Experimental evidence on the dependence of the standard GPS phase scintillation index on the ionospheric plasma drift around noon sector of the polar ionosphere

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First ever experimental proof of a clear and strong dependence of the standard phase scintillation index (σ_ϕ) derived using Global Positioning System (GPS) measurements on the ionospheric plasma flow around the noon sector of polar ionosphere is presented. σ_ϕ shows a strong linear dependence on the plasma drift speed measured by the SuperDARN radars whereas the amplitude scintillation index (S_4) does not. This observed dependence can be explained as a consequence of Fresnel frequency dependence of the relative drift and the used constant cut-off frequency (0.1 Hz) to detrend the data for obtaining standard σ_ϕ. The lack of dependence of S_4 on the drift speed possibly eliminates the plasma instability mechanism(s) involved as a cause of the dependence. These observations further confirm that the standard phase scintillation index is much more sensitive to plasma flow, therefore, utmost care must be taken when identifying phase scintillation (diffractive phase variations) from refractive (deterministic) phase variations, especially in the polar region where the ionospheric plasma drift is much larger than in equatorial and mid-latitude regions.

Keywords: Polar ionosphere, Ionospheric scintillation, Standard scintillation indices, Plasma drift velocity, Fresnel frequency, GNSS

