EMMAgeo – end-member modelling analysis of grain-size data

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Earth surface processes decisively shape our planet. Identifying and quantifying their rates and impact is one of the major challenges of current geoscientific research. The changing grain-size distributions of deposits (e.g. lake sediments, ocean floor deposits, landforms accumulated by wind-blown sediment) reflect their formation by distinct sediment transport processes and provide a fruitful possibility to unravel the contribution of such processes. However, interpreting sediment transport processes from grain-size data in terrestrial archives runs into problems when source- and process-related grain-size distributions become mixed during deposition. A powerful approach to overcome this ambiguity is to statistically “unmix” the samples. Typical algorithms use eigenspace decomposition and techniques of dimension reduction.

This contribution presents the package **EMMAgeo** (Dietze & Dietze, 2013) for the free statistical software *R*. It bases on an end-member modelling algorithm originally presented as *Matlab*-script (Dietze et al., 2012) and contains several extensions and added functionality. The package comprises 14 functions. It supports simple modelling of grain-size end-member loadings and scores (eigenspace extraction, factor rotation, data scaling, non-negative least squares solving) along with several measures of model quality. It also provides pre-processing tools (grain-size scale conversions, weight factor limit inference, determination of minimum, optimum and maximum number of meaningful end-members) and allows to model data sets with user-defined end-member loadings. **EMMAgeo** also supports uncertainty estimation from a series of plausible model runs and determination of robust end-members.

The contribution depicts important package functions, thereby illustrating how large data sets of artificial and natural grain-size samples from different depositional environments can be analysed to infer and quantify process-related proxies (Dietze et al., 2014) that can be used to better reconstruct environmental conditions in the past (and to learn for future environmental change).

References

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