Calibration of hydrological models is influenced by several different sources of errors, including the conceptualization of the model itself and uncertainty in observation systems. These errors must be properly accounted for in any rainfall-runoff model calibration or prediction. The Bayesian-Total-Error-Analysis (BATEA) methodology provides a rigorous framework to incorporate information on rainfall and runoff uncertainty. However, the separation of the different sources of uncertainty can only be achieved when strong prior information is available for both rainfall input and runoff output errors. Therefore, it is essential to thoroughly investigate errors in rainfall measurements and bring any valuable information into the BATEA model.

Lumped hydrological models usually consider catchment-average rainfall as input data, based on a limited set of raingauges. In this work, we describe spatial sampling errors by analysing rainfall radar data. Indeed, radar images cover both space and time at a very fine scale and provide important information on the spatial variability of rainfall. We use this alternative source of data to identify global patterns and to depict the statistical properties of rainfall errors. A rainfall error model is developed based on the observation that multiplicative errors are generally more dispersed for low rainfall events than for heavy rainfall storms.

The application of BATEA with this rainfall input prior improves the decomposition of the uncertainty, while a vague rainfall prior integrates the different sources of uncertainty into the multiplicative rainfall errors. Finally, we compare this approach with a different computation of rainfall errors, derived from a geostatistical method.