On external sources of secular variations of the Earth's magnetic field

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A b s t r a c t (extended): It is well known that secular variations of the Earth's magnetic field vary with time and space. Our aim was to obtain quantitative dependences of secular variations changes (SV) on changes of the geomagnetic activity expressed by ΣK_p indeces, i.e. to follow the part of SV caused by ionospheric and magnetospheric sources. The data from various observatories were used. Among them are preferentially European observatories along with some Asian observatories (mainly in the territory of the former USSR) and two USA observatories – Fredericksburg (FRD) and Tucson (TUC). The acronyms of the observatories and information on their location can be found elsewhere (e.g. *Data Catalogue, 1999*).

Mean annual values of horizontal intensity at the magnetic observatories have been used to calculate secular variations. Fig. 1 shows the mean differences between consecutive mean annual values of the horizontal component ΔH for the time interval 1890–1990 over the chain of observatories located at middle and subauroral latitudes of the North hemisphere around the globe. Differences of consecutive mean annual values ΣK_p are given at the bottom of Fig. 1. There is anticorrelation of SV(H) on $\Delta\Sigma K_p$ as seen in Fig. 1. The dotted vertical lines make it easy to follow this relationship for the years with the highest peaks.

Table 1 presents the correlation coefficients r and dispertions σ as well as corresponding equations of linear regression for a set of European and Asian observatories, for Tangerang observatory, and USA observatories Fredericksburg and Tucson. The values mentioned in the last column in Table 1 express the mean changes of $\Delta SV(H)$ per unit of ΣK_p index, so-called average sensitivity ε of $\Delta SV(H)$ to $\Delta\Sigma K_p$ changes. That does vary for individual observatories as seen in Fig. 2.

The analysis presented reveals some signatures of dependence of secular variations of the Earth's magnetic field on the level of geomagnetic activity. It can be noted that sensitivity of the secular variations increases from the eastern to the western European observatories. The higher sensitivity exists at the region of the Surlari Geomagnetic Observatory (SUA). The sensitivity seems to increase for the low latitude observatories.

Key words: secular variations, geomagnetic activity

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