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Jerks as chaotic fluctuations of the geomagnetic field

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The geomagnetic field is chaotic and can be characterised by a mean exponential time scale $< \tau >$ of around 6 years after which it is no longer predictable. It is also ergodic, so time analyses can substitute the more difficult phase space analyses. Taking advantage of these two properties of the geomagnetic field, a scheme of processing global geomagnetic models in time is presented, in order to estimate fluctuations of the time scale. Considering that the capability to predict the geomagnetic field is reduced over periods of geomagnetic jerks, here we propose a method to detect these events over a long time-span. This approach considers that epochs characterised by relative minima of fluctuations in time scale τ, i.e., those periods when the geomagnetic field is less predictable, are possible jerk occurrence dates. We analyse the last 400 years of the geomagnetic field (covered by the Gufm1 model) to detect minima of fluctuations, i.e., epochs characterised by lower values of the time scale. Through this method, most of the well known jerks are confirmed and a few others have been detected. Finally we also identify some short periods when the field is less chaotic (more predictable) than usual, naming these as periods of steady-state geomagnetic regime, to underline their opposite behaviour with respect to jerks.