The knowledge of the spatial power spectra of the main geomagnetic field and of its secular variation makes it possible to define a typical timescale (a correlation time) for each spherical harmonic degree. Investigating both observations and numerical dynamo models, we test the relevance of a one-parameter inverse linear law (in contrast to a more sophisticated two-parameter power law) to explain the decrease of correlation times with spherical harmonic degree.

The inverse linear law applied to spherical harmonic degrees 3 to 10 is well suited to describe the intrinsic behaviour of a dynamo, since it is compatible with the statistical way the observed correlation times are expected to fluctuate (according to a stationary isotropic statistical model). We show that this law is also appropriate to explain the behaviour of geomagnetic field models based either on historical or on satellite data.

The single parameter defining the inverse linear law (the so-called secular-variation timescale) could provide a convenient and sensible means to rescale the time axis of dynamo simulations, by multiplying the non-dimensional time of the numerical model by a factor equal to the ratio of the secular variation timescale of the Earth (expressed in years) to that of the model (dimensionless). As the secular-variation timescale is inversely proportional to the magnetic Reynolds number and also mildly sensitive to the value of the Ekman number, this rescaling would amount to adjusting the level of magnetic turbulence of the numerical model to that of the Earth, while mitigating the discrepancy in kinematic viscosities.