

Interactive comment on “Is groundwater sufficient to support sustainable irrigation agriculture in a reclaimed wetland region?” by Z. Pang et al.

Anonymous Referee #3

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Summary:

Pang et Al. use several tracers (major ions, water isotopes, carbon isotopes) trying to determine whether agricultural irrigation using groundwater can be considered sustainable. This is done by analyzing the interplay of groundwater, surface waters and agricultural practices in a wetland region in north-eastern China.

General Comments:

While the presented data set seems to be very interesting and may provide new information on ecological impacts of groundwater based irrigation practices the general techniques have been published by other studies before. The paper is written well (from my point of view as a non-native speaker), but the method section misses detailed information on the analytical procedures (as already asked for by the editor) and

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there are some unclear conclusions. At the present state of this paper, I do not support publication in HESS for several reasons: a) the research question is very unspecific, i.e. there is no clear hypothesis which allows the reader to understand the underlying plan of the study-design, b) some of the conclusions seem to be drawn more by guessing than by quantitative analysis and c) the question stated in the manuscript title is not answered in a quantitative way by the analysis presented in the paper. Nevertheless, I think that with some restructuring, a specification of the article-focus and some efforts the study might be interesting for the readership and thus publishable in HESS.

Specific Comments:

Introduction

The introduction section misses a brief introduction on the previous knowledge about the interplay between irrigation practices and recharge mechanisms for confined and unconfined aquifers with a clear statement of the research gaps which will be closed by this paper.

Study Area

While the results and the discussion are presented with respect to particular sampling locations there is no spatial information on the locations of these sampling locations (I have seen the coordinates in the tables, but this doesn't help/ would take a lot of time to locate the different stations on the map).

Methods

There is no clear methodology/procedure which explains how the results of the chemical analysis are treated. This also marks the big lack in this paper: There is no quantitative analysis of observed concentrations. For example, the presented nitrate and calcium concentrations are only “analyzed” with a rather superficial interpretation of “concentration groups” which does not fit at all (see comments on the result section). The method section would need a clear concept how the results of the chemical analysis

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were sorted, ranked, correlated, ... and a hypothesis how this procedure will lead to the answers sought by this paper.

Results

In general, the results miss any quantitative information on how "...groundwater is sufficient to support sustainable irrigation agriculture in a reclaimed wetland region". While the results of the isotopic analysis show the overlay of surface and groundwaters the interpretation of the major ion concentrations does not fit at all: Figures 3 and 4 show similar concentrations for Districts II and III either for nitrate and for calcium and not as presented for District I and III. Consequently, the following interpretations should be reassessed. The Deuterium enrichment in the paddy field water samples is interpreted as condensation (Figure 6). This is wrong, condensation fractionates along the LMWL (saturated conditions). A possible reason might be methanogenesis which can cause heavy Deuterium-enrichment of soil water.

E. g. Chidthaisong, A., Chin, K. J., Valentine, D. L., & Tyler, S. C. (2002). A comparison of isotope fractionation of carbon and hydrogen from paddy field rice roots and soil bacterial enrichments during CO₂/H₂ methanogenesis. *Geochimica et Cosmochimica Acta*, 66(6), 983-995.

Discussion

The discussion section misses for the largest parts the reflection of the actual literature with the results and the determination how the results presented within this study contribute to our understanding of the governing processes. For example, there is no explanation how the results of the groundwater age dating correspond to the various major ion concentrations (e.g. nitrate) for the different aquifer types and which recharge processes could cause observable chemical groundwater compositions.

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