

Interactive comment on “Comparison of monsoon variations over groundwater hydrochemistry changes in small Tropical Island and its repercussion on quality” by N. M. Isa et al.

Anonymous Referee #2

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This paper presents a study on groundwater chemistry for the island of Kapas in the nation of Malaysia. Groundwater samples are taken from 6 boreholes (all within 120 m from the coastline) during the pre-monsoon (dry) and post-monsoon (wet) seasons. 12 water samples were taken and analyzed from each borehole, with 6 during the dry season and 6 during the wet seasons. Samples were taken in triplicate. Samples were analyzed for major water characteristics (DO, pH, EC, salinity) and major anions and cations, with resulting solute concentrations used to calculate saturation indices. While an interesting case study, I have major reservations as to whether this paper can be published in HESS due to the major issues listed below. While I have listed my rating

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as "reconsidered after major revisions", I am doubtful as to whether the authors will be able to perform the requisite changes to the manuscript due to the small-scale and local nature of the study. There are also a number of minor changes that need to be made (listed below). In general, a native English speaker needs to carefully review the manuscript before re-submission. The grammar is very poor (including the title of the manuscript), and many sentences are not coherent.

Major Issues:

1. In general, this study seems like an interesting case study, but not one that would be applicable to a general worldwide journal audience. The procedures are fairly basic (sampling for typical water characteristics, saturation index calculations for certain minerals), and the study area is confined to a very small locale (6 wells along a 120-m line). The authors claim that the study is general to small tropical islands, but the nature of the study is too confined to be able to support this claim. The results may not even be applicable to the remaining sections of the island, let alone to other islands, especially since the wells were drilled in low-lying, densely-populated areas (although the population density is not reported). In reality, the study is performed along a 120 m stretch of a single island, with hundreds and thousands of other tropical islands experiencing different climatic patterns and human influences. Also, Kapas is located at the monsoon interchange (as stated on page 6410), and hence results seem to be applicable only to islands at this location. Overall, this manuscript reports a local case study that is not applicable (or at least cannot be proved to be applicable) to other study sites worldwide. Hence, the rating of "poor" in terms of Scientific Significance (see ratings above).

2. Even when results are reported, the authors do not go into great detail about the CAUSE of the results. On pages 6415 and 6416, the authors state that the evaporation process "may" contribute to salinization, and that infiltration of leachate from sewage piping systems "may" contribute to salinization. These are stated, but not tested nor is information given that could support the hypotheses. The authors must state substan-

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tiated causes for the conditions observed in the groundwater. Without a firm grasp on the causes, water management practices cannot be adjusted. Otherwise, the study is merely a chemical analysis of water. The authors do state that Na and Cl increases in significance during the dry season. However, I think it is quite intuitive that Na and Cl would increase in importance during the dry season, as the freshwater lens thins. Groundwater chemistry analysis is not needed to demonstrate that freshwater volumes in the aquifer decline during the dry season. Besides being intuitive, this has been shown in hundreds of other studies.

3. The implications of the study are not clear. The water collected from the six boreholes is fresh (all less than the freshwater limit of about 0.89 ppt, used in many other island hydrologic studies) in each of the 216 samples during both the dry season and wet season, and no data are available regarding other contamination (fecal coliforms, nutrients, trace metals, etc...). Hence, there is no indication that the water is not safe to drink (or that there is limited amount) during both the pre- and post-monsoon seasons. So how can results lead to better water management, particularly in regards to the tourist industry (which the authors point out is the reason for the study in the first place)? If there are no problems, how will the information "be of value in setting priorities and allocating resources within regulatory agency", as stated by the authors on Page 6420?

4. In regards to the quality of the water (in terms of salinity), the authors do not provide information regarding the thickness of the freshwater lens. They report only borehole depth and water table elevation, but not the depth at which the groundwater transitions from being fresh to being brackish. This is very important in terms of the quantity of groundwater that is available for use during the seasons of the year. Particularly since the context of the manuscript is providing enough clean, fresh water for the high-activity tourism season (e.g., Page 6407: the authors state that heavy withdrawals and over-pumping leads to salinization in the aquifer...), it seems that this information is vital. It would also help with explanation of the chemistry results, particularly in regards to the

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increase of Na and Cl during the dry season.

Minor Comments: (By the way, this would be much easier if line numbers were provided, instead of just page numbers)

- The abstract needs to mention the island that is studied! (Kapas)
- The first few sentences of the Introduction are too familiar, and the English needs to be checked rigorously (and throughout the manuscript). "the cult of busy life" in particular needs to be changed.
- Page 6406: "small tropical islands are known..." Please define small in terms of scale. A few square kilometers? Tens of kilometers? Many "small" islands do have surface water, but it depends on how you define "small".
- Page 6407: "heavy withdrawals" and "over-exploitation": aren't they the same thing?
- Page 6407: "evaporated salt": salt does not evaporate. But salinity can increase as the water is evaporated.
- Page 6407: "from inundation": are you referring to salt spray, or wave overwash? Please be more specific, and cite specific examples of inundation occurring.
- Page 6408: Ranges of rainfall depths are provided for the dry season and wet season, but there is no indication as to where these depths were measured. I assume the authors are providing data from Kapas, but this is not stated. In general, refrain from including detailed information about the study area in the Introduction, especially if the study area has not yet been mentioned!
- Page 6408: "a national view": which nation are you referring to? I assume Malaysia, but this is not stated. Besides, if the study is aimed at a national view, there perhaps it is not appropriate for a general journal readership.
- Page 6409: "and modeling": What modeling are you referring to? Groundwater flow, contaminant transport, climate, etc...?

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- Page 6409: first time that "Kapas Island" is mentioned. Probably does not belong in the Introduction, or perhaps the last paragraph when outlining the objectives of the paper.
- Page 6409: "can be applied in other tropical islands": Please be more specific. To what specific geographic locations would information be applicable?
- Page 6409: "concerning groundwater in small tropical islands": Again, this study is extremely limited in terms of scale (only 120 m line of wells on one island), and cannot be generalized as the authors attempt to do.
- Page 6410: the authors have a general conceptual model of small island hydrogeology (Figure 1). However, a detailed schematic of the hydrogeology of Kapas is needed. The authors then can refer to this throughout their discussion.
- Page 6410: the last paragraph of Section 2 should be the first paragraph of the section. Better to start with basic geographic location, and then move into the geologic details.
- Page 6410: "bimonthly" should be "semi-monthly"
- Page 6411: Equation at the top of the page should not be included. Instead, state the calculations in the text.
- Page 6411: Typically when taking groundwater samples for chemical analysis, a more rigorous procedure is followed to make sure that the water being sampled comes from within the aquifer (rather than just pumping for 10-15 minutes...this might be adequate, but data are required to show that water characteristics have stabilized through time as pumping continues...without this quantitative procedure, the results may not be valid).
- Page 6412: Which laboratory was used for major ion analysis? Is it certified?
- Equations (1)-(3) are basic to any water chemistry handbook, and probably should not be included in a journal paper. If any, only Equation (3) should be included.

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- Page 6413: The use of geochemical modeling and calculating SI values should be mentioned previously, perhaps in the Introduction. And also state WHY these are used.
- Page 6414: When presenting results, also include the standard deviation. And then discuss results (for example, why is there such a large difference between min and max DO, for each of the boreholes?)
- Page 6414: At some point, the reader needs to know the potable limit of groundwater (in terms of ppt), so that the results shown in Table 2 can have some context.
- Page 6415: "mixed with the brackish water": the authors refer to Figure 1, but information regarding the actual freshwater lens thickness within the vicinity of the boreholes is not reported. Information regarding the lens thickness must be reported so that the reader can decide if up-coning of the transition zone indeed is a cause of aquifer salinization.
- Page 6416: "clearly explained the important roles of rainfall as its' groundwater recharge": Rainfall is the only source of recharge. This is obvious, and hence this sentence can be deleted.
- Page 6418: The authors need to explain why there is more precipitation during the post-monsoon. Again, showing results is one thing; explaining the CAUSE of these results is quite another matter, but must be included.
- Figure 9 is the same as Figure 8
- Figure 10: need much more narrative and explanation in the text
- Page 6419: avoid the use of the word "excellent" when describing your own research

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