Geophysical Research Abstracts, Vol. 9, 00561, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-00561

Jerks and Secular Variations of the Main Geomagnetic Field in High-Frequency Spectrum Range

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The jerks as jump-like changes in piecewise constant rates of the second time derivatives of geomagnetic field components values temporal series were investigated. In order to detect all the jerk-like events in the geomagnetic field across the 20^{th} century complete set of annual mean values of geomagnetic field X, Y and Z-components uninterrupted data, measured on worldwide net of magnetic observatories was analysed. High-frequency variations of external origins were removed from observational data series through eleven-year gliding smoothing of secular variations temporal series observed from geomagnetic components measured values. Successive application of the method of piecewise linear approximation by use of technique of least squares provided statistically approved values of "virtual" geomagnetic accelerations on the points of magnetic observatories spread worldwide on the Earth's surface.

Construction of global spherical harmonic models by input of assessed "virtual" values of geomagnetic accelerations outputs 10 sets of spherical harmonic coefficients modelling the geomagnetic accelerations field on the Earth's surface across the 20^{th} century under the assumption of their piecewise constant character between the global geomagnetic jerks. Global fields of jerks within 20^{th} century were assessed as differences between the corresponding coefficients values in neighbouring accelerations field modelling coefficients sets.

Examination of the variations of the lengths of days for the same time period shows that several global jerks in the geomagnetic field are in time correlation with jump-like changes in LOD and in the variations of LOD changeability rate.

Expansion of MAGSAT based DGRF1980 field model in the time by use of obtained models of geomagnetic field annual changeability accelerations we have got every year spherical harmonic models of the main geomagnetic field and its secular vari-

ations. Comparison of temporal series of modelled values of secular variations with their "observed" values from different regions of the world and geomagnetic field models with the series of IGRF and DGRF models issues statistically meaningful feature of constructed/calculated models.

Appling the created models for depiction the global features of the main geomagnetic field year-by-year variability by means of global characteristics as a situation of magnetic centre, dip poles and dip equator, and for investigation of secular variations of dipole and non-dipole parts of the geomagnetic field allowed correspondingly to detect several jerks in the geomagnetic field global variability on dependence of which component of global field characteristics was investigated, and regions where secular variations are caused by development and/or decaying of origins of anomalies, to depict drifting feature of Brazil anomaly caused by steady westward drift of the main geomagnetic field across the 20^{th} century with a rate $\approx 2,5 \div 4,0$degree per year.

Reliability of jerk-based models approved by complex of testing investigations with reasonable outputs makes an effective basis for making the conclusion that geomagnetic jerks may be considered as quanta of geomagnetic variability within timescales less than one hundred year. Accordingly geomagnetic field secular variations in the high-frequency spectrum range are supposing to be formed by stochastic superposition of successive jerks appearing in different regions of the Earth's surface at different epochs. Although in any region of the world successive jerks are delayed for a few decades the jerks on the globe are of quasi-decade repeatability.

Question on similar temporal characteristics of global geomagnetic jerks repeatability and solar activity periods remains open at present and needs further detailed investigations in spite of the fact that owing to the applied method of investigations influence of solar related variations has been brought to ignorable minimal values.