

**THE DYNAMICS OF CURRENT CIRCULATION AT NEARSHORE AND
VICINITY OF ISLAND IN TERENGGANU WATERS**

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**Thesis Submitted in Fulfillment of the Requirement for the
Degree of Master of Science in the Institute of Oceanography and Environment
Universiti Malaysia Terengganu**

November 2014

DEDICATION

To my parents

Daud Adam & Siti Mariam A. Rahman

to my brothers and sisters

Anisah, Farhan, Hafiz & Ruby

for endless love, support and encouragement

*Say, "Indeed, my prayer, my rites of sacrifice,
my living and my dying are for Allah,
Lord of the worlds.*

Al- An'am [6:162]

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the degree of Master of Science

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AND ISLAND VICINITY IN TERENGGANU WATERS**

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This study aims to understand the dynamics of current circulation in Terengganu waters covering nearshore area and island vicinity which include two main purposes; 1) to determine the influence of wind on the currents circulation and 2) to examine the residual current in Terengganu waters and relate the factors of wind and tide in daily and seasonally current circulation in Bidong island waters.

The circulation model at coastal area of Terengganu waters was developed using DHI Mike Flow Modelling tools. This software used as the tool to simulate the coastal hydrodynamics, wind sensitivity and residual currents analysis.

This study conducted a wind sensitivity analysis to determine the influence of wind on currents circulation. The response of the Terengganu currents and water movement to wind was investigated under constant and uniform wind stress. Adopting the without

wind influence, moderate and extreme situation on both wind direction and wind speed in model was tested.

The experimental analysis for residual current based on three dominant factors in circulation. The evaluated factors were wind, tides and density. The model runs were undertaken including and excluding the three main forcing terms. There were seven experiments which each case has been run in specified condition.

The results shown that the wind factor in the current circulation is a dominant factor followed by tides for the coastal flow and central in open area. Higher wind speed and northeasterly wind give strong impact to current circulation in Terengganu waters. As well in residual current circulation study. Comparing by season, Northeast (NE) monsoon gives large wind impact to Terengganu circulation waters. While Southwest (SW) monsoon gives less impact but still define the present of SW monsoon influence.

The SCS current system is influenced by predominantly monsoon winds throughout the year. The effect of the wind on the currents depends on the duration and intensity of the wind forcing. Study found, strong wind speed in 45° wind direction gives strong impact to current circulation in Terengganu waters compare to strong wind flow from 225° direction. This is proven in the model wind sensitivity analysis.

During NE monsoon season, with 20m/s wind speed wind input, the strongest current are recorded in case 1. A maximum current flow is recorded 0.478 m/s. The current flow parallel to the coastline same direction of the spreading winds is suggested this enhanced by geostrophy.

In the surface layer, the southward flows from the offshore branch out into a strong western boundary that flows along the Terengganu. The current flows rather weak at the north part of Terengganu coast. The southward current flowing along Terengganu coast until south part of coast it hurtles into the land. The extreme northward wind stress blowing across the sea causes the surface layer of water to move southward. As the wind stress stimulated a wind-driven current at the surface layer.

This study concluded that wind and tides are controlling factors in Terengganu waters accordingly. While density have less influence in this currents circulation system.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Master Sains

**DINAMIK PEREDARAN ARUS DI PANTAI DAN SEKITAR PULAU DALAM
PENGAIARAN TERENGGANU**

NURUL RABITAH DAUD

November 2014

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Kajian ini bertujuan untuk mengetahui proses oseanografi fizikal di perairan Terengganu secara terperinci di peredaran semasa yang dinamik yang termasuk pertama, untuk menentukan sambutan peredaran semasa untuk menggulung di perairan Terengganu. Kedua, untuk memeriksa semasa pasang surut semasa dan bukan pasang surut di perairan Terengganu dan mengaitkan faktor angin dan pasang surut dalam edaran harian semasa di perairan pulau Bidong.

Peredaran arus di kawasan perairan Terengganu telah dimodelkan menggunakan perisian Mike Flow Model dari DHI. Perisian ini digunakan sebagai bantuan bagi simulasi dinamik hidro, angin dan analisis arus sisa di kawasan pantai.

Kajian ini telah menjalankan analisis sensitiviti angin untuk menentukan pengaruh angin ke atas peredaran arus. Gerak balas arus dan pergerakan air terhadap angin di perairan Terengganu dengan kekuatan angin yang tetap dan seragam. Dengan mengadaptasi

situasi angin yang tiada angin, sederhana dan angin yang kuat bagi kelajuan angin dan arah tiupan angin.

Bagi analisis eksperimen untuk arus sisa berdasarkan tiga faktor utama dalam peredaran arus. Faktor yang dinilai ialah angin, pasang surut dan ketumpatan. Model disimulasikan dengan mengambil kira memasukan atau menyingkirkan tiga faktor tersebut. Terdapat tujuh eksperimen dimana setiap satunya disimulasikan berbeza situasi yang telah ditetapkan.

Keputusan menunjukkan bahawa faktor angin dalam edaran semasa adalah faktor utama diikuti oleh air pasang untuk aliran pantai dan tengah kawasan terbuka. Kelajuan angin yang lebih tinggi dan arah angin timur laut memberi kesan yang kuat kepada peredaran semasa di perairan Terengganu. Serta dalam kajian sisa peredaran semasa. Perbandingan bermusim, Monsun Timur Laut (TL) memberi kesan angin yang besar untuk edaran perairan Terengganu. Manakala monsun Barat Daya memberikan kesan yang kurang kepada peredaran semasa tetapi masih jelas menunjukkan tempoh pengaruh monsun.

Angin merupakan faktor dominan dalam edaran semasa di kawasan kajian ini. Kajian mendapati, kelajuan angin yang tinggi pada arah angin 45° memberi kesan yang kuat kepada peredaran arus di perairan Terengganu berbanding dengan aliran angin yang sama dari arah 225° . Ini terbukti dalam analisis model sensitiviti angin.

Semasa musim monsun TL, arus kuat terhasil semasa 20m/s kelajuan angin direkodkan dalam kajian kes1. Arus maksimum direkodkan 0.478m/s. Arah peredaran arus yang selari dengan aliran angin di sepanjang sisir pantai ini dipengaruhi oleh faktor geostrofi.

Di lapisan permukaan, aliran arus ke arah selatan yang kuat bergerak dari kawasan laut ke persisir pantai. Arus mengalir agak lemah di bahagian utara pantai Terengganu. Arus ke arah selatan mengalir di sepanjang pantai Terengganu sehingga bahagian selatan pantai. Tiupan tekanan angin yang melampau merentasi laut menyebabkan lapisan permukaan air bergerak ke arah sempadan selatan. Tekanan angin ini dirangsang arus angin yang bertiup dilapisan permukaan.

Kajian ini merumuskan bahawa angin dan pasang surut adalah faktor mempengaruhi peredaran arus di perairan Terengganu. Bagaimanapun, ketumpatan mempunyai pengaruh yang kurang kepada sistem peredaran arus ini.