EGU21-3713
https://doi.org/10.5194/egusphere-egu21-3713
EGU General Assembly 2021

Karst generation in three-dimensional jointed layered rocks

Chuanyin Jiang and Xiaoguang Wang
Chengdu University of Technology, College of Energy, China (chuanyin_jiang@foxmail.com)

We use numerical models to investigate the generation of incipient karst in layered geological systems, and specifically to investigate the effects of the structural and hydraulic properties of both joints and bedding planes on the distribution of the developed karst cavities. We develop a numerical model which couples the processes of fluid flow, mass transport and dissolution kinetics that govern the growth of fracture aperture, based on three-dimensional discrete fracture networks. The synthetic fracture networks made up of two jointed layers separated by a horizontal bedding plane are generated to represent the typical layered fracture systems often formed in carbonate rocks. We assume a relatively uniform aperture field with a small variance for each joint set and for the bedding plane, but different joint sets and the bedding plane can have non-identical mean apertures. Results show that the aperture ratio of the joint sets to the bedding plane is found to dominate the flow heterogeneity on the bedding plane, leading to various behaviors of karst development. We further suggest that the distinct flow regimes, i.e., joint-dominated, transitional and bedding plane-dominated, controlled by the magnitude of the aperture ratio, are responsible for the different types of incipient karst morphologies. Our investigations have an important application on the understanding of clustering behaviors of karst cavities in layered fractured carbonate rocks.