

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

Adil Sbai

► **To cite this version:**

Adil Sbai. Novel groundwater travel time based approaches for groundwater modelling education and management. AGIC 2019 - Applied Geosciences for Groundwater, Mar 2019, Hammamet, Tunisia. hal-02072603

HAL Id: hal-02072603

<https://hal-brgm.archives-ouvertes.fr/hal-02072603>

Submitted on 19 Mar 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

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

Sbai Adil¹

¹ BRGM

Corresponding author: Dr. Sbai Adil, a.sbai@brgm.fr, BRGM (French Geological Survey), 3 Av. Claude Guillemin, 45060, Orléans, France, France

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 management, Surrogate models

References

- Sbai, M.A. 2018. A practical grid-based alternative method to advective particle tracking. *Groundwater* 56, no. 6: 881-892.
- Sbai, M.A. and N. Amraoui. 2019. Automatic generation of locally refined composite grids for efficient solute transport modeling. Accepted, *Groundwater*.
- Sbai, M.A. 2019a. An efficient method for delineating capture zones and groundwater contribution areas. Submitted, *Groundwater*.
- Sbai, M.A. 2019b. Optimal well rate placement and design for pump-and-treat systems with physically based surrogate groundwater models. Submitted, *Environ. Mod. & Soft.*