N_2O and CO observations at a suburban site, Nanjing

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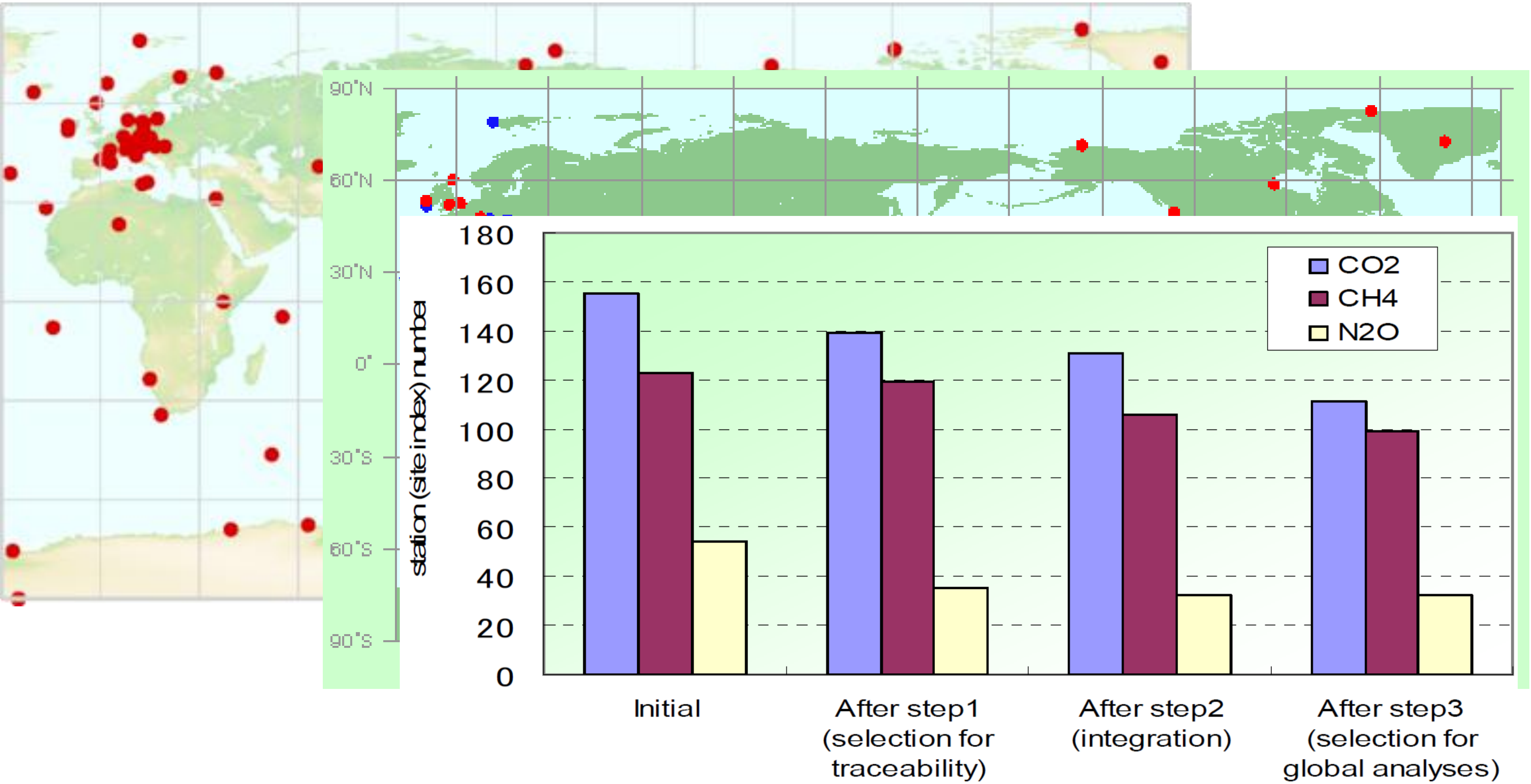
Background

- N_2O has 297 times the global temperature potential (GTP_{100}) of CO_2 [IPCC. *2013*].
- The increasing N_2O is caused by anthropogenic emissions from the use of fossil fuel as a source of energy and from land use change, especially from agriculture.
- The atmospheric N_2O concentration was 324 ppb in 2011 and has increased by approximately 20% since 1750 [IPCC. *2013*].

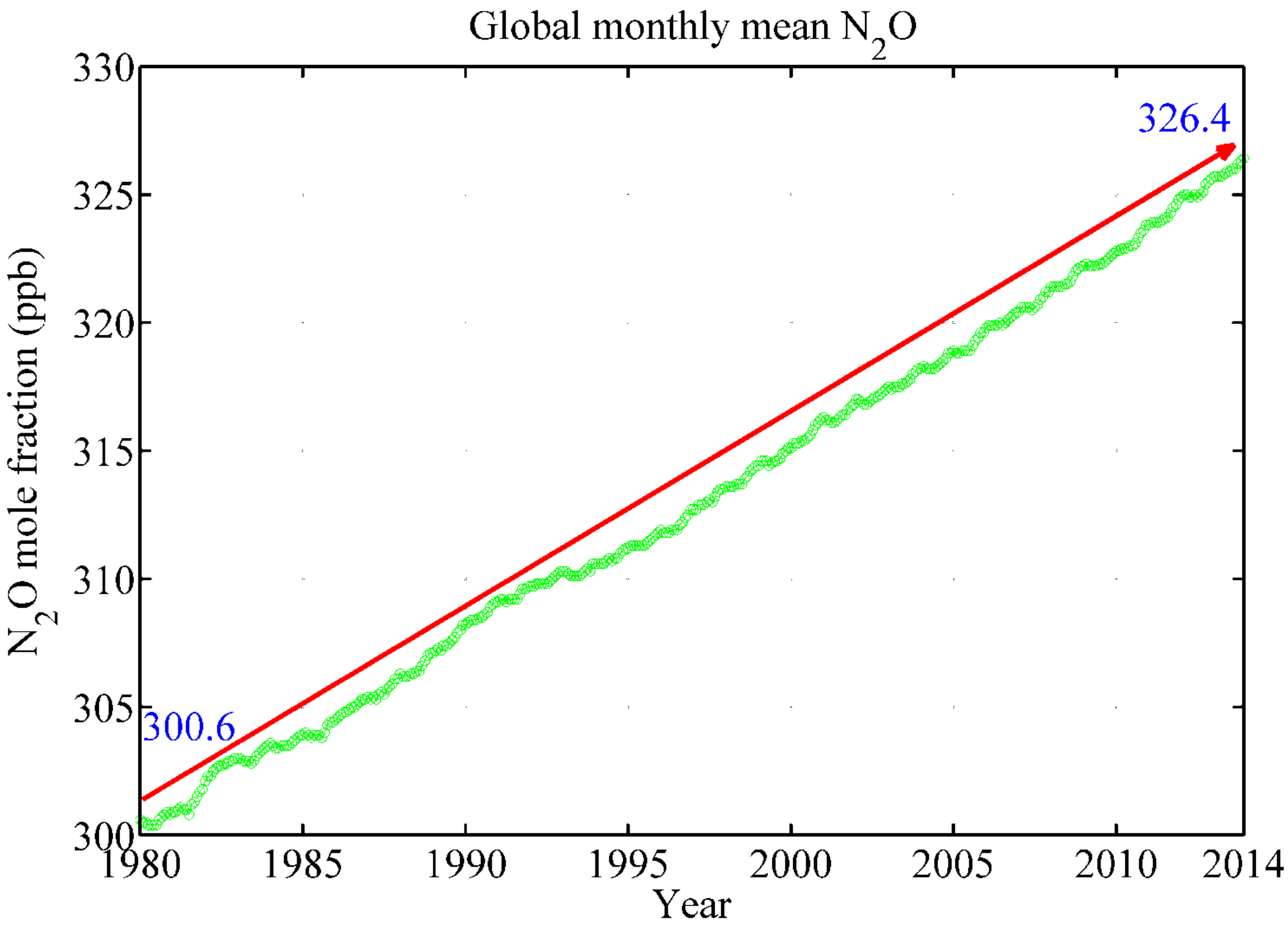
- Carbon monoxide(CO) plays a key role in tropospheric photochemistry, it is involved in the formation of tropospheric ozone, and the interaction of CO with Hydroxyl controls the oxidation capacity of the atmosphere and leads to the formation of carbon dioxide which is a key greenhouse gas of the atmosphere.[Crutzen et al.,]

- CO is toxic: when released into blood it hampers oxygen delivery to body tissues, breaks the Cardiovascular system, and adversly affects the metabolic processes. [Prockop et al., 2007].

Results



From http://ds.data.jma.go.jp/gmd/wdcgg/cgi-bin/wdcgg/map_search.cgi



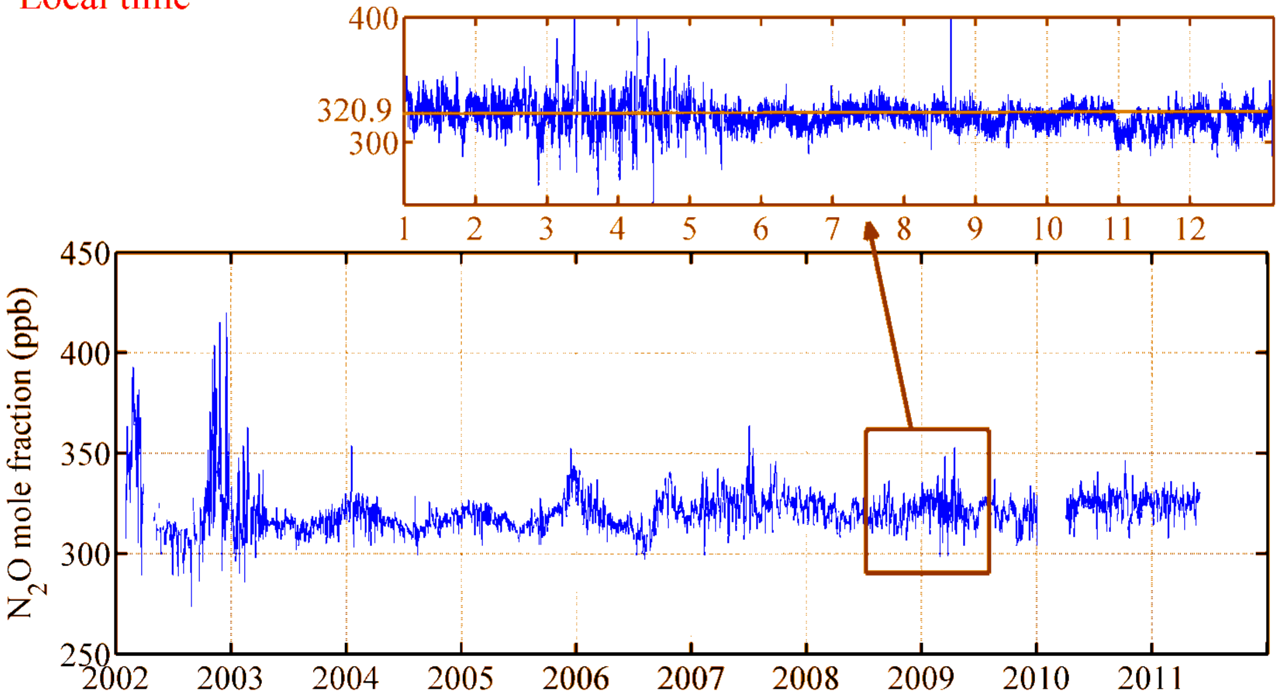
Global Atmosphere Watch. Data is available online: http://ds.data.jma.go.jp/gmd/wdcgg/cgi-bin/wdcgg/catalogue.cgi (accessed on 5 November 2014).

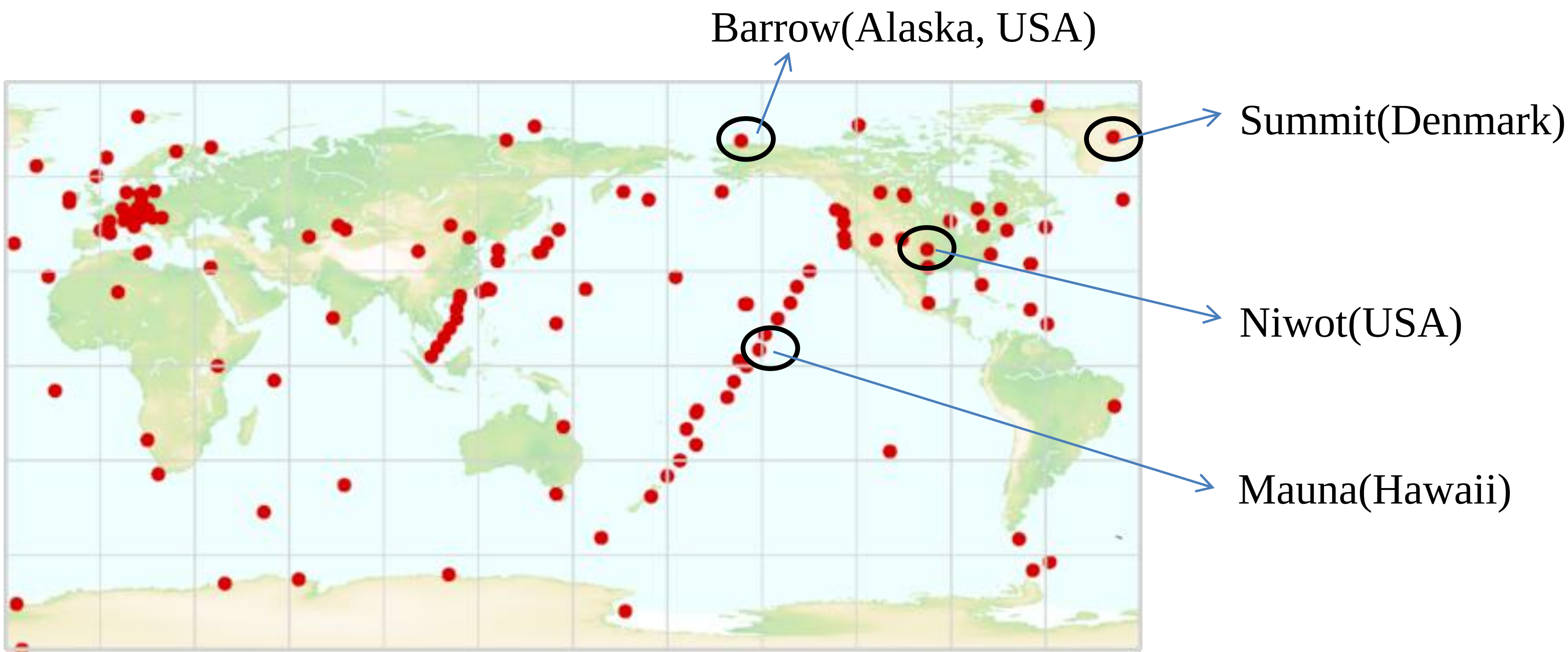
Gosan (33.17N, 126.10E, 72 m)

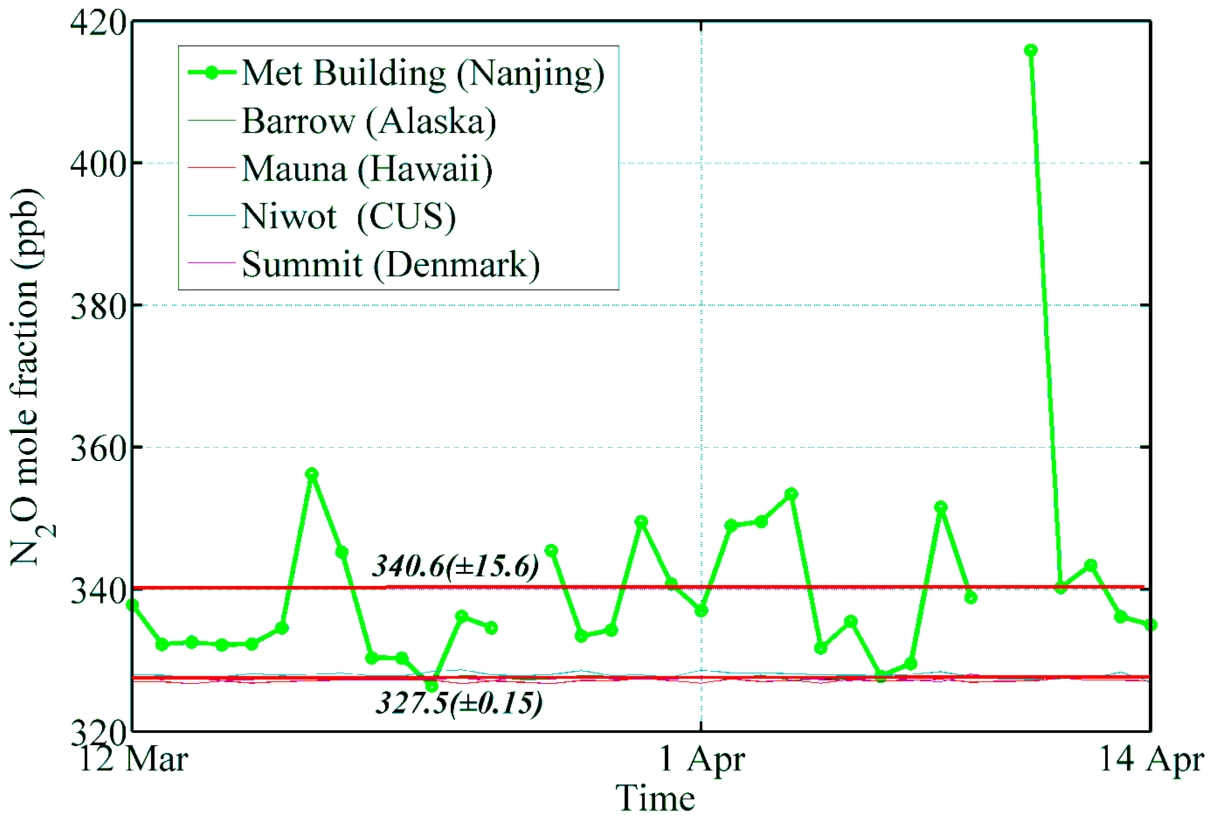
The Gosan site locates on Jeju Island of South Korea, Jeju Island is regarded as one of the cleanest areas in South Korea with low emissions of air pollutants, around 500 km northeast of Nanjing.

Gosan site (Korea)

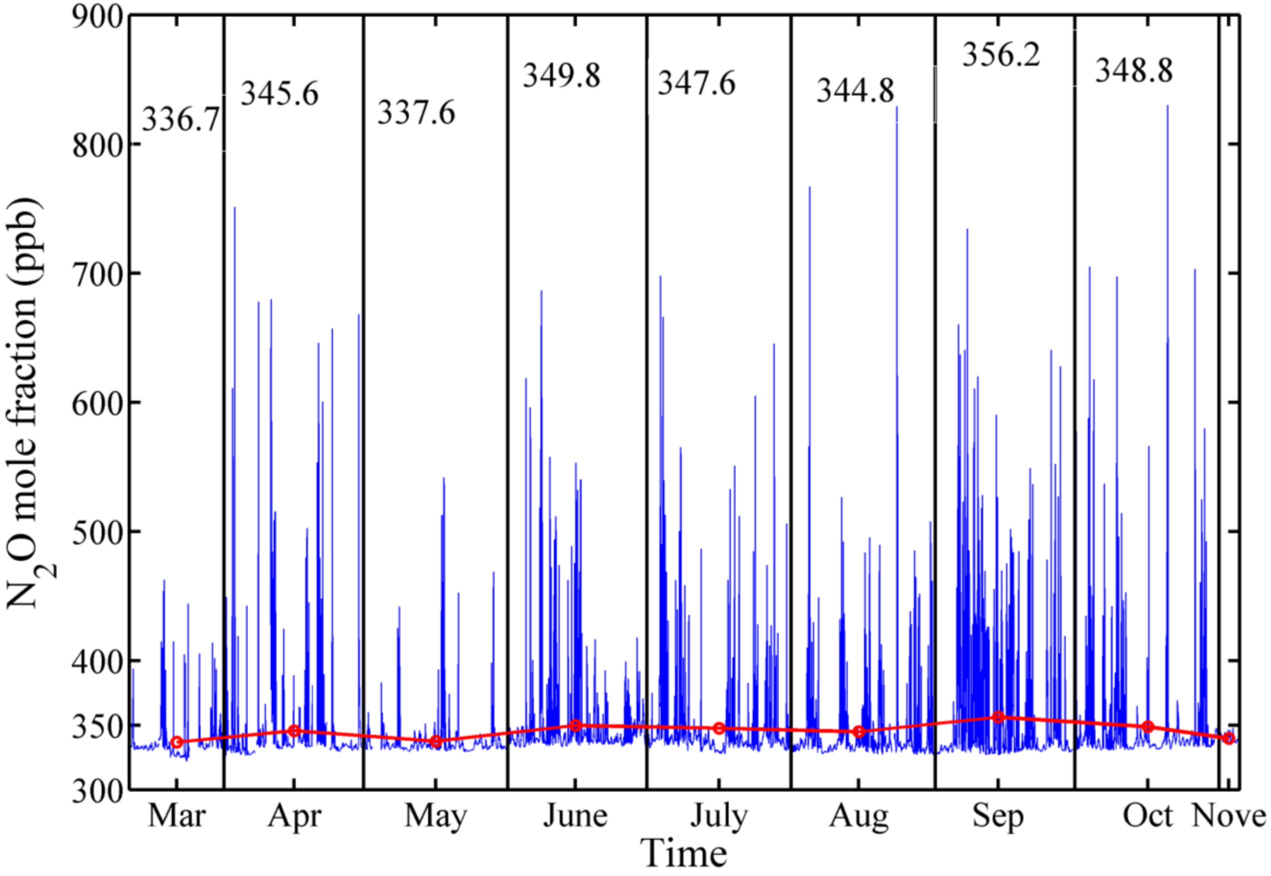
Local time



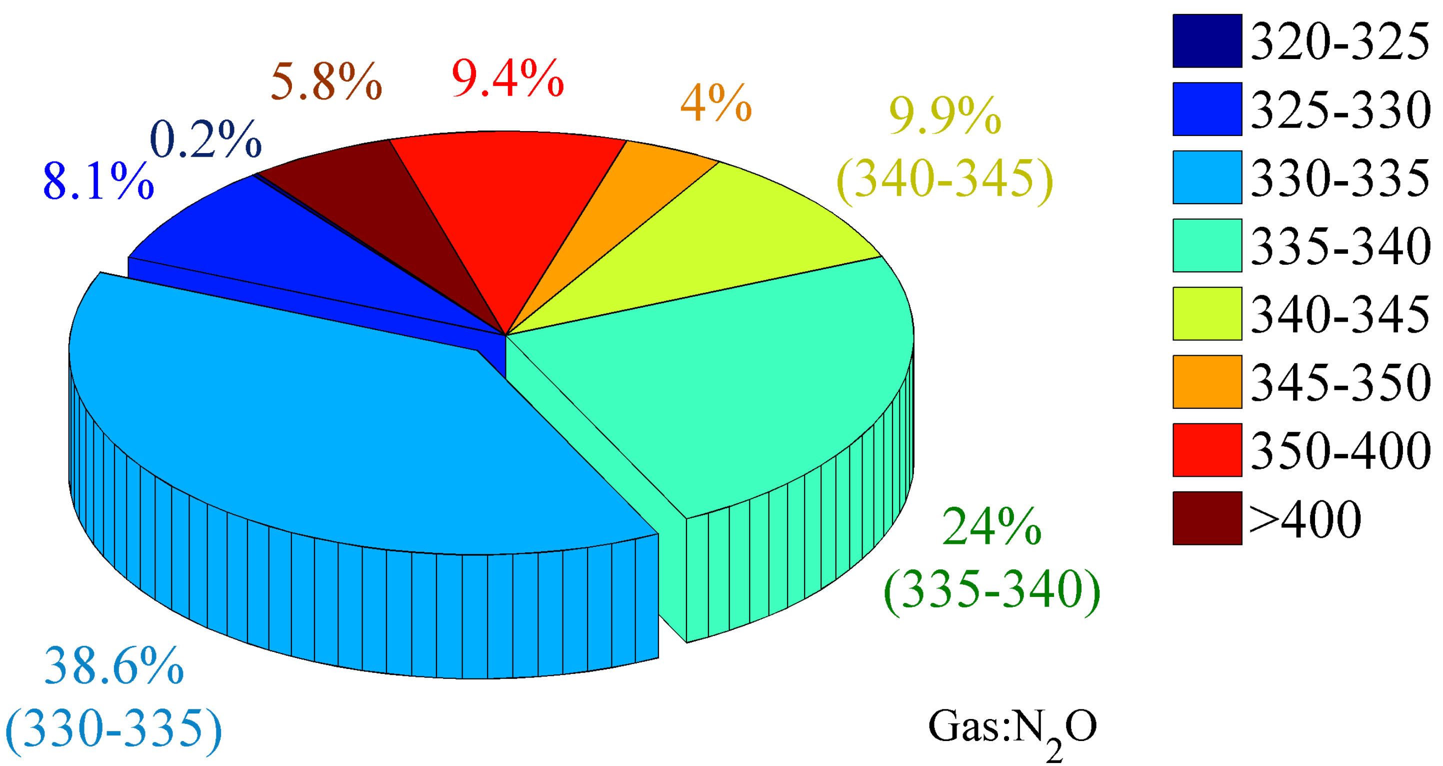

Barrow(Alaska, USA)
Summit(Denmark)
Niwot(USA)
Mauna(Hawaii)



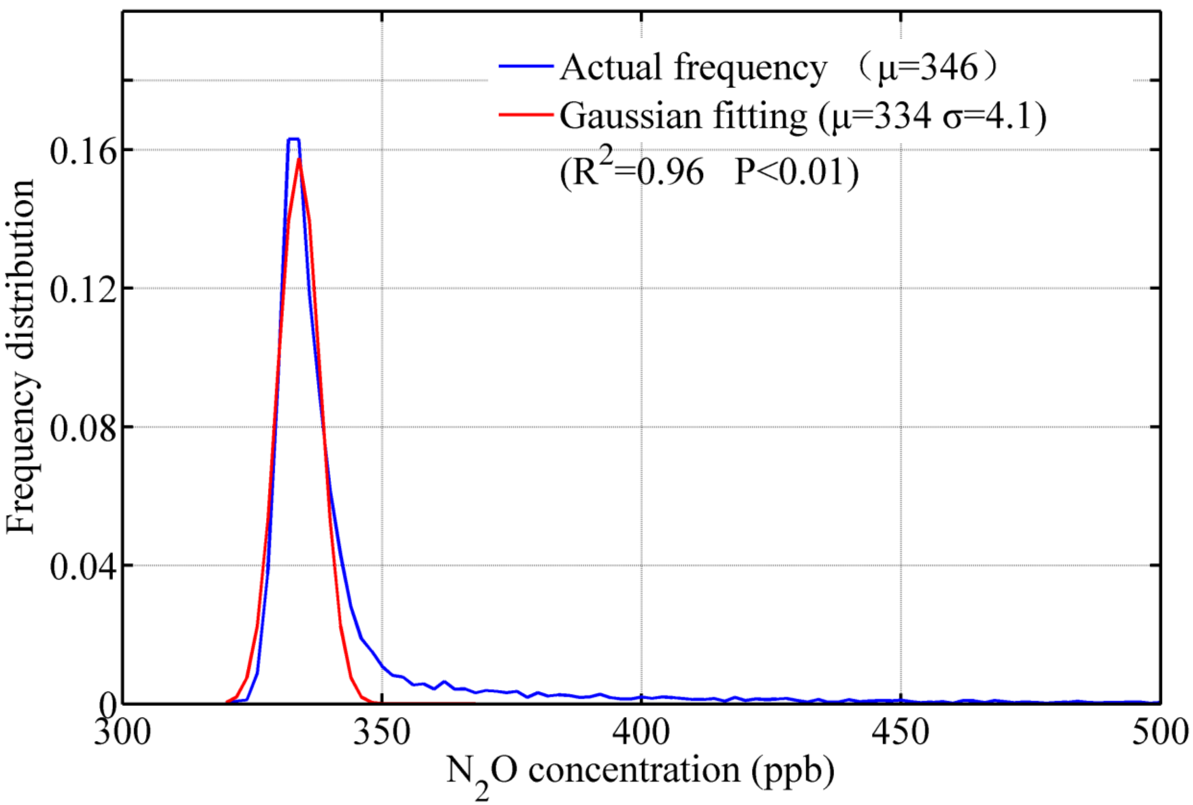
Comparison of N2O concentration between Met Building(Nanjing) and 4 background sites from 12 Mar to 14 Apr.



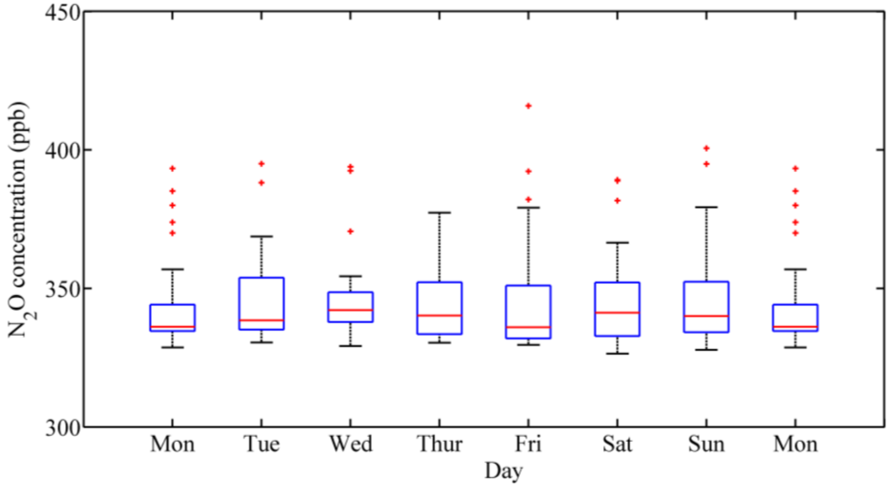
Time series of N2O concentration at a suburban site(Met building, Nanjing)

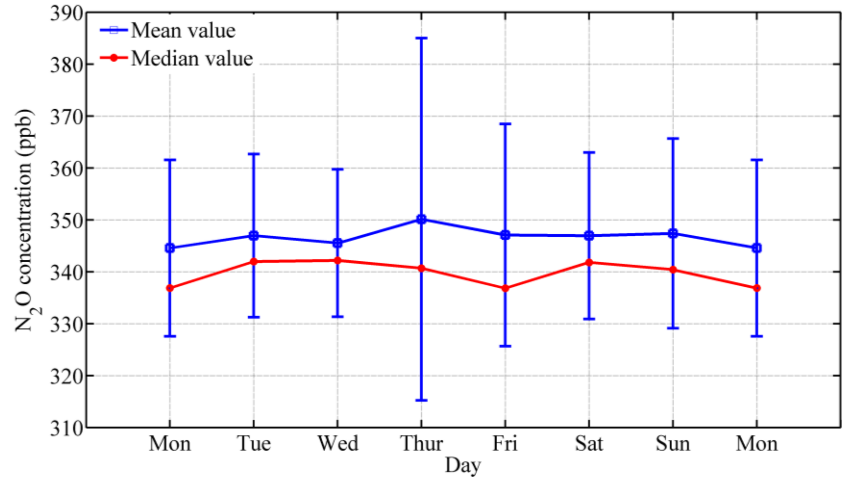


Gas: N_2O
Period:12 Mar-5 Nov (2014)
Unite:ppb



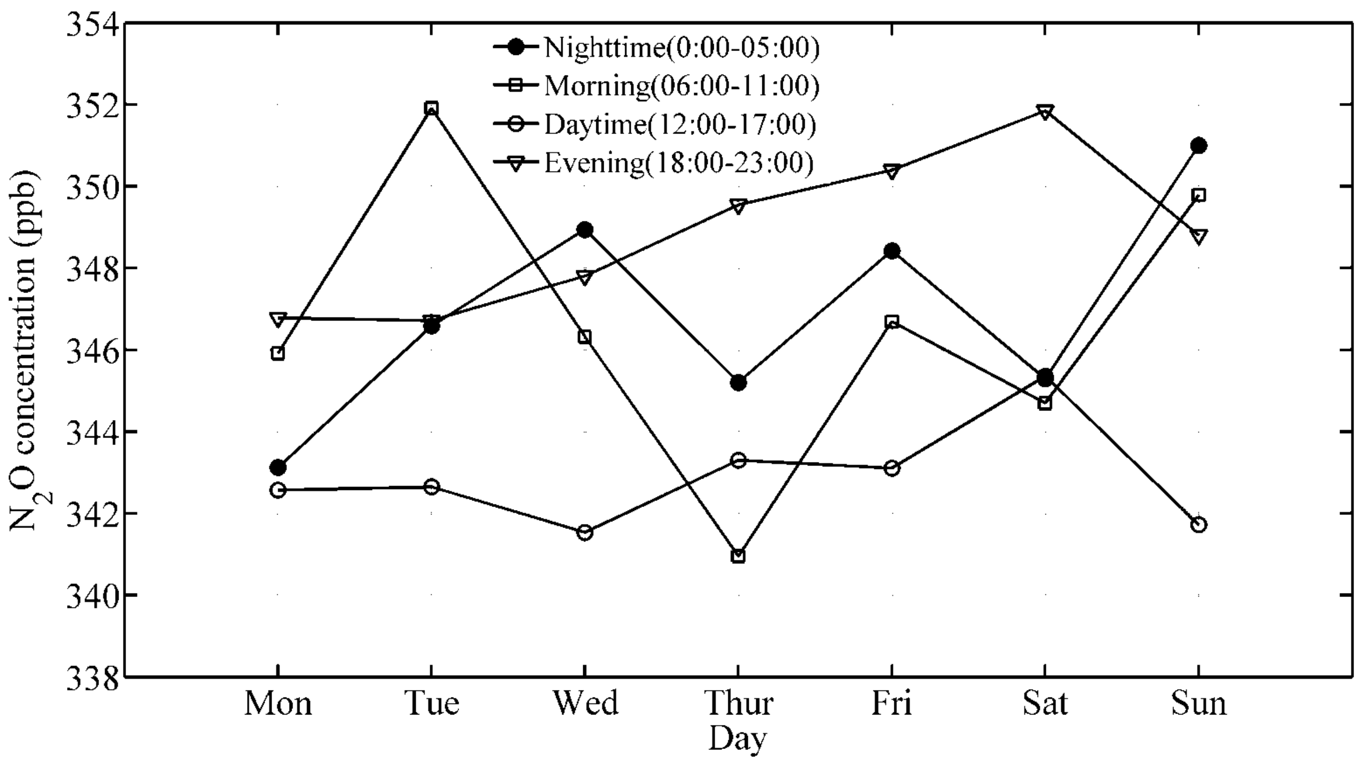
Frequency distributions of observed N_2Oconcentrations and its normal fitting line.



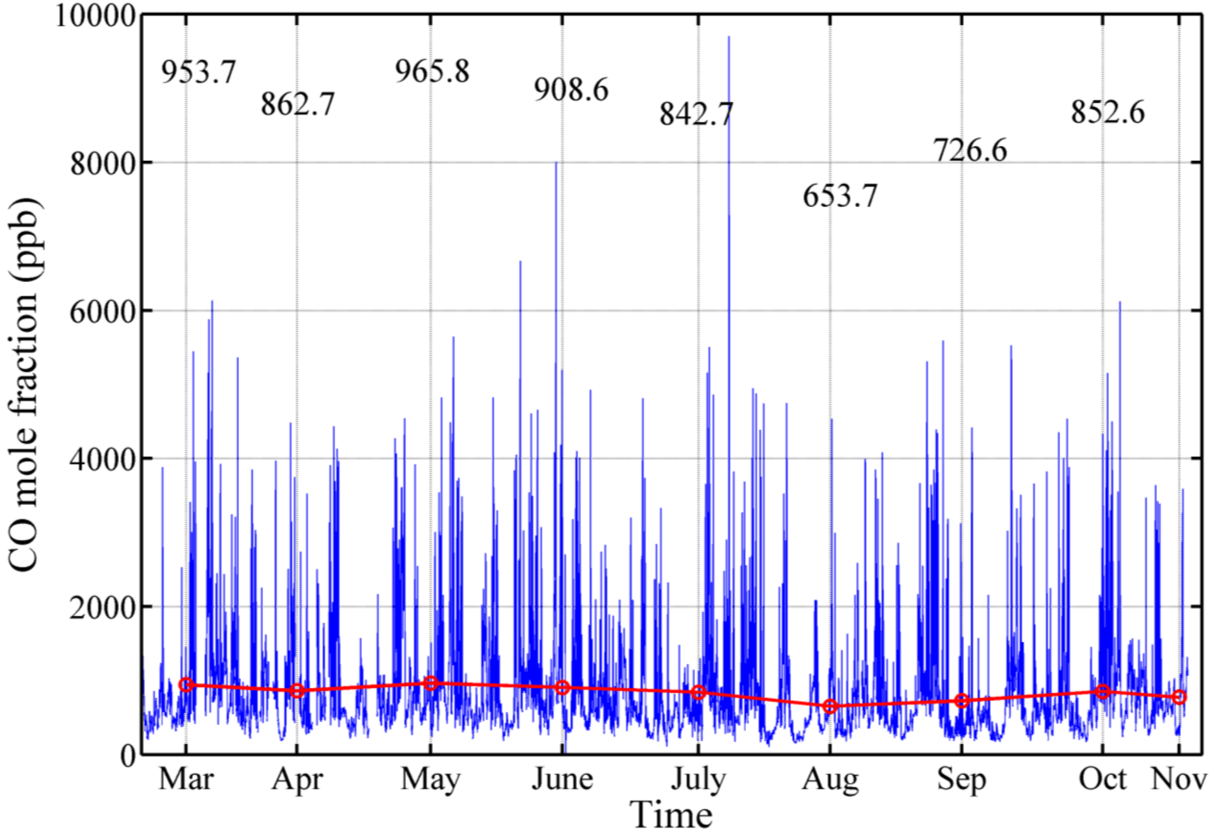


Weekly cycle of N_2Ovconcentration: (left) box and whisker plots of values observed on different days of the week and the red cross + symbols denote outliers.
(right) weekly changes of mean(blue curve with symbols; the vertical bars show the standard deviations of mean values) and median values (red curve).

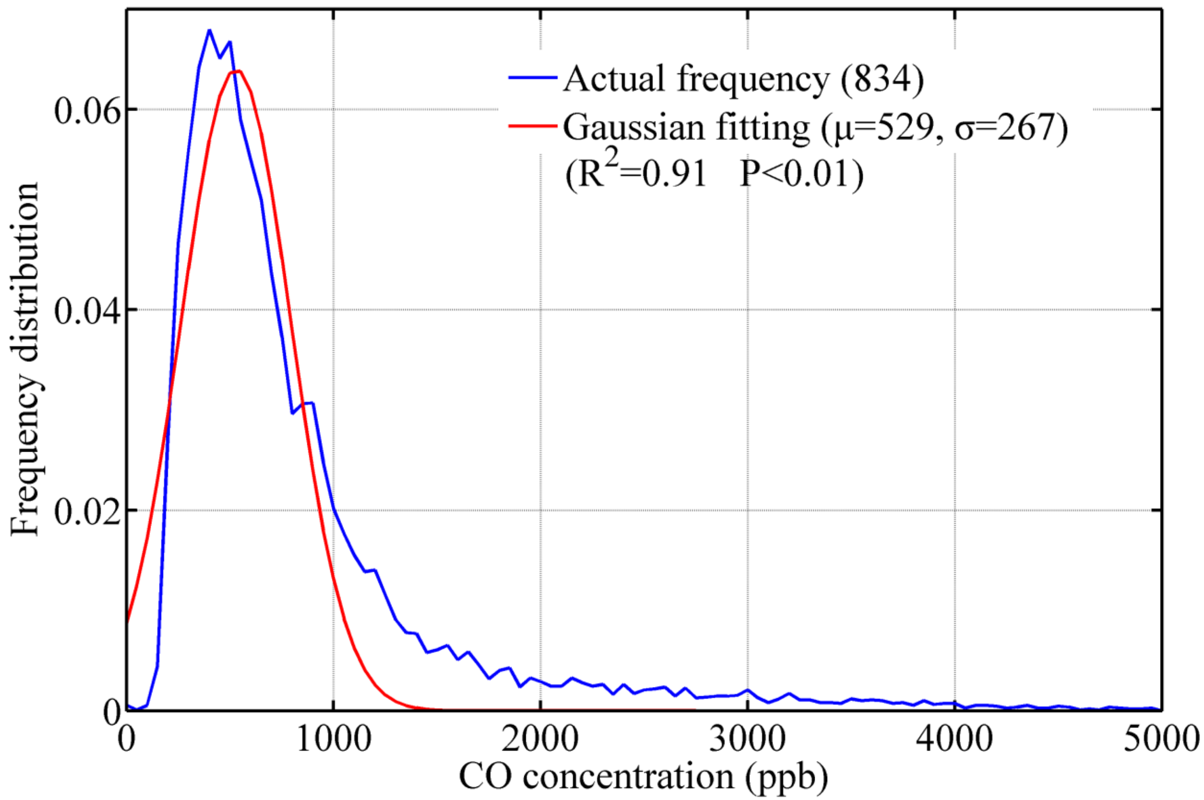
Points are drawn as outliers if they are larger than Q3+W*(Q3-Q1) or smaller than Q1-W*(Q3-Q1). where Q1 and Q3 are the 25th and 75th percentiles, respectively. And W equals 1.5.



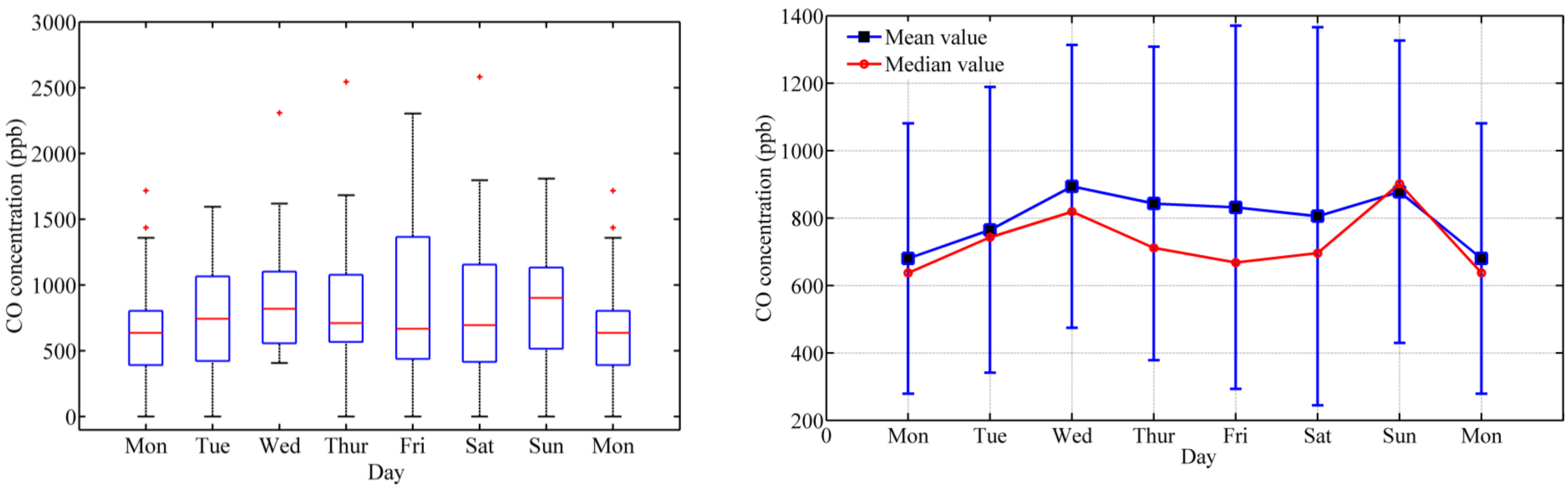
Weekly cycles of N_2O concentration in nighttime, morning, daytime, and evening data.



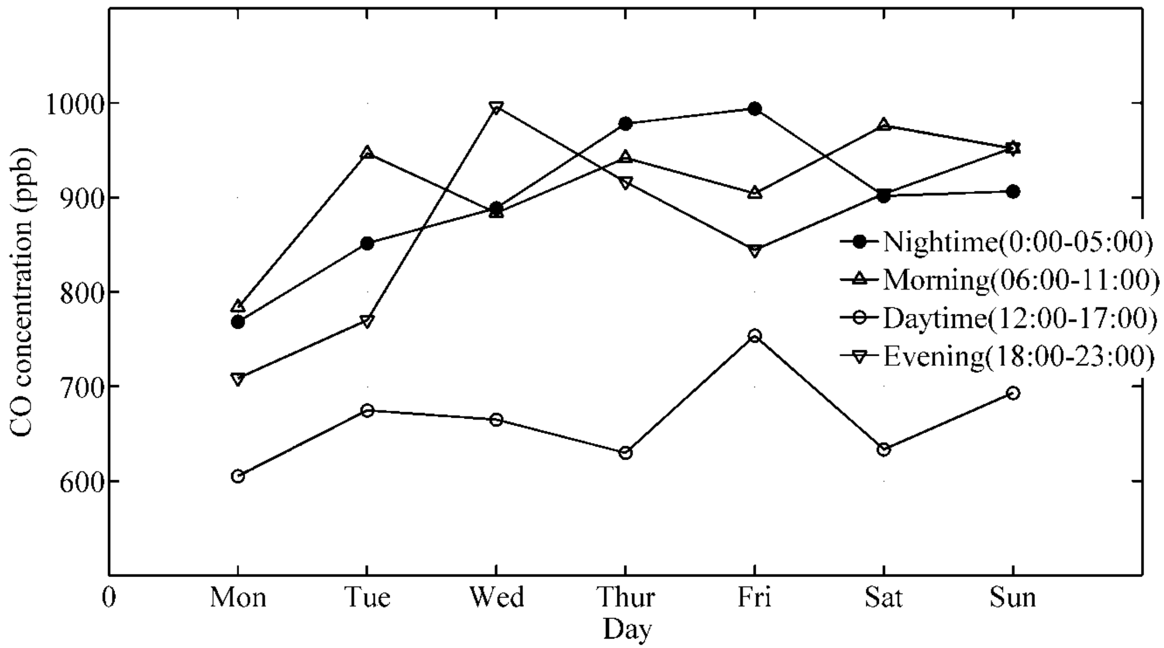
Time series of CO concentration at a suburban site(Met building, Nanjing)



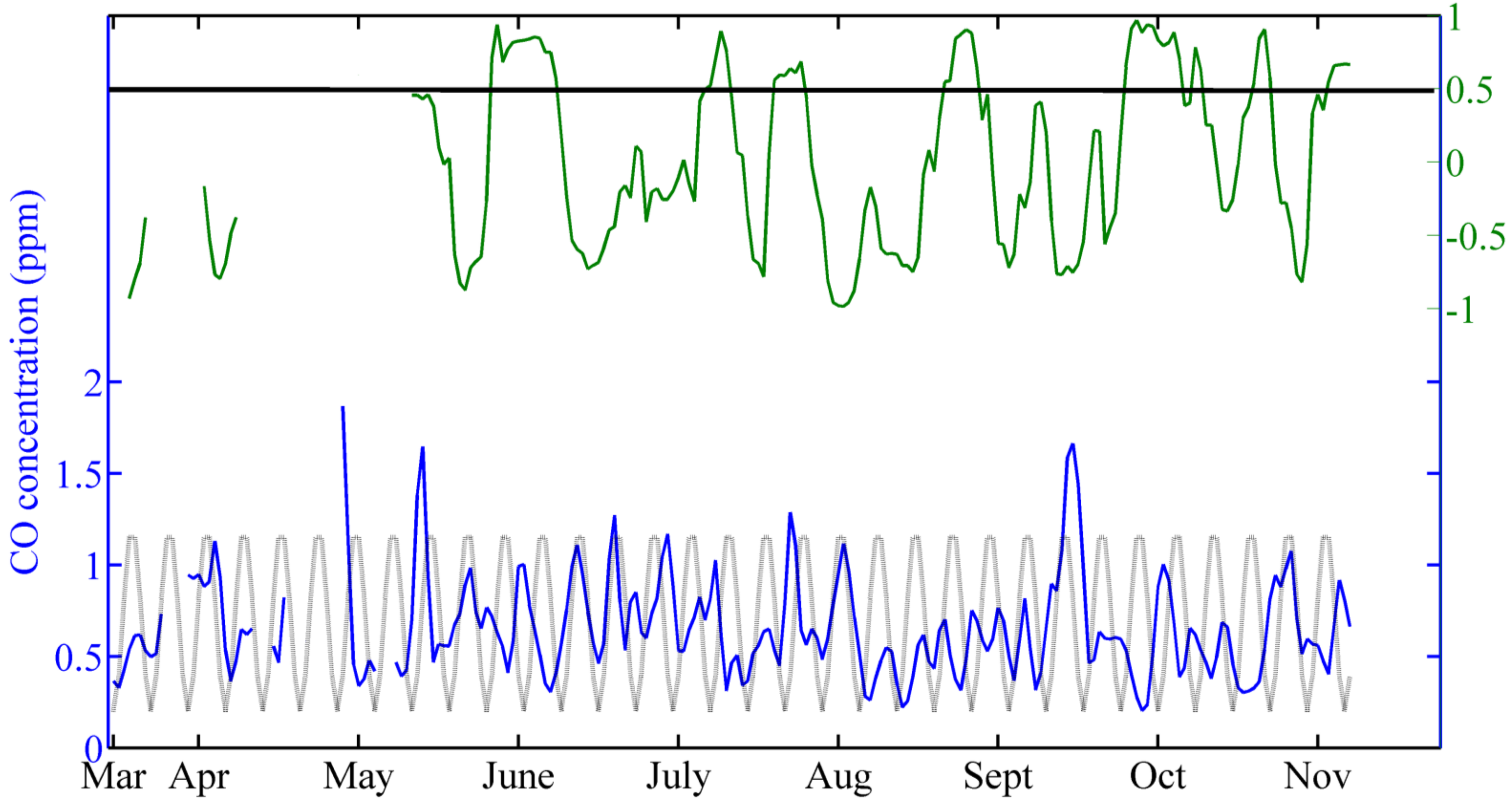
Frequency distributions of observed CO concentrations and its normal fitting line.



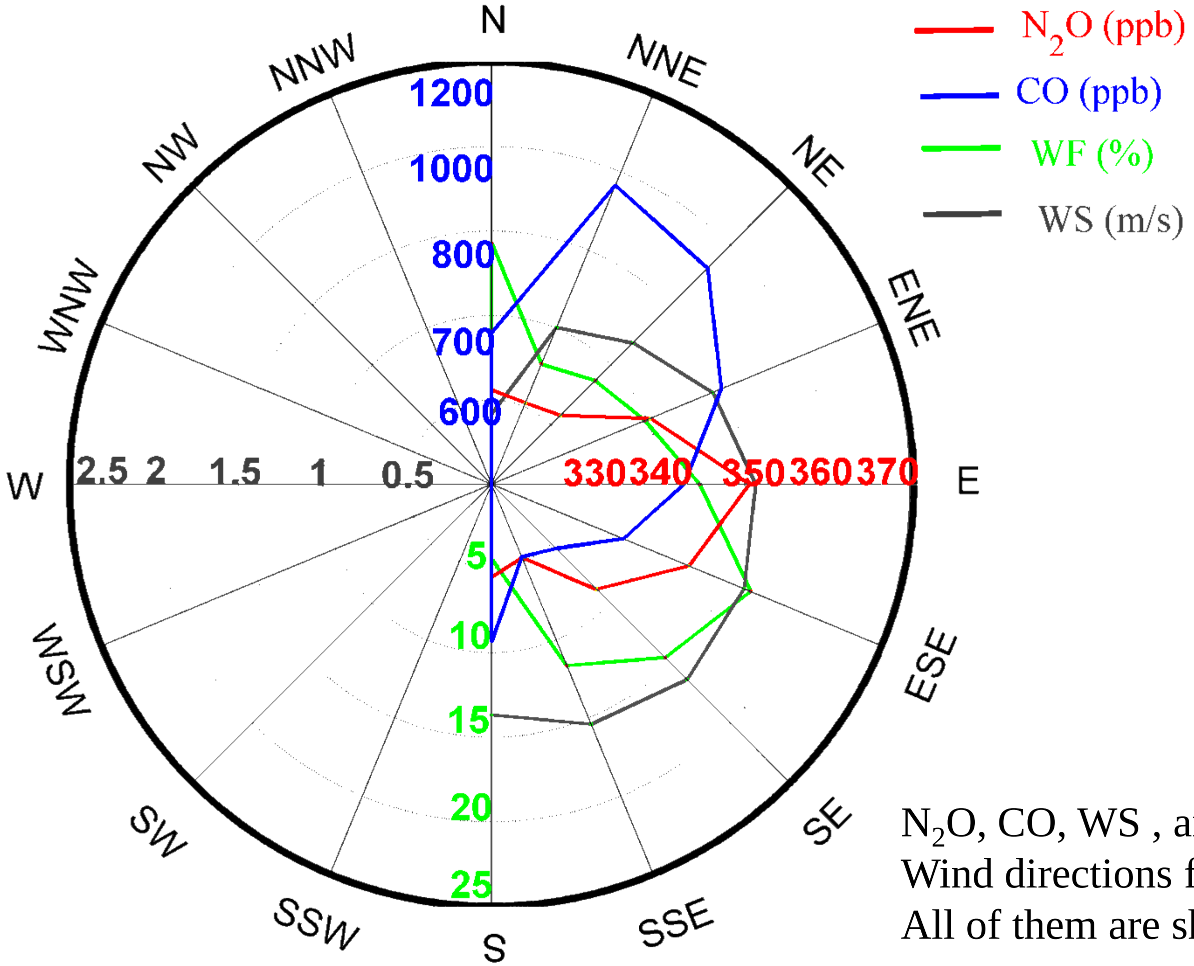
Weekly cycle of CO concentration :(left) box and whisker plots of values observed on different days of the week and the red cross + symbols denote outliers.
(right) weekly changes of mean(blue curvewith symbols; the vertical bars show the standard deviations of mean values) and median values (red curve).



Weekly cycles of CO concentration in nighttime, morning, daytime, and evening data.



Daily mean(12:00-17:00) CO concentration(13 Apr-4 Nov), the data is smoothed averaged over three days weights 1-2-1(blue line), the values of function $y = -0.5\cos\frac{2\pi}{7}(d+3)+0.7$, where d is the Julian day starting January 1, 2014(in gray line); the 7-day-moving coefficients r of correlation with cosine; the horizontal line shows the value of r=0.5.



N_2O, CO, WS , and WF mole fraction of 16 Wind directions from Apr, 2014 to Nov, 2014. All of them are shown in different colors and scales.

May

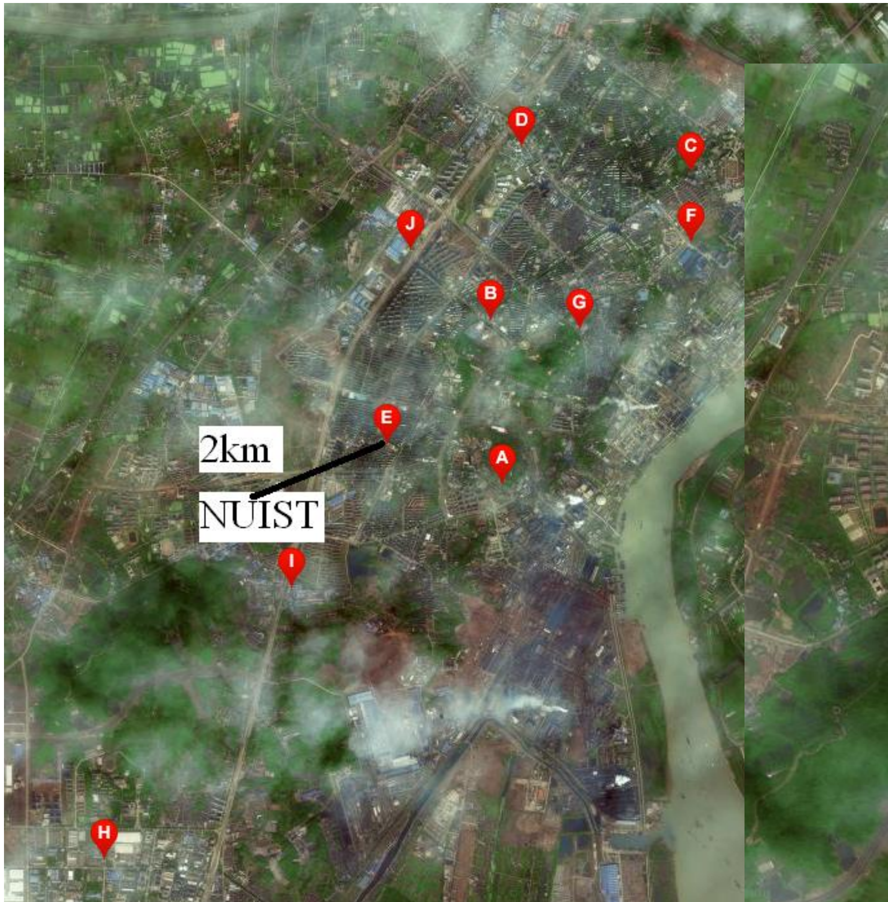
Interval	325-330	330-335	335-340	340-345	345-350	350-400	>400
N2O(ppb)	329.7	332.4	336.9	342.1	347.0	364.5	470.9
CO(ppb)	1564.1	941.5	964.6	975.9	1012.3	926.4	943.2

June

Interval	325-330	330-335	335-340	340-345	345-350	350-400	>400
N2O(ppb)	NaN	334.1	337.2	342.2	347.0	364.9	496.1
CO(ppb)	NaN	727.1	1017.1	812.0	850.3	941.8	707.9

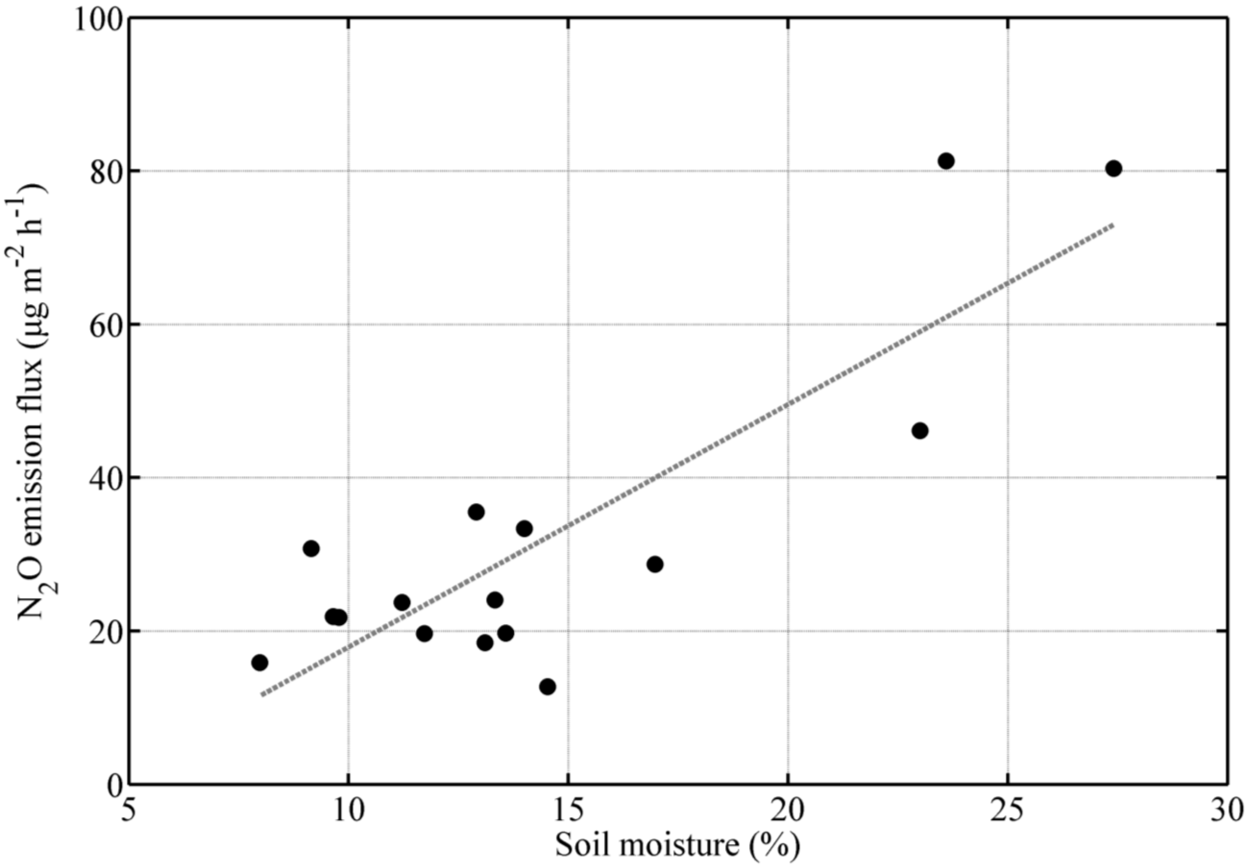
October

Interval	325-330	330-335	335-340	340-345	345-350	350-400	>400
N2O(ppb)	329.9	333.0	337.4	342.1	347.0	366.7	507.8
CO(ppb)	1745.2	933.8	818.9	819.1	822.8	727.5	613.3

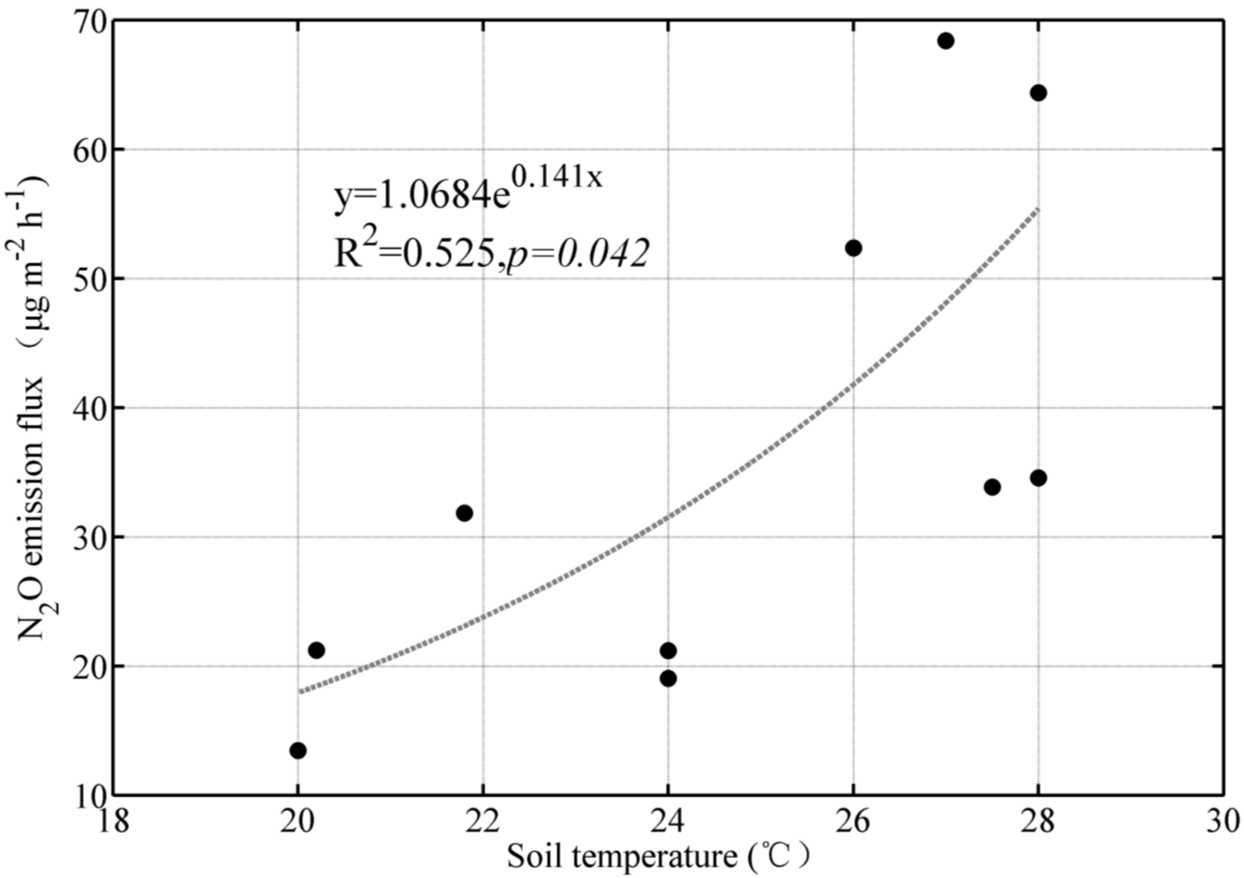


Locations of chemical works.

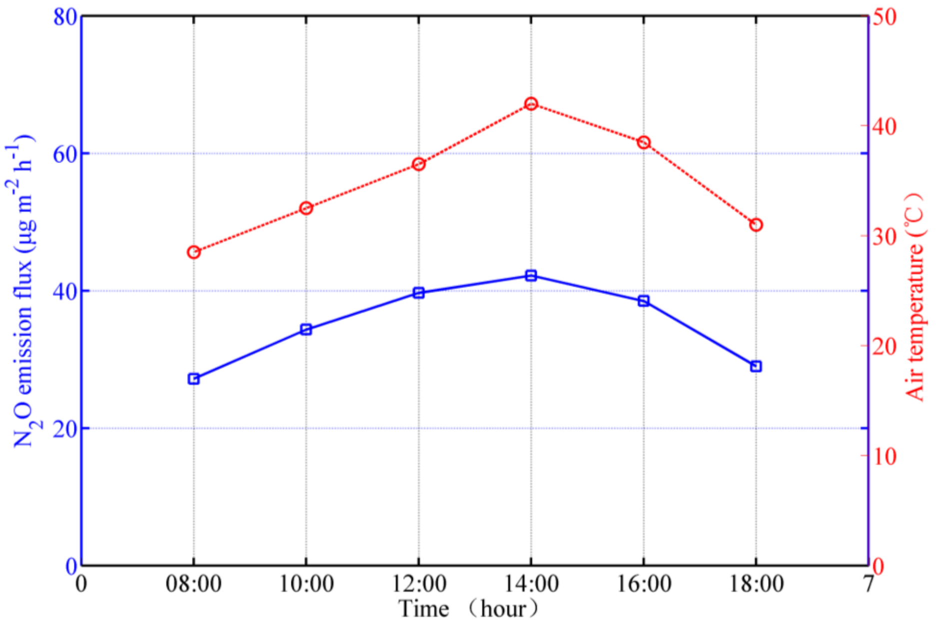
Locations of steel plants

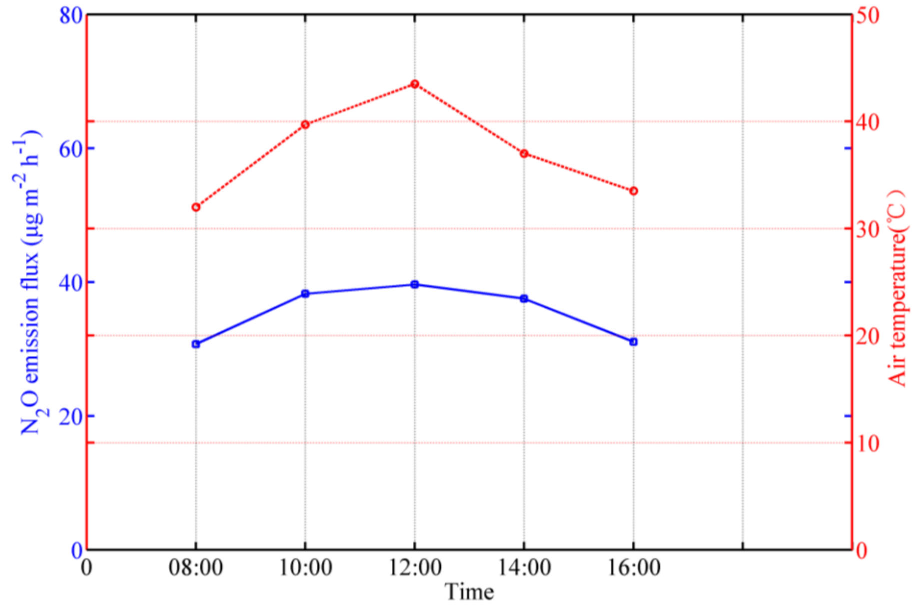


Data from experiments in 2012, by Cuihailin



y=1.0684e^0.141x
R^2=0.525, p=0.042
N2O emission flux （μg m-2 h-1）
Soil temperature (℃)
70
60
50
40
30
20
10
18
20
22
24
26
28
30


80
60
40
20
0
50
40
30
20
10
0
0
08:00
10:00
12:00
14:00
16:00
18:00
7
Time （hour）
N2O emission flux (μg m-2 h-1)
Air temperature (℃)


80
60
40
20
0
50
40
30
20
10
0
0
08:00
10:00
12:00
14:00
16:00
Time
N2O emission flux (μg m-2 h-1)
Air temperature(℃)

Conclusions

- Strong sources of N_2O and CO exist around this suburban site (Met Building, Nanjing).
- For the same gas in different wind directions, the concentrations are different.
- While for the 2 gases, the sources come from different directions(East for N_2O and Northwest for CO), which means their sources are different.
- N2O concentration in July and August is lower than that in June and September, which is the results of emission reduction rules before and during The Youth Olympic Games(16, Aug -28, Aug).
- The concentration of CO in the daytime is smaller than other 3 periods, its is different with the results of [Sitnov et al., 2014] , which concluded that the concentration in the nighttime was the smallest.

The end

Thank you