EGU2020-11140, updated on 20 Oct 2021
https://doi.org/10.5194/egusphere-egu2020-11140
EGU General Assembly 2020

A European groundwater model with variable aquifer thickness derived from spectral analyses of baseflow

Estanislao Pujades, Timo Houben, Mariaines Di Dato, Rohini Kumar, and Sabine Attinger
Helmholtz Centre for Environmental Research – UFZ, Department of Computational Hydrosystems, Leipzig, Germany
(estanislao.pujades-garnes@ufz.de)

Large-scale groundwater models are needed for assessing impacts of global changes, such as the “Global Warming”, and adapt the groundwater management strategies to ensure its availability. However, the construction of these models presents numerous difficulties, among which the lack of data concerning the properties (hydraulic parameters and geometries) of the subsurface is the most problematic. Although it is possible to find data concerning the hydraulic parameters of the soil (hydraulic conductivity and porosity), there is no realistic information about the saturated aquifer thickness which contributes to the active part of the flow regime. This thickness, which can be named “effective thickness”, is of paramount importance to improve the representativeness of large-scale groundwater models.

Commonly, a constant “effective thickness” is assumed for global models, which provides not a realistic boundary condition. Here, we propose a new approach based on spectral analyses of the baseflow in combination with hydraulic conductivity values to derive the spatial distribution of “effective thickness”. The calculated “effective thickness” can be used to build 2D groundwater models using a transmissivity field or to constrain the thickness in 3D models. The effectiveness of this approach is tested here by constructing Europe-wide groundwater. The representativeness of the model is improved by coupling off-line a mesoscale hydrological model (mHM), which computes near-surface water processes, and the deep groundwater simulation using the numerical model of OpenGeoSys.We demonstrate the implications of our study in conducting large-scale groundwater simulations across Europe for providing continental scale assessment of the impacts of global changes on groundwater system and discussing about the adaptation of different water management strategies affecting the regional groundwater system.