

CORRELATIONAL ACTIVITY BETWEEN GLOBAL WARMING AND
LIGHTNING DENSITY

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Dedicated with deepest love to:

**“My beloved parents Ismail bin Hussain and Hasnah binti Puteh,
My beloved wife, Noorul Aini binti Ramli,
My beloved kids, Iskandar Abu Dzar, Noorul Iman Adzraa,
Noorul Qisha Izara and Noorul Khayra Sufia,
My loving family and friends,
thank you for your support, advice, love and guidance.”**

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In the name of ALLAH S.W.T, Most Generous and Most Merciful and peace and blessing be upon the most noble of the Prophets and Messengers, our Prophet Muhammad SAW, and upon all his families and companions.

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ABSTRACT

Lightning discharge in thunderstorms is an indication of the intensity of atmospheric convection which is related to important climate parameters. Due to the interest in global warming, there have been numerous studies looking at the relationship and sensitivity of lightning activity to changes in surface temperature. Many studies have been done specifically in the temperate region of the globe, but number of studies done in the tropics especially Malaysia to identify correlational activities between temperature change and lightning formation is hardly found in the literature. Therefore, this research aims to study and investigate the correlational activity between global warming and lightning density in Malaysia specifically in the area of Johor Bahru and Kuala Lumpur, from 2011 until year 2016, based on data provided by Malaysian Meteorological Department and TNB Research. Statistical analysis of the data shows a positive correlation between temperature and lightning activities. It was found that surface temperature is a key driving factor of daily lightning activities and hence, higher surface temperature will lead to higher number of lightning. Thus, lightning may provide a useful tool for tracking global warming in the future. Outcome of this research work will be useful specifically to utility companies and electrical consultants in Malaysia in designing and enhancing their lightning protection system for better improvement. It will also benefit the public in the sense of educating and understanding the importance of environmental preservation and conservation to help reduce the impact of global warming.

ABSTRAK

Panahan kilat semasa ribut petir adalah satu petunjuk keamatan perolakan atmosfera yang berkaitan dengan parameter iklim yang penting. Rentetan kecenderungan tertumpu kepada isu pemanasan global, terdapat banyak kajian dilakukan untuk melihat hubungan dan kepekaan antara aktiviti kilat dan perubahan suhu permukaan. Banyak kajian telah dilakukan khususnya di kawasan beriklim sederhana dunia, tetapi sangat sedikit bilangan kajian yang dilakukan di kawasan tropik khasnya Malaysia untuk mengenalpasti kolerasi atau hubungan diantara perubahan suhu dan pembentukan kilat. Oleh itu, penyelidikan bertujuan untuk mengkaji dan menyiasat hubungan di antara pemanasan global dan ketumpatan kilat di Malaysia khususnya di kawasan Johor Bharu dan Kuala Lumpur, mulai tahun 2011 sehingga 2016 merujuk kepada data yang diperolehi daripada Jabatan Meteorologi Malaysia dan TNB Research. Analisa Statistik data menunjukkan hubungan yang positif di antara suhu dan aktiviti kilat. Didapati bahawa suhu permukaan adalah faktor pemacu utama aktiviti harian kilat dimana semakin tinggi suhu permukaan maka semakin tinggi bilangan kilat yang terhasil. Oleh itu, kilat boleh dijadikan perantara untuk mengesan pemanasan global di masa hadapan. Hasil penyelidikan ini berguna kepada khususnya syarikat utiliti dan perunding elektrik di Malaysia untuk menambahbaik dalam merekabentuk dan meningkatkan sistem perlindungan kilat mereka. Ia juga akan memberi manfaat kepada orang ramai dalam mendidik dan memahami kepentingan pemeliharaan dan pemuliharaan alam sekitar supaya kesan pemanasan global dapat dikurangkan.

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LIST OF ABBREVIATION

MMD	-	Malaysia Meteorological Department
TNB	-	Tenaga Nasional Berhad
TNBR	-	TNB Research
SPSS	-	Statistical Package For The Social Sciences
KL	-	Kuala Lumpur
JB	-	Johor Bharu

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Lightning is a fast electrostatic discharge that occurs naturally throughout a thunderstorm where the event of electrical discharge is very short duration and is usually accompanied by a very bright flash and loudest thunder sound. Thunderclouds are formed due to hot air rising upwards and rain falling. This process makes the top of the clouds positive, the bottom negative and creates a voltage difference in the cloud itself. Once this difference exceeds the voltage breakdown limit of air, it creates a flash[1]. Flash occur between electrically charged regions of a cloud is called intra-cloud lightning. Flash occur between two clouds is called cloud-to-cloud lightning and if occur between cloud to ground, these are called cloud to ground flash.

Lightning flash with a large current and strong electromagnetic radiation will effect on human life with the power of flash. Lightning occurrence is also an important parameter to indicate the convections and global warming. With the improvement of lightning detection technology and the expansion of lightning detection network, the data of lightning has been used in the fields of lightning protection, meteorology, industry and climate.

Today, our capability is very limited to forecast future global warming in the global lightning activity. To do so we need a better understanding of the global warming phenomena and lightning characteristic. Global warming refers to the increase in the Earth's average surface temperature since the Industrial Revolution, primarily due to the emission of greenhouse gases from the burning of fossil fuels and land use change[2]. Global warming is a major issue and is our challenge because it will influence on our future business environment. Burning up of fossil fuels, which generate carbon dioxide, is the main contributor to global warming and hence decreasing this release is the most important objective of global warming strategies.

This project aims to study the correlation between lightning density and global warming in Johor Bharu and Kuala Lumpur, Malaysia. Lightning and temperature data will be obtained from TNB Research and Malaysian Meteorological Department (MMD). A comprehensive analysis and verification using Statistical Package For Social Science (SPSS) Software will be done to show the correlational activities between them.

1.2 Problem Statement

Malaysia is the country with the second highest number of lightning strikes in the world since it is located near the equator. Most of the area closer to the equator generally have more lightning flashes compared to others due to the amount of sun rays received by these areas [3].

Lightning flash naturally happens during thunderstorms, when upward drafts of warm air carrying moisture interact against other water or ice particles high up inside the thunderstorm clouds, generating static electricity until it reaches an explosive threshold discharged. The more exposure to the sun in countries at the

Equator such as Malaysia speeds up the vertical updrafts process. This will causing clouds to form followed by rainfall and thunderstorm.

This phenomena will affect the lives, activities and decision of the people. The patterns and influences of lightning and rainfall shall be taken into consideration. Number of lightning accidents could be reduced if we take extra precaution. Many of us take things for granted and are not aware of the damages that lightning can do. Our country has a high number of lightning strikes and hence the public should be more informed and aware. We should take necessary action and precautions to stop or prevent lightning injuries and fatalities because we cannot stop lightning strikes from happening.

Study shown that the density of lightning flashes depend on the temperature. The hotter it is, the higher the density of lightning flashes will occur[4]. Since temperature has increased due to global warming, we should prepare ourselves for more thunderstorms in the future. The correlation between lightning occurrence and global warming are not much in-depth study in Malaysia. Therefore, the investigation and analysis of the relationship lightning occurrence and global warming have been done throughout this study.

1.3 Research Objective

The objectives of this project are:

- (i) To investigate trends of lightning occurrence and characteristic in Malaysia
- (ii) To analyse correlation between temperature and lightning occurrence in Johor Bharu and Kuala Lumpur, Malaysia

1.4 Research Scope

In a way to achieve the objectives of the proposed project, scope is used to definite the project to a certain limit. Thus, the scopes for this project are as follows:

- (i) Study and focus on collection of lightning and temperature data for period of year 2011 until year 2016 in Johor Bharu and Kuala Lumpur.
- (ii) To obtain the statistical analysis using The Statistical Package for the Social Sciences (SPSS) and focus on lightning occurrence with temperature.

1.5 Project Report Structure

This project report is dividing into five main chapters. Chapter 1 is the introduction of the whole project including project background, problem statement, research objective and finally research scope.

Chapter 2 contain on literature review consist of theoretical of lightning, lightning risk to human, what is global warming and its implication to human, temperature trend in Malaysia and not least about the relationship between lightning and temperature.

Chapter 3 will elaborate more on methodology consist of define issue and tool, selection of data location, analysis techniques and project flow chart.

Chapter 4 will cover results and discussions. The results obtained have been discussed in order to study and investigate the correlational between global warming and lightning density

Finally, chapter 5 will explain the conclusion, impact and contribution and the recommendations of this project. The conclusion more about brief a summary of this project and the recommendations are other alternative or suggestion to enhance the lacks that happen through this project

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