EGU2020-18227
https://doi.org/10.5194/egusphere-egu2020-18227
EGU General Assembly 2020

Reconstructing past hydrology from drift sand archives: possibilities and limitations

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Palaeohydrological studies usually focus on extreme events and long-term changes as observed from floodplain archives. As a consequence, the information that is obtained inheritely reflects palaeohydrological conditions from a specific compartment of the hydrological system only, namely the discharge area which acts as a drain for runoff and groundwater. In contrast, palaeohydrological conditions in recharge areas, outside the floodplains, are less well understood and documented.

Aeolian drift sands are a typical feature in the European sand belt, and reflect phases of human induced and climatically modulated Holocene landscape instability. As the European sand belt is characterised by shallow phreatic groundwater tables in climates with a precipitation surplus, we might theoretically expect aeolian activity to interfere with a fluctuating groundwater table and/or precipitation events. The aim of this presentation is to explore the possibilities and limitations of four types of palaeohydrological proxy that were retrieved from a variety of different sites in drift sand landscapes in NE Belgium (Campine area): (1) soil horizon morphology of buried podzols, (2) deflation surfaces, (3) drift sand depositional facies and (4) palaeobotanical remains in organic-rich sediment.

The palaeohydrological information that these proxies contain will be discussed according to various characteristics. These include the continuity of the archive (continuous or discontinuous), the resolution (high resolution or integrated proxy), and whether the proxy is indicative for outcropping groundwater or precipitation events.

Podzol soil horizon morphology is an indicator of the average highest groundwater table position over a time period of several thousands of years prior to landscape instability and sand drifting, and can thus be qualified as an integrated proxy. Overblown deflation surfaces can only be used as an upper limit of the highest palaeo-groundwater table in between podzolisation and drift sand deposition, and can be qualified as a discontinuous low-resolution proxy. Drift sand depositional facies is a highly discontinuous proxy but can be used to verify whether deposition took place in dry, wet or standing water environments, with or without the influence of significant precipitation

events and/or running water. Undoubtedly, palaeobotanical remains (macrobotanical and pollen) in overblown peat and peaty sand from the deepest parts of the drift sand landscape offer the highest resolution in terms of chronology (century to decades) and highest reliability in terms of water source tracing (outcropping groundwater vs precipitation).

Proxy verification mainly relies on fragmentary historical information derived from maps covering the last 250 years. Most importantly, when different proxies are available at the same site, they usually show strong internal consistency. A good example is the presence of peat with aquatic palaeobotanical remains in the deepest parts of the landscape where the underlying podzol soil also shows hydromorphic features and the overlying drift sand contains elements that are typical for deposition in wet environments.

We conclude that the above outlined complementary set of palaeohydrological proxies is a promising tool to reconstruct past hydrology in drift sand landscapes from the European sand belt.