PLANETARY GEOMAGNETIC ACTIVITY INDICES WITH A TIME RESOLUTION BETTER THAN 3 HOURS

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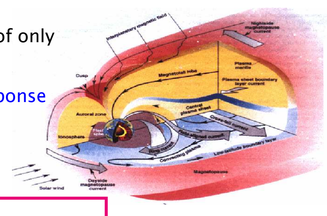
Monitoring the planetary activity…

- At subauroral latitudes, the irregular activity is:
  - sensitive to the same perturbations as those seen at low- and high-latitudes,

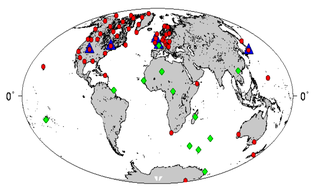
  but
  - not under the predominance of only one system of current.

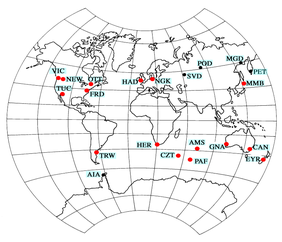
  It may be expected to show response to the different sources of magnetosphere currents.



… requires a network of subauroral observatories…

Considering the present status of observatories having routinely digital data on line…

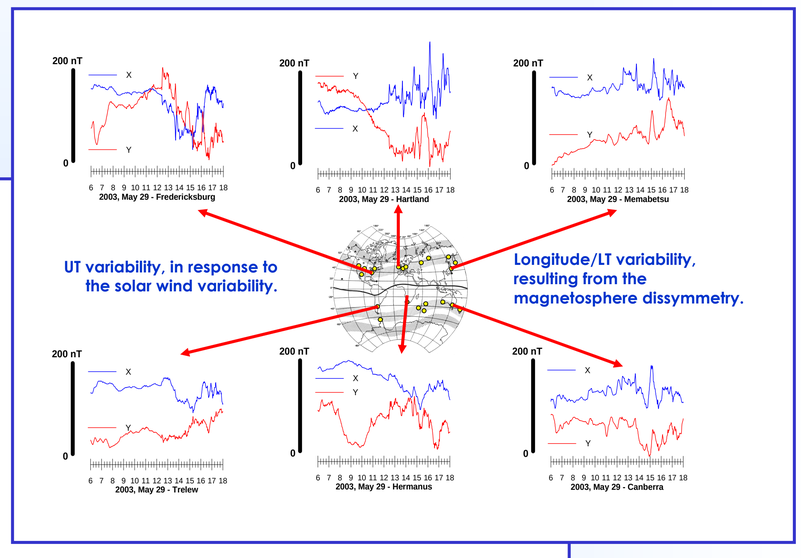




… the am network is a very good compromise for planetary Geomagnetic indices.

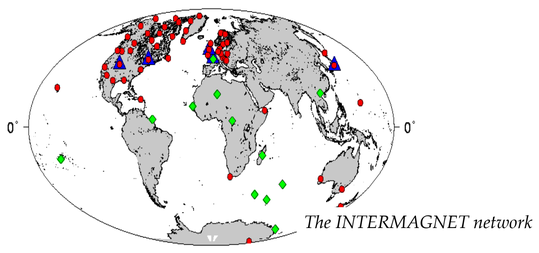
… evenly distributed in longitude.

The magnetic activity has time constants smaller than 3 hours.



am, aa and Kp magnetic indices are based upon K indices measured at stations of planetary networks of observatories; they are therefore 3-hour indices.

The routine on-line availability…



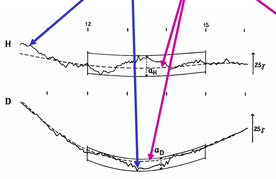
… of digital minute values…

Deriving an index requires to define…

- the stations, or network of station
- the quantity to be measured, or estimated
- Geomagnetic index
- the method of derivation
- the time interval

The K index is deduced from ranges in the K-variations during a given 3-hour interval, …

K-variations: $\Delta B_K(t) = \Delta B(t) - S_R(t)$



Estimated on a 24-hour basis

… and it is a proxy of the magnetic energy density provided it is measured at sub-auroral latitudes.

The routine on-line availability of digital minute values makes it possible to compute quick-look, then definitive K-variations.

… and the computer derivation of K indices…

At subauroral latitudes, the irregular variations are not under the predominance of only one system of currents → An index based upon deviations would be difficult to interpret in terms of magnetosphere physics

The present K-derived planetary indices provide a relevant monitoring of the overall status of the magnetosphere

K is related to the magnetic field energy density

Base the index upon a quantity that is representative of the magnetic energy density

Sum of the square roots of the K-variation components … → $(\Delta B_x^2 + \Delta B_y^2)^{1/2}$

… averaged over a time interval of duration τ

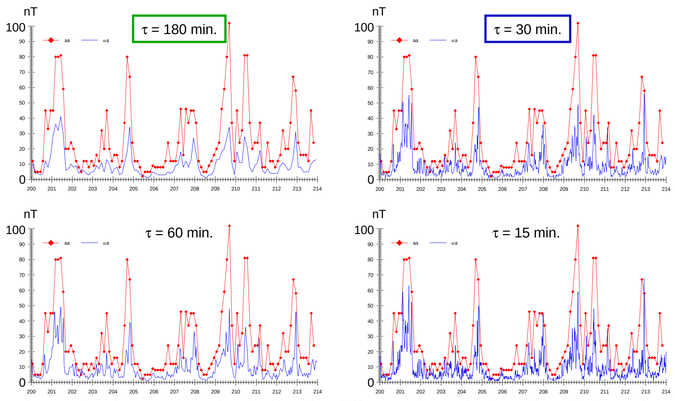
Unit: nT

$$\alpha(S_i,t) = \int_t^{t+\tau} \left(\Delta B_x^2(S_i,t) + \Delta B_y^2(S_i,t)\right)^{1/2} dt$$

… makes it possible to consider new quantities.

The time interval…

2000, July 18th to July 31st

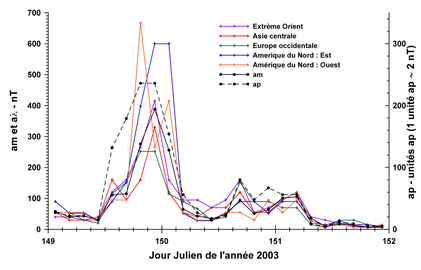


Comparison between aa and αa indices for different τ intervals. Regarding the ionosphere and magnetosphere time constants, τ = 30 minutes seems to be a good compromise.

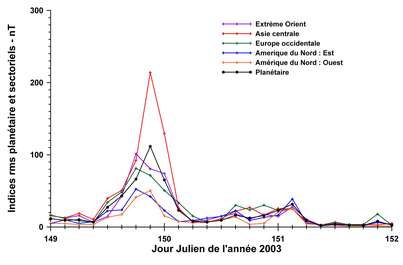
…can be 3 hours or less

The May 2003 storm

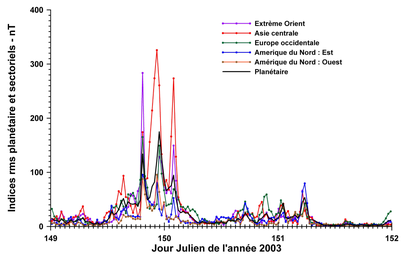
K-derived indices



rms indices – 180 min.

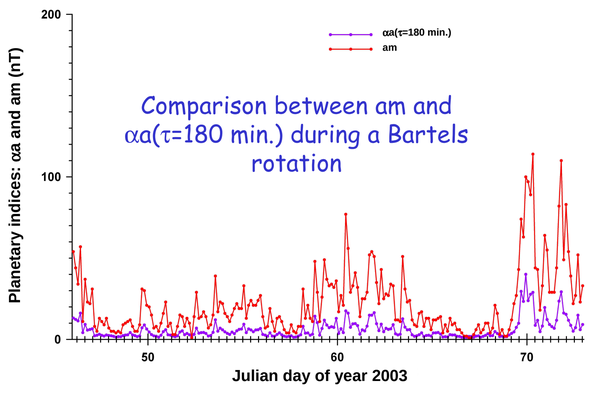


rms indices – 30 min.



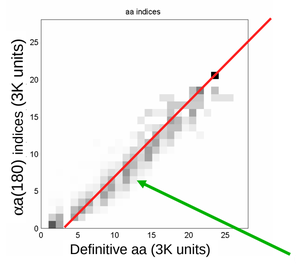
Comparison between K-derived and rms planetary indices

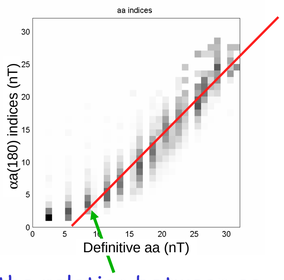
Time series



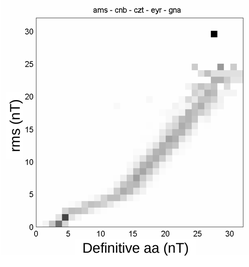
Statistics

As a first approximation, aa and αa(τ=180 min.) are proportional: αa(180) / aa ~ 0.4…





… but the relation between aa and αa is not the same for low and high magnetic activity…



… as it is the case between the range and the rms.

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