Assessment of Sea Surface Heights Using GNSS Interferometric Reflectometry at Lieyu, Kinmen

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SUMMARY

This study investigates the practical application of GNSS Interferometric Reflectometry (GNSS-IR) technology for tide observation by deploying a continuous GNSS station at the Nanshantou area in Kinmen National Park. We analyzed 176 days of GNSS Signal-to-Noise Ratio (SNR) data from November 6, 2024, to April 30, 2025, to derive sea surface height through the open-source software gnssrefl, and conducted harmonic analysis using the UTide program. The results demonstrate a root-mean-square error of 0.320 m between observed and reconstructed tide levels, with an average orthometric height of -0.047 m for the sea surface. The study confirms that GNSS-IR provides a stable tide observation solution with minimal environmental interference over a spatial coverage of approximately 200-400 m. Although current technological constraints prevent real-time water level acquisition, GNSS-IR is suitable for long-term monitoring applications such as mean sea level estimation and tidal analysis.

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