A Revisit to Component Analysis on Remanent Magnetization Curves

Xiangyu Zhao[1]; Yusuke Suganuma[2]; Masakazu Fujii[2]
[1] Paleomag, NIPR; [2] NIPR

The remanent magnetization curve is favorably measured to estimate the coercivity distribution of geological samples, which usually contain more than one magnetic component. As the magnetic components are often indicative of the associated geological or environmental processes, it is therefore desirable to quantify the contribution of individual components to the total remanent magnetization. This task can be achieved using the so-called unmixing method which fits a mixture model of certain end-member model distribution to the measured remanent magnetization curve. The lognormal, skew generalized Gaussian and skewed Gaussian distributions have been used as the end-member model distribution in previous studies, which are performed on the gradient curve of remanent magnetization curves. However, gradient curves are sensitive to measurement noise as the differentiation of the measured curve exaggerates the noise, which prevents the unmixing method from finding the correct components. Though either smoothing or filtering can be applied to reduce the noise before differentiation, their effect on biasing component analysis is vaguely addressed. In this study, we present a new model function that can be directly applied to the remanent magnetization curves and therefore avoid the differentiation. The new model function can not only approximate the lognormal distribution but also present more flexible skewness and kurtosis than lognormal distribution, which is a merit for modeling the coercivity distribution of complex magnetic component as it could avoid spurious component that is documented for the lognormal distribution. The new unmixing protocol is fully automated so that the users can be freed from the tedious work of providing initial guesses for the parameters for the mixture model and thus the subjectivity of component analysis is improved. We applied the unmixing method both to model and measured data, and compared the results with that obtained using other unmixing methods to better understand their interchangeability, applicability and limitation.