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

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Thank you for your comments concerning our manuscript entitled "Is groundwater sufficient to support sustainable irrigation agriculture in a reclaimed wetland region?" (MS No.: hess-2016-155). Those comments are valuable and helpful for improving our manuscript. We have numbered the comments for clarity. Responses are described one by one as follows:

Comment 1: The paper presents a very large amount of data, but the goal of this research remains unclear until the end. The introduction highlights that the goal of the paper is to understand "the implications of sustainable irrigation agriculture" (implications on what? Sustainable in terms of what?) as well as the "factors controlling groundwater regime". These goals are fairly unspecific, and I do not think they have

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been achieved in the study. For example, stable isotopes are widely used in the section recharge to aquifers, but there is not a single estimate of recharge rates. The same is true for the residence times.

Reply 1: Focused on understanding of groundwater residence times, recharge mechanisms and the interactions between groundwater and surface water, we tried to figure out whether groundwater is sufficient to support sustainable irrigation agriculture in terms of water quantity and quality. From the perspective of stable water isotopes, isotopic compositions of groundwater in the unconfined area are more enriched than that of groundwater in the confined area and some groundwater samples in the unconfined area is located on the local evaporation line (Fig. 7 and Fig. 8), indicating the links of the unconfined groundwater with the surface water. From the perspective of hydrochemistry, high NO3- and Ca2+ concentrations can be found in the shallow groundwater in the unconfined area (Districts I and III), indicating the interactions with irrigation water, while those in the confined area are generally low. From the perspective of 3H values, groundwater in the unconfined area shows a wide range of 3H values. Especially those groundwater samples near the river have high levels of 3H (6.5-71.3TU) indicating the links with river water. In a word, the groundwater in the unconfined area have strong links with the surface water, while groundwater in the confined area largely recharged by lateral flow. We found that hydrogeological conditions are the main controlling factors. In District I and III of the study area, the aquifers are composed of highly permeable cobble and gravel deposits and unconfined. In contrast, in the eastern part (District II), the aquifer is covered by a 16-20m thick clay layer and confined or semi-confined. The low 3H values in the confined area indicate that the groundwater is pre-modern and high 14C ages show that the recharge rate is very low. Based on the continuous decline of groundwater table, the groundwater alone is not sufficient to support sustainable irrigation agriculture. In the unconfined area, while the groundwater has strong links with surface water and relatively high recharge rate with stable groundwater table, the water quality is deteriorating affected by surface water which is unsustainable for irrigation agriculture. Furthermore, some samples with high

NO3- and Ca2+ concentrations (especially NO3-) in the confined area may indicate the leakage from the shallow unconfined groundwater. If the pumping in the confined area continues at or increases from the present levels, the groundwater table declining will continue and the water quality will also deteriorate in the future, which is also indeed unsustainable.

Comment 2: To be publishable, I suggest that the research questions are much more specific, and that the data are used for a quantitative interpretation. Right now the paper reads like a long and somewhat random collection of data without too much quantitative substance or research context.

Reply 2: In this study, focused on understanding of groundwater residence times, recharge mechanisms and the interactions between groundwater and surface water in areas with different hydrogeological conditions, we tried to figure out whether groundwater is sufficient to support sustainable irrigation agriculture in terms of water quantity and quality. As a matter of fact, the fast decline of water table in the confined aquifers called for the research conducted. The study is sufficiently quantitative to answer the question of sustainability and if another source of water support if necessary.

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