

Correlation between delta phase rate and ionospheric scintillation proxy index using Philippine low-latitude GNSS data

*Kyle Ezekiel Juadines*¹, Lung-Chih Tsai², Ernest Macalalad³*

¹ Graduate Student, Center for Space and Remote Sensing Research, National Central University, No. 300, Zhongda Rd., Zhongli District, Taoyuan City 320 Taiwan

² Professor, Center for Space and Remote Sensing Research, National Central University, No. 300, Zhongda Rd., Zhongli District, Taoyuan City 320 Taiwan

³ Professor, Department of Physics, Mapúa University, Muralla St. Intramuros, Manila 1002 Philippines

Over the years the Global Navigation Satellite System (GNSS) has been widely used for various research studies. These satellites transmit radio wave signals passing through the Earth's ionosphere. However, these signals experience rapid temporal fluctuations to its amplitude and/or its phase, called scintillation. This is due to the presence of ionospheric irregularities in the ionosphere. This reduces the information embedded inside the carrier signal. This paper observed ionospheric scintillation using various scintillation proxy indices, namely, the delta phase rate (DPR) and the S4p-index. Here, we correlated the two indices in two GNSS receivers in Basco, Batanes (20.4634°N, 122.0042°E) and Taguig City (14.5176°N, 121.0509°E) in the Philippines collected in March 2015. The GNSS data collected is at 1-Hz. This is much less than the typical sampling rate of 50-Hz used to derive the standard S4-index used to study scintillation. However, these receivers are very costly. It has been observed that DPR and S-4p from both stations during scintillation events correlated very well where the correlation coefficient (R-square) varied from 0.7 to 0.8. This shows a good agreement between the two parameters in describing scintillation events, this shows that scintillation can still be observed even for low sampling rate of 1-Hz.

Keywords: Global Navigation Satellite System, Ionosphere, Delta Phase Rate, Ionospheric Scintillation, S4-index