Concentration variation and law of greenhouse gases in Xining

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Abstract: Greenhouse gas means which can absorb reflection of solar radiation on the ground and re-emit some radiation, such as water vapor, carbon dioxide (CO2), methane (CH4), most refrigerants, etc. Greenhouse gases can cause the greenhouse effect, and lead to the increase of atmospheric temperature. Although most of the greenhouse gases are relatively stable in the air, it can impact on the atmospheric environment, and then affect the environment chemical reactions in the air and rust in atmospheric pollution. Xining, as a one of the major cities in Qinghai-Tibet Plateau, it is important to study the concentration variation and law of greenhouse gases.

1. Introduction

Xining is located in the eastern of Qinghai province, in the basin valley of HuangShui river, east-west strip, the terrain shows southwest higher than northeast. It is surrounded by the mountains, the South Mountain on the south of Xining and the North Mountian on the other side of Xining. Xining is Continental plateau semi-arid climate, the time of average annual sunlight is 1939.7 hours, the mean annual temperature is 7.6°C, the highest temperature is 34.6°C and the lowest is -18.9°C. As of 2011, the forest covered area was 340 million mu, the vegetation cover rate was 39%, according to 《the statistical bulletin of national economic and social development in Xining of 2011》, the resident population of Xining was 224.74 million.

2011, Qinghai Province Environmental Monitoring Center Station completed the construction of greenhouse gas representative station in Xining Najia mountain. The monitoring projects are CO2, CH4, non-methane hydrocarbons. Currently, analyzed the 2012 and 2013 monitoring data from greenhouse gas representative station in Najia mountain, we preliminary obtained the concentration variation and law of greenhouse gas in Xining.

2. Sources of data and research methods

2.1. Sources of data

In this study, the data was collected in greenhouse gas representative station of Xining Najia mountain, which was checked and accepted by China Environmental Monitoring Station. The data could reflect contents of greenhouse gases in Xining.

2.2. Research methods
Continuous measurements on methane and carbon dioxide were carried out in Xining from 2012 to 2013, the variation and relationship were discussed detailedly. Then, we explored the reasons and forecasted the law of variation in future.

2.3. Apparatus
CO2 was collected by API-M360E CO2, and adopted non-dispersive infrared gas filter correlation method. All of data were measured between 0 and 2000 mg/l, the limit of detection is 0.2 mg/l.
CH4 was collected by SYNSPEC-ALPHA115, and adopted FID. All of data were measured between 0 and 10/100 mg/l, the limit of detection is 0.05 mg/l.

3. Result

3.1. Average concentration of CO2, CH4
In 2012 and 2013, the concentration of CO2 were 387.6 mg/l, 389.03 mg/l, it increase 3.7%. Compared with concentration of CO2 which were monitored by Waliguan global atmospheric base station[1]. The concentration of CO2 in Xining was low, but it maintain a ascendant trend[2].

![Image of CO2 concentration in Xining 2012 and 2013](image)

**Fig.1** The concentration of CO2 of Xining in 2012 and 2013
The concentration of CH4 was 2.129 mg/l and 2.011 mg/l in 2012 and 2013. Decrease 5.5%.

3.2. Seasonal concentration of CO2, CH4
Analyzed the 2012, 2013 seasonal concentration of CO2, the values showed higher in first and fourth quarter, and lower in second and third quarter. The lowest value appeared in 2012 third quarter, and in 2013 second quarter. The 2012 concentration of CO2 in first and second quarter was higher than the value in 2013. It is conversely in later quarter.
Fig. 2 The concentration of CH$_4$ of Xining in 2012 and 2013

The concentration of CH$_4$ was higher in first and fourth quarter of Xining than second and third quarter. And the value is higher in 2012 than 2013.

Fig. 3 The transformation of concentration of CO$_2$ in a quarter of 2012 and 2013

The concentration of CH$_4$ was higher in first and fourth quarter of Xining than second and third quarter. And the value is higher in 2012 than 2013.
3.3. Monthly concentration of CO2, CH4

Compared with 2012, 2013 concentration variation of CO2, it is clearly that the concentration of CO2 is highest at January 2012. It decreased rapidly until September, low to 372.1mg/l. Then, the value increased gradually to 388.9mg/l. The concentration of CO2 was higher in January 2013, and then reduced until April to 374.7mg/l. There was a slight ascension in May. However, there was maximum in August, which is 382.7mg/l. It was 377.0mg/l in September, and then rise to 408.6mg/l. It irregular change may have close relationship with temperature changes in 2013.

3.4. Daily concentration of CO2, CH4

The concentration of CH4 was higher in January and lower in February, and fluctuated rise month by month. The concentration of CH4 changed regularity in 2012 than 2013, Compared concentration of CH4 in this two years, it can be found the concentration of CH4 has a small decline in November - December. Hence, we could preliminary inference that the concentration of CH4 declined year by year Xining.
Fig. 6 The monthly transformation of concentration of CH4 in a quarter of 2012 and 2013
According to 2012, 2013 the daily variation of CO2 in Xining, it obtained the value is higher early, and followed by a gradual decline. Meanwhile, plants respiration show undulant change, the concentration of CO2 is influenced by meteorology. 2013, the daily variation of CO2 is higher than 2012. It indicated that there is increase trend.

Fig. 7 The daily transformation of concentration of CO2 in a quarter of 2012 and 2013
2012 and 2013 the daily value of CH4 showed that, the daily concentration of CH4 show undulant change. By the time, there is a ascendant trend, but, the margin is slight. 2012, the concentration of CH4 was higher than it in 2013. It indicated that the concentration of CH4 in Xining have a decline.
3.5. Hourly concentration of CO2, CH4
The hourly concentration of CO2 changed obviously in summer, and the change magnitude was. The maximum and minimum concentration of CO2 appeared at 8 and 19. It is related with plant photosynthesis and precipitation. Due to terrestrial vegetation growth, the concentration of CO2 is relatively stable in other seasons. Plateau vegetation and soil biological process is weak in winter, so the value is stable. [3]

4. Conclusion

4.1. The law and variation of CO2
According to analyze, it obtained that the concentration of CO2 changed seasonally, and it was influenced by meteorological factors, especially, it was higher in first and fourth quarter. The range of concentration was 382.9mg/l-400.1mg/l. Therefore, it was lower in second and third quarter and the range of concentration was 374.7mg/l-388.2mg/l. The annual change magnitude is 25.3mg/l. Compared with other cities, the concentration of CO2 in first, fourth, second and third quarter was 420.0mg/l-455.0mg/l, 369.0mg/l-395.0mg/l in Huaiian of Jiangsu province[4]. The concentration of CO2 is lower, which related to population, economic development of Xining. The variation range is slightly smaller than the other cities, may have close relation with climate and vegetation coverage. Because of plants and soil, the rate of CO2 change present obvious in summer. The concentration of CO2 also showed a rise trend year by year in Xining. Hence, we must pay attention to the effects of rising CO2 concentration[5].

4.2. The law and variation of CH4
According to analyze, the concentration of CH4 changed seasonally. Because of the major fossil fuels were burned in first quarter, the value of CH4 is higher, the second quarter was the lowest. The range is between 1.90mg/l to 2.13mg/l. The value varies within a small range in second and third quarter. 2013, the concentration of CH4 have declined from 2012, it was closely associated with meteorological elements.

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