On the Auto-Calibration of Watershed Models

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Abstract. Over the last two decades, watershed models have been increasingly embedded in decision making processes to address a wide range of hydrologic and water quality issues. These models have evolved from lumped to distributed while operating on shorter time steps so that they can utilize input data at finer spatiotemporal resolutions. With the incorporation of more input and output factors has come an escalation in the level of structural complexity of watershed models. This study aims to evaluate the efficiency and applicability of optimization techniques for parameter estimation of a comprehensive watershed model (i.e., Soil and Water Assessment Tool) in several watersheds in Indiana and Colorado. Three evolutionary algorithms including Shuffled Complex Evolution (SCE-UA), single-objective Genetic Algorithm (GA) and multi-objective GA (MOGA) were used to calibrate streamflow, nutrients, and pesticides processes at various temporal scales. The efficiency of these methods were investigates using different objective functions including root mean square error, coefficient of determination and Nash-Sutcliffe efficiency coefficient. Results indicated that while flow processes can be reasonably ascertained, representation of nutrient and pesticide processes presents a challenge. The examined auto-calibration algorithms provide a systematic approach for parameter estimation and will significantly reduce the subjectivity and time requirements of the manual calibration exercises.

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