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Dear Editor,

We have considered all the review comments carefully and revised the paper accordingly. The details of our revision and individual response (blue) to each comment (black) are attached.

In addition to a clear copy of the revised manuscript (Luo_et_al_manuscript_R4.pdf), we have included in the resubmission a marked copy (Luo_et_al_manuscript_R4_M.pdf) with changes highlighted. Line numbers provided in our response to the comments correspond with the marked copy (Luo_et_al_manuscript_R4_M.pdf).

Thank you for considering our manuscript for possible publication in *Hydrology and Earth System Sciences*.

Yours sincerely,
Jun Kong

Responses to the Editor's comments

1. This sentence is not clear. It should be rephrased. It could even be erased, as it does not seem to be strictly relevant for the rest of the work.

We removed this sentence (Line 67).

2. Here it should be stressed that the geometry and the assumptions used lead to a cylindrical symmetry, so that the physical quantities are function of the radial coordinate only.

We modified accordingly. We state "the same velocity is assumed on the arc (w) for a given radial distance r, leading to radial flow only" (Lines 169-170).

3.Possibly, this should be substituted or integrated with "longitudinal vertical cross section".

We changed "side view" to "lateral vertical cross section" (Lines 138 and 764) since *ABCD* is a lateral cross section.

4. The use of "x" is confusing, because it recalls the use of a Cartesian coordinate system. I think that "x" should be replaced with "r", throughout the whole paper.

As suggested, we replaced "x" by "r" in the whole manuscript (e.g., Lines 152, 153, 160, 170 and 194).

5. Here it is important to stress which assumptions support the cylindrical symmetry and finally the "radial-flow condition". I think that among the assumptions, the condition that the aquifer bottom is horizontal is missing.

We rephrased accordingly. We state "homogeneous and isotropic aquifer with a horizontal bottom" (Line 166) and "the same velocity is assumed on the arc (w) for a given radial distance r, leading to radial flow only" (Lines 169-170).

6. This should be explained in a better way, because if water flow in the vadose zone is negligible, there is no aquifer recharge! As a consequence of the other assumptions and of the boundary conditions, there is no flow in the aquifer.

We made it clearer. At steady state, the water content distribution in the unsaturated zone does not change and hence we can assume that rainfall is equal to the replenishment of the saturated zone with a magnitude that is less than the saturated hydraulic conductivity (else overland flow will appear) (Lines 166-168).

7. Ponding depends on the relationship between "rainfall" and saturated K at the soil surface.

Therefore, the use of the word "recharge" here might not be fully rigorous.

We changed "recharge" to "rainfall" (Line 166).

8. It should be stressed that equation (1) is valid under the assumptions mentioned at the end of section 2.

We state "Under the abovementioned assumptions, groundwater flow in an ASA (Figure 2) can be described as (Fan & Bras, 1998; Paniconi et al., 2003; Troch et al., 2003)" (Lines 192-193).

9. This equation should be substituted with equation (2), because steady-state conditions have been assumed, so that this transient equation is not used throughout the whole paper.

We removed equation (1) (Line 194).

10. It should be specified the fact that this is the radial flux and that the unit length is considered along the radial direction.

We indicated that q [L^2T^{-1}] is the radial flux per unit length along the radial direction r [L] (Line 195).

11. The "hillslope-storage equation" includes the slope of the aquifer bottom, which does not appear in equation (1), because the latter is applied to a flat-bottom aquifer. I am not sure that this equation was first proposed by Troch et al. (2003), as I knew it since when I was a student in late 80's.

The hillslope-storage Boussinesq equation includes the aquifer slope (i). However, a horizontal aquifer bottom (i.e., $i = 0$) leads to sin (i) = 0 and cos (i) = 1. It further can be reduced to equation (1) at steady state. We state "Equation (1) is a special case of the hillslope-storage Boussinesq equation proposed by Troch et al. (2003)" (Lines 195-197).

12. This sentence is too simple, as the results of the paper by Paniconi et al. (2003) are more complex. Moreover, "seven" (not "nine" different geometries are considered (see section [37] of the referenced paper).

We modified accordingly. We state "Paniconi et al. (2003) validated the hillslope-storage Boussinesq equation by comparing it with a 3D Richards' equation model and found that predictions of the hillslope-storage Boussinesq equation matched well those of the 3D model for seven different geometries. For conciseness, readers are referred to Paniconi et al. (2003) for more details about the validation" (Lines 197-201).

13. All these cases refer to hillslope aquifers: none of those cases refer to coastal or plain

aquifers. This should be mentioned and possibly discussed.

We state "Subsequently, the hillslope-storage Boussinesq equation was used to for different analyses (Hilberts et al., 2005, 2007; Hazenberg et al., 2015, 2016; Kong et al., 2016; Luo et al., 2018), all of which focus on hillslope aquifers where the aquifer bottom is usually sloping. The hillslope-storage Boussinesq equation assumes that groundwater flow is parallel to the aquifer bottom (the Dupuit-Forchheimer approximation). Therefore, it can be applied to coastal unconfined aquifers where the aquifer bottom slope is usually mild (Lu et al., 2016)" (Lines 201-207).

14. Check the spelling. I think "s" is missing at the end of the first author's surname: Hilberts.

We corrected the first author's surname (Line 202).