

An enhanced singular spectrum analysis method for detecting the geomagnetic storm and quiet days by using GNSS-TEC time-series

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The geomagnetic storm is a temporary strong disturbance in the magnetosphere in which the enhancement of the net diurnal total electron content (TEC) occurred due the penetration of external electric field enhancing the fountain effect to result diffusion at farther latitudes. On the other hand, the net diurnal change in quiet days mostly depends on the photo-ionization production and recombination losses related to local solar radiation and the transported electrons from the equator due to field-aligned diffusion. These types of phenomenon create offsets in TEC time-series, sometimes non-secular trend and seasonal signals with time-varying amplitudes. Although there are several methodologies are used to detect the storm and quiet day's events such as sudden change in geomagnetic (Dst, Kp and Ap) indices, however, there is substantial scope for detecting the event by using offset in GPS-TEC time-series. In the current study we proposed a simple methodology by using an enhanced singular spectrum analysis (SSA) method for fitting Global Navigation Satellite System (GNSS) derived TEC (GNSS-TEC) time series and detecting the sudden change (increment due to the storm and decrement due to the quiet) in SSA predicted (SSA-TEC) time-series. We hope that the integrated approaches applied in the study would provide better insights and will be helpful for the scientific community.

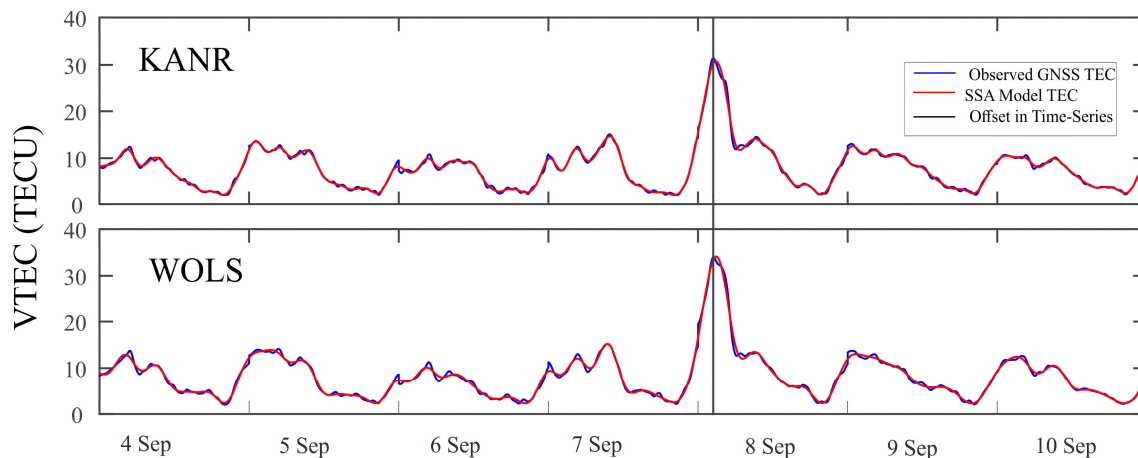


Figure 1. Storm time offset on 8 September 2017 on KANR and WOLS (South Korea) GNSS sites (See Ansari et al 2019 for more details).

References

- [1] Ansari K, Park KD and Kubo N (2019) Linear time-series modeling of the GNSS based TEC variations over Southwest Japan during 2011-2018 and comparison against ARMA and GIM models, *Acta Astronautica*, 165, 248-258; <https://doi.org/10.1016/j.actaastro.2019.09.017>