Authors' Response to Comments by Anonymous Referee #2

Specific Comments:

1. I found the topic interesting and important however in my point of view the paper is not well structured. The research question is not clear enough and was not answered properly. The authors started from a very broad and general problem of sustainable groundwater level to a very specific field-scale study and again tried to generalize it by introducing a longer time series of groundwater level record for the Tarim River Basin. But how the field-scale observation and modelling is transferred to a longer period of general groundwater behavior remains unclear to me as many factors like deep wells and other irrigation methods are simply neglected.

Response:

Thank you for the comments. We agree with the referee that the other irrigation methods and water extraction from the deep wells are important for us to understand the effects of irrigation on human-water system in oasis. Since the experiments were mainly implemented in the cotton field under mulched drip irrigation, information and data about other irrigation methods were mainly collected from the relevant literatures. The results from experiments and information from literatures were both discussed in the Section 5 (Discussion).

While we acknowledge that our field experiments were specifically carried out in a cotton field under mulched drip irrigation condition, our results can indeed be QUALITATIVELY extended to other crop fields under different irrigation methods. With these extensions, we can discuss the interactions between social and hydrological systems in this hyper-arid inland oasis, which is also the purpose of this special issue 'Predictions under change: water, earth, and biota in the anthropocene'. Such broad perspective also can help us gain deep insight into the multifaceted effects of irrigation method conversion and achieve a sound policy for sustainable water management.

We have also reorganized this manuscript and made it more concise. Section 2 (Description of Tarim River and Kaidu-Kongqi River Basins) has been greatly simplified. Meanwhile, the Section 5 (Discussion) and Section 6 (Conclusion) have been modified to focus on the measurements and results of the study.

2. The conclusion is too general, this conclusion and behavior of groundwater dynamics can be anticipated even without any calculation. I am wondering what is the novelty of the result and this work.

Response:

We generalize our conclusion based on the field experiment and qualitative extension. We agree that the qualitative extension about behavior of groundwater dynamics can be anticipated without any calculation. However, we place the results in the context of socio-hydrology and discuss the interactive aspects between human and water such as irrigation paradox. Moreover, the quantitative analysis implemented in this study can help us gain more insights on the general conclusion.

3. The presentation of model is not enough and clear. First of all, I ask the authors to clearly distinguish between fluxes and states. Fluxes and states cannot be summed or subtracted without considering time steps. I would suggest to change the labels into single letters with appropriate subscripts (e.g. I_{S}). I also suggest the authors to conceptualize the soil column and each layer clearly by explaining the states and fluxes one by one and their interactions. A flux can be positive or negative but this should be clearly explained. In the abstract there are positive and negative values which are reported, I suggest to remove them as you mentioned the upward or downward directions. The exchange flux (EF) is introduced in introduction but to my point of view it is too generic to be mentioned in this way as almost all the fluxes in a hydrologic systems can be considered as exchange fluxes.

Response:

Thanks for the suggestions. We have modified Section 3.3 (Methodology) to make the descriptions of model clearer. The fluxes and states have been distinguished, i.e., I, P, ET, EF and LF are fluxes, and the changes of SWC are states. Positive represents inflows and negative represents outflows of the control volume. That is to say, at the upper boundary of control volume, I and P are positive and ET is negative. At the bottom boundary, positive EF represents upward flux and negative EF represents downward flux. If we have mentioned the inflow or outflow directions, the plus or minus signs will be ignored. More descriptions of exchange flux have been added to the introduction to make the definitions clearer.

4. I would suggest the authors to make one figure with different panels with equal axis out of figures 3-6. This way they make it much easier for the reader to compare the fluxes, groundwater fluctuations and rain during different periods.

Response:

Thanks for the suggestions. Figure 3-6 have been merged into one figure with different panels. For the same period for different years, the equal Y-axis has been adopted. However, since the values of EFs are quite different for different periods, the Y-axis is not identical for all the periods.

5. I am not personally agree with the argument that any work must include uncertainty analysis. However for this study as the fluxes and states are estimated it would be interesting to see how the final finding, which in my point of view is not a surprise, will be affected.

Response:

Thanks for the suggestions. The error analysis has been carried out and the results are shown in a separate section (Section 4.5).