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Statistical and Hurst analysis of palaeomagnetic data

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The 4 Myr time series of magnetic data constructed from ocean floor samples as well as the series of polarity data for dipolar field reversals are analyzed from a new perspective. We have adopted the Hurst analysis and calculated the Hurst exponent (H) for both series. The aim is to determine if the preceding data in both series affect later data. The Hurst exponent, which is positive and smaller than 1, is well known in financial analysis. If H is substantially greater than 0.5 the values in the series are considered to be correlated, i.e. the next data are generally similar to the previous one. If H is considerably less than 0.5 than the data are considered to be anti-correlated and the following data are generally far away from the previous ones. Finally if H = 0.5 or close to it the series is considered to have very similar statistical properties to a random walk. For the 4 Myr time series we found H = 0.9624 which shows that the magnetic field has a strong memory. For the time series of reversals H = 0.7495 and shows a strong correlation also. This means that reversals should not be considered as statistically independent events. The statistical analysis of the 4 Myr time series suggests that the distribution of magnitudes of the magnetic field is better fitted by a Weibull distribution which is different from former results. This distribution appears in the wind speed distribution. This may suggest that the thermal convection is extremely crucial in the reversals dynamics.