CHAPTER I

INTRODUCTION

It is well known that the propagation of radio-waves of frequencies greater than 30 MHz is greatly influenced by the meteorological conditions in the transmission path. The radio energy of the radio spectrum above 30 MHz is not normally reflected by the ionosphere, wave will bend down when propagate throught the lower atmosphere of different radio refractive index. To account for the effects of atmospheric refraction of radio waves, an effective earth's radius, $a_e = ka$, is assumed where a is the true radius of the earth and k is the effective earth's radius factor. It is assumed that an effective earth is suitably larger than the actual earth such that the curvature of radio ray is absorbed in the curvature of the effective earth and the ralative curvature of the two remains the same, thus allowing the radio rays be drawn as straight lines over the assumed earth rather than curved ray over the true earth. This method permits a tremendous simplification in many practical problems of radio propagation engineering.

The effective earth's radius factor,*(1) k, is

$$k = \frac{1}{1 + \frac{a}{n}\frac{dn}{dh}\,\text{Cos}\,\theta}$$

where

a	=	the true radius of the earth
n	=	radio refractive index
$\frac{dn}{dh}$	=	gradient of refractive index with hight
θ	=	the angle between ray path and the surface of constant refractive index

For propagation in troposphere,[*(1)] θ is small and n is normally very close to unity, therefore cos θ and n may be set equal to 1. Consequently k becomes.

$$k = \frac{1}{1 + a\frac{dn}{dh}}$$

Radio refractive index depends on temperature, atmospheric pressure and vapor pressure. The atmosphere is not uniform, it is turbulent, temperature and humidity caused constant fluctuation. The refractive index fluctuates both in time and space. At the surface of the earth the value of the refractive index is highest and gradually decreases as the height from the earth surface is increased.

Since the gradient of refractive index of the atmosphere varies geographically, it is interesting to find the value of the effective earth's radius factor, k, which is appropriate to the atmosphere in Thailand. If k equals to the value that is commonly used, i.e., k = 4/3,[*(1)] it confirm that the communication systems planning calculation in Thailand is correctly done. If k differ from 4/3 it will explain the radio wave propagation problems encountered in Thailand. In addition the telecommunication systems such as tropospheric scatter and microwave link can be planned with more accuracy and economy.

Calculation for the value of k, the data of temperatures, atmospheric pressures and dew-point temperatures measured at different height from the earth surface are used. These data are observed every day at 0.00 GMT by the Meteorological Department, Ministry of Communications. The balloons carrying radiosondes are sent with 300 metres per second ascending rate at Songkhla, Bangkok, Chiengmai and Ubon Ratchathani. The data at different levels were sent back, by radiosonds to the ground receiving station.

This thesis is concern with the evaluation of k factor from the observed data only at Songkhla, Bangkok and Chiengmai during the period from 1954 to 1960. This is due to the fact that only the data at those location and during that period are made available by the Meteorological Department. Unfortunately, it is learned that the data at Ubon Ratchathani during this period is missing and no radiosonde measurements were conducted in other provinces beside those mentioned.

The continuous signals of atmospheric pressure, temperature and humidity are sent from the radiosonde carrying in the ascending balloon. The absolute height of balloon from the earth surface can not be known from the graph. However, the atmospheric pressure and height are related so that the measured pressure can be changed to the absolute height, and using the measured temperatures and humidity as correction factor of errors. The Meteorological Deperament present the data of temperature, pressure, humidity and height at the international standard levels. They are at the earth surface and different isobars namaly 1000 mb, 850 mb, 700 mb, 600 mb, 500 mb, 400 mb, 300 mb, 200 mb, 150 mb, 70 mb, 50 mb, 30 mb, 20 mb, 10 mb, and 5 mb.