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Discussions

Interactive comment on "Assessing the impact of climate variability and human activity to streamflow variation" *by* J. Chang et al.

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Thanks for reviewing the manuscript and giving valuable comments and suggestions. Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We have studied comments carefully and have made correction which we hope meet with approval. The main corrections in the paper and the responds to the reviewer's comments are as following: 1. Two process-based hydrologic models are used in this study. Can you explain why two models are used instead of one? What's the purpose? Just for comparative study? Response: A wide range of physically based hydrological models have been developed. All kinds of models could find their usefulness in different appli-

cations. Although these models have solid physical meaning and good performance in modeling streamflow, their simulation results have certain uncertainties mainly caused by the uncertainty of data and model structure. The purpose of selecting these models is to analyze the difference of climate and human impacts on streamflow variation from the large-scale hydrological model (VIC model) and simpler model (TOPMODEL), thereby obtaining a sound and reliable result. 2. It is assumed, in the TOPMODEL and VIC simulations, that all the model parameters will not changes under climate change only. This assumption should be stated clearly and discussed. Response: The aim of this assumption is to keep the effect of human activities unchanged on streamflow variation in the impacted period compared with the baseline period. Hence, the simulated streamflow in the impacted period only reflects the influence of climate change. Then, the impact of human activities can be separated based on the equation (2) in the manuscript. Some previous studies (Bao, Z. et al., 2012; Ma H et al., 2010) also used this assumption to conduct similar investigation about this topic. Bao, Z., Zhang, J., Wang, G., Fu, G., He, R., Yan, X., Jin, J., Liu, Y., and Zhang, A.: Attribution for decreasing streamflow of the Haihe River basin, northern China: Climate variability or human activities, J. Hydrol., 460–461, 117–129, 2012. Ma H, Yang D, Tan SK, Gao B, and Fu Q.: Impact of climate variability and human activity on streamflow decrease in the Miyun Reservoir catchment, J. Hydro., 389: 317-324, 2010. 3. Line 7 on the page 5258: "using Eq. ()," Response: The "Eq. ()" has been corrected as "Eq. (6)" in line 7 on page 5258. 4. Lines 11-12 on page 5258: "It is a holistic approach that assumes the equilibrium water balance is controlled by water availability and atmospheric demand." The explanation of Budyko curve at the process level has been also been proposed, e.g., DOI:10.1002/2014WR016857. Response: We thank the reviewer for the reminder and have rewritten the description about the Budyko hypothesis and corresponding references have been complemented. The Budyko hypothesis (Yang et al., 2008; Teng et al., 2012; Wang et al., 2015) produces a simplified but powerful coupled water-energy balance method. It is a holistic approach that assumes the equilibrium water balance is controlled by water availability and atmospheric demand. The water availability can be approximated by precipitation, the atmospheric demand represents the maximum possible evapotranspiration and is often equated with potential evapotranspiration. The role of landscape properties on mean annual water balance is mainly implicit, and is deemed as being subservient to the dominant role of climate. In some formulations of the Budyko formulation, the role of the landscape is represented by a separate, lumped parameter (Yu et al., 2014; Donohue et al., 2007), which is nevertheless estimated empirically. 5. Lines 26-27 on pages 5258: “w was set to 2.0 according to the land use and land cover status in the study area.” How? Is w estimated by fitting the data? Response: Thanks the reviewer for reminding us to pay more attention to data issue. To use Fu’s equation, the empirical parameter w needs to be determined as a prior knowledge. For example, it can be calibrated from historical data. In this paper, the value of w was set according to the study of Li et al (2013). During their study, a simple parameterization for the w parameter based on remotely sensed vegetation information is proposed and applied in the 26 global rivers including Amazon, Amur, Mississippi and Yellow River. The basins monthly time series of water budget terms, i.e., precipitation, evapotranspiration, runoff, and water storage changes is used in the paper. The results improves predictions of annual actual evapotranspiration as compared to the default w value used in the Budyko curve method. The modeled w for the Yellow River is similar to 2 according to study, and the Jinghe River is a branch of the Yellow River Basin. Hence, the parameter of w was set to 2.0 in our study. 6. Lines 3-6 on page 5259: check the sentence. Response: Thanks for the comment. The corrected are as following: A hydrological model was calibrated and validated by using the data of baseline period. Then the model was run with climate data (e.g., precipitation and potential evaporation) during the changed period to simulate the streamflow. 7. Line 19 on page 5260: “Tyson polygon”, correct “Tyson” Response: We have changed the word “Tyson polygon” to “Thiessen polygon” in the revised manuscript. 8. Lines 24-25 on page 5260: “The annual mean value of runoff was 43.47 mm from 1960 to 1990, and reduced by 17.39% compared with the multi-year average streamflow.”

“multi-year average streamflow” during XXX? Response: We feel very sorry to have brought the trouble to the reviewer. We have checked the results and corrected the sentence as “The multi-year average streamflow (from1960 to 2010) was 37.03mm, and the average annual streamflow was 43.47mm from 1960 to 1990, which means the streamflow from 1960 to 1990 increased by 17.39% compared with the multi-year average streamflow. The average annual streamflow was 27.05mm during 1991-2010, reduced by 26.96% compared with the multi-year average streamflow, therefore, the speed of streamflow decrease was higher since 1990.” 9. Line 7 on page 5261: change “underground water” to “groundwater” Response: Corrected. 10. Line 6 on page 5262: “recharger” to “recharge” Response: Corrected. 11. Line 19 on page 5262”change “divided” to “delineated” Response: Corrected. 12. Line 6 on page 5263” change “in calibration period, R value exceeds 0.8.” to “in the calibration period, and R value exceeds 0.8.” Response: Corrected. 13. Line 8 on page 5263: change “The validation NSE and WBE values” to “The NSE and WBE values during the validation period” Response: Corrected. 14. Line 2 on page 5264” change “with the finding” to “with other studies” Response: Corrected. 15. Line 10 on page 5267: change “model” to “models” Response: Corrected. 16. Line 14 on page 5267: change “impact” to “factor” Response: Corrected.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/12/C3305/2015/hessd-12-C3305-2015-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 5251, 2015.