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Impacts of different groundwater regimes on water balance components of a shallow water table site

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Large areas of the northern German Lowlands are characterized by shallow water tables and often these areas are drained peatlands. The water levels of the most ditches can be regulated with weirs. Thereby the groundwater levels of the shallow water table sites are also controlled and many hydrological and biochemical processes are affected. Because of these widespread effects, target water levels are heavily discussed between different stakeholder groups. A good level of knowledge about the effects of the different water levels on the water budget components helps to develop compromises paving the way for a well-balanced water resource management.
A lysimeter station located at a grassland site within the Spreewald wetland in North-eastern Germany was used to analyse the impact of increased target water levels in early spring on the development of the water budget components during the vegetation period from April to September. The higher target water levels in spring should help to retain water within the wetland and to buffer the dropping of the water levels in summer.
We compared the measured water balance components and groundwater levels of four water management variants from 2014 to 2017. One variant represents the actual situation of a typical grassland site of the Spreewald wetland. Two variants represent a regime with higher groundwater levels in early spring, as discussed between water managers, nature conversation groups and farmers of the region and one variant simulates constant, slightly lower water levels, optimal for agricultural production.
Our results attest that rising water tables caused increasing evapotranspiration if the vegetation has adapted to these conditions. This adaptation may take place within a few years of elevated water tables. High water tables in spring do increase the subsurface water storage. However, this can compensate for the increased evapotranspiration only for a few weeks and not for the entire season. The varying meteorological conditions of the investigation period from 2014 to 2017 and especially periods with extreme precipitation had a much greater effect on the water budget than raising target water levels in spring. In the long term, higher water tables lead to a change in the vegetation composition, being the main reason for increasing evapotranspiration values. The results underline an improved involvement of ecological processes in hydrological investigations under these site conditions and the need for long-term studies.