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Review of the manuscript "**A scaling approach, predicting the continuous form of soil moisture characteristic curve, from soil particle size distribution and bulk density data**"

The authors propose a modified version of an existing pedotransfer function (PTF) (MV-model from Mohammadi and Vanclooster, 2011; Mohammadi and Meskini-Vishkaee, 2013) to estimate the soil moisture characteristic curve (SMC) from the measurement of the particle-size distribution (PSD) and soil bulk density. The PSD is interpolated through the van Genuchten's (VG) equation (Eq.[9]) when considering the estimation of the suction head by using Eq.[4] (Mohammadi and Vanclooster, 2011). Subsequently a scaling approach is adopted to improve the predictions of the SMCs. The authors conclude that the proposed approach improves the model's estimates by about 30% if compared to the MV-model. Moreover the advantage of the proposed technique is the opportunity to avoid the use of empirical parameters that need to be calibrated on measured SMCs.

The minimal requirements for possible publication mandate the following 2 major revisions:

1) THEORY: there is confusion in defining some key theoretical concepts. The term "scaling approach" is used inappropriately in this context when referring to the geometric scaling of Miller and Miller (1956). This approach is based on the geometric similarity among porous media and aims to quantify the spatial variability of (either directly measured or indirectly estimated) soil hydraulic properties in a certain soil domain. Fig. 2 of Miller and Miller (1956) shows a clear representation of the concept: two soils have similar microscopic geometries when they have same porosity and differ only by a characteristic length. The advantage of this technique is to define a reference porous medium (with a reference characteristic length that is macroscopically representative for its corresponding pore-size distribution through a synthetic parameter of the SMC) that averagely describes the global behavior of the considered spatial domain. The relation between the reference macroscopic characteristic length of our reference "average" soil and the macroscopic characteristic length of a geometrically similar soil (synthesized in the scaling factor), determines how far or how close is the "similar" soil respect to the reference one. In other terms it determines the spatial variability of the geometric scaling factor. Soil porosity is not a characteristic length, ζ_{max} is not pertaining to a reference (average) soil, but to an ideal porous medium. The scaling factors do not scale a characteristic length in Eq. 12. Therefore the theory of Miller and Miller (1956) is not respected. Hence all the bibliographic literature associated to this concept (Das et al., 2005; Hayashi et al., 2007; Kosugi, 1996; Kosugi and Hopmans, 1998; Miller and Miller, 1956; Nasta et al., 2009; Tuli et al., 2001; Warrick et al., 1977) are out of context. Moreover, most of these studies employ the Kosugi's relation for the SMC instead of the VG form. This paper treats the development of an existing PTF simply to improve the estimates of the SMC but without considering their spatial variability.

The MV-model is based on shape similarity between PSD and SMC (Eq. 9). This hypothesis is rarely met in reality since the hydraulic properties are affected not only by soil texture (PSD) but also by other important factors (structure for example) (Haverkamp et al., 2002). For this reason, the semi-physical methods need to use an empirical parameter to correct (or to scale) the estimates from texture only (Arya and Paris, 1981; Arya et al., 2008). For example the α-parameter of the Arya and Paris (1981) method (AP-method) is defined as a scaling parameter since it corrects the ideal length of modeled capillary tubes (through cubic-packed spherical solid particles) into a real length of actual capillary tubes (with randomly packed variously-shaped solid particles). In doing so, the AP-method needs to use direct measurements of SMC to calibrate the α-parameter .

Similarly the authors of this manuscript adopt a "scaling approach" meant as the ratio between the real and ideal state of packing soil particles (Eq. 11). This mathematical transformation can be interpreted as the effect of soil structure since the packing state variable, ζ, derives from the bulk density. The strength of this paper is that the proposed method does not require any direct measurement of the SMC for calibration purposes. This should be the main novelty that needs to be highlighted in the text.

2) MODEL VALIDATION: considering this paper as a proposal for a novel PTF, I suggest to use Table 4 of Weynants et al. (2009 in VZJ) to evaluate the prediction performance through objective statistical indicators (quote also Verecken et al., 2011-VZJ since they review all the PTFs that estimate the van Genuchten equation). As the soil samples are taken from UNSODA, I suggest to compare the performance of the proposed PTF at least with ROSETTA (Schaap et al., 2001) and/or the AP-method and /or with others (Rubio et al., 2008; Walczak et al., 2006). I assume that ROSETTA will have a better performance because it relies on an advanced statistical tool, however it would be interesting to know how much performance the proposed model loses with the benefit of avoiding direct measurements of SMC for calibration purposes.

Moreover if the authors claim this method as "universal", they should run it on another different database and evaluate the uncertainty.

MINOR COMMENTS

- Page 14307, line 28: "...does not include empirical parameter.."

-Page 14308, line 23 to page 14309, line 6: delete

-Page 14309, line 26: "scaling approaches improve.."

-Page 14312, lines 10-20: suggest to delete.

-Page 14313: In Eq.[13] the shape parameter *m* should be "scaled" like *n**?

-Page 14315, lines 3-5: delete

- Page 14317, lines 18-21: "Moreover...(Kosugi and Hopmans, 1998)" delete

-Page 14318, line 20: "iv) this approach estimates the SMC more appropriately in comparison with many other models": which ones? I see only the comparison with the MV-model, but you need to add other existing models for validation purposes.

-Page 14325, Table 2: please add information on the scaling factors for each texture class

-Page 14327, Figure 1: improve quality, enlarge fonts

-Page 14328, Figure 2: improve quality, enlarge fonts

-Page 14329, Figure 3: improve quality, enlarge fonts, no need for the regression lines

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