

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
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## Comment on hess-2021-150

Anonymous Referee #2

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Referee comment on "A scaling procedure for straightforward computation of sorptivity"  
by Laurent Lassabatere et al., Hydrol. Earth Syst. Sci. Discuss.,  
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This is an excellent paper that provides scaling equations to estimate sorptivity for a wide range of hydraulic functions as well as initial and final soil moisture status. The mathematical derivation is thorough and accurate to the best of what I was able to follow. I have two main comments and a few minor corrections.

**Comment 1.** Eq. (22) gives rise to contrasting values of sorptivity for the different hydraulic conductivity functions. The authors attribute this difference to the dependence of the parameter  $c_p$  on the hydraulic functions (see section 4.4). However, sorptivity as defined in Eq 22 also varies with  $|h_g|$  and  $2|h_a^*|$ . Indeed, the authors defined a variable  $c_p' = c_p - 2|h_a^*|$ . Therefore, consider deriving shape indices for  $c_p'$ .

**Comment 2.** What is the value of  $h_a$ ? I suspect it is equal to  $h_g$  for the Delta and BC models and zero for the others. If that is the case,  $|h_a^*| = 1$  for the former two and 0 for the others (see the top of Page 5). Thus,  $c_p' = c_p - 1$  or  $c_p' = c_p$ .

If you plot  $c_p'$ , the curves for  $c_{p,d}'$  and  $c_{p,BC}'$  in Figure 3 would be lowered by 1 and the in (a) and (c). This would reduce the dissimilarity between the various hydraulic functions a bit.

### Other Small Comments

- In the first line of the introduction, verify if sorptivity is actually used for desorption.
- Eq (4), Eq (5), and elsewhere there is no need to show the detailed step-by-step derivation of straightforward algebraic manipulations.

- In the last paragraph of Page 3, rewrite the sentence that starts with "Secondly, ...".
- In the same paragraph as above, define "BEST."
- In the same paragraph as above, introduce hydraulic functions starting with the delta function to be consistent with how the equations are presented.
- Rewrite equation (6) using the Heaviside function since  $H$  is defined underneath and later references use  $H$  as well.
- Postpone the introduction of the scaling parameters section 2.1, where they are used.
- Consider moving Eq (23) (definition of  $c_p$ ) to just after Eq (15), where  $c_p$  is initially introduced. Also, provide more information of what assumptions were used by Haverkamp et al. in deriving  $c_p$ .
- Edit the incomplete first sentence of section 2.2.2.