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Hydrology and Earth System Sciences
Discussions

Interactive comment on "One-way coupling of an integrated assessment model and a water resources model: evaluation and implications of future changes over the US Midwest" *by* N. Voisin et al.

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Response to the Editor's review.

Dear editor,

Thank you for the feedback and suggestions to further improve the paper.

We have further revised the manuscript to clarify the purpose and significance of the study. Our ultimate goal is to develop a fully coupled earth system model in which

human systems and natural systems are interactive across a wide range of scales. As a first step towards that goal, this study demonstrates one-way coupling of an integrated assessment model that simulates water demand and a water resources modeling system that integrates a land surface model, a river routing model, and a reservoir operation model. Although climate scenarios are prescribed based on statistically downscaled scenarios, this study differs from many previous impacts studies in that socio-economic and energy policy are modeled (by the integrated assessment model) and explicitly considered in the water management through changes in water demand. Previous studies typically investigated only changes in natural streamflow driven by climate change, with or without water management, while water demand is fixed. Hence we consider a broader set of human-earth system interactions than typically included in previous studies. This allows us to investigate the relative influence of demand changes vs natural flow changes on water supply deficit in the future.

Therefore, in addition to the planned revisions described in our previous response, we added the following:

1) More discussion on the water demand projections and how they are driven by socio-economic factors. This distinguishes our research from previous studies that mostly ignored changes in water demand. The text added in the manuscript is in the supplement.

2) We also went deeper on the explanation for why changes in the regulated flows and supply deficit are more driven by changes in natural flow rather than demand overall but varies regionally. Covariances between the supply deficit and the inflow and demand quantify over multiple periods the driver of changes. The elasticities generalize the findings by quantifying the sensitivity of regulated flow and supply deficit to changes in flow and demand. The combination emphasizes the complex interactions between the regulated flow and supply deficit, with the changes in demand and flow, the spatial distribution of the demand and the region's storage capacity. These again highlight new insights that can only gained with our one-way coupled integrated assessment

and water resources models.

We added in the manuscript: i) a table for the covariances of the supply deficit with flow and demand (see supplement)

In the results section, the relative change in regulated flow and supply deficit are first presented, as before. The covariances complement the original analysis by identifying the drivers of change. Elasticities quantify the sensivitivies of regulated flow and supply deficit to changes in flow and demand for the different periods and scenarios.

ii) we also significantly augmented the discussion section on the drivers of change in the discussion section.(see supplement for the exact text added)

Thank you again.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/10/C4963/2013/hessd-10-C4963-2013-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 6359, 2013.