Title

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We would like to thank the discusser for the comments about our paper. These authors present replies regarding each point raised in the discussion to clarify issues for the discusser and the readers of the journal. However, most of the issues raised in the discussion have been treated in many publications dealing with various evolutionary and metaheuristic algorithms for solving different water resources problems, such as reservoir operation (Ahmadi et al. 2014; Bolouri-Yazdeli et al. 2014; Ashofteh et al. 2013a, 2015a), groundwater resources (Bozorg-Haddad et al. 2013; Fallah-Mehdipour et al. 2013a), conjunctive use operation (Fallah-Mehdipour et al. 2013b), design-operation of pumped-storage and hydropower systems (Bozorg-Haddad et al. 2014), flood management (Bozorg-Haddad et al. 2015b), water project management (Orouji et al. 2014), hydrology (Ashofteh et al. 2013b), qualitative management of water resources systems, (Orouji et al. 2013; Bozorg-Haddad et al. 2015a; Shokri et al. 2014), water distribution systems (Seifollahi-Aghmiuni et al. 2013; Soltanjalili et al. 2013; Beygi et al. 2014), agricultural crops (Ashofteh et al. 2015c), sedimentation (Shokri et al. 2013), and algorithmic developments (Ashofteh et al. 2015b), which are published in peer-reviewed journals.

These are our responses to the discussions' comments:

1. Eqs. (17)–(19) are penalty cost functions in the original paper. They are defined so that the values of penalties for large and small differences are high and low, respectively. Thus, the larger the violations of constraints, the larger the penalties and vice versa. Two other considerations are (1) small violations would occur when the parameter values of the solution are close to their defined thresholds in a problem. For example, if $S_i(t)$, the storage of the reservoir i at the beginning of the period t, is close to $S\min_i(t)$ or $S\max_i(t)$, the value of violation and the penalty values calculated from Eqs. (18) or (19) will be small, respectively. Thus, the algorithm calculates such a solution as the optimal solution for the problem, which is correct. Evolutionary algorithms such as the BA calculate near optimal solutions, but not global ones, and, therefore, the calculated solution is a near optimal solution, not a local or global one. The evolutionary algorithm will be trapped in local optima; and (2) Eqs. (17)–(19) impose large penalties on large constraint violations, which is correct, and helps describe problem conditions accurately.
2. In a spill event, part of the water is conveyed downstream without any beneficial use. The former statement would be acceptable only for single-reservoir systems or when the spill volume cannot be used for supplying downstream water demands. In multi-reservoir systems, however, the spills of upstream reservoirs can be discharged to downstream reservoirs, which leads the downstream reservoirs to be more effective in meeting water use and their operational purposes. Because the main purpose of the original paper is evaluating the performance of the BA algorithm for different reservoir systems, the volume of spill in different reservoirs is a factor in calculating the benefit of each reservoir, as shown in Eqs. (10) and (11).
3. The BA is an evolutionary algorithm that can achieve near optimal solutions. Defining constraints for different parameters in the modeling structure of the problem is applicable only when gradient-based optimization methods are applied, such as LP or NLP methods. In evolutionary algorithms such as the BA, penalty functions are introduced to enforce bounds for different parameters used in the problem to obtain feasible solutions. These penalty functions are applied only when the defined constraints are not satisfied. Also, Eqs. (18) and (19) are written to completely describe the problem modeling. These equations are considered in the coding of the problem as penalty functions.
4. The objective function [Eq. (21)] developed for single-reservoir systems minimizes the deficits of hydropower generation in the system. The original paper did not consider the vulnerability of hydropower generation. Therefore, in the supporting example given by the discusser, the objective function for the two introduced alternatives equals 67% because their deficits of hydropower generation are equal. Minimizing the vulnerability of alternatives was not the goal of hydropower generation in the problem of the original paper. This is something that could be entertained in future work.
5. The concept of carryover is captured by Eqs. (15) and (16) as an assumption of the standard operation policy (SOP). According to this assumption, the initial and final storage volumes during the operation period of the reservoir are equal to each other, and the final storage volume can be greater than the initial one. Thus, the obtained operation program can be efficiently and repeatedly used during each period equal to the modeled period, and the system will be stable. Also, it would be helpful to consider the equation $S^{\mathrm{target}} \geq S^{\mathrm{initial}}$ in the original paper to clearly represent the concept of carryover in reservoir operation.
6. The last issue raised in the discussion is about references in the original paper. The discusser criticizes the referencing used by the authors, which quote several of their previous publications in the original paper. The discusser should identify other published works to correct any perceived omission of pertinent works in the original paper.

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