CORRELATIONS BETWEEN EARTH’S MAGNETIC FIELD AND CLIMATE: THE USE OF CONTINUOUS WAVELET TRANSFORMS

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ABSTRACT: Recently there have been suggestions that changes in the earth’s magnetic field may influence climate on millennial, centennial and decadal scales. Continuous wavelet transforms are used to compare time series of geomagnetic and climatic variables.

Continuous wavelet transforms resolve a time series into its time and frequency components, meaning temporal variation in signal power at a particular frequency can be detected. This allows both continuous and intermittent periodic correlations to be found.

Continuous geomagnetic field monitoring in Australia began in 1840 at the Rossbank observatory. Since then the observatory has been re-located to Melbourne, Toolangi and finally Canberra, with all data corrected to the Canberra observatory reference. In this study monthly mean geomagnetic data for the period 1949-2006 were compared using wavelet transforms with temperature and rainfall data recorded at Canberra Airport and cloud data from Sydney Airport. Sunspot number data were also compared.

Wavelet analysis shows peaks in geomagnetic power at annual, 9-14 year and 45 year periods. Temperature, rainfall and cloudiness results show high power annually, at 2-5 years and at 10-15 years. Cloud and magnetic data both show a spike in annual power at 1990. Sunspot power is dominant at 11 years.

Annual variations are seasonal, while 9-15 year variations appear to be related to the 11 year sunspot cycle. The link between magnetic field variations and sunspot activity is well established. Current research suggests that solar activity may also affect climate, perhaps modulated by the Earth’s magnetic field. Other correlations are not currently explained and do not necessarily imply causality. Wavelet analysis has shown potential for further research into geomagnetic-climatic relationships.