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Dynamics and timing of reversals

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Information provided by records of geomagnetic reversals from lava sequences is constrained by irregular volcanic activity. We show that, despite different resolution, the ten most detailed volcanic records match surprisingly well and display the same dynamical characteristics after tuning to a common eruption rate. We thus infer that the reversal process has remained unchanged over the past 180Ma with the same time constants and duration. The reversing field is characterized by 3 successive episodes, a precursory event, a 180° polarity switch and a rebound. The first and third phases depict a large amplitude directional change which, by comparison with the archeological record, is estimated to last between 2 and 2.5 kyr. The transit between the two polarities does not exceed 1ka and is thus too fast for being properly recorded by most sediments. Similar results are obtained after reducing the directional clusters that are present at different periods in each record. These features and time constants are compatible with models that do not require any mantle control on reversals processes, which is also supported by the absence of preferred longitude of the pole. Lastly, based on the chronology of the successive reversal phases, the eruption rates are found to be at least twice larger for hot spots (<1flow/100yr) than for large flood basaltic provinces.