Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-16-RC2, 2020

Hydrology and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "Water stable isotopes (δ^2H and δ^{18}O) in the Peninsula of Yucatan, Mexico" *by* Eduardo Cejudo et al.

Anonymous Referee #2

Received and published: 19 May 2020

This technical note presents a dataset of stable isotopes in precipitation, groundwater, and lake water in the Yucatan Peninsula (YP), Mexico compiled from published and unpublished information. Using the compiled data the authors defined a regional meteoric water line for the YP and attempt to evaluate the spatial variability of the stable isotopic composition of groundwater in the region. Even though I appreciate the authors' effort, the lack of information regarding the depth of collection of the groundwater samples hampers the usefulness of the dataset and does not allow for an accurate inference of groundwater recharge and flow processes. Because of this important constraint, I consider the dataset will be of little to no use in future studies. In addition, the manuscript presents several major methodological and data interpretation issues that limit its suitability to be considered for publication in HESS. I describe these issues in detail below.

Printer-friendly version

Discussion paper

Major issues:

An analysis of the factors influencing the stable isotopic composition of precipitation was not carried out. I am not sure how the authors came to the conclusions in P1 L16-19. Supporting such statement would require a thorough investigation of the potential sources and trajectories of moisture contributing to local/regional precipitation (e.g., using Lagrangian back trajectory models) and the estimation of the fractions of convective (and stratiform) precipitation among other types of analyses.

The search literature protocol should be described in more detail. In general, the Boolean operators (AND, OR) and other type of operators (e.g., between and within) must be used to connect keywords (e.g., water, isotope, hydrology, etc.) appropriately. A thorough literature review should clearly indicate the used operators and how they were used to connect the search terms. In addition, since the study region is located in a Spanish speaking country, it is likely that valuable information has been published in scientific journals published in that language. Thus, the search should also be done using terms in Spanish and include literature databases that publish literature in that language such as Scielo, Latindex, Redalyc for completeness.

There is an important limitation with the compiled groundwater data. That is, in most of the cases the depth at which those data were obtained is not reported. I checked the Supplementary Material 1 and only 18% out of the 213 groundwater data reported this information and the depth of collection varied largely between 1 and 120 m for the cases in which this was included. The former issue hampers the correct interpretation of the groundwater isotopic data, while the latter indicates that constructing a groundwater isoscape that does not take into account the sampling depth is not meaningful. Unfortunately, these limitations hamper the utility of the compiled dataset for better understanding the groundwater hydrology of the YP in this and future studies.

As stated by the editor in the first revision of the manuscript, the basics of isotope hydrology are overemphasized and the value of the compiled data and related inferences

Printer-friendly version

Discussion paper

are not clear for the reader. For example, the basics on the factors that influence the temporal variability of the isotopic composition in precipitation is substantially described in lines P4 L108-117, but only a couple of sentences are regarded to the interpretation of the compiled data (P4, L117-119; in addition the reference Li et al. 2015 is missing from the list of references).

In their response letter to the previous revision by the editor the authors claim that the major finding of their work is the determined RMWL. However, the presented RMWL resembles well one previously reported for the study region (P4 L102-103). Thus, I do not find anything novel about this finding.

The authors mention a supposed altitude effect. Such effect is only apparent (i.e., the stable isotopic composition of rainfall decreasing as altitude increases) because the y-axis of the figure is in reverse order than in the other isotopic plots presented in the manuscript. Even though it is not clear what the data presented in Fig. 4 represent (this must be clearly described in the caption), it is very complicated to argue for a potential altitude effect given the very small range (< 100 m) in elevation among the sampling stations. In addition, I consider that the information presented is not relevant at all for the evaluation of the altitude effect since at some elevations there is a lot of information (6 and 27 m elevation) in comparison to others (a single value at 70 m elevation). I thus suggest the authors to reconsider the statements in P5 L129-133 accordingly.

The “retention of the meteoric of isotopic signature in groundwater that suggests fast recharge after precipitation” is argued. Although the aforementioned interpretation of the data could feasible depending on the hydrogeological characteristics of the groundwater reservoir, I am not sure how the data presented in Fig.5 alone supports this argument. This is because it is not clear when the groundwater samples were collected in comparison to the precipitation ones, and because the characteristics of the groundwater reservoir are not described. A through interpretation of the data would require the consideration of hydrogeological characteristics of the aquifer.

Even though it is clear that groundwater recharge is influenced by evaporation effects, the geographical location of the monitoring sites for itself (north versus south) cannot explain the differences among the stable isotopic composition of water in the different states of the YP (P5 L141-142). The variability depends on the specific features of each of the monitoring locations (e.g., type and spatial distribution of the soil/s, hydrogeological features, presence of open water bodies, etc.). However, since such information is not presented, it is not possible for the authors to explain the observed evaporative effects in the isotopic signal of groundwater across the study region. Because of this, most of their inferences in P5-P6 L144-170 are strongly speculative and are unsubstantiated by the presented data.

In open water bodies the lighter water isotopes are preferentially removed during evaporation, so the remaining liquid phase is enriched in the heavier stables isotopes of water (O18 and D). Thus, the inference of the authors in P6 L173-174 is erroneous.

The isotopic data presented in the figures is not sufficiently described and discussed (e.g., the GW, lakes, and seawater data in Fig. 1; the d18O versus d-excess variability across seasons in Fig. 2; the variability of the stable isotopic data at different elevations in Fig. 3).

Sections 3.3, 3.5 (section 3.4 is missing) and 4 are not directly related to the compiled dataset. Section 3.3 presents a summary of literature findings related to vegetation water uptake and sections 3.5 and 4 read rather like commentaries.

Minor issues:

P1 L22-24: Delete as these concepts are widely known by isotope hydrologists.

P1 L35: What do you mean by “input parameters”?

P1 L55: Pore water data is not presented.

P3 L63: Describe what is the “Virtual library and Catalogue” and why it was included for the literature search.

P3 L67: Specify that most of the compiled groundwater data did not include information about the sampling depth.

P3 L74: Specify what proportion of the data was interpolated to estimate the d2H values.

P3 L83-86: As mentioned above, I consider that constructing an isoscape without accounting for the depth of collection of the samples does not provide relevant information. I thus suggest to delete this analysis from the manuscript.

P4 L95: What does “on that matrix” refers to?

Figure 1: The map is confusing. It is not clear whether the text within the map refers to the states or the administrative regions. As the states are often referred to in the manuscript, I would suggest that the states names are shown in the figure instead of the administrative regions. Or even better, to present both with the text in different colors for the states and the administrative regions matching the line colors presented in the legend of the figure (red and black)

Figure 2: Specify what the circles of different colors and sizes represent as well as the error bars. This presents data from different water sources published in different studies but those are never discussed in the manuscript. I suggest to describe and discuss all the data presented in the figure or simply not showing it.

Figure 4: Describe what the dots of different color and size as well as the error bars represent.

Technical corrections:

P2 L31: change “d coefficient” by “d-excess” and use the latter consistently in the whole manuscript.

Correct the number of the subsections in section 3 (i.e., there are 2 subsections 3.2).

Figure 2: specify what the solid black line in the plot represents.

Figure 5: Delete the word “Groundwater” placed before “isotopic composition. . .”. Specify what the dashed line represents.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-16, 2020.