Geophysical Research Abstracts, Vol. 9, 08049, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08049

Aggregated 3D simulation of “fracture ensembles”

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A conceptual model for aggregated 3D numerical and geometrical simulation of distinct fracture systems of complex blocky rock masses is proposed. A geological model proper for the 3D simulation is firstly discussed and the main conceptual geological objects are then defined. Simulations are performed within a given bounded generation volume that represents a region of the real world where all the main structural features of the study domain are present, and their crosscutting relations are those more commonly observed on the field. The generation volume is internally subdivided into distinct generation regions where representative “fracture ensembles” of each main structural feature of the geological model are stochastically generated. The geometry and position of the boundaries between the generation regions are deterministic constraints given by the geological model. Statistical analyses, as well as aggregated 3D simulation of the several geological objects that are part of the model, are performed by means of FracMan code (Golder Ass.). Rescaling of input data for different size simulation windows was possible, since scale-laws of the main fracture systems were known by comparison of field fracture data, aerial photos and satellite images lineaments. The simulation gives satisfactory results in terms of the reproducibility of the fracture network, but shows that the fracture intensity parameter P_{32}strongly depends on the wedge-shape geometry of the generation regions. This fact, that could induce spatial heterogeneities in the simulated fracture network, deserves further analyses.