MILLENNIAL-SCALE CHARACTERISTICS OF THE GEOMAGNETIC FIELD

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A new series of continuous global magnetic field models has recently been developed spanning the past 3000 years, based on several subsets of available archeo- and paleomagnetic data. These and our previous CALS7K.2 model are used to investigate the evolution of various field characteristics and assess their robustness in the different models. The spatial resolution achievable for global models with the number and quality of data presently available lies in the order of spherical harmonic degree 4. Differences among the millennial scale field models partly reflect the uncertainties in the models, but can also be significantly influenced by variations in data distributions. This is especially true for models based only on archeomagnetic data, as to date very few of these data come from the southern hemisphere and the global distribution is strongly biased towards Europe. For example, even in the dipole tilt with respect to the rotation axis significant differences are seen between models that include magnetic information from sediment records and those that do not. We argue that field variations seen in the archeomagnetic data that seem to be accommodated by stronger tilt of the dipole reflect a strong bias in the associated data distribution. These stronger tilts are incompatible with the information from several sediment records, particularly those from the southern hemisphere. Models based on all available data suggest that on average the dipole tilt over the past few millennia was lower than today. Recent and historical models show two pairs of distinct magnetic flux lobes in the northern and southern hemisphere field at the core-mantle boundary and a growing patch of reversed flux in the southern hemisphere, causing the so-called South Atlantic Anomaly. Time averages of the 3 ka models suggest a preference for a similar flux lobe configuration and the possibility of an intensity minimum in the South Atlantic region, although these features also show clear temporal changes on this time-scale.

Geomagnetic field models, secular variation

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