



Tracing sources of sediments during flood events by Diffuse Reflectance Infrared Fourier-Transform (DRIFT)

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The identification and the quantification of the source of the suspended sediment transported by a river is becoming an increasingly important requirement in sediment investigations. An increasing number of works used fingerprinting to identify and trace one or more distinctive characteristics of the source material that can be recognized in the final sediment. As sediment fingerprints are often a combination of two or more characteristics, fingerprinting frequently requires a multi-tracer, composite or multi-proxy approach.

The most commonly used tracers are radionuclides (^{137}Cs , unsupported ^{210}Pb , ^{7}Be), chemical extracts of reactive elements and total chemical analyses. However, current sediment fingerprinting techniques are very selective and they are not always practical for catchment area monitoring because of their high cost (time and money) and because of the complexity of the analyses required. As consequences such approach is rarely used to compute the sources of sediment during flood events. Hence, the challenge is to develop methods (experimental and instrumental) that can be applied to large numbers of samples, that involve minimal sample preparation and that provide an acceptable level of sediment source selectivity.

In the framework of the STREAMS project aiming at understanding and modelling the sediment transport in mountainous areas (Bleone River, Southern French Alps), we study the potential use of a combination of Diffuse Reflectance Infra-red Fourier Transform (DRIFT) and multivariate analysis (Partial Least Squared) to quantify the main sources of suspended sediments during flood events.

The objectives of this study were i) to identify the sediment sources areas in the Galabre sub-catchment (20 km^2) for various rainstorm events and ii) to quantify the contribution of each sediment source in the suspended sediment flux at the outlet of the sub-catchment during floods.

A set of 38 soil samples were collected on the Galabre sub-catchment in potential sediment sources areas and then analysed by DRIFT. The spectral signatures were used to quantify specific sediment components such as aluminosilicates, quartz, CaCO_3 , CaSO_4 . The DRIFT signatures allow us to discriminate the main lithological sources of sediments : marly, marly-calcareous and molasse lithologies.

These three potential sources were used to build 45 ternary sources mixtures with various proportions of each source, each sample being analysed in DRIFT. The Partial Least Squared analyses was then used to quantify the proportion of each sediment source in the suspended sediment samples collected at the outlet of the catchment for various flood events and various times within a flood event.