

Interactive comment on “Characterizing interactions between surface water and groundwater in the Jialu River basin using major ion chemistry and stable isotopes” by L. Yang et al.

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General comments:

1. In general, the detailed description of the study area and the data acquisition is technically sound, but the interpretations and conclusions of the data are not adequately supported by the evidence. Most of the points discussed by the authors are based on guessing how some of the observed values might be caused (e.g. high concentra-

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tions of Na⁺ and Cl⁻ are likely to be caused by urban sewage water), but there is no quantitative evidence presented in the manuscript.

Reply: In the revised manuscript, the evidence is presented. Two rain water samples were collected in the first campaign after the flood event (July, 2010). The average of the concentrations of the Cl and Na were 4mg/L and 1mg/L, respectively, which were far less than that of the waters in the river. The untreated sewage waste (average 37 ton/day between 2007 and 2009) in Zhengzhou was eventually discharged into the Jialu River. The higher Cl and Na in the river could be coming from sewage wastes.

2. However, when reading the manuscript I did not find the title reflected in the content of the article as much as I expected it to be. There is only one section (5.2) in the manuscript discussing the interactions between the Jialu River and groundwater. Due to the large distances between the river and the wells the analysis could be done for only one observation well compared to the total of nine groundwater sample locations. Additionally, I consider the method used to estimate percentages of river water in the groundwater requires as not valid for the data analyzed in this study. The most important precondition of this estimation method is the assumption of constant fluxes of all end-members during the time of observation. The isotopic and chemical signature of river water is highly variable during flooding events. We know that the fraction of event and pre-event water is changing over time depending on rainfall and catchment/storage characteristics. Therefore, and with regard to the magnitude of commonly observed groundwater flow velocities, it is not adequate calculating fractions of infiltrated river water for a specific event using only one sample for each end-member. A data set sampled during base flow conditions will likely be better applicable for this purpose.

Reply: We acknowledge that this is a limitation of our study; one sample of observation seems to be less than satisfactory in detecting groundwater recharge in flooding event. It can provide information on the fraction of river to groundwater recharge for a specific period of time. Increasing the number of samples during flooding event would reduce

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uncertainties in estimation of groundwater recharge in a long run. We complemented this limitation in the discussion section of the revised manuscript. As to the base flow, it is necessary to collect the water samples in the next step.

3. I would recommend changing the title and the focus of the manuscript into sth. like: “Characterizing anthropogenic impacts on water resources in the JR Basin by synoptic sampling campaigns of major ion chemistry and stable isotopes” and I would suggest following the recommendations of Reviewer #1 and make a speciation using PHREEQC. By being able to distinguish between geochemical processes and anthropogenic impacts on groundwater quality a more differentiated picture of the groundwater resources can be shown.

Reply: The primary focus of the study was to examine the interaction between surface water and groundwater. In the revised manuscript, some hydraulic information, some gradients, and hydraulic conductivities are added. The historical precipitation, shallow groundwater and surface water level data were collected. The groundwater levels measured at two sites (Zhongmou site (W1) and Xinzheng site (W2)) in the Jialu River Basin over the period 1972–1973 were extracted from the Annual Hydrological Report. At Zhongmou site, the level of the ground water was higher than that of the river for most of the study period, including the period of the major flood. At the Xinzheng site the level of the groundwater was 5.5–7.2m higher than the river level. Overall, the river in this area is probably a “gaining” river for the most of the time. The anthropogenic impact on water resources is a small part of the manuscript. The PHREEQC was used to compute the saturation indices (SI) in the revised manuscript. The results will be better used to distinguish between geochemical processes and anthropogenic impacts on groundwater quality.

4. Some quantitative information on urban pollution (e.g. number/size of treatment plants or population access to sewer systems (%)), the type of agriculture and on the hydrological cycle such as runoff, evapotranspiration and recharge are needed as well, to explain to what extent the water cycle and the resources are impacted by human

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activities. Estimations of evaporation might help to better explain the observable deviations of isotope concentrations from the LML and to analyze the differences between samples collected in July and September.

Reply: The data about urban pollution, the type of agriculture and so on are present in the revised manuscript. Heavier isotopes were enriched in river water in the upper reaches, which resulted mostly from evaporation from reservoirs where these samples were collected in July. The surface water samples obtained in the second sampling campaign (September) present a wide range of stable isotopic signatures. Isotopic composition of river water was mostly negative. It could be due to precipitation with lighter isotope.

5. All Figures could be improved by using some colours: The location of lakes and reservoirs is very hard to identify on the maps. By adding a colour scale to Figures 4 and 5 a spatial assignment of sample locations could be done. A seasonal hydrograph of the JR showing the timing of the sampling campaigns might help to better understand observable in-stream concentrations.

Reply: All Figures have been improved by using some colors in the revised manuscript.

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