Calibrating a Hydrological Model for Pesticide Transfer while Considering Rain Uncertainty

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Misspecifying external forcings on a hydrological model can directly affect subsequent model calibrations. Indeed, by using classical calibration and problem inversion methods, the error in the forcings (such as rain) will be propagated to the model output, and if not treated correctly, this error will be compensated by overcalibrating the model parameters. To overcome this problem, robust calibration approaches have been proposed [3]. However, the robust approaches are difficult to apply on distributed hydrological pesticide transfer models, mainly due to their high dimension and computational cost.

In our study, we wish to calibrate the PESHMELBA [2] distributed hydrological pesticide transfer model used for the simulation of pesticide fate on small agricultural catchments. The PESHMELBA model is being developed with the aim of becoming a decision-making tool for water quality management.

We compare the calibration/parameter estimation of PESHMELBA in different rain misspecification settings. The rain uncertainty is modeled with the SAMPO [1] stochastic model. The computational cost of the optimization problem is reduced through adaptive enrichment of a surrogate model of the cost function. The methodology is evaluated through twin set experiments.

[1] Etienne Leblois and Jean-Dominique Creutin. Spacetime simulation of intermittent rainfall with prescribed advection field: Adaptation of the turning band method. page 13.

[2] Emilie Rouzies, Claire Lauvernet, Christine Barachet, Thierry Morel, Flora Branger, Isabelle Braud, and Nadia Carluer. From agricultural catchment to management scenarios: A modular tool to assess effects of landscape features on water and pesticide behavior. *Science of The Total Environment*, 671:1144–1160, June 2019.

[3] Victor Trappler, Élise Arnaud, Arthur Vidard, and Laurent Debreu. Robust calibration of numerical models based on relative regret. *Journal of Computational Physics*, 426:109952, February 2021.