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GIS based morphostratigraphic evaluation of glaciofluvial terraces in the foreland of the European Alps

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Glacial and glaciofluvial sediments of the North Alpine Foreland have been subject to extensive quaternary research for more than a century. Nevertheless, a regional scale stratigraphic model has not been proposed since Penk & Brückner (1909). Since then, geological evidence were fit into local stratigraphic classifications, leading to severe inconsistencies across different countries/regions. The following study aims to solve inconsistencies by a morphostratigraphical approach, applying innovative methods utilizing new high-resolution digital elevation models, existing geodata and information from literature.

First, the abundant information from literature was reviewed to create a synopsis of commonly used terrace stratigraphic classifications. Second, geologic maps and (high-resolution) digital elevation models were compiled in a GIS database. To process this data, a new toolset was developed (using software R), fitting the requirements of morphostratigraphic analyses. These mainly involve the processing and statistic evaluation of terrace-top surfaces. Based on these analyses, we discussed fluvial, glacial and geodynamic factors, controlling the observed hypsometric parameters (concavity, slope, relative heights). To stratigraphically compare results across catchments and regions, the modern Danube and Rhine River were used as “fixed” base-levels to which tributary terrace tops were extrapolated. Terrace elevations above these base-levels were used as proxy to evaluate the rare absolute and otherwise inferred terrace ages from literature. Derived morphostratigraphic evidence provides an objective basis to discuss and harmonise the highly complex and diverging stratigraphic classification schemes across North Alpine Foreland regions.

Penck, A., & Brückner, E. (1909). Die Alpen im Eiszeitalter. Leipzig: Tauchnitz.