1. Introduction

Hydrologic models are traditionally calibrated against discharge. Recent studies have shown however, that only a few global model parameters are constrained using the integral discharge measurements. It is therefore advisable to use additional information to calibrate those models. Signatures focused on low flows, for example, could improve the parameterization of baseflow processes, which might be under-represented when using only discharge. A common approach is to combine these multiple objectives into one single objective function and allow the use of a single-objective (SO) algorithm. A different strategy is to consider the different objectives separately and apply a multi-objective (MO) algorithm. Both methods are challenging in the choice of appropriate multiple objectives for calibration.

2. Model & Study Area

The study is performed using the distributed hydrologic model at the mesoscale (mHM) with 52 parameters. The model uses grid cells as a primary hydrologic unit, and accounts for processes like snow accumulation and melting, soil moisture dynamics, infiltration, surface runoff, evapotranspiration, subsurface storage and discharge generation. The model is applied in three distinct catchments of different hydrological characteristics over Europe.

![Image of catchments]

3. Parameter Screening

Parameter screening is performed using the Elementary Effects (EE) following the procedure described by Cuntz et al. (2015) [1]. The thresholds are determined for each objective individually and then either (a) parameters have to be in a rectangular region or (b) triangular region to be marked as noninformativeness.

4. Sensitivities Regarding Signatures

- Sobol’ sensitivity analysis regarding 64 hydrologic signatures such as features of FDC and limb densities [2]
- Identification of informative parameters, i.e. parameters contributing to 90% of total variability per signature
- 10 (DE), 9 (SLO) and 12 (ES) parameters are informative using only discharge
- 17 (DE), 16 (SLO) and 21 (ES) parameters are informative using 10 (DE), 9 (SLO) and 12 (ES) signatures
- Identified signatures later used for calibration to assure hydrologic consistency of inverted parameter sets [2]

5. How does MO calibration compare to SO calibration?

![Image of MO vs SO calibration]

6. Is a parameter screening prior to a MO calibration helpful?

![Image of parameter screening vs MO calibration]

References