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A new modelling approach to tracing sediment sources that incorporates distributions and their elemental correlations

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Identifying sediment sources is necessary to the management of increasingly scarce water resources. Tracing the source of sediment with elemental geochemistry is a well-established technique for ascertaining sediment provenance. Indeed, the modelling process is central to the confident apportionment of sediment to their lithogenic sources. Distributions have been recently incorporated throughout the modelling process including source contribution terms for two end-member sources. The transition from modelling source samples to modelling samples drawn from distributions removes relationships, including potential correlations between elemental concentrations, from the modelling process. Accordingly, a novel modelling approach is presented that re-incorporates correlations between elemental concentrations and also models distributions for source contribution terms for multiple source end-members. Artificial mixtures derived from catchment sources samples were derived to test the accuracy of this correlated distribution model and also other modelling approaches used in the literature. The most accurate model incorporated correlations between elements, did not use any weighting and used the absolute mixing model difference. This model was then applied to determine sediment sources in three South East Queensland catchments and demonstrated that Quaternary Alluvium was the most dominant sediment source (μ 44%, σ 2%).