利用GNSS-IR和GNSS浮標監測海水面變化

Monitoring Sea Surface Changes using GNSS-IR and GNSS Buoys

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摘　要

近年來，全球氣候變遷導致海水面持續上升，對人類社會與自然環境構成嚴峻威脅，因而持續監測沿岸海水面變化已成為關鍵工作。目前沿岸海面監測多仰賴潮位站，但潮位站維護不易，且易受地表變動影響而產生觀測誤差。本研究採用全球導航衛星系統干涉反射技術（Global Navigation Satellite System Interferometric Reflectometry，GNSS-IR），解析沿岸GNSS站訊噪比（Signal-to-Noise Ratio，SNR）資料，並結合定位解以推估絕對海水面變化。此外，我們亦蒐集GNSS浮標與傾斜之原始觀測資料，分別採用精密單點定位（Precise Point Positioning，PPP）與相對定位技術，以求得海水面變化。最後，將上述成果與共站潮位觀測及衛星測高資料進行比較驗證。

關鍵字：海水面變化、GNSS-IR、GNSS浮標

Abstract

In recent years, sea level rise induced by global climate change has posed an increasing threat to both human societies and natural ecosystems, making continuous monitoring of coastal sea-surface variations essential. Conventional coastal observations rely primarily on tide gauges, whose maintenance is difficult and whose measurements are prone to bias from local vertical movement. In this study, we apply Global Navigation Satellite System Interferometric Reflectometry (GNSS-IR) to coastal GNSS stations by analyzing signal-to-noise ratio (SNR) time series and integrating these observations with precise positioning solutions to estimate absolute sea surface changes. In parallel, we collect raw observations from GNSS buoys and tilt sensors and process them using Precise Point Positioning (PPP) and relative kinematic positioning techniques to derive independent sea surface heights. The resultant GNSS-based sea level time series are then rigorously compared against co-located tide-gauge records and satellite altimetry data to assess accuracy and reliability.

Key words : Sea surface change, GNSS-IR、GNSS Buoy