

Interactive comment on “Groundwater salinity variation in Upazila Assasuni (southwestern Bangladesh), as steered by surface clay layer thickness, relative elevation and present-day land use” by Floris Loys Naus et al.

Anonymous Referee #1

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Overview of Naus et al. (2018)

This study explores groundwater salinity variations in a village in southwestern Bangladesh using (1) geological evolution, (2) groundwater and lithological sampling, and (3) modeling. The paper is well written and logically describes the aim, methods, and findings of the groundwater investigation.

Major comments

–Figure 1 seems insufficient for the reader to fully understand the field site. An ad-

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ditional satellite image would give the reader a better sense of the region. Perhaps consider a two-paneled figure with a satellite image adjacent to the site diagram. An additional figure in an appendix would also suffice.

–To connect back to the first paragraph of your introduction, I would be interested in how you could relate your findings back to drinking water availability. Is there enough freshwater to sustain the villages with drinking water? Is it likely that the freshwater recharge in high elevation regions will recharge at a pace similar to the salinization from the nearby low-lying regions and aquaculture? See line 520.

–One of the main conclusions is that elevation is correlated with groundwater salinity, where higher elevations are fresher than lower areas. This appears to be a poldered region surrounded by tidal creeks (as noted by the embankments in Fig. 2). The polder regions in SW Bangladesh are highly altered. The inhabitants have cleared forests, built embankments, compacted the landscaped by limiting flooding, dug ponds, and raised areas around their villages. There is a massive amount of sediment movement at the surface. Does this study area have ~2 m natural variation in topography (partial answer in 4.1.3 b)? Or is the difference in elevation observed across the transect a recent development due to anthropogenic activity? If so, does that change how you would interpret the correlation between groundwater salinity and elevation? Could the salinity variations be more closely related to clay cap thickness?

Minor comments and additional questions

–What are the coordinates for the study area? This should be included in Fig. 1 or line 76.

–I’m a bit unsure how the “groundwater observation well” and “groundwater sample” data are different. Why include P16 and P17?

–Some of your groundwater tubes appear to be installed in the clay. In similar field environments, I have had difficulty extracting groundwater samples from clay layers,

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especially using hand-flapper drilling methods. It is always important to acknowledge the potential inaccuracies associated with this type of field environment. This type of tube installation can be a major source of error when dating or looking at cation exchange. Are you confident that you were able to evacuate the installation water, pump the tube, and extract groundwater despite the low permeability of the clay layer? It may be worth noting the potential limitations of the hand-flapper installation method.

–The variation in the clay cap thickness is substantial. Figure 3 shows the thickness varying from 5 to 35 m. The thickness of the cap has to play a major role in present-day surface water influence on groundwater salinity. Yet Figure 7 shows both freshening and salinization under the thickest region of the clay cap (near P9, P10, and P15). Can you better explain how the freshening and salinization stages can differentiate between current day processes (e.g. salinization due to aquaculture) and depositional processes (e.g. salinization due to evaporation of pore water during deposition of sediments 10 kyr BP)? Can you discuss any uncertainties associated with this methodology (without the use of dating), especially in an area with highly variable connate water? Most of these questions arose from the section 3.8.2. You do a nice job of answering some of these questions in your phased subsurface evolution in section 4.

Additional questions for discussion

–Do you see any seasonal changes in groundwater salinity associated with exchange with the tidal channels? If you see signatures of salinization and freshwater recharge in the thinned cap areas, how do you expect the groundwater signatures to compare near the tidal channels?

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