Interannual fluctuations of the core angular momentum and the secular acceleration of geomagnetic models

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Recent satellite models for Earth's core magnetic field suggest an existence of interannual core dynamics. Due to the small magnetic signals, however, it is a difficult issue to unambiguously resolve interannual variations of the core flow and the associated oscillation of the core angular momentum (CAM). It has already been shown that the phase of the oscillation is robustly determined, according to numerous CAM computations from diverse core flow models that are all estimated as a result of inverting a single geomagnetic model C^3FM2. Here, we discuss that the phase identification depends on the secular acceleration (SA) of a geomagnetic model, and that a large uncertainty still remains for the pre-satellite era. Estimates of the phase vary clearly with geomagnetic models, C^3FM2, gufm1 and COV-OBS, whose differences are readily specifiable in their SA representations. None of them may be an optimal model for describing the SA. Compared with the SA of a satellite model GRIMM3, C^3FM2 is overdamped in time, while the other two are parametrized inadequately. C^3FM2 may be optimized for better resolving the interannual CAM oscillations by properly modifying its temporal smoothness in reference to satellite SA models.

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