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Global Sensitivity Analysis of the WASIM hydrological model using VARS

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Sensitivity analysis (SA) aims to identify the key parameters that affect model performance and it plays an important role in model understanding, calibration, and uncertainty quantification. The increasing complexity of physically-based hydrological models warrants application of comprehensive SA methods for an improved and effective application of hydrological modeling.
This study aims to provide a comprehensive sensitivity assessment of WaSiM (Richards version 9.03) hydrological model using a novel and efficient global SA technique Variogram Analysis of Response Surface (VARS), at the experimental Schaefertal catchment (1.44 Km2) in lower Harz Mountains Germany. WaSiM is a distributed hydrological model that can simulate surface and sub-surface flows at various spatial and temporal scales. VARS is a variogram-based framework for global SA that can characterize the full spectrum of sensitivity-related information, thereby providing a comprehensive set of "global" sensitivity metrics with minimal computational cost.
Our preliminary SA results show that simulated streamflows in WaSim-ETH are most sensitive to precipitation correction factor followed by parameters related to the snowmelt and flow density. We aim to expand this sensitivity assessment by conducting a more comprehensive global SA with more than 70 parameters from various model components corresponding to interception, infiltration, evapotranspiration, snowmelt, and runoff. This will enable us to provide an enhanced understanding of WaSiM structure and identify dominant controls of its behavior that can be utilized to reduce model prediction uncertainty and reduce parameters needed for calibration.