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Hydrology and Earth System Sciences Discussions

Interactive comment on "Optimal operation of a multipurpose multireservoir system in the Eastern Nile River Basin" *by* Q. Goor et al.

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We would like to thank the reviewer for his/her comments, and we are responding to all points separately as given below. Changes made in manuscripts are also reported:

(i) English correction p4335 line 25, and p4337 line 4, done.

(ii) p. 4337 long paragraph, shortened and rewritten for better readability.

(iii) More details on linearization: The purpose of this paper is not to provide a detailed description of the SDDP algorithm but to focus on an application (here, the Eastern Nile river basin). Due to space constraints, we are left with no choice but to give a rather brief description of the optimization model. That is why we provide relevant references

for readers who would like to know more about SDDP.

(iv) Results of simulation model to compare: The identification of optimal policies using simulation is a daunting task when possible control policies are numerous. Reservoir operations frequently follow traditional policies that prescribe reservoir releases based on limited criteria such as current storage levels, season, and forecasts of future streamflows. In theory, optimization methods may be used as "screening tools" to efficiently and accurately identify optimal policies and, thus, to reduce the effort and risk of heuristic or trial-and- error approaches. Once the optimal operating policies are identified, they can then be used in more detailed simulation models. We agree with the reviewer that this could indeed be an interesting extension of the current study.

(v) if climate and land use change make the use of past hydrology questionable: We agree with the reviewer that climate and land-use changes make the use of past hydrology questionable. To address this issue, a preliminary study would be required to generate a "new" hydrology corresponding to "new" climate and land-use changes scenarios. The "new" time series of river discharges could then be processed by SDDP in the same way as the historical ones. However, we are aware of some climate change studies in the region which shows small future changes (Elshamy, 2009). On the other hand, researchers claim that land-use change may indeed impose significant changes to runoff in the long run. This could also be an interesting extension of the current study (e.g., Tessema et al., 2010).

(vi) what impact will sediment have over the life of these reservoirs and power plants? This is indeed an important issue. We would like to add the following paragraph and references to mention this issue in the manuscript: "Erosion of the intensively farmed highlands areas in the central and eastern parts of the basin in Ethiopia is one of the major sources of sedimentation in downstream reservoirs. According to [1], the annual sediment discharge of the basin is estimated around 140 Mt/y at Roseires. The construction of the four mega dams on the Blue Nile within Ethiopia will trap sediments which currently discharges down the Blue Nile in Sudan particularly in the flood season

months of July to September. An other possible study could be the design of reservoir operating rules that minimize sedimentation. In Roseires and Sennar, for example, the Sudaneses keep low reservoir level during flood time, until high silt-laden water passed through, and start filling only when water is relatively clean. Cited references: [1] Norplan, Norconsult & Lahmeyer International. Karadobi Multipurpose Projet pre-feasibility study (Final Report) - Volume 5, Initial Environmental Assessment. The Federal Democratic Republic of Ethiopia, Ministry of Water Resources, 2006

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