the limitations, drawbacks and applicability of those methods should be included.

-page 5206, line 15: 'The last-ones also provides' change to 'The last-ones also provide'

2. Data and methods:

-page 5307, line 10: What are the implications of the vegetation cover (herbaceous savanna) for the retrieval of soil moisture? Some comments on that should be given.

-page 5307, line 25: Table 1 is not very useful. The coordinates of the stations can be included in the text here.

-section 2.2 Satellite data: Before describing each sensor I suggest including a brief comment on the sensor characteristics (frequency, polarization, active/passive, time of observation) that are relevant for the inversion of soil moisture. In particular, the relation between the sensor frequency and the depth of the surface layer being mea-

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sured deserves some comments. I also think that some more details on the retrieval methods used for each sensor could be helpful for the later understanding and interpretation of results. I suggest including on each subsection dedicated to each sensor (1) a brief description of the retrieval method used and (2) more references to previous studies and main findings reported by other investigators. Also, some comments on the applicability of the techniques in other parts of the world could be very interesting. In particular, in the case of ERS-scat, two techniques are used here but one requires local soil texture data (to convert moisture index to volumetric units) and the other is a statistical inversion based on local calibrations. Can those techniques be easily applied in any other region? This information can be very useful for the readers.

-page 5309, lines 16-22: This issue of the confounding effects of soil moisture and vegetation cover on passive measurements is not specific of AMSR-E data. It should be placed before section 2.2.1.

-page 5310, section 2.2.2: The two techniques based on ERS-scat use both ascending and descending pass observations? -page 5310, line 19: 'absolutes values are valided' change to 'absolute values are valid'.

-page 5311, section 2.3, line 16: Table 2 does not show the time of the day at which each sensor observes the area. Besides, since the time of acquisition is crucial due to the diurnal moisture dynamics you could include a more detailed analysis of this issue. Based on your ground dataset (soil moisture data at 15 min time step), you could study the diurnal variation of soil moisture in the different seasons and relate it to the time of acquisition of each sensor. This can be important to interpret your results. In the sentence 'satellite products and ground measurements are considered at the daily time scale' it seems that the reference (ground) soil moisture values you used correspond to daily mean values. If your satellite products are acquired mostly during overnight passes some differences could be expected due to soil moisture diurnal variations. Could you please explain this issue?

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-page 5311, lines 18-19: Considering that soil moisture retrieval is performed here pixel by pixel (you are comparing single pixel values), the resampling method used (nearest neighbour) could have an influence on your analysis. Did you try other resampling methods and assess whether the results changed significantly or not? This issue is also illustrated in fig 1c.

-page 5311, lines 16-27: This paragraph can be divided into two. In this paragraph you describe MRD, but this statistic is only used on a small part of your analysis. You should at least mention that some other error measures (rmse) and correlation coefficients (R) are also used in the analysis.

3. Results

-page 5312, line 15: In my opinion, a figure with histograms or boxplots can be much more clear than Table 3 to illustrate the distribution and range of your different moisture products.

-In general, I think that some more discussion could be given in this Results section.

-page 5313, lines 4-8: Can this be related to the different frequency of AMSR-E/NSIDC? Or to problems in the inversion algorithm? More discussion please. The same comment for page 5312 line 24- page 5314 line 4.

-page 5314, lines 24-25: 'This result clearly shows that retrieval and remote sensing approaches are both...' I suggest: 'This result clearly shows that the retrieval approach and the sensor characteristics are both...' But again, this statement needs further discussion. Is it because of the sensor frequency, sensor type, time of acquisitions, parameters required in the inversion algorithm, problems or inconsistencies in the algorithm itself?

-page 5315, lines 8-9: Any implications of this?

-page 5315, lines 19-20: If I'm not mistaken, it is the first time you comment on the influence of the acquisition time on your results. A more detailed analysis of the influence

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of the time of observation needs to be carried out as commented above.

-page 5316, lines 2-3: Not clear what you mean here.

-page 5316, line 27-page 5317, line2: Why is moisture underestimated in the wet season with this sensors? Any suggestions?

-page 5317, line 5-17: Fig 8 represents the average moisture for three months (JFM, AMJ. . .) for each latitude? In that case, I don't think Fig 8 incorporates useful information. Maybe I miss something but in my opinion, the same conclusions can be extracted from Fig 7.

-page 5317, lines 19-27: This paragraph should be better placed in the introduction or the 'Data and methods' section.

-page 5318, line 1: How did you normalize your moisture data?

-page 5318, lines 11-14: Could this be a consequence of the parameterization of the inversion algorithm? or maybe due to the sensor frequency?

-page 5318, lines 14-27: In my opinion, it is more interesting to comment on the obtained rmse values rather than on the correlation coefficient. The correlation coefficient is only a measure of association between variables, it doesn't represent if those variables coincide or not. This is particularly important if you separate your results in two seasons, where your data probably do not have range wide enough to yield high correlation coefficients.

4. Conclusions

As already said, in my opinion, it is not necessary to summarized all the paper in this section. I think this section can be substantially shortened. The main ideas and conclusions obtained from your analysis should be given and their implications for future studies should be commented.

Tables:

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-Table 1 is not necessary. The coordinates of the stations can be inserted in the text.

-Table 3 can be replaced by a figure with histograms or boxplots.

Figures:

Figures are of very good quality.

Figure 1: very interesting. It should be large enough to be easily interpreted.

Figure 2: also interesting. If I'm not mistaken, it is not mentioned in the text (nor in the caption) what AMSR-E/NSIDC_used stands for.

Figure 7: It is not clear to me whether this time-latitude diagram represents average values over a latitude (for all the pixels with the same latitude) or shows only one specific longitude (that is kept constant). In this last case, the longitude used should be mentioned. In the caption is also mentioned that values are 10-day averaged, did you apply a 10-day average moving window? So the quick variations in moisture are missed in this figure? Could you explain why?

Figure 8: not very useful in my opinion.

Figure 9: In the legend it should be mentioned that measurements are represented in black.

Figure 10: very interesting. It should be large enough to be easily interpreted.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 5303, 2009.