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Geomagnetic field changes during excursions and reversals

The Earth's magnetic field is characterized by regular and complex changes, reflecting various geodynamo processes. Numerous paleomagnetic studies have provided evidence of multiple geomagnetic polarity reversals and excursions throughout Earth's history. We use data-based paleomagnetic field models such as LSMOD.2, GGFSS70, GGFMB and PADM2M, encompassing different time periods, to analyse the field characteristics during these extreme variations. In particular we study the asymmetry in growth and decay of dipole moment and paleo secular variation (PSV) index during different events. A sawtooth pattern of gradual dipole decay followed by rapid recovery during reversals, as proposed by past studies, has been observed in our study on the Matuyama Brunhes reversal. But, in contrast, we observed an opposite behavior of fast decay and slow recovery during most of the studied excursions, suggesting the possibility that excursions may be governed by a mechanism distinct from that of reversals. Although less pronounced than in the dipole moment, the PSV index also exhibits an opposite asymmetric pattern during excursions and reversals.

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