



High Accuracy Navigation Techniques under Scintillation Conditions

Presenter:

Dr. Adrià ROVIRA-GARCIA, adria.rovira@upc.edu, gAGE/UPC (Spain)

This work has been authored by:

J. M. Juan, J. Sanz, A. Rovira-Garcia, G. González-Casado, Y. Shao, D. Ibañez, M. T. Alonso, S. Segura, M. Escudero Royo.

Research Group of Astronomy and Geomatics (gAGE), Universitat Politècnica de Catalunya (UPC), Barcelona TECH, Spain, www.gage.upc.edu

Acknowledgements:

To Ministerio de Economía y Competitividad CGL2015-664 10-P and to the ESA project SCIONAV, contract No. 4000115300/15/NL/AF.

Abstract:

Global navigation Satellite System (GNSS) provides different kinds of applications and accuracies, having an increasing demand for precise navigation and positioning. Examples of applications requiring high accuracy are: civil engineering, mapping and surveying, agricultural uses, mining, marine navigation...

The Scintillation is one of the most challenging problems in GNSS navigation. This phenomenon appears when the signal pass through ionospheric irregularities, producing rapid changes on refraction index and, depending on the size of such irregularities, also diffractive effects affecting the signal amplitude and can produce cycle slips. In this work we show that the scintillation effects on GNSS signal are quite different in low and high latitudes.

For low latitude receivers, the main effects from the point of view of precise navigation, are the growing of the carrier phase noise (σ_{ϕ}) and a fading on the signal intensity (S4) that can produce cycle-slips in the GNSS signal. The detection of these cycle-slips is a challenging problem for precise navigation. Indeed, 1 cycle jump in the L1 carrier represents a jump of 48 cm in the ionosphere-free combination (the combination used in PPP), which, if it is not corrected, would derive in meters of position error.

In high latitude receivers the situation is not the same. In this region the size of the irregularities is typically larger than the Fresnel scale, so the main effects are related with the fast change on the refractive index associated to the fast movement of the irregularities (which can reach up to several km/s). Consequently, as we will show in the presentation, the main effect on the GNSS signal is a fast fluctuation of the carrier phase (large σ_{ϕ}), but with a moderate fading in the intensity (moderate S4).

