

Reply to the comments of the anonymous referee #3

The authors wish to thank the anonymous referee for the many helpful comments. The introduction has been improved so that context and scope of the study are now clearer. A reference to the explanation for the radar product has been added. Please find detailed answers to the other comments below.

The study area of the upper Danube must be improved. It is not clear why they choose that size of catchment with that data set. The rain gauges cover only one federal state of Germany but the head catchments in Austria and in the Southwest of Germany are not incorporated. If they simulate the upper Danube, then they have to take as well stations from those areas into account.

In these mountainous areas, SMOS soil moisture data are not available. Hence, simulated soil moisture data are not used for SMOS validation in these areas. Although it once was under consideration to mask them out completely, it was felt that it could still be interesting to see what happens to simulated soil moisture where rain gauges are missing, e.g. that the soil moisture patterns reflect the DEM due to the elevation-based interpolation of precipitation.

The description of database for the used hydrological model is missing. Is the model complexity with 4 layers with that resolution realisable from the available soil data set for an area 77000 km²? The calibration method is unclear. There is no information about uncertainties. The authors just present simulated soil moisture data.

The concept of the PROMET model is that it is based on 1st order physical and physiological principles. It completely closes the water and energy balance. The model is thus not calibrated with measured discharge, but of course the discharge is used to validate model performance. This information has been added to the text. The parameterisation of the land surface is done using remote sensing data source to a wide extent and standardized GIS tools, for example to derive routing parameters for each river section. More information on input data can be found in Mauser and Bach (2009), e.g. on the soil data set which was taken from a combination of the European and German soil map together with regional soil information. Details on the study of uncertainties by Schlenz et al. (2011) have been added to the introduction.

The description of the EMIRAD method is too coarse. What is the penetration depth under different vegetation conditions?

The soil layer contributing to the measured brightness temperature signal is the same for EMIRAD and for SMOS as they operate at the same wavelength. Depending on the vegetation conditions, soil moisture, etc., this layer contains approximately the upper 5 cm of the soil. This information has been added to the text.

The presented results give no additional gain in understanding and improvement. It is not surprising that the rain gauge network is not able to get local precipitation events compared to radar data. What is the benefit for SMOS from their results? That is not clear.

The benefit for SMOS is the result that the precipitation interpolation as used in the operational model configuration does not produce large uncertainties on the scale on which SMOS data are delivered. This confirms the suitability of the SMOS validation approach employed in other concurrent studies for the UDC area. The text has been improved in order to clarify this.

The EMIRAD data set of brightness temperature is only compared to the synthetic soil moisture, but no ground truth is presented.

A comparison of EMIRAD data with in situ soil moisture measurements is presented in the cited study dall'Amico et al. 2012 and the comparison is not repeated here. The comparison of EMIRAD data with synthetic soil moisture suggests that soil moisture patterns are simulated realistically on the 1 km x 1 km scale because similar correlation coefficients are reached as in dall'Amico et al. (2012). The reference to the dall'Amico et al. (2012) study has been expanded and the text improved in order to better explain this.

Specific Comments:

P3387, L25: Add the wave length of the L-band

Done.

P3387, L25: Add the observation depth of the soil moisture and information of the influence of vegetation.

Information on the approximate observation depth has been added. The influence of vegetation is more complex and the authors feel that it is not appropriate to discuss such a lengthy subject in this context.

P3399, L25-29: That is not comparable. The authors cannot compare synthetic soil moisture accuracy with the accuracy of soil moisture sensors.

This sentence has been removed.

Fig.1 Add geographic coordinates and a figure of Germany.

Done.