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# Subsurface particle transport in coarse-grained vineyard soils – a laboratory flume experiment

**Laura Kögler**[1], Thomas Iserloh[1], Alina Helmer[1], Enzo Steehouwer[2], Andreas Ruby[1], Manuel Seeger[1], and Johannes B. Ries[1]

[1]Trier University, Department of Physical Geography, Trier, Germany (s6lakoeg@uni-trier.de; iserloh@uni-trier.de; s6alhelm@uni-trier.de; s6anruby@uni-trier.de; seeger@uni-trier.de; riesj@uni-trier.de)

[2]Wageningen UR, Soil Physics and Land Management Group, Wageningen, the Netherlands (enzo.steehouwer@wur.nl)

The Mosel wine region (Rhineland-Palatinate, Germany) is the largest steep vineyard region in the world. Due to extreme slopes, tillage with heavy machinery, increase in extreme precipitation events, and new planting of vines, these vineyards are among the agricultural systems most affected by soil erosion.

As a result of viticulture since the Roman period and their special characteristics, almost all vineyard soils in the Mosel region are classified as Terric Anthrosols. These soils are characterized by a very high rock fragment content (mainly Devonian argillaceous schists and fluvial sediments) and a loose surface horizon over a compact one due to tillage or weathered parent material. This structure enables subsurface flows within the upper horizon, especially in periods of very high soil moisture.

There is a knowledge gap concerning the identification and quantification of transported soil particles in this subsurface flow. If these soil particles reach relevant amounts, superficial protective measures against soil erosion may be partially ineffective, and the soil degrades due to substantial loss of fine material. In consequence, there is a need to develop a method to determine this subsurface particle transport in situ.

In this study, a first experimental approach for assessing the occurrence of subsurface erosion of fine-grained soil particles within soils is presented. Using this experimental set-up, it is possible to prove the process of fine soil material transport as well as the development of sediment traps for in situ measurements.

The experimental approach consists of a sediment trap prototype, based on a drainage pipe, which is positioned into a test flume. The dimensions of this flume are 2.7 m x 0.9 m x 0.2 m (L x W x H). It is filled with material from a vineyard soil of the Mosel valley flanks. Water enters the flume from the upper end with the help of an 0.11 m high overflow. The sediment trap is 0.86 m long and has an 0.855 m x 0.4 m long side-cut-out where a mesh (mesh aperture 3 mm x 6 mm) is installed. It is connected to a separate drain where the water and eroded sediment are collected. This is analysed in the laboratory to quantify the amount and characteristics of the eroded

material. Additionally, the total subsurface flow is measured by a drain at the lower end of the soil body for having a total mass budget of runoff and erosion.

The preliminary results show a clear correlation between the measured total subsurface flow and sediment transport with the ones collected with the sediment trap. The results suggest that this sediment trap prototype is clearly suitable to quantify the subsurface soil erosion. In the further course of the work, the sediment trap will be installed in situ in the vineyards to test its field applicability to determine valid subsurface erosion rates in vineyard soils.