Deconvolution of paleomagnetic data: A MATLAB softwareand optimization of sensor response

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The development of pass-through cryogenic magnetometers has greatly improved our efficiency in collecting raw paleomagnetic data, and highlighted the quest for tools that can rapidly view and process the measurement data. In addition, the magnetometer sensor response inevitably convolves with the continuous magnetic measurements, reducing resolution of the acquired magnetic intensity and direction data. Based on Akaike's Bayesian Information Criterion (ABIC) minimization method, a deconvolution routine was developed by Oda and Shibuya (1996) to remove the smoothing effects of the magnetometer sensor response on long-core pass-through paleomagnetic data. The deconvolution algorithm was later successfully applied to improve resolution of u-channel paleomagnetic data (Guyodo et al., 2002). The lack of an easy-to-use user interface and the difficulty in measuring the magnetometer sensor response, however, hampered the deconvolution software to gain its popularity. Xuan and Channell (2009) recently introduced the UPmag software with graphical user interfaces that allows easy and rapid analysis of natural remanent magnetization (NRM) and laboratory-induced remanent magnetization measurement data for u-channel and half-core samples. Here, we present a new MATLABTM based software UDECON, with user-friendly interface similar to that of UPmag, to conveniently deconvolve u-channel and half-core magnetic measurement data using the ABIC minimization algorithm. UDECON directly reads the original magnetic measurement data file, and allows the user to easily view and compare the original data with the deconvolved data at each demagnetization step. Different to Oda and Shibuya (1996) who omitted the X-Y and Y-X cross terms assuming that the half-core sample is perfectly on the center line, all cross terms of the three orthogonal measurement axes are measured and used in UDECON. Optimization of deconvolution for each demagnetization step on pass-through paleomagnetic data is achieved in UDECON by automatically searching for the minimum ABIC. Oda and Shibuya (1996) assumed equally spaced measurement positions, however, we extend the deconvolution scheme to allow actual measurement positions for each demagnetization step by picking up the precise response values irregularly separated from the center. We also plan to implement the feature to evaluate the reliability of the sensor response curves measured for each paleomagnetic laboratory and the positioning errors by the extension of the sample tray string.