Geophysical Research Abstracts
Vol. 12, EGU2010-11861, 2010
EGU General Assembly 2010

Core field acceleration pulse as a common cause of the 2003 and 2007 geomagnetic jerks

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According to the recent CHAOS-2 geomagnetic field model, based upon about ten years of high-precision CHAMP and Oersted satellite data, a core field acceleration pulse occurred over the time interval 2002-2008, reaching its maximum power near 2006.0. This pulse is visible in spherical harmonic modes n=3 to 8 at the core surface and is best seen in the n=5 and 6 modes. We show that the 2003 geomagnetic jerk, observed at the Earth's surface in both the CHAOS-2 model and observatory data, is caused by the increasing phase of the acceleration pulse at the core surface. Similarly, another jerk observed near 2007 at several observatories, particularly in the South Atlantic region, corresponds to the decreasing phase of the same pulse. Our results suggest that this core field acceleration pulse is the relevant phenomenon to be investigated from the point of view of core dynamics, and not the jerks themselves. The observed time delays between the various modes of the pulse could possibly be used to constrain mantle electrical conductivity. We also investigate whether similar field acceleration pulses occurred in the past and whether they could explain previous pairs of jerks.