OPENGEOSYS: AN OPEN SOURCE PROJECT FOR NUMERICAL SIMULATION OF THMC PROCESSES

Thomas Kalbacher, Helmholtz Centre for Environmental Research - UFZ / Department of Environmental Informatics, 00493412351093, thomas.kalbacher@ufz.de

1. Thomas Kalbacher, Helmholtz Centre for Environmental Research - UFZ / D epartment of Environmental Informatics
2. Olaf Kolditz, Helmholtz Centre for Environmental Research - UFZ / Department of Environmental Informatics
3. Wenqing Wang, Helmholtz Centre for Environmental Research - UFZ / Department of Environmental Informatics
4. Haibing Shao, Helmholtz Centre for Environmental Research - UFZ / Department of Environmental Informatics
5. Norihiro Watanabe, Helmholtz Centre for Environmental Research - UFZ / Department of Environmental Informatics

State-of-the-art computational models used for integrated water resources management are rapidly developing instruments. Advances in computational mathematics have revolutionized the variety and the nature of the problems that can be addressed by environmental scientists and engineers. For each hydro-compartment, from precipitation and surface run-off to catchment water balance and groundwater interactions, there exist many excellent simulation codes. However, their development has been isolated within different disciplines. The OpenGeoSys (OGS) project is a scientific open source initiative for numerical simulation of thermo-hydro-mechanical-chemical (THMC) processes in porous media. The basic concept is to provide a flexible numerical framework (using primarily the Finite Element Method (FEM)) for solving multi-field problems in porous and fractured media for applications in geoscience and hydrology. To this purpose, OGS is based on an object-oriented FEM concept including a broad spectrum of interfaces for pre- and post-processing. The idea includes a web-based platform for community access, outfitted with professional software engineering tools such as platform-independent compiling and fully automated benchmarking. Another strategy is to utilize a toolbox that enables OGS simulations to interact sequentially with other individual modeling tools in order to address coupled processes in neighboring hydrologic disciplines. The OGS community also contributes to the DEVOVALEX and CO2BENCH / Hydrobench projects, in order to promote cooperation between different developer teams via code comparison and validation exercises.