Chapter 1

Introduction

1.1 The Importance of Rain

To develop the national economy and socicty is a significant task for every country, especially the developing countries. Since the economy most developing countrics dcpcnd on agriculture, it's necessary for agriculture to be first developed in order to effectively strengthen the economic and social system of the nation. Water is essential factor for life and development. Lacking water, development is obstructed. In Thailand, the water supply has been developed continuously. Embankments and dams have been constructed nationwide. The governments have tried to expand all projects involved in water supply in order to support the agricultural sector, the industrial sector and the energy supply of the country. Still, water in Thailand is insufficient to meet the demand of its citizens. Furthermore, most agricultural areas in Thailand still need rain as their major water supply (The Royal Rain Division, 1992). Agriculture in Thailand is only feasible in the appropriate season.

Thailand is one of the biggest agricultural producers. Most Thai agriculturalists have faced the problems of climatic changes, especially the changing level of rainfall (Raktabut, 1981: 80). In Southern Thailand, the long peninsula between the Pacific and an area with year-long rainfall, the quantity and the distribution of monthly and annual rainfall on the eastern and western sides are different. Two important factors that causc this difference are the geography of the south and landscape and climate, and the different types of rains in the south. (Arpakapakul, 1983: 1)

Pattani covers a land area of 2,013,194 square kilometres. It lies between latitude 6°32′-6°57′N, and longitude 101°01′-101°45′E, bordered to the north by the Gulf of Thailand, to the south-west by Narathiwat Province, to the south and to the south-west by Yala Province and to the west by Songkla Province. Pattani is affected by thc North-East monsoon during November till February and the South-West monsoon during May till September. The remarkable landscapc of Pattani is characterised by its lowland plain area: a large flood plain with scattered small hills in the southern part of its area. A wide range of hills border Pattani, Yala and Narathiwat Provinces. (Ninrat,

1982: 1-2) This brings Pattani a 7-month period of high rainfall and a 5-month period of drought on average.

There are 12 meteorological stations in Pattani. These are as follows:

- Pattani meteorological station (580001),
- Sai Buri meteorological sub-station (580002),
- Yarang meteorological sub-station (580003),
- Khok Pho meteorological sub-station (580004),
- Panare meteorological sub-station (580005),
- Mayo meteorological sub-station (580006),
- Nong Chik meteorological substation (580007),
- Yaring meteorological sub-station (580008),
- Kapho meteorological sub-station (580009),
- Mai Kaen meteorological sub-station (580010),
- Khok Pho meteorological sub-station (580011),
- Pattani Airport meteorological sub-station (580201).

(Uyuenyong, Nomparatkrailat and Hemsuhree, 1990: 77-78)

Pattani is divided into 12 districts, with 2 new districts. As a result, the number of climatic measurement stations was recently increased by two as follows:

- Thung Yang Dang meteorological sub-station (580012),
- Mae Lan meteorological sub-station (580013),

Pattani is in the southern part of Southern Thailand lying itself close to the Gulf of Thailand. It is affected by the South-West and the North-West monsoon, which brings humidity to the land. As a result, high rainfall is found in this area the whole year. Because of the sufficiency of water supply, most Pattanians are farmers. Normally, an area prevailed upon by the two monsoons is defined a tropical climate zone. However,

Pattani still cannot be defined as such because a marked variation of rainfall in Pattani is found every year, especially from June to September.

In some years, there is a paucity of water supply for crops, while in other years, ample quantity of rainfall causes flooding, which brings about a collapse in cultivation and shoreline farming in Pattani.

To invest in agriculture during the rainy season, collecting and analysing data on the quantity of rainfall to find out the predictive equation of the distribution of rainfall is beneficial. It is a mechanism to stop these possible misfortunes.

Moreover, it is advantageous for future investment in agriculture. Also, the influences of rainfall on flooding in Pattani would be studied. The problems above inspire the researcher to do research on the modelling of the distribution of monthly rainfall in Pattani Province over the last 20 years (1982-2001). The researcher hopefully expects that all information collected can be used for solving problems about the inconsistent quantity of rainfall in Pattani. (Uyuenyong, Nomparatkrailat, and Hemsuhree, 1990: 77-78)

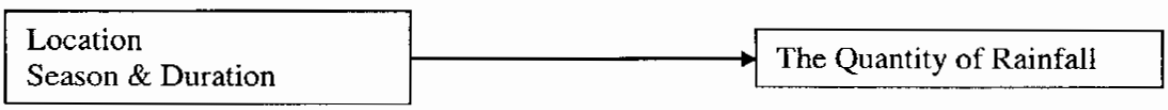
1.2 Objectives of Study

1. To study the spatial and temporal distribution features of rainfall over the last 20 years.

2. To study whether the distribution feature of rainfall in each season are related to the location of rainfall over the last 20 years.

3. To study the change of the distribution feature of the rainfall in each season over the last 20 years.

Conceptual framework



1.3 Relevant Theories and Research

Quantity of rainfall

Quantity of rainfall each day means the amount quantity of the rain which falls from 7 a.m. of a day to 7 a.m. of the next day (for example, the quantity of rain of January the first is the quantity of the rain falling from 7 a.m. of January the first to 7 a.m. of January the second) which is measured at 7 a.m. daily. The unit of the measurement is the millimetre (Auprasitwong and Jampon, 2001: 5).

Causes of Rain in the South of Thailand

1. The uncertainty of the air mass, which is caused by taking heat vertically, can cause heavy rain in hot seasons during March and April. This causes heavy rain somewhere but not frequently along the coasts usually having resident wind blowing towards the shores.

2. The monsoon, directed towards the land including North-East monsoon and South-West monsoon, causes rain, which is called monsoon rain.

3. A monsoon trough or trough of low pressure in the areas in which the North-East monsoon collides with the South-West monsoon. This is a cause of heavy rain.

4. A tropical whirlwind, which is a natural phenomenon, has counter-clockwise wind directing towards the centre which has low pressure. The South usually has tropical whirlwinds during October and December. Tropical whirlwinds can cause strong winds and heavy rain around the centre of the whirlwind. (Arpakapakul, 1998: 5)

Features of the rain in the South of Thailand

There are three features of the rain in the South as follows:

1. Convectional rain is caused by vertically combined clouds. It usually falls on windless and sunny days. On this day, ground temperature relative humidity are high and hot air mass lifting up vertically and rapidly. Water vapour composes itself to be clouds. The temperature decreases with the height until the water vapour finally condenses to be rain. This kind of rain falls in limited areas with various quantities as the sizes of cloud. While the rain is falling, the wind usually blows towards the combined clouds, with lightning, and thunderclaps or thunderbolts. These events are

called thunderstorms. Sometimes, there is hail falling as well. In hot seasons of April to May, this kind of rain usually falls.

2. Orographic rain or relief rain is caused by the vertical from places that have evaporation of water until the relative humidity saturated. When the wind collides with a mountain range being obstructed by the wind, the wind will be lifted up higher than the heights of the mountains. Then, water vapour is combined and condensed to be rain. The rain will fall along the hillsides. The quantity of rain water is usually large at the wind withstood side and there is a small quantity at the end of the wind. The wind blowing towards the back of the mountain has higher temperature and has a small quantity of rain water or is without rain water. This area is called the rain shadow. The mountains of the south have abundant forests so this kind of rain can fall almost all year long. Cyclonic rain is caused by an air-mass moving forward the centre of low pressure but the direction is deviated by the Coriolis force. This is a cyclone. If the velocity in the centre is within 33 knots (61 km/hr), it is called a depression, if within 33-64 knots (62-117 km/hr) it is called a tropical storm, and if over 64 knots (117 km/hr) it is called a typhoon (for the China sea), cyclone (for Bengal), hurricane (for the Caribbean sea), or a tornado (in North America).

If there is any kind of whirlwind, there is a sprinkle of rain up to hard rain. As a result the rain falls in a large quantity. It is the high average rain period, which is an important composition of the climate.

In the South, there is heat-carried rain between February and April especially, in areas far from the sea, such as the plain in the middle of Nakhon Si Thammarat mountain range and the southernmost of Sankala Kiri mountain range. There is mountain–struck rain in the beginning of the monsoon period in both the east coast and the west coast between May and June.

Quantity of rainfall in the South of Thailand in each season

In the South, in the west coast 72% of rain falls in the rainy season, 11% in summer and 17% in winter. However, in the east coast, 42% of rain falls in the rainy season, 7% in summer and 51% in winter. These show that in the South, summer is more barren than winter since in winter, the rainfall from the rainy season, which still remains in the rivers and the canals, moisturising the area. Besides, the application of

water in winter is less than in summer. On the other hand, in summer, there is little water remaining from winter and the high temperature with the great heat of the sun evaporates the water quickly, and therefore, summer is a season of drought and there can be a lack of water (Wongwitawat, and Auprasitwong, 1991: 6-7).

Rainfall and Climate zone in Pattani Province

The monthly rainfall of 14 stations in Pattani Province over 13-18 yearss of collection shows the maximum average yearly rainfall of 217.94 cm is at Mai Kaen station, while the minimum value of 113.87 cm is indicated at Khok Pho station. The climate at 11 stations is tropical wet and dry and the other three of Sai Buri, Mai Kaen and Kapho stations are tropical monsoon. The rainfall during southwest monsoons is distributed between 24.36 to 85.36 cm, while that during northeast monsoons and east wind or south wind are 39.34 to 148.16 cm, and 0 to 23.38 cm, respectively. According to the distribution of rainfall, three seasons can be defined on the eastern coast of southern of Thailand south of Surattani Province. Dry or low rainfall season is between January and April, the moderated rainfall season is between May and September and the high rainfall season is between October and December. (Hemsuhree.1997: 495)

Analysis of rainfall

Wongwitawat (1980) defined the kinds of rain in the monsoon zone based on the quantity of daily rainfall as follows:

less than 0.1 mm	unmeasurable
0.1-10 mm	small quantity
10.1-35.0 mm	medium quantity
35.1-90.0 mm	heavy rain
over 90.00 mm	very heavy rain

Taesombat (1988) said that the study and the basic analysis of the data of rainfall in a strong period can be divided into three types.

1. Point or station analysis

    1.1 The estimation of missing data of rainfall can be done through three methods

(a) finding the average of related data from at least three neighbouring stations.

(b) finding the missing data by drawing isohyets

(c) finding the missing data by normal ratio method

1.2 Double mass analysis can always be used to examine the consistency of data of rainfall. This can be done by comparing the annual collective amount of rainfall from the station that you want to examine with the annual collective amount of rainfall from neighbouring stations. When you plot the relation between the annual collective amount of rainfall from the station on a graph, if the curve is straight and the degrees of the slope are steady, the data are believable. But if there are many different degrees of slopes, the data from the station that you want to examine is unbelievable. Before using the data it must be improved by adapting the degrees of slope from the graph for use with the faulty data.

2. Time distribution analysis can be done by copying automatic rainfall measuring devices. The analysis can be done by copying hourly data and then calculating to find out the collective hourly data and the time when there is rain. The graph of collective hourly data and the time is called the "rainfall mass curve", which tells us the time and intensity of the rainstorm or the time of different density of rainfall. The comparison of each rainfall mass curves of the same rainstorm can also tells us the direction of movement of the rainstorm.

3. Areal distribution analysis is taking the information of rainfall from many stations to analysis finding the average rainfall in the area. It can be done through change methods

3.1 The arithmetic method is a method used to find a simple average mathematically by adding up the amount of rainfall from every station and dividing by the numbers of stations. This method is effective when there are many rainfall measuring devices and they are placed distributionally in the plain area. It may also be effective when placing rainfall measuring devices very densely in basic areas or low-lying areas on mountains.

3.2 The thiessen method is a method to find out the average by drawing polygons around the rainfall measuring station. The polygons can be drawn from the right angles, which are drawn from the diameter lines of the station. We all use the areas of the polygons to weight the data. The average amount is the result of multiplying together the amount of rainfall from the middle of the polygon and the total area of the polygon that surrounds all rainfall measuring stations and dividing by the basic area. This method can be used in an area which has no geographic effect.

3.3 The isohyetal method can be carried out by drawing isohyets around the area. We can find the average amount of rainfall by weighting the area with the amount of rainfall between the isohyets lines and dividing by the area of the basic areas. This method can be used in every kind of area but there should be an experienced officer, enough information on the area and enough time. These methods also tell us the geographic effect on the amount of rainfall.

3.4 The facet method is a method which can be used in mountainous areas or areas that have geographic effects. The method begins by dividing the area into zones according to the height of the area. Then, divide into small zones according to declines of the area and divide into smaller zones according to the slopes. After that, find out the centre and set the rainfall measuring device to find out the average by using the size of the area around the rainfall measuring device as the weight (Jankeaw and Tangtham, 1982).

Definitions of terms in the research

Rainfall: the amount of rain that falls from the upper atmosphere to the ground and can be measured by rainfall measuring devices.

A rainy day: For the 24 hour period from 7 a.m. of a day to 7 a.m. of the next day, the amount of rainfall must be over 0.1 millimetres.

Rainy season: a period of every year having a lot of rain and always be followed by a drought period.

Drought season: A period of continuous dry weather without rain

Af (Tropical wet climate): The amount of rainfall in the driest month is not over 6 centimetres.

Am (Tropical Monsoon Climate): the amount of rainfall in the driest month is less than 6 centimetres.

Aw (the tropical wet and dry climate): the amount of rainfall is less than in the hottest month.

(a=10–(r/25) and r = the average of the annual amount of rainfall measured in centimetre units (Hemsuhree, 1997: 497))

The area of research

In this research, the researchers focus their attention on the types of the distribution of rainfall and build the model of the distribution of rainfall of each month for 14 stations in Pattani in the last 20 years. The researcher collects the data of the daily amount of the rainfall from 14 stations for 1982-2001. The first 19 years from 1982 to 2000 are used for calibrating the model, and the model can then be compared with the data using the observed rainfall in 2001. The collection of the amount of rainfall is accumulated into 5-day periods. The reasons for using 5-day periods are because

(a) this technique reduces the proportion of periods with no rainfall

(b) it reduces the correlation between data in successive periods

(c) it reduces the amount of data to be analysed

(d) it gives a whole number of periods in one normal year (73)

So there are 73 periods in each station in 1 year.

Independent factors: consist of the stations and the years which collect the data.

Dependent factor: the amount of rainfall.