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Climate change impact on shallow groundwater conditions in Hungary: Conclusions from a regional modelling study

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A quantitative methodology has been developed for the calculation of groundwater table based on measured and simulated climate parameters. The aim of the study was to develop a toolset which can be used for the calculation of shallow groundwater conditions for various climate scenarios. This was done with the goal of facilitating the assessment of climate impact and vulnerability of shallow groundwater resources.
The simulated groundwater table distributions are representative of groundwater conditions at the regional scale. The introduced methodology is valid for modelling purposes at various scales and thus represents a versatile tool for the assessment of climate vulnerability of shallow groundwater bodies.
The calculation modules include the following:
1. A toolset to calculate climate zonation from climate parameter grids,
2. Delineation of recharge zones (Hydrological Response Units, HRUs) based on geology, landuse and slope conditions,
3. Calculation of percolation (recharge) rates using 1D analytical hydrological models,
4. Simulation of the groundwater table using numerical groundwater flow models.
The applied methodology provides a quantitative link between climate conditions and shallow groundwater conditions, and thus can be used for assessing climate impacts.
The climate data source applied in our calculation comprised interpolated daily climate data of the Central European CARPATCLIM database. Climate zones were determined making use of the Thorntwaite climate zonation scheme. Recharge zones (HRUs) were determined based on surface geology, landuse and slope conditions. The HELP hydrological model was used for the calculation of 1D water balance for hydrological response units. The MODFLOW numerical groundwater modelling code was used for the calculation of the water table.
The developed methodology was demonstrated through the simulation of regional groundwater table using spatially averaged climate data and hydrogeological properties for various time periods. The study was financed through the European Economic Area (EEA) Grants mechanism.