FREEWAT
Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project

Policy Brief
N. 7/7

Guidance on model-supported application of EU water directives

Key Policy Messages

- ✓ Computer models are effective tools to manage the groundwater resource
- ✓ Modelling in the Water Framework Directive (WFD)
- ✓ The guidance supports stakeholders in developing groundwater numerical models to comply with WFD, GWD, and other directives

WHAT H2020 FREEWAT is

FREEWAT is an HORIZON 2020 project financed by the EU Commission, aiming at promoting water resource management through innovative ICT tools and participatory approach.

Main result of the project is the free and open-source FREEWAT software: a QGIS integrated environment, where several simulation codes, based on the hydrological cycle, hydrochemical or economic-social processes, are integrated in a unique GIS project for conjunctive use of surface- & ground-water.

This Policy Brief is part of series of seven whose goal is to illustrate the FREEWAT approach and achievements.

European Commission

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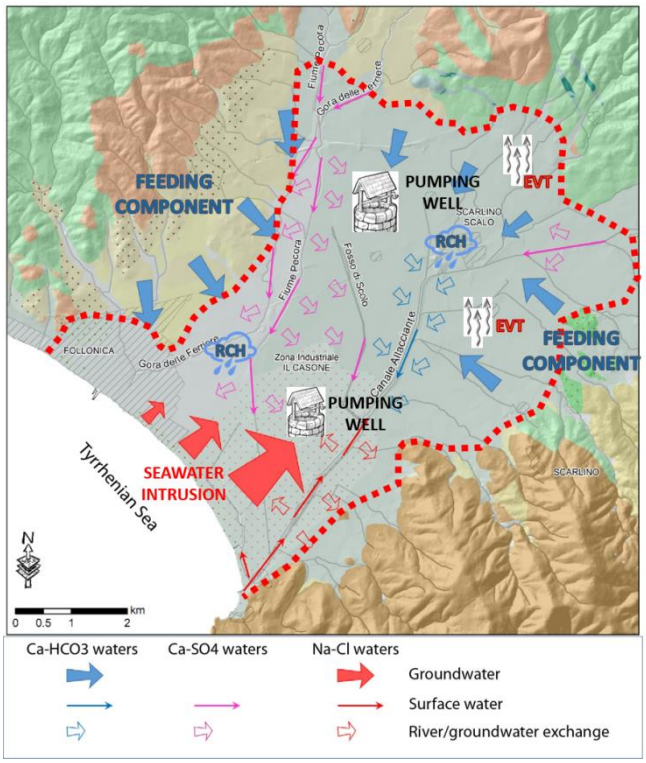
Computer models are effective tools to manage the groundwater resource

"While groundwater models are, by definition, a simplification of a more complex reality, numerical ones have proven to be useful tools over the last decades for addressing a range of groundwater problems, supporting the decision-making process, and estimating the potential hydrologic effects of management activities" (from Barnett et al., 2012).

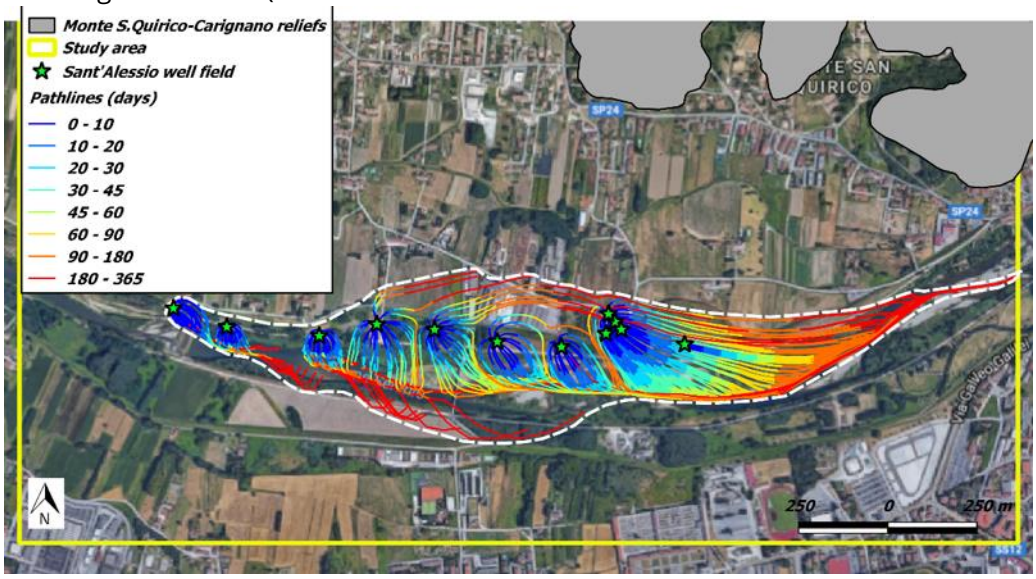
Developing and applying models for sustainable groundwater management have multiple benefits to stakeholders. Constructing and calibrating models improve understanding the processes that influence the good status of water bodies. The application of a model for testing the impact of construction projects and management actions on watershed conditions may provide a framework for stakeholders to screen and select the most appropriate strategies for the achievement of a good status of water resources and the socio-economic development. Further on, models have been used in forecasting effects resulting from climate or human-related changes in water use, occurring in the 15-year planning and implementation horizon envisaged within the EU Water Framework Directive (WFD).

Within the H2020 FREEWAT project, a document titled *GUIDANCE ON MODEL-SUPPORTED APPLICATION OF EU WATER RELATED DIRECTIVES FOR WATER QUANTITY AND QUALITY* was prepared. The Guidance may be considered as a proposal for a reference at the European level, as it refers specifically to the EU WFD and the Groundwater Directive (GWD), to be used as support for decision makers dealing with ICT (Information and Communication Technologies) tools for Water Resource Management, and, in particular, with groundwater numerical models.

The objective of this Guidance is to assist with the use and development of groundwater models, and the necessary interactions with surface water, including data analysis and development of water management scenarios, and model results reporting, using GIS-based ICT tools. The document is extensively based on the experience from the development of water management models applying the FREEWAT platform to 15 selected case studies in EU and non-EU Countries.



Conceptual model of a coastal aquifer (Italy).



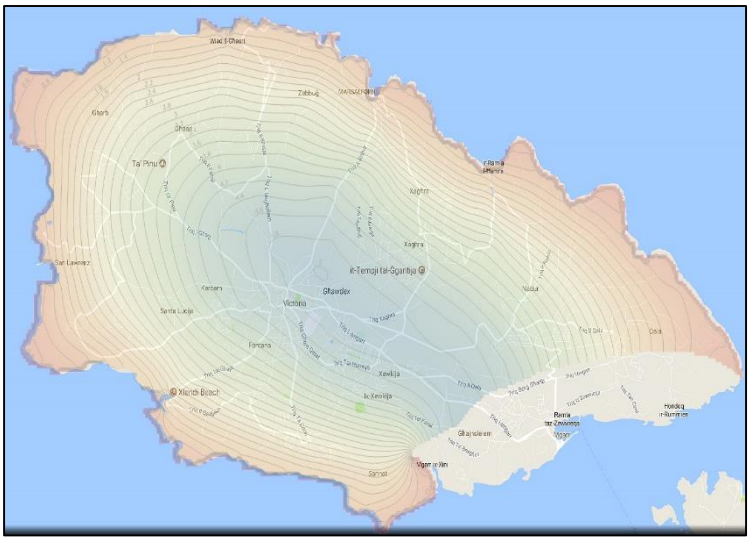
FREEWAT application to the definition of well-head protection areas (Italy).

Drilling of a piezometer.

Modelling in the Water Framework Directive

The purposes of groundwater numerical modelling in the broader context of the EU Water Framework Directive include:

- understanding the status of groundwater bodies, collating together the information generated under the Directive's characterization exercises into a comprehensive/advanced understanding of the water body;
- establishing the goal of the model and the expected results, and supporting the objectives of the Directive;
- supporting identification and development of potential planning and management actions to assure the future good status of the groundwater basin;
- supporting the justification of exemptions (natural conditions) and the setting of less stringent objectives under Articles 4.4 and 4.5 of the WFD;
- supporting the refinement of monitoring networks in a basin over time (Article 8);
- assessing the impact of measures under the Directive's Programme of Measures towards the achievement of good status conditions;
- supporting the interpretation of monitoring results for good status determination;
- supporting the identification of safeguard zones;
- enhancing the understanding of groundwater/surface water linkages and hence enabling the better protection of groundwater-dependent terrestrial ecosystems and surface water bodies.



Simulated piezometric head for the Gozo Mean Sea Level Aquifer system (Malta).

The Guidance at a glance

The Guidance defines guidelines and "best practices" for using GIS-based numerical modelling tools as fundamental instruments for preparing water management plans, with focus on groundwater, but including representation of groundwater/surface water interactions. Hence, the document focuses on groundwater and surface-/ground-water management and covers all stages of model development: planning, conceptualization, design and construction, model calibration, predictive scenarios, uncertainty evaluation, model review and reporting.

The Guidance is divided into two main sections:

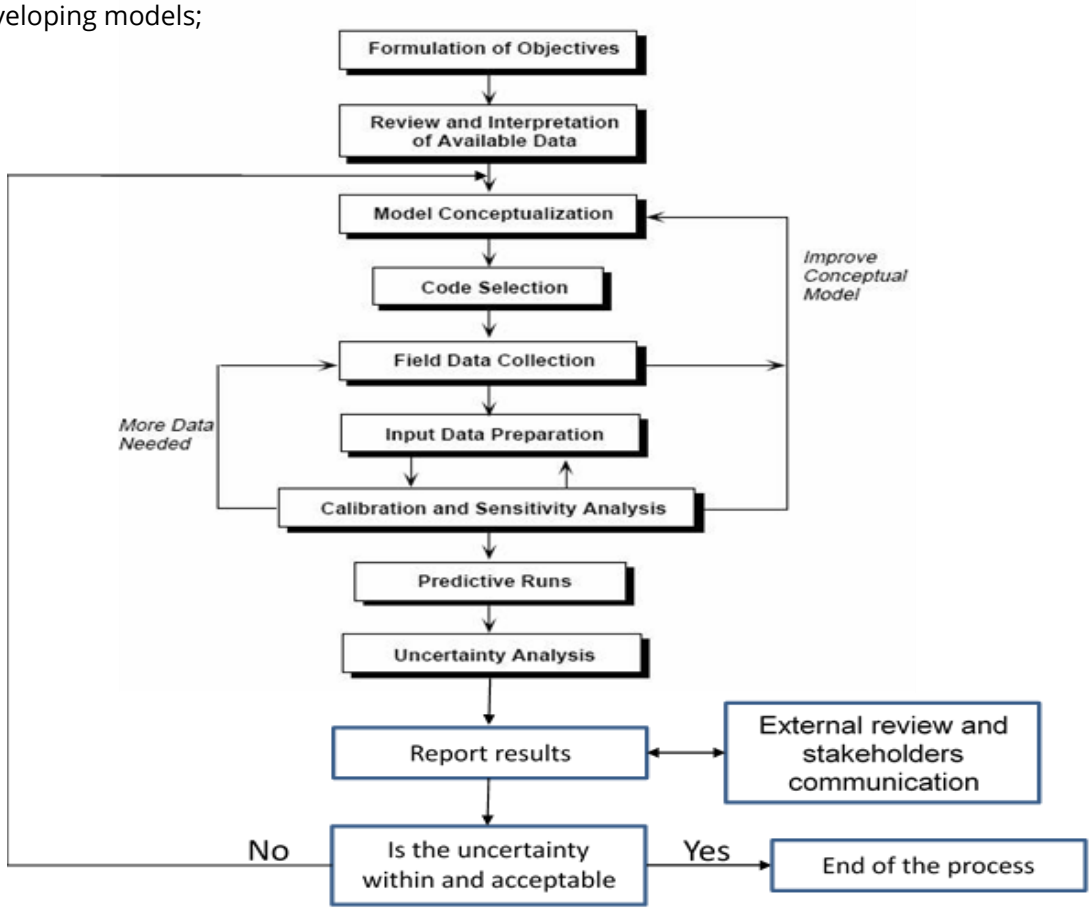
1) a more detailed section strongly connecting the modelling exercises to the application of the European Directives and analyzing how the WFD and GWD refers to the need of developing models;

2) a general section with guidelines for implementing groundwater numerical models for dealing with quantity and quality modelling.

Models and monitoring need to be increasingly used together for improved management. Monitoring results can help to calibrate models to ensure more reliability in model results. Models results can help in focusing on a more salient monitoring, in virtuous feedback loops. This iterative approach implies an adaptive management as a necessary aspect of model implementation.

For further details, the reader is referred to:

Foglia, L., Lotti, F., De Filippis, G., & Rossetto, R. GUIDANCE ON MODEL-SUPPORTED APPLICATION OF EU WATER RELATED DIRECTIVES FOR WATER QUANTITY AND QUALITY, December 22nd, 2017.



The modelling procedure (modified from Bear et al., 1992).

REFERENCES

Barnett, B., Townley, L.R., Post, V., Evans, R.E., Hunt, R.J., Peeters, L., Richardson, S., Werner, A.D., Knapton, A., & Boronkay, A. (2012). Australian groundwater modelling guidelines. National Water Commission, Canberra, June, 191 p. http://archive.nwc.gov.au/library/waterlines/82

Bear, J., Beljin, M.S., & Rose, R. (1992). Fundamentals of Ground-Water Modelling. EPA Ground Water Issue. http://www.epa.gov/tio/tsp/download/issue13.pdf

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