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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_R3.pdf), we have included in the resubmission a marked copy (Luo_et_al_manuscript_R3_M.pdf) with changes highlighted. Line numbers provided in our response to the comments correspond with the marked copy (Luo_et_al_manuscript_R3_M.pdf).

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

Yours sincerely,
Jun Kong

Responses to Referee #1's comments

The authors have addressed all my comments and revised the manuscript accordingly. Thus, I recommend publication in present form.

Thank you!

Responses to Referee #3's comments

The paper presents analytical solutions for seawater intrusion in annulus segment aquifers. The solutions are validated with third-party experimental data. Then the simple solutions derived are subject to a traditional sensitivity analysis and compared with those valid for rectangular aquifers. The new concepts in the revised version of this paper are limited and the paper, though well-written, is not suitable in my view for publication in HESS.

Analytical solutions are effective tools to assess the extent of seawater intrusion. The advantages of analytical solutions are that they are computationally efficient, can be used as test cases for numerical models, and can reveal the explicit relationships between parameters that influence seawater intrusion. Topography plays an important role in groundwater flow and hence seawater intrusion. It remains unclear whether analytical solutions of seawater intrusion for strip islands are appropriate for annulus segment aquifers (ASAs). It is moreover additionally unclear how island geometry affects the freshwater-seawater interface location and watertable elevation of ASAs. In this study, analytical solutions are derived for steady-state seawater intrusion for ASAs, with a focus on the freshwater-seawater interface location and its corresponding watertable elevation. After comparing their predictions with experimental data (Memari et al., 2020), the analytical solutions are employed to investigate the effects of aquifer geometry on the freshwater-seawater interface location and watertable elevation in ASAs.The key points of this manuscript are:

- Analytical solutions of steady-state seawater intrusion were derived for annulus segment aquifers
- Among three different aquifer geometries, divergent aquifers have the lowest watertable and hence the most extensive seawater intrusion
- Aquifer geometry effects on seawater intrusion depend on the aquifer width and distance from the circle center to the inner arc

Moreover, I have a fundamental doubt: why is the equation written in plane (x) coordinates when the appropriate system of coordinates is obviously radial? And in fact the 2020 referred paper including the experiments used to validate the authors new formulae writes Darcy's law in radial coordinates. How does the geometry play in the claimed differences between wedge-like and rectangular geometry? If some approximation is used, it should be clearly explained.

We thank you for the comments and explained the approximation accordingly (Lines 168-176). In the manuscript, we assume the velocity is the same everywhere on the arc (w) for a given radial distance x.

We state "Equation (1) is the so-called the hillslope-storage Boussinesq equation and was first proposed by Troch et al. (2003). For a given radial distance x, this equation assumes that the velocity is the same everywhere on the arc (w). Based on this assumption, the 3D flow problem can be simplified to 1D, making it possible to consider geometry effects analytically. Paniconi et al. (2003) validated equation (1) by comparing it with a 3D Richards' equation model and found that predictions of equation (1) matched well those of the 3D model for nine different geometries. Subsequently, equation (1) was used to for further analyses (Hilbert et al., 2005, 2007; Hazenberg et al., 2015, 2016; Kong et al., 2016; Luo et al., 2018)." (Lines 168-176)

Moreover, this assumption was already adopted in the referred paper (equation on page 4 of Memari et al., 2020). Furthermore, as shown in Figure 3, our analytical solutions can predict the freshwater-seawater interface accurately. This in turn suggests that this assumption is reasonable.

As shown in Section 4.3, the geometry plays a role in the differences between wedge-like and rectangular geometry.

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