



Evaluating current geomagnetic field models with respect to sedimentary paleomagnetic data: is a dipole sufficient?

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There have been efforts to construct complex global geomagnetic field models constrained by limited paleomagnetic data. Here we present four different versions of a time varying geocentric dipole model for the past approximately 9000 years, which is based on a limited selection of sedimentary paleomagnetic data with good spatial cover. The robustness of the modeling approach is evaluated using modern magnetic observation station data provided by the World Data Centre for Geomagnetism in Edinburgh and we discuss the magnitude of the error introduced by insufficient data coverage. The prediction in terms of directional variations is tested against paleomagnetic data from 64 different sedimentary sites and compared to the output of the CALS3K.3 and CALS7K.2 spherical harmonic models (Korte & Constable 2005, Korte et al. 2009). We find that our dipole estimate can explain the paleomagnetic data almost as well as the CALS3K.3 and CALS7K.2 models. More importantly, specific areas and/or records are identified where there is a significant difference between the performance of the dipole estimate and the spherical harmonic models. We discuss different explanations for these misfits with a focus on the problems involved with geomagnetic field modeling of imperfect paleomagnetic data. Our results suggest that many of the differences between the dipole estimate prediction and the paleomagnetic data can be related to poor paleomagnetic quality and/or the lack of accurate and precise time control inherent to some of the records. These results agree with Valet et al. (2008) who suggested that the CALS7K.2 model probably underestimates the dipole contribution in order to reduce the misfit between the inversion and the data. We conclude that better paleomagnetic data and associated time control can improve the predictions of global geomagnetic models. References: Korte, M. & Constable, C. G. 2005. Continuous geomagnetic field models for the past 7 millennia: 2. CALS7K. *Geochemistry Geophysics Geosystems* 6, Q02H16, DOI:10.1029/2004GC000801. Korte, M., Donadini, F. & Constable, C. G. 2009. Geomagnetic field for 0-3 ka: 2. A new series of time-varying global models. *Geochemistry Geophysics Geosystems* 10, DOI: 10.1029/2008GC002297. Valet, J.-P., Herrero-Bervera, E., Le Mouel, J.-L. & Plenier, G. 2008. Secular variation of the geomagnetic dipole during the past 2000 years. *Geochemistry Geophysics Geosystems* 9, Q01008, DOI:10.1029/2007GC001728.