

EGU21-13299

<https://doi.org/10.5194/egusphere-egu21-13299>

EGU General Assembly 2021

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Hydrogeological simulation of sedimentary basin evolution during a glacial cycle

Christian Silbermann

TU BA Freiberg, Institute of Geotechnics, Geosciences, Geoengineering and Mining, Chemnitz, Germany
(christian.silbermann@ifgt.tu-freiberg.de)

Co-authors: Francesco Parisio, Thomas Nagel

Glaciation cycles affect the long-term evolution of geosystems by crustal deformation, ground freezing and thawing, as well as large-scale hydrogeological changes. In order to properly understand the present and future conditions of potential nuclear waste repository sites, we need to simulate the past history.

For this, a sedimentary basin is considered here as a large-scale hydrogeological benchmark study. The long-term evolution during one glacial cycle is simulated using the open-source multi-field finite element code *OpenGeoSys*. The impact of the glacial loading (weight and induced shear) is taken into account using appropriate time-dependent stress boundary conditions. As a preliminary study, the hydro-mechanically coupled problem and the thermal problem are considered separately. For comparison with a previously published study by Bense et al. (2008), the entire displacement field is prescribed and the groundwater evolution (hydraulic problem) is regarded. Then, the displacement is only prescribed by means of boundary conditions. The impact of different constitutive assumptions on the deformation and hydraulic behavior is analyzed. The thermal problem is used to simulate the evolution of frost bodies in the subsurface beneath and ahead of the glacier.

V. F. Bense and M. A. Person. Transient hydrodynamics within intercratonic sedimentary basins during glacial cycles. *Journal of Geophysical Research*, 113(F4):F04005, 10 2008.