Title: Palaeo-modeling of coastal salt water intrusion during the Holocene: an application to the Netherlands
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MS No.: hess-2013-486

The manuscript “Palaeo-modeling of coastal salt water intrusion during the Holocene: an application to the Netherlands” is an interesting study which shows that the existing groundwater salinity in a coastal aquifer is not only the result of the current state of the system, but can be significantly influenced by its recent geological history. Besides showing an interesting case, supported by extensive data, manuscript is well illustrated by what it is, overall, a very attractive paper; however,it has aspects that must be corrected or treated further before publication. Therefore, I would recommend this paper for publication in HESS but only after major changes to manuscript.

It is a paper of complicated reading for several reasons:

1. Treats many issues of the same subject (evolution of salinity during the Holocene in a coastal aquifer in Netherland) which, in some cases, are not sufficiently clear because the information provided by the authors is insufficient for reader understanding. For example, there is insufficient information in the following sections: description of the study area, parameters and boundary conditions of the mathematical model, hydrochemical conditions selected for the hydrochemical analysis ...
2. The structure of the manuscript is deficient: the description and the geological setting of the study area are included in the methodology chapter, the sensitivity analysis of the model should be located before model validation ... Within the sections also there are mixture of different themes. For example, section 3.2 is repetitive and treats in a mixed way the evolution of groundwater salinity and the total amount of salt present in the model, both of which should be treated separately to facilitate the reader understanding.
3. The author is too meticulous in some sections which might be simplified to improve of the reader understanding. For example, Figures 2 and 6 should be more simplified and the Holocene palaeo-geographic development and the evolution of groundwater salinity chapters.

Another aspect that the author should address deeper is the eastern side boundary condition of the study area. The mathematical model has been made with a closed boundary throughout the period studied. Ie, through that limit has not been produced freshwater input in the 8500 years modeled. This is critical in the evolution of salt washing that has occurred since the 6500 BC transgression. The authors consider a limit of no flow due to the existence of a groundwater divide whose regional character is not sufficiently justified. Just as it has remained unchanged throughout the period considered. If through this limit occurs or has occurred freshwater input, the paper conclusions would not be valid.

Specific comments

Abstract

The abstract is too general. The sentences of generic character should be reduced and concrete results obtained in this paper should be added.

Methods

- Paragraph "Study area and Holocene palaeo-geographical development" should not be included in Methods, but should be a separate chapter of description of the study area.
- The authors considered a dividing of regional flow in the eastern side due to the recharge that occurs in the ice-pushed ridge. However, given the depth of the aquifer in this area is greater than 200 m and the existence of levels of low hydraulic conductivity about 50 m b.s.l., I do not find it difficult to believe the existence of a shallow local flow with a divide in this position and a deeper regional flow with a general EW component. Has this situation changed over time? This subject would have great impact on the salt washing that has occurred over time.
- This section (description of the study area) should include any information about Maassluis formation due its significance in the evolution of the groundwater salinity of the aquifer.
- Further explanation would be necessary about the infiltration scheme used since 1957 in the study area.

Palaeo-hydrogeological modelling.

- Please, consider adding a figure to represent the conceptual model used in mathematical modeling with the different boundary conditions considered.
- As I said earlier, the eastern side boundary condition should be addressed in more depth by the authors.
- What section has been modeled, the transect AB or the A'-B?
- From sentence found on lines 18 and 19 of page 13713, is understood that the Maassluis formation occupies the entire edge.
- K and S values used in modeling should be provided.
- Why authors speak of time slices and not of stress periods?

Hydrochemical facies analysis

- Authors should describe in more detail the characteristics of different hydrochemical zones considered in the study. In this sense, it would be interesting to complete the table I with more hydrochemical information.
- What is the difference between recharge and surface water in Table I?

Model validation

- It is desirable that the authors indicate the number of points used for model validation and also add their location in Figure 1.

- RMSE values (head and concentration) should be given in% for knowing the degree of mathematical model validity without having to check the range of variation of these parameters in the study area.

Evolution of groundwater salinity

- This section is very confusing and, in some cases, repetitive. Authors should simplify and structure more. Speaking, first, about the evolution of the salinity based on Figure 6, that should contain less phases and should coincide with the different phases seen in Figure 2 (it should also be simplified), then of the Total SP based on Figure 7 and, finally, of the evolution of water types considered. Authors should not intermix the different topics.
- From reading the text is deducted the river Vecht is a gaining stream and this should be made clearer.

Sensitivity runs

This section should come before the section on model validation.

Figure 1.

- Please, in the legend include the age of the materials.
- The different frames of the legend are not easily distinguished. It would be better to use different colors.
- What kind of rock is "heterogenous"?

Figure 2

I recommend simplifying the text shown in the different stages, leaving an explanatory chart by stage considered.

Figure 6

- Please, add the x axis in the right column.
- It would be interesting that graphs coincide with moments shown in Figure 2.
- Please, locate in the graphs the position of the coastline in each of the moments
- Please, locate in the graphs areas with pumping, river and lakes