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Influence of electrical conductivity heterogeneity in the D" layer on geomagnetic jerks

SHIMIZU, Hisayoshi[1*], UTADA, Hisashi[1]

[1]Eartthquake Research Institute, University of Tokyo

Geomagnetic jerks are known to have occurred globally around 1969, 1978 and 1991 and they are called as global jerks. Also, those occurred around 1999, 2003 and 2007 are identified as local jerks. One of the most prominent features of the 1969 geomagnetic jerk is the differential delay time of its appearance at the Earth's surface: the sudden change of the first derivatives was observed earlier in Europe compared with that in southern Africa. The cause of the difference as large as two years was attributed to the effect of conductivity anomaly in the D" layer. Here we assume the locality of the jerk appearance to be simply due to the shape and intensity of the anomaly, and a set of 3-d numerical modeling of electromagnetic induction in the mantle was performed to clarify whether features of the geomagnetic jerks can be reproduced by the effect of mantle heterogeneity and magnetic field of a single spherical harmonic mode, both poloidal and toroidal, at the CMB. Numerical results suggest that even an extremely high conductive body in the D" layer cannot generate differential delay time as large as two years at the surface of Earth by either the poloidal or the toroidal magnetic field at the CMB. On the other hand, it is demonstrated that a geomagnetic jerk originated from the toroidal magnetic field at the CMB is possibly observed as a local jerk. We consider that fast torsional oscillation in the core may produce the toroidal field variation by the omega effect. Global scale geoelectric field observed by transoceanic submarine cables in the north western Pacific may show possible contribution of the toroidal magnetic field on 2007 local geomagnetic jerk.