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Discussions

Interactive comment on "Reviving the "Ganges Water Machine": where and how much?" *by* L. Muthuwatta et al.

Anonymous Referee #1

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This article uses a hydrological model to determine surface runoff and unmet irrigation demand in the Ganges river basin. The premise is that surface water outflow from a subbasin could be used to recharge aquifers for use during post monsoon seasons. The model is publicly available, which is a great public service. The model seems to be well implemented and validated.

The overall results are useful for pointing to management possibilities, but the analysis has limitations that the authors are aware of but should be highlighted earlier in the text. In the conclusion the authors acknowledge that they have not determined whether there is sufficient aquifer storage available to hold the proposed "excess" surface water, or opportunities and locations for recharging the water. I think this should also be stated in the methods section. The authors suggest that flooding in Bihar could be

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alleviated by recharge, but I don't think that's well substantiated. They correlate runoff from upstream with inflow into Bihar, but the relationship between groundwater pumping, recharge, and surface water use is not sufficiently developed or modelled to make strong conclusions about the impacts of different management actions. This limitation should also be acknowledged in the methods and discussion.

The authors could also make a clearer link with recent research on groundwater in India, which suggests severe depletion in the western sub basins, e.g. (Rodell, Velicogna, & Famiglietti, 2009). However, there may be much less depletion in the eastern basin, where much of the surface water is available. The authors suggest that pumping could create extra storage space, which may or may not be the case in the basins with "excess" surface water.

Finally, the authors do not acknowledge that wide-spread pumping could have other hydrological impacts, including dry season streamflow depletion, depending on how the newly recharged water is pumped and released. I don't know in detail about Ganges flow availability, but I think low flow in the dry season is already a problem. Whether recharge could compensate for increased pumping is an unanswered question. So overall, I think the paper needs some more qualifiers about its recommendation for pumping and recharge, with acknowledgement of uncertainty in basin response and potential for unintended consequences.

Other comments: The difference between figures 3 and 4 need clarification. For example, subbasin 19 has low runoff in figure 3 but high total outflow. I think the difference is that figure 3 (and. Tables 3 and 4) are surface runoff generated within the subbasin while figure 4 is total outflow which includes ontributions from upstream subbasins.

Detailed comments can be found in the attached pdf.

Rodell, M., Velicogna, I., & Famiglietti, J. S. 2009. Satellite-based estimates of groundwater depletion in India. Nature, 460, 999–1002.

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Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/12/C4329/2015/hessd-12-C4329-2015-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 9741, 2015.