Dear Editor,

We wish to thank the two reviewers for their positive, thoughtful and constructive reviews. Below you will find our replies (in red) to the general and specific comments raised by the reviewers, and detailed description of the corresponding changes in the paper. Since the paper has been changed a lot from its original version, it went through another professional English editing, to ensure an easy reading. We hope you and the reviewers will find the paper suitable for publication.

The authors have made a substantial effort by including extra simulations and experimental data in their revised paper, which is highly appreciated.

Nevertheless, I think there are still a few issues that should be addressed.

First, the authors compared evaporation from layered (or top soil compacted) soils under saline and non-saline conditions with those from other soils and use these comparisons to draw conclusions on the effect of layering (or compaction) and salinity on evaporation. However, there are two issues the authors should pay attention to. First, they should always make clear with what they are referring, i.e. they have to clarify clearly the reference case. Second, they should define the reference case so that it is representative for the non-compacted soil. I do not agree that the case they are considering now as the reference case, namely the homogenized soil which has a much wider grain size distribution, than the layered soil that is used to represent a compacted soil, can be considered as a proxy for the non-compacted soil. Therefore, although the comparisons for the two cases: layered soils with layers of uniform grain sizes versus homogenized soil with mixed grain sizes is very interesting and illustrative, it does not represent a comparison between a compacted versus a non-compacted soil. Thus, it is not correct, to my opinion, to draw conclusions about the difference of evaporation between compacted and non-compacted soils based on this comparison. The comparison between the layered FU and CU soils is already interesting on its own and I am wondering what the additional value of the homogeneous HO scenario in fact is. To my opinion, it represents the behavior of another porous medium with a much wider pore size distribution. One could consider leaving it out and replacing it by a numerical simulation but using a homogenous soil profile that corresponds with the properties of the lowest layer (although this might be a bit extreme in hydraulic property contrast between the top and bottom).

This is a very important comment – thank you. We added another two setups to the model section: homogeneous coarse sand and homogeneous coarse sand with a 1 cm layer of fine matrix on top, to mimic compaction of the very top layer of the medium. The corresponding sections in the M&M (Section 3.3) and at the results (Section 4.3) where changed accordingly. Moreover, we went carefully over the text and make sure that the correct terms are being used to describe the compacted and the non-compacted scenarios.

Second, improve the quality of figure 7.

Figures 6 and 7 were changed and their quality was improved, in the revised section.

Third, explain in figure 11 why stage 1 evaporation of the saline compacted sand soil column is much smaller than the stage 1 evaporation of the saline non-compacted sand column.

We wonder if there may have been a mistake in the comment, since stage 1 evaporation of the saline compacted sand soil is longer than the saline non-compacted as expected.

Detailed comments:

Ln 119: 'It was shown that porous media composed of a fine texture domain that overlies a coarse texture domain may result in longer duration of S1 and increased cumulative evaporation.' As I commented in my previous review, it is important to mention the reference case. With respect to what does this layered medium evaporates more? With respect to a homogeneous coarse domain or a homogeneous fine domain? I think it is in most cases correct to state that the layered profile (with fine on top) will have more S1 evaporation than the uniform coarse profile. The depth of the drying front (i.e. where the transition between saturated and unsaturated conditions take place) in the coarse layer will be translated downward by approximately the thickness of the fine layer (if the thickness of the fine layer is smaller than its characteristic length) so that the same amount can be extracted from the coarse layer during S1 evaporation in the layered system as in the homogeneous coarse soil. Since water is also extracted from the fine layer on top, the total amount of water that can be evaporated from the layered system will be larger than the amount of water that is extracted from the coarse layer. Whether the layered system with a fine layer on top will evaporate more during S1 than a uniform fine layer, depends on the characteristic lengths of the fine and coarse soils, the thickness of the fine layer, and on the initial water content (or porosity when evaporation of a saturated soil is considered). When the thickness of the fine layer is much smaller than its characteristic length and when the stage 1 evaporation from the uniform coarse soil is lower than that from the uniform fine soil, the layered soil will evaporate less during stage 1 than the uniform fine soil. When the thickness of the fine layer is larger than its characteristic length, the layered soil will evaporate the same amount of water than the uniform fine soil. When the thickness of the fine layer is close to its characteristic length but smaller, then extra water can be wicked from the coarse layer below the fine layer at relatively low capillary pressures. Of course, this extra wicking is only possible when the water reservoir in the coarser layer did not drain by gravity (e.g. when there is a shallow water table).

Thank you for the detailed comment, it was added that we compare it to the initial case of a homogeneous coarse texture domain (page 5, line 121).

Ln 125 'Consequently, the coarse texture layer acts as a water reservoir that supplIES extra water to sustain a longer S1 and higher cumulative evaporation, compareD to a homogeneous FINE? soil structure.' See comment above. Can't it be stated that the thickness of the fine layer should be larger than Lcfine*delta_theta_fine – Lccoarse*delta_theta_coarse? In the line below, you mention that the fine layer should not be thicker than a certain threshold, which I understand. But, I think it should also not be thinner than another threshold.

We are not sure we fully understand the comment. For the discussed situation of a fine texture domain over a coarse texture domain, the key issue is the ratio between the thickness of the layer and the characteristic length characterize the fine texture. This is explained in details in the revised version: "*It was shown that porous media composed of a fine texture domain that overlies a coarse texture domain may result in longer duration of S1 and increased cumulative evaporation with respect to homogeneous domain, composed of the coarse texture matrix only. In the layered structure, as soon as the drying front reaches the layers with the relatively larger pores, a rapid water displacement will occur from the large pores to the overlying finer pores. The pressure in the coarse layer changes abruptly from its air-entry value to the air-entry value at the evaporation front, which is associated to the higher capillary suction of the small pores (Or et al, 2007; Shokri et al, 2010). Consequently, the coarse texture layer acts as a water reservoir that supplies extra water to sustain a longer S1 and higher cumulative evaporation, compared to the homogeneous soil structure. It is important to emphasize that this process will occur only if the thickness of the fine texture layer is shorter than its characteristic length as only at this state the drying front may reach the coarse texture domain, while the system is at S1 and the evaporation front is still at the soil surface (Assouline et al., 2014; Assouline and Narkis, 2019)*."

Ln 152: 'In some cases, if the precipitated salt layer over the soil surface is hydraulically connected to the solution in the pores below, it may accelerate evaporation, as the surface area of the precipitated salt is usually higher compared to the underlying bare soil. Consequently, as long as the salt crust can pump liquid water from the underlying media, the elevated surface area of the salt crust would increase total evaporation' Why would an increase in surface area increase the evaporation? I think this would be related to the increase in surface roughness which increases for the same wind speed the latent and sensible heat exchange. This would imply an increased S1 evaporation.

As explained in the paper – increased surface area by the precipitated salt may increase evaporation as more area is available to contribute water for evaporation. It is explained in the paper and relevant papers are cited. However – we agree that salt crust roughness may also affect evaporation and we mentioned that at the revised paper (page 7, line 158).

Ln 218: compareD to…-
Done.

Ln 225: The salt crust will reduce (skip s) –
Done.

Ln 338, layer 60-80 mm: why does this layer have such a low porosity. Also the mixed layer has a much lower porosity than most of the layers in the layered soil profile.

It was determined experimentally, as detailed in the text.

Ln 523: compareD to –
Done.

Ln 550: I am still not convinced that a comparison between a simulation of a layered porous medium consisting of layers with a different textures and a porous medium that represents a mixture of the grain sizes of these layers is appropriate for a comparison between compacted versus non-compacted soils. This homogeneous layer would not represent a non-compacted soil.
I think the layered medium should be compared with a homogeneous profile that either consists of the layer with the coarsest texture or the layer with the finest texture.

Please see our reply to the major comment above. As said, we added a numerical model of homogeneous coarse texture domain and a compacted domain with a 1 cm layer of fine texture layer at its upper level. Now the paper covers four compaction / non-compaction setups, which are better explained in the text.

Ln568 Figure 7. The figure is hardly readable since the legend of the figure does not explain all the lines shown in the figure.

As detailed above – both figures: 6 and 7 were changed with the revised numerical model section.

Ln571: I do not understand which simulation results are shown here. When the evaporation is still in s1, the evaporation flux at the top of the soil and the interface with the salt crust should be nearly equal to the potential evaporation rate. But it is much smaller in the simulation. How can these simulation results then still represent S1 evaporation?

Entire section was revised.

Ln 666: 'no salt crust was observed (in CU) because of the low cumulative evaporation' I don't think that the low cumulative evaporation can explain this since the cumulative evaporation was nearly as high in CU as HO. In HO, a salt crust was built up. I think the reason is mainly the fact that in HO, the evaporation front remains longer at the soil surface so that all salt accumulation occurs there.

We agree and we changed the text to say: "*As aforementioned, for the CU saline conditions, no salt crust was observed because of the receding evaporation front, that did not support the processes of salinity buildup at the soil surface*".

Ln 747: 'The differences in the impact of salinity on evaporation between the HO and FU setups (Figures 9-10), together with the differences in patterns of drying (Figure 8), support the research hypothesis that even though more salt accumulation on the surface is expected in compacted conditions, its impact on evaporation is expected to be moderate compared to neutral conditions, since the hydraulic connection to the surface persists longer and includes the salt crust.' The problem is that the HO setup must not be considered as the 'neutral condition'. The HO is a different porous medium than the FU and does not represent the 'uncompacted analogue' of FU. The closest that comes to the uncompacted analogue is the CU setup.-

As detailed above – this was corrected throughout the entire manuscript.

Ln 775: 'an experiments' Skip 'an.'
Done.

Ln 785: 'For saline conditions the compacted sand also displayed higher cumulative evaporation compared to the uncompacted state, with total cumulative evaporation of about 16.5 mm and 14.5 mm, for the compacted and uncompacted samples, respectively (Figure 11).' Under saline conditions, the cumulative evaporation is indeed larger for the compacted sand than for the uncompacted sand. But why is the stage 1 evaporation in the compacted sand much lower than in the uncompacted sand?

We afraid we didn't understand your comment correctly, the compacted condition has longer s1 as we were expected.

REVIEWER #1

Page 5, Line 118 and Line 125: Shokri et al. (2010) may fit better than Or et al. (2007) because the evaporation experiments from the layered sand was discussed there in more detail and more quantitatively.

Thanks - added.

Page 7, Line 154: It is an effect of enhanced surface area or reduced pores size (increasing the absolute value of the critical capillary pressure)?

It may be both, however, the reduced pores sizes in the salt surface are not yet commonly tested in the literature, and in this section we review previous studies.

Page 16, Line 371: "for", not "or"
Done.

Page 17, Lines 386-389: The sentence is a bit unclear; please be more specific.

The sentence was revised.

Page 18, Line 411: Can you specify "every few hours?"
Time gaps between the measurements were not consistent, due to technical constrains. Therefore, we used this term.

Page 35, Lines 725: The hypothesis that salt deposition resulted in hydraulic discontinuity and existence of ‘mulching layer’ for the HO-Salt experiment is – from my point of view – supported by the observation that the evaporation rate (based on Figure 9) is relatively constant between 20 and 100 hours (after S1) – it looks like the evaporation plane remains at the bottom of the ‘mulching layer’ for almost 100 hours; this is sort of ‘secondary stage-1’ with constant evaporation rate but with the evaporation rate below the surface at constant depth

This is correct. Text was revised to say: *"The precipitated salt crust acts as a mulching layer that results in hydraulic discontinuity between the saturated domain and the atmosphere. Even though the matrix under the salt crust is moist enough to support S1, under salt free conditions, it is not wet enough to support liquid water flow into the salt crust, therefore vapor flow through the salt dictates the evaporation rate. This is in agreement with observations from previous studies (Gran et al., 2011; Nachshon and Weisbrod, 2015), and the numerical simulation.* "

Page 38, Line 790 ff: The relevance and context of this very general statement is not clear; it could be explained in more detail in the following section 5.

We agree. This sentence was deleted and in section 5 we elaborated on that (page 39, line 854)

Page 39, Line 831: The authors mention several times that the drying front from compacted soil propagates from bottom to top. This is true in the case of extreme layering as used in the experimental study but in case of more gradual compaction it is possible that water is extracted continuously from entire profile but with higher water content close to the surface (see Figures 6 and 7: the water content drops in each time step in all layers, not just from bottom to top; there is no clear drying front moving from bottom to top); but in contrast to the HO case, the water content increases in upwards and not the downwards direction. The authors may consider to rephrase and explain in more detail.

We went over the text and better explained this issue.

Figure 3: The scale used for the distance map in (b) is not very illustrative and the effect on pore size cannot be seen; consider to use log scale or truncate the scale. In the captions you may state that these are vertical cross-sections

We tried several options and that was the best one. We believe that together with figs (a) and (c) – the message of the figure is clear.

Figure 4: Could you use the colors consistently in a and b (green is UN in (A) and LC in (B)).

It was a mistake in the legend. It was changed.

Figure 5: Should the curves in (B) not go to 0 for a column of 100 mm length?

Right, there was an error in the Y axis limits. Changed.

Figure 7: You may add in the captions that salt layer is 2mm deep and mark it by arrow in the figure.

Figure was changed and it present the hydraulic conditions prior to the salt crust onset.

Figure 8: Switch (A) and (C) in the captions;-
Done.

in (A) the homogeneous case is shown. You may state in (B) that there must be an air conduit “through the saturated layers” (in that sense they are not entirely saturated) – added in line 619.

Figure 10: I propose to denote CU as “tilled” (not loose) according to the definition in text
– Done.