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A linear theory of physical properties in inhomogeneous sediments and its application to relative paleointensity determination

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Abstract. A linear model is developed to study the effect of variations in composition upon extensive physical properties of continuously deposited sediment sequences. By applying this model to natural and synthetic remanence acquisition, an optimal method of relative paleointensity determination is derived. The sediment is regarded as a mixture of independent components, each of which behaves uniformly in depth with respect to its physical properties. The concentration of each sediment component is assumed to independently vary linearly with an external "environmental" signal. Remanence acquisition in each sediment component is linear in external field and concentration of the component. It is demonstrated that in this case the ideal normalization procedure for relative paleointensity determination is to divide the natural remanent magnetization by a biased normalizer. Common magnetic cleaning techniques improve the relative paleointensity record by removing nonlinear behavior and by reducing the bias to the normalizer. The proposed linear sediment model for any extensive physical property clearly separates the influences of concentration of sediment components from those of environmental signals. It thus opens many possibilities for extensions to nonlinear models.

Discussion Paper (PDF, 415 KB) Interactive Discussion (Final Response, 3 Comments)

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