Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2016-8-RC1, 2016

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Eco-hydrological effects of stream-aquifer water interaction: A case study of the Heihe River Basin, northwestern China" *by* Y. Zeng et al.

Anonymous Referee #1

Received and published: 9 March 2016

A scheme for stream water - aquifer interaction, originally developed by Di et al (2011), was incorporated into CLM model to simulate the influences of river contribution to aquifers through lateral movement of water. Two simulations with and without activating this scheme were run and compared. Based on the model comparisons the importance of taking the surface water – groundwater interactions into consideration for water, energy and carbon balance models was underscored. Overall, the experiments are interesting and adding such a scheme to CLM could potentially improve models accuracy in areas where groundwater surface water interactions exist especially in riparian areas. However, the paper lacks of clarity in presentation. The objectives were not clearly defined and the approach is somewhat obscure. I believe that the most of

Printer-friendly version

Discussion paper

this paper needs to be rewritten and many additional information need to be supplied before it can be considered for publication.

The model was tested in a single case where river is recharging the groundwater. It would be interesting to see how the model response to the other case such as groundwater recharges to the river. As a matter of fact, this could be the case in the study area, where the original CLM in CTL simulations resulted in depth to groundwater levels about 20 m deeper than the observations. However, it is quite difficult to be sure with the provided groundwater observations data. Also, I would be interested in seeing depth to groundwater level values in TEST and CLM simulation to better understand how groundwater levels respond to lateral water movement from the river as well as how close the groundwater to the surface. Groundwater levels were either given as elevations or difference between CTL and TEST simulations but not in depths. I think giving these values as depths would provide more insight in terms of conceptualize the groundwater interactions with the land surface processes.

Even the critically important model parameters were not provided in the paper. I think that the model parameters and initial conditions as well as how these values were determined need to be explained explicitly. Some of the important parameters including, for example, the soil types and parameters in the simulated stations, the vegetation type and their distributions, the specific vegetation parameters and architecture especially root length density distributions were not provided in the paper. Following the paper is somewhat difficult without knowing the model parameters. A table showing the model input parameters would be quite helpful.

Two sets of sensitivity simulations were run. The first one was used to investigate the model responses to river stages and the second one to river bed hydraulic conductivity. In the second sensitivity simulations, it was found that the model results are not sensitive to the hydraulic conductivity of the river bed (Kr). Theoretically, Kr is a parameter that controls the water transfer between the river and the aquifer besides the head difference between them. However, the reason why the model is not sensitive to the Kr

was not discussed in the paper. I think this is important to know and the reason should be discussed in detail and if necessary the additional simulations should be conducted to test if it is a problem related to the numerical scheme or the structure of the model.

An eddy covariance (EC) station was used to validate the model findings. However, some additional information about the station need to be given. For example, the exact location of the station should be placed in Fig. 3. Also, its fetch area needs to be described with the vegetation information. Moreover, EC data were only compared with TEST simulations. I think including the CTL simulations to the same plot would show how the model results improved by adding the stream-aquifer interaction scheme to the model.

In Fig. 7, simulated surface temperature was compared with remotely sensed temperature values. The heat transfer algorithm used in the model can be briefly explained because it would be helpful to understand how the shallower groundwater could alter the surface temperature. Also, I would be curios about to know how the boundary conditions were set up, and how the temperature of the river was treated, used as model forcing or a constant temperature was assigned. Again, I think CTL simulations needs to be included in Fig. 7 as well to show the degree of improvement of the model results. Some specific comments:

1) Abstract could be improved by adding a conclusion sentence. Also, it reads as no validation available in the paper.

2) Introduction part is quite brief and lack of objectives of the paper, which needs to be clearly stated.

3) Model time step definitions should be consistent. Please use either 1800s or 0.5h.

4) The title of section 4.2 is identical with the title of section 4, please add titles properly as necessary.

5) Figures are usually not well presented and explained. For example:

Printer-friendly version

Discussion paper

(a) Figure 1c: what the lengths of the boxes represents is not clear. Are these grid cells as described in the caption or they are water heads?

(b) Figure 4: why and how 20 grid cells were used was not explained.

(c) Figure 5, 7: please add CTL simulation results.

(d) Figures 12 to 16: the reason why the left and right sides of the river channel are not symmetrical is not clear. Is it due to the soil type or vegetation? Please clearly provide their distributions.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-8, 2016.

Printer-friendly version

Discussion paper