Influence of high electrical conductivity heterogeneity at the bottom of the mantle on generation of 2007 geomagnetic jerk

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Wavelet transform has been used to analyze geomagnetic jerks, sudden change of second time-derivatives of the geomagnetic field components (e.g., [1]). A ridge in wavelet transform allows us to identify a possible geomagnetic jerk and its occurrence time. Character of a geomagnetic jerk is quantified by regularity, which is the gradient of the ridge with respect to dilation. Regularity of geomagnetic jerk depends on the geomagnetic field variation at the surface of the Earth's core and the electrical conductivity of the mantle. Regularity distribution obtained for 1969 geomagnetic jerk implies that its regularity at the CMB is 1.55 and electrical conductivity of the bottom 2000 km of the mantle is about 8 S/m [2].
Geomagnetic jerks somewhat localized in the south Atlantic region were observed around 2003 and 2007 (e.g. [3]). Superposition of fast equatorial Rossby waves at the top of the core [4] and Alfvén wave excited by buoyancy heterogeneity at some depth in the core [5] are proposed as possible cause of the localized geomagnetic jerks. An alternative of the cause is outcome of interaction between sudden variation of the toroidal magnetic field at the CMB and electrical conductivity heterogeneity in the D" region [6].
Regularity of 2007 geomagnetic jerk is expected to provide a clue for discussing the involvement of high electrical conductivity heterogeneity since it would results in higher regularity than the other geomagnetic jerks but different from that due to magnetohydrodynamic waves.
Estimated regularities of magnetic field eastward component at M'Bour (MBO, Senegal) and Chambon la Forêt (CLF, France) around 2007 geomagnetic jerks are larger than that for 1969 geomagnetic jerk at both stations. This is compatible with the scenario of the generation of 2007 geomagnetic jerk by interaction between toroidal field variation and high electrical conductivity heterogeneity while 1969 geomagnetic jerk is purely due to the poloidal field from the core. It seems that the variations are not from simple sinusoidal wave which should result in higher regularity.

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