

**UNIVERSITI TEKNOLOGI MARA**

**SEASONAL SURFACE  
CIRCULATION IN STRAITS OF  
MALACCA USING SATELLITE  
ALTIMETER AND LOW COST GPS-  
TRACKED DRIFTING BUOY**

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## ABSTRACT

With increased maritime transportation in the Straits of Malacca, it is expected that the impact of oil pollution will increase. This situation not just will affect the coastal ecosystems, but also marine fisheries in the strait. Thus, accurate knowledge of ocean surface circulation in the Straits of Malacca is crucial for scientists to formulate emergency plans for clean-up and recover the ocean from oil spill. In Straits of Malacca area, the information of ocean current only focus by using hydrographic method and numerical model which is need high cost and more time to gather the information of ocean current. By using this new technology which is satellite altimeter, the data will be question in term of capability to determine ocean current. To resolve the problem, this study presents an effort to estimate the surface circulation in Straits of Malacca by employing eight (8) satellite altimeter missions namely Topex/Poseidon, ERS-1, ERS-2, Jason-1, Jason-2, Envisat, Cryosat-2 and Saral/Altika within a period of 23 years, starting from 1993 until 2015. The surface currents during northeast monsoon, first inter-monsoon, southwest monsoon and second inter-monsoon have been mapped using satellite altimeter data. The major current flow is northward during each season except during southwest monsoon. The surface current pattern during SW monsoon was rather complex than NE monsoon. For SW monsoon, the surface current flowed northward at the southern region of the strait along the east coast of Sumatra before converging with southward current from Andaman Sea at around 6°N. The convergence caused an anti-cyclonic eddy form at the central region of strait centered at (6°N 99.5°E). In order to validate the altimeter derived geostrophic current, low cost GPS- tracked drifting buoy were developed and released in the Straits of Malacca during April and September 2016. The trajectories of the drifters were used to determine the surface circulation pattern during inter-monsoons. During first inter monsoon, the current from drifter flowed from south to north direction and vice versa during second inter-monsoon. From the achievement in altimetric result, it can be concluded that the satellite altimeter not only can determine ocean circulation but also capable to detect eddy while the drifter also give a good indicator that can be used to study surface circulation.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 RESEARCH BACKGROUND

Straits of Malacca are the strategic place that located between the west coast of Peninsular Malaysia and the east coast of Sumatra Island. Geographically, Straits of Malacca is narrow water area with average depth of this area is 53 meters and the length of Straits of Malacca is nearest to 980 km with width of 445 km in the north and 52 km in the south (Haoliang et al., 2014). In the northern area, the strait is wider with distance 341km and depth of 66m but the south is more narrow with minimum 25km and shallow with average 40 meters. However, the depth is reduced dramatically starting at fathom Bank area the south (Ku Kassim et al., 2007) as shown in Figure 1.1.

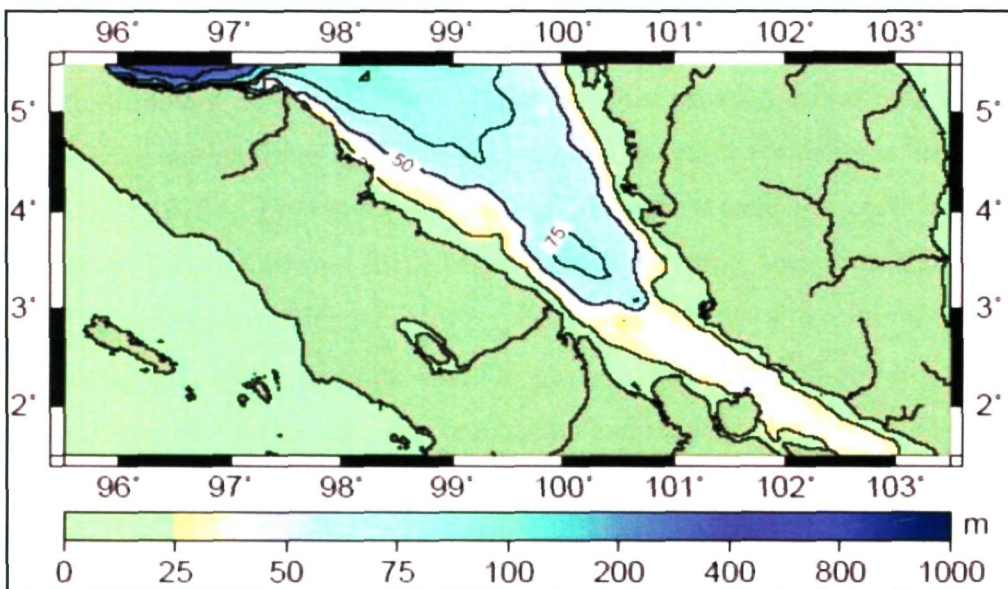


Figure 1.1: Bathymetric of Malacca Strait (Rizal et al., 2010)

Strategically located and rich in coastal resources, Straits of Malacca contribute big support in marine industries and contributing significantly to the economy. This region become one of the important waterway because of its strategic location for economic activities that form the shortest route connectivity both the