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 GS4004 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 received intensity ($S_I$) and the standard deviation of the received phase ($S_\Phi$), typically calculated over 1 minute of data. Moreover, the intensity scintillation activity is described by using $SI$ parameter [3].

$$S^2_4 = \frac{\langle I^2 \rangle - \langle I \rangle^2}{\langle I \rangle^2}$$

$$S_\Phi = \sqrt{\left\langle \frac{\partial \Phi}{\partial t} \right\rangle^2}$$

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

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.

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. $S_I$ 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 $S_\Phi$ showed to be almost independent on the detrending conditions (Fig. 4a, 4b), also it can be noticed that the behaviour of $S_\Phi$ in particular time intervals was somehow followed by the behaviour of $S_I$. The same behaviour can be also noticed for $SI$ between 5 dB and 10 dB, in particular time intervals was somehow followed by the behaviour of $S_I$ (Fig. 1d, 1c).

Finally the spatial distribution of these percentages of occurrence was calculated. It can be noticed that $SI$ between 5 dB and 10 dB, in particular time intervals was somehow followed by the behaviour of $S_I$. The same behaviour can be also noticed for $SI$ between 5 dB and 10 dB, within the same time intervals.

IV. References


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