Chapter 5

Conclusion and Discussion

The conclusions are presented and discussed in this chapter. In the following section, the results for each of the objectives of the study are described.

Conclusions

For this study, the research investigated how climatic factors influence the incidence of Dengue Haemorrhagic fever in Southern Thailand. The outcome variable is DHF incidence and the determinant variables include rainfall, rain days, maximum temperature, minimum temperature, and humidity. The data were collected retrospectively during 1978 – 1997 and we selected two provinces from the west coast and two provinces from the east coast. The first objective was to determine the climatic factors influencing the occurrence of DHF and to compare the climatic factors between the west and east coast of Southern Thailand. The second objective was to develop a model for forecasting rainfall and DHF incidence using time series analysis.

From comparison of DHF incidence and rainfall by location, it was found that DHF incidence of the west and east coast were not different over the 1978 – 1997 period. However, the seasonal pattern of DHF incidence between the west coast and east coast was similar. The occurrence of DHF was lowest in December and April, and highest in June, July and August. The occurrence of DHF in the west coast was higher than that of the east coast. The pattern of rainfall between the west coast and east coast was not different, but a variation in rainfall pattern in the east coast was found to be more than that of the west coast. Furthermore, the seasonal patterns of rainfall between the west coast and east coast were different. High rainfall in the west coast occurred during April to November and low rainfall in December, while in the east coast the highest peak of rainfall was in November. DHF incidence was found to have a weak correlation with rainfall for the four provinces with highest r^2 of 0.459 for Krabi and lowest r^2 of 0.143 for Nakhon Si Thammarat.

Finally, the bivariate time series of rainfall for all provinces were stationary but the bivariate time series of DHF incidence for each province was not stationary.

The climatic factors influencing the incidence of DHF

The influence of the climatic factors on DHF incidence was then investigated by using time series analysis. It was found that in Krabi, after fitting the model with the16th and 32th harmonics, maximum temperature was found to be statistically significant. For other climatic factors including rainfall, rain days, minimum temperature and humidity, these were not statistically significant.

For Trang, as the DHF incidence data was not stationary it was necessary to remove the trend before fitting the model at the 20th and 40th harmonics, and it was found that all climatic factors used in this study were not statistically significant.

For Nakhon Si Thammarat and Songkhla, when fitting with the model at the 20th harmonic, rain days were found to be statistically significant. For other climatic factors including rainfall, maximum temperature, minimum temperature and humidity, these were not significant.

Comparison of the climatic factors influencing the incidence of DHF between the west and east coast

For the west coast, which includes Krabi and Trang provinces, it was found that maximum temperature was found to influnce DHF incidence in Krabi alone.

The models of DHF incidence for Krabi and Trang provinces are as follows:

Krabi

signal: $y(t) = -3.013 + 0.0055\, x_1(\text{maximum temperature})$

$+ 0.584 \cos(16at+2.2764) + 0.1388 \cos(32at-0.2504) + z(t)$

noise: $z(t) = 0.58\, z(t-1) + 0.26\, z(t-2) + w(t)$

Trang

signal: $y(t) = -2.255 + 0.0049\, t\,(\text{trend}) + 0.38\cos(20at+2.306)$

$+ 0.116\cos(40at-0.808) + z(t)$

noise: $z(t) = 0.90\, z(t-1) - 0.12\, z(t-2) + w(t)$

From the model, we can forecast only Krabi province with white noise. The DHF incidence rates for Krabi in each month for 12 months were 22.32, 34.06, 34.78, 19.32, 7.57, 3.42, 2.64, 3.57, 6.26, 10.54, 15.97, and 24.6 respectively.

For the two provinces in the east coast, rain days were found to influence DHF incidence. The models of DHF incidence for Nakhon Si Thammarat and Songkhla are as follows:

Nakhon Si Thammarat

signal: $y(t) = -1.3758 - 0.005\, x_1(\text{rain days}) + 0.488 \cos(20\, at+2.0052) + z(t)$

noise: $z(t) = 1.085\, z(t-1) - 0.25\, z(t-2) + w(t)$

Songkhla

signal: $y(t) = -1.59 + 0.0063\, x_1(\text{rain days}) + 0.324 \cos(20\, at+1.9508) + z(t)$

noise: $z(t) = 0.97\, z(t-1) - 0.11\, z(t-2) + w(t)$

From these models, we can forecast only Songkhla with white noise. The DHF incidence rates for Songkhla in each month for 12 months are 232.43, 212.67, 163.95, 108.62, 65.52, 39.41, 26.1, 20.51, 19.97, 23.68, 32.1, and 45.14 respectively.

Discussion

From this study, we found that maximum temperature is positively correlated with DHF incidence in the west coast of Krabi only. This result is in accordance with that reported by Kuno (1997) that peak transmission occurs in the particular months of the year having high rainfall and high temperature. Furthermore, the ambient temperature is of importance in dengue transmission. However, none of the factors were statistical significance for Trang. In Trang the trend of DHF incidence was to increase (5%) over the twenty-year period.

For the east coast, rain days were found to be positively correlated with DHF incidence in Nakhon Si Thammarat and Songkhla. This is consistent with results reported by Kuno (1997).

These results are possibly due to difference in province area, population distributions in each area and control measures for DHF. In addition the Division of General Communicable Diseases Control has revealed that the DHF incidence has a variable seasonal pattern.

Therefor climatic factors influencing DHF incidence between the east coast and west coast are different due to the geographical location, the monsoon effect and seasonal pattern.

Limitations and Suggestion for further studies

The limitations of the study are as follows:

1. The climatic data were recorded daily and averaged by month over all meteorological stations in the province.

2. The factors related to the incidence and transmission trends of DHF in the Southern region of Thailand include the climate parameters but also human behaviour, mosquito breeding site and density and dengue virus transmission in the mosquito (*Aedes aegypti*).

3. In addition, reported cases of DHF were the only clinically diagnosed cases at hospitals.

Factors including larval density, breeding sites, human behaviour and transmission of dengue virus having accurate results should be taken into account to provide a better understanding of factors influencing DHF incidence. The study should be extended to include more provinces. Data should be obtained for smaller geographical regions.