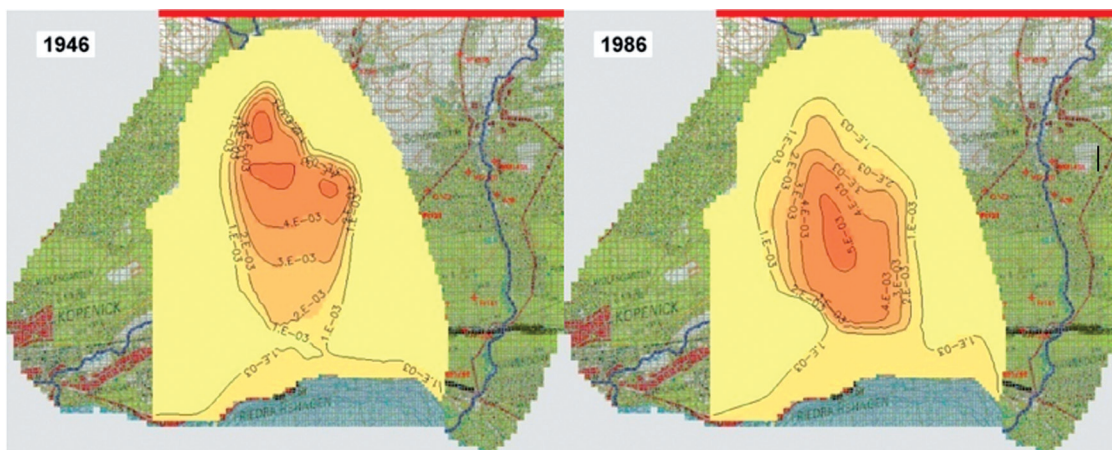


# WATER RESOURCES AND CONTAMINANT TRANSPORT MODELLING

## DESCRIPTION

### Why modelling?

Numerical models are important tools in the study of water resources. They can help understand processes (and their importance) that occur in a certain geological context. The rapid progress in the development of numerical models and computer hardware has improved simulation capability to an extent where we can routinely develop basin scale models. One of the main driving forces for hydrogeological model is the need to assess **water supply potential of aquifers**. Over the past 20 years, however, the emphasis has shifted from water supply problems to water quality issues. This means that while formerly the focus was almost exclusively on developing methods to assess and measure the water-yielding properties of aquifers, now the focus is largely **on transport and dispersion processes, retardation and degradation of chemical contaminants**.



*Contamination plume evolution simulated with PMWIN*

Numerical models are also applied to describe and interpret the reactive processes affecting contaminant transport through the porous media during laboratory-level experiments.

## IMDEA-WATER SOLUTIONS

Numerical models and, occasionally, analytical models are developed at the Imdea-Water facilities to identify processes affecting the occurrence and behaviour of contaminants during infiltration through the vadose zone and passage through the aquifer. Imdea Water can act as a consultant to propose remediation strategies, forecast contamination plume propagation and decontamination times in the case of contaminant spills.

In this context, the knowledge of our Institute is also applied to provide an overview of the impact on water quality during activities such as irrigation, artificial recharge, etc. with the aim of proposing ad-hoc strategies to improve water application programs.

Contaminants routinely investigated by the Imdea Water working group include **inorganic contaminants**, organic substances and **emerging compounds** (e.g. pharmaceuticals, personal care products, life-style compounds).

Modelling is also applied as a tool to assist in **water resource management** at groundwater basin level, defining abstraction well rates, well distributions and well protection zones.

Up to now, both field-scale and laboratory-scale data have been successively simulated using several modelling software packages, such as: CXTFIT, MT3DMS, PHREEQC-2, PHT3D, PMWIN, HYDRUS, etc.

## IMPLEMENTATION SECTOR

- Water Companies
- Any company or public body interested in carrying out contaminant hydrogeological studies
- Environmental consulting firms
- Agricultural associations and owners of agricultural lands of medium-large dimensions
- Any company interested in carrying out groundwater contamination studies for water supply in developing countries

## ADDITIONAL INFORMATION

<http://www.madrimasd.org/blogs/remtavares/2011/12/23/131714>

- Meffe, I., Kohfahl, C., Hamann, E., Greskowiak, J., Massmann, G., Dünnbier, U., Pekdeger, A., 2014. *Fate of para-toluene sulphonamide (p-TSA) in groundwater under anoxic conditions: modelling results from a field site in Berlin (Germany)*. Environmental and Pollution Research. 21, pp. 568 - 583.
- Martínez Hernández, M.V., Meffe, R., Herrera, S., Arranz, E., De Bustamante, I., 2014. *Sorption/desorption of non-hydrophobic and ionisable pharmaceutical and personal care products from reclaimed water onto/from a natural sediment*. Science of the Total Environment. 472, pp. 273 - 281.
- Córdoba Melgarejo, D.F., Meffe, R., Martínez Hernández, M.V., 2013. *Metodología para el desarrollo de un modelo hidrogeológico mediante herramientas de Información Geográfica*. Cuadernos de Geomática. 2, pp. 6 - 35. ISBN 978-84-695-8162-9.
- Meffe, R., Gudrun, M., Kohfahl, C., Taute, T., Richter, D., Dünnbier, U., Pekdeger, A., 2012. *Investigating the redox sensitivity of para-toluene sulphonamide (p-TSA) with a column study*. Environmental Earth Sciences. 65 - 3, pp. 861 - 870.

- Meffe, R., Massmann, G., Kohfahl, C., Taute, T., Holzbecher, E., Richter, D., Dünnbier, U., 2011. *Investigation and modelling of the degradation during rapid sand filtration and redox sensitivity of the industrial contaminant p-TSA*. Book Series: IAHS Publication. 342, pp. 42 - 45. ISSN 0144-7815.
- Meffe, R., Kohfahl, C., Holzbecher, E., Massmann, G., Richter, D., Dünnbier, U., Pekdeger, A., 2010. *Modelling removal of the sulphonamide para-toluene sulphonamide (p-TSA) during rapid sand filtration used for drinking water treatment*. Water Research. 44, pp. 205 - 213.

## TECHNOLOGY KEYWORDS

Reactive transport modelling; groundwater; vadose zone; field-scale models; laboratory-scale models; water resources management

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