

## **A multi-model multi-objective study to evaluate the role of metric choice on sensitivity assessment**

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Sensitivity analysis (SA) is an essential tool for providing insight into model behavior, calibration, and uncertainty assessment. It is often overlooked that the metric choice can significantly change the assessment of model sensitivity. In order to identify important hydrological processes across various case studies, we conducted a multi-model multi-criteria sensitivity analysis using a novel and efficient technique, Variogram Analysis of Response Surfaces (VARS). The analysis was conducted using three physically-based hydrological models, applied at various scales ranging from small (hillslope) to large (watershed) scale. In each case, the sensitivity of simulated streamflow to model processes (represented through parameters) were measured using different metrics selected based on various hydrograph characteristics including high flows, low flows, and volume. It is demonstrated that metric choice has a significant influence on SA results and must be aligned with study objectives. Guidelines for identifying important model parameters from a multi-objective SA perspective is discussed as part of this study.