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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Calibration and downscaling of seasonal soil moisture forecasts using satellite data" *by* S. Schneider et al.

Anonymous Referee #1

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In this paper, 0.7° resolution ECMWF seasonal soil moisture forecasts are calibrated using ASCAT soil moisture data (CDF matching), and downscaled at 1 km resolution using ASAR data (Wagner et al., 2008). Results are evaluated against time series collected at two soil moisture stations. The observed improvement seems to originate from the CDF matching.

My main concern is that the validation strategy is weak, for several reasons :

- only two stations are used to assess the performance of the approach. The empirical nature of the methodology would require a large number (statistically speaking) of stations ;

- the two stations are not included in the same low resolution pixel, so that the capability

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of the downscaling method to represent the sub-pixel soil moisture variability is not evaluated ;

- comparisons between downscaled soil moisture and in situ measurements are made in time and not in space, although the rationale for downscaling is to improve the spatial (not the temporal) representation.

- results for the two stations are not consistent : downscaling improves results at one station (KLEE), and degrades results at the other station (Mpala-North).

As CDF matching is a well known calibration method and relatively straightforward to implement, it is not clear to me what the innovative aspect of the paper is. Perhaps, a deeper assessment of the downscaling part, through a more consistent validation strategy and a discussion about possible error sources, would strengthen the study.

Please find below additional comments :

- To have a better assessment of the downscaling method in Wagner et al. 2008, it would be good to see : 1) a scatterplot of ASAR-downscaled ASCAT soil moisture vs in situ measurements ; 2) a scatterplot of (original without downscaling) ASCAT soil moisture vs in situ measurements. The comparison between the two above scatterplots would provide useful information about the performance of the dowsncaling method, prior to application to the soil moisture forecast data set.

- L21 P14784 : "the high variability of soil water content both in time and space" seems to contradict the temporal stability assumption of the dowscaling method. Please discuss.

- L22 P14790 "the added value of this product is not yet very clear given that the downscaling parameters are static." Results from this paper do not clarify the added value of this product, whereas it is one of the objectives as mentioned in the abstract, introduction and conclusion.

- L9 P14793, "It can be concluded that the proposed calibration and downscaling ap-

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proach is working and provides useful results." To me the validation using two stations is not sufficient to really assess the performance of the approach, especially for the downscaling part, which does not provide consistent results even for the two considered stations. More validation is needed.

- Fig. 2. Why not presenting the results for the other station (Mpala North) ?

- L23 P14793 : "This might be due to problems in the representativeness of the soil properties used in the model soil or small scale features at the measurement site not resolvable with this approach". There are many other factors to be considered. This might also be due to temporal changes in the soil moisture distribution (i.e. temporal changes in the supposedly static downscaling parameters), and to some temporal changes in ASAR backscatter coefficients unexplained by soil moisture changes (e.g. changes in viewing configuration, vegetation, soil roughness etc.).

- L1 P14784 "A new approach to calibrate and downscale soil moisture forecasts from the seasonal ensemble prediction forecasting system of ECMWF is presented in this study". Calibration is made using CDFmatching. Downscaling is provided by the method in Wagner et al. 2008. The authors should be more specific and better highlight the original aspects of the paper.

- L5 P14784 "Weaknesses of the model soil scheme in forecasting soil water content are the main reason why soil water information is not used so far". Do you provide any evidence that poor results in soil moisture predictions are due to weaknesses in the soil scheme ? Do the authors assume that uncertainties in forcing data (e.g. precipitation, evaporative demand) have a minor impact ?

- L3 P14787 : "In order to compare ECMWF output and ASCAT data, the ECMWF data unit has to be transformed from the original volumetric soil water to an index with values between 0 and 100." As stated in the title and abstract, the objective is to calibrate and downscale seasonal soil moisture forecasts. Therefore we would expect choosing the ECMWF soil moisture unit as reference, and transforming ASCAT index to volumetric

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soil moisture.

- L18 P14788 : Similarly, COSMOS data should be kept with a volumetric unit, consistent with ECMWF and soil moisture physical values.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 14783, 2013.