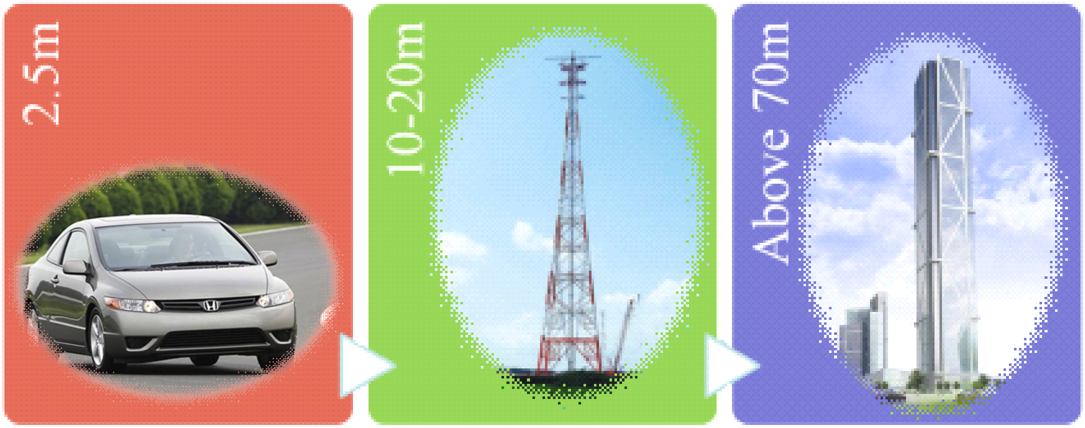
Yale 耶鲁大学-南京信息工程大学大气环境中心

Yale-NUIST Center on Atmospheric Environment

Temporal and spatial variations of CO_2 in Nanjing



3-SCALE OBSERVATIONS

2013.5.10

Temporal and spatial variations of CO_2 of street-level in Nanjing (Summer)

Temporal and spatial variations of CO_2 of street-level in Nanjing (Winter)

Temporal and spatial variations of CO_2 in fixed point observation in Nanjing (within mixed layer height)

Temporal and spatial variations of CO_2 in fixed point observation in Nanjing (mixed layer height)

Temporal and spatial variations of street-level CO_2 in Nanjing

Reporter : Wang Shumin
Gao Yunqiu
Deng Lichen
Li Hanchao

Outline

- Introduction
- Methods
- Results
- Discussion and summary
- Inspiration

◆ Introduction

- Urban environments can change the local climate. The urban is net CO_2 source. They can affect the life of an increasing proportion of the world's population that lives in and around cities *(Onil Bergeron, Ian B. Strachan,2011)* .

- Among the largest carbon dioxide emitters in the world *(IEA,2009)*, China has been considered responsible for two thirds of the global increase in anthropogenic carbon dioxide emissions of 3.1% in 2007 *(Yan andYang,2010)* .

- We observe Nanjing CO_2 concentration in order to quant ify carbon emissions and calculate parameters for carbon models.

◆Method

➢ Experimental design：

Fig. 1. Schematic of selected lines in Nanjing taken from Google Earth

- Instrument : LI -840A CO_2 /H_2O gas analyzer

- Time : 6/6 (THU)

  9/6 (SUN、 Dragon Boat Festival)

  14/6 (FRI)

  15/6 (SAT)

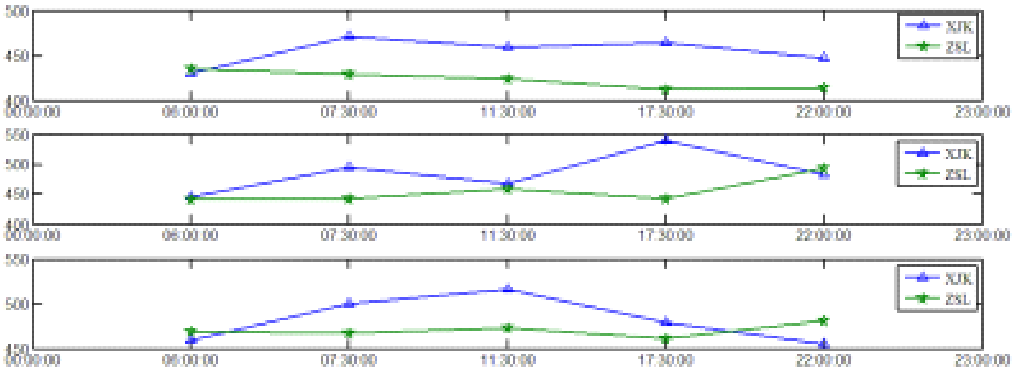
  17/6 (MON)

  06:00:00 07:30:00 11:30:00 17:30:00 22:00:00

Process:

4号线第二次（2）.AVI

18:43:41	446.8926578
18:43:42	446.5125481
18:43:43	446.4025163
18:43:44	446.4725366
18:43:46	446.872652
18:43:47	447.0827127
18:43:48	447.2627646
18:43:49	448.5231284
18:43:50	449.5234171



Results

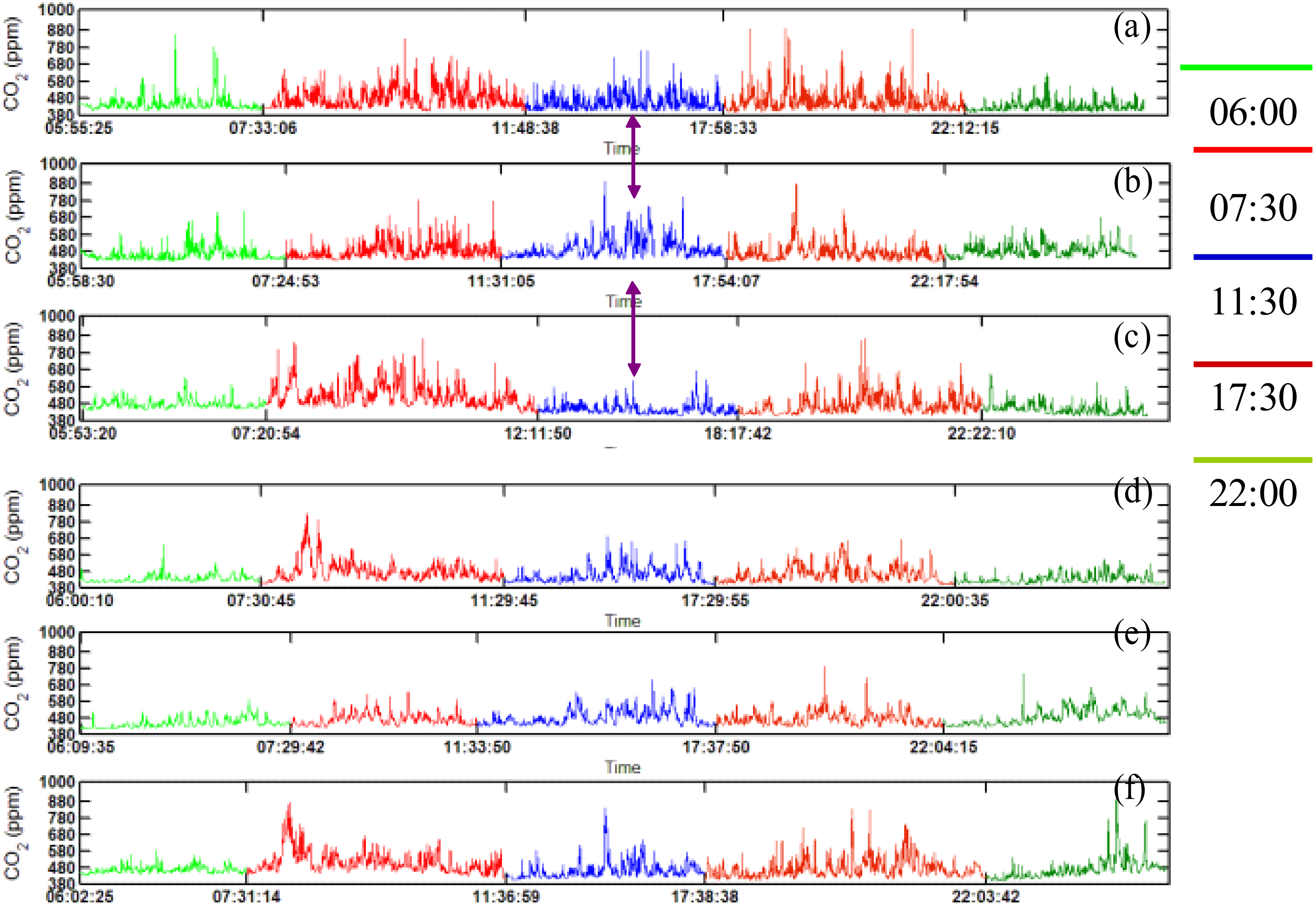


Fig.2. Diurnal variation of CO_2 concentrations of three days.Line 1 (a,b,c represents 0614,0615,0617,respectively.); Line 4 (d,e,f represents 0614,0615,0617,respectively.)

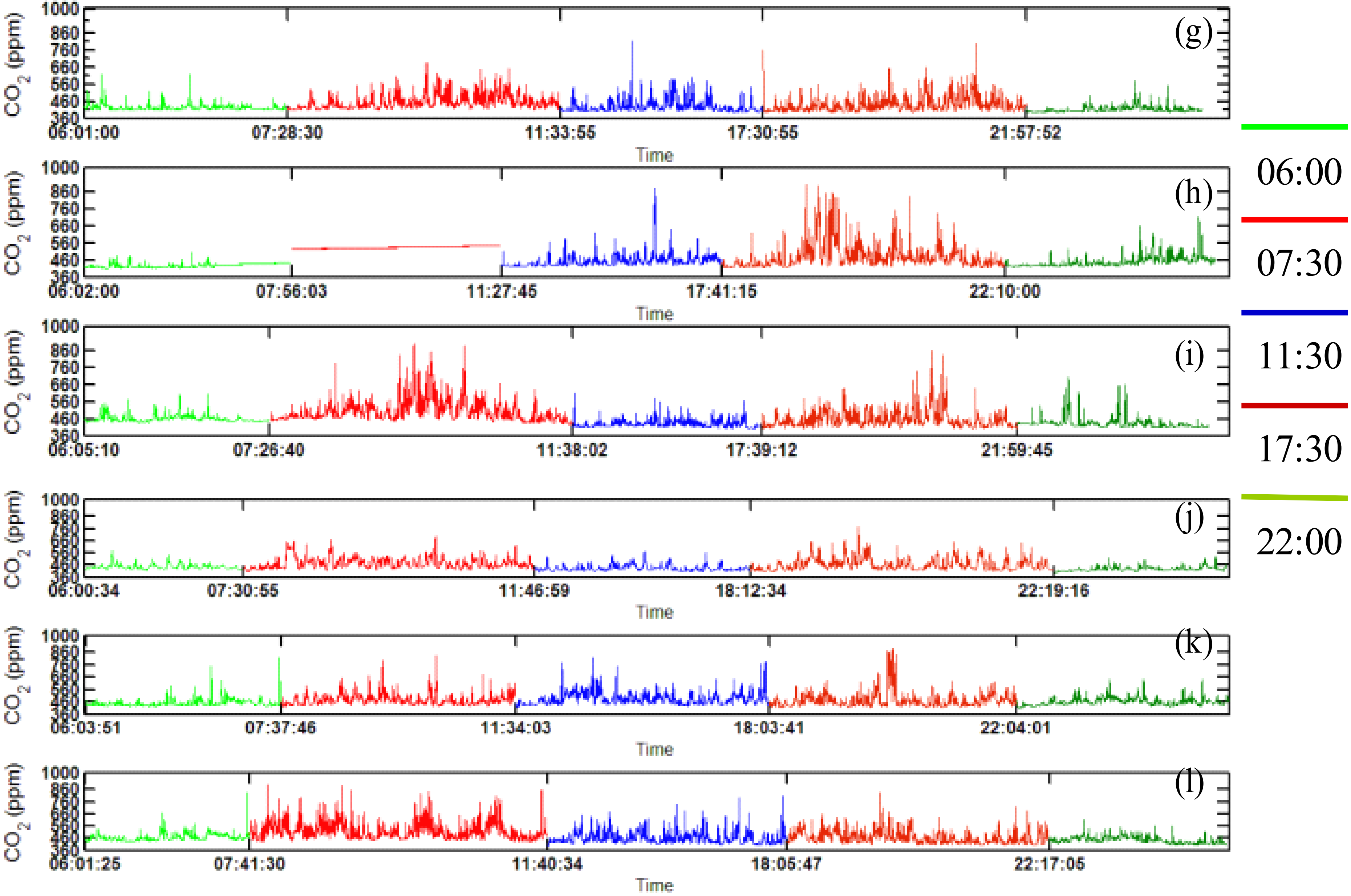


Fig.3. Diurnal variation of CO_2 concentrations of three days.
Line 2 (g,h,i represents 0614,0615,0617, respectively.);Line 3 (j,k,l represents 0614,0615,0617,respectively.)

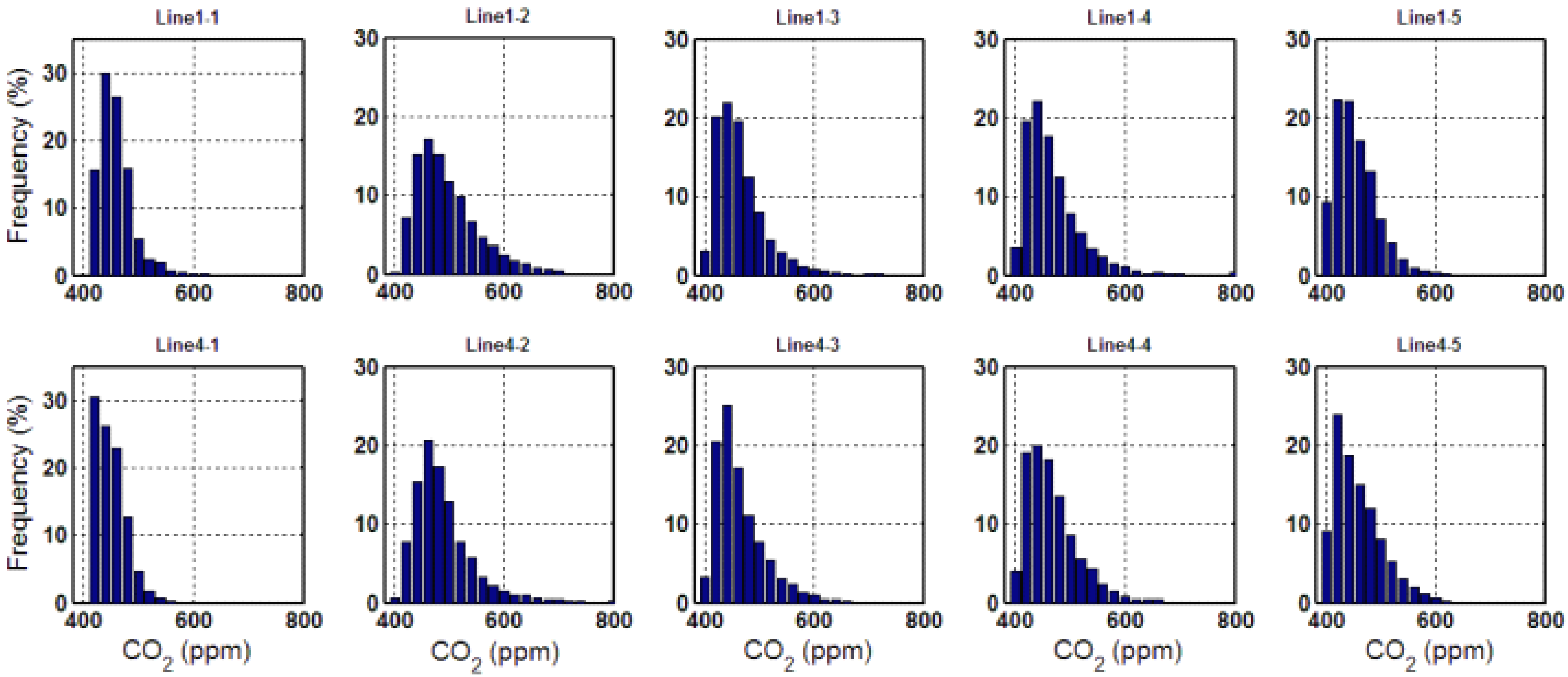


Fig.4. Frequency distributions of CO_2 concentrations for line 1 and line 4

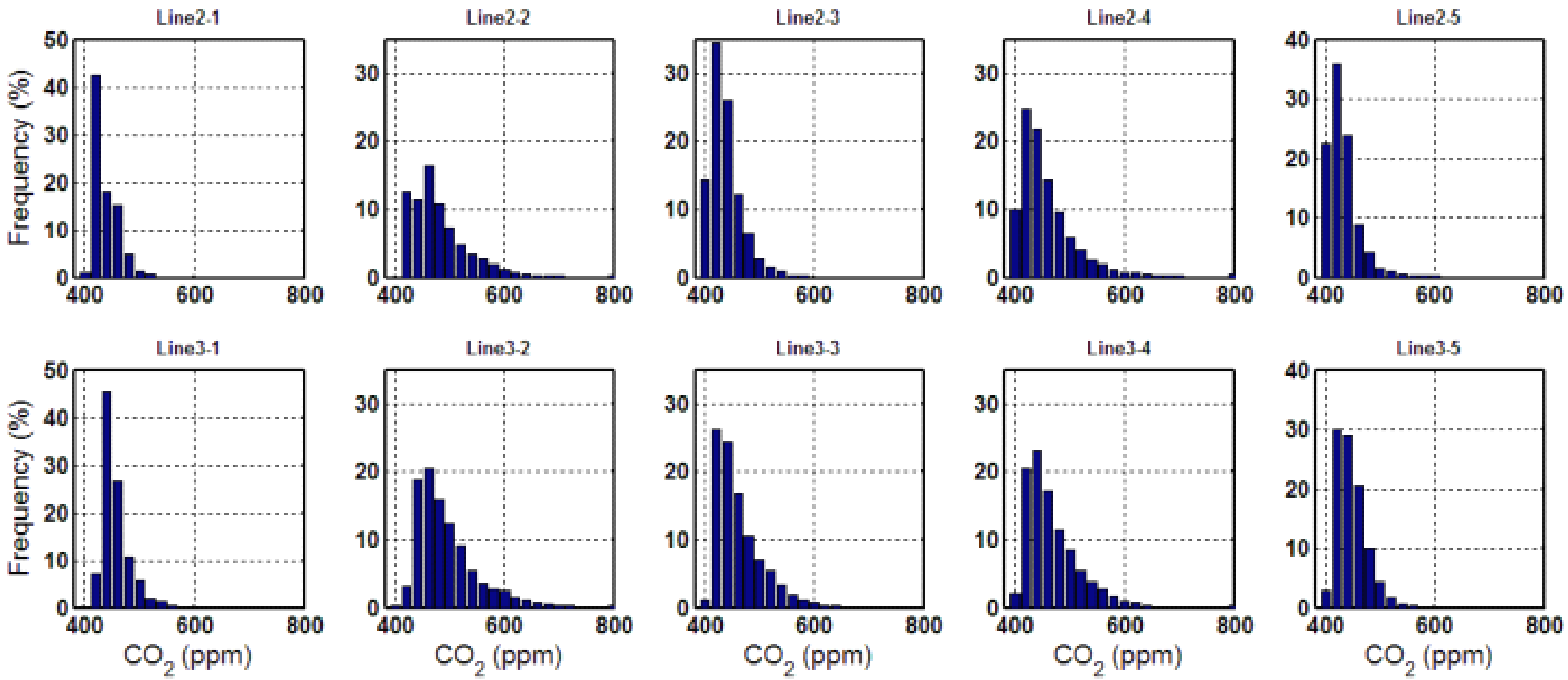


Fig.5. Frequency distributions of CO_2 concentrations for line 2 and line 3

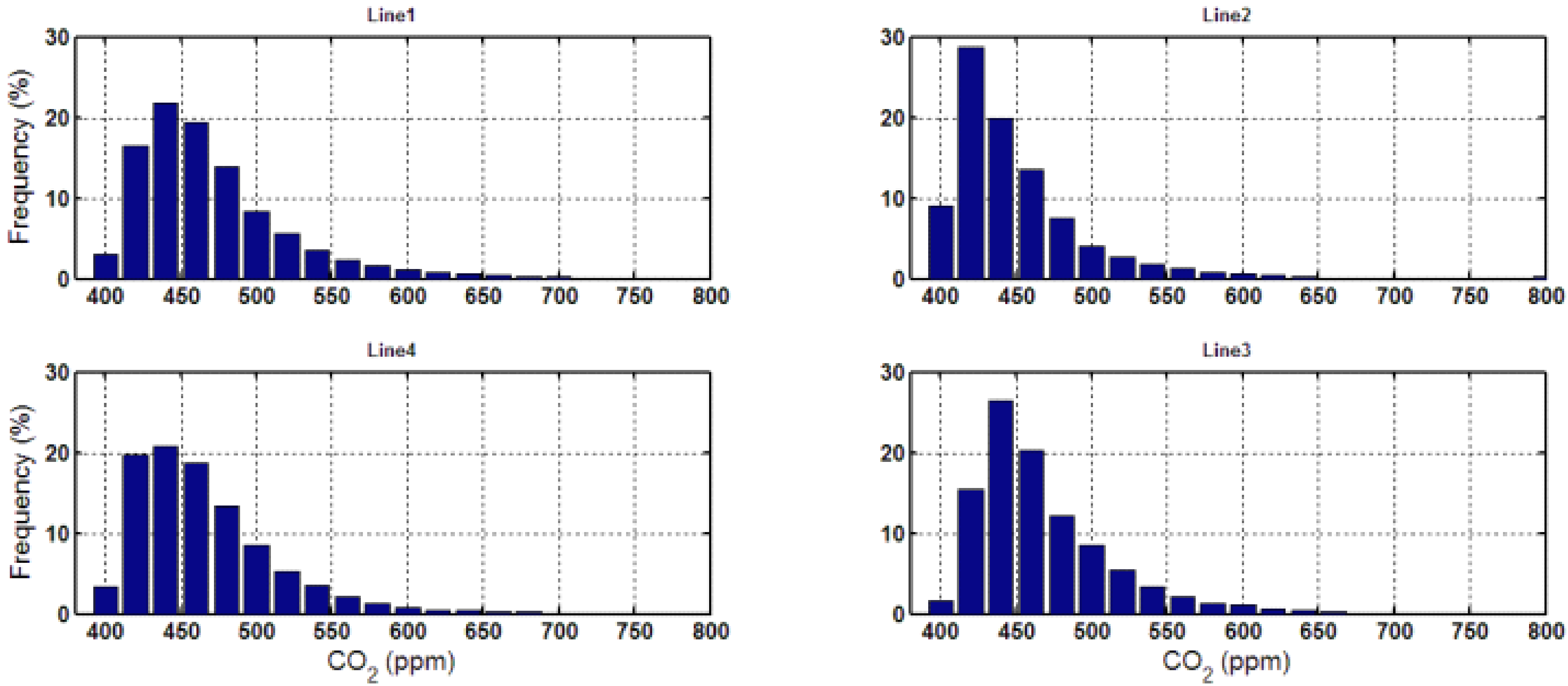


Fig.6. Frequency distributions of CO_2 concentrations for each line

(a)

	06:00	07:30	11:30	17:30	22:00
Line 1	444.76	480.15	453.71	462.80	431.14
Line 4	434.19	478.54	452.89	458.41	430.56
Line3	446.18	475.58	433.71	464.87	429.18
Line 2	423.28	454.67	430.10	441.90	412.07
ZSL	435.10	429.26	424.11	412.58	414.99
YF	385.78	373.02	381.03	355.88	357.583

(b)

	06:00	07:30	11:30	17:30	22:00
Line 1	459.15	483.57	497.19	475.38	483.60
Line 4	446.69	471.31	481.20	473.29	485.20
Line3	451.21	477.62	487.04	475.53	463.22
Line 2	421.47	NaN	454.99	482.48	450.32
ZSL	441.75	442.42	459.30	442.81	481,66
YF	367.49	394.81	377.77	365.28	379.62

(c)

	06:00	07:30	11:30	17:30	22:00
Line 1	476.19	524.19	446.04	471.87	447.54
Line 4	465.91	510.41	459.52	472.19	466.98
Line3	468.40	520.80	462.96	467.24	444.66
Line 2	460.45	505.01	430.35	457.61	433.40
ZSL	469.77	467.56	473.68	461.99	481.67
YF	361.06	344.99	323.09	320.13	343.62

Tab.1. Average CO_2 concentrations (ppm) of four lines and two sites (ZSL and YF), a,b,c represents 0614, 0615, 0617, respectively.

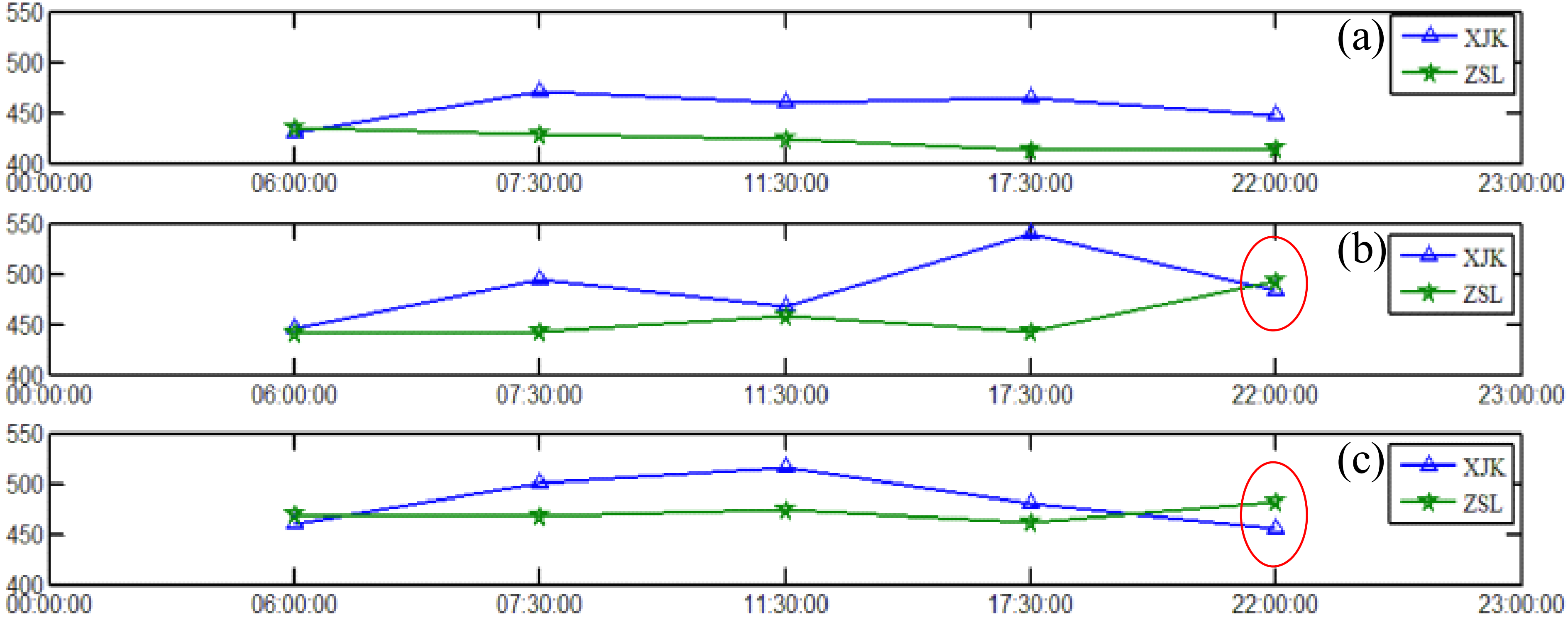


Fig.7. Average diurnal pattern of CO_2 concentrations (ppm) of two sites (XJK and ZSL),a,b,c represents 0614,0615,0617, respectively.

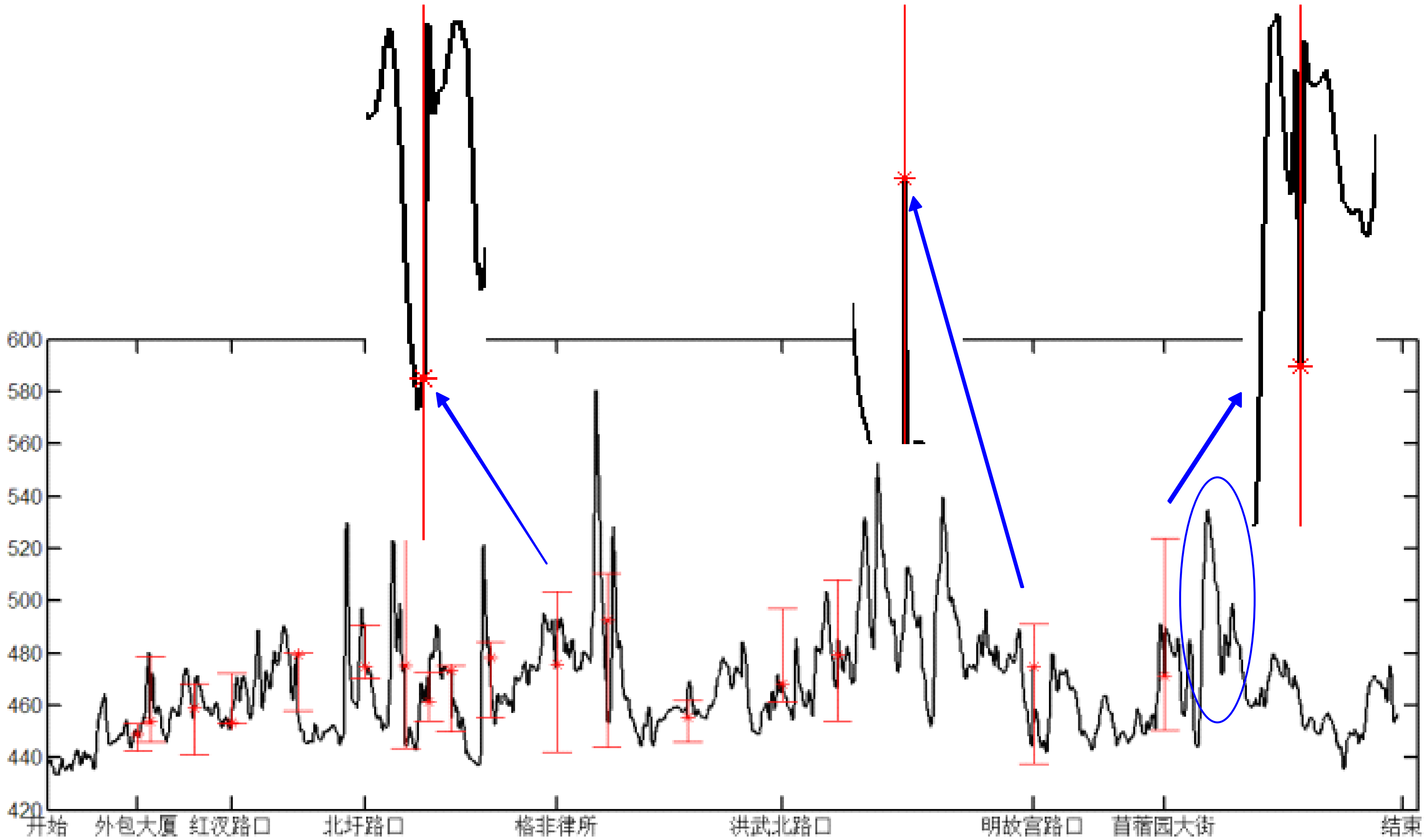


Fig.8. CO_2 concentrations (ppm) for parking of line 4 (20130617_4_1)

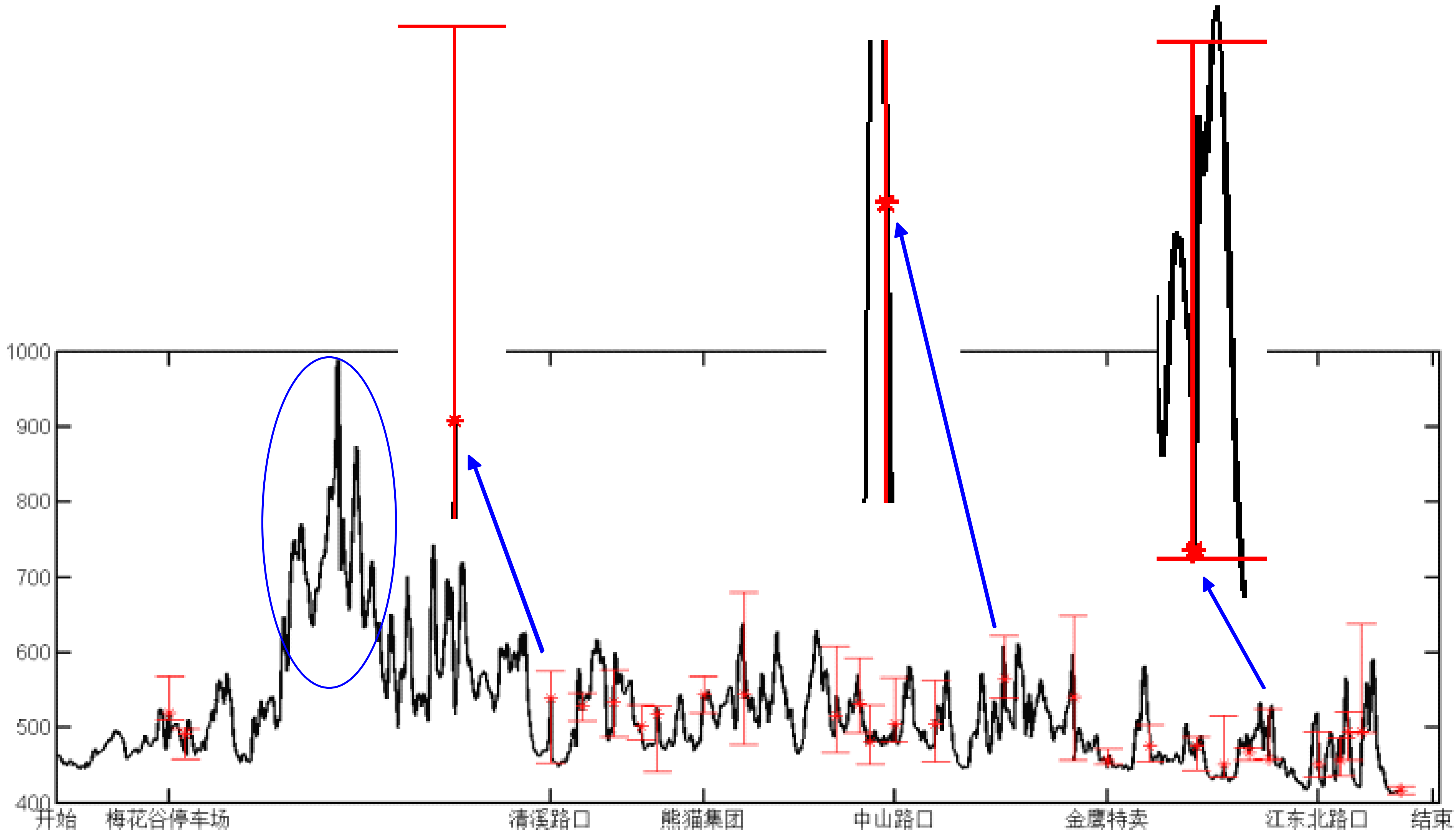


Fig.9. CO_2 concentrations (ppm) for parking of line 4 (20130617_4_2)

Discussion and summary

- CO_2 concentrations showed obvious diurnal variation.
- Different lines had certain differences in frequency distributions during the three days.
- The highest values of each average CO_2 concentrations were not observed in the same time during the three days.
- The average CO_2 concentrations in daytime of XJK was higher than ZSL's, while the nighttime's values was opposite.
- We found that the higher CO_2 concentrations happened after parking which was not the same as we expected before.

Inspiration

- We are not sure that the values we observed is representative and significant.
- We should be skilled in LI-840A in case of any emergency.
- Paper experimental records are very necessary, especially in these street-level tests.
- We should consider the differences among instruments before data processing.

Temporal and spatial variations of CO_2 in fixed point observation in Nanjing

Reporter : Gao Yunqiu
Wang Shumin
Deng Lichen
Li Hanchao

◆Outline

- Introduction
- Methods
- Results
- Discussion and summary
- Inspiration

Introduction

- Urban ecosystem is the main source of CO_2 (Moriwakia, R., 2004) and the CO_2 emission is much higher than the suburbs and the natural landscape *(Ziska et al., 2004; Zhao et al., 2010)*.
- Urban and suburban areas, despite covering only 2.4% of the earth's surface (Potere et al., 2007), are responsible for over 80% of CO_2 emissions to the atmosphere *(Turner et al., 1994)*.
- We observe Nanjing CO_2 concentration in order to quantify carbon emissions and calculate parameters for carbon models.

◆Method

- Instrument : LI -840A CO_2 /H_2O gas analyzer

- Time : 20130628(14:00)~20130804(14:00)
  20130804(15:30)~20130805(15:30)

- Measurements sites:
  Xinjiekou(9F)
  Bailuzhou(5F)
  Jiuxiaoqu(5F)
  Shengjunqu(7F) & Hehai(4F)
  Xinxiaoqu(3F)

(a) Schematic of measurement sites location

(b) Surrounding environment of measurement sites

Fig. 1. Map of Nanjing around the measurement sites taken from Google Earth

◆Results

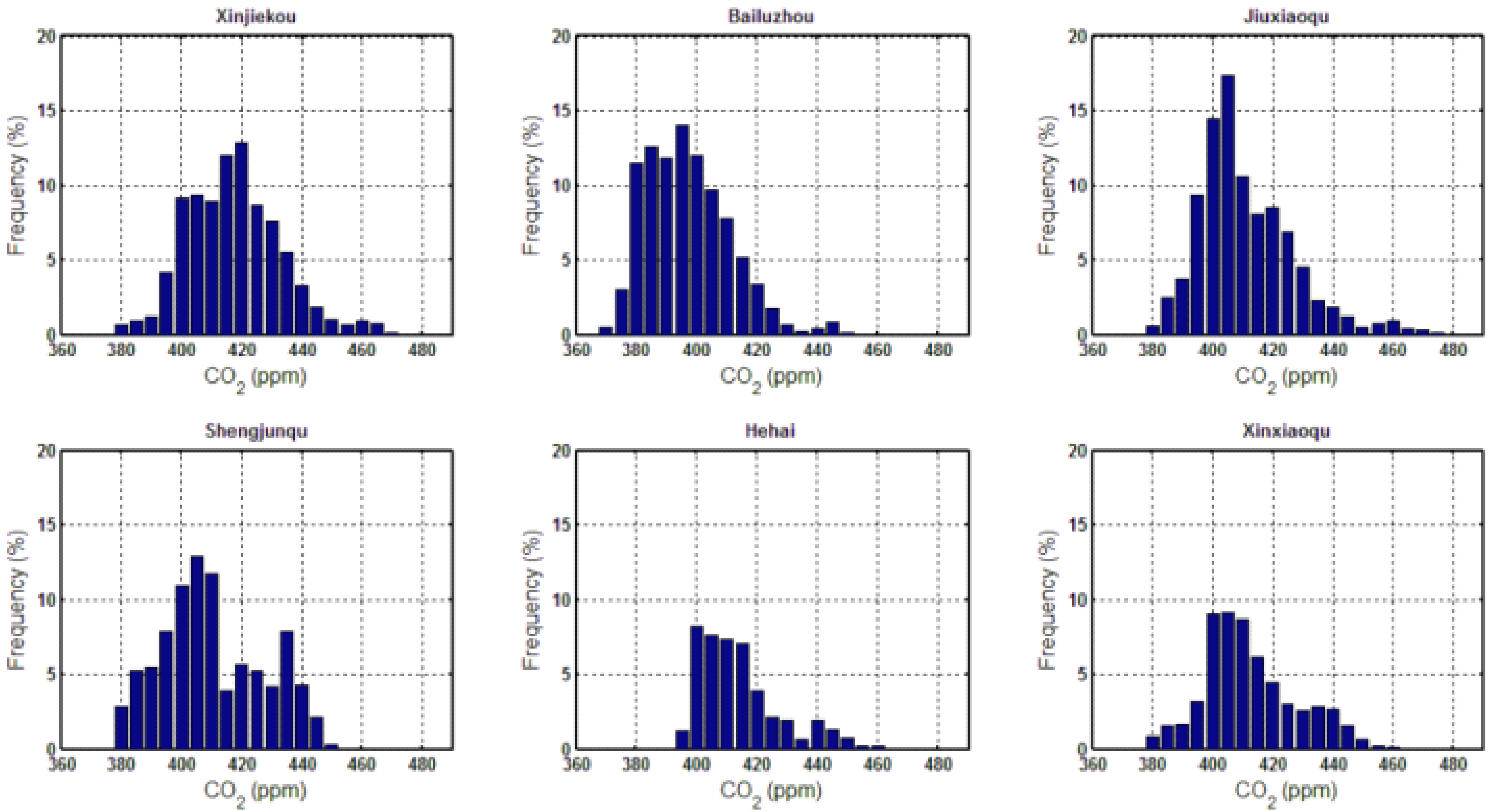


Fig. 2. Frequency distributions of CO_2 concentrations of six mearsurement sites (0728_14:00~0804_14:00)

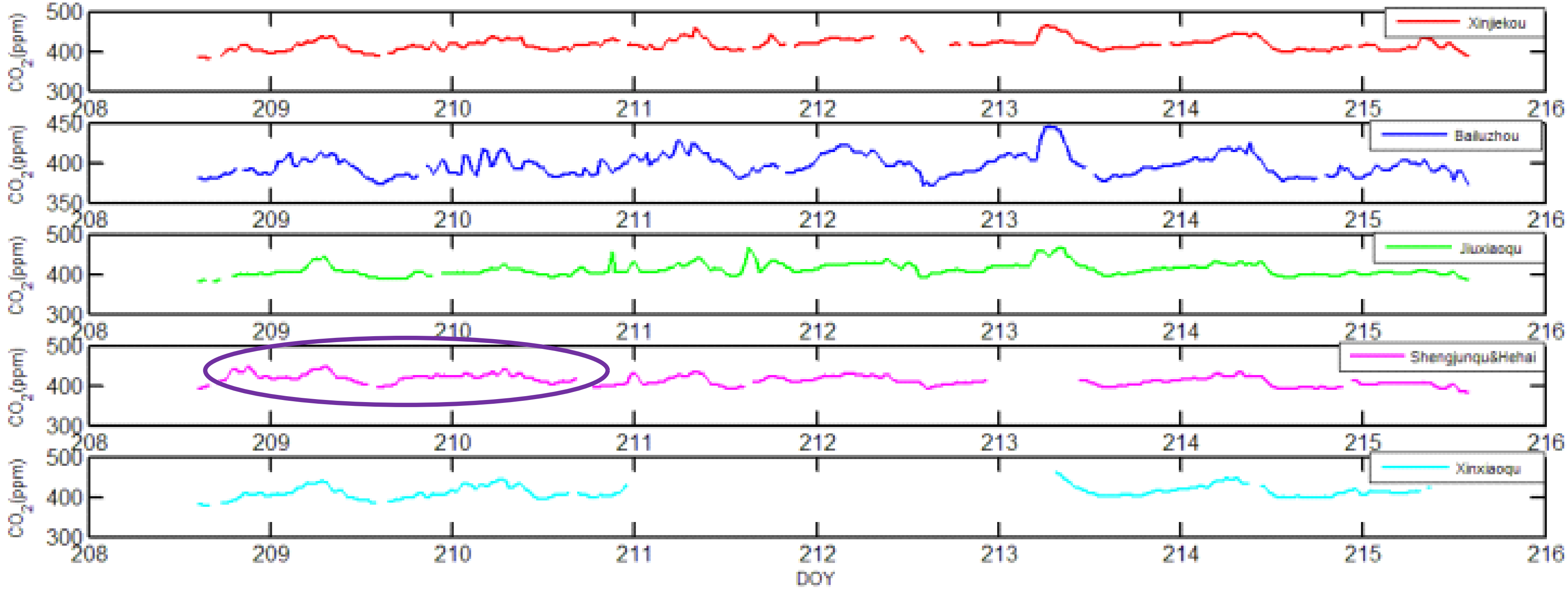


Fig. 3. Weekly pattern of CO_2 concentrations for the entire study (0728_14:00~0804_14:00)

Tab.1. Average CO_2 concentrations (ppm) of five measurement sites

	total	weekday	weekend
Xinjiekou	417.4623	419.1034	412.4839
Xinxiaoqu	412.4136	414.1008	411.4503
Jiuxiaoqu	411.0746	413.2485	404.5179
Hehai	409.1151	411.064	405.7072
Bailuzhou	396.9968	398.4507	392.7355

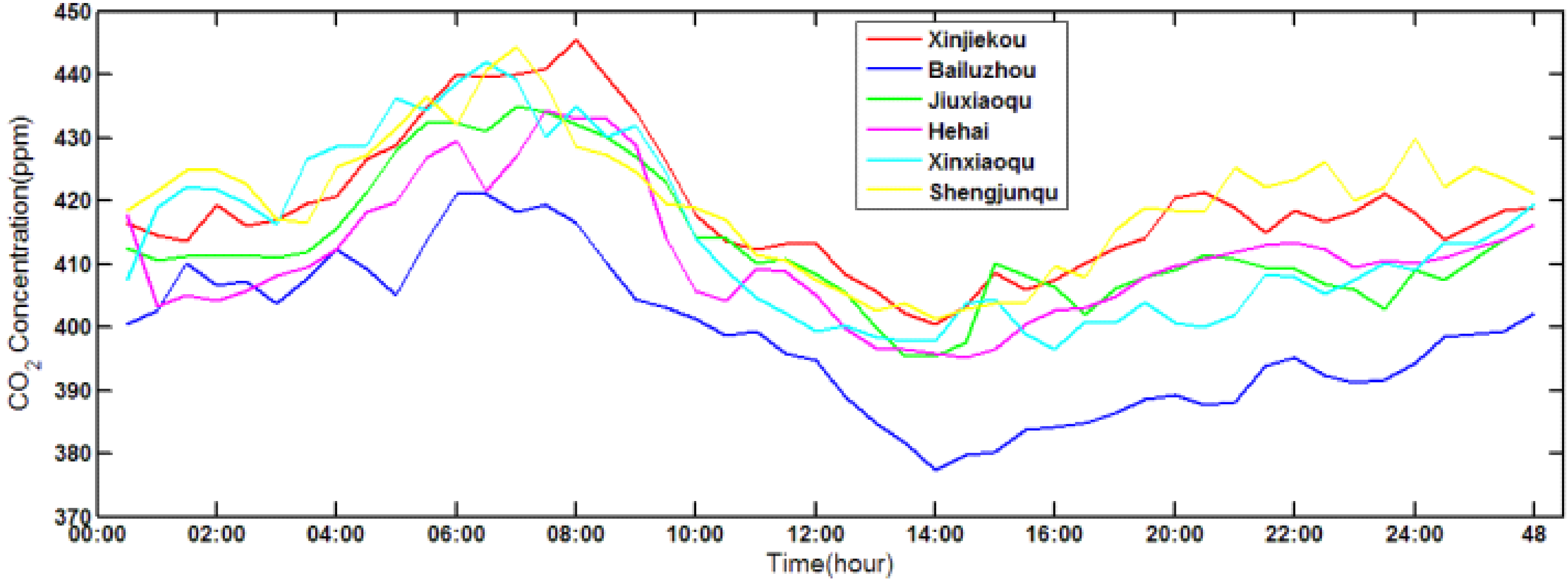


Fig. 4. Average diurnal pattern of CO_2 concentrations for the weekdays

The CO_2 concentrations showed a clear diurnal pattern. The highest concentrations occurred between 6:00 and 8:00 with a range from 420 to 445 ppm. The lowest CO_2 concentrations were observed during afternoon.

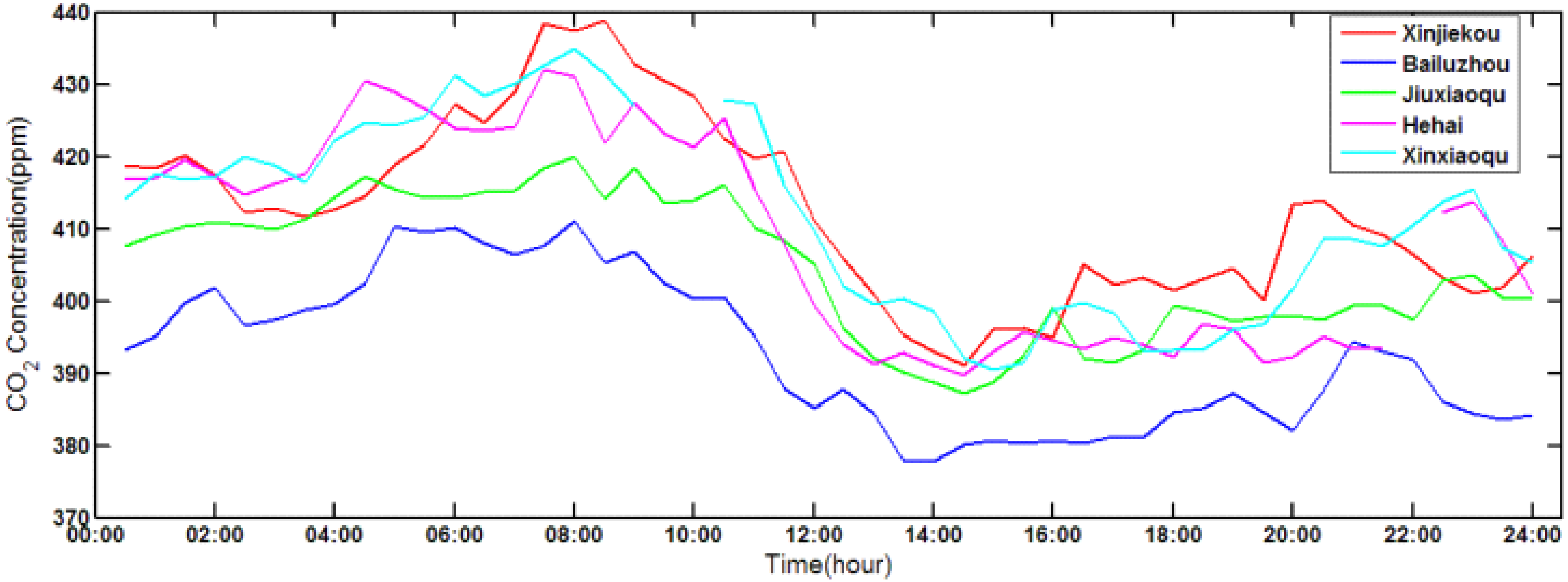


Fig. 5. Average diurnal pattern of CO_2 concentrations for the weekends

The CO_2 concentrations showed a clear diurnal pattern. The highest concentrations occurred between 7:30 and 9:00 with a range from 410 to 440 ppm. The lowest CO_2 concentrations were observed during afternoon.

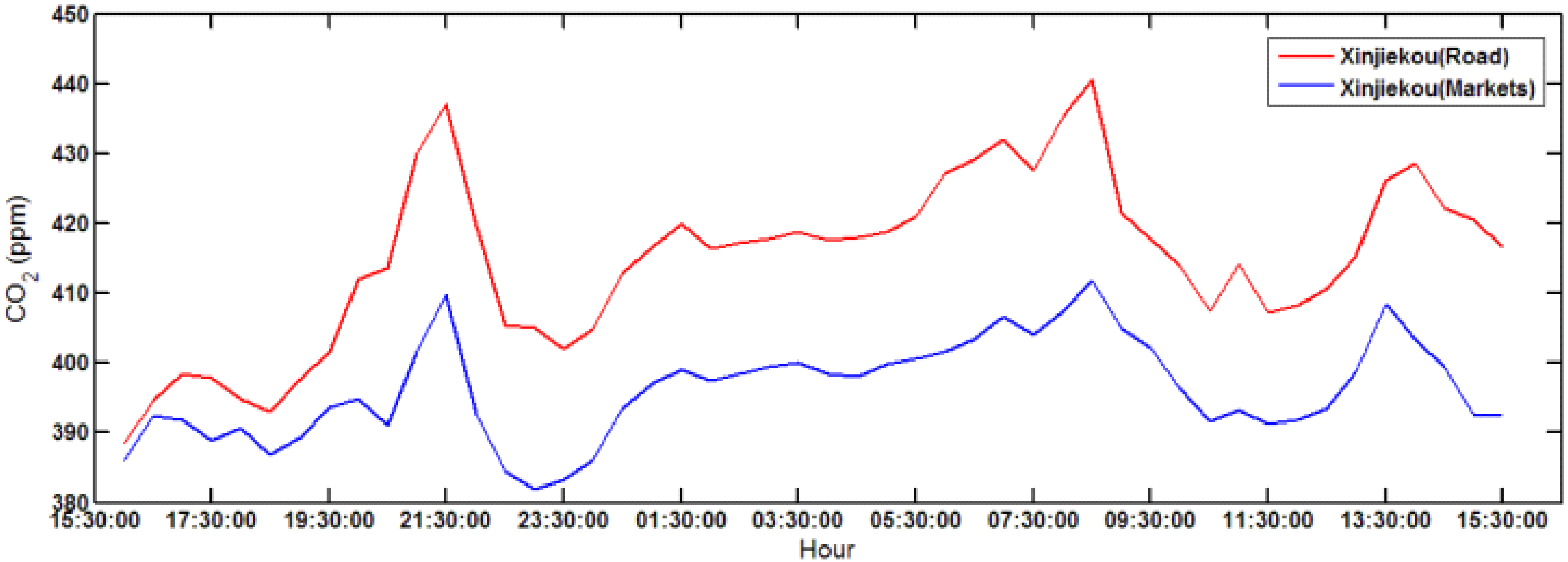


Fig. 6. Average diurnal pattern of CO_2 concentrations of two sites in Xinjiekou 20130804_15:30~20130805_15:30

These two sites' diurnal pattern shared the same trend and Road's concentration is 18.6 ppm higher than the Market's on average. Three daily average values of CO_2 concentration from different heights were 474.6ppm(street), 396.3ppm(Market) and 414.9ppm(Road).

◆ Discussion and summary

Consistent with the expected, in the different underlying surfaces, CO_2 concentrations showed certain differences and some of them were significant. In our experiment, Xinjiekou's concentrations were the highest and Bailuzhou's were the lowest.

Traffic had certain contribution to carbon emissions, but we were not sure whether the '18.6 ppm' were the true value come from traffic emissions.

We still doubt whether the heights we chose were suitable.

◆ Inspiration

It is necessary that the instrument needs to be checked regularly. It may stop working, record the same value which is obviously wrong, record wrong date and so on.

We should be good at calibration process in case of something unexpected like screw slippery of pressure-reducing valve.

Something wrong with calibration which we cannot explain.

We should consider the differences among instruments before data processing.

Thank You