P. Stauning: Comment on "Troshichev et al. 2020: The PC index variations during 23/24 solar cycles: relation to solar wind parameters and magnetic disturbances.": Invalid data base. Manuscript: 2021JA029151 Initial submission 4 February 2021. Submission of revised version 16 April 2021

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Abstract

P. Stauning: Comment on "Troshichev et al. 2020: The PC index variations during 23/24 solar cycles: relation to solar wind parameters and magnetic disturbances.": Invalid data base. Abstract. The contribution from O.A. Troshichev, S. Dolgacheva, N.A. Stepanov, and D.A. Sormakov: "The PC index variations during 23/24 solar cycles: relation to solar wind parameters and magnetic disturbances", https://doi.org/10.1029/2020JA028491 , is to a large extent based on data made available at the web portal http://geophys.aari.ru/PCspaceweather. However, an examination of the data presented there has disclosed what appears to be serious errors in the calculated values of polar cap (PC) index values, amplitude span of the quiet day curves (QDC) used for the reference levels, and values of the solar wind merging (or geoeffective) electric field (E KL) used for calibration of polar magnetic data to form PC indices. Parts of the essential data files are reproduced in the Appendix here. Some of the discrepancies reported in the present commentary affect directly the illustrations presented in their contribution while other possible errors may not be apparent since the use of relative values in their presentation makes assessments difficult.

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Abstract. The contribution from O.A. Troshichev, S. Dolgacheva, N.A. Stepanov, and D.A. Sormakov: "The PC index variations during 23/24 solar cycles: relation to solar wind parameters and magnetic disturbances", https://doi.org/10.1029/2020JA028491 , is to a large extent based on data made available at the web portal http://geophys.aari.ru/PCspaceweather . However, an examination of the data presented there has disclosed what appears to be serious errors in the calculated values of polar cap (PC) index values, amplitude span of the quiet day curves (QDC) used for the reference levels, and values of the solar wind merging (or geoeffective) electric field (E_{KL}) used for calibration of polar magnetic data to form PC indices. Parts of the essential data files are reproduced in the Appendix here. Some of the discrepancies reported in the present commentary affect directly the illustrations presented in their contribution while other possible errors may not be apparent since the use of relative values in their presentation makes assessments difficult.

1. Introduction

The contribution from O.A. Troshichev, S. Dolgacheva, N.A. Stepanov, and D.A. Sormakov (2020): "The PC index variations during 23/24 solar cycles: relation to solar wind parameters and magnetic disturbances", https://doi.org/10.1029/2020JA028491 published in J. Geophys. Res. Space Physics holds a number of correlations between various solar wind parameters and geospace magnetic disturbance indices.

Much of the work is based on relations involving the Polar Cap (PC) indices, PCN (North) and PCS (South). These indices are presently submitted jointly by the Arctic and Antarctic Research Institute (AARI) and the Danish Space Research Institute (DTU Space) in versions recommended by the International Association for Geomagnetism and Aeronomy (IAGA) by its Resolution #3 (2013).

However, it appears that there are serious errors in the PC index values reported at the web portal: http://geophys.aari.ru/PCspaceweather holding the data base for the commented publication. Furthermore, the amplitude spans of the quiet day curves (QDC) forming the reference level for the definition of polar magnetic variations appear to be incorrect. In addition, the reported solar wind merging electric field (E_{KL}) values (Kan and Lee, 1979) used for calibration of the PC indices (e.g., Troshichev et al., 1988, 2006) appear to be calculated incorrectly.

The data file "YearlyQDCPC.dat" and part of the "MonthlyQDCPC.dat" files from the AARI web portal http://geophys.aari.ru/PCspaceweather are reproduced in Appendix A and form basis for the discussions of the questionable data.

2. Yearly average PC index values.

"Definitive" PCN index values in the version endorsed by IAGA are available at the web portal http://isgi.unistra.fr/indices_pc.php operated by the International Service of Geomagnetic Indices (ISGI), and at DTU Space at https://doi.org/10.11581/DTU:00000057 comprising links to the PCN data series and also documentation of the IAGA-endorsed index version held in "PC_index_description_main_document_incl_Appendix_A.pdf" which includes software and scaling parameters. Recalculations of average PCN index values have indicated disagreement between these values and the average PCN values presented at the AARI web portal http://geophys.aari.ru/PCspaceweather used as the reference for the data presented in Troshichev et al. (2020) discussed here. Furthermore, calculations with IMF and solar wind parameters downloaded from http://omniweb.gsfc.nasa.gov of the solar wind geoeffective electric field, E_{KL} (Kan and Lee, 1979), by the formula shown in Eq. 1 have disclosed disagreements between these values and the values presented at the AARI web portal.

$$E_{KL} = (B_Y^2 + B_Z^2)^{½}\, V_{SW} \sin^2(\theta/2) \qquad (1)$$

Yearly average QDC, PCN and E_{KL} values presented in the file "YearlyQDCPC.dat" made available at the AARI web portal (cf. Appendix A) are shown in the 6 leftmost columns of Table 1. The AARI yearly average PCN values are also presented by the blue dotted line in Fig. 2a of the commented publication, Troshichev et al. (2020).

The corresponding values derived from averaging the "definitive" PCN index values calculated by DTU Space and made available at the ISGI web portal, http://isgi.unistra.fr/indices_pc.php are presented in the rightmost 3 columns of Table 1along with the recalculated E_{KL} values (Eq. 1):

Table 1. AARI yearly average QDC, PCN index, and E_{KL} values in column 1-6 (cf. "YearlyQDCPC.dat" in Appendix A). DTU PCN and recalculated E_{KL} in columns 7-9.
AARI QDC, PCN, and E_{KL} downloaded from http://geophys.aari.ru/PCspaceweather
DTU-Space definitive PCN indices downloaded from ISGI portal http://isgi.unistra.fr/indices_pc.php .

Year	QDC_N nT)	QDC_S(nT)	QDCtot(nT)	PCN(mV/m)	EKLmV/m)	**PCNY(mV/m)**	**PCNYP(mV/m)**	**EKL(mV/m)**
1998	51.67845	57.93726	109.61571	0.72583	0.5975	1.098	1.176	1.159
1999	67.94812	71.47073	139.41885	0.76917	0.63083	1.076	1.185	1.152
2000	73.5618	70.67319	144.235	0.80333	0.62917	1.137	1.282	1.278
2001	66.99001	67.11466	134.10467	0.71167	0.58917	1.055	1.166	1.166
2002	75.59892	77.95675	153.55567	0.76	0.71833	1.046	1.165	1.240
2003	96.72696	--	--	0.9975	0.84083	1.338	1.458	1.486
2004	60.71267	44.60527	115.16565	0.78833	0.59083	1.147	1.226	1.206
2005	52.35769	52.73583	105.09352	0.81167	0.54917	1.184	1.245	1.125
2006	33.44098	41.74591	75.18689	0.61167	0.36917	0.970	0.995	0.816
2007	33.86162	39.74026	73.60188	0.6	0.32583	0.868	0.892	0.707
2008	29.58641	36.08013	65.66654	0.57167	0.305	0.829	0.847	0.649
2009	41.35253	24.86098	45.47604	0.36917	0.23167	0.549	0.574	0.520
2010	39.53543	39.79292	79.32835	0.49167	0.33083	0.730	0.767	0.695
2011	44.65849	44.85985	89.51835	0.53417	0.38667	0.799	0.847	0.777
2012	57.91273	59.9873	117.90002	0.62917	0.46083	0.991	1.070	1.008
2013	55.25221	57.21562	112.46783	0.52	0.40167	0.867	0.930	0.836
2014	48.12346	59.42977	107.55323	0.58917	0.47083	0.822	0.902	0.870

2015	54.87197	56.29178	111.16375	0.71667	0.55333	1.048	1.138	1.122
2016	42.87233	50.35361	93.22594	0.72167	0.54167	1.044	1.101	0.982
2017	43.48377	44.20509	87.68886	0.69833	0.47083	1.049	1.092	0.904
2018	38.45339	39.80017	78.25356	0.49833	0.375	0.778	0.805	0.707
2019	36.82602	35.55304	72.37906	0.4825	0.36	0.719	0.750	0.692
mean	52.08209	51.06715	100.50473	0.65462	0.48769	0.961	1.028	0.946

The DTU-Space values shown in the column "PCNY" in Table 1 display the plain yearly average PCN values while the column headed by "PCNYP" displays the averages derived by zero-filling for negative PCN values.

It is evident from comparing the values shown in the AARI PCN column 5 of Table 1 and displayed in their Fig. 2a with the values presented in the right columns of the table that there are considerable differences. The PCN values in the file YearlyQDCPC.dat from AARI are around 68% of the plain yearly average values derived from the "definitive" PCN index values calculated at DTU Space and about 64% of values calculated by zero-filling for negative PCN hourly values.

The differences in E_{KL} values are still more remarkable. The reported AARI values differ considerably from the recalculated values although they use the same data and formula. Their mean values are only 51% of the recalculated values. Furthermore, it is a fundamental rule for deriving PC index values (e.g., Troshichev et al., 1988, 2006) that the polar magnetic variations are scaled to make the PC indices and values of the merging electric field, E_{KL}, equal on a statistical basis. Thus, their averages should be nearly equal which they, obviously, are not. From the bottom line of Table 1, the epoch-mean AARI PCN value is 0.65462 mV/m while the mean E_{KL} value on 0.48769 mV/m is only 74% of the PCN value.

The recalculated E_{KL} values are based on available OMNIweb data (http://omniweb.gsfc.nasa.gov). As shown in Table 1 (column 7 vs. column 9), their values match values of the definitive PCN indices as they should according to the PC index derivation method (e.g., Troshichev et al., 1988, 2006). The AARI E_{KL} values (column 6) are only around half the correct E_{KL} values. Thus, the calculations at AARI appear to have generated invalid results.

3. Reference level.

It is stated in section 2 of the commented publication that: "*The polar cap magnetic disturbance value δF at stations Thule and Vostok is counted from level of quiet daily variation (QDC – Quiet Daily Curve), which is determined for each day of year [Troshichev at al., 2006]*".

It is further stated in section 2 that: "*Taking into account this distinctive feature of the PC index, the International Association of Geomagnetism and Aeronomy (IAGA) approved PC index as "a proxy for the energy that enters into the magnetosphere during solar wind – magnetosphere coupling" [Resolution of XXII IAGA Assembly, 2013].*"

However, the procedures defined in Troshichev et al. (2006) and further specified in Janzhura and Troshichev (2008) are not in agreement with the index derivation methods endorsed by IAGA.

In Troshichev et al. (2006) the quiet reference level is defined in section 2.1 by the statement: "*Magnetic deviations δD and δH are calculated from a certain level, "curve of quiet day" which presents the daily magnetic variation, observed at the particular station during extremely quiescent days*".

In the documentation (Matzka and Troshichev, 2014) submitted to IAGA in 2013 in order to fulfil the requirements in "*Criteria for endorsement of indices by IAGA*" (2009), the reference level for

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the magnetic disturbance values is defined as the sum of a solar sector (SS) term, defined to be the 7 days running mean of daily median values, and a 30-day's residual QDC. This method builds on the descriptions provided in Troshichev et al. (2006), Janzhura and Troshichev (2008), Janzhura and Troshichev (2011), and Troshichev and Janzhura (2012, Ch. 4.4) as noted in the document: *PC_index_description_main_document.pdf* available from http://isgi.unistra.fr/Documents/References/PC_index_description_main_document.pdf or from the DTU Space portal at https://doi.org/10.11581/DTU:00000057 . The associated document, *PC_index_description_Appendix_A.pdf* holds more specific reference level descriptions.

It should be noted that the reference levels defined in the documentation presented in Matzka and Troshichev (2014) are presently being used at DTU Space for calculations of the "definitive" PCN index series. It might also be noted that this reference level, which includes a median term, is not a quiet level in the sense defined by Troshichev et al. (2006).

The solar wind sector (SS) term was implemented in the derivation of PC index reference levels by Janzhura and Troshichev (2011) (J&T2011) which is reproduced in chapter 4 of Troshichev and Janzhura (2012). The SS-terms illustrated in Fig. 6 of J&T2011 have been added to the residual quiet day variations with slowly (seasonally) varying amplitudes calculated by the method published in Janzhura and Troshichev (2008) to generate the summer section (days 145-245, 2001) of the reference level. This level is displayed by the solid line superimposed on the 1-min H-component values in thin line shown in Fig.1a reproduced (including caption) from Fig. 1 of J&T2011.

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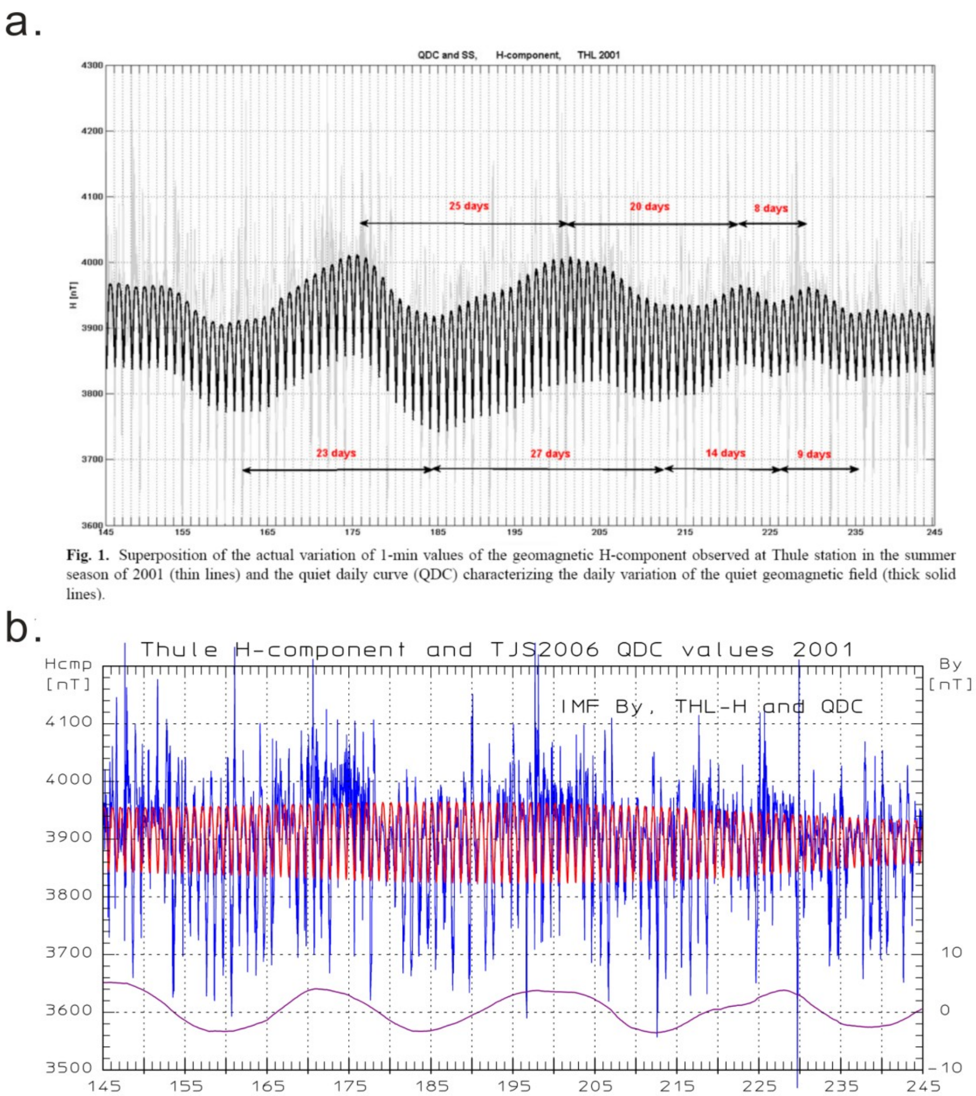

Fig. 1. Superposition of the actual variation of 1-min values of the geomagnetic H-component observed at Thule station in the summer season of 2001 (thin lines) and the quiet daily curve (QDC) characterizing the daily variation of the quiet geomagnetic field (thick solid lines).

Fig. 1. (a) PCN reference level (thick line) in IAGA-endorsed version superimposed on recorded Qaanaaq (THL) H-component data (thin line). (from Fig. 1 of Janzhura and Troshichev, 2011, caption included). (b) PCN reference level (red line) by the method of Troshichev et al. (2006) superimposed on H-component data (blue line) for days 145-245 of 2001. Smoothed IMF By values are shown in magenta line on the lower right scale.

In Fig. 1b, the curves for the reference level in red line superimposed on recorded H-component values in blue line have been drawn on basis of INTERMAGNET magnetic data (https://intermagnet.org) processed by the QDC method published in Troshichev et al. (2006) and detailed in Janzhura and Troshichev (2008). The IMF B_Y values shown in Fig. 1b are based on OMNIweb data from http://omniweb.gsfc.nasa.gov .

The disagreement between the reference level derived according to the documentation described in Matzka and Troshichev (2014) and the reference level derived by the methods presented in Troshichev et al. (2006) (referenced in the commented publication) is evident when comparing Fig. 1a with Fig. 1b.

The reference level defined in section 2.1 of TJS2006 and further detailed in Janzhura and Troshichev (2008) use in a first step the quiet samples collected over an interval of 30 days to

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construct an initial "30-days QDC" which, depending on the distribution of quiet samples refers to a specific day of the interval. Next, the interval is shifted and a new "30-days" QDC is calculated referring to the same or another day. In a final step the series of initial "30-days" QDCs are combined and smoothed by a special cubic spline function to generate the resulting QDC for each day of the total interval (e.g., a year).

Since the 30-days interval length is close to the solar rotation period, every initial "30-days QDC" and also their smoothed combination will lose indications of variations associated with the solar rotation and the solar wind sector structure. The absence of variations within the 30-days intervals is evident in all QDC presentations based on the description in Troshichev et al. (2006), e.g., Figs. 4.4a,b of Troshichev and Janzhura (2012)

4. QDC amplitude.

In section 3.1 of the commented Troshichev et al. (2020) publication it is stated "*To examine the QDC alteration in course of solar cycles we examined the yearly-averaged amplitudes of QDC at the northern and southern polar cap stations and counted their sum (QDCtotal) for each year during 1998-2019 (see http://geophys.aari.ru/PCspaceweather).*

The file "MonthlyQDCPC.dat" available at http://geophys.aari.ru/PCspaceweather holds columns "QDC_N (nT), QDC_S (nT), and QDCtot (nT) for the monthly average amplitudes in the QDCs. As an example for 2001 seen in the file "MonthlyQDCPC.dat" and extracted to the left columns of Table 2, the average "QDCtot" value would be 134 nT in agreement with the deflection seen in Figure 1a of Troshichev et al. (2020) and the value reported in the file "YearlyQDCPC.dat" at the AARI web site.

Table 2. AARI and DTU-S QDC monthly average amplitude values 2001
AARI values in column 1-5 are downloaded from http://geophys.aari.ru/PCspaceweather (cf. Table A2 of Appendix A. QDC values based on magnetic data from INTERMAGNET and using the QDC method from Troshishev et al. (2006) are displayed in columns 6-8.

Year	month	QDC_N (nT)	QDC_S (nT)	QDCtot (nT) |	**QDCX_N(nT)**	**QDCY_N(nT)**	**QDCT_N(nT)**
2001	01	23.54839	116.19355	139.74194	21	19	28
2001	02	29.75	79.42857	109.17857	30	29	41
2001	03	57.22581	69.19355	126.41935	57	55	79
2001	04	80.93333	50.06667	131	81	89	120
2001	05	128.80645	23.6129	152.41935	129	122	177
2001	06	151.63333	16.7	168.33333	152	108	186
2001	07	115.19355	21.06452	136.25806	115	132	175
2001	08	78.70968	29.67742	108.3871	79	90	119
2001	09	58.76667	52.66667	111.43333	59	53	79
2001	10	36.77419	83.80645	120.58065	37	33	50
2001	11	21.7	107.93333	129.63333	22	18	28
2001	12	20.83871	155.03226	175.87097	22	15	27

Assuming that the tabulated values refer to the QDC values derived by using the methodology from Troshichev et al. (2006) detailed in Janzhura and Troshichev (2008) makes it possible to calculate the values using INTERMAGNET magnetic data (https://intermagnet.org). Such calculations are presented in 3 rightmost columns of Table 2.

The values in the column marked ”QDCX” are the monthly averages of min-to-max QDC values in nT for the X-component of the residual QDC (THL). The column marked “QDCY” holds the corresponding values for the Y-component. The columns marked “QDCT” holds the square roots of the squared contributions from the X and Y components (i.e. the numerical value of the total horizontal vector) of the residual QDC.

Comparing the values presented in the left and right sections of Table 2 makes it evident that the QDC_N values of the file “MonthlyQDCPC.dat” are the results from considering the THL X-component values only. Thus, the question is whether the use of the X-component only in the calculation of QDC amplitudes is justified or just a mistake.

5. Further PC index calculations

It should be noted that a new reference level concept was defined in p. 7 of the booklet by Troshichev (2017) by the statement:

“*To resolve the problem, a special procedure (running technique) has been elaborated [Troshichev et al., 2006], which makes it possible to incorporate the effects of regular and irregular UV radiation and SS effects into the QDC. In this case, the quiet daily curve is automatically recalculated for each particular day taking into account the data from the 5 quietest days selected from 30 previous days with extrapolation of results for each subsequent day*”.

Examples are shown in Fig. 2.1 of Troshichev (2017) reproduced from Troshichev et al. (2006) and in Fig. 2.2 reproduced from Troshichev and Janzhura (2012), both examples are void of indications of SS effects.

However, this new definition of the reference level construction is not in agreement with the definition in Troshichev et al. (2006) where there is no mentioning of SS effects. The method is also not in agreement with Matzka and Troshichev (2014), i.e., the method endorsed by IAGA and presently used at DTU Space for the calculations of “definitive” PCN indices (http://isgi.unistra.fr/indices_pc.php). The disagreement must raise the question whether PC index calculations since 2017 have been conducted according to the above concept based on arguments much in agreement with the statements made in the commented publication by O.A Troshichev, S. Dolgacheva, N.A. Stepanov, and D.A. Sormakov (2020).

Introducing a new ad hoc QDC concept (whether or not justified) invalidates the present “definitive” PCN indices which have been made available to the international scientific community since 2014 with values derived back to 1975, and starts another index series different from the IAGA-endorsed PC index series.

Conclusions

(i) The correlation studies and conclusions presented in the commented article by Troshichev et al. (2020), *The PC index variations during 23/24 solar cycles: relation to solar wind parameters and magnetic disturbances*, https://doi.org/10.1029/2020JA028491, are devaluated by the apparent inconsistencies and errors in the underlying data basis presented in the files: “MonthlyQDCPC.dat” and “YearlyQDCPC.dat” made available at the web portal: http://geophys.aari.ru/PCspaceweather (latest entry 15 April 2021).

(ii) The reported PCN index values are only around 68% of corresponding values derived from the definitive index series generated at DTU Space. The questionable features call for recalculation of

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PCN values to derive, among others, their monthly and yearly average values by independent recalculations using the definitive PC index series from either DTU Space: https://doi.org/10.11581/DTU:00000057, or ISGI: http://isgi.unistra.fr .

(iii) Recalculations of the important merging electric field parameter, E_{KL}, based on the commonly accepted formula (Kan and Lee, 1979) and available IMF and solar wind data (OMNIweb) have shown that the calculations at AARI have generated values of around half the correct magnitude.

(iv) The authors of the commented article should clarify the consequences of using one component only of the horizontal magnetic variation vector in calculations of QDC ranges in response to solar illumination.

(v) Introducing a new QDC procedure invalidates the current "definitive" PCN indices calculated by DTU Space using the IAGA-endorsed method. The PCN index series going back to 1975 will have to be recalculated and redistributed if the new QDC procedure is adopted.

(vi) In consequence of the apparent errors made in the calculations of polar cap (PC) indices and merging electric field (E_{KL}) values at AARI, the results inferred from the questionable data basis used for the commented publication by Troshichev et al. (2020) should be considered with some reservation. It might be appropriate to caution against uncritical use of these data and results.

Data availability statement.

The data used in the present commentary have been downloaded from the web portals: http://geophys.aari.ru/PCspaceweather , http://isgi.unistra.fr/indices_pc.php , https://intermagnet.org , http://omniweb.gsfc.nasa.gov and https://doi.org/10.11581/DTU:00000057 . Most recent access for confirmation was made on 15 Apr. 2021.

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Appendix A.

The appendix holds in Table A1 yearly average PCN index and E_{KL} electric field values and QDC amplitudes for the interval 1998-2019 from the reference data set, "YearlyQDCPC.dat" while Table A2 displays the monthly averaged values from the file "MonthlyQDCPC.dat" used for the commented publication by Troshichev et al. (2020) and made available at http://geophys.aari.ru/PCspaceweather . Most recent access on 15 April 2021.

Table A1. AARI Yearly averaged data from file: YearlyQDCPC.dat .
from http://geophys.aari.ru/PCspaceweather .(Most recent access 15 Apr 2021)

List of symbols:

Year Month - year and month of the averaged data
QDC_N – magnitude of QDC at Thule station
QDC_S – magnitude of QDC at Vostok station
QDCtot = QDC_N + QDC_S
PCN - PC index in the northern hemisphere
PCS - PC index in the southern hemisphere
PC mean - mean quantity as (PCN+PCS)/2
PC winter - index fixed in the winter polar cap
Ekl (mV/m) - solar wind electric field Ekl [Kan and Lee, 1979]

Year	QDC_N (nT)	QDC_S (nT)	QDCtot (nT)	PCN(mV/m)	PCS(mV/m)	PCmean	PCwinter	Ekl(mV/m)
1998	51.67845	57.93726	109.61571	0.72583	0.67583	0.70083	0.64167	0.5975
1999	67.94812	71.47073	139.41885	0.76917	0.7325	0.75083	0.69875	0.63083
2000	73.5618	70.67319	144.235	0.80333	0.8275	0.81542	0.745	0.62917
2001	66.99001	67.11466	134.10467	0.71167	0.72917	0.72042	0.65917	0.58917
2002	75.59892	77.95675	153.55567	0.76	0.69083	0.72542	0.70833	0.71833

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2003	96.72696	--	--	0.9975	--	--	--	0.84083
2004	60.71267	44.60527	115.16565	0.78833	0.68636	0.74045	0.72	0.59083
2005	52.35769	52.73583	105.09352	0.81167	0.78583	0.79875	0.7425	0.54917
2006	33.44098	41.74591	75.18689	0.61167	0.52417	0.56792	0.50708	0.36917
2007	33.86162	39.74026	73.60188	0.6	0.51083	0.55542	0.50708	0.32583
2008	29.58641	36.08013	65.66654	0.57167	0.505	0.53833	0.48375	0.305
2009	41.35253	24.86098	45.47604	0.36917	0.28545	0.32636	0.28417	0.23167
2010	39.53543	39.79292	79.32835	0.49167	0.45	0.47083	0.42042	0.33083
2011	44.65849	44.85985	89.51835	0.53417	0.72083	0.6275	0.5825	0.38667
2012	57.91273	59.9873	117.90002	0.62917	0.65833	0.64375	0.5875	0.46083
2013	55.25221	57.21562	112.46783	0.52	0.49167	0.50583	0.39583	0.40167
2014	48.12346	59.42977	107.55323	0.58917	0.54833	0.56875	0.44292	0.47083
2015	54.87197	56.29178	111.16375	0.71667	0.73833	0.7275	0.60292	0.55333
2016	42.87233	50.35361	93.22594	0.72167	0.71333	0.7175	0.61375	0.54167
2017	43.48377	44.20509	87.68886	0.69833	0.66417	0.68125	0.58667	0.47083
2018	38.45339	39.80017	78.25356	0.49833	0.465	0.48167	0.37833	0.375
2019	36.82602	35.55304	72.37906	0.4825	0.5025	0.4925	0.39833	0.36
mean	52.08209	51.06715	100.50473	0.65462	0.61457	0.6267	0.55746	0.48769

Table A2. AARI Monthly averaged data from file: MonthlyQDCPC.dat (for 1998-2001 only). from http://geophys.aari.ru/PCspaceweather . (Most recent access 15 Apr 2021)

Year	month	QDC_N(nT)	QDC_S(nT)	QDCtot(nT)	PCN(mV/m)	PCS(mV/m)	PCmean	PCwinter	Ekl(mV/m)
1998	01	19.09677	99.09677	118.19355	0.4	0.46	0.43	0.4	0.41
1998	02	19.75	83.14286	102.89286	0.52	0.56	0.54	0.52	0.53
1998	03	31.16129	53.16129	84.32258	0.95	0.96	0.955	0.955	0.7
1998	04	61.76667	33.63333	95.4	0.75	0.66	0.705	0.705	0.65
1998	05	102.45161	24.87097	127.32258	0.97	0.81	0.89	0.81	0.69
1998	06	95.9	17.03333	112.93333	0.73	0.39	0.56	0.39	0.6
1998	07	93.54839	14.77419	108.32258	0.8	0.47	0.635	0.47	0.38
1998	08	76.09677	23.06452	99.16129	0.9	0.72	0.81	0.72	0.64
1998	09	42.63333	43.86667	86.5	0.64	0.66	0.65	0.65	0.58
1998	10	35.45161	76.70968	112.16129	0.81	0.87	0.84	0.84	0.75
1998	11	24.83333	106.7	131.53333	0.73	0.87	0.8	0.73	0.54
1998	12	17.45161	119.19355	136.64516	0.51	0.68	0.595	0.51	0.7
1999	01	24.90323	136.06452	160.96774	0.66	0.63	0.645	0.66	0.62
1999	02	23.21429	93.39286	116.60714	0.58	0.64	0.61	0.58	0.6
1999	03	46.96774	67.83871	114.80645	0.82	0.78	0.8	0.8	0.67
1999	04	67.36667	27.56667	94.93333	0.7	0.6	0.65	0.65	0.66
1999	05	78.54839	16.29032	94.83871	0.65	0.48	0.565	0.48	0.34
1999	06	117.23333	14.56667	131.8	0.53	0.31	0.42	0.31	0.42
1999	07	145.25806	18.58065	163.83871	0.59	0.4	0.495	0.4	0.58
1999	08	134	39.74194	173.74194	1.04	0.86	0.95	0.86	0.69
1999	09	82.86667	64.46667	147.33333	1.01	0.95	0.98	0.98	0.78
1999	10	45.74194	96.67742	142.41935	1.2	1.23	1.215	1.215	0.67
1999	11	30.43333	148.33333	178.76667	0.88	1.07	0.975	0.88	0.87
1999	12	18.84375	134.12903	152.97278	0.57	0.84	0.705	0.57	0.67
2000	01	22.32258	131.32258	153.64516	0.86	1.13	0.995	0.86	0.81
2000	02	31.86207	107.41379	139.27586	0.85	0.77	0.81	0.85	0.54
2000	03	45.16129	68.29032	113.45161	0.59	0.5	0.545	0.545	0.56
2000	04	79.2	43.73333	122.93333	0.85	0.73	0.79	0.79	0.73
2000	05	132.64516	30.09677	162.74194	0.9	0.85	0.875	0.85	0.69
2000	06	156.73333	20.23333	176.96667	0.93	0.62	0.775	0.62	0.56
2000	07	155.87097	23.12903	179	0.82	0.57	0.695	0.57	0.81
2000	08	97.54839	32.09677	129.64516	0.82	0.71	0.765	0.71	0.42
2000	09	58.93333	48.63333	107.56667	0.99	1.04	1.015	1.015	0.55
2000	10	46.54839	84.48387	131.03226	0.92	1.12	1.02	1.02	0.74
2000	11	29.4	120	149.4	0.69	1.23	0.96	0.69	0.66

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2000	12	26.51613	138.64516	165.16129	0.42	0.66	0.54	0.42	0.48
2001	01	23.54839	116.19355	139.74194	0.55	0.88	0.715	0.55	0.64
2001	02	29.75	79.42857	109.17857	0.44	0.65	0.545	0.44	0.33
2001	03	57.22581	69.19355	126.41935	0.69	0.72	0.705	0.705	0.44
2001	04	80.93333	50.06667	131	1.11	0.87	0.99	0.99	0.74
2001	05	128.80645	23.6129	152.41935	0.54	0.43	0.485	0.43	0.75
2001	06	151.63333	16.7	168.33333	0.82	0.52	0.67	0.52	0.64
2001	07	115.19355	21.06452	136.25806	0.67	0.58	0.625	0.58	0.72
2001	08	78.70968	29.67742	108.3871	0.62	0.6	0.61	0.6	0.62
2001	09	58.76667	52.66667	111.43333	0.85	0.74	0.795	0.795	0.42
2001	10	36.77419	83.80645	120.58065	1.14	1.24	1.19	1.19	0.68
2001	11	21.7	107.93333	129.63333	0.45	0.71	0.58	0.45	0.43
2001	12	20.83871	155.03226	175.87097	0.66	0.81	0.735	0.66	0.66
