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High-frequency absorbance measurements for sediment source apportionment – laboratory and field assessment

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To manage effectively excessive sediment inputs to rivers and streams, it is crucial to have detailed and reliable information on key sediment sources. Such evidence is important for implementing targeted measures for improving ecosystem functioning and meeting environmental objectives. Although sediment fingerprinting is increasingly adopted worldwide to provide such evidence, current procedures do not provide detailed information on how sediment sources can change over both short (e.g., events and in between events) and long (e.g., over seasons or years) time scales. These limitations are mainly due to the conventional methods used for target sediment sampling and the high workloads and costs associated with laboratory analyses for tracers, which limit both high-frequency and longer duration sampling campaigns. To address this issue, we propose the use of a submersible spectrophotometer, which measures absorbance in the UV-VIS range in situ and at high frequency (e.g., minutes) to trace suspended sediment sources. In our proof of concept investigation, the approach was first tested in a laboratory setting, using soil samples and artificial mixtures with known proportions of two, three and four soil source samples in an experimental water tank. A total of six soil samples were collected, which were sieved to different fractions to investigate the influence of particle size on the sensor absorbance readings. Both soil samples and artificial mixtures were suspended in the laboratory tank set-up at different concentrations to investigate the effects on: (i) absorbance, and; (ii) un-mixing accuracy. The results showed that absorbance was linearly additive and could be used to predict dominant samples in the artificial mixtures correctly using a Bayesian tracer un-mixing model, largely regardless of particle size and of the concentration inside the experimental tank. This approach is currently being tested in a field experiment in the Attert River Basin (Luxembourg) to investigate if the results found in the laboratory experiments hold under natural field conditions. Our preliminary insights into the use of absorbance for sediment source apportionment in the field will be presented.