

This text is based on the 'Relevant supporting material' as sent to IAGA on 25/02-2013 and describes the IAGA endorsed PC index.

It is prepared by Dr. Oleg Troshichev, Dr. Alexander Janzhura and Dr. Jürgen Matzka.

National Space Institute, DTU Space
Att. Dr. Jürgen Matzka
Technical University of Denmark
Elektrovej 327
DK-2800 Kgs. Lyngby
Denmark

Arctic Antarctic Research Institute, AARI
Att. Dr. Oleg Troshichev
8 Bering str.
St.Petersburg, 199397
Russian Federation

The Index

The name of the index is Polar Cap index (abbreviation PC index) and it is consisting of the Polar Cap North index (PCN index) and the Polar Cap South index (PCS index).

Two datasets of the index are provided: A provisional data set and a definitive data set. The definitive data is the final form and supersedes at any time the provisional data set. It is based on definitive geomagnetic observatory data. The provisional data is provided in near real time. It is at the discretion of the institute in charge of the index derivation to update the provisional index after near real time production and prior to publication of the definitive data (provided that IAGA accepts this handling of the provisional data set).

The unit of the PC index is 1 mV/m.

PC Index coefficients

The PC index coefficients are given in the files in the subdirectory 'PC_Index_coefficients'.

Regarding index endorsement criterion 1:

We refer to Troshichev and Janzhura (2012), chapter 2 and, in particular, paragraph 3.5, and references therein: The PC index is a value of polar cap magnetic activity, calibrated by the coupling function EKL and parameterized by a season, UT and a hemisphere. The PC index must be considered as a convenient proxy of energy that entered into the magnetosphere by solar wind - magnetosphere coupling.

We also note that no other IAGA endorsed geomagnetic index is describing polar cap geomagnetic activity.

Regarding criterion 2:

The derivation of the index is described in the following publications:

Troshichev et al. (2006)

Janzhura and Troshichev (2008)

Janzhura and Troshichev (2011)

Troshichev and Janzhura (2012) (here, chapter 4 describes derivation of the provisional data set)

A very detailed description of the procedure to allow independent reproducibility is given in Appendix A. This description is valid for the definitive data set. Please refer to note 1 to 3 in Appendix A regarding thorough testing, reproducibility and documentation. Please refer to the 'notes on calculation' for a short description of the method.

Appendix A is also including all program-, coefficient- and data files are part of the supporting material we present here and will be made publicly available at the WDC for Geomagnetism, Copenhagen. The WDC will also arrange for a unique identifier to this information, for example a DOI (www.doi.org) or a comparable identifier.

In case of discrepancy, Appendix A is taking precedence over all earlier description. (One difference is for example, that we for the first time have calculated the coefficients for the PCN index for the years 1997 to 2009, which is identical to the period used for PCS index. This has improved the statistical basis for PCN.)

Calculation of the PCN index is based on publicly available data (geomagnetic observatory data for THL from WDC for Geomagnetism, Edinburgh) for the years 1997 to 2009.

Calculation of the PCS index is partly based on data (VOS from 1999 to 2009) that is currently in the processes of being reformatted for publication at the WDC for Geomagnetism, Edinburgh, and partly on data that is already available at that WDC (VOS 1997 to 1998).

The homogeneity of the time series is ensured by the institutional assurances by AARI (from December 2012) and DTU Space (from March 2011), which have been supplied to IAGA.

Regarding criterion 3

The geomagnetic observatory Qaanaaq (earlier name Thule, IAGA code THL) is member of Intermagnet.

An geomagnetic observatory Vostok (IAGA code VOS) is member of Intermagnet.

Regarding criterion 4

The index has been available from AARI in a very similar version since 2006 (Unified PC index), and have been used extensively in the scientific literature (e.g. McCreadie and Menvielle, 2010).

Regarding criterion 5

DTU Space and AARI have given the necessary institutional assurance (Appendix B). The PC index will be made available at the institutes, at ISGI and through the WDC for Geomagnetism, Copenhagen, which guarantees universal and equitable access to quality assured scientific data, data services, products and information and ensuring long-term data stewardship.

References

Kan J.R., Lee L.C., 1979. Energy coupling function and solar wind-magnetosphere dynamo., *Geophys. Res. Lett.* 6(7), 577-580

Janzhura, A. and Troshichev, O., 2008. Determination of the running quiet daily geomagnetic variation. *J. Atmos. Solar-Terr. Phys.*, 70, 962-972

Janzhura, A. and Troshichev, O., 2011. Identification of the IMF sector structure in near-real time by ground magnetic data. *Ann. Geophys.* 29, 1491-1500

McCreadie, H. and Menvielle, M., 2010. The PC index: review of methods. *Ann Geophys.*, 28, 1887-1903

Troshichev, O., Janzhura, A. and Stauning, P., 2006. Unified PCN and PCS indices: Method of calculation, physical sense, and dependence on the IMF azimuthal and northward components. *J. Geophys. Res.*, 111, A05208, doi:10.1029/2005JA011402

Troshichev, O. and Janzhura, A., 2012. *Space Weather Monitoring by ground-Based Means. PC index.* Springer, Berlin, 287 pages