Geophysical Research Abstracts
Vol. 20, EGU2018-3452, 2018
EGU General Assembly 2018

Constraining complex post-depositional history of fluvial deposits using 10Be depth profile and forward modelling

Nathan Vandermaelen (1), Veerle Vanacker (), Koen Beerten (), and Marcus Christl ()

(1) University of Louvain, Earth and life institute, Geography, Belgium (nathan.vandermaelen@uclouvain.be), (2) Engineered and Geosystems Analysis, Waste and Disposal, Belgian Nuclear Research Centre SCK•CEN, Boeretang 200, 2400 Mol, Belgium, (3) Laboratory of Ion Beam Physics, ETH Zurich, Department of Physics, Zurich, Switzerland

The Campine Plateau (CP, NE Belgium) is a low-altitude plateau (100-30 m a.s.l.) covered with fluvial sediments and gently dipping towards the north. The area west of the plateau is known to be in an erosive regime since the last 0.6 to 1 Ma, the dominant geomorphic process being differential erosion between the surrounding region and the relatively erosion resistant material of the CP. Nonetheless, the post-depositional history of the different lithological units of the CP remain poorly understood, and quantitative data on topographic evolution of these sediments is scarce. The objective of this research is to constrain past denudation, along with potential burial episodes, of a lithological unit made of fine to coarse gravels (called “Zutendaal gravels”) of the CP over the last 1 Ma.

To do so, in-situ cosmogenic radionuclide (CRN) dating is applied using a 10Be depth-profile in the Zutendaal gravels, containing 14 samples covering 9 meters of depth at regular interval. The 10Be concentration of the sediments was measured at the AMS facility of ETH-Zurich.

Subsequently, a forward modelling approach simulating scenarios of post-depositional denudation and burial episodes was developed. The model output is the concentration in 10Be over a 20 m depth column at centimeter resolution. The model encompasses 3 production pathways (spallation, fast muons and negative muons) and dynamically adjusts 10Be concentrations as a function of time-variable denudation and burial, inheritance and exposure duration.

Model output is then compared with observed data. Diagnostic scenarios for the observed 10Be concentrations and its variability in the Zutendaal gravels were determined from optimization of the Nash-Sutcliffe efficiency index, over a limited and incremental range of parameter values.