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Reconstruction of subsoil heterogeneity on provincial scale in Lombardy Region (Italy), using a well database.

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The present work is part of the research project RICLIC "Regional Impacts of Climatic Changes in Lombardy Water resources: Modelling and applications" (that involves University of Milano-Bicocca, University of Milano, University of Pavia, ARPA Lombardia and Fondazione Lombardia per l'Ambiente) whose purpose is to develop a scientific methodology, to evaluate climatic impacts on water resources of Lombardy region (in North Italy); in particularly, concerning the groundwater, the project aim is the study the effects of the mass-balance changes on the hydrogeological system. The project time table is three years. The first part related to the structural reconstruction is here presented.

The first step of the presented work is a detailed quantitative reconstruction of subsoil textural characteristics in the study area, where the shallow aquifer is composed by very heterogeneous fluvial and glacio-fluvial sediments. We would like to exceed the strong subdivision into aquifers and aquitards and to introduce the concept of textural changing inside an aquifer. To realized it, first of all it is very important to collect and store, in a specific hydrologic database, TANGRAM, the most high and reliable number of georeferenced water wells, with their own stratigraphic data: each stratigraphic levels are codified and, during the extraction step, are translated in textural percentage classes (gravel, sand and clay), according to a vertical subdivision (also metric), chosen by the user.

The second step is to estimate hydraulic conductivity and effective porosity values, us-

ing a linked database module. Literature values for the parameters for cobbles, gravel, sand and clay are taken into account. Values may be user defined and chosen to better represent the subsoil characteristics. The idea is to associate a value of hydraulic conductivity with different texture percentages as well as a value of effective porosity, weighted by the scaling approach described. Based on the different percentages of materials in each layer, the estimated values are assigned to each individual stratigraphic layer, while field measurements, such as pumping tests, yield average values for the whole aquifer thickness.

The last step is to link the specific hydrologic database and a three-dimensional modelling software GOCAD (Geological Object Computer Aided Design). With this three-dimensional modelling software, the properties are interpolated, using the powerful three-dimensional interpolator inside GOCAD. Into the whole studied volume of the subsoil, a 3d rebuilding results of the heterogeneous distribution of the hydraulic parameters or the textural percentage. The user may chose the detailed vertical subdivision related to the collected stratigraphic logs. The data are elaborated within a three-dimensional grid, built according to the boundary surfaces of the hydrogeological system (the topographic surface and the aquifer bottom).

The purpose of the work is to rebuild the heterogeneity of the hydraulic conductivity and the effective porosity because they reproduce the real heterogeneity of sediments in the subsoil and it may be the input for groundwater flow models. The high level of hydrogeological detail may simulate heterogeneous plumes and reduce uncertainty about their dispersivity value. Inconsistent representation of heterogeneity prevents plausible predictions of future development contaminant transport. However, if a model capturing heterogeneity in all its complexity is able to reproduce the behavior of the aquifer, the modeler should be more confident in future predictions.

This procedure has been used within some different Lombardy provinces like Milano, Cremona and Lodi, where about 4800 stratigraphic data were collected, codified and stored. In the work the firs results are shown.