

Interactive comment on “Characterization of the field saturated hydraulic conductivity on a hillslope: measurement techniques, data sensitivity analysis and spatial correlation modelling” by C. Fallico et al.

Anonymous Referee #2

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The accuracy of predictions of numerical models simulating water flow and contaminant transport through the vadose zone heavily relies on accurate estimates of the soil water retention and unsaturated soil hydraulic conductivity function. The typical way to estimate these functions is to a-priori describe closed-form mathematical equations and estimate the unknown model parameters in these functions using column scale laboratory measurements or by numerical inversion using scale-appropriate boundary conditions. In this paper the authors investigate the spatial variability of the saturated hydraulic conductivity (K_s) of an experimental field site (70 x 40 meters) in Italy, using direct measurements on undistributed soil cores, and a large number of insitu tension disc and pressure ring infiltrometer measurements. To evaluate the influence of mea-

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surement errors on the final estimated parameter values, the authors consider a simple Monte Carlo analysis in which the measurements are perturbed using a prescribed error deviation. Results demonstrate significant variations in estimated K_s -values between different methods, and that estimated K_s -values from ring and disc infiltrometer methods are relatively insensitive to measurement errors.

Unfortunately, my review is not very positive. The paper lacks several aspects that are needed to warrant publication in a primary international journal such as Hydrology and Earth Systems Science.

MAJOR COMMENTS

(1) A native speaker needs to be involved to improve the English. The current paper is not ready for detailed review yet, as it contains many grammar and style errors.

(2) In the absence of figures containing information about the measurements of the ring and disc infiltrometer it is particularly difficult to assess the reasonableness of the derived K_s -values. More detailed information about the quantity and quality of the data would help provide more confidence in the findings. For instance, how can the lab and ring infiltrometer data result in hydraulic conductivity values that are of the range about 300 m/d, considering that we are dealing with an alluvial loamy deposit?

(3) The authors employ a simple Monte Carlo analysis to confront how sensitive the estimated K_s -values are to measurement errors? I think this is a useful approach, but in the presence of all potential errors articulated on Page 5 (second paragraph) I fail to understand how a simple normally distributed, homoscedastic error distribution is going to give useful answers? The authors should consider auto-correlated error distributions to better reflect actual observed errors.

(4) Why do the authors not directly compare the observed spatially distributed fields of K_s -values derived with the different methods? Despite large magnitudes in their values, is a similar spatial pattern present? This would certainly answer important questions.

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(5) What is the main contribution of the current paper? For instance, the authors state that “Such a statistical comparison of Ks data obtained with different measurement techniques provides results which are coherent with the conclusions of other studies on the Ks estimate problem (Herman et al., 2003).” If this is the case, what is the new contribution of this paper? The authors should focus on the thrust of their manuscript and critically assess how each element (such as MC analysis) is contributing to the overall goal.

(6) Why are the pressure ring infiltrometer measurement and undistributed soil sampling points done at the same locations? Which problem is being confronted here: a comparison between measurement techniques or assessment of spatial variability of Ks-values?

(7) The manuscript contains far too many figures. The authors should condense their figures and only focus on those ones which prove essential to establish confidence in the findings.

ADDITIONAL COMMENTS

Page 1: Please rewrite the abstract and draft in a more direct mode. What is meant with “well-known geostatistical techniques”? Please mention which method is used.

Page 2, Line 2 - 4: How can research about water flow and pollutant transport processes be a goal on itself?

Page 2, Line 9 - 11: The practical use of a numerical simulation model requires only information about the model inputs, boundary conditions, and parameter values. Experimental measurements have been used a-priori for parameter estimation.

Page 2, Line 13 - 16: Please reformulate this sentence. Please consult a native speaker.

Page 2, Line 16 - 18: Please reformulate this sentence.

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Page 2, Line 21: “Modeling issues”? What is meant with issues? Please be more precise and accurate in writing.

Page 2, Line 25: Reference to Gupta et al. 1998 is misleading as this work deals with rainfall-runoff modeling and holds no relationship with the presented research about estimation of the spatial distribution of hydraulic conductivity values.

Page 2 - 3, Line 26 - 4: Please reformulate this section.

Page 3, Line 8: Which geostatistical method?

Page 3, Equation (1): Why not indicate water content with the well-known symbol “theta”. This would be consistent with the literature.

Page 4, Line 1 - 3: Is this true? What about the Multi-Step Outflow method?

Page 4, Line 3: “tool”. Everything is a “tool”. Please be more specific.

Page 4, Line 4: References should be within one set of brackets. Please change consistently throughout paper.

Page 4, equations: How do the various equations relate to each other? Difficult too follow.

Page 4, Equation (6): The comma in 0,316 should be replaced with a dot.

Page 5, Line 4 - 5: Please reformulate “Ěsome warnings should be taken into account”

Page 5, Third paragraph: I wouldn’t elaborate on the various errors associated with the ring infiltrometer. I would just state that measurements are subject to various sources of errors, and that this will be confronted in the MC analysis.

Page 5, Equation (7) - (8): Difficult to read and contain type errors.

Page 6, Line 2 - 6: Please reformulate “Ěsome warnings should be taken into account”

Page 6, Section 2.3: Remove this part to later in paper, where the actual results are

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discussed.

Page 6, MC analysis: So errors are assumed to be homoscedastic and uncorrelated?
See previous comment.

Page 8, Line 5 - 8: Please reformulate “Other data will not be used in the remainder of this paper.”

Page 9, Line 1: Remove last part of sentence after ; and rephrase “and Pearson asymmetry”

Page 9, First paragraph: Why not present result preserving spatial variation? Move all the results to one figure, so as to reduce the number of figures.

Page 9, Line 9: Rephrase to “the following conclusions can be drawn”.

What is new about the results presented on this page?

Page 10, Line 1 - 4: Please use another word for the ratio. The word Likelihood is confusing as it means something totally different in Bayesian statistics.

Page 10, MC analysis: See previous comments.

Page 11, Merging of datasets: How can you merge data sets if the variation between measurement types is so large? How does this generate confidence in the findings?

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