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Identifying precipitation uncertainty in crop modelling using Bayesian total error analysis

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Water availability is critical to crop growth and modelling. Although advances in generating diverse sources of climatic data are achieved, input uncertainty such as precipitation is still expected to corrupt parameter estimation and predictive consistency in soil water and crop modelling. In this study, we develop a Bayesian total error analysis (BATEA) framework for the water-oriented crop model AquaCrop to identify the input uncertainty from multiple precipitation products respectively, including gauge observation, gauge-corrected grid dataset CPC, remote sensing-based TRMM and reanalysis-based ERA-Interim. This methodology uses latent variables to correct the systematic errors of input data before simulation starts. Here we adopt a multiplier method for precipitation correction and apply it to the maize growth simulation in both field and regional scales in China. It results in an improved robustness for crop modeling with each precipitation product and demonstrates the proper usage of multiple products for different purposes.