

Morphological response of GPS derived ionospheric scintillation activity to disturbed magnetic conditions in the European auroral sector

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I. Introduction

A morphological response of the scintillation activity to disturbed magnetic conditions in the European auroral region is derived and analysed, based on 50 Hz GPS measurements recorded by using a standard GSV4004 ionospheric monitor, at Dirigibile Italia Station (Ny-Alesund, Svalbard). These effects are described by using typical scintillation indices able to assess the scintillation activity on both the intensity and phase of the received signals.

The scintillation activity is measured by means of several indices, such as the normalized standard deviation of the the received intensity $(S_4)[1]$ and the standard deviation of the received phase $(\sigma_{\phi})[2]$, typically calculated over 1 minute of data. Moreover, the intensity scintillation activity is described by using *SI* parameter [3].

$$S_4^2 = \frac{\langle I^2 \rangle - \langle I \rangle^2}{\langle I \rangle^2} \qquad S_\phi = \sqrt{\left\langle \left(\frac{\partial \phi}{\partial t}\right)^2 \right\rangle}$$

$$SI = \frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}}$$

II. Data

The events shown below refer to disturbed conditions in the year 2004. The indices above have been calculated by using raw data directly.





Figure 1: Dst index with marked period being considered in December 2004.

II. Results



Figure 3: Frequency of occurrence for individual hours and days from 06-12-2004 to 08-12-2004; a) ercentages of occurence for all the events with 0.3 < σ_{ϕ} < 3 and b) 0.9 < σ_{ϕ} < 3 with with cut-off 0.1 Hz; c) percentages of occurence for all the events with 0.3 < σ_{ϕ} < 3 and d) 0.9 < σ_{ϕ} < 3 with with cut-off 0.5 Hz; from 06-12-2004 (1) to 08-12-2004 (3).



Figure 4: Percentages of occurrence for all the events with $3 < S_{\star} < 10$ from 06-12-

Figure 2: Frequency of occurrence for individual hours and days from 06-12-2004 to 08-12-2004. a) ercentages of occurence for all the events with $S_4 > 0.2$ and b) 5 dB < SI < 10 dB from 06-12-2004 (1) to 08-12-2004 (3); c) geographical distribution of the frequency of occurrence for all the events with $S_4 > 0.2$ and d) 5 dB < SI < 10 dB on the day 08-12-2004 (considering all PRNs tracked throughout all that day).

Acknowledgments

This work has been funded by the Slovenian Research Agency under the Young Scientists Fellowship scheme. AS thanks the INGV for kindly providing with the experimental dataset and assistance on the analysis.

2004 (1) to 08-12-2004 (3), with cut-off 0.1 Hz (a) and 0.5 (Hz) (b). III. Discussion and conclusions

The events considered (from 06-12-2004 to 08-12-2004) show almost very low intensity scintillation on all the PRNs. S_4 exceeded 0.2 in very few circumstances during particular time intervals (Fig. 1a). Phase scintillation shows high values only in the case of a lower detrending cut-off (Fig.2a, 2b) [4]. On the contrary the S_{ϕ} showed to be almost independent on the detrending conditions (Fig. 4a, 4b), also it can be noticed that the behaviour of S_4 in particular time intervals was somehow followed by the behaviour of S_{ϕ} . The same behaviour can be also noticed for SI between 5 dB and 10 dB, within the same time intervals.

Finaly the spatial distribution of these percentages of occurance was calculated. It can be noticed that SI between 5 dB and 10 dB seems following the S_4 (Fig. 1d, 1c).

IV. References

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EGU General Assembly 2011, Vienna, Austria, April 4th-8th, 2011