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rms-based planetary geomagnetic activity indices

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Planetary geomagnetic indices aa, am, and Kp are based upon K indices measured at geomagnetic observatories. K indices are directly related to the range during 3-hour intervals of the irregular variations in the horizontal components of the magnetic field. There are
accordingly 8 K-derived planetary indices per day, corresponding to UT intervals 00-03, 03-06 up to 21-24.

K-indices are proxies of the energy related to the geomagnetic activity, as predicted from semi-quantitative arguments (Menvielle, Ann. Géophys., 35, 189, 1979). The K-derived planetary geomagnetic indices therefore monitor the evolution with time of this energy, with a time resolution of 3 hours. This approach of 3-hour resolution is a strong limitation for many applications, such as, e.g., precise modelling of the Earth environment.

One of the by-products of the FMI algorithm for computer determination of K indices is the series of minute values of the so-called irregular variations, from which K indices are derived. For both H and D components, irregular variations are the difference between the actual observed magnetic variations and the estimated diurnal variation. The availability of such minutes values makes it possible to derive quantities that monitor the magnetic energy density with a time resolution better than 3-hours.

We therefore introduce new indices based on another proxy of the magnetic energy, namely the root mean square (rms) of the irregular variations in the magnetic horizontal components. Using such proxy does not put constraints on the length of the time interval over which the indices are derived. Local rms indices can be computed at each observatory, and rms planetary indices derived following algorithms similar to those used for am, or aa planetary geomagnetic indices derivation. The contribution of such indices is illustrated by means of both selected events and statistical studies.