

CHAPTER 1

INTRODUCTION

1.1 Introduction

Rainfall occurs naturally and the patterns are unpredictable. It exists in several types which either occurred in highly volume of rainfall with shorter amount of time that covers small regions or a constant medium flow rate rainfall that occurs in longer period of time. In Malaysia, both types of rainfalls occur in various regions throughout the year. Malaysia have two monsoons, they are Northeast monsoon which typically starts on November to February and the Southwest monsoon that occurs on March until October. Heavy rainfall is normally happened in the Northeast monsoon where during this season, the stronger winds with more 30 knots take over east coast areas in Peninsular Malaysia which create colder condition than normal. Therefore, it is best to conclude that heavy rainfall takes place during the northeast monsoon season especially on the exposed areas on the east coast in Peninsular Malaysia (Met Malaysia, 2016).

Every year, as predicted, during the northeast monsoon, heavy rainfall occurs. However, due to the unexpected flood disaster in the recent years that washed out almost the entire area of Kuantan, it clearly shows that the weather in Malaysia has fluctuated over the years. The change in climate contributes the most in the rainfall variability and rainfall rate in Malaysia. Although some might believe that change in climate is natural, but the intense increment of the Earth temperature leads the scientist to believe that it is scientifically related. Anthropological effects that came mostly from humans are the major cause that leads to global warming such as fossil fuels combustions from vehicles, factories, open burning, the greenhouse gasses (GHGs), industrial processes and landfills. Wilby *et al.* (2002) believed that the climate implications to the global and regional are very much related to the emissions of GHGs.

Some of the GHGs emitted are causing the global warming such as carbon dioxide. This gas is responsible to the most warming condition. Other than that, methane is also one of the contributors to the global warming which caused from the composts, refrigeration utilized gasses, the procedures of mechanical and logging. Chlorofluorocarbon is thinning the ozone layer too but the concentration isn't as great as carbon dioxide which making the carbon dioxide is the number one that caused global warming. IPCC (2009) recorded the increment of 0.74% in temperature for the past century that occurred because of the GHGs which also cause in the increment of rainfall intensity. Atmosphere-Ocean General Circulation Models (AOGCMs) predicted that the increment in temperature for Malaysia also very much affected especially during the northeast monsoon.

1.2 Statement of Problems

In December 2013, east coast Malaysia received an abnormally high volume of rainfall within few days that cover the actual value for the whole month in the previous year three times higher. One of the places that were badly affected was Kuantan. Due to the high intensity in the rainfall, flood disaster occurred and washed out almost the entire city which coming from the Kuantan river basin along with the high tide from the ocean. The heavy volume of surplus runoff made the Kuantan River could not hold its capacity thus create heavy overflow to the low laying areas (Akbari *et al.*, 2014).

The whole flood incident took every piece of these civilians' own with the total number of victims of 50,000 people. Even before the flood incident, every related stakeholder had prepared for the disaster and the whole save and rescue victims to different shelters that have been prepared started right away once the water level elevated. These shelters included school hall, community hall and many other places (Malaysia Kini, 2013). The flood disaster limited the access to the affected areas including the east coast highway which forcing the public to use the alternative ways. Akbari *et al.* (2014) wrote that Kuantan River is the main factor that caused the flood due to the continuous rainfall and this incident occurred repeatedly over the past decades and it is believed that the climate change is related to the fluctuated weather especially in the rainfall variability.

While the global warming is unavoidable and mainly factored due to the emission of GHGs especially carbon dioxide which every scientist believe that it is the main reason for the climate change, there are many other ways that researchers nowadays could do to avoid the same flood incident to occur such as river alteration to enable it to manage the variation of the future water flow. Drainage system along Kuantan River and along the low laying areas could also be improved for better irrigation system. Not only to avoid the flood incident but also for better irrigation on agriculture and agro-based field. Minimization the land use contributes a lot in avoiding the flood incident. We are living in fast globalization and people are competing in producing better and more structure which making the land use reached its optimum capacity and the quality getting poorer each day passes.

Just as important as the other possible way to help reducing the probability of the flood, future climate prediction also enables to predict the future rainfall variability and changes for us to alter and settle in for better solution for this problem. Future climate prediction is using one of the climate model, General Circulation Models (GCMs). But, due to the coarse resolution in the output, it does not help in the prediction in finer resolution or locally. Therefore, the downscaling technique is used to refine the coarse resolution output from the GCMs. For this study, the downscaling used is the statistical downscaling, using the model Statistical Downscaling Model (SDSM).

1.3 Objectives of the Study

The purpose of this study is to predict the rainfall variability and changes for Kuantan river basin using Statistical Downscaling Model (SDSM) in the year of 2040-2069 using historical data from the past 30 years. This study covers the following objectives:

- i. To evaluate the performance of Statistical Downscaling Model as a climate agent.
- ii. To predict the long term trend of rainfall at Kuantan river basin in the year 2040-2069.