P1.2 THE FORECASTING OF ATMOSPHERIC POLLUTANT DENSITY IN XI'AN CITY

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1. Introduction

Based on the observed daily data of three main pollutants (PM_{10}, SO_2, NO_2) and metrological data from January 2001 to December 2003 of Xian City, the spatial and temporal distributions and variations of the pollutant densities were analyzed. A series of regression equations were built, and then the pollutant densities are used to predict from February 2004.

2 Data Sources

The data required for the density of atmospheric pollutant forecasting are provided by Xi'an environmental observation Center and Xi'an observatory. The densities of PM_{10}, SO_2 and NO_2 are daily average value. The radiosonde data are temperature, pressure, humidity and wind at 00 and 12 GMT, and the surface observation data are daily minimum temperature, amount of low cloud, daily mean temperature, dew-point temperature, and so on.

3 Spatial And Temporal Distribution Of Pollutant Density

Figure 1 shows the variations of the monthly average densities of PM_{10}, SO_2 and NO_2 of Xi'an city. It can be illustrated from figure 1 that pollutant densities are higher in winter than in summer.

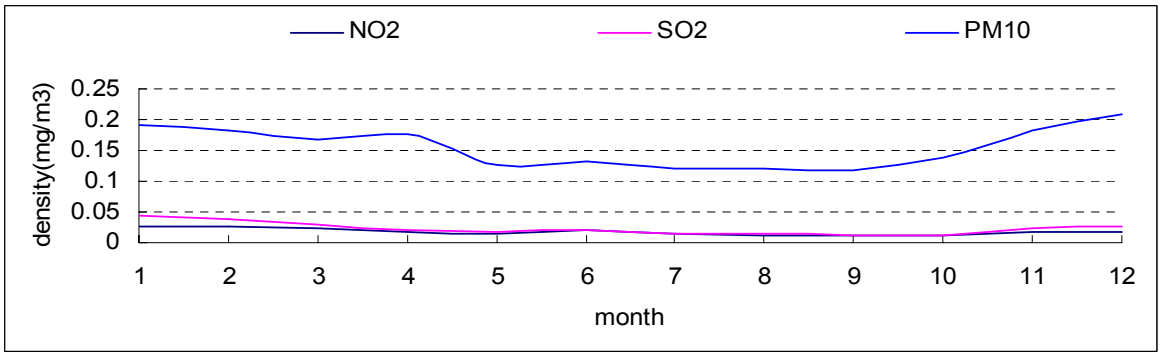

Fig.1 The variation of monthly average densities of PM_{10}, SO_2 and NO_2 of Xi'an

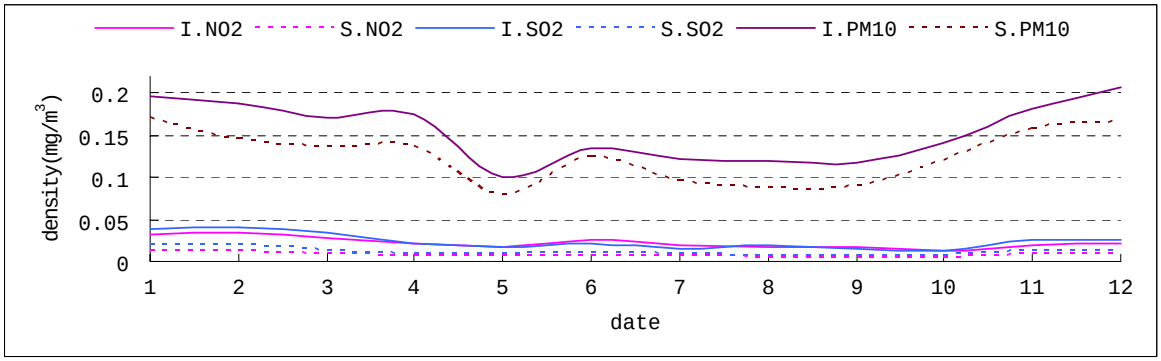

Fig.2 The variation of monthly average densities of PM_{10}, SO_2 and NO_2 of different area of Xi'an

(solid line: Industrial park, dotted line: suburb)

Figure 2 shows the monthly average densities of PM_{10}, SO_2 and NO_2 of different area of Xi'an. It can be illustrated from figure 2 that pollutant density is higher in industrial park than in suburb.

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4 Forecasting Equations

By using the daily average pollutant densities and the radiosonde and surface observation data of Xian, 11 surface meteorological elements and 9 atmospheric stratification parameters affecting the pollutant density were calculated. With stepwise regression analysis[1], significance test F_α, $\alpha < 0.05$, a series of regression equations for every month were built during 2001 and 2003. The regression equations of July as follow (ug/m^3):

$$Y_{SO_2} = 21.62-0.34X_1-0.20X_2+1.30X_3-0.99\times10^{-3}X_{12}+1.75\times10^{-3}X_{16}$$

$$Y_{NO_2} = 51.81-0.20X_4-0.195X_5-0.917X_1+0.391X_6 -1.375\times10^{-3}X_{12}+1.22\times10^{-3}X_{13}-2.705X_{14}+0.635\times10^{-3}X_{15} +1.76\times10^{-3}X_{16}$$

$$Y_{PM\,10} = 182.5-1.01X_7-1.701X_4-1.170X_5-0.276X_8+2.135X_9-60.0X_{16}-1.695\times10^{-3}X_{20}$$

Where X_1 is the daily minimum temperature(°C), X_2 is the pressure variation of 24h at surface(hpa), X_3 is the atmospheric stability, X_4 is the value of low cloud, X_5 is the visibility(km), X_6 and X_7 are the daily mean temperature, the dew-point temperature (°C) , X_8 is the daily rain(mm), X_9 is the daily maximum temperature minus the daily minimum temperature, X_{12} and X_{13} are the maximum and minimum mixing condensation levels(m), X_{14} is the height of inversion base(m), X_{15} and X_{16} are the thick and the intensity of inversion layer(m, °C/100m), X_{20} is the ventilation coefficient, (m^2/s).

5 Forecasting Conclusions

Use the perfectprog method (PPM), with the application of daily numerical prediction and local weather forecasting, by using the program of VB6.0[2], an operation system is established for air pollutant density in Xian City, and then the pollutant densities are used to predict from February 2004. Figure 3 shows the daily average densities forecasting and observations of PM_{10}, SO_2 and NO_2 of Xi'an, during July 2004, which suggest that the forecast agrees well with the observation.

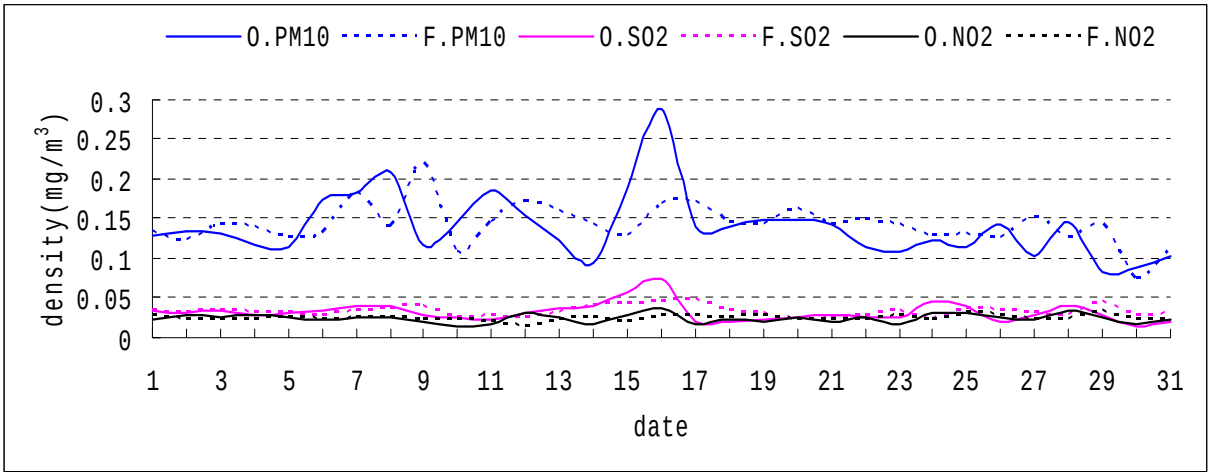

Fig.3 forecasted and observed pollutant densities from 1 to 31 July 2004

(solid line: observation, dotted line: forecasting)

References

1 Jiayou, H., 2003: Statistic Analysis and Forecast Methods in Meteorology. M. *In Chinese.* Beijing: Meteorology Press,.60-79.

2 Yudong, L., 2000: Microsoft Visual Basic 6.0.M. *In Chinese.* Beijing: Publishing House of Electronics industry.