

## Extreme Wind, Wave and Current in Deep Water of South China Sea

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Based on 30-year wind, wave and current data in the South China Sea (SCS), hindcasted by using numerical models and data assimilation, the extreme wind, wave and current for many return periods in the SCS deep water are calculated by using the 3-parameter Weibull distribution model. The results in this paper can provide primary reference for design and management of ocean engineering in this deep water. Because research on the engineering environment in the SCS deep water is the first try, these results need to be verified further and combined with more in situ observational data in the next step.

### INTRODUCTION

Traditionally, the South China Sea (SCS) is very important in trading, transportation and military affairs because of its special geographic location. With the development of underwater exploration, we have known that the current estimation for the total natural gas and oil resources in the deep water of the SCS is huge, and many oil and gas companies plan to tap them in the near future. Estimation of the extreme wind, wave and current for different return periods is the first step before any maritime affairs. Traditionally, this needs plenty of observed data, especially a long-time series data set. However, there are limited data with very sparse sampling in space and time in the SCS deep water. In order to provide a first guess at the basic environmental parameters in the SCS, we have to use a mesoscale atmosphere model combined with data assimilation to hindcast the wind fields from 1976 through 2005, and then hindcast the wave and current fields based on wave and current numerical models forced by the wind field.

In this paper, we first give a general description of the wind, wave and current in the SCS to show a whole picture of the marine environment involved. Next we present the data preparation and the method to calculate the extreme values. The results on the extremes of the wind, wave and current for return periods of 50 and 100 years are shown below, with a discussion and summary at the end.

### GENERAL DESCRIPTION OF SCS

The SCS is the largest semi-enclosed marginal sea in the north-west Pacific and connects to the outside seas through the Taiwan Strait, Luzon Strait, Mindoru Strait, Para Barke Strait, Banka Strait, Gaspar Strait, Karimata Strait and Malacca Strait. Its mean water depth is about 1800 m, and the maximum water depth reaches some 5400 m. It covers the region from the Equator to 23°N and from 99°E to 121°E. The water area of the SCS is about 3.5 million sq km (Fig. 1).

The SCS is located in a subtropical and tropical area belonging to the Asian monsoon region. Previous studies show that the SCS

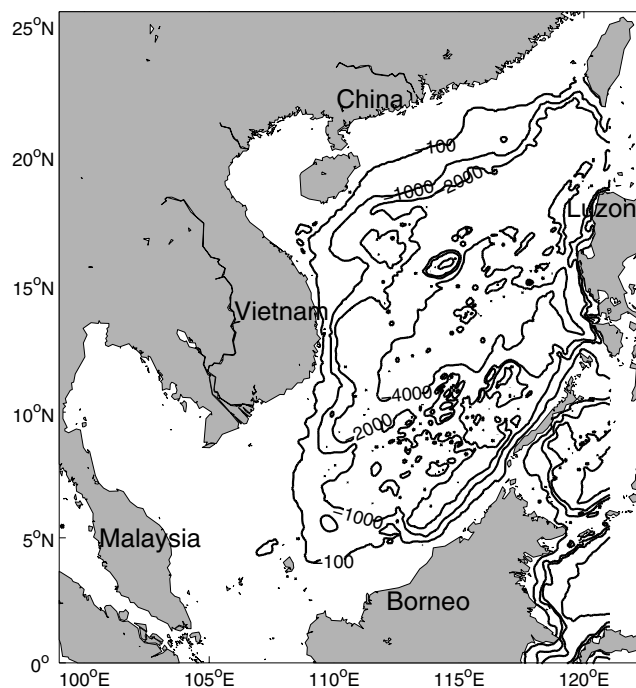


Fig. 1 Topography of South China Sea (unit: m)

climate is characterized by a half-year-long winter monsoon and a half-year-long summer monsoon, with a short period of seasonal transitions. The sea-surface wind over the SCS is strongest during the winter monsoon and gets weaker during the summer monsoon. In the period of seasonal transitions, spring and autumn, the average wind speed is lower than in summer and winter. Fig. 2 shows the climatic wind fields over the SCS from January to December based on QuikSCAT data from 1999 to 2005. The distributions of wave and current are omitted here.

Fig. 2 shows that the averaged wind speed over the SCS has an obviously seasonal variability. In general, the winter monsoon season is from October to March; the summer monsoon season is from June to August; and April, May and September are the monsoon transitional period. During the winter monsoon, the spatial distribution of wind speed shows high values in the northern SCS and low values in the southern SCS. The wind speed becomes stronger before December and gets weaker after December. In September, the wind field transits from the summer monsoon to

Received July 25, 2009; revised manuscript received by the editors November 3, 2009. The original version (prior to the final revised manuscript) was presented at the Third ISOPE Deep-Ocean Technology Symposium (IDOT-2009), Beijing, June 28–July 1, 2009.

KEY WORDS: South China Sea (SCS), deep water, wind speed, ocean wave, ocean current, extremes for return period.