Geophysical Research Abstracts
Vol. 18, EGU2016-18270, 2016
EGU General Assembly 2016

Flexible simulation framework to couple processes in complex 3D models for subsurface utilization assessment

Thomas Kempka, Benjamin Nakaten, Marco De Lucia, Natalie Nakaten, Christopher Otto, Maik Pohl, Elena Tillner, and Michael Kühn

GFZ German Research Centre for Geosciences, Section 3.4 - Fluid Systems Modelling, Telegrafenberg, 14473 Potsdam, Germany

Utilization of the geological subsurface for production and storage of hydrocarbons, chemical energy and heat as well as for waste disposal requires the quantification and mitigation of environmental impacts as well as the improvement of georesources utilization in terms of efficiency and sustainability. The development of tools for coupled process simulations is essential to tackle these challenges, since reliable assessments are only feasible by integrative numerical computations. Coupled processes at reservoir to regional scale determine the behaviour of reservoirs, faults and caprocks, generally demanding for complex 3D geological models to be considered besides available monitoring and experimenting data in coupled numerical simulations. We have been developing a flexible numerical simulation framework that provides efficient workflows for integrating the required data and software packages to carry out coupled process simulations considering, e.g., multiphase fluid flow, geomechanics, geochemistry and heat. Simulation results are stored in structured data formats to allow for an integrated 3D visualization and result interpretation as well as data archiving and its provision to collaborators. The main benefits in using the flexible simulation framework are the integration of data geological and grid data from any third party software package as well as data export to generic 3D visualization tools and archiving formats. The coupling of the required process simulators in time and space is feasible, while different spatial dimensions in the coupled simulations can be integrated, e.g., 0D batch with 3D dynamic simulations. User interaction is established via high-level programming languages, while computational efficiency is achieved by using low-level programming languages. We present three case studies on the assessment of geological subsurface utilization based on different process coupling approaches and numerical simulations.