

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.

Overview of Naus et al. (2018)

This manuscript analyzes ground water salinity variations in southwestern Bangladesh using geological reconstruction, lithological sampling and modeling. The manuscript addresses a very important issue of water resource problem that the southwestern Bangladesh currently facing. According to the script ground water salinity mostly depends on the surface elevation. In the higher lying area with a thin surface clay layer always have a clear pattern of fresh ground water which stored by directly infiltration or via rainfed pond. The fresh ground water is bordered by brackish-saline water at greater depth under the higher area. On the other hand, lower area often flooded by tides and tidal surges and in the direction of the adjacent lower area saline ground water is found only at relatively shallow depth below aqua cultural ponds. So, here we can find that it is possible to clear the pattern in ground water salinity by using salinity data, PHREEQC-interpreted cation exchange data and to identify the hydrological process and geographical and geological control. Thickness, relative elevation and land used are the most common geographical controlling factor in which the ground water salinity depends.

However, there are some concern summarized below and I hope these comments could help the authors to improve the manuscript.

Major comments:

- 1) I am concerned about the sample preservation process use in the study since nothing was described in the paper. How were the sample preserved since you are running IC and ICP-MS back to the Netherland. I am thinking about NaCl concentration.
- 2) See line 520. 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?
- 3) Your whole paper is based on the correlation between surface elevation and ground water salinity. Ground water salinity is higher when the elevation is lower and ground water salinity is lower when the elevation is higher (Fig 2). Thickness, relative elevation and land used are the most common geographical controlling factor in which the ground water salinity depends (line 546 and 546). But as far I know that 80 percent of the land mass of Bangladesh is made up of fertile alluvial lowland called Bangladesh plain. In plain area salinity basically depend on precipitation, infiltration and evapotranspiration (Yan,2015). So, from my point of view you should think about this too.

Minor comments:

- Line 63: Use it as a simple sentence because you are using too much “and” in one sentence and there should be no comma (and,) after and.
- Line 100: Two groundwater observation wells P16 and P17 were installed a year later but the sample campaign ended so no water is available for them. So, I don't understand why you installed P16 and P17.

- What is the difference between “ground water observation well” and “groundwater sample”?
- It is always important to acknowledge inaccuracy and error in the field work. Some of your tube is installed in the clay and it is very difficult to extract water from this condition. So, are you confident enough that there is no error in your field work? Because you didn't mention anything about that.
- In all over the manuscript there is lots of spacing problem. I can give you some example. In line 55: “Boun daries” should be “boundaries”. In line 66: “Re constructed” should be “Reconstructed”. And you can also check Line 216,217,232,244.
- 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?

Figures and Table:

- In Figure 1, there is no coordinates of the study area.
- 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)?
- “Figure 1” seems like insufficient and difficult to understand. If you can add an additional satellite image, it will be helpful.
- In Figure 6, what is that dot line indicated.
- In Table 1, you should add more result for ICP-MS and IC test. Example, percentage of Al, As, Be, B etc.

Reference:

- 1) Yan, S. F., Yu, S. E., Wu, Y. B., Pan, D. F., She, D. L., & Ji, J. (2015). Seasonal Variations in Groundwater Level and Salinity in Coastal Plain of Eastern China Influenced by Climate. *Journal of Chemistry*, 2015.
<https://doi.org/10.1155/2015/905190>
- 2) Islam, K. R., & Weil, R. R. (2000). Land use effects on soil quality in a tropical forest ecosystem of Bangladesh. *Agriculture, Ecosystems and Environment*, 79(1), 9–16. [https://doi.org/10.1016/S0167-8809\(99\)00145-0](https://doi.org/10.1016/S0167-8809(99)00145-0)