

Interactive comment on “Geostatistical modeling of spatial variability of water retention curves” by H. Saito et al.

Anonymous Referee #3

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This is a well-written and well-structured paper that addresses an interesting topic. Authors are up to date with recent advancements in this area of research and apply state of the art techniques. References are up to date and relevant. Results are valuable although improvement is possible. See specific comments below.

Recommendation: acceptance with minor revision

Specific comments:

1. Authors use ordinary kriging to interpolate parameters of the water retention curves (P approach) and water content values (NP approach). It seems to me that they should have used cokriging instead. Parameters of the retention curves

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- are known to partially compensate for each other and are therefore likely to be (possibly negatively) correlated. Also, water content values at different pressure heads are likely to be correlated. Cokriging would yield different results and might affect the main conclusion of the paper (i.e., that the NP approach outperforms the P approach).
2. The paper judges the quality of the interpolations on the MAE and MSE. Both measures are very similar and in fact just one of the two will be sufficient to characterise random error. In addition, they should include measures that look at systematic error. The overall Mean Error (ME) may be computed, although this will presumably yield a value close to zero because kriging is unbiased. However, ME values calculated for individual pressure heads or subsets of the total of 11 would provide valuable insight. For example, Figure 7 shows that both methods yield a smoothed version of the observed water retention data. Is this a general phenomenon? Is smoothing generally stronger or P than for NP? Note that this can also be analysed by computing the standard deviation among the 11 water contents and comparing these between the observed data and the P and NP approach, but that smoothing is not captured in the MAE or MSE.
 3. The case study is a 2D case but not the conventional lateral one. Instead, one of the axes is the vertical (depth). Clearly, the behaviour and spatial correlation of the water retention characteristic is different in the lateral and vertical direction. Authors take care of this by including geometric anisotropy. It seems to me that this may not be sufficient. Instead, differences in the mean at different depths (i.e., a non-constant vertical trend) may be included and/or zonal anisotropy. I am not insisting that this is done, but it should at least be mentioned as an improved modelling approach.
 4. The fitted nuggets of the vertical (and horizontal) variograms (Figures 5 and 6) are systematically too small. Many of the experimental variograms suggest a

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considerable and in some cases pure nugget, but it looks that all nuggets are forced to zero. The analysis should be redone with more realistic fitted nuggets. Note that nuggets in the vertical and horizontal direction need not be the same, hence requiring zonal anisotropy.

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