臺灣周邊海流之觀測與模擬分析

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摘　要

過去研究利用水文調查、衛星偵測海表溫度及數值模式等方式，歸納出不同季節受盛行風及海底地形綜合影響下的臺灣周邊海流，漂流浮球觀測資料也證明臺灣周邊流況受海表風力轉變、東部黑潮入侵及海底地形因素等影響。近年因遙測科技進步之便，由高頻雷達所建構的岸置海流觀測系統(TOROS)，可提供離岸200公里範圍內的近即時表面海流資料。本研究針對臺灣周邊海流，將觀測資料與數值模擬結果相互比對，期能透過時間及空間上的差異性，從而找出模式的模擬特性、調整模擬參數，以提升數值模式的模擬效果。

首先，相較2019年全年的TOROS觀測海流，儘管HYCOM重分析資料在數值上除冬季差異較小，其他季節則都偏強，且對地形效應亦不敏感(尤以東海岸為最)，然仍能描述大多數的TOROS海流現象，因此可做為與海洋模式結果的比較基準。其次，POM模擬黑潮主軸位置，各季節都較為偏東，東海入侵流呈現冬春強、夏秋弱的季節變化特性，呂宋海峽的黑潮套流於夏季偏弱，以及較能模擬區域性地形效應引起的彎流現象。而NCOM呈現偏東的黑潮主軸位置且流速較大，較強的東海入侵流(尤以春季較顯著)，呂宋海峽的黑潮套流具有季節變化強弱特性，以及臺灣海峽夏季明顯形成向北支流的西部沿岸流。最後，經與HYCOM比較及定量分析顯示，可得出POM的f00時初始場及NCOM的f96時預報場表現較佳；綜合而言，在不同預報作業時程上，以NCOM具較佳整體性預報能力。

關鍵字：海流、海洋雷達觀測系統、HYCOM、POM、NCOM

Analysis of Observed and Simulated Surface Currents in the Vicinity of Taiwan

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Abstract

Based on hydrographic investigation, satellite-measured sea surface temperature and numerical modelling, previous studies summarized the seasonal surface currents influenced by the prevailing wind and underwater topography. The anomalous currents affected by the changing wind field, Kuroshio intrusion and terrain effect were also revealed by the drifters. With the technological development in recent years, the high-frequency radar system (TOROS) could provide near real-time observation of surface currents covering the coastal area within 200 km. In this study, it is expected to examine the temporal and spatial differences by comparing the results of numerical simulation with observations. Thus, the characteristics of modelling should be better understood to adjust the simulating parameters and improve models' performance.

First, the HYCOM reanalysis data shows the stronger surface currents almost all the time than that of TOROS in 2019, except for winter. Although it is not sensible to topography, especially along the east coast, HYCOM could still illustrate most of the anomalous currents in the vicinity of Taiwan and be considered as the ground truth to further compare with model output. Then, the performance of POM contains seasonal characteristics, including slightly eastward position of Kuroshio mainstream, the strong and weak pattern of intruding branch from East China Sea (ECS) during winter/spring and summer/autumn, weaker loop circulation in Luzon Strait in summer, and better simulation of recurving circulation with respect to regional terrain, etc. On the other hand, the performance of NCOM demonstrates slightly eastward position and stronger current speed of Kuroshio mainstream, stronger intruding branch from ECS in spring, seasonally stronger or weaker loop circulation in Luzon Strait, and a northward current along west coast of Taiwan during summer, etc. Finally, by comparing with HYCOM, the quantitative analysis suggests the final result. While POM performs well with its initial data (i.e. f00), NCOM shows the better f96 forecasting result. In general, NCOM has the better forecasting ability.

Keywords: ocean currents, TOROS, HYCOM, POM, NCOM