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Hydrology and Earth System Sciences Discussions

Interactive comment on "Agricultural-to-hydropower water transfers: sharing water and benefits in hydropower-irrigation systems" *by* A. Tilmant et al.

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Dear Ms Montosi,

Thank you for your review of "Agricultural-to-hyropower water transfers". Here are our responses to your comments

1.The overall objective of this paper is to compare the performance of static and dynamic management strategies for a water resources system characterized by important hydropower and agricultural sectors. In the dynamic approach, water for crop irrigation

is no longer considered as a static asset but is rather allocated so as to maximize the overall beneïňĄts taking into account the latest hydrologic conditions and the productivities of other users throughout the basin. Most of the studies on water reallocation reported in the literature are focusing on agriculture-to-urban water transfers whereby farmers are ïňĄnancially compensated by industries and/or municipalities for increasing the availability of water through temporary and/or permanent transfers. To the best of our knowledge, there is no study that analyzes the economic rationale of water transfers from the agricultural to the hydropower sector. The vast body of literature on hydropower scheduling and multipurpose multireservoir operation usually assumes that irrigation water demands are constant quantities that must be met as long as there is enough water in the system

2.In this study we are only considering the impact of the hydrologic uncertainty on the intersectoral, basin-wide, allocation decisions. Cropping patterns, farm-gate prices, energy prices etc. are assumed to be known. Consequently, the vector of state variables in SDDP includes the storage levels at the beginning of time period t and the previous inflows qt-1. A built-in PAR(p) hydrologic model provides a link between current flow qt and the previous (sampled) flow qt-1. The parameters of this PAR(p) model are used to derive the coefficients of the EXPECTED hyperplanes, which are then employed to approximate the future benefit function in the optimization phase of the SDDP algorithm. The 50 realizations of synthetic flows are only used in a simulation phase whose objective is to check whether the approximation of the expected future benefit function is statistically acceptable or not. If it is not, then a new optimization phase is implemented to refine the approximation. For further details on the SDDP algorithm, the reader is invited to refer to :

- Tilmant, A., and R. Kelman (2007), A stochastic approach to analyze trade-offs and risks associated with large-scale water resources systems, Water Resour. Res., 43, W06425, doi:10.1029/2006WR005094

- Tilmant, A., D. Pinte, and Q. Goor (2008), Assessing marginal water values in multipurpose multireservoir systems via stochastic programming, Water Resour. Res., 44, W12431, doi:10.1029/2008WR007024

3.Thank you for raising this issue of cooperation and the difference between static and dynamic annual benefits. Actually, this difference reflects the cost of non-cooperation in planning basin-wide water resources. Here this difference is not that large because we are only considering existing irrigation schemes and those in an advanced planning phase, which correspond to less than 50% of the original plan in Turkey. According to the model, it would therefore not be wise (economically) to further expand the irrigation areas in Turkey and thus increase irrigation withdrawals. There are essentially two lessons we can learn from this modeling exercise: (1) from a water resources planning perspective, it is not economically justifiable to increase irrigation withdrawals in Turkey, (2) the transaction costs must be less that the additional benefits associated with coordinated management should basin-wide water resources be jointly managed (allocated). This then triggers the question as to whether a dynamic allocation mechanism is always economically rationale, especially for carefully planned and developed river basins. We are currently analyzing this issue.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 2041, 2009.