

Group presentation WP 5

Design inverse modelling strategies for dynamic processes in complex subsurface structures



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- Activities

- define new strategies for representing complex architectures of sedimentary and fractured media, based on training images, multi-point geostatistics, and genetic approaches (ESR 4,15)
- develop inversion frameworks that integrate data of diverse nature, and model uncertainty (ESR 14, 15)
- establish novel tomographic inversion approaches for 3D imaging based on fully coupled inversion of time lapse ERT and GPR of tracer motion, hydraulic tomography and heat tracer tests (ESR 13)

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- Common main questions :
 1. How can geophysics help in the prediction of hydrogeological data?
 2. What are the benefits of time-lapse data for modeling dynamic processes?
 3. How to efficiently join geophysical and hydrogeological data?
 - 3.a. Data weighting?
 - 3.b. Information flow - how is time lapse data connected.
 4. Limits of space and time resolvability of hydrological phenomena with time-lapse geophysics?
 5. What is the best way to prepare data for any kind of inversion/data assimilation?
E.g. compressing original data of breakthrough curves by using temporal moments

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- Possible joint experiments or actions :
 1. "Prediction focused approach" (Bayesian Evidential Learning))in Argenton site.
 2. Inversion of time lapse crosshole ERT (CHERT) data using Ensemble Kalman Filter for "natural" salt tracer tests in Argenton site.
 3. ERT acquisition strategies (surface and CHERT).
 - 3.a. ERT data filtering - because time-lapse data might be very sensitive on noise in the data
 4. Comparison of data inversion, data assimilation and Bayesian Evidential Learning methods
 5. Applying result to the Selke site (Gui, Leipzig)

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- Existing reviews:
 - [Geological realism in hydrogeological and geophysical inverse modeling: A review.](#) N Linde, P Renard, T Mukerji, J Caers - Advances in Water Resources, 2015
 - [Inverse problem in hydrogeology.](#) J Carrera, A Alcolea, A Medina, J Hidalgo, LJ Slooten - Hydrogeology journal, 2005

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- Possible ideas of “reviewlets”
 1. Joint inversion of ERT/GPR and hydrogeological data.
 2. Use of time-lapse geophysics to monitor hydrodynamic processes