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"The relative secular variations of the geomagnetic field along the Zgorzelec-Wiżajny profile in the period of 50 years"

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Secular variations



- also named as secular anomalies of the Earth's magnetic field changes,
- long-term changes of the geomagnetic field,
- caused by:
 - magnetic-hydrodynamic processes occurring in the Earth's outer core and in the border part of core-mantle,
 - but in a local/regional scale caused by processes occurring in the mantle and/or in the Earth's crust:
 - stresses involved with tectonic movements,
 - increased seismic activity (volcanoes, earthquakes),
 - chemical processes,
 - changing thermal conditions.

"On secular variations of the geomagnetic field intensity in Poland and their dependence on geographical coordinates and geological structure"

Location of Z-W profile





(Grad et al., 2003)



Magnetic anomaly map of Poland



EEC granitoid massifs: dobrzyn massif, pomorze massif, mazowsze massif; metamorphic-igneous complex; metamorphic folding zones: kaszuby zone, Ciechanów zone, Podlasie zone; quartzites; rapakivi-like granitoides and anorthosites massifs.

(Petecki & Polechońska, 2017)

Annual means of TMI recorded in the Geophysical Observatory IGF PAN in Belsk from 1966 to 2016





Poland 33 nT/year



s://www.ngdc.noaa.gov/geomag/WMM/data/WMM2015/WMM2015_F_SV_MERC.pdf

Methodology of survey

1. The definitive value of relative secular variation $(\Delta T_{n,t})$ in a secular point (n) in the year (t) is an average value of reduction results

$$\Delta T_{n,t} = \frac{1}{60} \sum_{1}^{60} \left| \vec{T}_{obs,n,(\tau + \Delta \tau)} \right| - \left| \vec{T}_{Belsk,\tau} \right|$$

 τ - time of measurement in GMT (Greenwich Mean Time) $\Delta \tau$ - time correction related to the difference in longitude between measurement point and the Belsk Observatory

2. Linear approximation of definitive values of relative secular variations

$$W_n(t) = b_n \cdot t + a_n$$

3. Graphical illustration of slope coefficient

$$b_n = \partial(\Delta T_{n,t})$$



Changes in time of the relative geomagnetic field values $\Delta T_{n,t}$ in secular points of the Zgorzelec-Wiżajny profile

linear approximation in total time period (1966-2016) of the magnetic measurements

Comment:

 ΔT_n - mean values of $\Delta T_{n,t}$ in the period 1966-2016 for individual secular points



Changes in time of the relative geomagnetic field values $\Delta T_{n,t}$ in secular points of the Zgorzelec-Wiżajny profile

linear approximation in two time intervals (1966-2000, 2000-2016)

Comment:

 ΔT_n - mean values of $\Delta T_{n,t}$ in the period 1966-2016 for individual secular points



Data comparison



(thanks to courtesy of Mr. Jan Reda, IGF PAN)

Dynamic of TMI shouldn't be taken into account in the relative secular variations analyses (disagreement between the rate of geomagnetic field changes and TMI secular variations along the Z-W profile).





Changes in time of the relative geomagnetic field values $\Delta T_{n,t}$ in secular points of the Zgorzelec-Wiżajny profile

linear approximation in two time intervals (1966-2000, 2000-2016)

Comment:

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Summary



The relative secular variations of the geomagnetic field along the Zgorzelec-Wiżajny profile in the period of 50 years:

- No relationship between the local relative secular variations and the geomagnetic field dynamic
- Lower amplitudes of the relative secular variations after 2000 year.
- A different dynamic of relative secular variations in PP and EEC.
- Reversal of relative secular variations trend after 2000 year.
- A qualitative relationship between relative secular variations, tectonic units of Poland, geothermal conditions and lithosphere structure.



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