

## ***Interactive comment on “Error characterisation of global active and passive microwave soil moisture data sets” by W. A. Dorigo et al.***

### **Anonymous Referee #1**

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#### General comments:

An interesting paper which applies a triple collocation error estimation technique to soil moisture data sets derived from different operational radar systems and reference sets ERA-Interim and GLDAS-NOAH. The paper is well written and well organized. Nevertheless, a few questions need to be clarified:

1. The triple collocation technique requires data sets to be independent. However, if I am not mistaking, SSM/I radiances have been assimilated for the development of the ERA-interim product? This could cause an interdependence, through which the use of SSM/I may not be justified, and should be verified.

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2. I think the interpretation of the results could be improved by explaining in more detail the motivations and particularly the consequences of using soil moisture anomalies instead of absolute values, for instance in Section 3.2. Which information can or cannot be revealed by this type of error analysis, e.g. in terms of bias, the dynamic range of the soil moisture products, soil moisture variability, etc., and what are the differences with an error analysis based on absolute moisture levels. Such information could be particularly useful since the results are compared with those of Scipal et al. (2008b). Besides, I am not completely convinced that differences between anomaly errors and absolute value errors are always small (p5632.I21). This should be further elaborated, or reference should be provided.

Specific comments:

P5626-5627: Please add a few details in the explanation of the soil moisture products, i.e. make sure you mention for each product: the polarization, the incidence angles, time span of data availability, spatial and temporal resolution, and some details on the climatology (e.g. dynamic range or choices on the minimum and maximum soil moisture). Most of these items are given, but not consistently for all products. If the authors wish, this could be summarized in a Table, simplifying a comparison between products.

P5627-5628: are there any references for the ERA-Interim and GLDAS-NOAH data sets?

P5630.I5: Is the seasonality observed for all data sets, or only for the SSM/I Ku-band? Now, it seems there are only such effects for SSM/I.

P5630.I13: Is the long term mean at a specific DOY calculated over a large time period, and over the same time interval for each product? Changes in time of the mean at specific DOYs (e.g. through climate change) could have an influence on the calculation of anomalies. Such changes have for instance been reported Australia (subject to frequent droughts since 2000, ref: Liu et al. 2007 in Geophys Res Lett).

P5630.I27: ‘assuming errors in both variables to solve for the calibration constants’: please explain in a bit more detail.

P5631.I18: please clearly mention that the errors refer to anomaly values and are not related to absolute soil moisture errors. In the present form, the reported mean global errors could be easily confused with absolute soil moisture errors.

P5631.I22: Is it the dynamic range of ERA-Interim in terms of range between wilting point  $0.17\text{m}^3/\text{m}^3$  and saturation  $0.472\text{m}^3/\text{m}^3$ , or in terms of observed soil moisture variability for each specific DOY that most affects the errors?

P5633.I13-21: in general I am a bit sceptic about the assumed better sensitivity of active C-band radar to soil moisture under dense forest stands. In the active case, soil backscatter is also attenuated by vegetation, whereas the latter reflects also a part of the incoming signal directly toward the sensor. In dense forest stands, the radar signal will probably not even reach the ground. In spite of this, it might be that the retrieval technique in the active case is better adopted to vegetation and forests?

P5635.I28: there is a large difference between the results expressed in the climatology of ERA-Interim (previous sections) and the one of AMSR-E C-band. Is this because of the low dynamic range of ERA?

The use of only three data sets for triple collocation is a bit scarce. This may have an influence on the results of the error analysis and should be mentioned in the (conclusions of the) paper

Figures 1-3 should be larger in order to enhance interpretation

Technical corrections:

P5623.I5: data sets or datasets, please be consistent throughout the paper

P5624.I4: data sets span a period of more than 30 years (Table 1): Please rephrase. In the present form, it looks like data are only available from 2002 onwards, whereas

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the Table provides the product availability instead of satellite data availability.

p5624.I9: 'remotely sensed soil moisture observations'

P5625.I14: ERA-Interim

P5626.I24: please correct 73x43 or 51\_x\_30

P5627.I3: use 'whereas' instead of 'while'; the latter refers to simultaneous events

P5629.Eq1: soil moisture estimates and hypothetical truth seem to have changed places.

P5629.I9: Please remove text between brackets (X equals...), as it has been mentioned earlier.

P5629.Eq2: remove brackets on the left of the equation sign

P5629.I14: replace '\_SCAT' by '\_X'

P5629.I13: please refrain from using 'measurements' for satellite-derived products

P5630.I18-19: Please rephrase

P5630.I26: Scipal et al. (2008b) used...

P5631.I1: remove 'for all sensors'

P5631.I2 soil moisture anomaly

P5631.Eq5: I think 'R' should not be italic, as X is also not italic

P5631.I9: 't' should be italic

p5632.I1: ERA-Interim

p5623.I7+I13+I18+I20: Scipal et al. (2008b)

p5632.I12: Most remarkable are the lower errors obtained for...

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p5633.l4: errors of soil moisture anomaly... lower than error estimates derived from ASCAT ... than the errors of ERA-Interim

p5634.l5: please rephrase: On average, there is a clear average increase...

p5634.l21-25: please rephrase. I think this could be described more concisely to enhance clarity.

P5638-5641: Use journal abbreviations consistently, read over references, e.g. IEEE instead of leee on p5640.l8+20

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 5621, 2010.

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