AN ANALYSIS OF CLIMATE CHANGE IN PENINSULAR OF MALAYSIA USING REMOTE SESING TECHNIQUES

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ABSTRACT: Climate change has become the most debated issues since the past few years and the issues remain as a major environmental concern until now. Among impact of climate change are changes in pattern of rainfall, density, duration and magnitude, which will then lead to extreme weather such as flood. Climate change will also lead an increase in temperature and causes drought events. Thus analysis of climate change is very important and the information can be used for the prediction of the occurrences of flood and drought. Remote sensing data of Tropical Rainfall Measuring Mission (TRMM) are used to analyze the spatial and temporal distribution of rainfall pattern for duration of thirty years, since 1979 until 2010 for Peninsular of Malaysia.

1.0 INTRODUCTION

Nowadays, our Earth is experiencing the effect of climate change and global warming due to natural causes or human activities. The rainfall and temperature is become uncertainty with changes in pattern, density, duration and magnitude. Refer to IPCC 2007, the average global temperatures increased since the mid of 20^{th} century due to the increase of greenhouse gas concentration. In 1990 until 2000, the global average temperature had increased of $1\text{-}4^{0}$C. This climate change may bring effects and impacts on physical, ecological, social or economic. Besides the uncertainty on weather, it also causes the mean sea level rise and snow cover melted on the Northern hemisphere.

Observation shows that climate change gives effects most on weather. The weather experienced changes in the amount, intensity, frequency and type of precipitation and lead to extreme events such floods, droughts, hurricanes, typhoons or cyclones. Decrease of rainfall and increase in temperature causes the water supply decrease and demand is increase with the rate of population. Study by Jlanying et al. (2007) and H. Xu et al. (2011) show that there is correlation between

annual runoff, temperature and precipitation. Therefore, water management became the most important for the whole region for sustainability of fresh water resources. Remote sensing provides a tool to monitor and model climatic and environmental change with the ability to observe the Earth in spatially and temporally. By monitor the changes in weather, the impacts and effects from climate change can be analyzed and at the same time, the planning for water resource can be managed adapting with time frame of 20 to 25 years. Many studies had been conducted to study the climate changes based on rainfall and temperature.

In this paper, the rainfall is observed spatially and temporally for duration of thirty years since 1979 until 2010 using Tropical Rainfall Measuring Mission (TRMM) data. It is important to study the variability of rainfall in Malaysia as it affects the water sources for human use, agriculture, industrial and also the water cycle.

2.0 STUDY AREA

The study area covers Peninsular of Malaysia located at latitude of 1-7^0 North and longitude of 99-105^0 East. Peninsular of Malaysia is consist of 14 states which surrounded by South China Sea on the East side and Strait of Malacca on the west side.

Figure 1: Peninsular of Malaysia as study area

3.0 DATA AND METHODOLOGY

3.1 Satellite Data

The Tropical Rainfall Measuring Mission (TRMM) data launched by NASA acquired for temporal of thirty-two years (1979-2010) each with 2.5^0 spatial resolutions. This data is downloaded in ASCII format for free from http://disc2.nascom.nasa.gov/Giovanni/tovas website.

3.2 Methodology

Methodology of this study is illustrated as Figure 2 below.

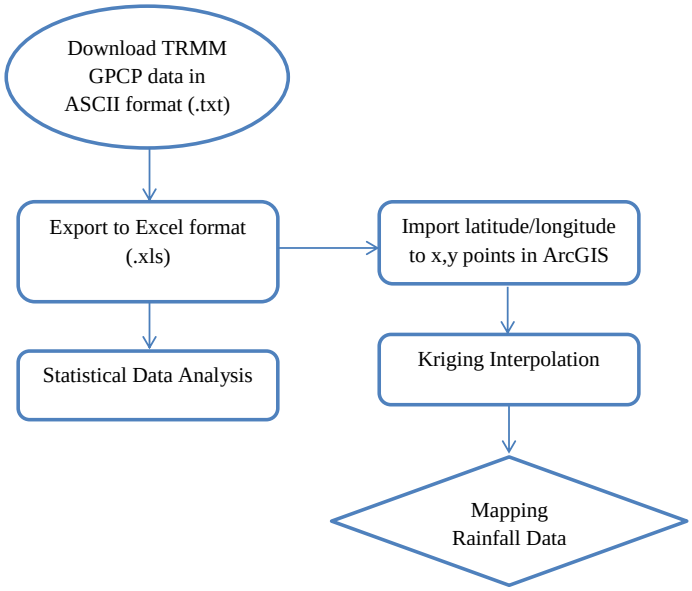

Figure 2: Flowchart of Methodology Used In This Study

TRMM GPCP data downloaded are in .txt format. For do analysis in Excel, the text file is export in Excel then imported to ArcGIS as in points for value of latitude and longitude. Then the x,y points are interpolated using Kriging to produce smoothed surface map.

4.0 RESULTS

The result in Figure 3 below shows the graph of accumulated rainfall in Peninsular Malaysia in unit of mm/year for period of 1979 until 2010 obtained from TRMM GPCP data.

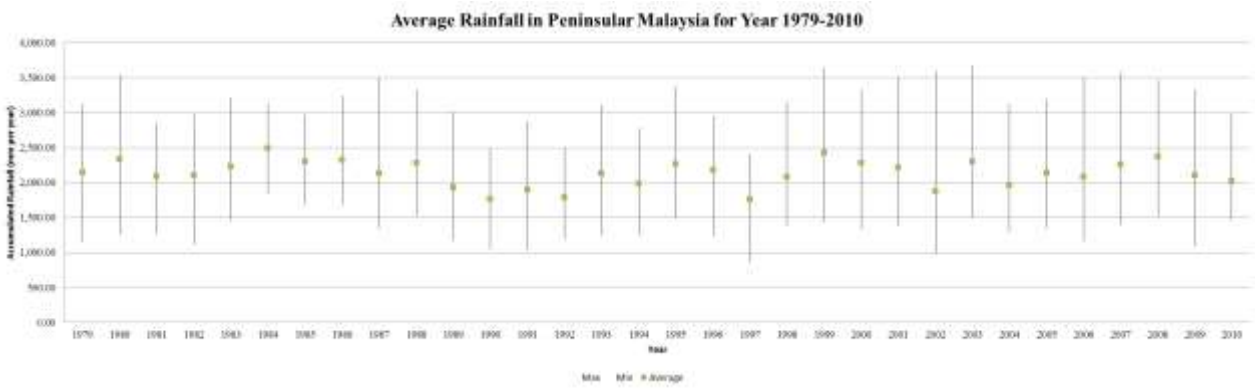

Figure 3: Graph of Accumulated Rainfall in Study Area for period of 1979 to 2010

From the graph, x-axis is year for period of 1979 to 2010 while y-axis is value of accumulated rainfall in unit mm per year of maximum, average and minimum value.

Figure 4: Total Rainfall in Peninsular Malaysia for period of 1979 to 2010

Bar chart in Figure 4 shows the total accumulated rainfall for duration of thirty-two years in unit of mm per year. The yearly rainfall value is accumulated from monthly data downloaded from TRMM websites.

5.0 DISCUSSION

Rainfall data for Peninsular of Malaysia for period of 1979 to 2010 was obtained from TRMM GPCP. An analysis from statistical data shows that Malaysia received high rainfall every year with range between 1,000.00-3,500.00 mm per year with minimum rainfall received in year 2002 and maximum in year 1984 with 28,081.62 mm per year and 39,812.95 mm per year respectively. In average, Peninsular Malaysia received high rainfall, for about 2,131.85 mm per year. In the early 90's, total accumulated rainfall was drop about 5,696.63 mm from 36,515.65 mm per year to 30,819.02 mm per year in 1989 and drop again to 28,196.07 mm per year in 1990. However, two consecutive years from 1997, rainfall increased abruptly to 5,203.39 mm and 5,532.44 mm respectively. During this wettest year, southern part of Peninsular Malaysia experienced great flood for almost three months. Overall, rainfall trends in Malaysia for thirty-two years show that linear trend line is negative to 29.84, meaning that the accumulated rainfall is decreased .

6.0 CONCLUSION

Analysis of temporal series of rainfall in Peninsular of Malaysia for period of 1979 to 2010 obtained from TRMM GPCP data. The analyzed results of the long-term change trends of annual rainfall over thirty years show that rainfalls have decreased. The amount of change in annual rainfall is significantly decreased since early 90's. In conclusion, rainfall quantity is likely affected by climatic change. There is correlation between temperature and rainfall.

7.0 REFERENCES

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