

Shannon information of the geomagnetic field for the past 7000 years and implications on the present field understanding

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The present behaviour of the geomagnetic field as expressed by IGRF (International Geomagnetic Reference Field) model deserves particular attention when compared with that shown over the past few thousands of years by several paleomagnetic/archeomagnetic models, such as CALS3k, CALS3k_cst, ARCH3k, ARCH3k_cst, SED3k and CALS7k. In order to exploit the dynamical properties of the geomagnetic field in its whole complexity, we apply some Information Theory concepts to the above models, in particular analysing the behaviour over time of Shannon Information and Kolmogorov Entropy. The results show how the present geomagnetic field is rather distinct, at least for the past 400 years. This is consistent with a significant global critical state started at around 1750, and still present, characterized by significant low geomagnetic dipole energy and Shannon information and high K-entropy. The details of how these characteristics may develop are not clear, since the present state could move toward an excursion or a geomagnetic polarity reversal, although we cannot exclude the possibility that the “critical” behaviour will become again more “normal” and the present geomagnetic field will arrest its decay.