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Interactive Comment

Interactive comment on "Global-scale analysis of river flow alterations due to water withdrawals and reservoirs" *by* P. Döll et al.

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Döll et al. presented a new study based on the WaterGAP Global Hydrological Model (WGHM) simulation to assess to provide a thorough assessment of the anthropological flow alterations global. WGHM is undoubtedly a state-of-the art model to carry out the presented research. The authors run the model in several configuration turning on and off various human disturbances (reservoir operation, irrigational water uptake). It is somewhat unclear, how the model was calibrated against the long term mean flow conditions at 1235 station that likely experienced varying degree of human flow alteration during their operation.

The presented work is still valuable since it gives a detailed account of how flow characteristic change due to human activities. The tested flow indicators go well beyond the ones normally used in global scale studies. To some degree, one has to question if WGHM is indeed capable to reproduce these characteristics realistically. The authors spent a great deal on showing the model performance in terms of reservoir operation and the WGHM performance as a water balance model was documented in the past. What is missing is the demonstration that the low flow frequencies, the flow variation amplitudes, flow regime, time shifts, inter-anual variability of the monthly flow (the indicators that the authors evaluated) are indeed reasonable approximation of the real world. Without having prior and post human alteration discharge records the demonstration of the model capabilities is obviously difficult, but the authors should show at least a comparison to observed time series data that the model actually captures these characteristic realistically. To some degree, I doubt if a monthly model can depict shifts in discharge records that are likely to be in the order of weeks rather than months. The tested model discharge gauges (Figure 9) clearly show that WGHM has limited ability to capture the flow amplitude and the flow regime. Since, the model runs at daily time step internally (if I understood correctly), one has to wonder, why the authors did not try to evaluate these metrics at the computed daily time step. I realize that the precipitation downscaling the authors used (based on wet days frequencies) is not sufficient to generate reasonable daily output, but combining the GPCC full product with daily precipitation from NCEP or ERA40 reanalysis (preserving the monthly totals) could provide realistic daily precipitation input.

The incorporation of the 6000+ GRanD reservoirs in this study is somewhat unclear. The GRanD reservoirs spread over a 30-minute network (roughly 65000 continental grid cells) would take up ten percent of the grid cells if they were distributed as one reservoir per grid cell. Obviously the authors performed some degree of lumping multiple reservoirs sharing the same grid cells. I suppose the 1074 reservoirs where the authors actually applied the reservoir operation (according to Hanasaki et al.) represents some sort of combined reservoirs operating per grid cell.

To some degree, one has to wonder, why the authors went through all the hoops to test so many metrics and at the and to use simple discharge vs. fish species relationship to assess the lost biodiveristy, due to human activities. On the side note, I am not sure where these kind of assessments lead us. The reality is that over 6 billion people live on our planet that will reach 9 billion in our lifetime. With all my sympathy to endangered species, if I had to choose between feeding people or saving fish, I would undoubtedly choose the first. To some degree, these studies should try to inform us, how much the human alterations are “wasteful” and how much inevitable.

My overall assessment is that this paper is worthy for publication with minor to moderate changes.

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