

Interactive comment on “Climate change impact on groundwater levels: ensemble modelling of extreme values” by J. Kidmose et al.

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Reply to comments to Climate change impact on groundwater levels: Ensemble modelling of extreme values

Author comments

Manuscript changes

Since the manuscript was submitted, more than half year ago, the central groundwater model applied in the presented study has been recalibrated with new data. On top of this, work has been done to reduce the largest uncertainty source (downscaling of climate data) seen for the extrapolation of extreme groundwater heads. This

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work consists of a new and more local downscaling for the distribution based scaling which include a bias correction performed on the used 10x10 km grid, instead of a bias correction for the whole region (central part of Jutland). Finally, the methodology for the estimation of future groundwater extremes has been slightly changed so that the return periods now are estimated for the period of 1991-2010 and again for the future period of 2081-2100 (and the climate change found by subtraction of the T estimates, $T_{100}(\text{future}) - T_{100}(\text{present})$). We think the latest method is more novel because the analysis is done directly on the simulated hydrological variable rather than on the difference of the variable over time and would therefore like to incorporate this revision into the manuscript. In the current case study, the changes in selection of data for extreme value analysis only affect results to a minor degree. Recalibration incorporates discharge data from four stations and new hydraulic head data collected in 2012. Together with a more detailed description of paved areas the new calibration improves model performance, especially annual head fluctuation in the upper terrace aquifer are improved to an extent worth incorporating in the manuscript. Applying local bias correction (to a 10x10 km climate grid) reduces differences between downscaling methods, thereby reducing the uncertainty contribution from downscaling.

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