S$_H$ynergie: Development of a virtual project laboratory for monitoring hydraulic stimulations

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Hydraulic stimulations are the primary means of developing subsurface reservoirs regarding the extent of fluid transport in them. The associated creation or conditioning of a system of hydraulic conduits involves a range of hydraulic and mechanical processes but also chemical reactions, such as dissolution and precipitation, may affect the stimulation result on time scales as short as hours. In the light of the extent and complexity of these processes, the steering potential for the operator of a stimulation critically depends on the ability to integrate the maximum amount of site-specific information with profound process understanding and a large spectrum of experience. We report on the development of a virtual project laboratory for monitoring hydraulic stimulations within the project S$_H$ynergie (http://www.ruhr-uni-bochum.de/shynergie/). The concept of the laboratory envisioned product that constitutes a preparing and accompanying rather than post-processing instrument ultimately accessible to persons responsible for a project over a web-repository. The virtual laboratory consists of a data base, a toolbox, and a model-building environment. Entries in the data base are of two categories. On the one hand, selected mineral and rock properties are provided from the literature. On the other hand, project-specific entries of any format can be made that are assigned attributes regarding their use in a stimulation problem at hand. The toolbox is interactive and allows the user to perform calculations of effective properties and simulations of different types (e.g., wave propagation in a reservoir, hydraulic test). The model component is also hybrid. The laboratory provides a library of models reflecting a range of scenarios but also allows the user to develop a site-specific model constituting the basis for simulations. The laboratory offers the option to use its components following the typical workflow of a stimulation project. The toolbox incorporates simulation instruments developed in the course of the S$_H$ynergie project that account for the experimental and modeling results of the various sub-projects.