Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2018-617-AC2, 2019

Hydrology and Earth System Sciences
Open Access
Discussions

Interactive comment on "Decomposition technique for contributions to groundwater heads from inside and outside of an arbitrary boundary: Application to Guantao County, North China Plain" *by* Ning Li et al.

Ning Li et al.

ning.li@ifu.baug.ethz.ch

Received and published: 17 April 2019

This is an interesting study, focusing on splitting inside and outside contributions to groundwater head changes. The studied issue is commonly encountered by groundwater modelers. I believe this work is helpful for large-scale groundwater simulation study. A minor revision is suggested by the reviewer.

1.ËİThe detailed boundary conditions, especially the upper boundary (irrigation, evaporation and evapotranspiration), should be presented when running Hydrus 1D. We

recommend a soil water balance study in the NCP (Hu, X., Shi, L., Zeng, J., Yang, J., Zha, Y., Yao, Y., & Cao, G. (2016). Estimation of actual irrigation amount and its impact on groundwater depletion: A case study in the Hebei Plain, China. Journal of Hydrology, 543, 433-449). The authors may refer to some of balance components from this paper. Four years of tracer experiment data were also given in this paper. I also recommend few other papers for the soil moisture dynamics simulation in the NCP to reïňĄne the Hydrus 1D simulation. (Li, X., Zhao, Y., Xiao, W., Yang, M., Shen, Y., & Min, L.(2017). Soil moisture dynamics and implications for irrigation of farmland with a deep groundwater table. Agricultural Water Management, 192, 138-148.; Min, L., Shen, Y., Pei, H., & Jing, B. (2017). Characterising deep vadose zone water movement and solute transport under typical irrigated cropland in the North China Plain. Hydrological Processes, 31(7), 1498-1509.)

1.1 Response

We agree. All mentioned papers are cited in this manuscript.

1.2 Modification

The Paragraphs on page 11 and page 12 are changed to "Tan (2014) shows that in the NCP the average recharge ratio from tracer experiments is 0.16 ranging from 0.11 to 0.21, which is quite close to the results from another tracer test done in NCP by Hu et al. (2016)." and "The response time becomes longer with increasing depth to groundwater while the peak flux becomes smaller with a more even distribution over the year. Similar results can be observed in other areas of the NCP (Li et al., 2017; Min et al., 2017)."

2. It will be more convincing to add a discussion or cite reference to support the way of handling channel inïňĄltration, river inïňĄltration, and inïňĄltration from these smaller sub-channels in the manuscript. Some details may be provided to increase the validity of model development.

2.1 Response

We agree. New citations are added.

2.2 Modification

The paragraph on page 7 is changed to “This is a common way to deal with the leakage to groundwater from numerous field channels in the irrigated cropland which can also be found in other similar studies (Rejani et al., 2008; Cao et al., 2013).”

3. Moreover, the determination of the sources and sinks inside and outside Guantao is critical for the decomposition. The spatial location and the number of pumping wells are highly unknown in this area since there is no ofïňĄcial statistical data on these. Under this condition, it may be more reasonable to use to areal sink/source terms (area-averaged discharge) while not using point sink/source terms. Due to importance of sources and sinks during the simulation, a discussion on the modeling uncertainty is required.

3.1 Response

The reason we use point sink/source terms to simulate the pumping rate is due to the investigation conducted in 2012 by Guantao Water Resources Department recording all pumping well locations in Guantao.

We agree that an uncertainty discussion would perfectly complement this manuscript. The sections from 4.4 to 4.6 are sensitivity analyses, which are actually based on one ensemble of model realizations. Another paper mainly focusing on model uncertainty and using the Ensemble Kalman Filter is in preparation and will be submitted in a month’s time. In section 4.5 of this manuscript, we will add comparisons between results from models with reduced pumping rate to those without any change. This comparison will reflect the uncertainty of the source/sink term’s influence to some degree.

3.2 Modification

The paragraph on page 19 is modified to “After increasing the pumping rate by 20%, the groundwater head changes over time averaged over the whole of Guantao County is around - 3.32 m (δh_Guantao), of which -5.37m is caused by inside contributions ($\delta\Delta$h_Guantao) while +2.05 m is due to outside contributions (δh_out). Compared to the results from Sect. 4.3, the increased pumping rate increased the inside contribution from 48.5% to 72.4% when compared to the aggregated groundwater head changes”.

The information is also added in the conclusion part.

4. Some minor comments are provided: 4.1 There are far too many ïňĄgures (17 ïňĄgures) in this manuscript. It is better to remove some less relevant ones. 4.2 Is there any groundwater abstraction for domestic use and industrial use in Guantao? I notice that except March, April, May, June, and October, there is no groundwater abstraction in other months during the simulation.

4.1.1 Response

We agree.

4.1.2 Modification

Figure 3 and Figure 5 are deleted.

4.2.1 Response

The groundwater abstraction for domestic use and industrial use in Guantao is from the deep aquifer, which has a suitable water quality. The water abstraction from the more mineralized shallow aquifer is used for irrigation only.

4.2.2 Modification

The paragraph on page 4 is modified to “It is discharged through pumping wells for irrigation. The deep layer receives only little recharge from upstream at the piedmont, so groundwater levels have been decreasing since pumping for domestic, industrial and irrigation uses started .”

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2018-617, 2019.