

Interactive comment on “Coupling biophysical processes and water rights to simulate spatially distributed water use in an intensively managed hydrologic system” by Bangshuai Han et al.

Anonymous Referee #3

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The paper “Coupling biophysical processes and water rights to simulate spatially distributed water use in an intensively managed hydrologic system” by Han et al. presents a modelling framework to integrate water rights allocation into a hydrologic model capture the spatial distribution of irrigation water diversion in semi-arid basins in Western US. Agricultural irrigation is the largest water consumption, but the socioeconomic and institutional factors affecting irrigation behavior are generally not well represented in hydrologic models. This paper provides an effort to better representing anthropogenic factors in biophysical models and will provide insights on how better water use regulation will support sustainability of water resources management. The paper is well-written and the results are clearly presented. I would suggest a minor revision to the

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manuscript. Below are some specific comments: In Line 292, how is water diversion water loss handled in the model? Is diversion water loss added to soil or groundwater or river near the diversion channel? Speaking of irrigation return flow, will the water loss be considered as return flow? Due to the significant amount of water loss (60% of diverted water), more details are needed. This would also provide important information about how irrigation efficiency will affect water allocation and stream flow. In Line 190, the land use and land cover in 2011 is used for the whole simulation. Does the irrigated crop area vary significantly during the simulation period? In Line 294 - Line 306, the irrigation requirements are satisfied based on the seniority of water rights. It would be interesting to see the model results on the allocated or unsatisfied water from different water rights seniority groups. For example, how much water is demanded and actually diverted for different water rights seniority groups? Will senior and junior water rights holders will be affected in wet/dry years? Since the model is unique in representing the water rights, how water is actually diverted to different water right seniority groups would provide important information for water resources management. The unit of y axis in Figure 5 is misleading. The blue color is for discharge rate (m^3/s), while the red line is discharge volume (m^3). Is it possible to represent the simulated and observed irrigation water in a same unit? The black dash line of Black Canyon Irrigation District in Figure 8 is difficult to capture. In addition, the average annual allocated irrigation water in some places are more than 1000 mm/yr, or even more than 1500 mm/yr. It seems to me the irrigation amount is quite big. Will farmers in these regions apply some much water in the fields? Farmers' irrigation behaviors are affected by many factors, such as irrigation technology, insurance, farmer's preference on profit/risk. Although these are beyond the scope of this study, the authors should briefly discuss it and cite some existing literature on how farmers' behavior affect the hydrologic systems.

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