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Forecast from hindcast: Evaluation of groundwater dynamics in the Baltic region from drought indices agreement.

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Surging global increase of water demand as well as decrease in water quality put forward planning of the forthcoming water resource availability in much longer term with climate change included in this algorithm. The climate is already changing, and changes are predicted to be more accelerating in the future (IPCC, 2022). In the latest UN report the projected changes in annual mean precipitation vary substantially across the world (IPCC, 2022), while increase in global temperature is forecasted to be less spatially heterogeneous. Evaluation of future climate change impact on groundwater long term level change therefore its resources is the aim of the study.

The study is of regional scale and covers the Baltic states with 35 representative groundwater wells. The study covers three countries and wells more than 100 m deep. Regional coverage, overall long-term trends and identification of possible governing variables controlling spatial groundwater balance patterns considering climate change is the scope of this study.

Here we present our work of projected groundwater forecast for the short, middle and far future based on an ensemble of 13 EURO-CORDEX climate regional models under three Representative Concentration Pathway scenarios (RCPs) from the mildest to worst case scenario.

Future estimations of groundwater levels are based on the similarity of nowadays groundwater drought episode coincidence with surface drought indices individually estimated based on groundwater and surface water regime interaction during climate normals period.

Results show that overall increase of groundwater levels compared to recent climate normals period is expected without significant seasonal bias or spatial conformity. Gained results show that predictability of dry and wet periods during the autumn in most wells has the best results, therefore autumn can be also forecasted the best. Overall groundwater drought will be less frequent and less severe. Still, more extreme conditions are expected in the closest future period 2011-2040 with bias towards droughts and floods are expected in the period 2071-2100. There are indications that extreme conditions might occur more frequently during summer and autumn seasons. Also, wells with a trend towards dry condition are situated in the North-Eastern coast of Estonia while wells with less expected changes at all are typical in the central upland of Estonia.

Even though, the results are relevant solely to the Baltic region the used methods can be easily adopted worldwide.

IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, in: Pörtner, H.-O., Roberts, D.C., Tignor, M., Poloczanska, E.S., Mintenbeck, K., Alegría, A., Craig, M., Langsdorf, S., Löschke, S., Möller, V., Okem, A., Rama B. (eds.), Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, New York, pp. 3056.

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