[JJ] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG63]Rheology, fracture and friction in Earth and planetary sciences

convener:Osamu Kuwano(Japan Agency for Marine-Earth Science and Technology), Ichiko Shimizu(Department of Earth and Planetary Science, Graduate School of Science, University of Tokyo), Hidemi Ishibashi(静岡大学理学部地球科学専攻, 共同), Miki Tasaka(Shimane University)

Sun. May 20, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

The aim of this session is to join people from various research area in the earth and planetary sciences and to stimulate discussion beyond the boundaries of each research area. Our goal is to deepen our understanding of dynamics in geosciences by looking over whole areas in the earth and planetary sciences from the viewpoint of PHYSICS OF DEFORMATION, FLOW, AND FRACTURE. We welcome any field (e.g., earthquake, volcano, earth surface, crust, mantle and the core, and other planets and satellites) and any approach (e.g., laboratory experiments, numerical simulations, field observations, and theories).

[SCG63-P06]Permeability benchmark using 3D numerical modelling

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Keywords:digital rock, permeability, sand stone, numerical simulation

Migration of geological fluids is an important process controlling chemical transport and mechanical properties in the Earth’s interior (e.g. melt segregation from partially molten region; segregation of dehydrated fluid from a subducting slab).

Geological fluids percolate upwards due to their buoyancy and permeability is a key factor that controls the flow rate. Therefore the effective permeability depends on the microscopic pore fluid connectivity.

Here we calculate permeability numerically for high resolution CT scans of rocks. For this purpose we use the 3D thermomechanical code LaMEM (Lithospheric and Mantle Evolution Model) (Kaus et al., 2016). We compute the flow velocities and then plug them into Darcy’s law. For benchmarking, we calculate fluid flow through single and multiple pipes using LaMEM. We compare the resulting permeabilities using different grid resolutions against the analytical solution for Hagen-Poiseuille flow.

In a next step we computed the permeability of Fontainbleau sandstone digitalized by Andra et al., 2012. We obtained 2171mD which is higher than 1100mD from laboratory measurement (Keehm 2003). However, our result is almost consistent with numerical results by Andra et al., 2012 which are 1503mD for Lattice-Boltzmann method and 1914mD for Explicit Jump method respectively.

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Andra et al,(2013). Digital rock physics benchmarks-Part I: Imaging and segmentation Computers and Geoscience, 50 25-32

Andra et al,(2013). Digital rock physics benchmarks-part II: Computing effective properties Computers and Geoscience, 50 33-43

Kaus, B et al, (2016). Forward and inverse modeling of lithospheric deformation on geological timescales. In: Binder, K., Mller, M., Kremer, M., Schnurpfeil, A. (Eds.), NIC Proceedings. Vol. 48. pp. 299–307.

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