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Discussions

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# Interactive comment on "On the representation of water reservoir storage and operations in large-scale hydrological models: implications on model parameterization and climate change impact assessments" by Thanh Duc Dang et al.

**Anonymous Referee #1**

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This paper presents a computational framework based on the Variable Infiltration Capacity (VIC) model and a Multi-Objective Evolutionary Algorithm that enables to analyze the effects of water reservoir representation on the parameterization of hydrological models. The modelling approach was applied to the upper Mekong river basin, upstream the Chiang Saen gauging station, considering two configuration schemes with and without water reservoirs. The authors exposed the theme in a clear, logical sequence, which resulted in a well-written comprehensive text. In my opinion, this work should be accepted for publication at the Hydrology and Earth System Sciences

(HESS) journal after minor revisions. Attached you find some comments/suggestions. Introduction: A comprehensive literature review was done concerning hydrological modelling applied to large river basins, highlighting the limited number of model approaches that enables the direct representation of reservoir water storage with target operating rules to achieve pre-defined objectives. Furthermore, the scientific contribution of this manuscript is clearly defined from line 21 to 34 (Page 03). Study area: The study area description looks poor. Please include more information concerning soil properties and classes, land use, geology and geomorphology, just to enable a better comprehension of main driving forces related to hydrological processes in the Upper Mekong river basin. In Section 3.2.1 you presents the way the input variables (Land use and land cover data, soil data, and flow direction are obtained/processed, but a discussion about those data is lacking. Materials and methods: The way used to achieve the objectives of the manuscript is clearly presented and well-organized. Nevertheless. I would suggest including a sensitivity analysis of the model results to the parameters controlling the rainfall-runoff process (Ds, Dmax, Ws, b, d1 and d2) in the Variable Infiltration Capacity model. Results: The questions raised in the introduction section were answered. The results showed that a flawed model parametrization by disregarding anthropogenic interventions (such as hydraulic infrastructure) led to the overestimation of baseflow and runoff during the dry season to compensate water release related to hydropower production. Despite this, I would suggest discussing more deeply the model parameterization and results. According to the authors, the VIC model has been previously used by other researchers. Could your results be compared with them? Or other models with similar purpose?

Specific comments are listed as follows: 1) Page 04, line 07: How large is the Upper Mekong river basin? Please include the catchment area in $km^2$. 2) Page 04, lines 07-08: The information of elevation ranging from 362 m to 6,494 m should be included. 3) Page 04, line 30: Please include a complementary information explaining why the hydrological alterations became more evident since 1992. The largest reservoir (Xi'er He 1) was built before in 1989. 4) Page 05, line 19 and Table 1: How the feasible ranges

of the two çãosoil layers thickness (d1 and d2) were defined? 5) Page 06, line 29: How the target water level is defined for each reservoir? 6) Page 08 lines 02-17: What processes are considered in the reservoir water balance and operation? Are infiltration loss and groundwater inflow disregarded? 7) Page 09, line 11: "parellelized" should be changed to "parallelized". 8) Page 11, lines 05-24: Please discuss the pattern observed in Figure 6, with different ranges of the model parameters for the simulation with and without reservoirs. Some parameters presented a more spread pattern for the scenario with reservoirs and a more uniform one for the scenario without reservoir and vice versa. 9) Fig. 2: Please use the term "modelling approach" instead "model" (Figure legend). 10) Fig. 3: Please include a legend describing the four levels highlighted in Figure 3c. 11) Fig 8: I would suggest to reduce the number of baseflow intervals to enable a better visualization of model results related to the configuration scheme with and without reservoirs.