# Preliminary study of detecting jerk-like magnetic secular variation in a numerical dynamo model

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The geomagnetic field, which is generated by the geodynamo, varies in a wide range of time scale. Focusing on short time scale variation, it is well known that a sudden and abrupt change in the first time derivative of the magnetic field (a V-shape-like change) occurs in typically one-year time scale. This abrupt change is called the geomagnetic jerk. Although we don’ t fully understand the mechanism of the geomagnetic jerk, Malin and Hodder (1982) show that internal sources can generate the geomagnetic jerk. Subsequent spherical harmonic analysis and wavelet analysis (Alexandrescu et al. 1995; Le Huy et al. 1998; Bloxham et al. 2002) establish that the geomagnetic jerk is an internal origin in a broad sense.
In this study, we examine magnetic field variation using a result of numerical dynamo simulation in order to see whether or not any jerk-like variation could be observed in the numerical model. The adopted values of the Ekman number in the model is 3x10^{-5}, which is not state-of-the-art but considerably low, and therefore, seems suitable for a pilot study. As a first step, we investigate the radial component of the magnetic field at the core-mantle boundary truncated at spherical harmonic degree 12. With a second order centered finite differencing, the first and second time derivatives are evaluated globally at every time step. According to the procedure utilized in observations, we calculate jerk-amplitude to find jerk-like discontinuous change in the second time derivative. As a result, jerk-like variation is found at some point in the first time derivative, whereas it is not evident in the second time derivative. In conclusion, our preliminary study suggests a possible detection of jerk-like behavior in a numerical dynamo model. More careful analysis is required to confirm first detection of magnetic jerk in numerical dynamos.

Keywords: geomagnetic jerk, dynamo, numerical simulation

 