Referee comments

General comments

The manuscript presents a study in which lab and numerical experiments were conducted to study the influence of rock fragments on soil hydraulic conductivity. It is interesting to use 2D numerical simulations to study the influence of rock size and shape on soil hydraulic conductivity. However, some conclusions in this research were not convincing or at least drawn rashly for the reasons below:

(1) Lab experiments have no sufficient replications.

(2) The authors knew that the influence of new created voids were not considered in numerical experiments but neglected this point when evaluating the effects of rock size and shape.

(3) There are not enough comparisons between the results herein and those in literature, especially the contents about the soils with glass beads and the results on unsaturated hydraulic conductivity.

The manuscript is not written concisely and logically. There are also some grammar errors. Therefore, I am not convinced that the manuscript can be published in its current form.

Specific comments

(1) Why not conducted evaporation experiments with more rock fragment contents? I think experimental results can be more convincing than the simulated data for the great influence of possibly new created voids by stones shown in Figure 1. Because only the effects of reducing cross sectional area for water flows and increasing the tortuosity of water flow paths were considered in the numerical simulations, I don't think the conclusion "Indeed, under unsaturated conditions, the models seem to represent the hydraulic behaviour of stones reasonably well" in abstract can be drawn from the results in this research.

(2) In the manuscript, there are no replications of the experiments to measure K_{se} with different R_v. I don't think the explanation ("We did not perform any replications since the setup was totally artificially controlled") in the manuscript is sufficient. Normally, the variation of the saturated hydraulic conductivity of stony soils is

greater than other soils, and thus at least three replications are required to obtain the representative values of K_{se}.

(3) What is the size of glass bead used in experiments? Without replications, the reliability of the experimental data of soils with Glass Balls in Figure 1 is questionable. I am surprised the almost linear increase of K_{se} with R_v, even at the range of low R_v, for soils with glass beads, which is so different from the results of Peck and Watson (1979) and Ravina and Magier (1984) and the numerical results with circular inclusions in this research. Please explain it.

(4) Which data were used in Figure 1 to represent numerical experiments? If the data from all the numerical experiments of soils with different sizes and types inclusions were used, why not show error bar in the Figure 1. Maybe we can confirm from Figure 2-4 that the shape and the size of inclusions have influence on K_{se}, but compared to Figure 1, I cannot draw the conclusion "the shape and the size of inclusions have a significant effect on K_{se}" on line 12 in page 1119.

(5) Generally, there is a problem when inserting a tensiometer into a stony soil with influence on soil structure as little as possible. I am interested of the size of the tensiometers used in evaporation experiments, when and how did the authors placed them in stony soils. It should be explained in more details in the main text.

(6) Most of the stony soils in literature are coarse texture. However, the soils used in this research have high clay content (55%). Soil texture may considerably affect the relationship between soil hydraulic properties and Rv. The possible effect of soil texture on the surprising result in Figure 1 (if it is true) should be discussed.

(7) As for the influence of new created voids by stones, no new insights or explanations were given in this research. Whether in virtual evaporation experiments or in permeability test, the influence of new created voids was not considered. The authors mentioned to use X-ray CT to study the influence of new created voids. It is a good idea but unfortunately they did not conduct in this research. I suggest removing this part of contents and concentrating this research on the influence of rock size and shape, which may change soil tortuosity or influence zone area overlapped. It is better to add figures to show the rock arrangement in soils for each treatment of virtual experiments.

(8) Some sentences are difficult to understand and there are also some grammar errors such as:

Line 19 in page 1112, "permeameter tests" should be "permeability tests".

Line 23 in page 1115, “permeameter experiment” should be “permeability experiment”.

The sentences on lines 5-12 in page 1114 are not clear.

Line 2 in page 1117, “Beibei et al. (2009)” should be “Zhou et al. (2009)”.

Line 29 in Page 1118, “E.g.” should be “For example” .

(9) The size of soil columns used in lab experiments should be added.

(10) The names in the references are wrong. The correct formats are

Zhou, B.B., Shao, M.A. and Shao, H.B.: Effects of rock fragments on water movement and solute transport in a Loess Plateau soil, Comptes Rendus Geosci., 341, 462–472, 2009.

Ma, D.H. and Shao, M.A.: Simulating infiltration into stony soils with a dual-porosity model, Eur. J. Soil Sci., 59, 950–959, 2008.

Ma, D.H., Zhang, J.H., Shao, M.A. and Wang, Q.J.: Validation of an analytical method for determining soil hydraulic properties of stony soils using experimental data, Geoderma,159, 262–269, 2010.

(11) Normally, tortuosity factor l = 0.5 in van Genuchten model. In Table 1, the authors used l = -0.135. Why?

(12) The contents in Table A1 are repeated in Figure 2-4. I suggest removing it.

(13) The evaporation method is well known for measuring unsaturated hydraulic conductivity. I do not think it is needed to describe it with so many words in page 1111.