

RESEARCH ARTICLE

# Dynamics of the Water Circulations in the Southern South China Sea and Its Seasonal Transports

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## Abstract

A three-dimensional Regional Ocean Modeling System is used to study the seasonal water circulations and transports of the Southern South China Sea. The simulated seasonal water circulations and estimated transports show consistency with observations, e.g., satellite altimeter data set and re-analysis data of the Simple Ocean Data Assimilation. It is found that the seasonal water circulations are mainly driven by the monsoonal wind stress and influenced by the water outflow/inflow and associated currents of the entire South China Sea. The intrusion of the strong current along the East Coast of Peninsular Malaysia and the eddies at different depths in all seasons are due to the conservation of the potential vorticity as the depth increases. Results show that the water circulation patterns in the northern part of the East Coast of Peninsular Malaysia are generally dominated by the geostrophic currents while those in the southern areas are due solely to the wind stress because of negligible Coriolis force there. This study clearly shows that individual surface freshwater flux (evaporation minus precipitation) controls the sea salinity balance in the Southern South China Sea thermohaline circulations. Analysis of climatological data from a high resolution Regional Ocean Modeling System reveals that the complex bathymetry is important not only for water exchange through the Southern South China Sea but also in regulating various transports across the main passages in the Southern South China Sea, namely the Sunda Shelf and the Strait of Malacca. Apart from the above, in comparison with the dynamics of the Sunda Shelf, the Strait of Malacca reflects an equally significant role in the annual transports into the Andaman Sea.

## OPEN ACCESS

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## Introduction

The South China Sea (hereafter abbreviated as SCS) is a marginal sea with a depth of about 4000–5000 m in the central region, becoming shallower towards the southern region with depths of 50–70 m in the Sunda Shelf. The Sunda Shelf (hereafter abbreviated as SS) here is fringed by Peninsular Malaysia, eastern Sumatra, Borneo Island, Java, and their surrounding