Review

Analysis of SMOS brightness temperature and vegetation optical depth data with coupled land surface and radiative transfer models in Southern Germany

by F. Schlenz et al.

Journal: Hydrology and Earth System Sciences
Manuscript ID: doi.10.5194/hessd-9-5389-2012

Summary

The study compares SMOS Level 1c brightness temperatures and Level 2 vegetation optical depth to modeled data in the Vils test site in the Upper Danube catchment, Southern Germany, for the year 2011. Data recorded by the airborne L-band radiometer EMIRAD 2 at the SMOS Validation Campaign in 2010 are used for validation of the coupled models PROMET and L-MEB.

A small dataset size induces that no conclusions are drawn from the direct comparison of SMOS and airborne brightness temperatures. The comparison of SMOS Level 1c data and time series of modeled brightness temperatures shows a positive bias. The expected seasonal behaviour could not be observed. Showing lower correlation coefficients than correlation coefficients of Level 2 soil moisture data and modeled soil moisture it is concluded that most of the observed problems of the SMOS data are due to RFI. The analysis of SMOS Level 2 optical depth showed high values in comparison to modeled data and not the expected seasonal behaviour, which leads the authors to the conclusion that the data set is not a reliable source of information about vegetation characteristics. Exhibiting a strong correlation between SMOS optical depth and soil moisture this problem is assigned to a retrieval problem.

General statement

The paper is an interesting contribution to the validation activities of the SMOS mission and presents new data for the Upper Danube Catchment. The language is fluent, the methods are explained clearly and the results are discussed thoroughly. However, the structure of the paper is sometimes confusing. In some parts of the text it is difficult to distinguish between the results presented in this paper and results of prior studies. In the Introduction and in the Material and Methods part it is sometimes difficult to get the point of the argumentation because reasoning tends to jump from one issue to another.

Specific comments

1 Introduction

This part should be restructured, because the literature review is somehow confusing and seems to be mixed up with the objectives of the study.

2.3 SMOS data

P. 5399, L. 22: Please give the source.

2.4.1 Land surface model PROMET

P. 5401, L. 26: Why did you not do a simulation with a layer depth of 0-5 cm? This would have been more straightforward than the averaging.

P. 5402, L. 21-24: You write about local and regional scale. Are the soil moisture measuring stations as well as the handheld probes of the validation campaign 2010 both point measurements?

P. 5402, L. 18 - P. 5403, L. 15: In the description of the uncertainties of soil moisture estimation from Schlenz et al. (2012a) it is hard to follow the explanation, which RMSE and R^2 belong to local / regional scale or to a specific soil type. Maybe this can be structured differently or shortened.

2.4.2 Radiative transfer model L-MEB

Please restructure. You jump from the parameterization of the model and the new rape parameterization to the validation of the models and then back to the rape parameterization.

2.5 SMOS L1c data analysis and 2.6 SMOS optical depth analysis

Maybe it would be better to shorten these parts and leave out the subheadings or to combine it with the prior section 2.3.

3.1 Model validation and L-MEB parameterization under local conditions

P. 5408, L. 20: Please give the citation.

P. 5408, L. 11: Provide values of RMSE of modeled and airborne brightness temperature here, rather than in section 2.4, because these are the new results.

3.2.1 Comparison with airborne brightness temperatures during the SMOS Validation Campaign 2010

Why did you do the comparison of SMOS Level 1c data to airborne data, as nothing can be concluded from this due to the small sample size? Maybe make this clearer and give your reasons for doing that.

3.3 Analysis of SMOS optical depth Tau

P. 5414, L. 11: What does “some peaks are constant in time” mean?

P. 5414, L. 20: ORNL-DAAC, 2012 is not in the references

4 Conclusion and outlook

You conclude that the problems of SMOS brightness temperatures and through that the soil moisture product is mainly due to RFI, while the SMOS vegetation optical depth data suffers mainly from a retrieval problem. However, could RFI that effects the soil moisture retrieval influence the optical depth data in the same way? And could a retrieval problem also influence the soil moisture retrieval? Maybe you can explain that clearer, it sounds a bit contradictory.

Tables and Figures

Table 1: Please give explanations of the parameters.

Table 2: Again, please give explanations of the parameters. In the text you mention the bias, while the table says “offset”. How is the gain calculated?

Fig. 10: Please replace R^2 by R, because you use that in the text.

Technical corrections

P. 5396, L. 18-19: Please rephrase the sentence.

P. 5397, L. 27: Give only 2 decimal points.

P. 5395, L. 4, P. 5397, L. 21 and 25, P.5401, L. 19 and 21, P. 5402, L. 16, P. 5416, L. 4, 19 and 22: Please change citation to make all citations uniform.

P. 5410, L. 23: “brightness temperature” should be plural.