Geophysical Research Abstracts
Vol. 20, EGU2018-2833, 2018
EGU General Assembly 2018

Magnetic jerk features recovered by quasi-steady synthetic core flow models

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Geomagnetic jerks are the shortest temporal variations of the core field registered by observatories and satellites. Neither the physical mechanism producing such abrupt changes nor their spatio-temporal characteristics at the Earth's surface are well understood. We use a set of synthetic core flow models to solve the radial magnetic induction equation in order to reproduce geomagnetic jerk characteristics. Our results demonstrate that jerks may be caused by roughness of the field on the core-mantle boundary. Steady flow models may reproduce important characteristics of geomagnetic jerks, such as non-simultaneous behaviour, non-global pattern, spatial variability of amplitudes and strongest jerks in the radial component. However, secular acceleration changes of sign in our synthetic steady models produce too weak amplitudes compared to geomagnetic jerks. Flow models with a fixed pattern but a time-dependent amplitude produce jerks amplitudes about 70 times larger than steady flow models. These amplitudes are comparable to those recorded at magnetic observatories.