First of all, we would like to thank the reviewer for his help improving the paper. Reviewer' comments are in italic, our answers are in bold.

Referee comment #2

This paper presents an interesting experimental and numerical study on the effect of soil stoniness on the soil hydraulic properties. Stony soils cover a substantial area of the terrestrial land surface. A proper characterization of their hydraulic properties is therefore important. But, experimental data of hydraulic properties of stony soils are scarce, also because it is a challenge to take undisturbed samples from such soils. The main results of these studies are that the relation between stone content and saturated hydraulic conductivity can be non-monotonous with an increase of saturated conductivity with increasing stone content when a threshold stone content is reached. Theoretical models and numerical simulations were not able to reproduce the increase of conductivity with increasing stone content. This because they do not consider that at the interface between stones and bulk soil, the structure of the porous medium can be disturbed and different from its structure in the bulk fine soil material. On the other hand, for unsaturated conditions, the hydraulic conductivities decrease with increasing stone content. For unsaturated flow conditions, the interface between the soil and bulk soil is not playing an important role since the larger pores or voids at this interface are drained. Besides the effect of different properties at the interface, also the shape and size of the stone fragments on the hydraulic properties was investigated and was found to play a role in addition to the total volume fraction of the stones, especially when the stone content is high.

The authors found that for unsaturated conditions, the hydraulic properties could be fairly well reproduced by simply scaling the unsaturated conductivity function with the relative saturated hydraulic conductivity of the stony sample. This indicates that the same shape parameters could be used for the stony and non-stony soils. However, I think that this conclusion only holds for the considered case. When the saturated conductivity of a soil with a higher stone content is higher than expected based on the fraction of fine soil whereas the hydraulic conductivity at lower pressure heads corresponds with the fraction of fine soil, then the shape parameters of the unsaturated conductivity curve of the stony soil should differ those of the fine soil fraction. **The reviewer is right, the text is not written correctly. We do think –as the reviewer- that the shape parameters are different for stony soil than for fine earth only. In fact the sentence "According to these experiments, hydraulic conductivity in the unsaturated zone is well defined using a correct K_{se} and shape parameters do not depend on the stoniness" relates models and simulations assumption. Besides these elements and the ones pointed by the reviewer, we can add that comparing measured and modelled (so based on these assumptions) retention curves with a Rv 20%, we can see that shape parameters are different. We didn't include it in the paper but we'll modified the text to precise this part.**

The text is in general well written but the authors should try to be more precise in their formulation at some locations.

Detailed comments

Abstract p 1104 ln 16: I would reformulate this sentence. It is not presence of rock fragments by itself that counteracts the effect of a reduced volume available for flow. It is the presence of voids at the interface between rocks and bulk soil that is responsible for this effect. Therefore, I propose to merge this sentence with the next sentence.

Abstract p1104 ln 18: Why 'Nevertheless' Skip that maybe.

P1105: ln 9: Their usage tendS to increase

P1105: ln 28: '… tends to increase to higher Rw.' This suggest that Kse will increase to a value that is equal to Rw. I think you mean: '… and then at higher Rw, Kse tends to increase with Rw.

P 1105 ln 29: change 'greater Kse' to 'larger Kse'

All these comments will be addressed in the text.

P1106: ln 4: This sentence is confusing. Increasing negative pressure heads means that the pressure head becomes less negative and comes closer to zero. I suppose that you mean the opposite. I would *propose to write: 'with decreasing pressure heads.. (more negative pressure heads).* **This sentence will not exist anymore following the modifications asked by another reviewer.**

General comment on the introduction part: the stoniness of the soil can be quantified using either a volumetric or gravimetric stone content. In the literature, both numbers have been used. In order to bring data from different studies together and compare them, it would be better to use the same parameter. Therefore, I would propose to include calculated volumetric stone contents if gravimetric stone contents are given. These calculations will have to use estimates of the stone density and bulk soil density but I suppose that these can be derived from the literature sources or that an estimate can be made. **The text will be modified**

P1107 ln 7: The equations that were derived by Peck and Watson based on the heat transfer theory, did they assume that the heat conductance of the cylindrical and spherical inclusions was equal to zero? To make the analogy to water flow, this is important. **Yes, indeed.**

P1107: In the equation of Novak et al. (eq. 5), an additional empirical parameter a is introduced to account for the hydraulic resistance of the stony fraction. I suppose that the model of Ravina and Magier assumes that the resistance of the stony fraction is infinite (this means that there is no water flow through the stony fraction). So, if you account also for flow through the stony fraction, assuming that its resistance is not infinite, then I would expect that the conductivity of the stony soil is larger than when you assume that there is no flow through the stony fraction. Therefore, I would expect that Eq. 5 should give a higher conductivity than Eq. 3. This can be achieved by choosing a to be smaller than 1. But, the authors write that a is larger than one for clayey soils. I do not understand this in combination with the explanation that was given for a parameter. **The parameter a accounts for the hydraulic resistance of flow but considering size and number of inclusions. It is not related to the imperviousness of inclusions as Novak et al. (2011) performed numerical simulations with impermeable circular inclusions.**

P 1108: ln 3-4: '…hydraulic properties of water'. I suppose you mean hydraulic properties of unsaturated soil. **Indeed.**

P 1108 ln 13-14: Explain why it could be a plausible assumption that the shape parameters of the hydraulic functions of stony soils are the same as the shape factors of the functions that describe the hydraulic functions of the fine soil fraction. **In fact we just presented the model from Hlaváčiková and Novák (2014), and we don't think that shape parameters are independent on stoniness. Our results will be discussed regarding the assumptions on which the model relies.**

P 1108: Sample preparation. I think it is necessary to include the number of replicate samples that were prepared. I propose to include also a bit of information about the rock fragments that were used. **Concerning rock fragments and glass beads, we propose to include a picture of inclusions as it is clearer than text.**

P1109: 'experiments were performed USING cylindrical Plexiglas samples …'

Data processing: This part is not consistent I am afraid. The flux is generally defined as:

Where z is defined positive in the upward direction. This is not consistent with equation 9. That should read:

I suppose the authors took instead of the pressure heads, the absolute values of the pressure heads.

P1111: ln 10 and 11: should be 'difference in tensiometer k and j.'

These parts will not exist anymore following the modifications asked by another reviewer but your comments are right.

P1112: ln 6: the hydraulic gradient is dh/dz + 1 and is different from the pressure head gradient dh/dz. The authors should indicate which of both they used. Furthermore, the hydraulic gradient for upward flow should be negative. Therefore, change to a criterion for the absolute value of the hydraulic gradient. **Since we used this definition of the hydraulic gradient :** $\nabla K = \frac{\Delta|h|}{\Delta z} - 1$**, the value of the limit used is 1 cm/cm.**

P1112 ln 18: Skip 'infiltration'

P1115: ln 19-20. I do not agree that the artificial control of the experiment implies that no replications are needed. Also the evaporation experiments can be considered to be artificially controlled. Besides the compaction of the fine soil, also the location of the stones in the sample has an impact on the hydraulic properties and may vary between different setups. For the same Rv, it is possible to have different configurations of the stony fractions which leads to a variability in hydraulic properties between different replicates. **This has been addressed with 4 more replications of permeability measurements.**

P1116: 95% confidence intervals of what? I find the word confidence interval not appropriate here. I would rather speak of the range of the model predictions. Instead of a 95% confidence interval, I would just show the largest and the smallest model prediction. **The interval is the 95% around the median of the predicted values. So it is not a confidence interval, but an interval of the variation between models results. It will be modified.**

P1117: ln 5: 'Our experiments show a similar behavior for dry soils' This is confusing since the experiments were done under saturated conditions. I propose to chance to 'dry packed soils'

P1119 ln 9: 'The Kr predicted by the models is always higher than the Kr determined by the simulations, except for soils containing one inclusion on its shortest side. One can conclude that the shape and the size of inclusions have a significant effect on Kse, which is usually neglected by the models.' Isn't the smaller Kse that is obtained from numerical simulations than from the theoretical model also caused by the fact that theoretical models consider a three-dimensional flow field whereas the simulations are for a two-dimensional flow field? **As suggested by the reviewer, we'd like to add the following elements. As a general rule, the hydraulic conductivity of a heterogeneous medium tends to be higher for 3D than for 2D simulations (Dagan, 1993). Similarly, for a same level of heterogeneity, the flow will be more hampered using 1D rather than 2D simulations. In the present study, we performed 2D simulations: the quantitative and qualitative conclusions from these experiments can be only extended to the third dimension for their corresponding 3D form with an infinitely long axis.**

Figure 5: I am wondering whether the plot wouldn't be more clear if K is also plotted on a logarithmic scale. Then Figure 5 would be consistent with figure 6.

P1119: 'Shape parameters do not depend…'

P 1120: I would propose not to use pF but use pressure heads instead. If you want to use pF, then you would have to define it.

P1121: ln 11: 'many -> may be ill-founded.'

These comments will be addressed.