

Nonlinear dynamic analysis of reservoir inflows: a case study from South India

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Abstract In water resource studies, it is a common practice to use stochastic methods for simulation of future inflows for reservoir operation purposes. However, recent studies have revealed that complex and random-looking streamflows could also be the outcome of simple deterministic systems. The present study investigates the dynamic nature of inflows to the Pechiparrai Reservoir in the state of Tamil Nadu in South India. Inflows over a 32-year period are studied, and the correlation dimension method is employed to identify the nature of the underlying system dynamics. Considering the weekly time scale normally adopted for operation of the Pechiparrai Reservoir, the nature of inflow dynamics at daily, 2-day, 4-day, and 8-day scales is investigated. The low correlation dimension values of 1.98, 2.10, 2.21, and 2.35 estimated for these four series suggest the presence of low-dimensional chaotic dynamics, with the number of variables dominantly governing being in the order of 2 or 3.

Key words reservoir inflows; time series analysis; stochastic; chaos; autocorrelation function; phase space reconstruction; correlation dimension; scale; Kodiyar Reservoir