



ABSTRACT

The conceptualisation of a groundwater system involves continuous monitoring and evaluation of a large number of parameters (e.g., hydraulic parameters). Regarding hydraulic properties, their quantification is one of the most common problems in groundwater resources and it is recognised that all methods to obtain them have their limitations and are scale dependants. Therefore, it is necessary to have methods and tools to estimate them within a spatial context and to validate their uncertainty when they are applied in an upper scale.

All these datasets collected and generated to perform a groundwater conceptual model are often stored in different scales and formats (e.g., maps, spreadsheets or databases). This continuous growing volume of data entails further improving on how it is compiled, stored and integrated for their analysis.

This thesis contributes to: (i) provide dynamic and scalable methodologies for migrating and integrating multiple data infrastructures (data warehouses, spatial data infrastructures, ICT tools); (ii) to gain higher performance of their analysis within their spatial context; (iii) to provide specific tools to analyse hydrogeological processes and to obtain hydraulic parameters that have a key role in groundwater studies; and (iv) to share open-source and user-friendly software that allows standardisation, management, analysis, interpretation and sharing of hydrogeological data with a numerical model within a unique geographical platform (GIS platform).

A dynamic and scalable methodology has been designed to harmonise and standardise multiple datasets and third-party databases from different origins, or to connect them with ICT tools. This methodology (described in Chapter 2) can be widely applied in any kind of data migration and integration (DMI) process, to develop Data warehouses, Spatial Data Infrastructures or to implement ICT tools on existing data infrastructures for further analyses improving data governance.

Chapter 3 describes a software to analyse pumping tests in a GIS platform environment. This platform supports the hydraulic parameterization of groundwater flow and transport models. The interpretation of pumping tests within its spatial context can reduce the uncertainty of its analysis with an accurate knowledge of the aquifer geometry and boundaries.

The quantification of the hydraulic conductivity based on grain size methodologies have been compiled, reviewed and analysed in Chapter 4. Then, the uncertainty of applying these methods on a larger scale has been addressed and discussed by comparison of the upscaling results with pumping tests performed in the study area.

Finally, an open-source and user-friendly GIS-based tool is presented in Chapter 5. This new generation of GIS-based tool allows to standardise, manage, analyse and interpret hydrogeological and hydrochemical data. Due to its open-source architecture, it can be updated and extended depending on the tailored applications.