Chair for Hydrology and River Basin Management
Faculty of Civil, Geo and Environmental Engineering
Technical University Munich

Study Project – Environmental Engineering

Workload: 12 ECTS, 360 hours

A possibilistic approach for understanding uncertainties in hydrological modeling

Description:

The hydrological modeling process is affected by several aleatory and epistemic uncertainties. In response, the formal evaluation of uncertainties has become a fundamental tool in theoretical and experimental studies (Di Baldassarre and Montanari, 2009; Merchán-Rivera et al., 2021; Smith, 2013). Possibility theory (Dubois and Prade, 1988) has recently received more attention for being a hybrid alternative to understand and quantify uncertainties (e.g., Hose and Hanss, 2020; Peikert et al., 2017; Toscani et al., 2018). In contrast to the probabilistic approach, possibilistic calculus is based on the fuzzy set theory and the idea of describing imprecise probabilities, also known as possibilities (Lallechere et al., 2019).

Objective:

The main goal of this study project is to analyze how the combination of probability and possibility approaches can be used to properly account for aleatory and epistemic uncertainties. A general model example will be provided to the student (e.g., groundwater contamination case or river-aquifer interaction system). The student will write the scripts and algorithms to apply the researched methods into the provided model and report the advantages and drawbacks of employing such framework.

General tasks:

- Read and understand technical literature related to possibility theory
- Script and run the synthetic model
- Analyze and report findings

Skills and requirements:

- Some experience with hydrological modelling
- Knowledge about probability theory and statistics
- Programming with Python

Application time: From 1st March 2022 to 15th April 2022

Beginning: April/May 22

Contact:
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References:
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Lallechere, S., Carobbi, C.F.M., Arnaut, L.R., 2019. Review of Uncertainty Quantification of Measurement and Computational Modeling in EMC Part II: Computational Uncertainty. IEEE Trans. Electromagn. Compat. 61, 1699–1706. https://doi.org/10.1109/TEMC.2019.2904999
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Peikert, T., Garbe, H., Potthast, S., 2017. Fuzzy-Based Risk Analysis for IT-Systems and Their Infrastructure. IEEE Trans. Electromagn. Compat. 59, 1294–1301. https://doi.org/10.1109/TEMC.2017.2682643
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