THE POTENTIAL OF DAMAGES INDUCED BY WIND SPEED

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ABSTRACT

Malaysia is located near the equator and natural disasters such as hurricanes, tsunamis and tornadoes usually not occur in Malaysia. Known as a tropical country, Malaysia was not excluding from the strong winds as tropical storms and monsoon phenomenon. Damage rate in Malaysia cause by storm hazard is seen quite a surprise. Currently, there is no properly guidance to identify the wind hazard location in Malaysia. Therefore, the main objective of this study is to produce the spatial wind speed map for the peninsular Malaysia. Furthermore, in this study, the mean wind speed data at each of the capital state from 2008 to 2012 were collected. Databases are establishing through the GIS techniques. GIS techniques were used to create the spatially database information. Average wind speeds of the regions are identified in peninsular Malaysia. From the result, the relationship between the average wind speed and damage ratio due to wind speed in Malaysia are show good agreement. Therefore, the results of this study can be used as a guideline in the future.

ABSTRAK

Negara Malaysia terletak di garisan khatulistiwa dan bencana alam seperti taufan, tsunami dan puting beliung biasanya tidak berlaku di Malaysia.Turut dikenali sebagai sebuah Negara Tropika, Negara Malaysia tidak terlepas dari bencana angin kencang seperti ribut tropika dan fenomena angin monsoon. Kadar kemalangan disebabkan kecelakaan angin di Malaysia dilihat agak mengejutkan. Namun demikian,sehingga kini,masih belum wujud panduan untuk mengenalpasti lokasi bahaya angin di malaysia. Oleh yang demikian, objektif utama kajian ini adalah untuk menghasilkan peta kelajuan angin di Semenanjung Malaysia. Justeru, dalam kajian ini, data kelajuan angin di setiap ibu negeri dari tahun 2008 hingga tahun 2012 telah dikumpul. Kelajuan angin di Malaysia telah dikenalpasti dan diolah menggunanakan teknik GIS. Teknik GIS telah digunakan untuk mewujudkan pangkalan data kawasan kajian dan maklumat analisis ruang untuk mendapatkan zon kelajuan angin dan peringkat-peringkat kerosakan disebabkan angin di Malaysia. Secara tidak langsung, kadar purata kelajuan angin dan peringkat kerosakan disebabkan angin telah dapat dikenalpasti di seluruh kawasan di semenanjung Malaysia. Kesimpulannya, objektif kajian terbukti berjaya dalam hubungan antara purata kelajuan angin dan peringkat kerosakan disebabkan angin di Malaysia. Oleh itu, keputusan kajian ini boleh dijadikan garis panduan pada masa akan datang.

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LIST OF SYMBOLS/ SHORT FORMS

GIS	=	Geographical Information System
NST	=	New Straits Time
RM	=	Ringgit Malaysia
AS	=	Alor Star
JB	=	Johor Baharu
KL	=	Kuala Lumpur
KT	=	Kuala Terengganu
KB	=	Kota Bharu
Knots	=	Unit of Speed
MMD	=	Malaysian Meteorological Department
m/s	=	Unit of Speed
Minutes	=	Unit of Time
m	=	Meter
%	=	Percentage

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Lately many damages cause by wind occur. (Utusan Malaysia, 2012) reported 3rd of august 2012, at Jempol Negeri Sembilan, 16 canopy of bazar Ramadan stall flew by strong wind. No one injured and no dead is reported but the entire 16 canopy cannot be used anymore. At the same places, Jempol on 29th June 2012,(Sinar Harian,2012) reported 44 houses were attacked by storm. Almost all of the houses were experienced roof damage. On 6th June 2012 (Sinar Harian; New Straits Time, 2012) also reported storm at Jempol Negeri Sembilan. Almost 50 resident of Felda Palong suffered losses of up to RM 30,000 when their home damaged by storm. The storm flown off roof and also damaged other parts of house. Based on the residents, numerous houses were damage during storm as the wind were very strong and nothing could protect their homes. The strong wind also happen all over peninsular Malaysia. 2nd October 2012 four houses recently damaged during a three hour pre-dawn storm in Tangkak Johor. 3rd December 2012, (Fairul Asmaini Mohd Pilus, 2012) from New Straits Time reported 61 houses damaged by storm.

Wind is basically caused by the temperature gradient of the atmosphere due to variable Solar heating of the earth's surface. It is initiated, in a more immediate sense, by density difference or pressure gradient between points of equal elevation. (Tamura & Cao, 2010)

Strong winds are the most common means of destruction associated with hurricanes. Their sometimes continuous barrage can uproot trees, knock over buildings and homes, sink or ground boats, and flip cars. (Department of Atmospheric Sciences, 2010)

(Holmes, 2007) Stated that Malaysia is entirely in the equatorial zone. Malaysia does not experience typhoons and has very low extreme winds from weak thunderstorms and monsoons winds. But from the observation, there are still damage causes by strong wind. As an example, 18th December 2012, typhoon Utor occurs in JB and cause lots of damage which cost millions Ringgit Malaysia. It shows that more study need to be done.

1.2 PROBLEM STATEMENT

The significance of this study is to reduce the potential damages cause by wind speed which occur during thunderstorm and identified as serious level of damages around peninsular Malaysia **(Figure 1.1)**. Year by year, the storm occurrences is increase. But the damages are just the same. No improvements were made to reduce the damages level. This may cause by:

1. The position of building do not consider the wind speed that may cause damage due to topographic or roughness and mean wind speed profile.
2. Structure of the building which may not kind of engineered building.
3. Storm occurs not recorded by weather station due to location of weather station.

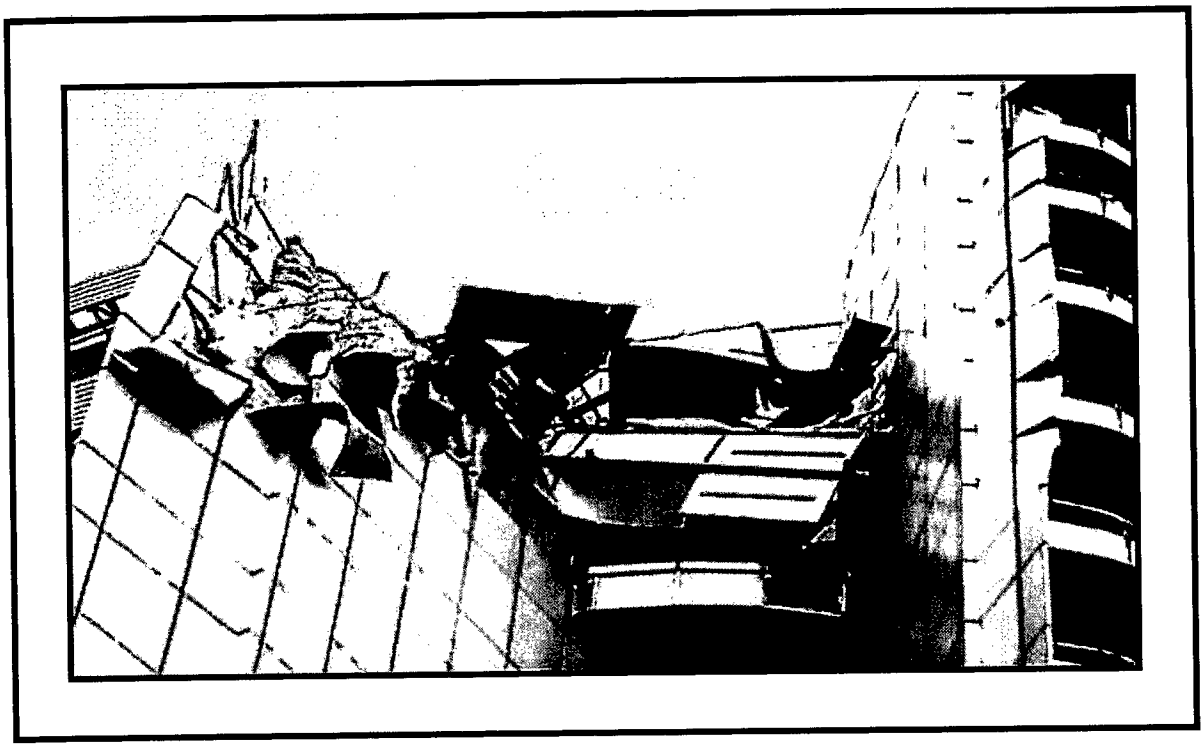


Figure 1.1 Damages Cause By Strong Wind Speed at Pulau Pinang 2013

Source: New Straits Time 2013

1.3 OBJECTIVES

Level of damages due to strong wind may be reduced if safety precaution were taken. People may plan their type of roofing system and consider wind loading during construction of building if they know the level of damages at their residential area.

The objectives if these studies are:

1. To produce the mean wind speed map of peninsular Malaysia.
2. To study the relationship between mean wind speed and level of damage in peninsular Malaysia

1.4 SCOPE OF STUDY

The scope of the study is to determine the success of the objectives. The scopes of this study are

1. The ArcGIS database system that complete with information that related to mean wind speed data, wind hazard ratio, and location of wind station.
2. The area of study is limited to Peninsular Malaysia only.
3. The ArcGIS software to produce map and zoning area

1.5 STUDY AREA

The study area of this study is limited to peninsular Malaysia only **(Figure 1.2)**. Sabah and Sarawak are excluded in this study

Figure 1.2 Peninsular Malaysia

1.6 SIGNIFICANT OF STUDY.

Many study conducted on topographic effect on the wind flow. This study is to determine mean wind speed of every district in peninsular Malaysia. By conducting this study, pattern of wind at Malaysia can be determined and wind hazard damage can be reduced. As an example, if any place record high mean wind speed for past 5 years, the structure of building at the area should be design vary with the sustainability to withstand high wind speed. **Figure 1.3** shows zoning area of wind speed around the world and sonamu typhoon direction.

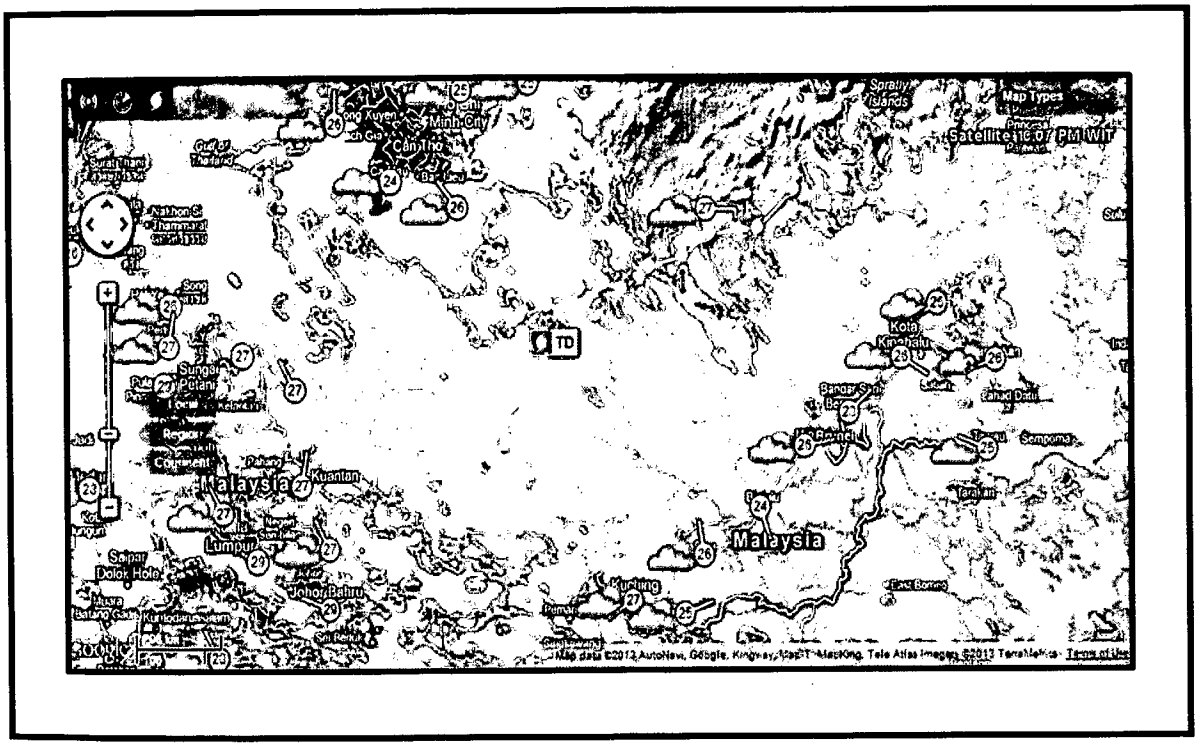


Figure 1.3 Sonamu Typhoon Directions

Sources: Malaysian Meteorological Department

1.6 THESIS STRUCTURE

Chapter I discussed the overall introduction of the study. Firstly, the problems statement and followed by objectives of the study. After that, study limitations such as scope of study and study area are identified. In doing the research, the significant of study also were considered.

Chapter II is discussed on literature review. Background and the definition of Geographical Information System are discussed. Other than that, previous researches on wind hazard damage also were written. Other kind of information related to wind and wind hazard damage is simplified in this chapter.

Chapter III is the methodology part. It discusses briefly the flow method of this thesis from the beginning until the result is obtained.

Chapter IV is analysis and result's chapter. It presents the result from data analysis of mean wind speed and wind hazard damage.

Chapter V is conclusion and recommendation part. The conclusion stated at the end of this study to show that the effective and suitability of Geographical Information system (GIS) as the application in information management system for wind hazard according to study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents a review of the literature review on wind effect and related previously study.

2.2 WIND HAZARD DAMAGE

Wind hazard damage is one kind of natural disaster that cause by wind. Known as hydro-meteorologal hazards wind storm including cyclones, hurricanes and typhoons contribute to percentage of damages by natural disaster around the world. (Bosher, 2008) In Malaysia, there are a lot of storm and if we review back, all the damages cause by wind is almost the same like the other country, but no action taken to prevent it from happen including no safety precaution were made. By determination of wind mean speed for every district in Malaysia may help the engineer design better design based on mean wind speed profile.

Environmental wind studies-investigate the wind effects on the surrounding environment caused by erection of the structure (e.g. tall building). This study is particularly important to assess the impact of wind on pedestrians, motor vehicles and

architectural features such as fountains, etc, which utilize public domain within the vicinity of the proposed structure. (Mendis, Ngo, Haritos, Hira, B.Samali, & Cheung, 2007)

High wind speeds can cause significant damage to property. Hurricanes, cold fronts, strong areas of low pressure and even simple thunderstorms can produce winds strong enough to cause damage and threaten buildings and boats. Understanding the level of threat posed by sustained winds at high speeds can help you to minimize the risks to property and physical well-being. (McBride, 2012).

(Perry & Symons, 1994) also stated that. Improvements to the format of weather forecasts and warnings is considered to offer some prospect of reducing the hazard, but a databank of wind-related transport accidents is also needed for planning and preliminary operational statistical analysis. So the analysis of mean wind speed may help.

(Holmes, 2007) stated that Malaysia only experience wind speed between 24-32 m/s and. It has been concluded based on 50 year gust values for 20 stations of the Malaysian Meteorological Service around Malaysia but as we can see almost every month there are storm occurs and cost a lot of money.

From **Figure 2.1** and **Figure 2.2**, analysis from year 1980 to 2010 shows that storm are third kind of natural disaster reported and it also the third natural disaster occurred per year.

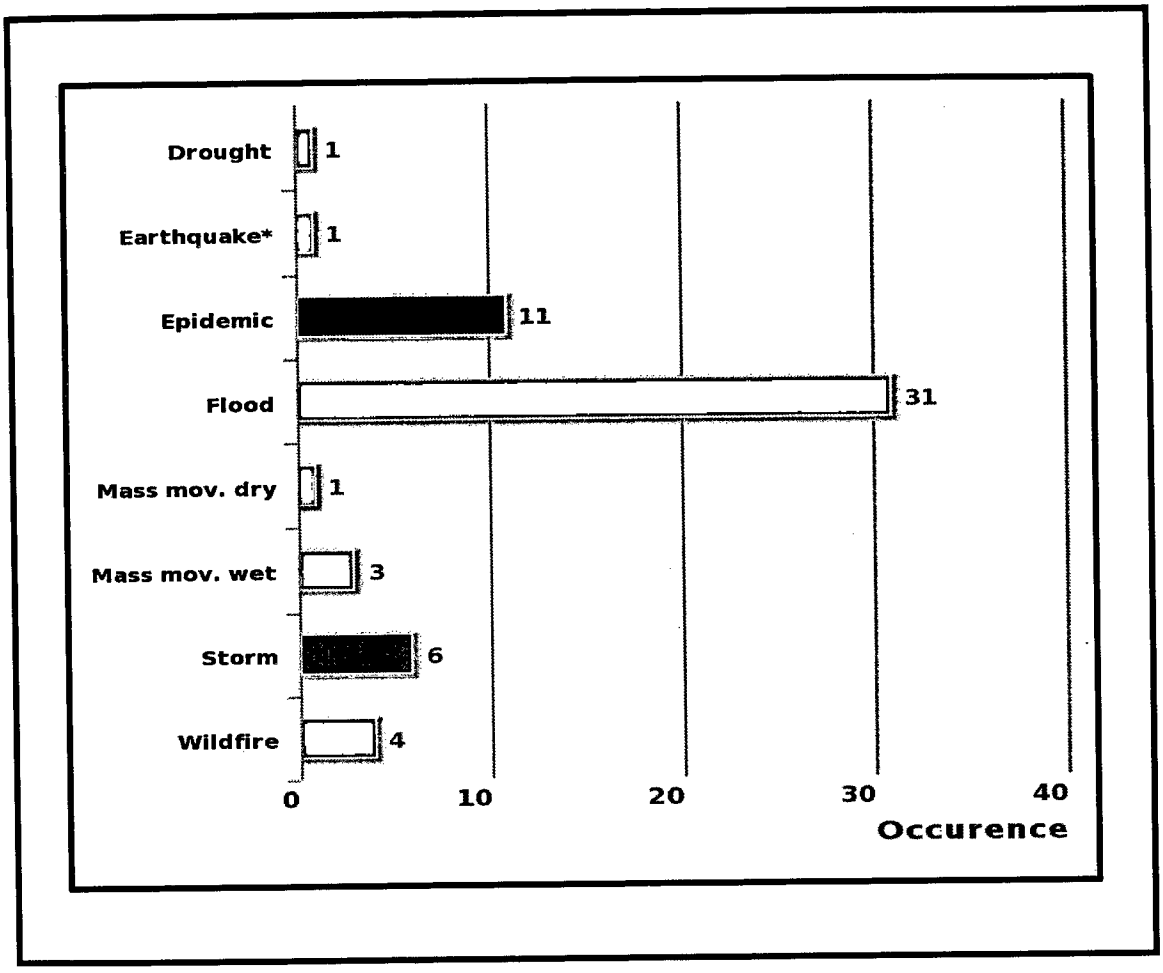
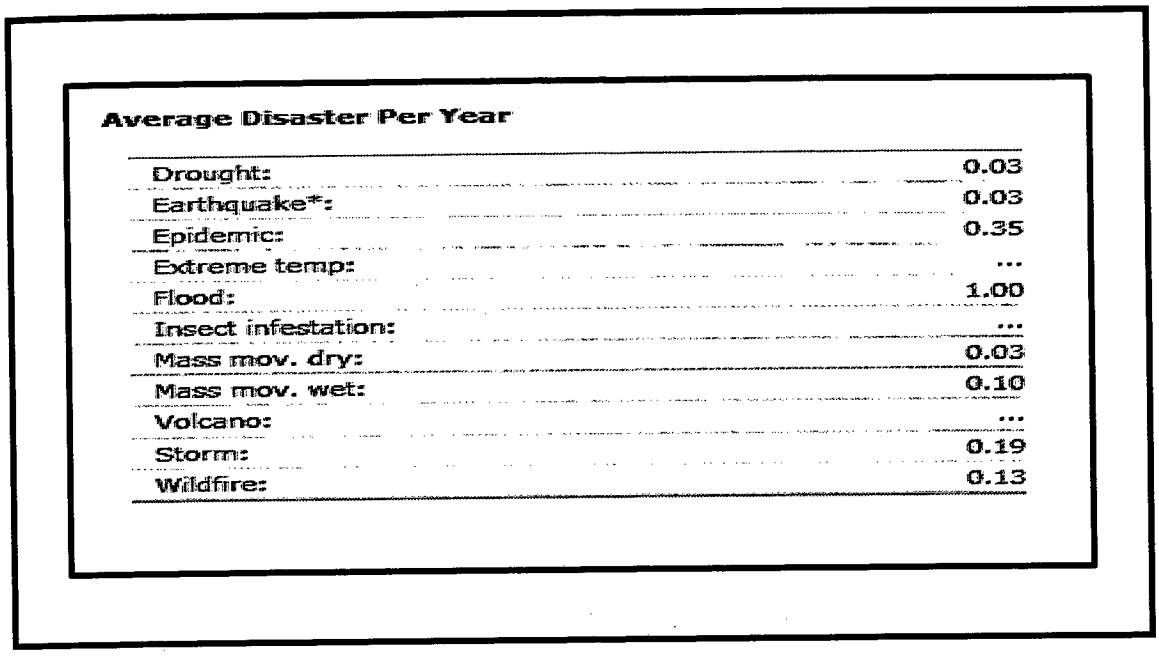


Figure 2.1 Natural Disaster Occurrence Reported 1980-2010

Source: Preventionweb



Average Disaster Per Year

Drought:	0.03
Earthquake*:	0.03
Epidemic:	0.35
Extreme temp:	...
Flood:	1.00
Insect infestation:	...
Mass mov. dry:	0.03
Mass mov. wet:	0.10
Volcano:	...
Storm:	0.19
Wildfire:	0.13

Figure 2.2 Average Disasters from Year 1980-2010

Source: Preventionweb

2.3 MALAYSIA

Located in northern hemisphere, north of the equator of Malaysia, Malaysia consists of two main areas separated by South China Sea which covers almost 531.1 square kilometers. Both have similar geographic pattern. Such as dense forest, sloping coastline and rolling hills. The climate is equilateral but for some places, especially northern part of peninsular Malaysia and northern Sabah has a tropical monsoon climate. Divided to eleven states and 1 federal territory, Pahang is the biggest state in peninsular Malaysia **(Figure 2.3)** and Perlis is the smallest states.

Malaysia located near the equator **(Figure 2.4)** between 1 and 7 latitude North and longitude 100 and 119 East, and subject to the influence of the sea and the wind system changes from the Indian Ocean and the South China Sea. Usually, the climate here is

divided into the southwest monsoon and the northeast monsoon. The average temperature in most of Malaysia is between 21 °C to 32 °C. Humidity is rather high. (Chempawan Mat Abu, 2009)

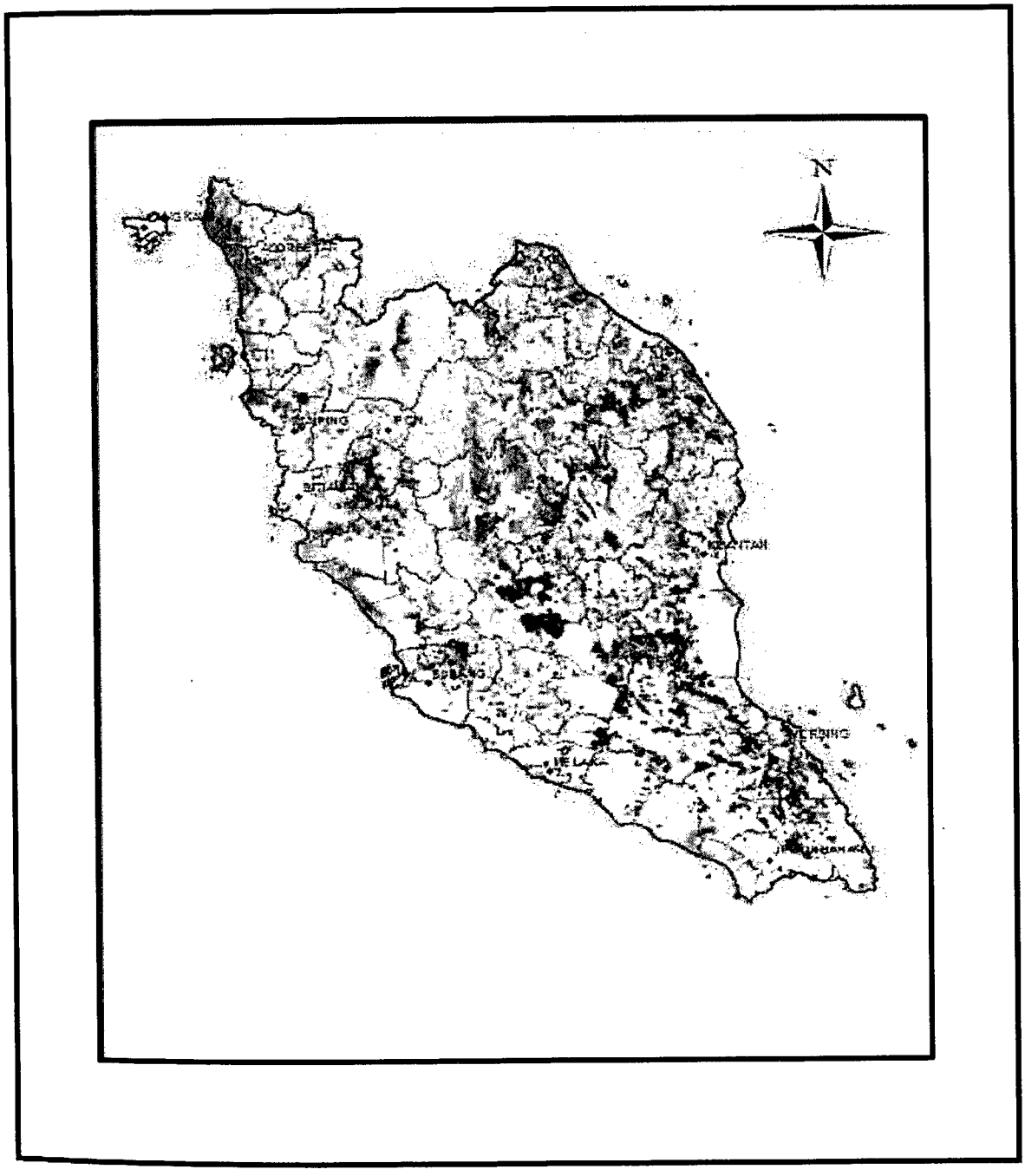


Figure 2.3 Peninsular Malaysia Map

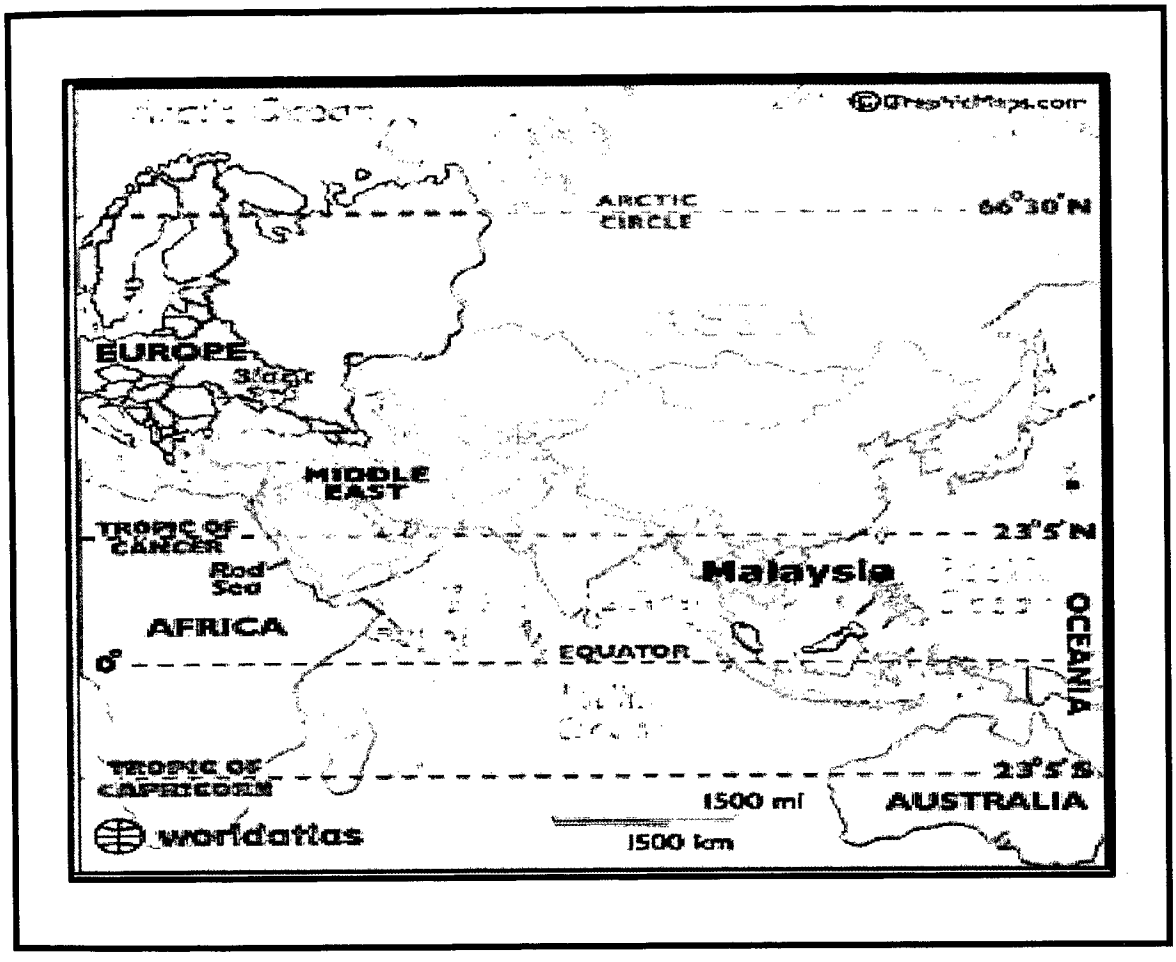


Figure 2.4 Malaysia Located Near The Equator

Sources : worldatlas.com

2.3.1 Type of Wind in Malaysia

In Malaysia, wind low over the country is generally light but some periodic changes in the wind plow type. There are four seasons that can be distinguished relatively known as southwest monsoon, northeast monsoon and two shorter periods of inter-monsoon seasons. In half of May or early June, the southwest monsoon occurred and ends in September. The wind flow pattern is light and it was below 15knots.

Vary to northeast monsoon which usually commences in early November and ends in March. The wind flow may reach 30 knots at the east coast states area due to strong surges of cola air from the north.

The winds are generally light and variable during the two intermonsoon seasons because the equatorial lies over Malaysia during these seasons.

Typhoon frequently occur during April to November over the west pacific and move westwards across Philippines. The wind flow may reach 20 knots or more over the northwest coast of Sabah and Sarawak region.

The effect of land breeze on general wind flow pattern is very marked especially during days with clear skies due to Malaysia as a maritime country. Sea breezes of 10 to 15 knots very often develop and reach up to ten kilometers inland on bright sunny afternoons. Differ to night days, the reverse process takes places. (Malaysian Meteorological Department)

2.4 WEATHER WARNINGS

Weather warning provided by the Malaysian Meteorological Department (MMD) seems to ignore the potential threat cause by tropical storm **(Figure 2.5)**. This is due to possible impact MDD identified in relation to two warning stages: red and orange.

The orange one list "flooding in low lying areas and river banks" as well as "thatched/zinc roofs being blown off by wind" as possible impact of tropical storm. The red one is stronger tropical storm and much stronger typhoon list only "swift water currents that can be dangerous to children playing beside monsoon drains and river banks".