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Unravelling the Temporal Variability of Aeolian Dust Supply by Statistical Decomposition and Modelling of Grain-Size Distributions from Sediment Layers on the Eastern Canary Islands

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Grain-size distributions obtained from sedimentary sequences are a reliable palaeoclimatic proxy. Different sources and mechanisms of transport and deposition lead to a varying probability of different object sizes which may be interpreted in terms of climate variability. It is still debated, however, how much information can actually be derived from time series of grain-size distributions. For this purpose, we compute a measure for the number of statistically relevant components, the LVD dimension density, and discuss possible modifications of the underlying statistical approach.

The climatologically relevant information contained in grain-size records is extracted by two different statistical approaches: Non-parametric statistical decomposition (like principal component analysis and more sophisticated extensions of this method) allows to distinguish size-classes which are especially sensitive to changing environmental conditions. A parametric description of the respective distributions by means of a finite mixture model yields qualitative and quantitative information on the varying influence of different transportation mechanisms.

Both methods are applied to three time series of grain-size distributions obtained at fluvioeolian archives at Lanzarote, Eastern Canary Islands. We show that - in combination with other palaeoclimatic proxies - grain-size distributions are an excellent recorder of past variations in the aeolian dust supply from North-Western Africa. They help to identify more moist periods than today during the Quaternary.