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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Quantification of seasonal variabilities in groundwater discharge in an extensive irrigation watershed using H, O, and Sr isotopes" *by* Takeo Yoshida et al.

Anonymous Referee #1

Received and published: 2 January 2019

The authors present a study about quantification of groundwater discharge in a river in an extensive irrigation watershed in Japan. Their study used three methods to estimated the groundwater impact: flow measurements and 2 isotopic approaches (stable isotopes of the water molecules and St isotopes). The global approach and the sampling strategy is good and appropriate to answer the question (the raw data are not provide and should be added as supplementary material). This study is of interest for the scientific community and also as potential tools in terms of water management. The text is relatively short considering the work presented and the various approaches applied. Thus, the detail reasoning especially concerning the groundwater contribution estimated through the 3 approaches is hard to follow and thus the main conclusions are

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too weakly supported by the main text. The manuscript would benefit to have a more detailed text, and to remove at least one or two figures (e.g. figures 6 and 12). The discussion section should be more detailed and argued with a solid comparison of both isotopic approaches considering their discriminating power. Sr is a WRI marker and thus will translate the lithological variations and water circulations, to be useful, contrasted signatures of the considered end-members are required; while stable isotopes of the water molecule, will mainly trace (in this context) the evaporation effect and could highlight variations along the hydrological cycle. For these reasons, and comments below, I recommend this work to be published in HESS with major revisions.

Specific comments :

Almost all the references are cited in the introduction. The main text, and especially the discussion, should refer to appropriate references. Note that only 23 references are cited, which is not enough considering the 3 applied approaches and the abundant available literature available for each approach.

Method section:

Samples dedicated to Sr isotopes analysis must be filtered and acidified to pH 2 with suprapure HNO3. Authors probably do it this way and this should be specified.

Sr isotopes analysis : change 87Sr/86Sr of 8.37.... to 88Sr/86Sr (page 4,line 17).

Sr concentration analysis method is not reported: please add it with the uncertainty.

Water isotopes analysis too poorly explained: especially using laser method, the salinity effect of the samples should carefully considered. Here we have no idea of the electric conductivity or TDS of the samples to evaluate a potential impact.

More generally, the manuscript would benefit to have a brief overview of the major elements concentration.

For water isotopes, the uncertainty for both O and H measurements should be added.

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Section 2.2.1 : specify the measurements period, over a same day, week , . . . ? what as the weather during that period ?

Section 2.2.2 : Equation 3 is not very clear, why not simply using for [Sr] and Sr isotopes (with R = 87Sr/86Sr , C = Sr concentration, f = fraction of endmember 1) : Rm = [f(R1*C1)+ (1-f)(R2*C2)] / Cm and Cm = f C1 + (1-f) C2 Specify that equation 4 is only true for stable isotopes of the water molecule.

Section 3.1.2 : line 9 : . . . because of mixing with fractionated water . . . Could we also consider that water has undergone direct evaporation and not only a mixing with an "older" evaporated water ?

Section 3.2.1 : in this section, the choice of the groundwater end-member (ODK / SAK) need to be better explained and argued as we note that the local wells present great variations for Sr isotopic signatures (figure 6). In the same way in figure 7 and the text referring to this figure, the end-members "surface water" derived from the irrigation channel and the "groundwater end-member(s)" derived from the springs SAK and ODK should be explained.

Section 3.2.2 : lines 25-30 : data plotting below the LMWL have an explanation, the studies cited give this explanation, it's not only an observation. Line13 page 9 : data from the paddy define a line with a slope of 5.1, is this value in agreement with local annual humidity ?

Section 4.1 : line 17 : specify why percolation has no effect on sable isotopes of water molecule. Lines 23-24: not clear, do you mean that spring (ODK) water reflect the buffering effect of the aquifer ?

Section 4.2.1 : lines 6 to 16 : this part can be shortened (too descriptive in the discussion section) . Figure 12 can also be removed. Line 31 and followings : How is calculated the fraction of groundwater estimated from Sr isotopes in Br 1 and Br 23 ? from figure 7 , Br1 is constituted of less than 10% of groundwater and Br23 has the

signature of the groundwater end-member, i.e. almost 100% of groundwater . . . Please clarify. Same thing for the global calculations in figure 13 and 14. In figure 14, colors are inversed compared to figure 13, to be checked.

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