BEAM-R1: A BAYESIAN EUROPEAN ARCHEOMAGNETIC MODEL FOR THE PAST 2000 YEARS

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Ongoing efforts are currently being made to enrich the available archeomagnetic database and to represent the data in space and time by means of Spherical Harmonic models. However, it is well known that the sparse spatial and temporal data distribution at the worldwide scale hampers the modeling to high resolutions.
The data density is comparatively higher in Europe than in any other part of the world for the past 2000 yr. This situation offers a good opportunity to model the archeomagnetic field at spatial scales higher than permitted by spherical harmonics. In principle, such a regional modelling should give us the possibility of better exploring the reliability of the rapid spatial and time variations of the past magnetic field.
We complement the recent regional modeling advances made by Pavón-Carrasco et al. (2009) with a new approach based on a Revised Spherical Cap Harmonic Analysis (R-SCHA2D; Thébault, 2008) and a Bayesian inversion scheme in order to process the most up-to-date archeomagnetic database for Europe. This allows us to solve non-linear inverse problems and to avoid the use of strong a priori information. We obtain the marginal probabilities of each regional parameter with a Monte Carlo Markov Chain at all epochs between 50BC and 1850AD. This helps us assessing the reliability of some time variations. Our method provides the maximum likelihood of the magnetic field components, their probability distribution, but also misfit histograms for all individual data. This exhaustive statistical information allow us to conclude that directional data are self-consistent in Europe but that important issues are faced when considering intensity data.
By a comparison with other regional and global models, we conclude that our new Bayesian model represents the data to higher spatial resolutions than what is obtained by other techniques. However, given the data error and uncertainties, this does not necessarily lead to higher accuracies. Moreover, other methods seem to perform equally well, if not better, when considering the time variation of the archeomagnetic magnetic field.

Regional modeling, Paleo Secular Variation Curve, archeomagnetic field.

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