

## **Application of a particle swarm optimization to the tank model**

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**Abstract** A major risk concerning the modelling of hydrological processes with conceptual models is the optimization of the parameters because they cannot be directly measured in the field, mainly in nonlinear models. Several optimization methods have been tested in the past during the calibration of such models, but it is difficult to ensure that the final values are not trapped in a local minimum. Thus, the difficulties involved in calibration of hydrological models have been partly attributable to the lack of robust optimization tools. This paper presents the essential concepts and application to optimize the main parameters in a conceptual hydrological model, with a global optimization method known as Repulsive Particle Swarm (RPS), which is a variant of the Particle Swarm Optimization (PSO) method. The hydrological model that was chosen is the tank model, whose basic principle consists of representing the river basin as a set of tanks in which the outflows of each tank are proportional to the water height from the respective outlets. The tank model is nonlinear and mathematics is nearly useless for nonlinear problems. Therefore, mathematics could not be used for the tank model calibration, and consequently, the RPS technique seems to be suitable for such a task. The optimization technique was tested with the field data from Ishite River Dam, which is the reservoir that supplies water to the city of Matsuyama, Japan. On the basis of these results, the parameter values are given, which could serve as an initial estimate for other similar Japanese watersheds.

**Key words** hydrological modelling; optimization; RPS; tank model