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Relict soil polygon patterns in previously permafrosted lowland Europe as observed from a high-resolution DTM

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In contrast with patterned ground polygons in present-day permafrost regions, their fossil counterparts in lowland Europe have rarely been described in sufficient detail due to the poor preservation potential by later sediment deposition and land reclamation. Previous observations were principally based on cropmarks from aerial photographs of grassland and arable land, and highly dependent on weather conditions. This inevitably leads to inaccurate mapping of these features. However, the spatial distribution and planform dimension of polygons are crucial elements in understanding past permafrost conditions and to reconstruct palaeoclimatic conditions at the time of formation and/or decay. Such information is needed for, e.g., future permafrost modelling in support of long-term management of radioactive waste repository systems.
In this presentation, we show that the recently released high-resolution Lidar DTM of Flanders ($1m^2$ resolution) shows unprecedented images of well-preserved fossil polygon networks, enabling to study the observed features in detail. We will present several examples and discuss their relation to the substrate and compare them with geometries of polygons in actual permafrost regions. Most interestingly, the features seem to be preserved only under forest, indicating that 20th century land use has had a significant impact on their preservation. Despite the fact that the polygons can easily be recognized from subtle differences in surface elevation (several cm to dm), they are difficult to identify in the field as a result of their dimensions and vegetation cover. This implies that the number of intact polygons and polygon networks in formerly permafrosted regions such as the Campine area in northern Belgium is probably strongly underestimated. We conclude that the inventarisation of fossil periglacial polygon networks in lowland Europe should mainly be focussing on forested areas.