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Aeolian drift sand archives show evidence of Late Holocene groundwater dynamics in NE Belgium

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The sandy unconfined aquifers of NE Belgium (Kleine Nete catchment, Campine area) underlay a flat and slightly undulating landscape. It is drained by small rivers that occupy shallow valleys separated by weakly expressed interfluves. Instrumental time series (collected since the 1980s) show that the mean highest groundwater table (MHG) on these interfluves (late winter – early spring) is generally 1-2 m below the surface. For earlier periods there are no systematic observations of groundwater tables in the area. Such information would allow to extend the time window for hydrological model validation and verification under different boundary conditions (soil, land-use, climate) and thus build confidence in future hydrological predictions.
The sandy interfluves of the Kleine Nete catchment have witnessed strong aeolian morphodynamics during the last few millenia. Many of the podzols that developed during the Holocene became either eroded by wind deflation or buried under drift sand. This situation provides a unique means to study palaeohydrological features, events and processes in such shallow unsaturated zones. Therefore, the aim of this presentation is to explore the potential of pedological, geomorphological and historical archives from drift sand landscapes in the Campine area as proxies for past groundwater tables. The adopted approach includes a wide variety of techniques, such as field descriptions of palaeosol profile morphology, optically stimulated luminescence (OSL) dating of intercalated drift sands, determination of groundwater-controlled blow-out surfaces and observations of surface water bodies on historical maps.
The buried podzols often display hydromorphic properties, such as redoximorphic features, vague horizon boundaries and peat development. OSL dating of associated drift sands suggests that a very shallow MHG existed from ca. 6 ka until at least ca. 2 ka. Subsequently, historical maps suggest that groundwater tables started to decline during the second half of the 19th century (ca. 150 a).
So far, the aeolian record of palaeohydrological conditions in the Campine area suggests that groundwater tables on interfluves were often shallower during the last few millenia than today, with MHG levels regularly reaching the surface. Since groundwater tables in this area are largely dependent on infiltration, we infer that either evapotranspiration would have been lower, or precipitation would have been higher during the timeframes considered. The significance of these findings is yet to be understood, given the highly discontinuous and integrated nature of the investigated archives. Future work will focus on expanding the palaeohydrological database and confronting the obtained results with hydro(geo)logical modelling exercises.