Novel groundwater travel time based approaches for groundwater modelling education and management

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AGIC2019_Id: 125

ABSTRACT – TOPIC4: GROUNDWATER MODELLING & RISK MANAGEMENT

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Abstract: In this talk, a set of Eulerian travel time-based approaches for modelling flow and solute transport processes in groundwater systems are presented. A new grid-based method has been developed to compute groundwater trajectories. The method holds more promise than particle tracking because the interpretation and visualization of travel and residence times are easier. It was shown to be more powerful in practice than the conventional particle tracking method (Sbai 2018). Furthermore, it is easily extended for visualizing capture, swept, and connection zones between well pairs (Sbai 2019a). Therefore, it is promising as an educational tool not only in the classroom but also among practicing groundwater engineers and scientists. Advanced aspects using concepts will be also presented. First, a novel algorithm is developed for automatic optimal grid generation for transient solute transport models. First results show that this approach can lead to a substantial speedup in practical applications presenting a tradeoff between computational accuracy and computational resources (Sbai and Amraoui, 2019). Next, steady-state grid-based travel time simulations are used as physically-based surrogate models in the framework of groundwater quality management models. This approach does not only simultaneously optimize well rates and locations but drastically reduces the involved computational cost. In particular, examples will be presented for three-dimensional models with random and layered subsurface heterogeneities presenting a bottleneck for standard approaches (Sbai, 2019b). They all show that groundwater modelling interpretations and management practices are significantly enhanced by applying such concepts.

Keywords: Travel time, Solute transport, Groundwater managment, Surrogate models

References

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