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A protocol for variable-resolution first-order reversal curve (FORC) measurements

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High-resolution first-order reversal curve (FORC) diagrams are being increasingly used in rock and environmental magnetism, including for detection of biomagnetic signals in sediments. Resolution can be a major barrier to obtaining high-quality FORC diagrams and timeconsuming measurements that employ small field steps are necessary to resolve the finest features of a FORC distribution. We present a new experimental protocol with irregularly spaced field steps that allow different parts of a FORC diagram to be measured at different resolutions. Larger numbers of measurements can, therefore, be made in key regions of a FORC distribution to resolve diagnostic features at higher resolution. Specification of the field steps in the irregular measurement grid is based on major hysteresis properties; no a priori knowledge concerning the underlying FORC distribution is required. FORC diagrams obtained with conventional measurements and with our new measurement protocol give consistent results. Because of its variable resolution, the irregular protocol provides a clear representation of finescale features produced by quasi-reversible superparamagnetic and non-interacting singledomain particles. Although the proposed irregular measurement protocol is not as efficient at suppressing noise as recently developed post-processing techniques (e.g., VARIFORC, Egli [2013]), it enables efficient high-resolution analysis for relatively strongly magnetized samples where measurement noise is not detrimental to FORC distribution estimation.