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

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1. Introduction

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.

The mathematical model METUL (developed by Latvian University of Agriculture) was chosen for the ground water modelling, for 1D results, as well as the hydrogeological mathematical model developed specially for BAB by the University of Latvia for 3D. Using the 1D model to control the quality of the larger BAB model.

Regional climate models where used as a source of forcing data for future scenarios.

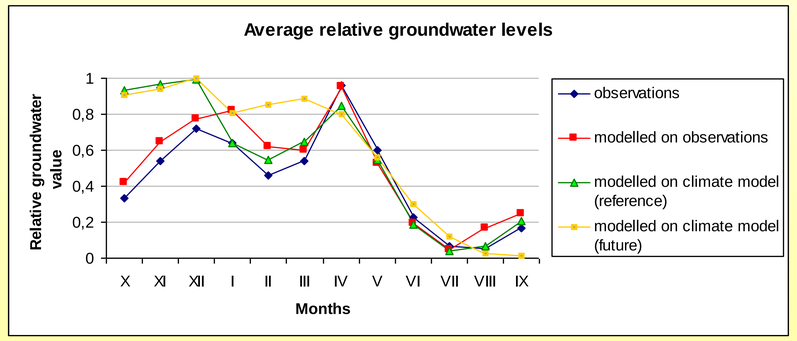
The qualitative differences in future and contemporary annual groundwater regime where calculated.

2. Area of study

The Baltic artesian basin, located in Eastern Europe. Includes territories of Latvia, Estonia and Lithuania, as well as parts of Russia, Poland and Belarus. It's territory is about 480000 square kilometres.

As it is the main drinking water source for the Baltic states, extensive groundwater research is needed, to avoid mismanagement and to understand potential threats caused by climate change.

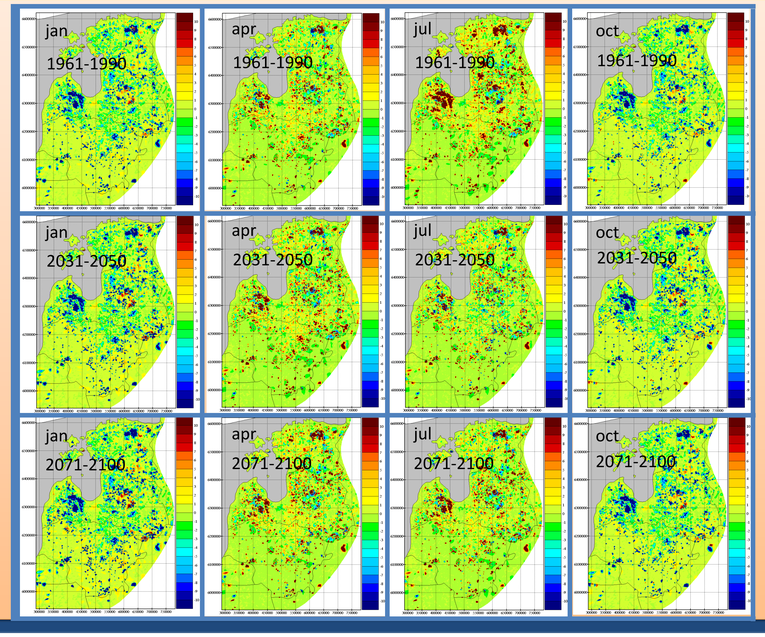
3. 1D METUL model



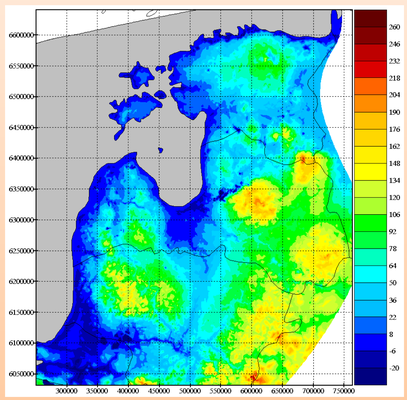
Using a modified DMI_HIRHAM_ARPEGE RCM data as forcing , the model is ran for 140 years.

The METUL model gives an easy way to qualitatively look at the regime changes in the future.

As can be seen the usual M-shaped groundwater regime changes to a single peak regime already in the near-future (2020-2050) and makes it more dominant in the far future (2070-2100).



4. 3D BAB model



Reference water table (average water table 1961-1990)

Period	Month	Change
2020-2050	January	-0.53
2020-2050	April	1.24
2020-2050	July	-4.33
2020-2050	October	-0.57
2070-2100	January	-0.70
2070-2100	April	0.72
2070-2100	July	-3.76
2070-2100	October	-0.61

Future model data compared to reference period, showing water table changes in selected points.

The 3D model represents the same qualitative changes, and allows to estimate the possible magnitude.

Further studies are needed to correctly interpret the water table changes in the basin, but the study shows that the 3D model is capable of representing the annual water table fluctuations.

5. Conclusions

- In the future Latvian groundwater regime will change from M-shape to a single peak .
- The BAB 3D model is capable of representing the annual groundwater regime, and gives a possibility to estimate the magnitude of the changes.
- From preliminary results it seems that both droughts and floods will become more severe due to climate change.

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