Hydrol. Earth Syst. Sci. Discuss., 12, C3870–C3875, 2015
www.hydrol-earth-syst-sci-discuss.net/12/C3870/2015/

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Evaluation of soil moisture downscaling using a simple thermal based proxy – the REMEDHUS network (Spain) example" *by* J. Peng et al.

N. Sánchez (Referee)

nilda@usal.es

Received and published: 25 September 2015

I perused this manuscript with great interest. First, I know the previous work of the authors in which the current methodology was proposed and refined. Second, the research was developed in the REMEDHUS network, which our team has owned since 1999 and where a good number of studies have been done related to remotely sensed soil moisture products. I found this manuscript very interesting, well written and structured, and the objective (a downscaling approach of soil moisture products) is a must

nowadays for the remote sensing community. However, I would like to propose and discuss several aspects with the authors.

GENERAL COMMENTS

I would like to suggest enlarging the period of study. I am aware that the reason for choosing this interval was to coincide with other similar studies to be compared. This comparison can be preserved but the robustness of the analysis would be improved with more years of testing.

I find the use of SEVIRI very promising owing its detailed temporal resolution. Indeed, I myself proposed the integration of SEVIRI data with SMOS in another downscaling scheme. You proposed the use of SEVIRI for the LST alternative and MODIS for the vegetation. I wonder why you discarded the SEVIRI FVC (or LAI alternatively). Actually, the FVC is the parameter originally proposed by Carlson in the Universal Triangle and, furthermore, this product has a much better temporal resolution and, thus, higher free-cloud cover potential. I would appreciate some discussion about this.

Other analysis I would have liked to see in this paper was the spatial correlation for each date of study, i.e., a correlation for each day using all possible ground measurements on that given day. I am aware that for the current remotely sensed soil moisture (especially passive-derived products, e.g., SMOS) it is difficult to reproduce the spatial variability at point scale owing to the (low) spatial resolution of the radiometric measurements. But after a downscaling model like yours, a test of the spatial patterns makes sense at the improved resolution, and it would be a valuable and challenging analysis. It could be interesting to test if your downscaling approach is able to reproduce the spatial variability of soil moisture. In your paper, this issue is neither addressed nor discussed.

Finally, the overestimation found for both the original CCI SM and the downscaled soil moisture in this area deserves further analysis, perhaps not in this research study but in future comparisons. After our experience with passive-based soil moisture estimations in REMEDHUS, the retrieved values generally underestimated those observed, despite

the semi-arid climate and low soil moisture content. It would be interesting to analyze the overestimation in light of the passive/active inputs of this product separately.

SPECIFIC COMMENTS

- In Section 3.2 about MODIS products, explain in more detail the Aqua/Terra source of the products and justify their choice (Aqua/Terra).

- The study of the topography seemed contradictory to me with the downscaling approach, and wrongly focused. First, since the area of study is selected, among other reasons, based on its flatness (lines 12–13 p.8510, according to the Triangle method assumption), I do not see how the topography would be worth considering. Second, you chose a criterion based on 'removing the areas with 300 m higher or lower elevation than the average REMEDHUS elevation'. Given the REMEDHUS average of 777 m, there are almost no areas below the range you chose, and only a few beyond. I enclose the Figure 1 to illustrate this reasoning. Thus, the poor influence of the topography showed in the sensitivity analysis is not surprising, as you recognize on p.8520 and in Figure 5.

Figure 1. Digital Elevation Model of Castilla y León

- Similar to the previous comment, I find the analysis of the 'land cover heterogeneity' meaningless and contradictory here. As you stated, 'the study area also needs to be homogeneous' (L3 p. 8518). Actually, the area is distinctly homogeneous, with 80% of the area corresponding to rain-fed areas and almost 90% to 'cropland areas', the category you chose to separate from the 'full land cover'.

- In the sensitivity analysis, you justify the better performance of the LAI over the NDVI because of the NDVI saturation at dense vegetation levels. My experience in this area with very different kinds of image datasets and field radiometric measurements is that the NDVI never saturates here owing to the type of vegetation canopies (herbaceous crops, sparse vineyards or trees, grassland/pasture, etc.). Perhaps this better perfor-

mance should be attributed to other causes?

- It is unclear if the analysis in 5.2, and consequently Figure 4, compute the station average or another kind of spatial average. Also, in this section it is stated that 'the VTCI, combining the information from both LAI and surface temperature, agrees well with soil moisture with R of 0.37/0.52'. A correlation coefficient in such a range does not seem to 'agree well' to me.

- In 5.4. Section of validation, you show the results of R in terms of 'mean R'. These results are a bit confusing. I assume that you mean an average of each station correlation. But those values differ from those in Table 4 of your current study. Do the results in Table 4 come from a correlation of the comparison from the soil moisture average of all stations? Please, clarify.

- It would be interesting, in Figures 5 f and g, to add the soil moisture records of each point as a colour ramp, to see if the theoretical distribution in Figure 2 was verified. In our experience, the supposed distribution in the Universal Triangle of the wet/dry edges does not always work as expected, depending on several conditions. It would be good to know your results with the original and derived products.

FORMAL/TYPO

L4, p. 8506: 'prediction', I guess.

L13, p. 8510: 'central' is meaningless.

L16, p. 8510: 'most of the area is larger than 450 m'. This is not correct. The mean elevation in the Castilla y León region is 800 mm. Plus, the citation of Zhang et al. is inadequate here.

L18, p. 8510: For a description of this area, a more appropriate citation could come from our own research there, which we have developed since 1999. I suggest: Antonio Ceballos, José MartÄśÌĄnez-Fernández, Miguel Ángel Luengo-Ugidos, Analysis of rainfall trends and dry periods on a pluviometric gradient representative of Mediter-

ranean climate in the Duero Basin, Spain, Journal of Arid Environments, Volume 58, Issue 2, July 2004, 215-233, ISSN 0140-1963.

L23, p. 8518: I guess you use the form ‘satellite minus in situ’ for BIAS. Please, indicate.

L20, p. 8525: ‘Evaluation’.

L12-13, p. 8519: I do not see the meaning of this explanation: ‘It might be caused by the use of high quality surface temperature products in this study’.

L13-14, p. 8520: The 85% of the cloud mask category cannot be seen in Figure 3.

Please, be careful with the citations of the Spanish accent marks in Sánchez, Fernández and so on, as there are lots of mistakes.

Table 1: J14 is rainfed.

Table 3 and Figure 3: Abbreviations for products must be indicated.

Table 4: Is the field ‘soil’ actually ‘soil moisture’?

Figure 4: Clarify if the series you show come from a spatial average.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 8505, 2015.

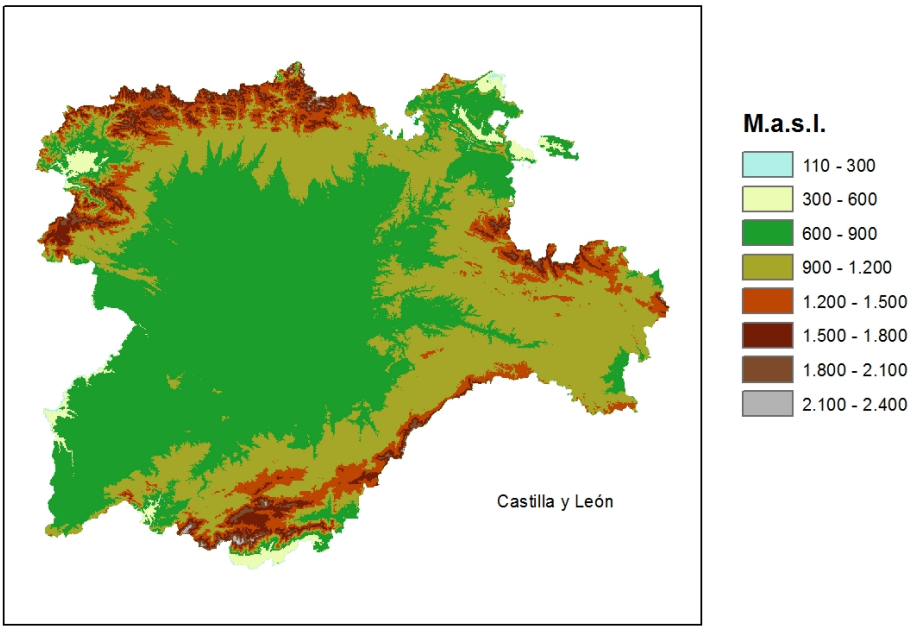

Fig. 1.