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Hydrology and Earth System Sciences Discussions

Interactive comment on "On the comparison between the LISFLOOD modelled and the ERS/SCAT derived soil moisture estimates" *by* G. Laguardia and S. Niemeyer

Anonymous Referee #1

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GENERAL COMMENTS

This paper presents an interesting piece of research where two coarse scale soil moisture estimation techniques are compared. Both techniques are applied to the entire European continent producing regional moisture estimates that can be useful for meteorological and hydrological applications. The issues analyzed are of relevance for HESS and the paper is well structured and written. However, there are a number of aspects that need to be improved before the paper can be accepted for publication.

My main criticism is related to the fact that none of the methods (ERS/SCAT or LISFLOOD) can be considered as a reference to evaluate the other. This complicates the

interpretation of results because of the impossibility to know whether observed errors are caused by one of the methods or the other. As a result, substantial conclusions cannot be reached here because the interpretation of results is not sufficiently solid.

I know that this is something unlikely to be modified in the manuscript. I still think that the comparison between both methods is interesting and the paper could be published. But I think that the authors should recognize this inherent weakness of the study and interpret the results with caution mentioning these limitations. Consequently, the following sentences, and any other similar comments, should be modified:

- Abstract, first sentence: ‘In order to evaluate the reliability of the soil moisture product obtained by means of the LISFLOOD hydrological model, we compare it to soil moisture estimates derived from ERS scatterometer data.’ It is not possible to evaluate the reliability of LISFLOOD if ERS/SCAT is also affected by errors.

- Introduction, last paragraph (page 1232, lines 11-15): ‘In this work we present the results of a validation exercise of the LISFLOOD modelled...’ Although interesting, this study is not a validation exercise.

In my opinion, results should be given in soil moisture units, preferably cm3/cm3, to allow an easier interpretation of results by the readers. It is not so easy to deduce whether a 0.5 rmse in pF units is low or high in terms of soil moisture. I think that the whole analysis should be made in moisture units. This is also important for comparison of your results with those presented in the literature.

Another important issue is related to the timing of moisture estimates. What is the time step of LISFLOOD? ERS/SCAT provide an instantaneous observation, is it compared to modelled moisture in that precise moment?

Two accuracy measures are used for the comparison: rmse and R. Both represent different things, but their meaning is not taken into account in the discussion. Which one is more important? In my opinion R is a very weak measure of accuracy and

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results should be mainly evaluated taking into account the rmse. In fact, your modelled soil moisture is likely to have a very high R with rainfall patterns, vegetation LAI or other characteristics but these are not real estimates of moisture. This is important in the definition of error classes for Figure 4. Is class 2 better than class 3??

SPECIFIC COMMENTS

Introduction:

-The importance of soil moisture for agriculture (page 1229, line 3) is much more than a mere element for the determination of irrigation practices

-Page 1229, line 15. There are some extensive ground moisture databases that need to be mentioned here (for instance SMEX experiments, REMEDHUS network and some others),

-Page 1229, line 17. Quite a few studies on temporal and spatial stability of soil moisture measurements have been published and could be commented here.

-Page 1229, line 27. Microwave observations are classified here as direct techniques for moisture estimation. But they are not exactly direct moisture observations. You should define what you consider direct and what indirect.

-Page 1230, line 1. The penetration depth is also related to the moisture content of the soil.

-Page 1230, line 4. Give references (for instance, Verhoest et al. Sensors 2008, 8, 4213-4248; DOI: 10.3390/s8074213) or further information related to the influence of vegetation and roughness on the estimation of moisture from active microwave observations.

-Page 1230, line 7. The temporal frequency of high resolution SAR sensors is improved in RADARSAT, ENVISAT with the different incidence angle capabilities.

-Page 1230, line 8. What about SMOS?

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-Page 1230, line 16. Give a more recent reference than that of Price, 1980.

-Page 1230, line 24 to 1231 line 9. This is very weak. More information should be added, mentioning most used models, land surface parameterizations, sources of errors and uncertainty, etc. This is especially relevant for your paper because you are applying a model to very different regions in terms of climate, topography, vegetation... It is not so easy to design a model applicable to so different conditions.

-Page 1232, line 10. Some more information on Data Assimilation should be included.

2. Data:

Section 2.1. ERS/SCAT:

-The deficiencies of the technique are very weakly commented: what about the influence of vegetation? roughness variations? How are snow covered areas identified in the observations before they can be masked out?

-The literature review should be improved, what are the results of previous studies like? What are the main difference with your study?

Section 2.2. LISFLOOD:

-Is the model calibrated and validated? further information should be given in this aspect.

-The uncertainties associated to the estimation of parameters from soil and land cover spatial databases should be mentioned. How accurate are those databases? what errors can be expected in the simulations if you use them?

-A critical evaluation of the model and its performance is missing.

3. Methods

-As mentioned before is not clear to me why you made your analysis in soil suction units.

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-Page 1237, line 10. Both methods require soil parameters. What is the uncertainty in the estimation of those parameters, and what errors can be expected in the moisture estimates.

-The equations of rmse and R can be deleted since they are commonly known.

4. Results

-It is not clear to me why average errors in the temporal and spatial domain are different. If you calculate the mean error for each pixel and then average out all the pixels you should obtain the same as if you calculate the mean error of each time step and then average out the whole research period.

-Page 1239, line 17. You chose a very homogeneous area to calculate the semi-variogram. What about the scaling properties in more heterogeneous areas?

-Page 1240, line 2 – line 9. The discussion of results here is very weak. Explain the causes of the different seasonal behaviour plotted in figs. 7 and 8 and discuss the differences with the paper of Ceballos et al.

-Page 1241, lines 11-15. This limitation of the ERS/SCAT approach should be commented in section 2.1. What about the behaviour of the model in those extreme climatic conditions? is the model equally reliable in Central European areas and in Southern European Mediterranean areas?

Figures:

-In my opinion the quality of figures is good in general.

-Maybe it is not necessary to include all figures from Fig 9 to Fig 14. It could be better to summarize this information in one only figure or table. In case those figures are kept the units in the X axis should be indicated.

-Fig 16 is not very clear. Another combination of patterns and colors should be used to provide a clearer interpretation.

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