CHAPTER V

1. DISCUSSION AND CONCLUSION

The monthly values of the effective earth radius factor, k, at Chiengmai, Bangkok and Songkhla are calculated using the radiosonde data during the period from 1954 to 1960 made available by the Meteorological Department, Ministry of Communications. From the monthly values, the fifty per-cent of the time value of k is evaluated and found to be 1.59. This value is supposed to be the representative value applicable to Thailand since the atmospheric data are taken from various geographic location of the country. However, it should be mentioned that, strictly speaking, the usage of k is limited to the region within one kilometer above the earth's surface owing to the fact that the profile graphs and gradients of refractivity are drawn and evaluated, repectively, in that region. This is reasonable since the VHF or Microwave link, especially between ground station, involves radio wave propagation which is normally restricted to the lower troposphere close to the earth surface. If, however, one is interrested in extending the resulting value of k to higher elevation, he may do so by re-evaluation using the data and procedures described in this thesis.

The value of N and k are closely related. To obtain the exact value of k, N must possess high accuracy. In addition, the long-term average value of N at various elevations should be employed in calculation. This can be done by calculating the daily value of N from daily values of observed atmospheric data and then averaging over many years

period. Unfortunately, only the long-term average values of temperature, pressure and humidity are available, and consequently the value of N found in this thesis is an appearent average. This appearent average differs from the true average since the inter-correlation of pressure, temperature, and humidity is neglected. Bean and Dutton*(11) explained that the difference between the two methods is about 1.5 N unit.

The k factor depends on the temperature, pressure and humidity which vary both in time and space. The seasonal and geographic variation of 20 to 100 N units are observed in this thesis. The systematic in variation is not quite trivial due to the method in obtaining the appearent average value of N instead of the true average as mentioned previously. However the observed variation of k may be explained as follow.

Refer to Table 3, the value of k in Bangkok during the period between February and June has small variation. During this period, the percentage humidity is not high and the changing of weather condition is rather smooth. During the period between June to the end of October the variation of k is very large. It is the rainy season so the humidity is high and the weather condition are changed all the time.

At Songkhla the values of k obtained have little variation since it is located beside the sea. The vapor content is very high and the temperature close to the earth surface also has little variation, especially during the time of measurement of atmospheric data.

The values of k for Chiengmai have much more variation than that for Songkhla and Bangkok. Chiengmai is located at the elevation of 314 metres above the mean sea level. Between December and the end of January it is very cold and the weather is dry. During this period k is nearly constant. During other period, k becomes larger. This may be due to the higher humidity during the hot season which last from February to the end of April. During rainy season, the weather is more humid, and so are the higher values of k.

The values of refractivity, N, obtained in this thesis are compared to the standard values in Table 9.30 - 9.35*(12) which is calculated at different standard pressure by digital computer. It is found that they are very close. The difference is not exceed 5N unit. The calculated values of N are also very close to that published in the world wide contour map.*(13) From these comparison it may be concluded that thevalues of N obtained in this thesis is reasonable, and so is the value of k.

The fifty per-cent of the time value of k, which equals to 1.59, is higher than $k = \frac{4}{3}$ or 1.33 which is normally used in temperate country. This is approximately 19.60 per-cent higher. This means that in Thailand the effective earth's radius is longer or the earth is flatter than that in temperate countries. So with the same antenna height, the radio line-of-sight distance in Thailand is farther than that of temperate countries. Stating in another way, with the same coverage needed by direct wave, the required antenna height used in Thailand is shorter than that of temperate countries.

In addition, the divergent factor of the reflected wave from the spherical earth is larger in Thailand indicating that the signal received is stronger.

From all these points of view, the radio communication can be planned with more economic.

This thesis also tabulate the monthly variation of the surface refractivity, N_s, at various locations. The seasonal and geographic variation will be very useful for radio engineers in predicting the strength of the received signal and the fade margin required can be recommended.

Pickard and Stetson*(14) note the correlation of N and received field strength. The correlation of N and field strength over a particular path has been studied quantitatively*(15) and found to be highest (correlation coefficient of 0.8 to 0.95) when the variables are averaged over periods of a week to a month. The latter study has shown that the regression coefficient (decibel change in field strength per unit change in N_s) varies diurnally from 0.14 dB in the afternoon hours to 0.24 dB per unit change of N in the early morning hours. Norton*(16) utitize this correlation in the prediction methods of transmission in a band of 100 to 50,000 MHz. In addition, the coefficient of 0.2 dB per unit change in N has been tentatively adopted by CCIR Study Group V in their revision of 30-to 300- MHz tropospheric-wave propagation curve to account for the geographic and seasonal variations of field strengths.

2. RECOMMENDATION FOR FUTURE WORK

Since the whole in this thesis is limited to the finding of the effective earth radius's factor, k, suitable for the troposphere in Thailand, based on the long - time average atmospheric data. There exists some work that should be carried on in the future.

i) Re-evaluate the value of k using recent available daily data of the atmosphere. Collect the result over a period of several years and re-calculate the fifty per-cent of the time value. This is the more appropriate approach, then, compare the results to check the accuracy of the k value obtained in this thesis. It is expected that the discrepancy should be very small, i.e., on the order of several N units.

ii) Experimentally, verify the values of k obtained in this thesis. This can be done by collect the propagation data and study the path losses between the transmitting and receiving stations. By correlating the received field strength to the refractivity,*(14) the accuracy of the work in this thesis can be checked.