Numerical Methods for Medium Scale Traveling Ionospheric Disturbances Signal Pre-processing

Heng Yang[1], Enrique Monte-Moreno*[1], and Manuel Hernndez-Pajares[2]

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Abstract

In this paper we discuss the effects of several signal preprocessing methods for enhancing the Medium Scale Traveling Ionospheric Disturbances (MSTIDs) signal. The MSTIDs signal are the ionospheric signatures of waves with a typical scale variation from 50 to 300 m/s, which can be detected and modeled from variation of the ionospheric Vertical Total Electron Content (VTEC) with dual-frequency measurements of Global Navigation Satellite Systems (GNSS). In order to enhance the useful information of the signal, and also reduce the noise, we purpose the use of different numerical methods for preprocessing the MSTIDs signal. A first approach to preprocessing the signal is a simple high-pass filtering or Slant Total Electron Content (STEC) detrending of the ionospheric carrier phase LI [see Hernndez-Pajares

*Corresponding author: enric.monte@upc.edu

[1]Departament de Teoria del Senyal i Comunicacions, TALP, Universitat Politcnica de Catalunya, Barcelona, Spain.

[2]Departament Matemtica Aplicada IV, IonSAT, Universitat Politcnica de Catalunya, Barcelona, Spain.

et al. 2006, Hernndez-Pajares et al. 2012]. In this work, we propose the following signal processing steps in order to enhance the signal: (1) Parabolic subtraction adopted in eliminating the typical geometric length variation within the ionosphere carrier phase LI, (2) decimation techniques used to instead of classic STEC detrending method, (3) low pass filtering adapted to the properties of the desired signal. From the results by testing the observing data on the day 1, 2011 obtained from the small area GNSS network in California, it's shown that the MSTIDs signal after preprocessing techniques are more clear, smooth and robust.