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Comment on hess-2021-72

John Ndiritu (Referee)

Referee comment on "Water sharing policies conditioned on hydrologic variability to inform reservoir operations" by Guang Yang and Paul Block, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-72-RC5, 2021

Review of Article hess-2021-72

Transboundary water sharing policies conditioned on hydrologic variability to inform reservoir operations

Author(s): Guang Yang and Paul Block

General comments

The article is well-written, scientifically sound and within the scope of the journal.

Detailed comments

Following are the aspects that could be incorporated into the article.

The actual values of the constraints defined in equation 4 to 7 need to be specified. This is especially pertinent because the range of optimal power generation obtained in the study range from 1707 to 1788 MW while the estimated power generation of 15130GWH per year which implies an average power generation of 4202 MW. The reservoir storage trajectories on Figure 6d reveal an assumed maximum storage of 74 billion cubic metres which is the intended capacity of GERD. The article does not indicate whether the upper power generation limit ($\boldsymbol{PU_t}$ in equation 7) equals the intended installation capacity of 5000 MW. On Figure 6d, the reservoir trajectory for a power output of 1788MW is very high and close to full storage for most of the period suggesting that achieving 15130GWH (4202 MW) would require more of what has been simulated as spillage to run through the turbines to generate more electricity. A discussion of how the analysis here relates to the intended installed capacity and power generation would enhance the relevance of the article to the practical transboundary issues regarding the operation of the GERD.

Following are the aspects that could be incorporated as recommendations for further work.

The study applies the historic sequence (from 1965 to2017) just downstream of the GERD dam and reliability considerations are incorporated by the statistical treatment of the residuals of the linear function relating annual releases to annual inflows (equation 10) during low flow years. The resulting range of variability for the different exceedance levels as illustrated in Figure 4 is low and probably underestimates the impact of hydrologic variability. Since the historic sequence is not very long and seems to include only two severe drought periods (from 1978-1988 and 1991 - 1997 as seen on Figures 7 and also reflected on Figure 6d), the extension of the historic inflow records using (its correlation with) the longer-term records available in the Nile basin could enable a more realistic assessment of the effects of droughts on the system and how the GERD could be best operated during such severe droughts. It is during such periods of severe water shortage that tensions are likely to rise among the riparian countries. A more comprehensive probabilistic approach based on stochastically generated ensembles of the extended inflows could also be considered.