

“Responses to reviewer’s comments”

Ref.: Ms. No. GSD-D-21-00157

Assessment of mechanical dispersion effects on mixing zone under extreme saltwater intrusion

Reviewer #1

Overall, this is an interesting topic related to saltwater intrusion problems. The paper is interesting and easy to read, and the research perfectly fits into the scope of the journal. However, before publication, moderate revision is needed. I recommend that authors improve some issues as mentioned in the following.

Response: In the following text, we answered all the questions accurately and precisely.

1.Highlight: replace "SI" with "saltwater intrusion"

Response: It is modified.

2. Abstract: present some quantitative results of the study.

Response: We now modify the abstract part. The quantitative comparison of mixing zone in passive and active SI is added. We also put the repulsion behavior of toe position in active SI.

3. Introduction section ignores the systematic review of published work related to the subject of this paper and exploitation of the gap of knowledge in this field. Please conclude such needed expression before line 111.

Response: The gap of knowledge was already stated in the introduction part (i.e. lines 88-90). We now modify some lines and add recent literatures for better understanding.

4. Line 102-111: I recommend including a phrase with indicating the novelty and differences between this paper and similar research.

Response: The first line of the last paragraph is now started with “Due to scarce of research on active SI”. Moreover, we now indicate three recent types of research on overexploitation hazards to state the novelty of the manuscript.

5.Lines 102-111: Please describe the necessity of (or advantages of) such investigation and why previous studies did not tackle to such application.

Response: We revised the last paragraph of the introduction part in a way that the necessity of research on the freshwater head decline as a result of active seawater intrusion becomes clear.

6. Lines 117-126: The definition of the considered SI indicators can be presented as the associated equations to better and clear definition of them.

Response: With respect, there is not an equation for the studied SI indicators (i.e. x_{toe} , x_{tip} , $w_{m1,2,3}$). However, the mentioned lines are now modified for better representation.

7.Lines 117-156: This section can be shortened and the detailed explanations can be moved to figures and tables of this section.

Response: The section is modified. Some unnecessary descriptions are now removed. Some others are moved to another section.

8. Conclusion: It is not necessary to include too much information, rather than explains the major results. I recommend including a paragraph with indicating the contribution and differences between this paper and similar research and some information about how such investigation can be extended to other cases with other objectives.

Response: The conclusion part is now converted to one paragraph. A sentence as “The results of this study highlight the role of these two parameters in shaping the extent of seawater intrusion especially under the active state which was not studied in detail at the previous works of literature” is now added to clarify the distinction of the current work with others.

9. Please explain how the findings of the results extend to the field and the considered case study and how those extend to other cases. What is the basis for the validity of such observation for other conditions?

Response: The field-scale cases were modeled to validate the findings of the study. The work generally wants to highlight the effect of dispersivity (especially the transverse one) on the behavior of the transition zone. We believe that sufficient description is available in the manuscript for this respected question.

Reviewer #2

General comments: The present work is nicely presented, and it is under the scope of the journal. Also, the manuscript is well written, and citation given whenever required throughout the manuscript. I would appreciate the efforts made by the authors and suggest a minor revision before it is considered for publication in the GSD journal. I hereby recommend that work is worthy to be published in this journal after addressing the following comments.

Response: We modified the text according to the comments accurately.

Reduce the length of the sentences throughout the manuscript because it is hard to read the complete sentence. Please give equal weightage to the paragraph.

Response: We once more read the entire manuscript and revised any lengthy paragraphs.

Highlights: Authors mention three highlights in the current manuscript, but they will not serve the purpose of highlighting their work in the future, so I would recommend please you rewrite the highlights. Highlights must highlight your research work and triggered the reader interest in the article.

Response: Two other bullet points are now added to present the outcome of the paper.

Graphical abstract: Please modify the graphical abstract; it does not give the sense of work that you have done in the article.

Response: The graphical abstract is now changed entirely for better presentation of the study.

Abstract: Line 18: Rephrase this sentence entirely.... The previous studies primarily identify the two types of SI processes like active SI (seawater intrusion) and passive SI (submarine groundwater discharge).

Response: The proposed sentences of the reviewer are replaced with the initial sentence.

Line 30: The FHD abbreviation is redundant, please remove it.

Response: It is removed in the revised version.

Introduction: Line 45: Please rephrase the line entirely

Response: The sentence is now replaced with "Progressive seawater intrusion (SI) into coastal aquifers is one of the common effects of overexploitation in coastal areas (Custodio, 2002)"

Line 47: The sentence is not clear; please rewrite "Mixing zones on SI delineate."

Response: For better clarification, it is replaced with "Mixing zones delineate the water exchange between groundwater and intruded seawater and are affected by mechanical dispersion and molecular diffusion. (Lu et al, 2009)"

Line 54: Not clear sentence "In passive SI, the hydraulic gradient inclines towards the sea, forcing density and fresh groundwater flow to work in opposite directions of what????"

Response: To clarify the aim of the phrase, it is now replaced with “In passive SI, the positive hydraulic gradient is towards the sea and forces seawater and fresh groundwater to flow in the opposite direction.”

Methodology: Please mention on what basis the parameters in table 1 selected for the present work ; please give a proper explanation of each term so that the reader can understand its logic.

Response: They were adopted from an experiment conducted at Flinders University, Adelaide, and are provided in detail in Badaruddin et al. (2015)’s study. We now add “The FHD experiment in their study was carried out by a tank with 52 mm width filled by natural sand” in the manuscript. We also add the sentence “The measurement process of soil and fluid characteristics are provided by Badaruddin et al. (2015) and is not stated here for brevity.” to address the reader to find the process of experiment.

Results and discussion: Slight confusion is happening in the result and discussion part while reading; I would suggest to the author please focus on this part and try to write as explicit as much as you can (Improvement is required). Please write like this Figure 2 (a, b and c) Figure 8 legends are missing.

Response: The beginning of all paragraphs in this section is now modified. The text once more was read carefully and any amendment for explicit writing has been implied. The legend of Figure 8 is added. For a better description, some sentences are now removed. Some quantitative comparison is now inserted for simulated cases.

Line 238: Please reduce the length of the sentence

Response: It is now changed to two sentences.

Line 326: What is the seawater concentration (please explain in the manuscript)

Response: The sentence is now modified as “35 kg/m³ salt concentration was considered for seawater boundary”.

Line 348: Please write "in this research work"

Response: It is done.