CHAPTER - VI
CONCLUSIONS

6.1 Introduction

Since the beginning of man, there has been a desire to forecast the future. The advent and evolution of science and technology has made predictions in many areas possible. In fact the successful scientific predictions in areas such as meteorology or astronomy have heightened the expectations of the scientific society. Physicists and geologists are under tremendous pressure to predict climate change and environmental problems. Various factors like the green house gases loading, aerosol loading, ozone depletion, increasing surface ozone, acid rains are influencing the climate change. The main goal of this thesis has been concerned on diurnal and seasonal variation of surface ozone over a tropical region. In this thesis linear and non linear forecasting model were used to predict the surface ozone.

6.2 Summary

Surface ozone was measured by portable aeroqual ozone meter in Chennai in 2011 to 2012 with other meteorological parameters like temperature, wind speed, and relative humidity. The relationship of meteorological parameters such as relative humidity, wind speed and temperature were developed by regression analysis.

In time series data, time series is classified as persistence or anti persistence, was carried out by Hurst and Fractal dimension analysis. Chaotic behavior was analyzed by Lyapounav exponent. Based on the mathematical
analyses the surface ozone was forecasted by four methods. They were CD, ARIMA, ANN and ANFIS.

Total ozone column (1995 to 2005) and rainfall (2000 to 2010) of Kodaikanal data also gathered and analyzed. Based on the mathematical analyses the TOC and rainfall was forecasted by CD and ARIMA model.

Based on this study, the following conclusions are made. The conclusions from 1 to 13 are concerned with the surface ozone. The conclusions from 14 to 17 are concerned with TOC and rainfall.

1. We were the first researchers visited most of the district of Tamil Nadu state and measured surface ozone. We had made an effort to identify areas where there was elevated surface ozone concentration.

2. An hourly and daily mean value of surface level ozone concentration in Tamil Nadu was 0.0109 ppm and 0.0108 ppm respectively.

3. The highest surface level ozone concentration was in Kanyakumari district (0.0179 ppm). The lowest was in Cuddalore district (0.0038 ppm).

4. The results of this study showed that surface level ozone concentration has a positive correlation with the temperature and negative correlation with the relative humidity and wind speed.

5. The surface ozone concentration has a diurnal cycle as surface ozone is being gradually increased at day time and decreased at night time. The highest value has been measured at around 1500 hours in the day time.

6. Surface ozone is increasing in summer season only (April and May) compared with other seasons. Thus in chapter II, we have confirmed that surface ozone has both diurnal and seasonal variations.
7. During the study period, the concentration of surface ozone over Tamil Nadu had never exceeded the prescribed national ambient air quality standard value of (0.075ppm).

8. Hurst exponent for the Chennai surface ozone was found to be 0.516, this means that the phenomenon was very low degree of persistence and, it was very much close to random process. The fractal dimension value of Chennai surface ozone was 1.484, which was also random behavior.

9. The maximum value of Lyapunov exponent for the Chennai surface ozone was 0.2540. The Lyapunov time for the above system was 3.93 that indicate the time after which the system started to behave in a chaotic manner. Thus the chapter III, we have confirmed the presence of trend and chaos in ozone forecasting.

10. Based on the mathematical analysis surface ozone was forecasted by SDPV and DIMP forecasting method.

11. In SDPV-CD methods mean absolute error percentage of Chennai surface ozone was 0.01250 which was less than 10% and SDPV-ARIMA model was 253.859 it was greater than 10%. In SDPV method CD model was better than ARIMA.

12. In DIMP-ANN methods mean absolute error percentage of Chennai surface ozone was 8.64% which was less than 10% and DIMP –ANFIS model was 0.2545% which was less than 1%. These methods gave best result.

13. From the four forecasting methods it clearly showed DIMP methods results were given less errors, as meteorological parameters wind speed, relative humidity, and temperature were taken as input and ozone was output. So ozone problem was nonlinear problem.
14. Hurst exponent for the Total Ozone Column was found to be 0.789; this means that the phenomenon was persistence behavior. The fractal dimension value of total ozone was 1.2109, which was also persistence behaviour.

15. Based on the mathematical analysis Total Ozone Column and rain fall of Kodaikanal was forecasted by SDPV forecasting method.

16. The relationship between TOC and rainfall from the Classical decomposition forecasting method, graph clearly indicated total ozone reduces rainfall also expected to be reduced.

17. The relationship between TOC and rainfall from the Auto Regressive Integrated Moving Average forecasting method, the next four months expected rainfall was predicted. This method also a graph clearly indicated total ozone reduces rainfall also expected to be reduced.

6.3 Scope for future work

1. **High-end instrument implementation**: We were used handheld portable ozone monitoring device, if we will use high-end device (ie automatic ozone monitoring and storing device) we will get more accuracy.

2. **Applications of cellular automata**: In the prediction of non linear systems, there are some major limitations, such as sensitive dependence to initial value and errors due to truncation. To get accuracy in the prediction cellular automata may be used in the analysis.

3. **Enforce regional level measurement**: Ozone measurement in regional and local scales is needed. It will identify the influencing climate change factor globally.

4. **Identifications of suitable climatic factors**: The relevant climatic factors that affect rainfall should be easily identified.
5. **Enforce weekly or monthly forecast:** - Research on making quantitative and objectively testable statements regarding future air pollution hazards should be encouraged. Methodology in this area should be systematically validated and upgraded by comparison of forecasts to actual daily or weekly or monthly air pollution.

6. **Encourage broad co-operation and public awareness:** - Reducing air pollution risk requires the co-operation of scientists, engineers, statisticians, social scientists, government authorities, the news media, non-governmental organizations and general public.

7. **Remove the invasive species trees:** - Even though regional climate is linked with surface level ozone, the ozone alone will not act as the major climate factor in that region. Many recent studies, on based on biological point of view, Intentional or unintentional introductions of invasive species like “**Prospopis Juliflora**” in Tamil “**Seemai Karuvelam**” also affect the climate change in many tropical and subtropical regions of the world.