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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Integrated hydrological modeling of the North China Plain and implications for sustainable water management" *by* H. Qin et al.

Anonymous Referee #2

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I enjoyed reading this paper which is well written and conveys a significant message on how to address the sustainable water management for the North China Plain (NCP) hydrological system. For that area, in order to take account of the dynamic of the evaporation and the irrigation effects a coupled surface water-groundwater model using the well-known MIKE SHE was came up with. Evapotranspiration estimates based on remote sensing are employed as well.

In my opinion, the paper has the merit to present a methodological contribution that attempts to address how to cope with the over exploitation of groundwater due to the rapid economic growth of the China. However, this merit is hidden to reader because

of contents sometime confused and analysis and results incomplete. Details are given below.

1) Considering the groundwater component, I expected a comparison of achieved results against findings of previous studies done in the same area, e.g. by using MODFLOW. This is necessary to showing how and in which terms the use of the proposed model is of benefit for a correct analysis of the NCP hydrological system and in particular of the groundwater one.

2) As regards data. Precipitation is collected by TRMM having a resolution of 25 km and then resampled to 10 km. It's not clear what is the procedure adopted for the resampling. For that, did the authors use rainfall recorded at the meteorological network? In this regard, it would be very useful to add in Table 2, the average annual temperature observed at each station along with the reference Evapotranspiration (ET) computed by Penman–Monteith.

3) As far as the groundwater pumping is concerned, two aspects need to be clarified. The first, how is it possible that a total of 580 pumping stations are generated if the constraints are i(city)<21 and Ni(well)<20? On average one should have Ni=27>20. It's likely that I didn't realize well how the random procedure is applied, but I think that the authors need to address this point carefully.

The second aspect regards Eq.(1). Based on that, the two water demand pumping rate, DW and IW, are uniformly distributed at each well and this should be unrealistic considering that groundwater might be exploited in a different way according to the groundwater sensitivity to the abstractions, less for larger recharges. However, I guess that the authors employ the random approach just to allow for the spatial variability of the wells that should be unknown. If so, this makes sense. Please clarify this aspect.

4) Honestly, I didn't understand how the sensitivity analysis of parameters has been addressed. I have gone over the manuscript but I didn't find it. I think that this should be the focus of the analysis and it has to be thoroughly detailed in a separate para-

graph. The features need to be clarified are: a) what the authors mean about “the most sensitive parameters” and to what; b) where do the parameters listed in Table 6 come from? Which data are used; c) what is the criteria adopted for which both the horizontal conductivity has to be log-transformed and a parameter may be tied to a different one.

5) In Table 7, some Nash-Sutcliff values are negative and this needs to be justified. In this case, the observed mean is a better predictor than the model and this results in the residual variance described by the model is larger than the data variance. In other words, for these situations the model should be useless.

6) Please, clarify how Modis data are combined with interpolated data from meteo network.

7) In Figure 9, it would be useful if the average areal rainfall was plotted along with the discharge for each identified river site. In this way, one can infer if the trend in the discharge can be affected also from the rainfall.

Finally, I would like to add a general comment about the topic. I deem that no measure can be envisaged to cope with the water shortage if climate changes are not considered in the analysis. Besides, whatever measure one could plan, this one has to be tested in terms of cost necessary to accomplish it. This results in the need to develop optimization algorithms in order to identify the correct water allocation and meet demand in the investigated area. Based on that, it seems to me that this work can be considered as preliminary and this has to be pointed out in the abstract, introduction and conclusions.

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