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eEarth Discussions



# *Interactive comment on* "A linear theory of physical properties in inhomogeneous sediments and its application to relative paleointensity determination" *by* K. Fabian

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In this article, Karl Fabian introduces an interesting linear theory of relative paleointensity records taking into account the environmental modulation of sediment physical properties. The content of this paper is mostly mathematical, with strong assumptions about linearity of both NRM and magnetic parameters relative to sediment composition and in particular magnetic carriers concentration. In this model, the concentration is linearly dependent on the environmental signal. Sediment complexity is taken into account by considering a sum of independent components for each stratigraphic level. The mathematical treatment appears well presented, although I think that even in a simple configuration (i.e., a unique environmental source) this model would probably require defining an almost infinite number of components with specific DRM behav-

ior associated to specific matrix composition, carrier concentration, mineralogy, shape, magnetic history, etc.

In fact, everything seems so straightforward and logical that, after reading the discussion, one could then think that any sediment will yield a publishable record relative paleointensity. The following sentence may be misleading: "...inhomogeneous sediments often works by far more better than should be expected from considering the rigid prerequisites which are usually demanded for its validity". The main argument used in favor of this statement is a paper by Haag (2000), in which the discussion pointed out that only the main features were similar to the Sint-200 reference curve for the time interval considered. In fact this means that only the major intensity changes associated with dramatic dipole variations, e.g., when the field was weak, are recovered with confidence. Other intensity variations cannot be accurately reproduced. The model proposed in Fabian's paper is general and does not consider specific intensity values or gradients. Therefore it should be applicable to all values. So, in that case, why would only dramatic intensity changes be recovered in the natural sediments of the Haag (2000) paper?

Generally speaking, the paper lacks examples from natural sediments. Although one could argue in favor of most of the author's assumptions, the paper would have a greater impact if the theory were applied to real cases. Concrete questions such as "How do we estimate the number of independent components in a sediment from a specific location?" or "How do we estimate if such sediment will yield a reliable paleointensity record?" or "How do we calculate the normalizing bias?" should be answered, and illustrated by concrete cases.

This also stands for numerical modeling. In the discussion, the author states that "numerical modeling indicates that even if a linear sediment has a small non-zero bias...the classically inferred RPI record deviates only slightly...", but does not show any results. This should be illustrated and quantified.



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These comments should naturally lead to increasing the reference list, which I find incomplete and relatively out of date. In addition, a justification of the equations defining the NRM is required. For instance, it is necessary to prove that equation (4) reflects what is known about magnetization locking, DRM and pDRM in sediments. There have been several papers in the past few years on the subject.

Concerning the only figure of the paper, more details are needed. It should be divided into at least three sub-figures and labeled accordingly. A more detailed description of each sub-figure is then required. At present, the model needs to be understood in order to follow a figure that is supposed to explain the model. I think that additional information is needed in order to make this contribution more useful to our community.

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