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A wavelet investigation of possible orbital influences on past geomagnetic field intensity

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A number of sedimentary records of relative palaeointensity have been reported to contain modes of variability that could have been driven by changes in the Earth's orbital or climatic state. Proposed relationships are often based on visual correlation in the time domain or the presence of peaks in relative palaeointensity frequency spectra close to those of the orbital components. When discussing hypothesized connections it is not common for the phase relationship between palaeointensity and orbital change to be addressed, so a true mechanistic link cannot be confirmed. The existence of a direct link between records of palaeointensity and orbital/climatic variation is tested using the cross-wavelet transform and squared wavelet coherence. It is found that whilst all the records show common power at certain periods, the geomagnetic and orbital/climatic variations do not exhibit a consistent phase relationship, suggesting there is no direct physical link between them. This interpretation is supported by a lack of significant correlation in the time-frequency plane between the studied records as measured by the squared wavelet coherence. Thus palaeointensity data from available archives spanning the past 800 kyr suggest that changes in orbital parameters / global climatic conditions did not influence the geodynamo sufficiently to exert a detectable linear influence on the magnitude of the recorded field vector.