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Use of regional climate models data for groundwater recharge modelling in Baltic artesian basin

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Baltic artesian basin (BAB) covers about 480000 square kilometres. BAB includes territory of Latvia, Lithuania, Estonia, parts of Poland, Russia, Belarus and Baltic Sea. The closed hydrogeological mathematical model for the BAB is developed in University of Latvia and reference calculations made in steady state mode. No-flow boundary condition is applied on the bottom and side boundaries of BAB. Hydraulic head is fixed on the seabed and largest lakes, and along the main river lines. Main water supply wells also are presented in the model as a pointwise water extraction.

Precipitation is the main source of the groundwater recharge in the BAB region. Infiltration parameterization is responsible for this water source in BAB model.

During the early stage of calibration of BAB hydrogeological model an automatic calibration for the hydraulic conductivities of permeable layers and single infiltration rate was attempted. Performing BAB model calibration it was noted that the differences of calculated and observed hydraulic heads (used for calculating the calibration penalty function) can be reduced by introducing a spatially distributed infiltration model. The aim of the present study is improving of the infiltration model, as well as preserving a short computation time (several minutes) for the piezometric head. Direct solution of improvement of the infiltration would be a usage of the advanced hydrological models. However, an accurate hydrological model requires a lot of computational power. It should couple meteorological and hydrological parameters and requires additional calibration.

The regional climate model (KNMI-RACMO$_2$ 25 km resolution) results from ENSEMBLES project are used for the spatially distributed infiltration field calculation. The infiltration field is constructed as weighted difference of 30 year averaged precipitation and evaporation fields. The weight value is calibrated and a considerable decrease of the value of penalty function of the groundwater model is obtained (in comparison with penalty function value of the BAB model with constant infiltration). Impact of near and far future climate changes on the groundwater is estimated using the climate projections provided by RCM.

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