超伝導岩石磁力計のセンサー感度曲線の推定と校正
Sensor Response Estimate and Calibration of Superconducting Rock Magnetometers

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Pass-through superconducting rock magnetometers (SRM) offer rapid and high-precision remanence measurements for continuous sediment samples that are essential for modern researches on paleomagnetism and environmental magnetism. However, continuous SRM measurements are smoothed and distorted due to the convolution effect of SRM sensor response. Thus, deconvolution is necessary to restore accurate magnetization from pass-through SRM data, and robust deconvolution requires reliable estimate of SRM sensor response. In the presentation, we present a new software tool ‘uresponse’ developed for the purpose of evaluation and optimization of SRM sensor response. The example sensor responses were acquired for two SRMs at University of Southampton; i.e. liquid He-operated (old) and liquid He-free (new) ones. Precise point source held in the center of 5×5×5mm plastic cube was used for the measurement with a magnetization pointing to one of the faces together with a gridded measurement block. With the software, each tensor components of sensor response for magnetization in X-, Y-, Z-axes to a pick-up coil in X-, Y-, and Z-axes acquired for the measurement grids are smoothed, interpolated and integrated over the cross-sectional area of a measured u-channel sample. In addition, absolute magnetization of the point source was estimated by cross calibration with a palladium standard using MPMS at National Institute of Advanced Industrial Science and Technology. By comparing repeated measurements of a u-channel sample containing geomagnetic reversal on the two SRMs before and after deconvolution, we demonstrate the significant differences in measurements caused by different sensor responses of the two types of magnetometers, and show how deconvolution with well-constrained response functions can help to largely overcome the convolution effects and distortion for measurements on both SRMs.

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