

## Coastal Sea Level Variations Derived from GNSS SNR Data –A Case Study in Taiwan

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Global sea level rise has caused many disasters, damaging the lives and property of numerous human beings, especially in low-lying coastal regions. Therefore, understanding and monitoring coastal sea level changes are of great importance for human society. The traditional method to measure coastal sea level is using tide gauges; however, the records consist of vertical land motions and sea level variations that are difficult to separate. Recently, Global Navigation Satellite System (GNSS) reflected signals are widely used for determination of soil moisture, snow depth and sea surface height. On the other hand, GNSS Reflectometry (GNSS-R) technique based on the analysis of Signal-to-Noise Ratio (SNR) data has a great potential to derive local sea level height variations. Taiwan is an island and most populated cities are located near the coasts, where sea level rise has a significant impact. Therefore, accurate estimation of sea level changes around Taiwan is extremely important. In this research, we aim to assess the feasibility of GNSS-based tide gauges in Taiwan and develop a procedure to improve the accuracy of the sea level variations derived from GNSS SNR data. The procedure contains (a) constraints of GNSS station azimuth angles and elevation angles (b) sea level variations derived from all satellites using the dominant frequency of detrend SNR data by Lomb Scargle Periodogram (LSP) (c) constraint of sea level heights using tidal harmonic analysis (d) inverse modeling of detrended SNR data through nonlinear least squares adjustment. In this study, GNSS SNR data from Kaohsiung, Suao and TaiCOAST sites were used for retrieval of sea level changes and the results were compared with co-located or nearby tide gauge records. For comparison, standard deviation of differences between tide gauge and GNSS-derived sea level and correlation coefficient of the two time series were used for assessing the GNSS-derived result and the adaptability of the processing system.

Keywords: GNSS-R, SNR, Lomb Scargle Periodogram, Sea Level Variation