Geophysical Research Abstracts
Vol. 18, EGU2016-14766, 2016
EGU General Assembly 2016

Verification of the karst flow model under laboratory controlled conditions

Hrvoje Gotovac, Ivo Andric, Luka Malenica, and Veljko Srzic
Department of Civil Engineering, Architecture and Geodesy, University of Split, Croatia (hrvoje.gotovac@gradst.hr)

Karst aquifers are very important groundwater resources around the world as well as in coastal part of Croatia. They consist of extremely complex structure defining by slow and laminar porous medium and small fissures and usually fast turbulent conduits/karst channels. Except simple lumped hydrological models that ignore high karst heterogeneity, full hydraulic (distributive) models have been developed exclusively by conventional finite element and finite volume elements considering complete karst heterogeneity structure that improves our understanding of complex processes in karst. Groundwater flow modeling in complex karst aquifers are faced by many difficulties such as a lack of heterogeneity knowledge (especially conduits), resolution of different spatial/temporal scales, connectivity between matrix and conduits, setting of appropriate boundary conditions and many others. Particular problem of karst flow modeling is verification of distributive models under real aquifer conditions due to lack of above-mentioned information. Therefore, we will show here possibility to verify karst flow models under the laboratory controlled conditions. Special 3-D karst flow model (5.6*2.6*2 m) consists of concrete construction, rainfall platform, 74 piezometers, 2 reservoirs and other supply equipment. Model is filled by fine sand (3-D porous matrix) and drainage plastic pipes (1-D conduits). This model enables knowledge of full heterogeneity structure including position of different sand layers as well as conduits location and geometry. Moreover, we know geometry of conduits perforation that enable analysis of interaction between matrix and conduits. In addition, pressure and precipitation distribution and discharge flow rates from both phases can be measured very accurately. These possibilities are not present in real sites what this model makes much more useful for karst flow modeling. Many experiments were performed under different controlled conditions such as different levels in left and right end of reservoirs (boundary conditions), different flow regimes in conduits, flow with and without precipitation, free and pressurized discharge from conduits or influence of epikarst (top layer) on recession period. Experimental results are verified by conventional karst flow model (such as MODFLOW-CFP) showing that hydraulic (distributive) models can describe complex behavior of karst flow processes if substantial amount of input data are known from site investigations and monitoring. These results enable us to develop more advanced karst flow models that will improve understanding and analysis of complex flow processes in the real karst aquifers.