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

Spatial and temporal variation of CH_4 traffic emissions in Nanjing

Zhang Xue

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Outline

- Background
- Experiment and data
- Objectives
- Preliminary results
- Next work

Background

- Cities are responsible for 70%–80% of global anthropogenic greenhouse gas (GHG) emissions. In China, **85%** of the greenhouse gas sources in the city[Canadell et al., 2009; Dhakal, 2009]. Within the urban core, the **dominant source of emissions** often is the **traffic**[Erickson et al., 2013].

- In recent years, research on carbon emissions in the area of city, just considering the CO_2 emissions from traffic, almost **regardless of CH_4 emissions of traffic**[Xu, 2011; Yang, 2013], or only considering the CH_4 emissions of diesel/gasoline vehicle[Zhao, 2011].

- But for Nanjing, with the increase in the number of **taxis using natural gas fuel**, the study of methane emissions from traffic is conducive to further improve the city's emissions inventory of methane.

Experiment and data

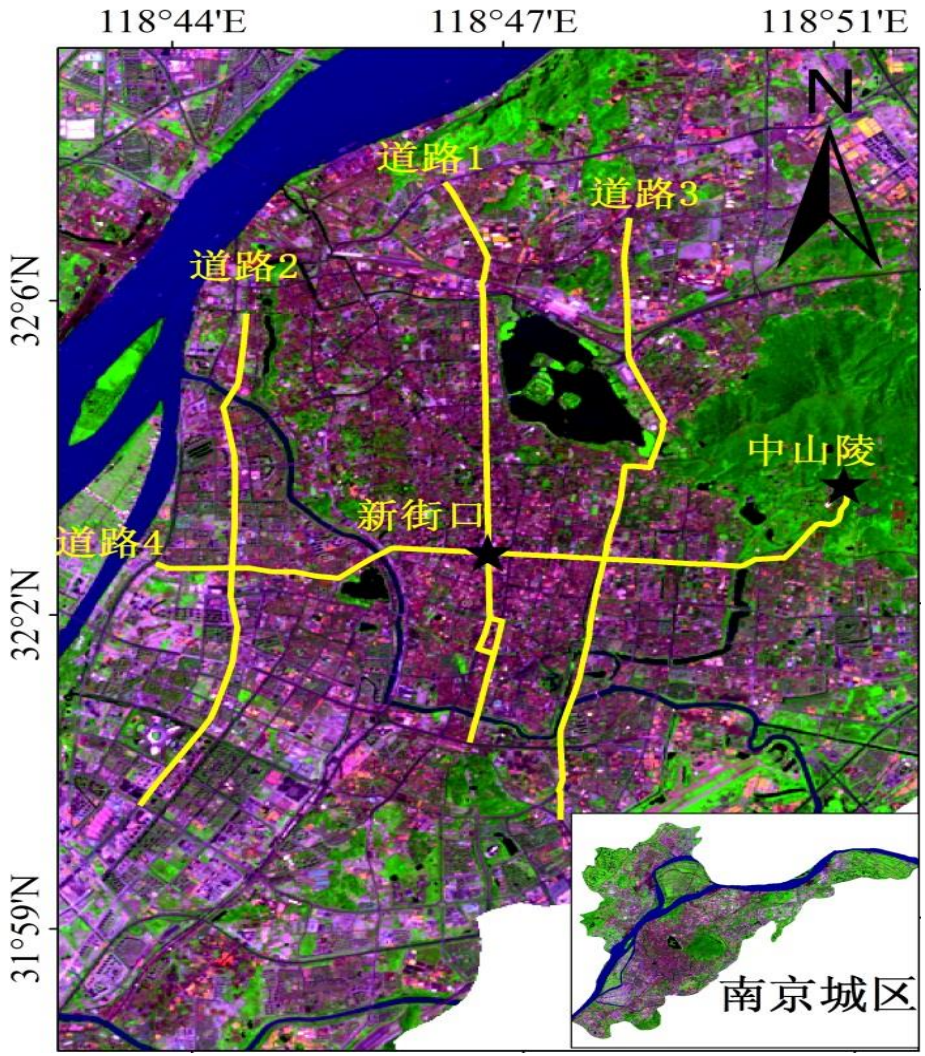


Fig. 1. Map of Nanjing city showing the roads of data obtained.

Instrument: LGR gas analyzer
video GPS

Time: Oct. 17, 18, 20, 23, 2014
Autumn
06:00 07:30 11:30
17:30(17:00)
22:00

Speed: 30km/h

Objectives

- Analysis of spatial and temporal variation of CH_4 traffic emissions in Nanjing.

- Estimation of methane emissions of traffic by IPCC method.

Preliminary results

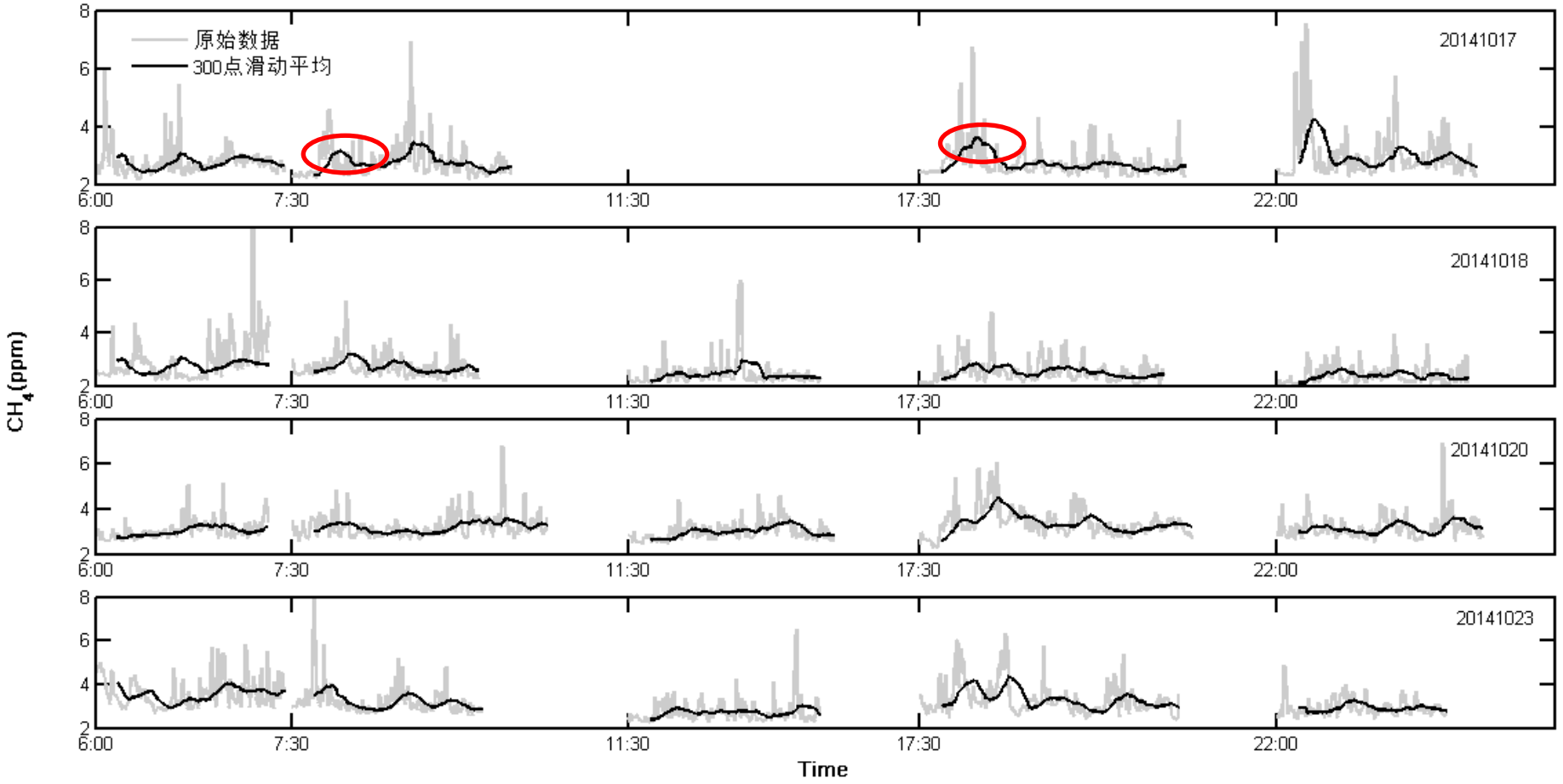


Fig. 2. CH_4 concentrations (ppm) on the road 1 during the experiment.

Preliminary results

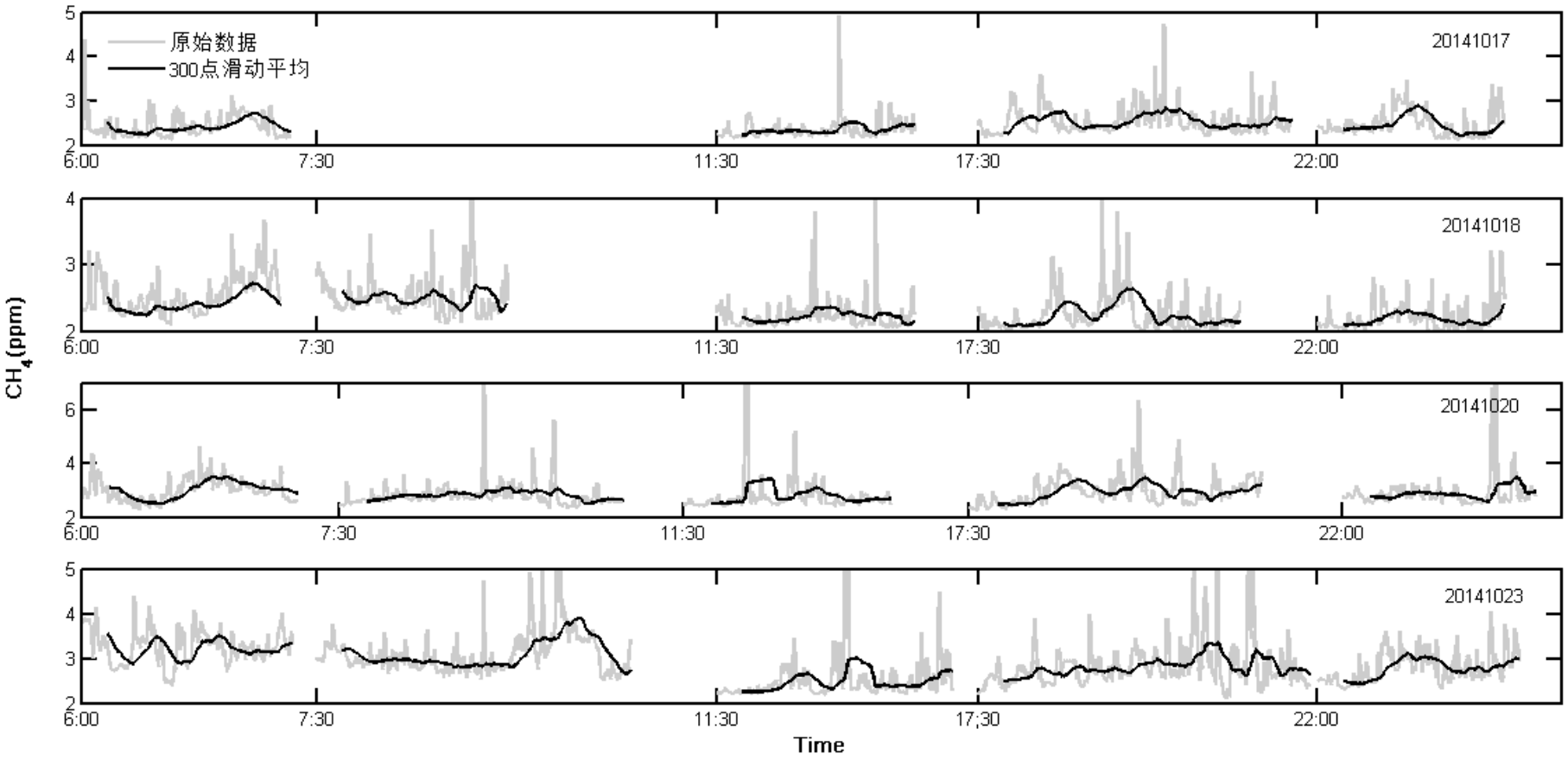


Fig. 3. CH_4 concentrations (ppm) on the road 3 during the experiment.

Preliminary results

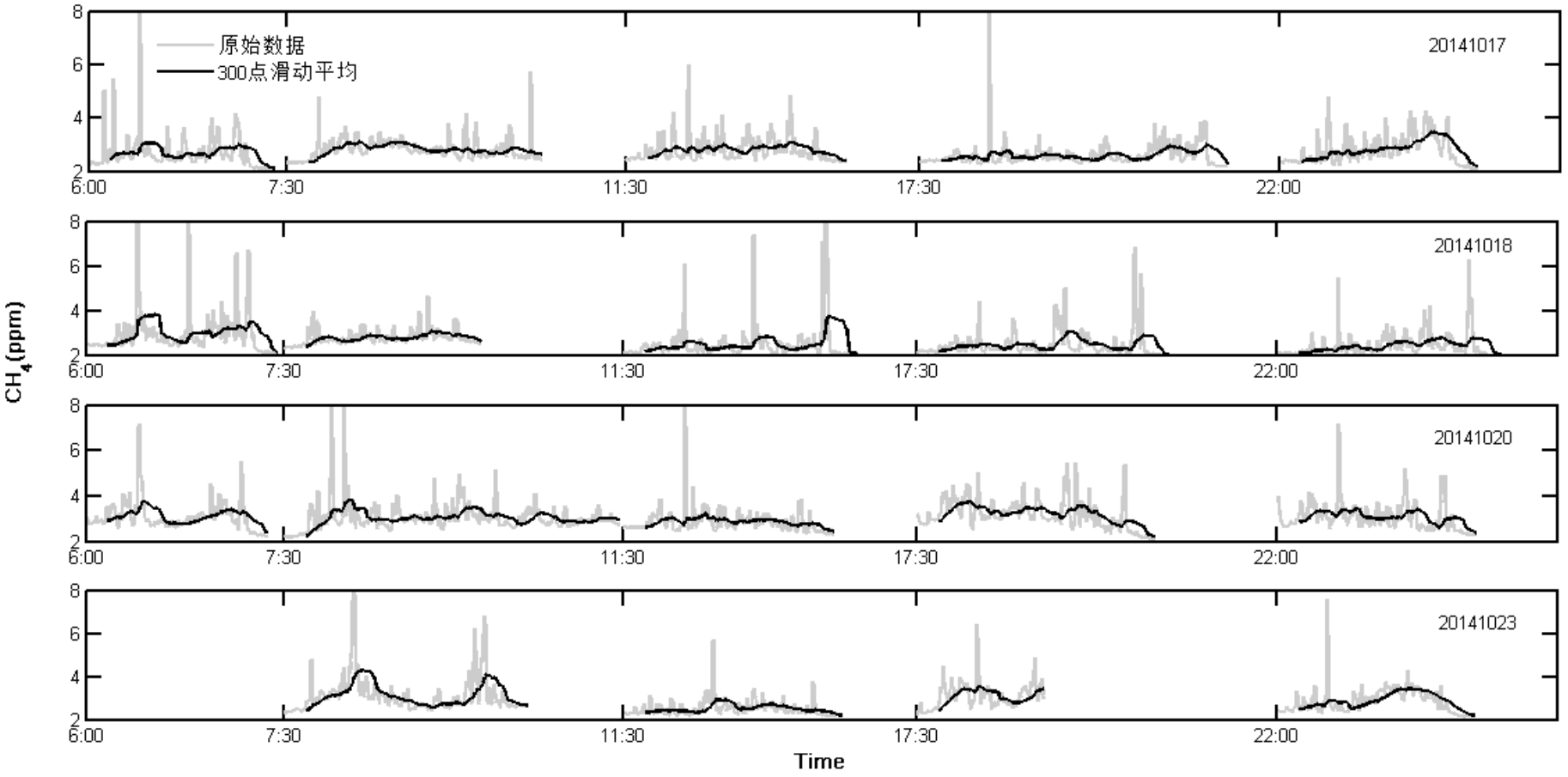


Fig. 4. CH_4 concentrations (ppm) on the road 4 during the experiment.

Preliminary results

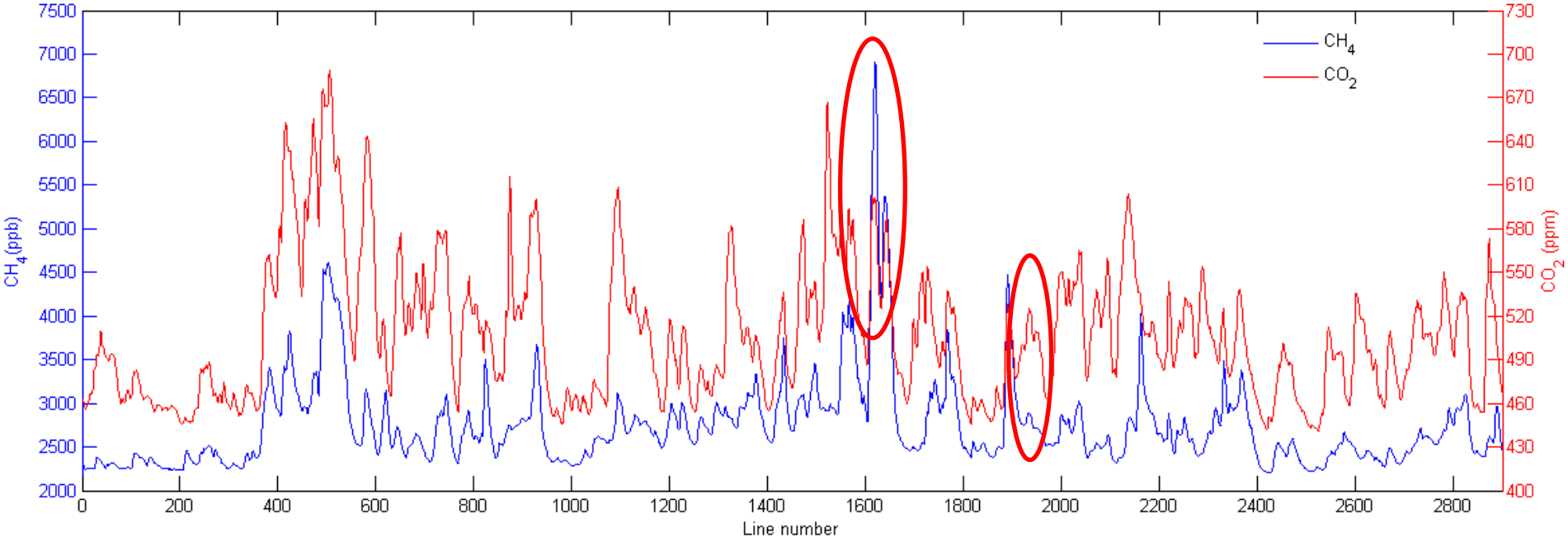
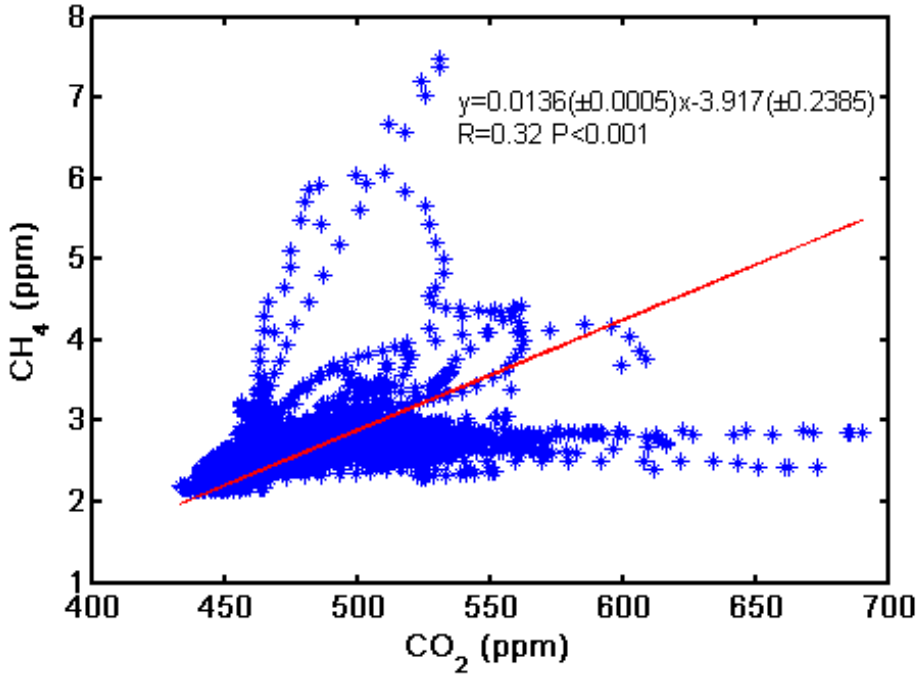


Fig. 5. CH_4 and CO_2 concentrations (ppm) on the road 1 at about 7:30 am. Oct. 17 in 2014.

Preliminary results



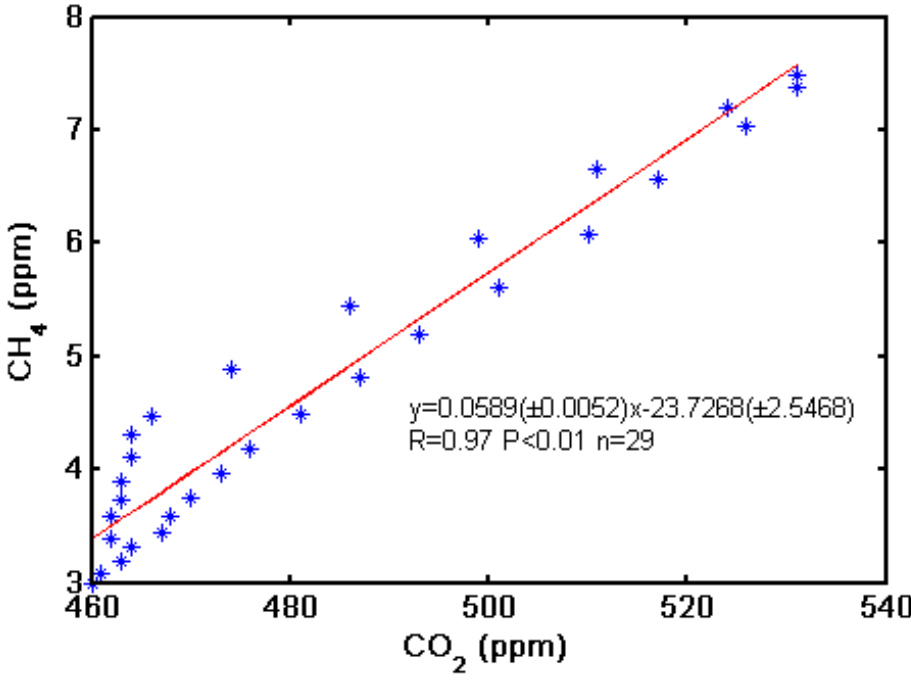


Fig. 6. The ratio of methane and carbon dioxide on the road 1.

Preliminary results

Table. 1. Mean, Max and Min value of CH_4 concentration (ppm) and CO_2 concentration (ppm) on different roads.

road	CH_4 (ppm)			CO_2 (ppm)		
	mean	max	min	mean	max	min
1	2.79	8.94	2.03	493.99	876.88	409.05
3	2.53	13.98	1.98	477.59	856.50	409.43
4	2.73	23.62	1.97	502.05	876.47	410.54

Preliminary results

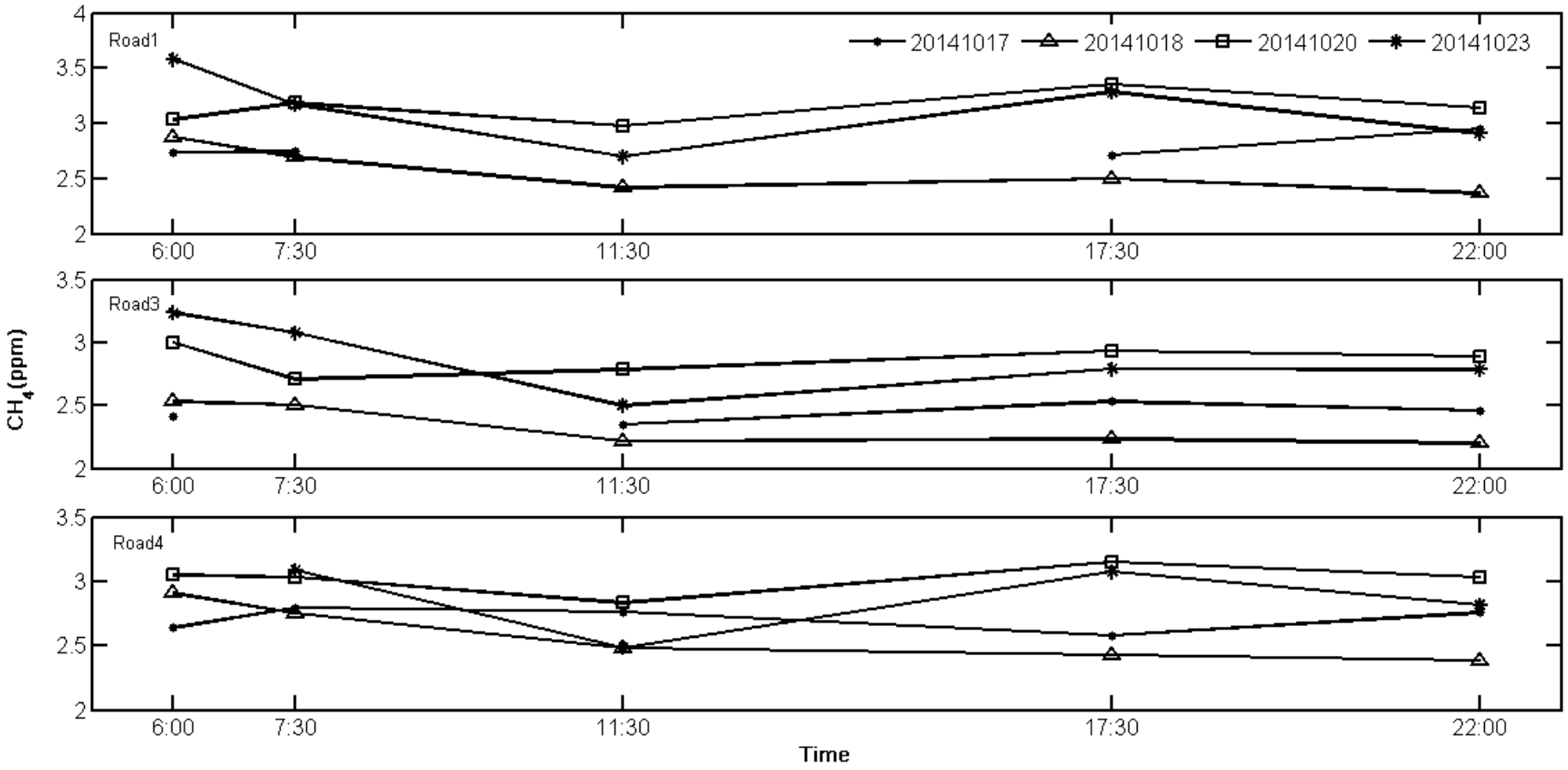
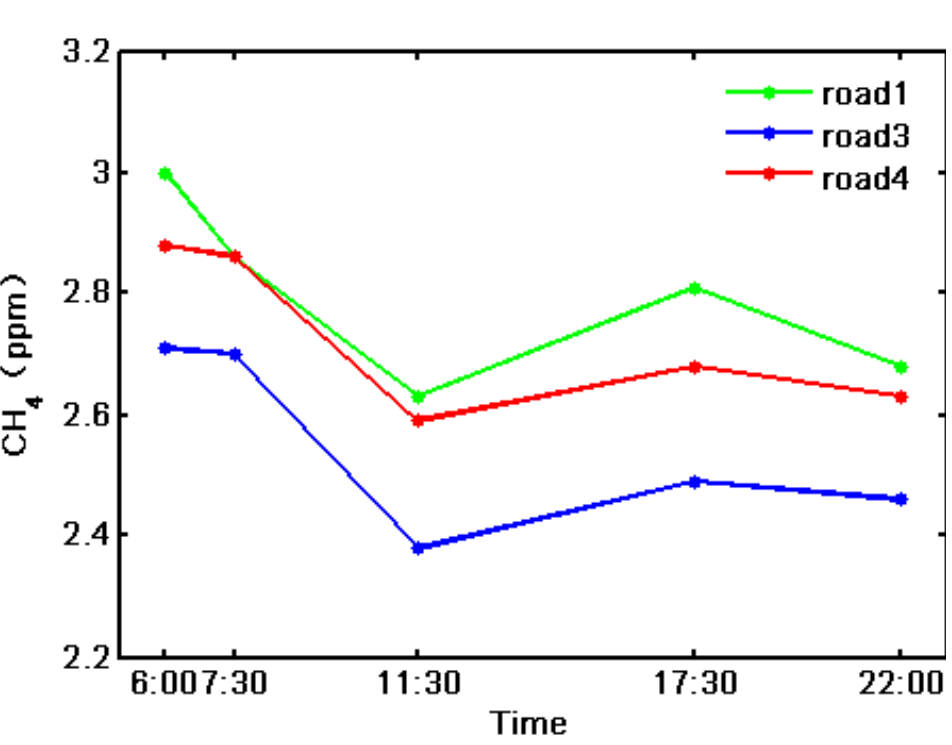


Fig. 7. Mean diurnal variation of CH_4 concentrations (ppm) on different roads during the experiment.

Preliminary results



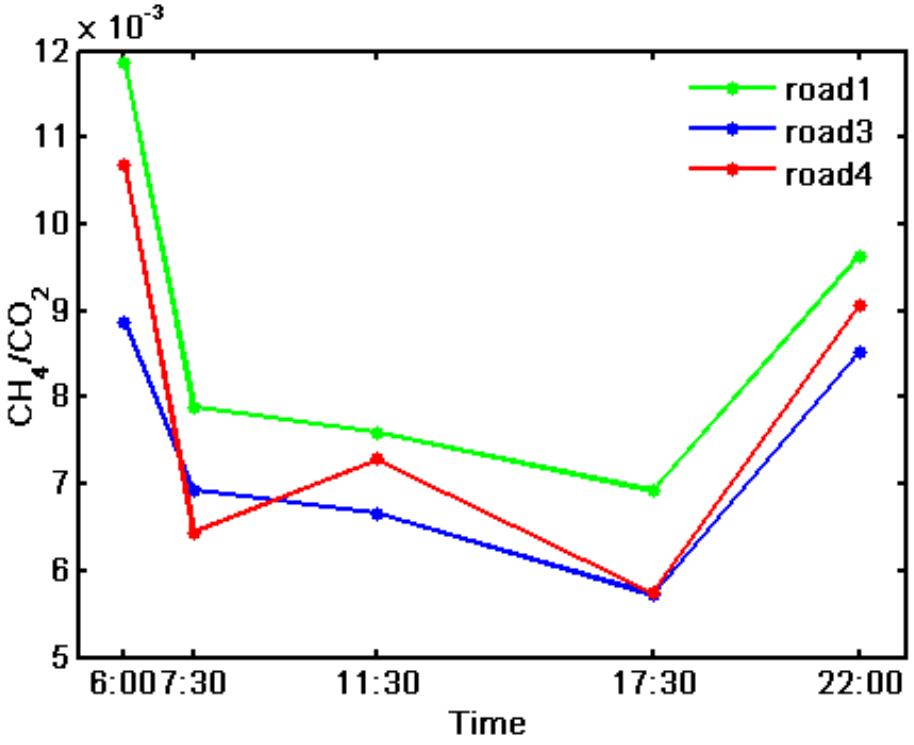


Fig. 8. Mean diurnal variation of CH_4 concentrations (ppm) and CH_4:CO_2 on different roads.

Preliminary results

Table. 2.1 CH_4 concentrations (ppm) and CO_2 concentrations (ppm) and vehicle number on Xinjiekou road 4 in Nanjing.

XJK		road4				
		6:00	7:30	11:30	17:30	22:00
20141017	CH_4	2.88	2.86	2.76	2.48	2.84
	CO_2	478.90	534.00	509.62	539.45	489.82
	CH_4/CO_2	0.0110	0.0067	0.0072	0.0039	0.0094
	taxi	9	34	56	26	57
	total	51	354	277	323	177
	taxi/total	17.65%	9.60%	20.22%	8.05%	32.20%
20141018	CH_4	2.59	2.76	2.36	2.74	2.62
	CO_2	471.35	535.56	485.71	527.12	475.98
	CH_4/CO_2	0.0085	0.0059	0.0048	0.0061	0.0084
	taxi	33	41	61	27	59
	total	108	133	361	290	180
	taxi/total	30.56%	30.83%	16.90%	9.31%	32.78%

Preliminary results

Table. 2.2 CH_4 concentrations (ppm) and CO_2 concentrations (ppm) and vehicle number on Xinjiekou road 4 in Nanjing.

XJK		road4				
		6:00	7:30	11:30	17:30	22:00
20141020	CH_4	2.79	2.95	2.96	3.37	3.01
	CO_2	495.32	594.19	587.88	623.10	505.86
	CH_4/CO_2	0.0084	0.0052	0.0054	0.0063	0.0096
	taxi	10	47	44	24	44
	total	56	466	251	330	115
	taxi/total	17.86%	10.09%	17.53%	7.27%	38.26%
20141023	CH_4		2.69	2.50	2.99	2.87
	CO_2		532.69	511.71	588.55	521.89
	CH_4/CO_2		0.0056	0.0049	0.0055	0.0073
	taxi	11	30	63	29	47
	total	44	321	430	204	129
	taxi/total	25.00%	9.35%	14.65%	14.22%	36.43%

Preliminary results

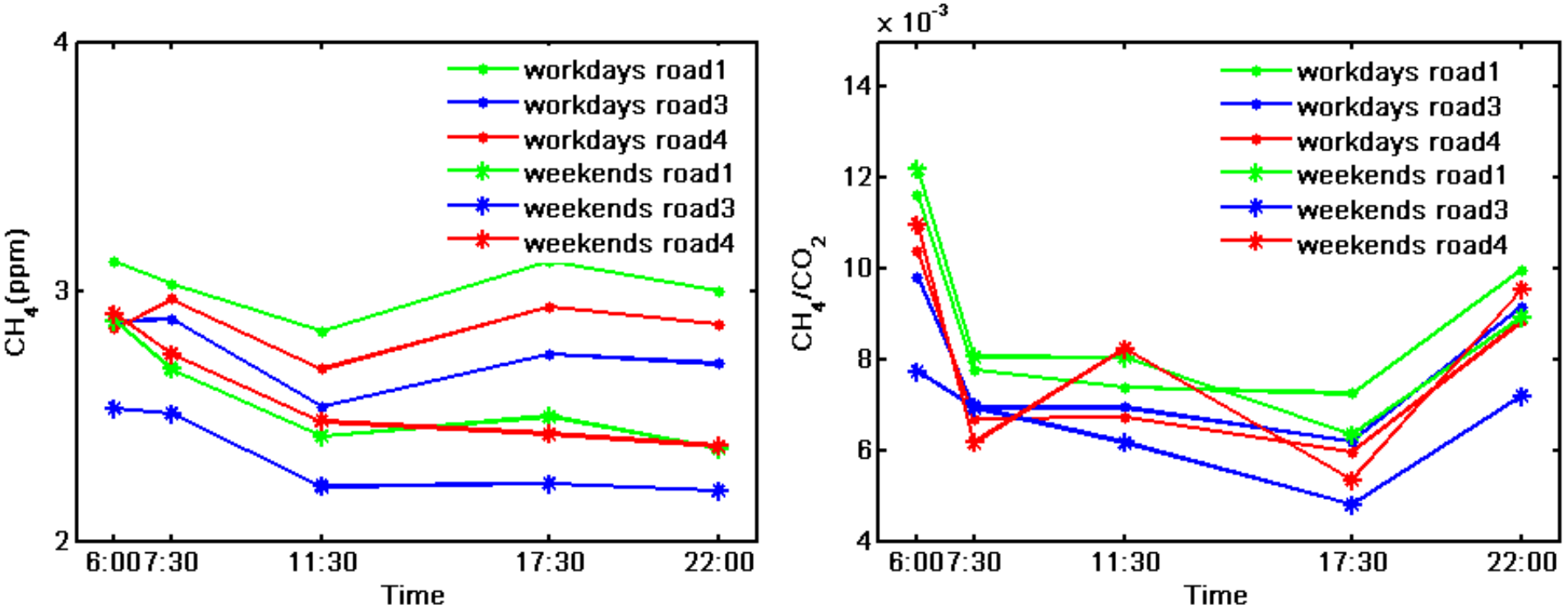


Fig. 9. Mean workdays and weekends diurnal variation of CH_4 concentrations (ppm) and CH_4:CO_2 on different roads.

Next work

- Distinguishing the two cases in the video: only natural gas vehicles (taxi) and the use of other fuels vehicles, calculating methane and carbon dioxide emissions ratio.

- Application of IPCC method to estimate methane emissions from traffic.

- Further refinement of emission factors, in order to make traffic methane estimation more accurate.

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Thank you