



Data Assimilation and Uncertainty Analysis in Decision-Support Modelling

Date: 30th October – 3rd November 2023

Location: University of Neuchâtel

Speaker: Dr. John Doherty, the author of PEST

The program is as follows:

Day 1

morning:

- welcome
- models and decision support - what models can and cannot achieve
- harvesting and transfer information using models
- parameters as receptacles for information
- revision of basic linear algebra and statistics

afternoon:

- parameter estimation for well-posed inverse problems – theory and practice
- introduction to the PEST suite
- introduction to the PEST++ suite
- basic workshop on PEST/PEST++ model interface protocols

Day 2

morning:

- highly parameterized inversion
- nonuniqueness and the null space
- the cost of uniqueness
- manual, subspace and Tikhonov regularisation
- recognition and prevention of overfitting

afternoon:

- parameter estimation in groundwater modelling
- pilot points as a parameterization device
- structural overlay parameters
- SVD-assisted inversion
- workshop on calibrating a highly-parameterized model

Day 3

morning:

- calibration of defective models - theory and practice
- the need for creativity in formulating an objective function

- one-sided penalty functions
- surface water model calibration
- continuation of workshop on highly parameterized inversion

afternoon:

- uncertainty analysis – basic concepts
- Bayes equation and conditioning
- basic geostatistics
- stationarity, nonstationarity and spatially-varying variograms
- stochastic parameter field generation

Day 4

morning:

- the importance of working in high parameter dimensions
- linear sensitivity and uncertainty analysis
- data worth assessment
- workshop on linear uncertainty analysis

afternoon:

- enforcing calibration constraints for a highly-parameterized model
- quasi linear methods
- ensemble methods
- benefits and drawbacks of ensemble methods
- workshop on nonlinear uncertainty analysis

Day 5

morning:

- working with very complex models: data space inversion
- direct predictive hypothesis testing
- decision outcome optimization
- optimisation under uncertainty

afternoon:

- course participants discuss their own examples
- farewells

If you are interested and want to sign up please visit: <https://www.unine.ch/phdschool-wes>

If you have any question about the program or the organization of the course, please do not hesitate to contact us.

The course is free for PhD students who are members of the PhD school Water-Earth systems.

Thanks also for letting this information circulate among your colleagues and students who could be interested.

Contact: school.earth-water@unine.ch