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THE EFFECTS OF EQUINOX PHENOMENON ON CLIMATE CHANGE

***Zildawarni Irwan[1], Wan Farahiyah Wan Kamarudin[1], Abdul Rahman Mat Amin[1], Adida Muhammud[1] , Siti Munirah Muda[1] , Noor Erni Fazlina Mohd. Akhir[2], Salihah Abdullah[3]**

[1]Faculty of Applied Sciences
Universiti Teknologi MARA Cawangan Terengganu
23000 Dungun, Terengganu, Malaysia

[2]Faculty of Computer and Mathematical Sciences
Universiti Teknologi MARA Cawangan Terengganu
23000 Dungun, Terengganu, Malaysia

[3]Academy of Language Studies
Universiti Teknologi MARA Cawangan Terengganu
23000 Dungun, Terengganu, Malaysia

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Abstract

In recent years, Malaysia has been experienced with the weather changes especially in increasing of the temperature. The highest temperature usually occurs during equinox. Equinox is the phenomenon when the sun is directly above the Earth's equator and this happens twice a year. Therefore, this study is carried out to determine the effects of equinox on climate change for five consecutive years. The information of this study was obtained from Malaysian Meteorological Department. The study involved three states and one federal territory in Peninsular Malaysia, namely Alor Setar (Kedah), Kota Bharu (Kelantan), Johor Bahru (Johor) and Kuala Lumpur. These states were chosen based on their location in North, East, South and West of Peninsular Malaysia. As a result, the overall mean temperature at all stations is in the range of 27°C to 30°C. The analysis revealed that the mean temperature in March showed significant increase from year 2011 to 2015 in all stations and Alor Setar recorded the highest mean temperature. However, other factors are also needed to be considered to the rising of the temperature such as El Nino phenomenon, amount of rainfall, number of rain days, Southwest and Northeast Monsoon seasons and others.

Keywords: Equinox, climate, peninsular Malaysia, temperature, pollution

1.0 INTRODUCTION

As one of the countries in Southeast Asia, Malaysia lies close to the equator between latitudes 1° - 7° North and longitudes 100° and 119° East (Malaysian Meteorological Department, 2015). Malaysia comprises of Peninsular Malaysia and East Malaysia. There were 11 states in Peninsular Malaysia while two states (Sabah and Sarawak) in East Malaysia. Malaysia's climate is categorized as equatorial, being hot and humid

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throughout the year with the average rainfall of 250 cm a year. The temperature ranges between 26°C to 29°C while the average relative humidity is from 70% to 80% (Tangang et al., 2012). Malaysia is exposed to the equinox and due to the transition of the sun from the Southern to the Northern Hemisphere, Malaysia experiences low amount of rainfall and the temperature will keep increasing.

The word equinox is derived from the Latin words, *aequus* (equal) and *nox* (night) which refer to a day when daytime and nighttime are almost in equal duration (Mothe, 1965). During equinox, the length of the day and night is equal and the Earth's axis neither tilts towards nor away from the sun when the earth crosses the plane of the celestial equator twice in each year (Aziz, 2015). All parts of the earth experience 12 hours of day and night during equinox. This phenomenon usually occurs around 20 March and 23 September every year. The equinox happens due to the passage of the earth around the sun with the plane of the earth's tilting at an angle of 23.5 degrees. In addition, equinoxes are opposite on either side of the equator, so when Northern Hemisphere is having the autumnal (fall) equinox on March 20, the Southern Hemisphere is experiencing the spring (vernal) equinox on September 23 and vice versa (The Star, 2016).

There was speculation about equinox that lead to the rising of temperature from normal levels (The Star, 2016); (Tiong, Pereira & Pin, 2009). Equinox event were also related with global warming which is a result of climate change. One thing to remember with this season is the wind of change will blow from the south to the north through Malaysia and nearby countries. Winds from the south are dry and will take haze effect to the north (The Star, 2016). Apart from that, the arrival of a weather phenomenon will also cause heat stress and danger to humans' health (Lee, 2009). This is due to the temperature in Peninsular Malaysia which is higher than normal during the equinox. Therefore, the main intention of this study is to determine the effect of equinox on climate change for five consecutive years during equinox phenomenon in Peninsular Malaysia. The findings of this study will give beneficial information in raising awareness of early warning on equinox phenomenon. Finally, it is hoped that this research will give strong signal that the drought will occur in the region.

2.0 METHODOLOGY

This research is based on secondary data. The daily temperatures (ºC) of March and September were obtained from Malaysian Meteorological Department for the period 2011 – 2015. The daily temperatures were recorded for March and September due to equinox phenomenon that usually occurs during these months. For this study, four stations were chosen based on their locations: north, east, south and west of Peninsular Malaysia (Table 1). The data was then analyzed by using descriptive statistic method and the time series graphs of March and September monthly mean temperature for 5 consecutive years were plotted.

Table 1: Four Selected Stations in Peninsular Malaysia

No	Station	Longitude	Latitude
1	Kota Bharu	102.2929° E	6.1669° N
2	Alor Setar	100.3981° E	6.1897° N

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3	Kuala Lumpur	101.6981° E	2.7433° N
4	Johor Bharu	103.6696°E	1.6413°N

3.0 RESULT AND DISCUSSION

Based on the data of the daily temperature, the mean values of the monthly temperature are calculated for the past five years for March and September as presented in Table 2. Based on the table, the overall mean temperature at all stations is in the range of 27°C to 30°C. The minimum mean temperature (27ºC) was recorded in Kota Bharu (March 2011, March 2012, March 2013, March 2014, September 2012 and September 2014) and Johor Baharu (March 2011, March 2012, September 2011 and September 2012), while the mean maximum mean temperature (30°C) was recorded in Alor Setar in March 2014 and March 2015.

Table 2: Mean Temperature during Equinox (2011-2015)

	Temperature (ºC)			
Month,Year	Kota Bharu	Johor Baharu	Kuala Lumpur	Alor Setar
March 2015	Max: 32 Mean: 28 Min :24	Max: 33 Mean: 28 Min: 24	Max: 33 Mean: 29 Min: 24	Max: 36 Mean:30 Min:24
September 2015	Max: 32 Mean: 28 Min: 24	Max: 32 Mean: 28 Min: 24	Max: 33 Mean: 28 Min: 24	Max: 32 Mean: 28 Min: 25
March 2014	Max: 31 Mean : 27 Min: 23	Max: 33 Mean: 28 Min: 23	Max: 34 Mean: 29 Min: 24	Max:36 Mean: 30 Min: 24
September 2014	Max: 31 Mean: 27 Min: 23	Max: 32 Mean: 28 Min: 24	Max: 33 Mean: 28 Min: 24	Max: 32 Mean: 28 Min: 24
March 2013	Max: 31 Mean: 27 Min: 24	Max: 33 Mean: 28 Min: 24	Max: 33 Mean: 29 Min: 24	Max: 35 Mean: 29 Min: 25
September 2013	Max: 32 Mean: 28 Min:24	Max: 31 Mean: 28 Min: 24	Max:32 Mean:28 Min:24	Max: 31 Mean: 28 Min: 24
March 2012	Max: 31 Mean : 27 Min :24	Max: 31 Mean: 27 Min: 24	Max: 32 Mean:28 Min:24	Max: 33 Mean:28 Min:25
September 2012	Max :31 Mean : 27 Min :23	Max: 32 Mean: 27 Min: 23	Max:33 Mean:28 Min:24	Max: 31 Mean:28 Min:24

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March 2011	Max: 29 Mean: 27 Min: 23	Max: 31 Mean: 27 Min: 24	Max: 33 Mean: 29 Min: 24	Max: 33 Mean: 28 Min: 24
September 2011	Max :32 Mean: 28 Min :24	Max: 32 Mean: 27 Min: 23	Max: 33 Mean: 29 Min: 24	Max: 32 Mean: 28 Min: 25

Source: Malaysian Meteorological Department (2015)

Further temperature variation analysis has been carried out for Peninsular Malaysia during equinox by plotting graph of mean temperature versus state on different months. From Figure 1, the analysis revealed that the mean temperature in March showed significant increase from year 2011 to 2015 in all stations and Alor Setar recorded the highest mean temperature. The increasing in temperature from year to year has supported the finding from (Jaafar, 2016) who reported that Malaysia is exposed to the risks of climate change and global warming like most of the countries in the world. In addition, at the end of the 21st. century, the average surface temperature of Malaysia may increase by three to five degrees Celsius (National Weather Service, 2018). There is also a risk of sea level rise. Over the last forty years, Malaysia has faced both the rise in temperature (around 0.180 C per decade from 1951) and rise in the sea levels (Hashim, 2016). However, Malaysian Meteorological Department (2015) stated that the equinox is not a contributor to warmer weather because every year the highest temperature in Malaysia is recorded a week after the equinox. For example, the 40.1 Celsius temperature at Chuping, Perlis in 1998 occurred a week after the equinox. The shift to the Southwest Monsoon season has caused less rainfall and temperature increased, where coincidentally, the end of the Northeast Monsoon season has clashed with strong El Nino phenomena, resulting in rising temperature which lead to severe drought, dry condition and hot weather (Nik Ahmad & Hussain, 2015).

Furthermore, the reason of the highest temperature in north area (Alor Setar) recorded is caused by the low amount of rainfall and few numbers of rain days. In March, generally Malaysia is encroaching towards the end of Northeast Monsoon season where most areas are experiencing hot and dry conditions. Based on the amount of rain recorded, Peninsular Malaysia has received a total average to below average rainfall. The eastern and northern regions of Peninsular Malaysia recorded monthly rainfall less than 100 mm. However, central, southern and interior part of Peninsular Malaysia recorded rainfall exceeding 200 mm (Suparta, 2016).

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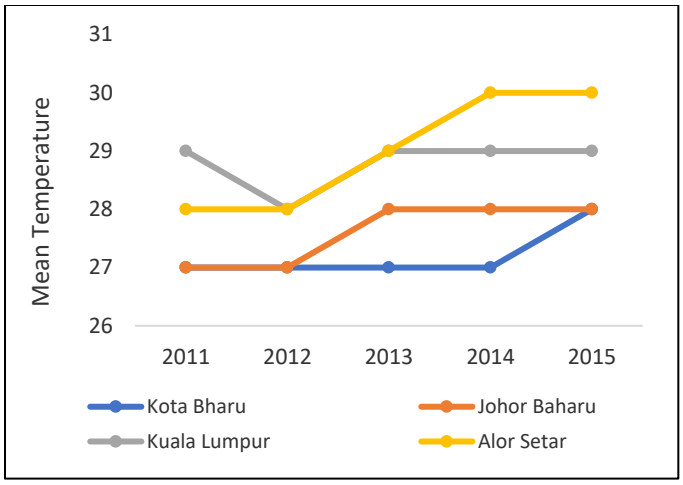

Figure 1: Mean temperatures in March for selected stations in Peninsular Malaysia

Figure 2 showed that, there is a decrease in mean temperature for Kuala Lumpur and Kota Bharu from year 2011 to 2012 (1°C) compared to Alor Setar and Johor Baharu. However, all the mean temperature of the states remained constant at value 28°C for three consecutive years (2013 to 2015). Almost all areas in Peninsular Malaysia, especially Kelantan, Terengganu, interior Pahang, Malacca and Negeri Sembilan received below average rainfall with total rainfall less than 200 mm. However, the northern Peninsular Malaysia experienced normal weather condition with total rainfall between 200 mm to 350 mm. The weather condition in September 2015 was affected by the tropical storms that occurred over the South China Sea, which has affected more dry weather on the east coast of Peninsular Malaysia, Sarawak and the coast of West Sulawesi. While the El Nino condition that continues to happen had affected rainfall patterns, particularly in eastern Sabah (Suparta & Yatim, 2015).

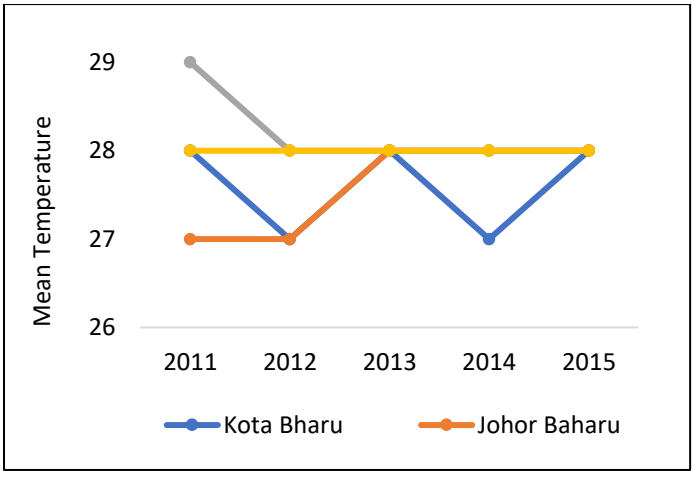

Figure 2: Mean temperatures in September for selected stations in Peninsular Malaysia

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4.0 CONCLUSION AND FUTURE WORKS

Generally, Peninsular Malaysia does encounter temperature variation during equinox. The equinox causes a spike in temperature as the solar radiation hits the earth directly. Without any doubt, Malaysia and the rest of the world experience warmer-than-usual climate during equinox (March 21). Besides that, this equinox phenomenon also gives a clear indication that the drought will occur in the region. Nevertheless, there are other factors that need to be considered in the rising of the temperature, such as El Nino phenomenon, amount of rainfall, number of rain days, Southwest and Northeast Monsoon seasons, just to name a few. The change of climate is very important in many sectors of life. Thus, phenomenal education by the authorities to the public must be intensified to raise awareness of effective early warning.

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