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A 6-year quasi-periodicity in the Earth's core magnetic field dynamics from 1932 to 2022

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Recent studies suggest that the secular variation dynamics of the geomagnetic field exhibits periodic patterns that indicate underlying wave processes in the Earth's core. However, as long as the analytical core field models are based on geographically sparse and noisy observatory data, they have apparent limitations for studying fine structure of its spatiotemporal variations. The advent of satellite measurements of the full geomagnetic field vector in 1999 removed this limitation and made it possible to produce reliable and highly accurate models of the secular variation, allowing downward continuation to the core-mantle boundary. These models have revealed rapid core field variations on a time scale of the order of 10 years. In particular, the 6-year quasi-periodicity in the second time core feld derivative has been established. In our recent research, we expand our previously successful efforts to extract the secular variation and secular acceleration signal from the magnetic observatory data over 90-year period (1932-2022), i.e. far before the advent of the space era. As a result, our approach to data analysis for the first time has made it possible to confirm the existence of a 3-year quasi-periodicity of secular acceleration pulses of alternating polarity over the mentioned period. The proposed methodology does not imply an intermediate production of a core field model, as done according to classical approaches.