

行政院國家科學委員會補助專題研究計畫成果報告

計畫編號：NSC93－2611－M－002－012

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一、中文摘要

由三維原始方程模式計算北太平洋副熱帶海洋環流的結構。年平均流場顯示黑潮在呂宋海峽內形成一流套，只有在冬季期間才可能大量入侵到南海北部海域。

Abstract

A three-dimensional primitive equation model is used to simulate the subtropic gyre of the north Pacific ocean. Annual mean flow pattern shows that Kuroshio forms a small loop current in the Luzon Strait. Only during the winter monsoon period, Kuroshio can intrude westward across the Luzon Strait into the northern South China Sea.

二、緣由與目的

本計畫的工作是用三維數值模式探討呂宋海峽附近海域的流場的季節性及可能的年際變化。由實際的水文觀測資料顯示在南海北部每年冬季都會有黑潮水越過呂宋海峽向西入侵，但到了次年春季黑潮水是否會退出北南海則隨著不同的年份會呈現不同的結果。要了解這個物理過程需要對於呂宋海峽內黑潮運動行為有完整的模擬，這就是本計畫的主要目的。

三、九十三年度進度報告

A three-dimensional nonlinear primitive

equation model is used in this study. The model basin is a rectangular basin of 700x200 grids in the horizontal plane and 12 layers in the vertical. The resolution is 0.2° and a time step is 5 minutes. The southern boundary of the ocean is at equator and the western boundary of the model basin is at 100 E. The annual mean wind stress and the sea surface temperature of the year 2000 is used to drive the subtropical gyre in the model basin. After a three year spin up period, a baroclinic western boundary current is developed. We use the annual mean flow at the 6th year as our new initial flow field and use the monthly mean surface wind stress and sea surface temperature to simulate the seasonal flow variations.

Figure 1 depicts the horizontal distribution of the volume transport stream function and the surface current of the annual mean flow in the 6th year. The Kuroshio is well simulated and there is a small loop current in the Luzon Strait. The mean circulation in the South China Sea is a cyclonic gyre, consistent with the flow pattern revealed from previous hydrographic observations.

Figure 2 depicts the horizontal temperature and velocity distributions in the first layer (0-25 m) of the annual mean flow simulation of the 6th year. The temperature field agrees well with the published

climatologic atlas in the western Pacific region.

Figure 3 depicts horizontal temperature and velocity pattern around Luzon Strait in the winter of year 2000, at day 300 and 330 respectively. The westward intrusion of the Kuroshio warm water across the Luzon Strait and the presence of a cyclonic cold eddy to the northwest of Luzon is evident. Figure 4 depicts the horizontal temperature and velocity pattern around Luzon Strait in the spring of year 2001, at day 120 and 150 respectively. The weakening of the cyclonic eddy to the west of Luzon and withdraw of the intruded Kuroshio water back into the Luzon

Strait is also clear revealed.

四、計畫成果自評

本年度的計畫已完成呂宋海峽內流場的年平均流況及季節變化的模擬。接下來將進一步以每日風場來驅動模式，探討模擬海域流場的日變化及可能的年際變化。

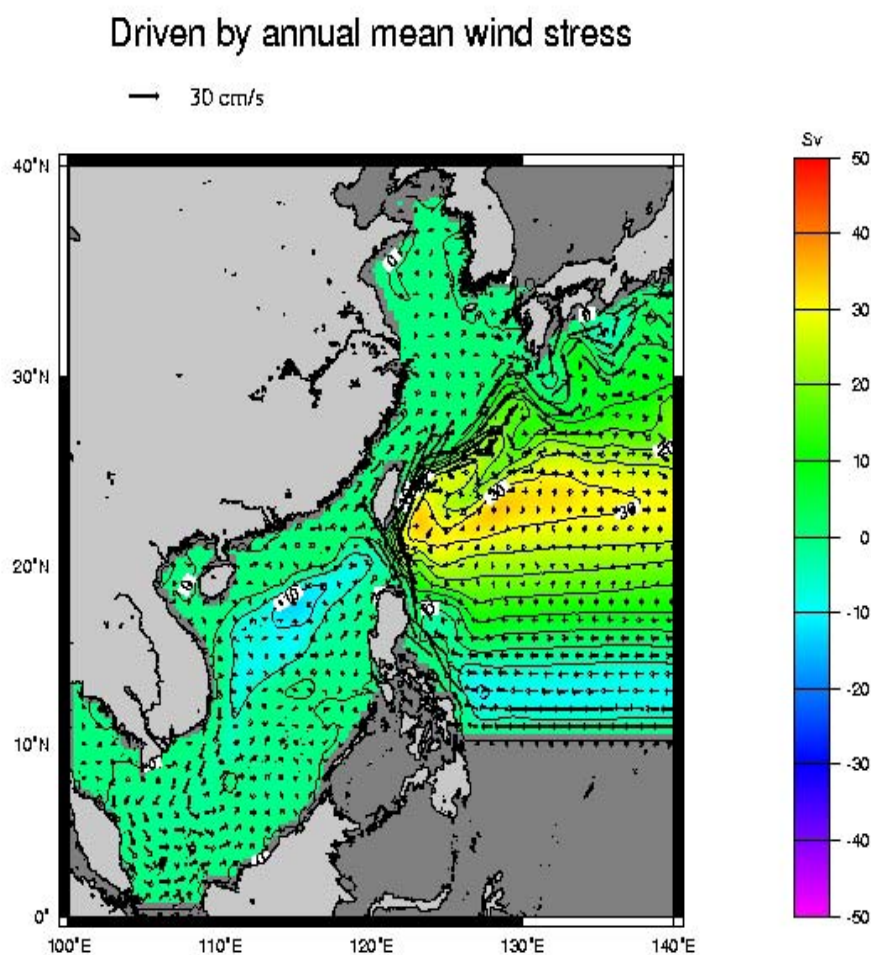


Fig. 1 Horizontal distributions of the transport stream function and the surface current of the model result

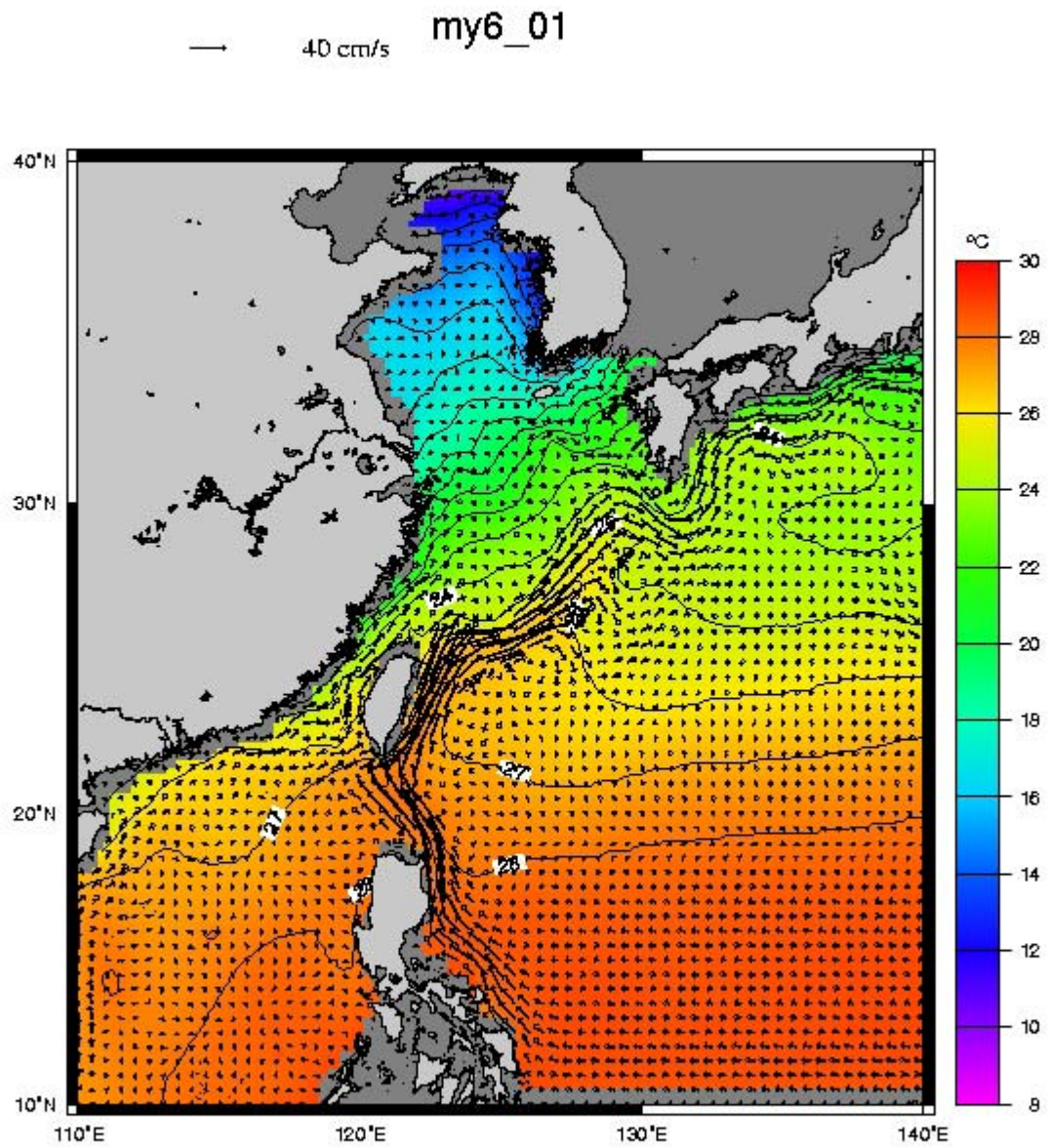


Figure 2 Horizontal temperature and velocity distributions of the simulated flow in the first layer of the annual mean field of the 6th year.

Year 2000

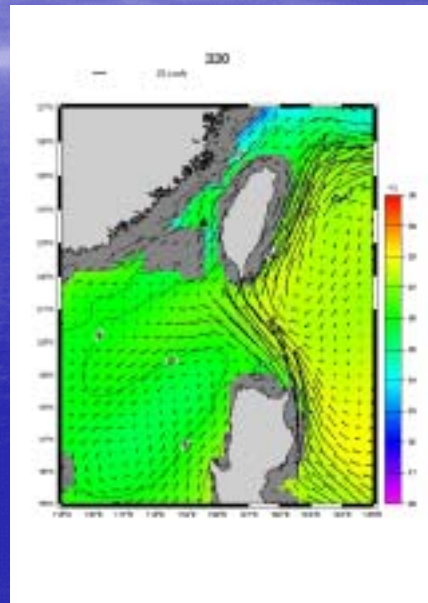
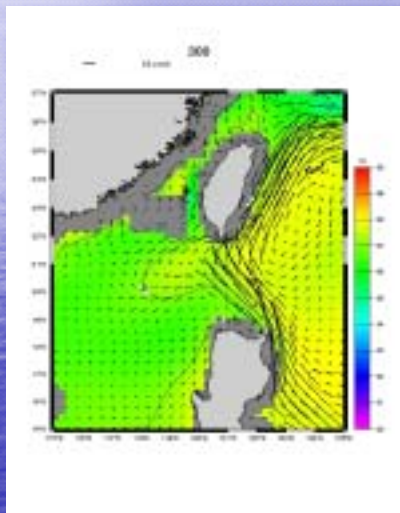


Fig.3 Horizontal distribution of temperature and velocity at 0-25 m depth range at day 300 and 330 of year 2000

Year 2001

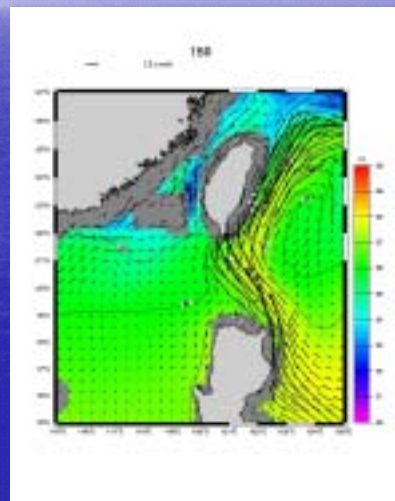
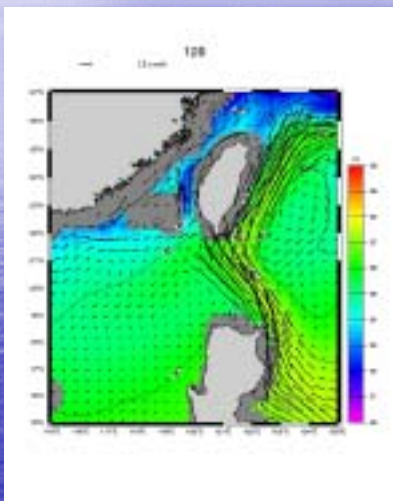


Fig. 4 Horizontal distribution of temperature and velocity at 0-25 m depth range at day 120 and 150 of year 2001