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# A composite geomagnetic power spectrum constructed from paleo- and geo-magnetic data

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We construct a power spectrum of geomagnetic dipole moment variations or their proxies that spans a broad range of periods from some tens of million years to less than one day. For completeness we include non-dipole variations at high frequencies. Constable and Johnson (2005) derived empirical estimates of the spectrum from the magnetostratigraphic time scale, from marine sediment relative paleointensity records, and from a time varying paleomagnetic field model for the past 7kyr. We extend the spectrum to shorter periods where direct field measurements have been made with observatory, satellite, and high frequency instruments. The spectrum has the most power at long periods, reflecting the influence of geomagnetic reversals and in general decreases with increasing frequency (decreasing period). The empirical spectrum is compared with predictions from simple parametric models in various frequency ranges. Discrepancies between observed and predicted spectra are discussed in the context of (i) changes in reversal rate, (ii) overall average reversal rate, (iii) cryptochrons, (iv) the time taken for a reversal to occur and, (v) long and short term geomagnetic secular variations in both internal and external parts of the field.