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The PC index: method of calculation and physical sense

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The PC index has been introduced [Troshichev and Andrezen, 1985; Troshichev et al., 1988] to characterize magnetic activity in the polar caps generated by the solar wind coupling with the magnetosphere. The concept of the antisunward convection within the polar cap, controlled by the interplanetary electric field EKL determined by Kan and Lee (1979), served as a basis for the method of the index calculation. Value of disturbances in the polar cap geomagnetic H and D (or X and Y) components form the basis for derivation of the PC index. The technique of PC index derivation consists of two separate procedures: (1) derivation of the statistically justified regression coefficients determining relationship between the coupling function EKL and vector of polar cap magnetic disturbance δF, and (2) calculation of PC indices by data on current δF values with use of the regression coefficients established in course of the first procedure. To exclude from examination the geomagnetic field changes unrelated to the solar wind variations the value of geomagnetic disturbance is calculated in reference to the quiet daily variation. The regression coefficients α (slope) and β (intersection) describing a linear link between values δF and EKL are calculated in combination with the optimal angle φ providing the highest correlation between δF and EKL. Parameters α, β and φ are derived based on the statistically justified sets of data. As a result the PC index corresponding to the value of coupling function EKL, irrespective of UT time, season and point of observation is determined.
Validation of the PC proper derivation has been testified by the following requirements imposed on the calculated PCN and PCS indices: PCN and PCS indices should be consistent with the interplanetary electric field EKL; PCN and PCS indices should be in close agreement with each other irrespective of season and UT time; indices should not demonstrate seasonal variation; indices should not demonstrate regular daily variation (i.e. dependence on UT-time). By its derivation, the PC index is regarded as a proxy of the interplanetary electric field EKL affecting the magnetosphere in course of constant solar wind – magnetosphere coupling.