Characterization of the Pc5 activity at L’Aquila magnetic station in 22 years of observations.

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An important aspect of the interaction between the solar wind (SW) and the Earth’s magnetosphere concerns the possible relationship between SW and magnetospheric fluctuations under different SW conditions.

Di Matteo and Villante (2017, 2018) revealed the critical role of the analytical methods and the spectral analysis techniques in the identification of fluctuations between f=1-5 mHz in the SW parameters as well as in the magnetospheric field measurements at the geostationary orbit. They showed that the event identification can be deeply influenced by the signal characteristics and analytical methods and developed a new approach, based on the joint use of the Welch and the Multitaper methods, for a more robust identification of these oscillations in both regions.

In this preliminary investigation, we extended the analysis to ground measurements, analysing 22 years of geomagnetic field measurements (H and D) at low latitude (L’Aquila, Italy, λ=36.3°, L≈1.6), examining the LT and seasonal variation of the power spectra and paying attention to the possible contamination of the Sq variation and of the spectral slope on the event identification. The power spectra have been evaluated on two hours intervals during low geomagnetic activity conditions (Dst≈−50).

**THE LT VARIATION.**

The ratios between each 2-hr spectrum and the global average spectrum (24 hr) show that the power is enhanced at low frequencies in the nighttime (black and blue) and at high frequencies in the daytime (yellow and red).

A strong LT modulation shows much greater power in the daytime. H exceeds D after ≈09 LT, suggesting an increasing ionospheric influence on the signal characteristics in the daytime hours.

**THE SEASONAL VARIATION.**

The results obtained for different seasons (spring equinox: 6 May–5 Aug; summer solstice: 6 Aug–5 Nov; autumn equinox: 6 Nov–5 Feb; winter solstice: 6 Feb–5 May) show that the difference between the H and D slope is greater in the autumn equinox while it is steeper in the summer months; the spectra’s slope is slower in the winter months.

**REFERENCES:**


Conclusions.

- On average, the slope of the geomagnetic spectra range between −2.1 and −3.2, steeper than the ones observed in the SW and at the geosynchronous orbit.
- In winter, the Pc5 activity is lower and the power spectra show a slower decrease with frequency.
- The LT dependence of the integrated power suggests a more explicit influence in summer.
- The event identification, especially at lower frequencies, may dramatically depend by the analytical methods.

**Fig. 1:** The Sq variation at L’Aquila (H and D).

**Fig. 2:** The average spectra for H (blue) and D (red) as evaluated with the Welch method over 22 years. Similar results are obtained with the Multitaper.

**Fig. 3:** The ratio between each two hour and the 24-hr spectrum.

**Fig. 4:** The LT dependence of the power (f=1-5 mHz).

**Fig. 5:** The average spectra for different seasons.

**Fig. 6:** The LT dependence of the power for different seasons.

**Fig. 7:** Distribution of the events identified in synthetic representations (Sq + red noise) by WM, MTM, and both methods simultaneously at the 98% confidence level.

Substantially, the power spectrum slope α influences the events distribution which establishes the confidence level to distinguish real events from spurious ones in the analysis of real data.