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Testing FingerPro mixing model using experimental sediment mixtures

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Fingerprinting techniques provide information to identify the sources of mobilised sediments in catchments. Discriminating the potential contribution from sediment sources is necessary for understanding soil redistribution processes. Unmixing models are an effective statistical tool for quantifying source apportionment, providing valuable data to support soil and water conservation and catchment management strategies. One of the most important limitations of fingerprinting research is to validate the source proportions estimated by mixing models.
Our study aims to test the new FingerPro mixing model using a set of experimental sediment mixtures created with known proportions of different soil sources. FingperPro mixing model is a standard linear mixing model compiled in an Open Source R package that unmix sediment mixtures by accounting for the variability of the sediment sources to assess the statistical distribution of the source contributions. To test the sensitivity of the model, elemental composition of source and mixture materials was analysed by XRF in a set of four experimental sources and four sediment mixtures. The study aimed to assess the accuracy of source apportionments modelled by FingerpPro comparing the model outputs with the theoretical source contributions. The model was able to unmix the experimental mixtures providing consistent results with values of goodness of fit (GOF) greater than 90% for all simulations. The mean value of the absolute error estimated for the source contributions was 3%. Greater errors were obtained for those sources that made a lesser percentage contribution to the experimental mixtures. Our findings demonstrate that FingerPro performed satisfactorily in reconstructing the experimental mixtures tested, adding confidence to the accuracy of this new unmixing model. A model which provide advantages such as time-saving by unmixing several sediment mixtures at a time, the use of raw data and the possibility of using different functions for tracer selection.