Comments on “Inclusion of flood diversion canal operation in the H08 hydrological model with a case study from the Chao Phraya River Basin – Part 1: Model development and validation”

Integrating anthropogenic factors in GHMs is an important but tough job due to vast varied implementations of water conservation engineering and lack of data. In this study, Gopalan et al., developed a novel diversion module in a GHM H08 and tested its performances as well as other anthropogenic processes in a data-rich river catchment in Thailand. This module enhanced the robustness of GHMs in reproducing hydrological processes under human perturbations. Additional, it provides the fundamental to evaluate the potential of flood control, which is a crucial topic regarding sustainable development under climate change. Although there are several issues needed to clarify before considering for publication, they do not affect the significance of this study and the interests of broad readership.

Major comments

1. Although the introduction underlines the importance of integrating water diversion in GHMs regarding floods control, the structure can be tighter. For instance, Paragraph 2 and 3 (Line 38 — 57) can be combined to introduce the demand of water diversion for flood control and its potential impacts on the water cycle. Paragraph 4 (Line 59 — 72) can be modified by reviewing relevant studies regarding flood control (water quality is trivial) and pointing out the limitation of hydrodynamic models in investigations of earth systems and the lack of water diversion in GHMs.
2. According to the Eq. 2, there may be a jump of D_wet (from Q_min to Q-Q_env) when the Q is reaching the Q_rivcap. Is it what you expected? Additional, a minor issue is that the case Q<Q_env is not listed in Eq. 1 or 2.
3. The introduction of the diversion operation (Line 144 — 179) can be clarified more briefly. Instead of explaining each cases listed in Eq. 1 and 2, it is better to describe the logic of operation. The dry season for example, the operation strategy tries to meet the minimum flow diversion (Q_min) on the premise of guaranteeing the environmental flow (Q_env).

4. Two issues are needed to clarify in the calibration.
    a. The model is calibrated by naturalized and regulated discharges. And irrigated discharge is mentioned as well. How was the discharge naturalized? Is the regulated discharge equivalent to the irrigated discharge. What is the difference between the two and the observed discharge? Please provide more information.
    b. The crop module is calibrated the crop module to meet the census irrigated discharge. How is the contribution of diversion canal to irrigation withdrawal in CPRB? If it was significant, the calibrated irrigated discharge (no irrigation due to diversion) must be higher than the observations, correct?
5. Several questions regarding the physical processes
    a. Do the canal network and the retention area affect the land surface processes? For example, does the retention area (1-m deep) maintain water during precipitation? Will surface runoff go to canals instead of going to the natural river channel?
    b. Is the assumption of retention storage cleaning (Line 178 — 179) reasonable? I guess that a part of the water might be loss through deep drainage. Moreover, it is more proper to re-set the retention storage at the end of a hydrological year rather than a normal year?
    c. Canal water only can be withdrawn by neighbouring grid cells for irrigation. Does it imply that the spatial resolution of simulation will affect the results?
    d. Seems that the rain-fed cropland is assumed to be used as retention pond. Is it a universal assumption in the future global simulations? If so, will it affect the crop yield?
6. In Figure 7, the annual average discharge is employed to demonstrate the effect of flood control. I think it is more suitable to present the intra-annual fluctuations of discharge rather than the annual mean, isn't it?
7. The presentation skill can be further improved. I listed several suggestions below in 'minor comments', but not limited to them.

Minor comments

1. Line 76: "have been generated by" —> "due to"
2. Line 110: Do 0.5° and one-day represent the finest resolution that the H08 can reach? If not, please remove it.
3. Line 144: Please briefly describe the definition of dry/wet season.

4. Line 228 — 233: Please shortly explain what 5, 50, and 90 means in Q_5, Q_50, and Q_90 (% of quantile?).
5. Line 279: “these 5 canals …” It is properer to use word rather than Arabic numeral if the number is less than ten, or less than one hundred if the number represents for the amount of objects. Please check other places as well as the supplement.
6. Line 453 “a great potential” —> “a great potential of flood control”.
7. Line 489: “values”: What values?
8. Line 490: Remove “simulated”.
9. Figure 2: Modify the second sentence to “The green area denote the river basin”.
10. Please modify the y-label of Figure 8. It looks like number of days divided by 25 years.
11. Supplement Line 150: Please add the unit of cropping intensity.