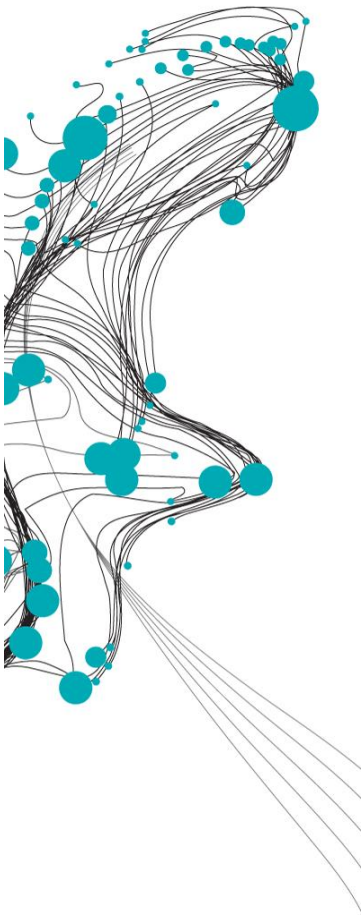
THE EFFECT OF CLIMATE CHANGE ON GROUNDWATER LEVEL VARIATION IN DE WIEDEN, THE NETHERLANDS



Climate change predictions and subsequent consequences have received increased attention over the past decades. However, the effect on groundwater remains underexposed, especially in peatlands due to their complex hydrological systems. This is also the case for De Wieden, a lowland peat area in the Netherlands, in which it is uncertain how climate change will impact groundwater. Therefore, this research aims to determine the effect of climate change on temporal and spatial groundwater level variation in De Wieden for 2050 and 2085 compared to a reference situation.

To achieve this objective, first the reference GWL situation is determined by simulating the daily groundwater level (GWL) conditions from 1981 to 2010 using the MIPWA v3.0 numerical groundwater model. The resulting GWLs are assessed temporally and spatially. Temporally, the inter- and intra-annual coefficient of variation (CV) and spatially averaged annual and seasonal GWL are determined. Spatially, the average highest and lowest GWL are determined. Next, the changes in climatological variables for 2050 and 2085 compared to the reference situation are determined based on the four KNMI'14 scenarios (named GH, GL, WH, and WL). Subsequently, these scenarios are used as input for the same model used to simulate the reference situation and compared. The temporal results are shown in table 1.

Temporally, all scenarios showed a small change in average- and inter-annual GWL variation for 2050 and 2085. Seasonally, the GWL is expected to increase or does not change in winter and fall and decrease or does not change in summer and fall for all scenarios in 2050 and 2085 except scenario GL. The latter scenario shows an increase or no change for all seasons for 2050 and 2085. It also became clear that large precipitation deficits in summer result in a lower GWL in fall even though a precipitation surplus is present.

Spatially, in all scenarios for 2050 and 2085 the GWL variation is expected to increase slightly at the edges of the study area while the centre is not influenced. This is a result of the large presence of surface water in the centre of the area.

Table 1. Spatially averaged annual and seasonal groundwater levels (GWL) and intra-annual and inter-annual coefficient of variation (CV) for a 30-year period and the cumulative net precipitation. In the table blue represents an increase, grey no change, and red a decrease.

Focus year	1995	2050				2085			
Scenario	**Reference**	**GH**	**GL**	**WH**	**WL**	**GH**	**GL**	**WH**	**WL**
Coefficient of variation [-]									
Intra-annual	0.09	0.12	0.10	0.14	0.10	0.13	0.09	0.18	0.12
Inter-annual	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.10
Spatially averaged GWL [m -GL]									
Annual	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.28	0.27
Winter	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.23
Spring	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26
Summer	0.30	0.32	0.30	0.33	0.30	0.32	0.29	0.35	0.31
Fall	0.27	0.27	0.26	0.28	0.27	0.27	0.26	0.29	0.28

The results showed that the effect of climate change on GWL variation in De Wieden is limited. This is mainly due to the large presence of surface water with a constant water level throughout the year. If this changes in the future the spatial and temporal (inter- and intra-annual) GWL variation is expected to increase.

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