Geophysical Research Abstracts
Vol. 15, EGU2013-11783, 2013
EGU General Assembly 2013
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Role of different types of solid models in hydrodynamic modeling and their effects on groundwater protection processes

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Defining extraction-modified flow patterns with hydrodynamic models is a pivotal question in preserving groundwater resources regarding both quality and quantity. Modeling is the first step in groundwater protection the main result of which is the determination of the protective area depending on the amount of extracted water. Solid models have significant effects on hydrodynamic models as they are based on the solid models.
Due to the legislative regulations, on protection areas certain restrictions must be applied which has firm consequences on economic activities. In Hungarian regulations there are no clear instructions for the establishment of either geological or hydrodynamic modeling, however, modeling itself is an obligation. Choosing the modeling method is a key consideration for further numerical calculations and it is decisive regarding the shape and size of the groundwater protection area.
The geometry of hydrodynamic model layers is derived from the solid model. There are different geological approaches including lithological and sequence stratigraphic classifications furthermore in the case of regional models, formation-based hydrostratigraphic units are also applicable. Lithological classification is based on assigning and mapping of lithotypes. When the geometry (e.g. tectonic characteristics) of the research area is not known, horizontal bedding is assumed the probability of which can not be assessed based on only lithology.
If the geological correlation is based on sequence stratigraphic studies, the cyclicity of sediment deposition is also considered. This method is more integrated thus numerous parameters (e.g. electrofacies) are taken into consideration studying the geological conditions ensuring more reliable modeling. Layers of sequence stratigraphic models can be either lithologically homogeneous or they may include greater cycles of sediments containing therefore several lithological units. The advantage of this is that the modeling can handle pinching out lithological units and lenticular bodies easier while most hydrodynamic softwares cannot handle flow units related to such model layers. Interpretation of tectonic disturbance is similar.
In Hungary groundwater is extracted mainly from Pleistocene and Pannonian aquifers sediments of which were deposited in the ancient Pannonian Lake. When the basin lost its open-marine connection eustasy had no direct effects on facies changes therefore subsidence and sediment supply became the main factors. Various basin-filling related facies developed including alluvial plain facies, different delta facies types and pelitic deep-basin facies.
Creating solid models based on sequence stratigraphic methods requires more raw data and also genetic approaches, in addition more working hours hence this method is seldom used in practice. Lithology-based models can be transformed into sequence stratigraphic models by extending the data base (e.g. detecting more survey data). In environments where the obtained models differ significantly notable changes can occur in the supply directions in addition the groundwater travel-time of the two models even on equal extraction terms. Our study aims to call attention to the consequences of using different solid models for typical depositional systems of the Great Hungarian Plain and to their effects on groundwater protection.