



Groundwater flow and solute transport modelling from within R: Development of the RMODFLOW and RMT3DMS packages.

Bart Rogiers

Institute for Environment, Health & Safety, Belgian Nuclear Research Centre (SCK•CEN), Mol, Belgium
(brogiers@sckcen.be)

Since a few years, an increasing number of contributed R packages is becoming available, in the field of hydrology. Hydrological time series analysis packages, lumped conceptual rainfall-runoff models, distributed hydrological models, weather generators, and different calibration and uncertainty estimation methods are all available. Also a few packages are available for solving partial differential equations. Subsurface hydrological modelling is however still seldomly performed in R, or with codes interfaced with R, despite the fact that excellent geostatistical packages, model calibration/inversion options and state-of-the-art visualization libraries are available. Moreover, other popular scientific programming languages like matlab and python have packages for pre- and post-processing files of MODFLOW (Harbaugh 2005) and MT3DMS (Zheng 2010) models.

To fill this gap, we present here the development versions of the RMODFLOW and RMT3DMS packages, which allow pre- and post-processing MODFLOW and MT3DMS input and output files from within R. File reading and writing functions are currently available for different packages, and plotting functions are foreseen making use of the ggplot2 package (plotting system based on the grammar of graphics; Wickham 2009). The S3 generic-function object oriented programming style is used for this.

An example is provided, making modifications to an existing model, and visualization of the model output.

References

Harbaugh, A. (2005). MODFLOW-2005: The US Geological Survey Modular Ground-water Model—the Ground-water Flow Process, U.S. Geological Survey Techniques and Methods 6–A16 (p. 253).

Wickham, H. (2009). ggplot2: elegant graphics for data analysis. Springer New York, 2009.

Zheng, C. (2010). MT3DMS v5.3, a modular three-dimensional multispecies transport model for simulation of advection, dispersion and chemical reactions of contaminants in groundwater systems. Supplemental User's Guide. (p. 56).