

# 海洋模式同化衛星水位高對臺灣東部黑潮流場模擬之影響

## Impact of Satellite Sea Level Data Assimilation on Modeling Kuroshio Currents East of Taiwan

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### 摘 要

本研究使用海洋模式ROMS內建的4-dimensional variational (4D-Var) 資料同化演算法，在每天的00:00 UTC同化Copernicus Marine Service的網格化衛星水位高產品，進行2018年7月至2019年4月臺灣週遭海域的模擬，分析資料同化對黑潮流場模擬的影響。資料同化演算法會反覆微調模式的初始與邊界條件，進行線性化方程組的模擬來測試最佳的初始與邊界條件，再以此條件進行完整的非線性方程組模擬，使模擬水位貼近輸入的觀測水位高，同時流速、溫度、鹽度也符合海洋流體動力。模擬資料與2018、2019年佈放於台灣東部外海的五個錨碇ADCP流速進行比較，近岸三站的日平均100公尺深北向流速，在2018年9月與11月間，未同化的模擬出現北向流減弱，最後甚至向南流的現象，但錨碇觀測的流速一直是向北流。經過同化模擬後，消除了這個差異，模擬結果趨近於觀測流速，表示資料同化技術改善原本的模擬結果。而離岸較遠的站點，在11月中旬至12月中旬的比較也顯示資料同化改善了模擬結果。研究也將展示衛星水位高資料同化對模擬臺灣東部黑潮流量與主軸位置的影響。

關鍵字：海洋模式，資料同化

### Abstract

This study presents a case of ocean circulation simulation incorporating satellite sea level data through data assimilation. The built-in four-dimensional variational (4D-Var) data assimilation scheme of ROMS was employed, assimilating gridded satellite sea level products from the Copernicus Marine Service at 00:00 UTC daily. The modeling period spans from July 2018 to April 2019 and covers the regional seas surrounding Taiwan. The assimilation process iteratively adjusted the model's initial and boundary conditions by simulating a linearized dynamical model to obtain optimal initial and boundary conditions. These optimized conditions were then used to initialize and constrain the full nonlinear model, producing analysis fields. The sea level in the analysis closely matched the assimilated satellite sea level, while the associated current, temperature, and salinity fields remained dynamically consistent. The analysis fields were compared with current measurements from five moorings deployed east of Taiwan during 2018–2019. From September to November 2018, the unassimilated model showed large discrepancies on the 100-m currents measured by the three onshore moorings, whereas the assimilated results were more consistent with observations, indicating improved accuracy due to data assimilation. Similarly, better agreement was observed at the offshore moorings from mid-November to December. This study will also present the impact of data assimilation on modeling the Kuroshio transport and its central position.

Key words : ocean circulation model, data assimilation