CORRESPONDENCE OF *EOP* AND GEOMAGNETIC FIELD

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ABSTRACT. Connection of *EOP* with centred and eccentric geomagnetic dipole fields is described (with the use of Gaussian coefficients) for the epoch 1880-2000. The main tools of statistical investigation carried out were Laplace-type robust estimation (in case of ΔLOD) and the non-linear regression analysis (for PM). On the basis of computations carried out it can be concluded that the statistical comparison of temporal variation of earth magnetic and *EOP* data shows significant correlation.

1. DECADAL VARIATIONS OF LOD AND GEOMAGNETIC DIPOLE FIELD

Dependence of LOD from processes of the liquid outer core is especially strong in case of periods between 20 and 60 years. This phenomenon determined first of all by core mantle interactions. These interactions can be of different kind. Bloxham (2000) and Gubbins et al. (2003) describe the sensitivity of the axial geomagnetic dipole to thermal interactions at the CMB. Mound and Buffett (2006) detected gravitational oscillations in the LOD. Yukutake (1972) and Yokohama and Yukutake (1992) explain the connection between sixty-year variation in length of day and magnetic field with the electromagnetic core-mantle coupling. Extension of the range of the link between variations of geomagnetic field and LOD in direction of shorter than 20 year periods is problematic because the worldwide geomagnetic data are available recently with a time step of 5 years. More principal difficulty is related to the strong influence of the atmospheric angular momentum on LOD in case of annual/sub-annual periods (Abarca del Rio, 2003), what hides the possibly existing core-mantle interactions. In case of longer, secular, periods one meet the problem of sparse LOD data and indefinability of dating both the magnetic (archeomagnetic) and LOD data. For the aims of present investigation in case of decadal variations the geomagnetic data were obtained from IAGA global spherical expansion database for the time-interval 1880-2000 with a five-year step. Length of day variation data for the same time-interval (and digitalization) are given in form of mean annual values derived from long-term data set of IERS.

2. STATISTICAL BACKGROUND

For the study of correlation of geomagnetic and *EOP* data the robust estimation technique were used together with well-known non-linear regression analysis. The robust estimation is a generalization of least-squares method which reduces the influence of outliers and allows optimal solution in case of different error distribution. According to authors numerous mathematical tests for correlation of LOD and geomagnetic dipole moment the best fit is in case of use of Laplace robust modelling (Laplace type modelling means: the central part of the distribution curve is normal while the wings are linear). In case of correlation of PM and geomagnetic dipole moment the non-linear regression analysis of degree n=6 was in use. In Table 1 the correlation coefficients both for three components of central geomagnetic dipole and for the four components of eccentric dipole field are collected together. The connection of X and Y components of PM are shown and described by Figs. 1a and 1b.

3. CONCLUSIONS

Statistical dependence was detected between the geomagnetic dipole moment M_0 and ΔLOD (Table 1). The orientation and eccentricity of the geomagnetic dipole show also somewhat weaker correlation with variations of axial rotation speed. In case of polar motion the X and Y components of PM have

	M_0	θ	ϕ	δ
Central dipole	0.928	0.210	0.361	0.000
Eccentric dipole	0.808	0.612	0.740	0.703

Table 1: Correlation of LOD and components of geomagnetic field. M_0 is the dipole moment, the angle between the geomagnetic dipole and geographic axes is θ, the azimuthal angle is ϕ, while the distance of the dipole from the Earth centre is given by δ.

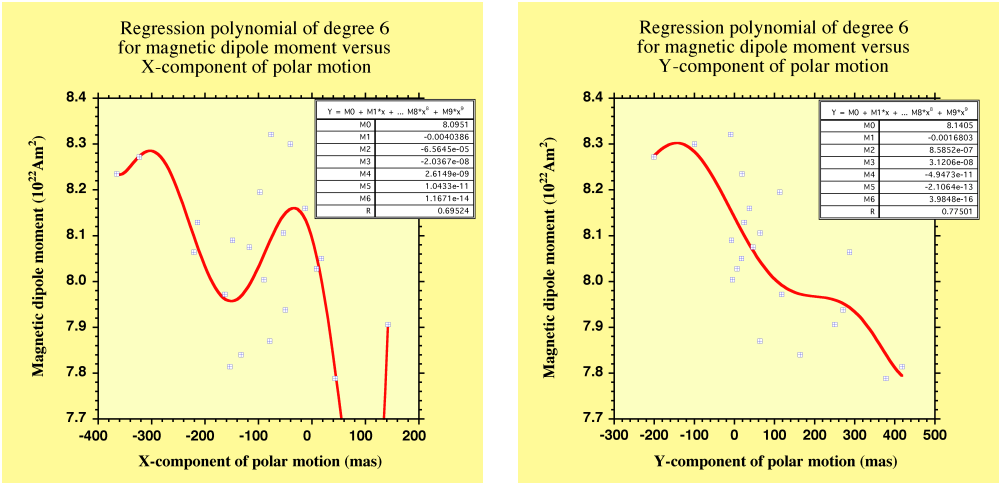

Figure 1: Relationship of X, Y components of PM and M_0 (the reliability factors are 0.69 and 0.77)

also statistical connection with M_0.

The physical meaning of above described results is: the interrelation between the variation of ΔLOD and the geomagnetic field in decadal time-scale can be explained with toroidal circulation in the liquid outer core which leads to the temporal variations of the core angular momentum through frictional processes at the core mantle boundary. The dependence of ΔLOD on temporal variations of orientation of geomagnetic dipole and also correlation of PM and M_0 suggest that beside the toroidal flow in the liquid outer core there are also spheroidal flows present what leads to the radial mass redistribution within the outer core.

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