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# Development of Real-Time Conjunctive Use Operation Rules for Aquifer-Reservoir Systems

**Elahe Fallah-Mehdipour · Omid Bozorg Haddad · Saeed Alimohammadi · Hugo A. Loáiciga**

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**Abstract** Real-time operation rules are strategies that use prior and current system states to achieve desired conditions in future periods. Commonly, these rules are based on estimates of current and future inflows, current aquifer and reservoir storages, hydraulic heads, power plant capacities and energy demands, and water demand values from users. This paper proposes the development and implementation of a linear real-time operation rule for lumped and distributed aquifer-reservoir systems. A fixed length gene genetic programming (FLGGP) approach is applied to find linear operation rules for a lumped aquifer- reservoir system and compared to an approach using genetic algorithms (GA). Results obtained with the FLGGP are significantly better (over 30 %) than those calculated with GA. The added functions and mathematical operators of the FLGGP create more effective operation rules in a conjunctive aquifer-reservoir system. In addition, lumped and distributed model performances are compared. Results obtained show reliability higher and vulnerability lower for water allocations in distributed aquifer-reservoir systems than those corresponding to lumped systems.

**Keywords** Fixed length gene genetic programming · Aquifer-reservoir system · Real-time operation · Optimization

E. Fallah-Mehdipour
Department of Irrigation & Reclamation Engineering, Faculty of Agricultural Engineering & Technology, College of Agriculture & Natural Resources, University of Tehran, Karaj, Tehran, Iran
e-mail: Falah@ut.ac.ir

O. Bozorg Haddad (✉)
Department of Irrigation & Reclamation Engineering, Faculty of Agricultural Engineering & Technology, College of Agriculture & Natural Resources, University of Tehran, Karaj, Tehran, Iran
e-mail: OBhaddad@ut.ac.ir

S. Alimohammadi
Department of Water Resources, Faculty of Water & Environmental Engineering, College of Shahid Abbaspour, University of Shahid Beheshti, Tehran, Iran
e-mail: Alimohammadi@pwut.ac.ir

H. A. Loáiciga
Department of Geography, University of California, Santa Barbara, CA 3106, USA
e-mail: Hugo.Loaiciga@ucsb.edu

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