

Title: Analyzing Geomagnetic Activity in the Context of a 22-year Solar Magnetic Cycle

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Abstract:

McIntosh (2014) proposes a model for the 22-year magnetic cycle, based on a pattern of overlapping polarity bands. Typical predictors of solar activity such as sunspot number are shown to align with the model. However, patterns of geomagnetic activity were not compared. Legrand and Simon (1981) investigated the solar cycle by classifying geomagnetic activity into three main categories: (1) quiet day activity when $aa < 20\gamma$, and active days of either (2) recurrent activity, when the activity level changes smoothly and the pattern that persists for longer than four solar rotations, (3) fluctuating activity, each of which they linked to a different solar feature. Through their analysis they found evidence for an “extended” solar cycle of 17 years with a 6 year overlap between 2 successive cycles. Utilizing their classification scheme, 143 years of aa data spanning from 1868-2011 was analyzed, then compared to the 22-year model for the solar magnetic cycle proposed by McIntosh (2014). IMF and solar wind data from OMNI was used to provide information about the possible solar sources of the geomagnetic activity. The data indicates that geomagnetic activity precedes sunspot activity. Most geomagnetic activity is accounted for by the presence of high speed solar wind streams. Recurrent activity shows a longitudinal periodicity of approximately 35 days, suggesting a high latitude origin of the streams. The correlation with the 22-year model is unclear, as the OMNI data set contains many periods of missing data.