Geophysical Research Abstracts
Vol. 20, EGU2018-7374-1, 2018
EGU General Assembly 2018

Simulation of coupled groundwater flow and contaminant transport in a confined aquifer using the meshless Element Free Galerkin Method

Tinesh Pathania (1), Andrea Bottacin Busolin (2), and Ashok Kumar Rastogi (3)

(1) Department of Civil Engineering, Indian Institute of Technology Bombay, Mumbai, India (tineshpathania@iitb.ac.in), (2) School of Mechanical, Aerospace and Civil Engineering, University of Manchester, Manchester, United Kingdom (andrea.bottacinbusolin@manchester.ac.uk), (3) Department of Civil Engineering, Indian Institute of Technology Bombay, Mumbai, India (akr@iitb.ac.in)

Groundwater flow and contaminant transport in aquifers are often studied using mesh-based finite difference (FDM) and finite element methods (FEM). In the application of these methods, the generation of an appropriate computational mesh is a fundamental, and often a time-consuming preprocessing step which significantly affects the accuracy of the results. Meshless methods are emerging as an alternative to mesh-based methods and have been applied to the simulation of groundwater flow in a few recent studies. The absence of a computational mesh saves preprocessing time and allows nodes to be added during a computation without disturbing the existing nodal arrangement. In this study a coupled flow and transport model is developed using the Element Free Galerkin method (EFGM) which uses the Moving Least Square (MLS) method for approximating the field variables and evaluating the EFG shape functions. EFGM has a higher rate of convergence than FEM due to the MLS approximation and was found to be very accurate in previous studies. The EFG shape functions do not hold the Kronecker delta property and hence the Dirichlet boundary conditions are imposed using either a penalty method or Lagrange multipliers. The applicability of the EFG method to the simulation of groundwater flow and transport is demonstrated with an application to an idealized confined aquifer system. The results are compared with those obtained from MODFLOW as a benchmark finite-difference model. Both models are found to give nearly the same results which demonstrates the applicability of EFGM as an alternative mesh-free method for coupled groundwater flow and transport in confined aquifers.