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Impact of the climate change to shallow groundwater in Baltic artesian basin

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The purpose of our work was to find the long term pattern of annual shallow ground water changes in region of Latvia, ground water level modelling for the contemporary climate and future climate scenarios and the model generalization to the Baltic artesian basin (BAB) region.
Latvia is located in the middle part of BAB. It occupies about 65'000 square kilometers. BAB territory (480'000 square kilometres) also includes Lithuania, Estonia as well as parts of Poland, Russia, Belarus and the Baltic Sea. Territory of BAB is more than seven times bigger than Latvia. Precipitation and spring snow melt are the main sources of the ground water recharge in BAB territory.

The long term pattern of annual shallow ground water changes was extracted from the data of 25 monitoring wells in the territory of Latvia. The main Latvian groundwater level fluctuation regime can be described as a function with two maximums (in spring and late autumn) and two minimums (in winter and late summer).

The mathematical model METUL (developed by Latvian University of Agriculture) was chosen for the ground water modelling. It was calibrated on the observations in 25 gauging wells around Latvia. After the calibration we made calculations using data provided by an ensemble of regional climate models, yielding a continuous groundwater table time-series from 1961 to 2100, which were analysed and split into 3 time windows for further analysis: contemporary climate (1961-1990), near future (2021-2050) and far future (2071-2100). The daily average temperature, precipitation and humidity time series were used as METUL forcing parameters. The statistical downscaling method (Sennikovs and Bethers, 2009) was applied for the bias correction of RCM calculated and measured variables.

The qualitative differences in future and contemporary annual groundwater regime are expected. The future Latvian annual groundwater cycle according to the RCM climate projection changes to curve with one peak and one drought point.

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Reference: Sennikovs, J., Bethers, U. 2009. Statistical downscaling method of regional climate model results for hydrological modelling. In: Proceedings of 18th World IMACS / MODSIM Congress.