Geophysical Research Abstracts
Vol. 20, EGU2018-8276-1, 2018
EGU General Assembly 2018

Optimisation of Multipurpose Reservoir Operation by Genetic Algorithm for Optimal Operating Policy (Case Study: Ganga River basin)

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Reservoirs are recognized as one of the most efficient infrastructure components in integrated water resources management and development. At present, with the ongoing advancement of social economy and requirement of water, the water resources shortage problem has worsened, and the operation of reservoirs, in terms of consumption of flood water, has become significantly important. Reservoirs perform both regulation of flood and integrated water resources management, in which the flood limited water level is considered as the most important parameter for trade-off between regulation of flood and conservation. To achieve optimal operating policies for reservoirs, large numbers of simulation and optimization models have been developed in the course of recent decades, which vary notably in their applications and working. Since each model has their own limitations, the determination of fitting model for derivation of reservoir operating policies is challenging and most often there is always a scope for further improvement as the selection of model depends on availability of data. Subsequently, assessment and evaluation associated with the operation of reservoir stays conventional. In the present study, a Genetic Algorithm model has been developed and applied to three reservoirs in Ganga River basin, India to derive the optimal operational policies. The objective function is set to minimize the annual sum of squared deviation form desired irrigation release and desired storage volume. The decision variables are release for irrigation and other demands (industrial and municipal demands), from the reservoir. As a result, a simulation-based optimization model was recommended for optimal reservoir operation, such as allocation of water, flood regulation, hydropower generation, irrigation demands and navigation and e-flows using a definite combination of decision variables. Since the rule curves are derived through random search it is found that the releases are same as that of demand requirements. Hence based on simulated result, in the present case study it is concluded that GA-derived policies are promising and competitive and can be effectively used operation of the reservoir.