Reply to Editor's comments

I do think the manuscript can benefit from an additional revision, which can be defined as minor, in my view. After receving these, I do think I will be in a position to make my final assessment.

Response:

Dear Editor,

Thanks for giving us the opportunity to make refinements to our manuscript. According to the reviewer's and your suggestions, we made the following revisions:

(1) Regarding the suitability of the V-G SWRC in the crack domain discussed by the reviewer, we added more explanations in the section "6.3 Model performance". See line 609-615 and below in direct response to prof Coppola. Basically, we agree that our conceptual approach to use VG for linking water potential with water content in a crack domain has limitations as one can argue capillarity has little effect in a cracked domain. But we argue there remains some capillarity. Moreover, we show with both our numerical analysis and supported with previous publications it is clear that with effective parameter settings the conceptual approach is quite suitable in practical conditions.

(2) We also made other two minor changes at line 261-265 and line 275 to better correspond our response to the suitability issue of the V-G SWRC in the crack domain.

Hope these revisions can meet with your approval.

Reply to Professor Coppola's comments

Dear Professor Coppola, thank you for the positive and constructive suggestions to improve our manuscript. Below are my responses to your comments.

Comment: *This is the second time I read the manuscript. To me, many of the issues I raised in the first review have been mostly solved. Some statements I found too strong have been smoothed.*
The only problem still remaining in the paper is related to the fracture porosity, which in the approach of the authors, taken from Stewart et al. (2006) would completely consist of voids. This assumption allows finding an analytical relationship describing the changes of the macropore weight with shrinkage. Nevertheless, this is in contradicted in the text by the use of a van Genuchten-Mualem type hydraulic properties, with parameters that would indicate some gradual changes of water contents which may be only related to a porous system not simply consisting of voids. To avoid this contradiction, Coppola et al. (2012; 2016), assumed a true double porous system, thus with a macropore system being a true porous system, which can well be described by its own van Genuchten-Mulalem hydraulic properties. By doing that, the toll to pay was to assume a different shape of the β(h) relationship, depending on the fact that the shrinkage changes the fraction of the macropore system, the hydraulic properties, or both. The higher complexity introduced by these assumptions was to look for keeping some of the physical reality of changes induced by shrinkage.

Response: Thank you for your insightful comments. Below are our response and also the revision to your comments:

Line 609-615: Secondly, the results support the suitability, in the crack domain, where capillarity has little effect, of V-G SWRC with effective parameters and a constant relative hydraulic conductivity (K_r=1). In fact, a common defect in classical DPMs is that they often set the hydraulic conductivity of the crack domain (K_c) varies as a function of the saturated degree calculated from the SWRC of the crack domain (i.e Eq. (25)). This will lead to an unreasonable extremely low K_c in drying initial conditions (Aguilar‐López et al., 2020). Setting K_r=1 ensures that the magnitude of K_c only depends on the crack area or the saturated degree of the soil matrix domain, which provides

a potential solution for remedying the shortcoming mentioned above.