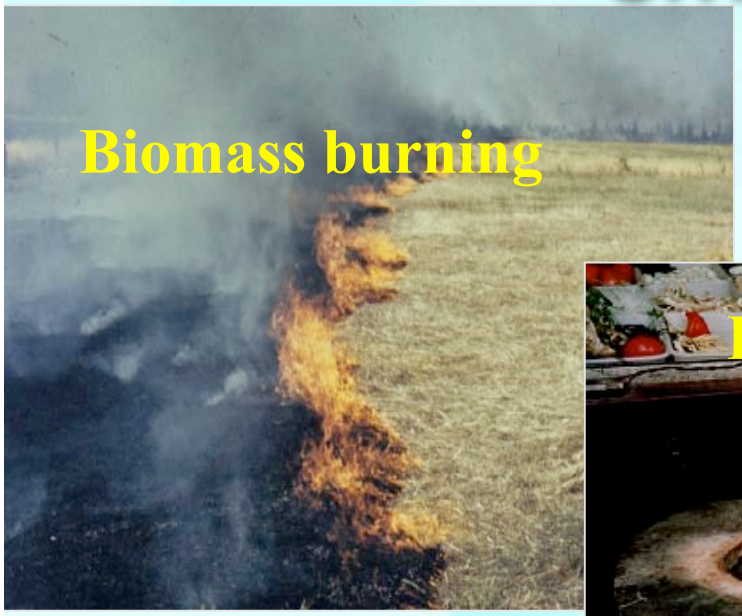
EC/OC Emissions and Aerosol/Gas Observations in China

ZHANG, Xiao-Ye; Qiu, J H; Gong, S L; Cao, G L; Zhou, L X; Sun, J Y; Wang, H; Wang, Y Q; Xu, D; Zhang, H; Ma, J Z; Liu, Y; Li, Yang; Che, H; Ding, Y

Centre for Atmosphere Watch & Services, CMA

Emission Inventory of EC & OC in China

Carbonaceous aerosol emission source



Fuel types considered in this work

Residential

- Agriculture residues
- Fuelwood
- Rural residential-coal
- Rural residential-oil
- Urban residential coal
- Urban residential-oil

Biomass burning

- agriculture waste
- Forest fire
- Grassland fire

Industry

- Urban industry-coal
- Urban industry-oil
- Rural industry-coal
- Rural industry-oil
- Biofuel

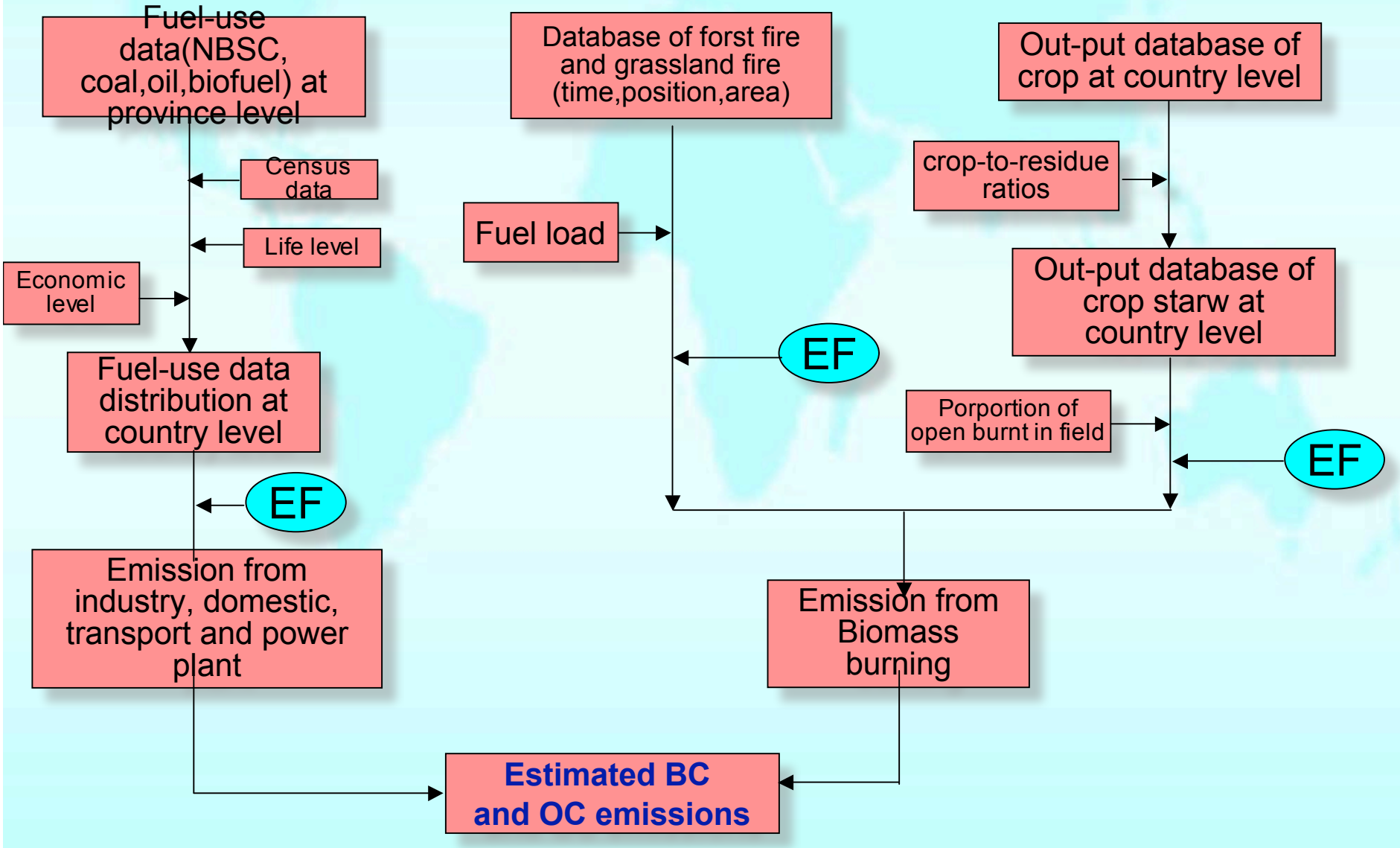
Power Plant

- Coal
- Oil

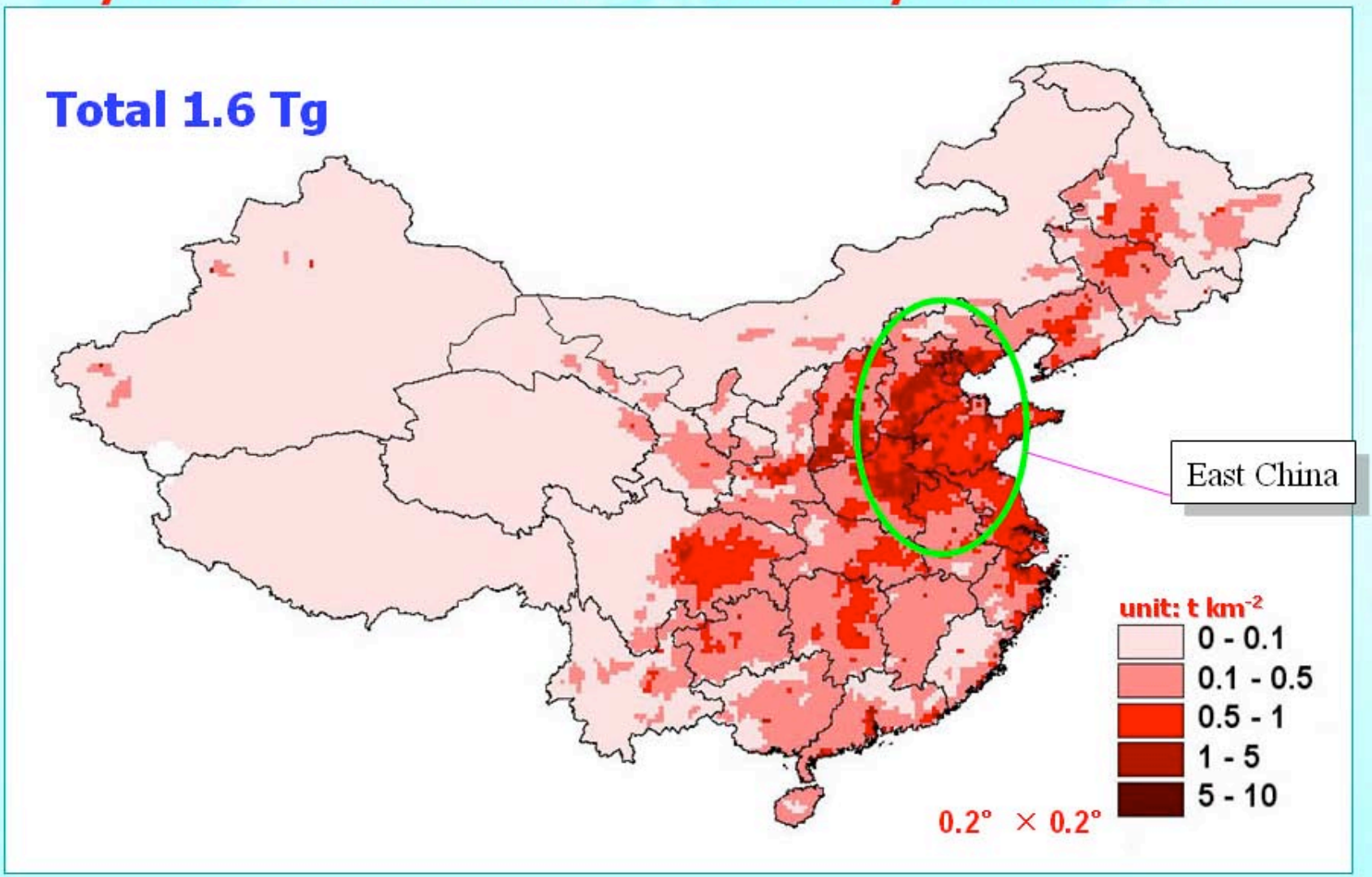
Transportation

- diesel
- gasoline

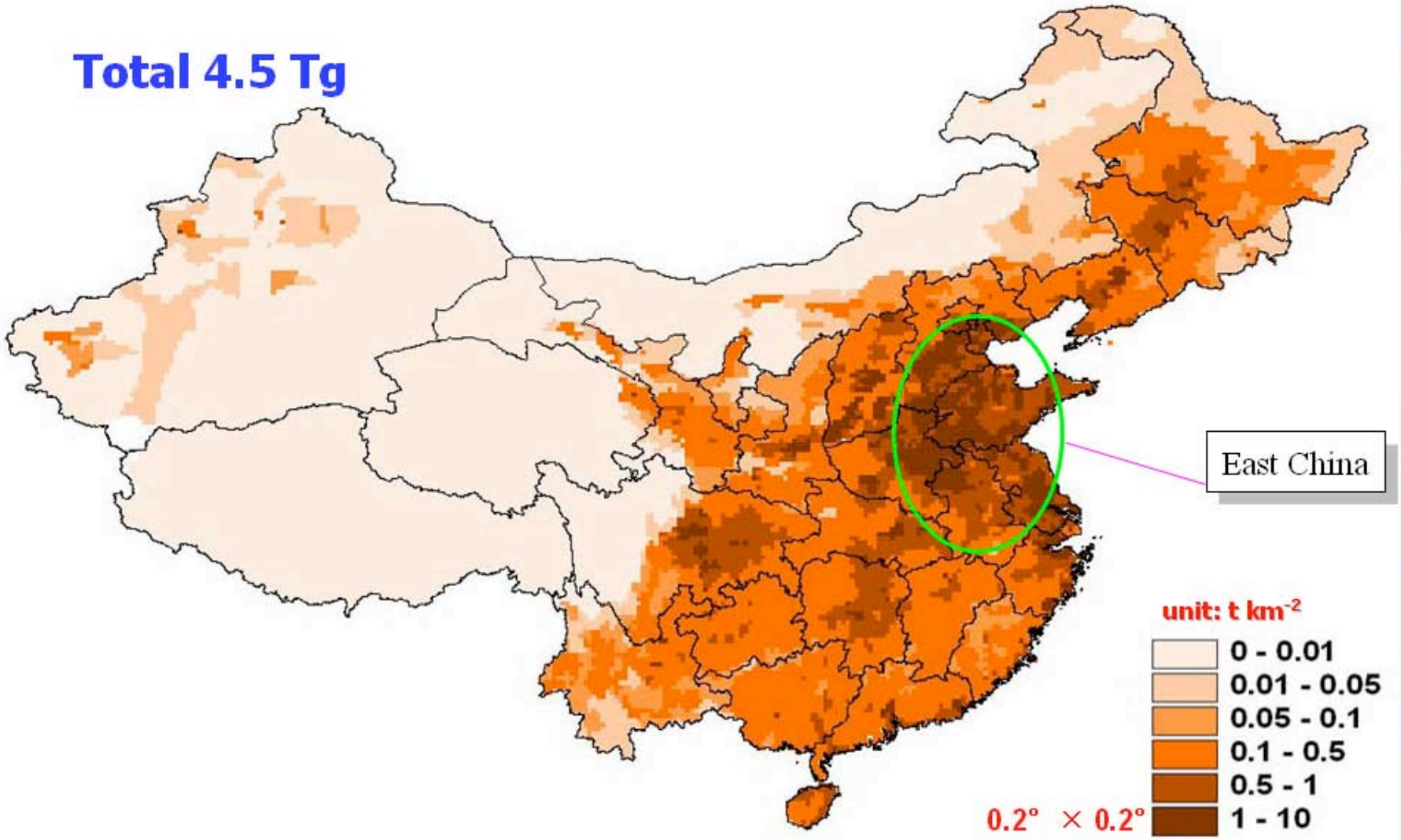
Methodology



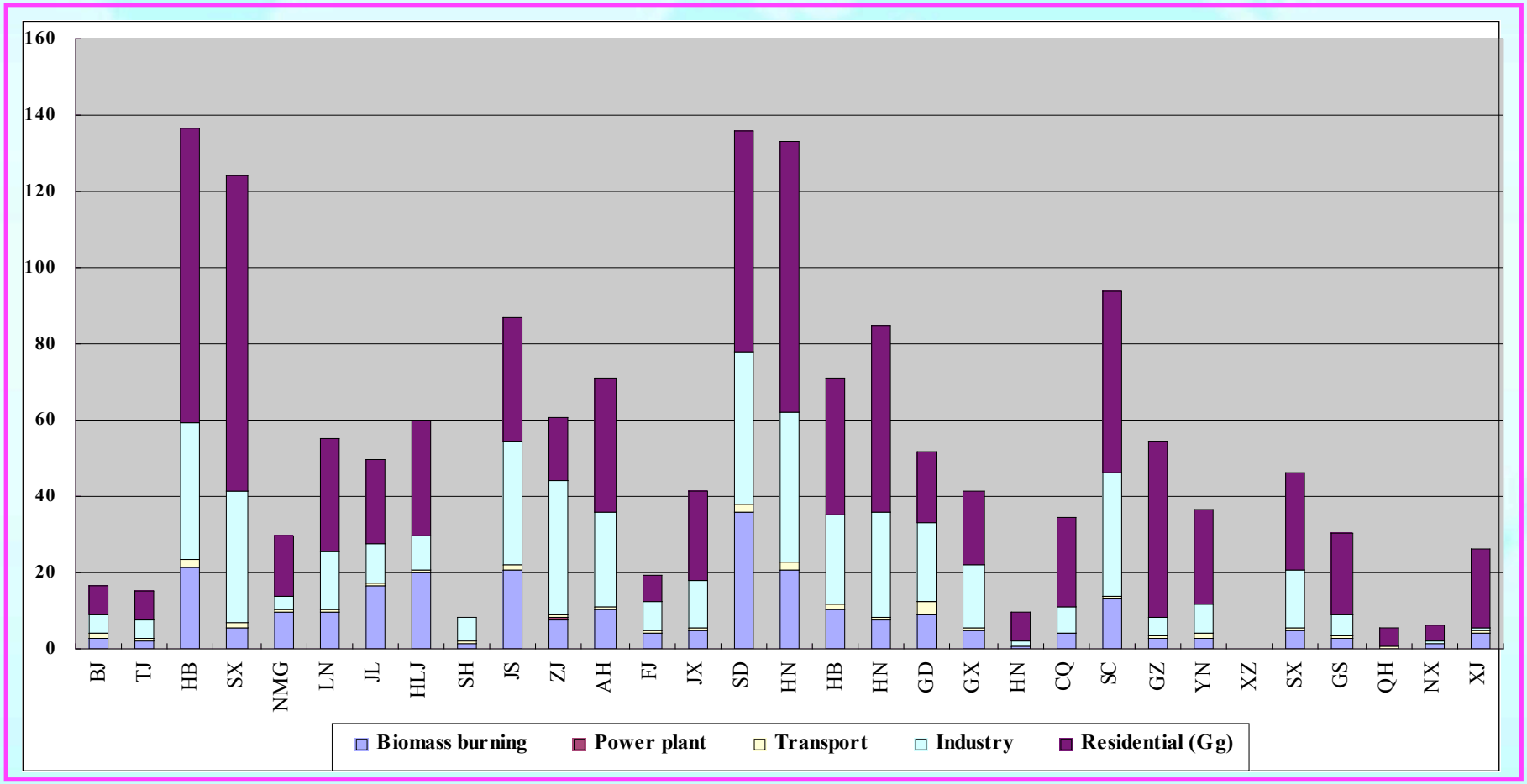
Estimated BC emission for the year 2000 in China by CAWAS



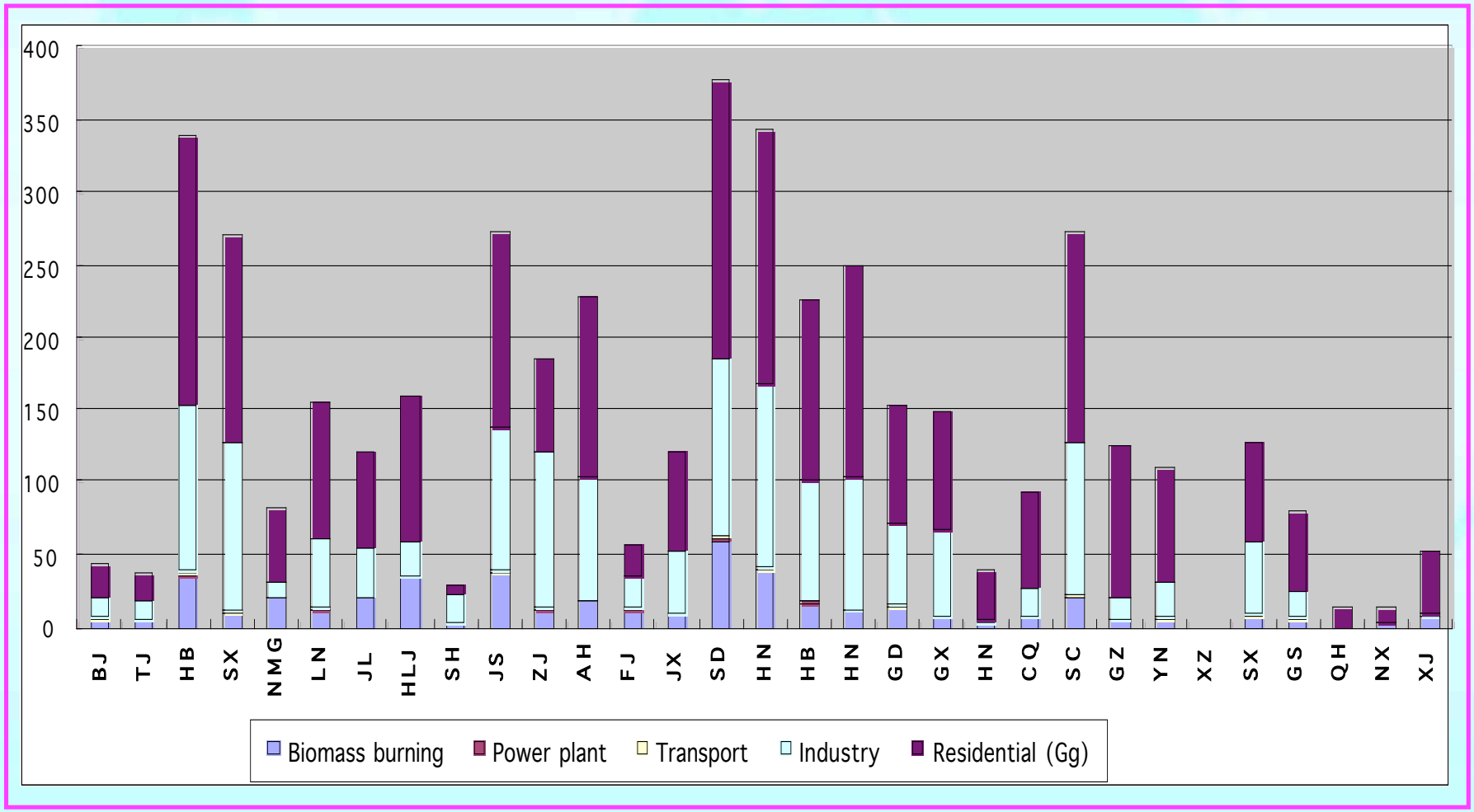
Estimated OC emission for the year 2000 in China by CAWAS



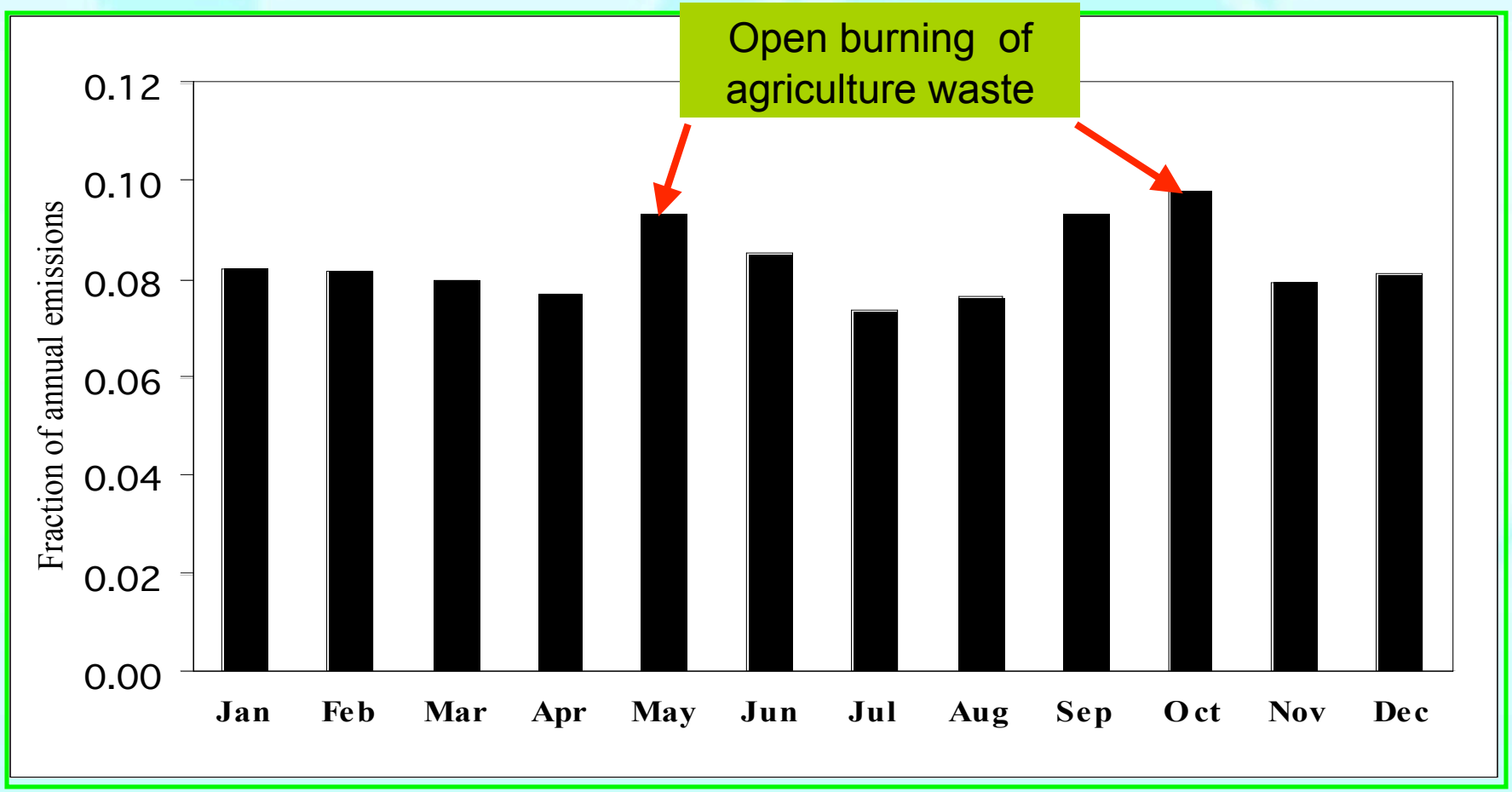
Regional BC Sources



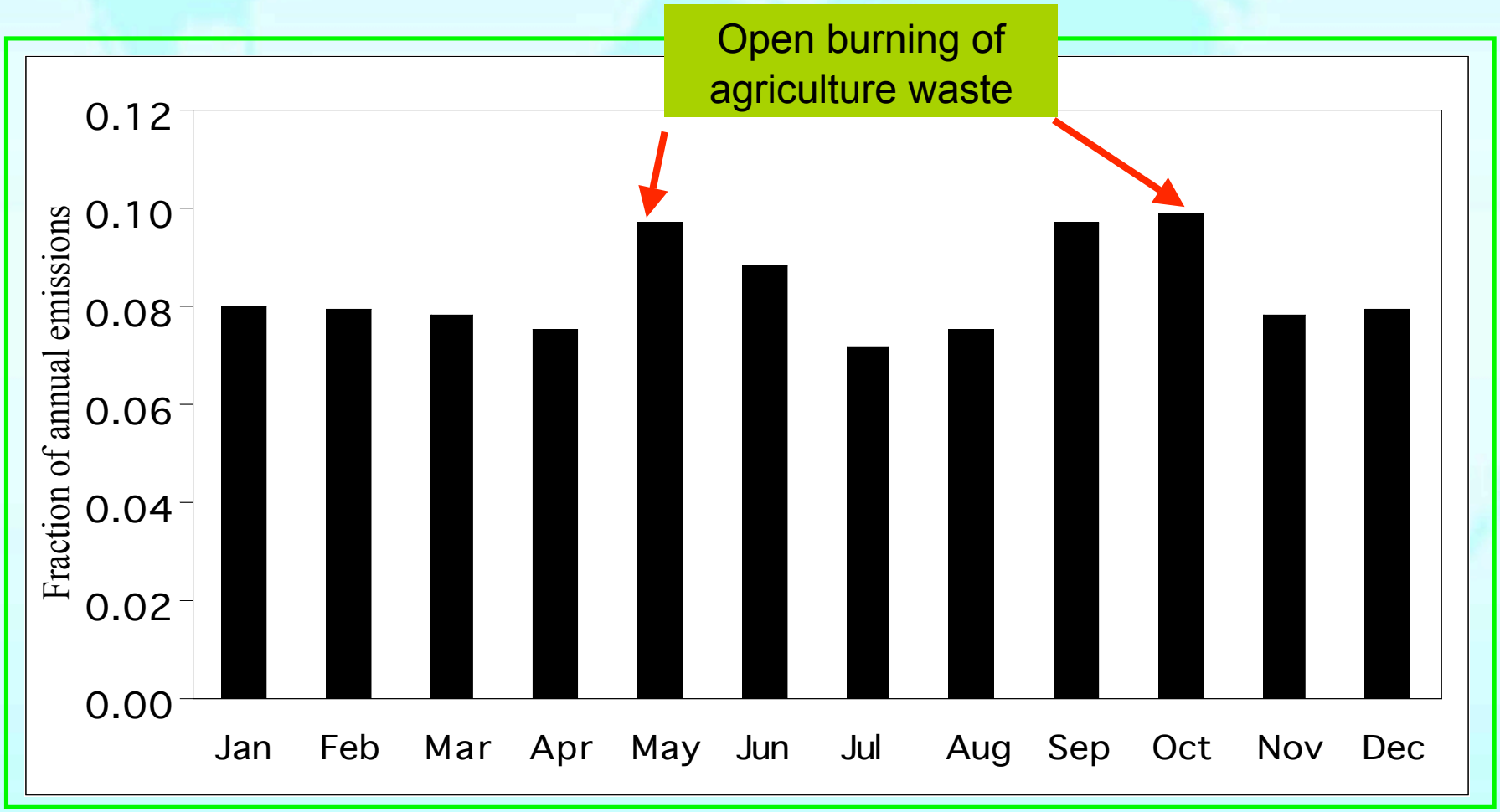
Regional OC Sources



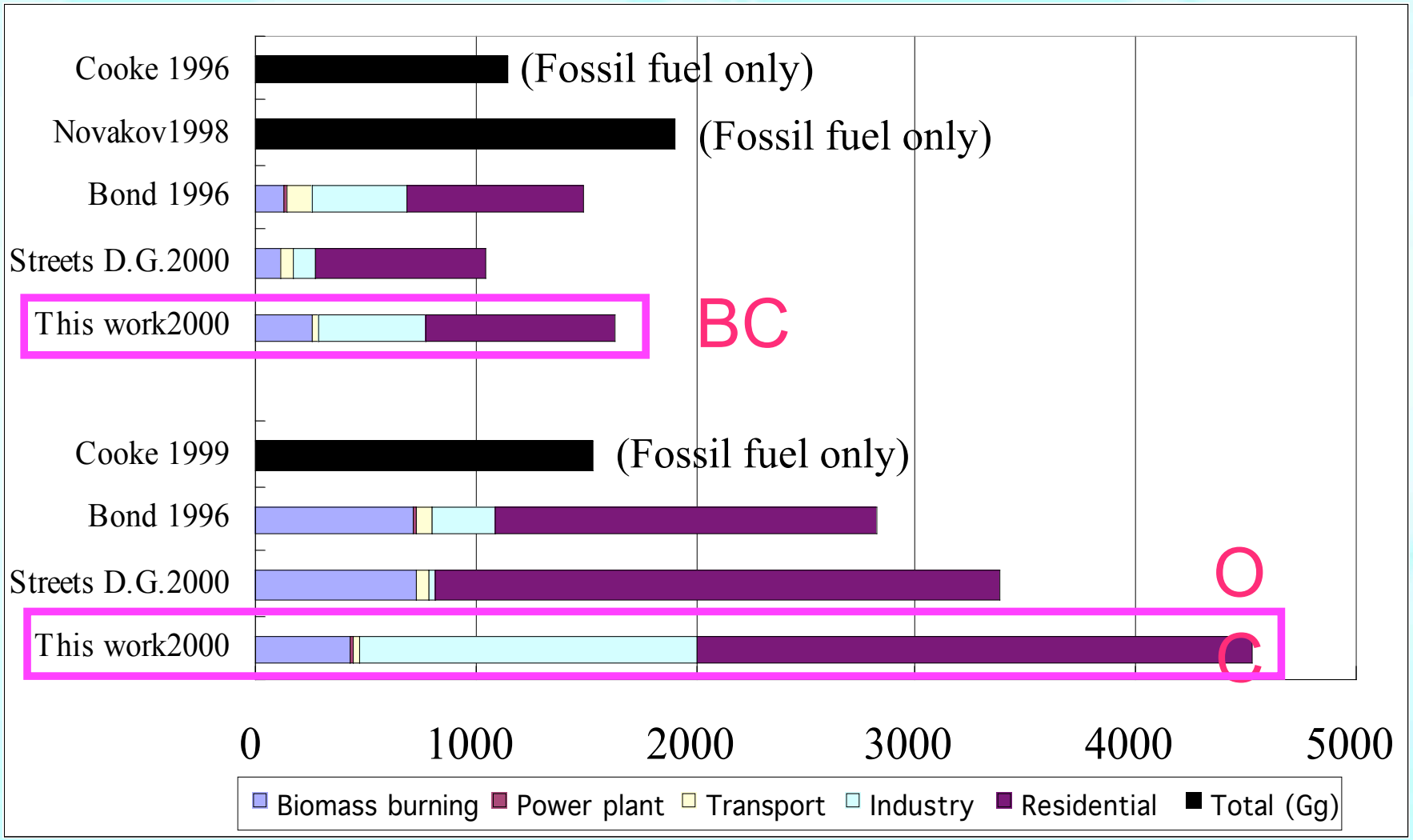
Monthly fractions of total BC emission



Monthly fractions of total BC emission



Emission inventory Comparisons (China)



Fuel types considered in this work

Residential

- Agriculture residues
- Fuelwood
- Rural residential-coal
- Rural residential-oil
- Urban residential coal
- Urban residential-oil

BC: .556 Tg
OC: .848 Tg

Biomass burning

- agriculture waste
- Forest fire
- Grassland fire

BC: .259 Tg
OC: .402 Tg

Industry

- Urban industry-coal
- Urban industry-oil
- Rural industry-coal
- Rural industry-oil
- Biofuel

BC: .356 Tg
OC: 1.23 Tg

Power Plant

- Coal
- Oil

Transportation

- diesel
- gasoline

Some Aerosol/Gas Observations in China

Global & Regional Atmosphere Watch

Chemical：

- GHGs
- Reactive Gases (CO, SO2, NOx, O3) & PAH

Aerosol

- Mass
- Ionic Species
- Mineral dust
- Carbonaceous Materials
- Trace Components

Optical：

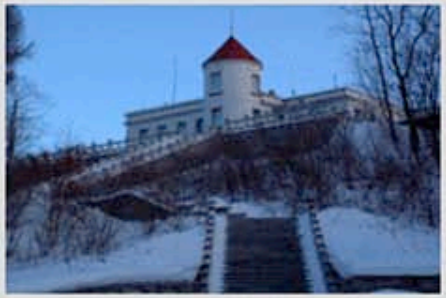
- Light Scattering
- Light Absorption
- Aerosol optical depth （AOD)

Measurements at GAW

Global & Regional GAW Stations, CAWAS, CMA

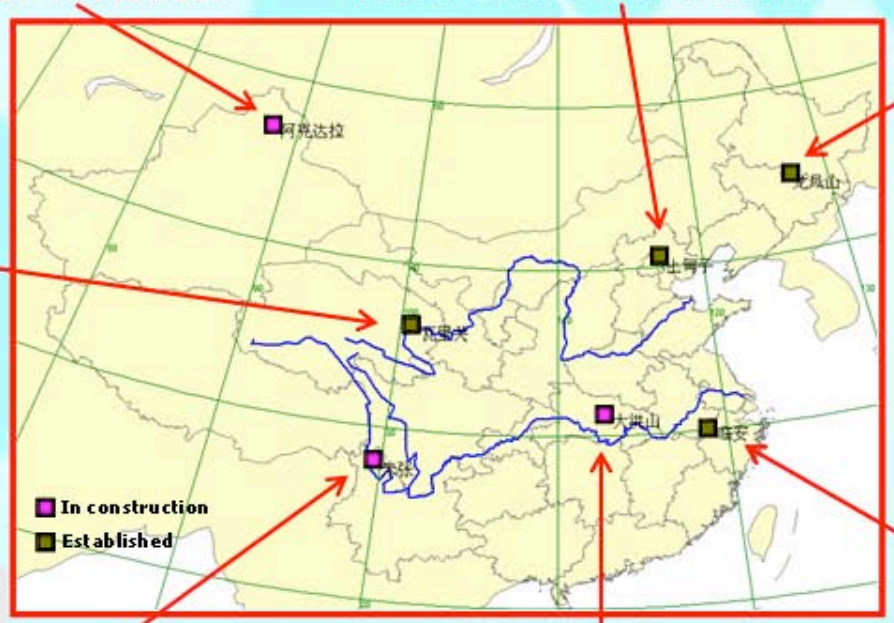
Akdala
(47° 06´N, 87° 58´E, 562m asl)

Shangdianzi
(117.07° E, 40.39° N, 293.9 m asl)



Longfengshan
(127.6 ° E, 44.73 ° N, 310 m asl)

Waliguan
(36.3° N, 100.9° E , 3810m asl)

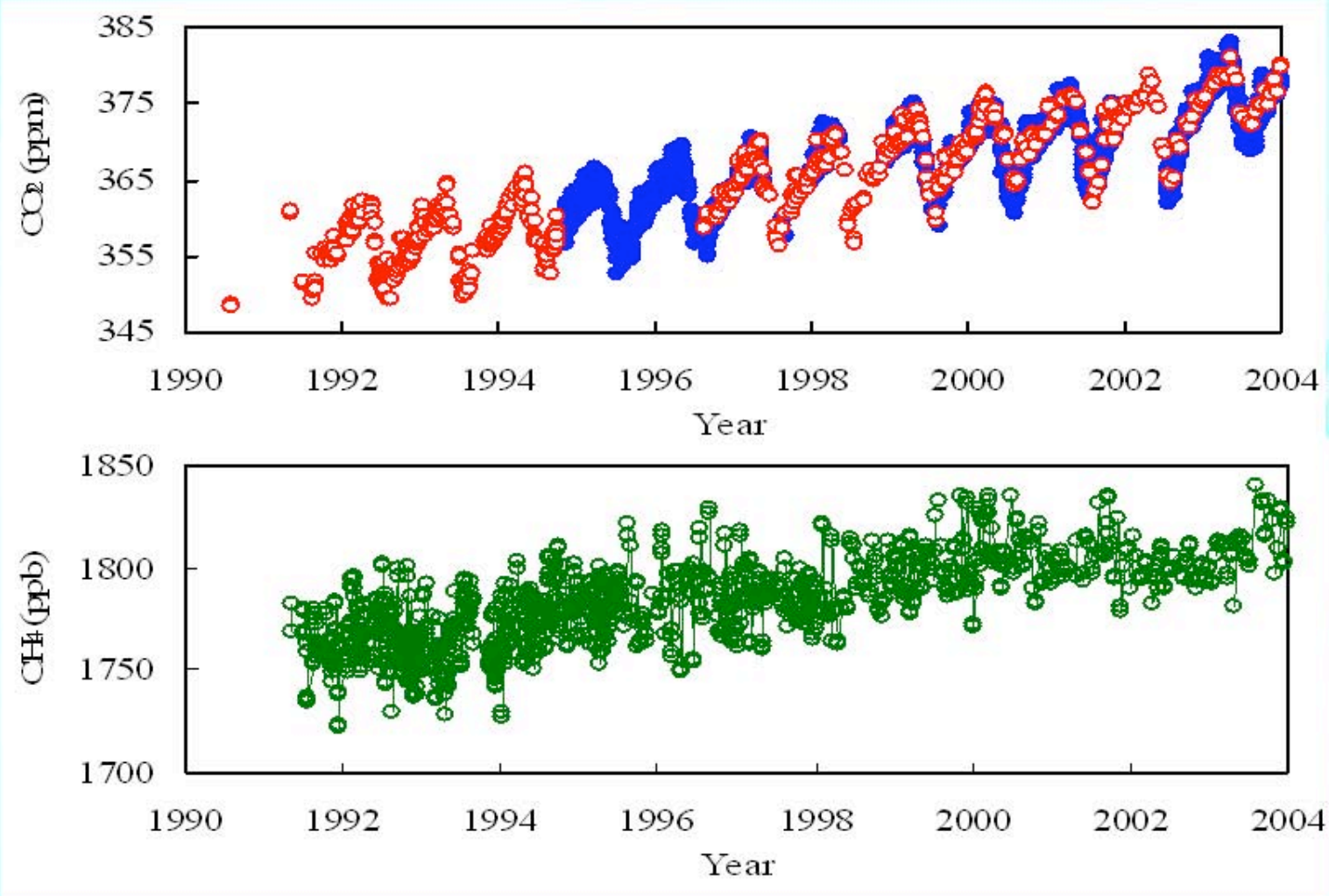


LinAn
(119.73 ° E, 30.3 ° N, 138m asl)

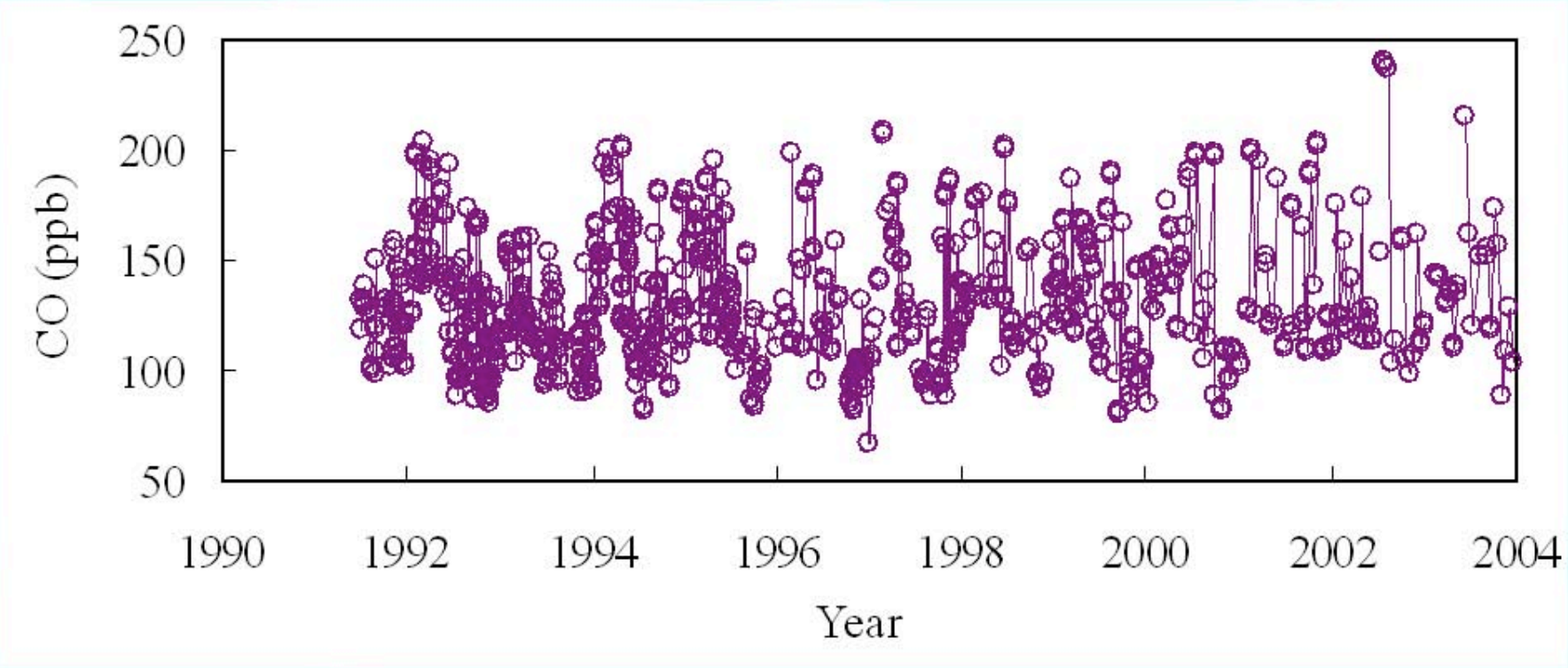
Zhuzhang
(27° 30'N, 99° 0.5'E, 3580 m asl)

Xianning (31° 24.5′ N, 112° 59.5′ E , 862 m asl)

GHGs, Waliguan



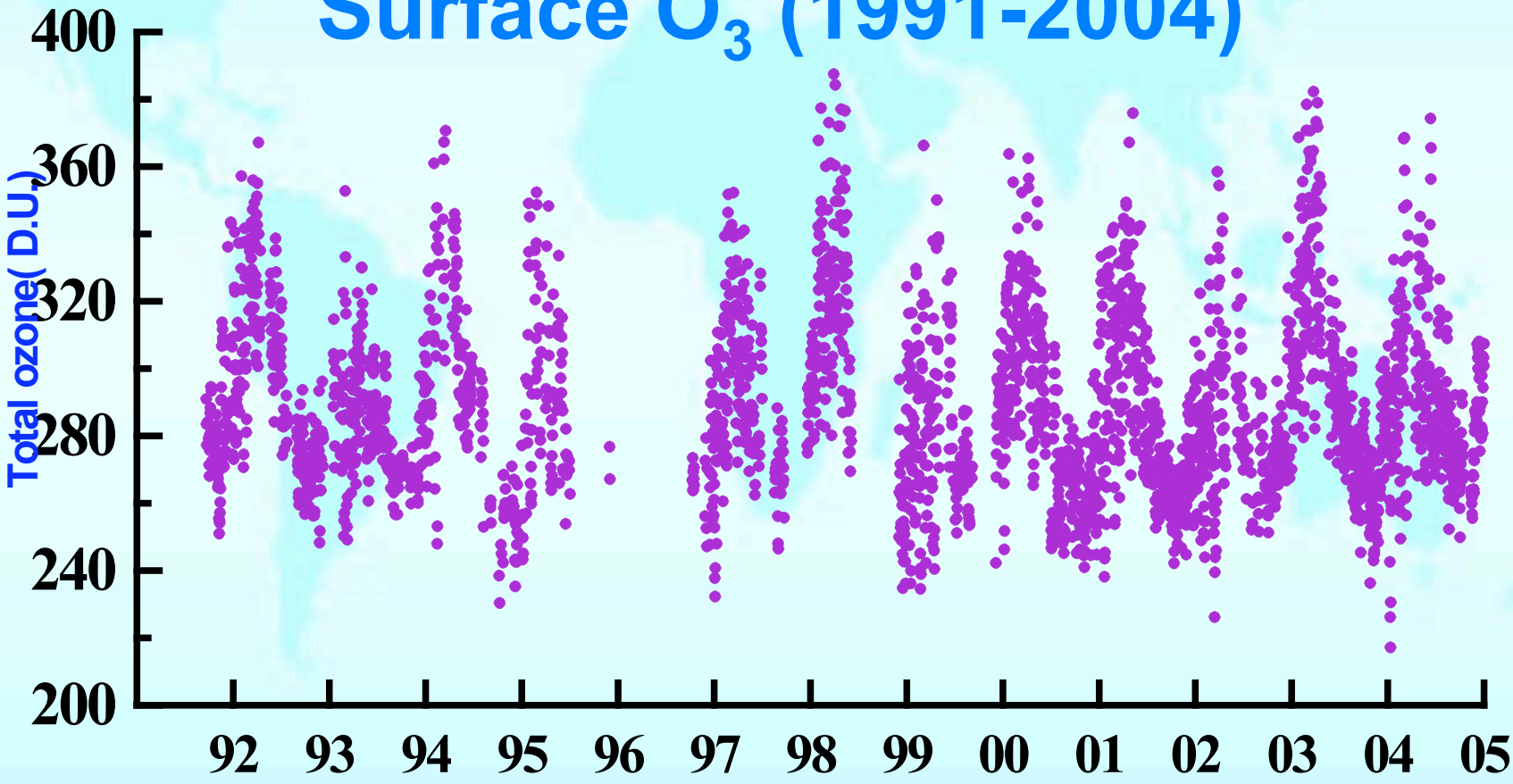
CO, Waliguan


250
200
150
100
50
CO (ppb)
1990
1992
1994
1996
1998
2000
2002
2004
Year

Ozone

地基臭氧总量在瓦里关山的观测

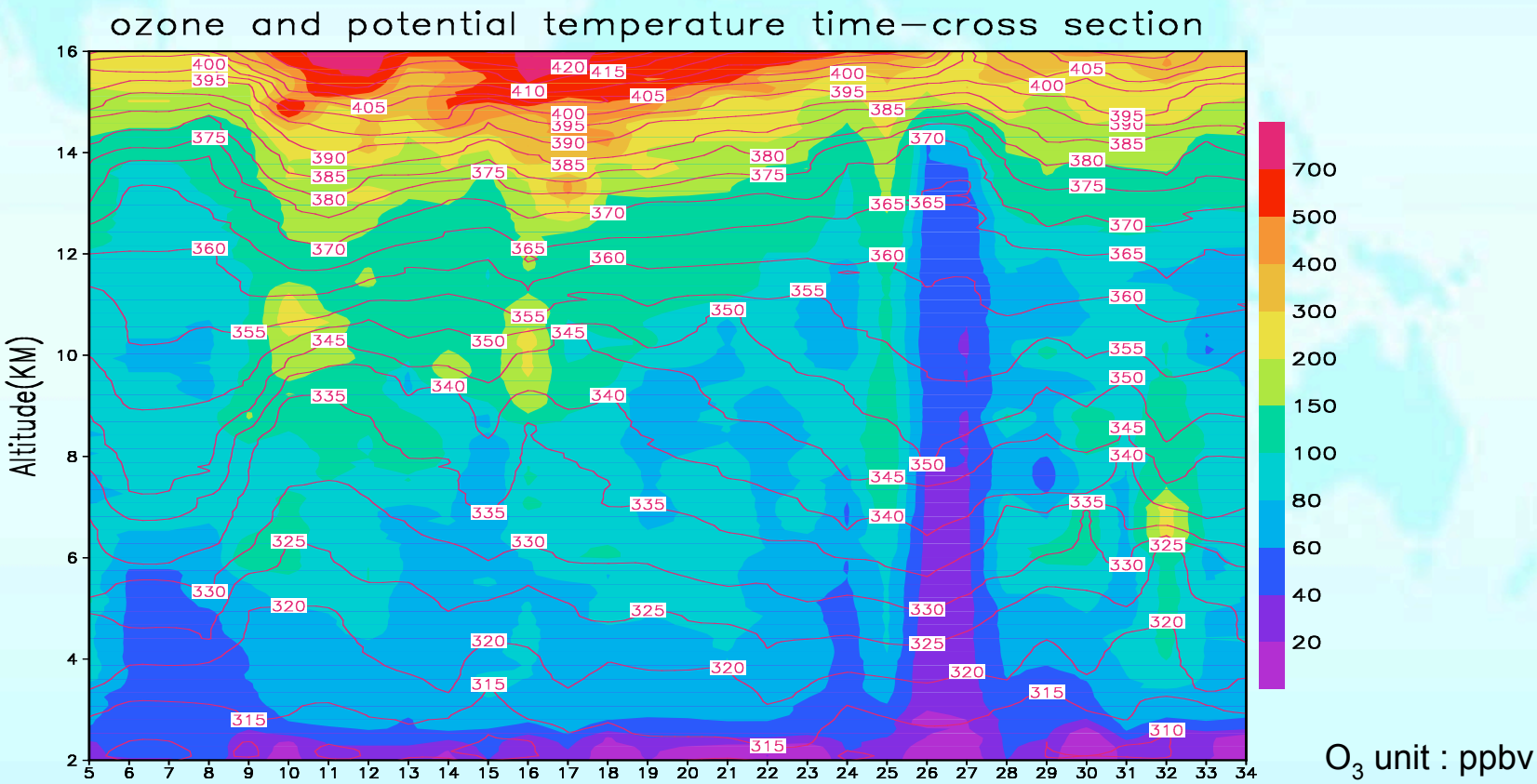
Surface O_3 (1991-2004)



臭氧垂直分布的变化(从地面到18公里)

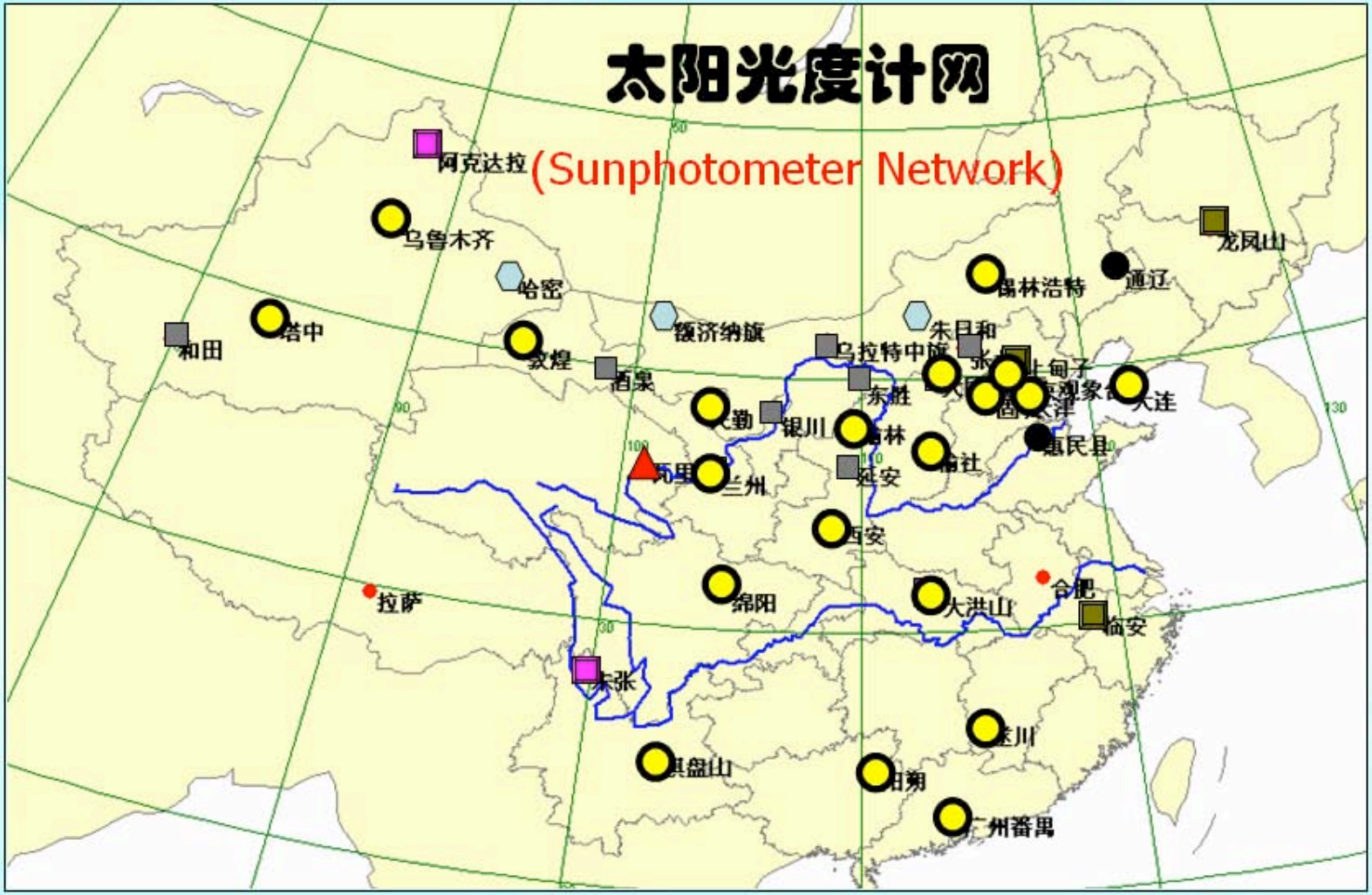
Column Ozone (surface to 18 km)

(7 July – 3 August 1996, Xi-Ning)



(对流层臭氧,位温在天气尺度的垂直演变过程)

Other Network Observations



太阳光度计站点
(Sunphotometer Stations)

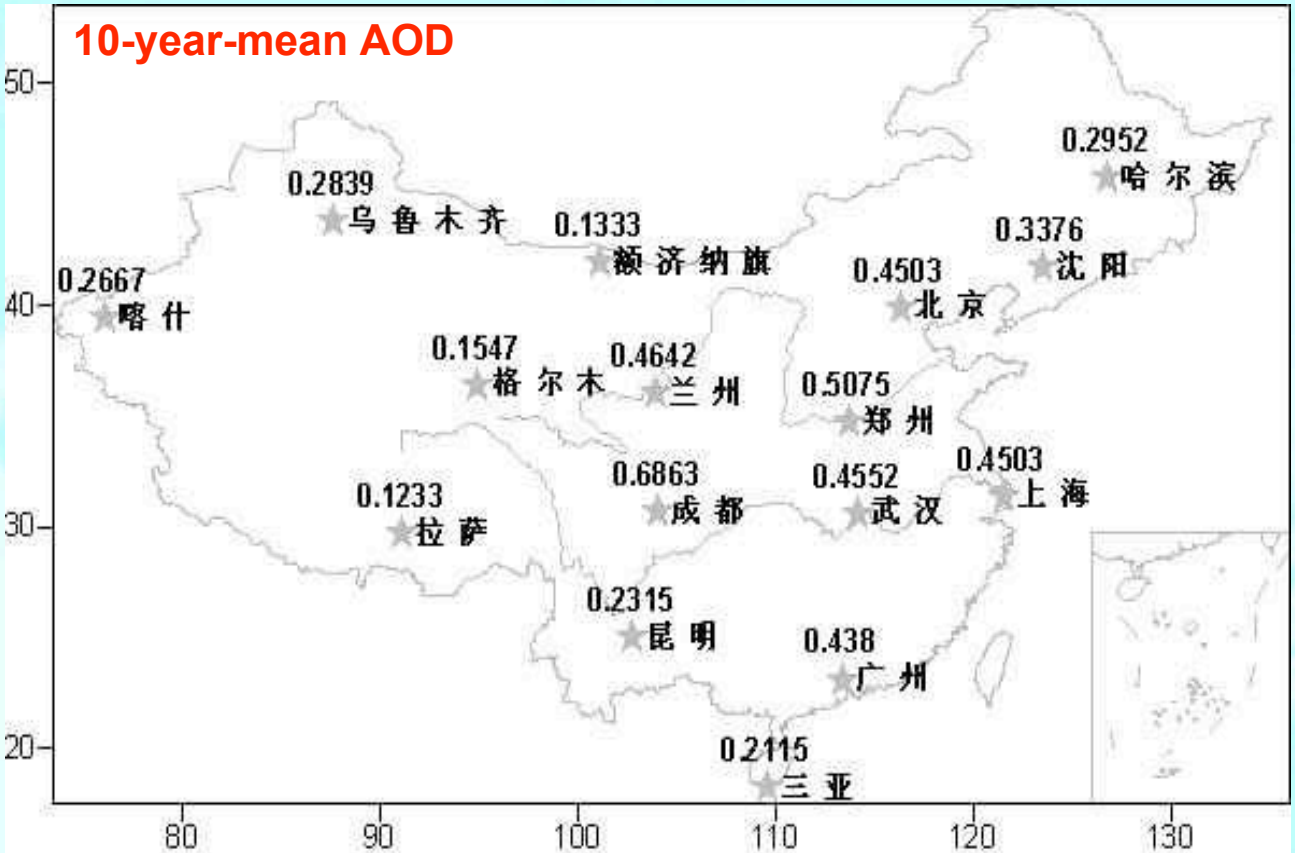
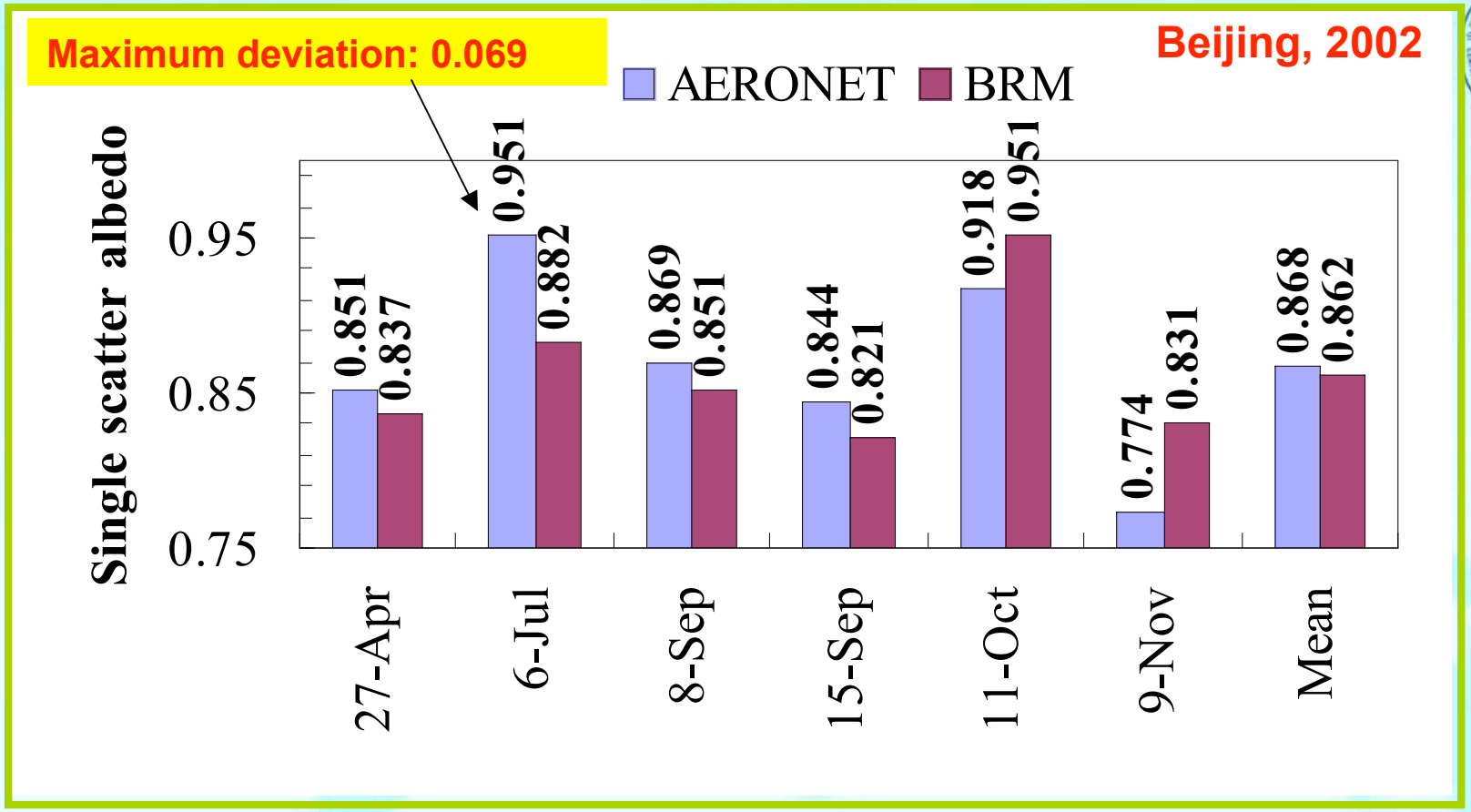


图1　　16个辐射站10年平均气溶胶光学厚度分布图

年份	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
AOD	0.363	0.336	0.320	0.354	0.341	0.331	0.339	0.364	0.338	0.345

16-site-mean yearly-mean AOD (750nm): 0.32～0.36

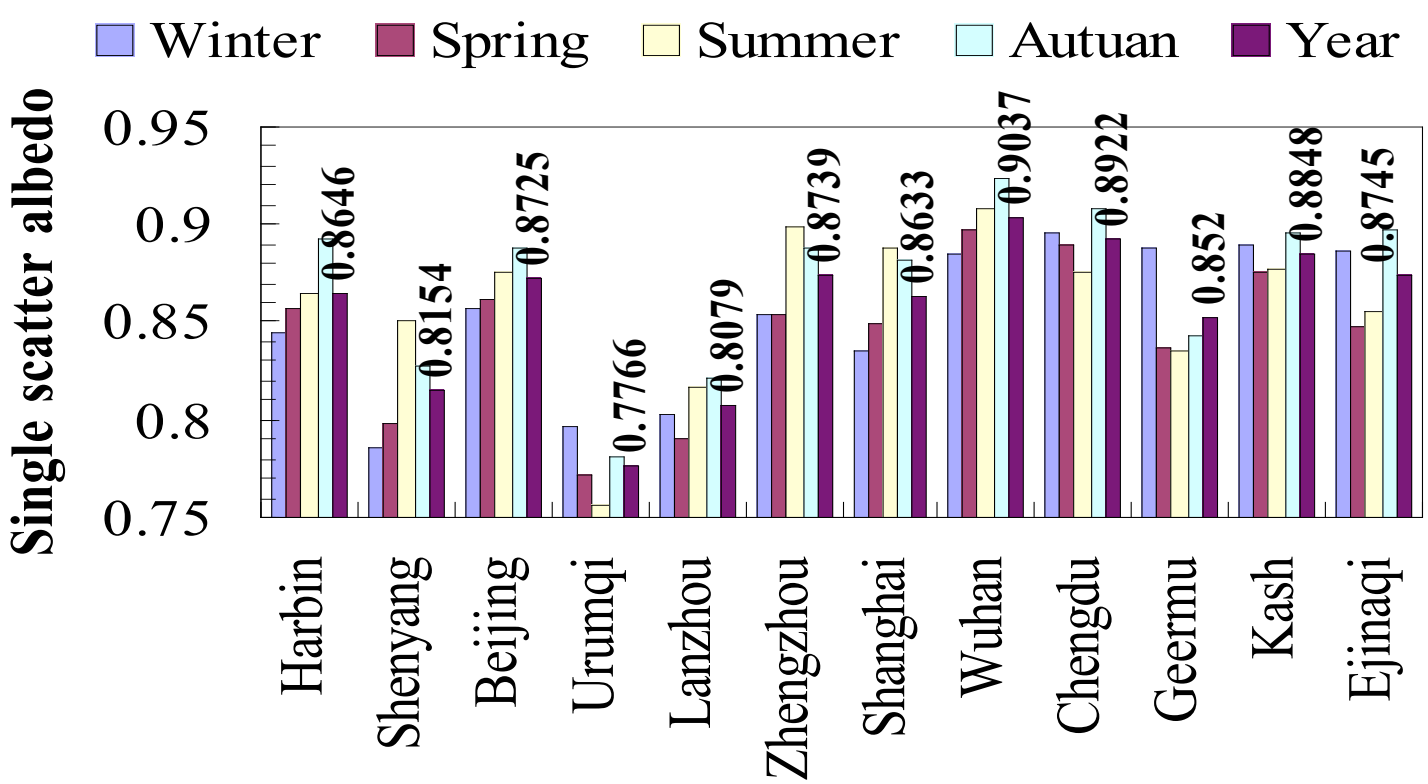
Qiu's group



Comparisons between daily-mean SSA from AERONET (Nakajima's method) and SSA from BRM (Qiu et al's method)

Deviation of total-mean SSAs：0.006!

Qiu's group

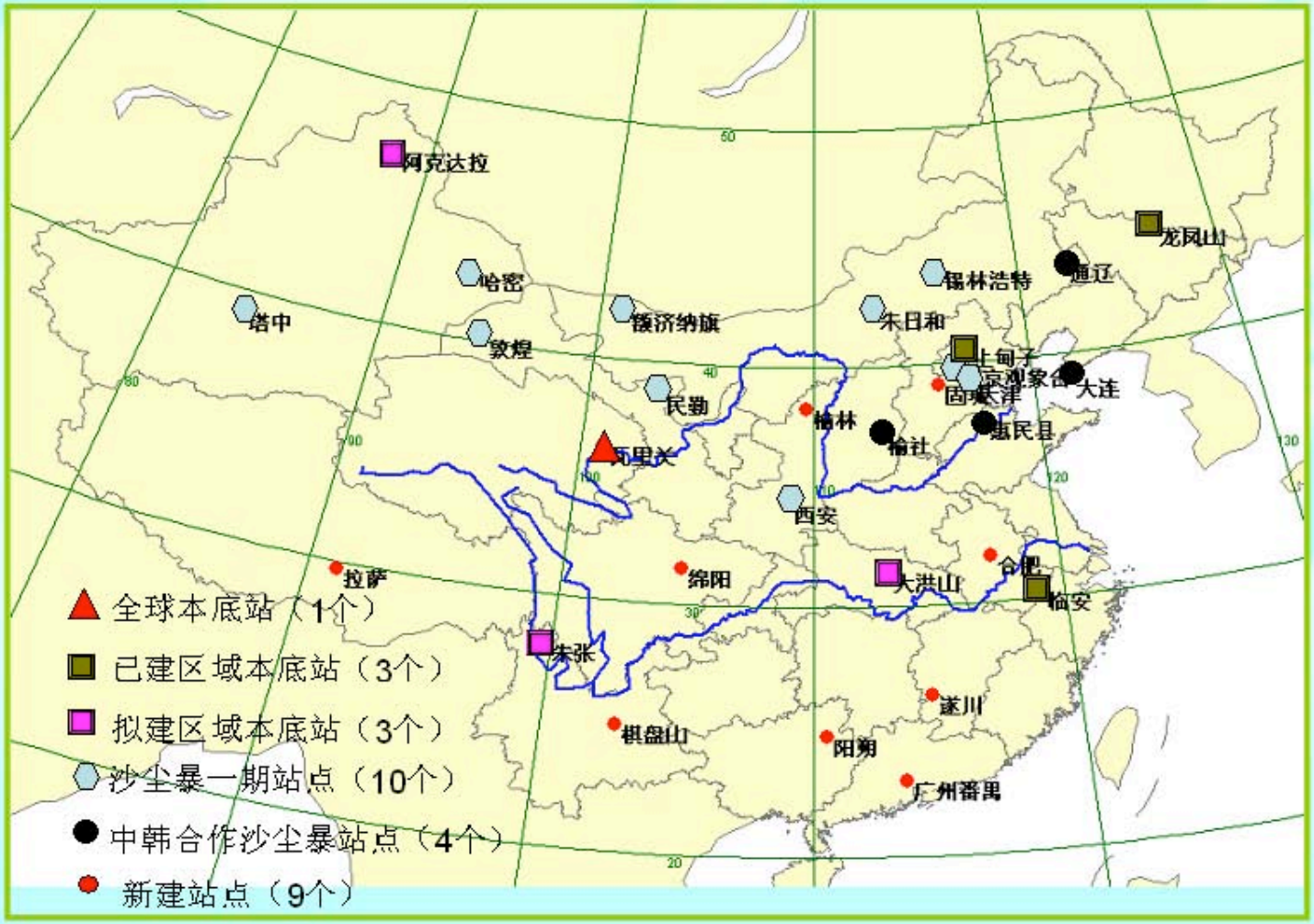


- Total mean SSA：**0.864**
- **Beijing ：0.872**
- **Shenyang：0.815； Urumqi：0.777**
- **Small SSA during winter over some sites such as Shenyang**

Qiu's group

CMA Aethalometer Network (2005)

中国气象局微粒吸收计网



沙尘暴站网（一期）分布

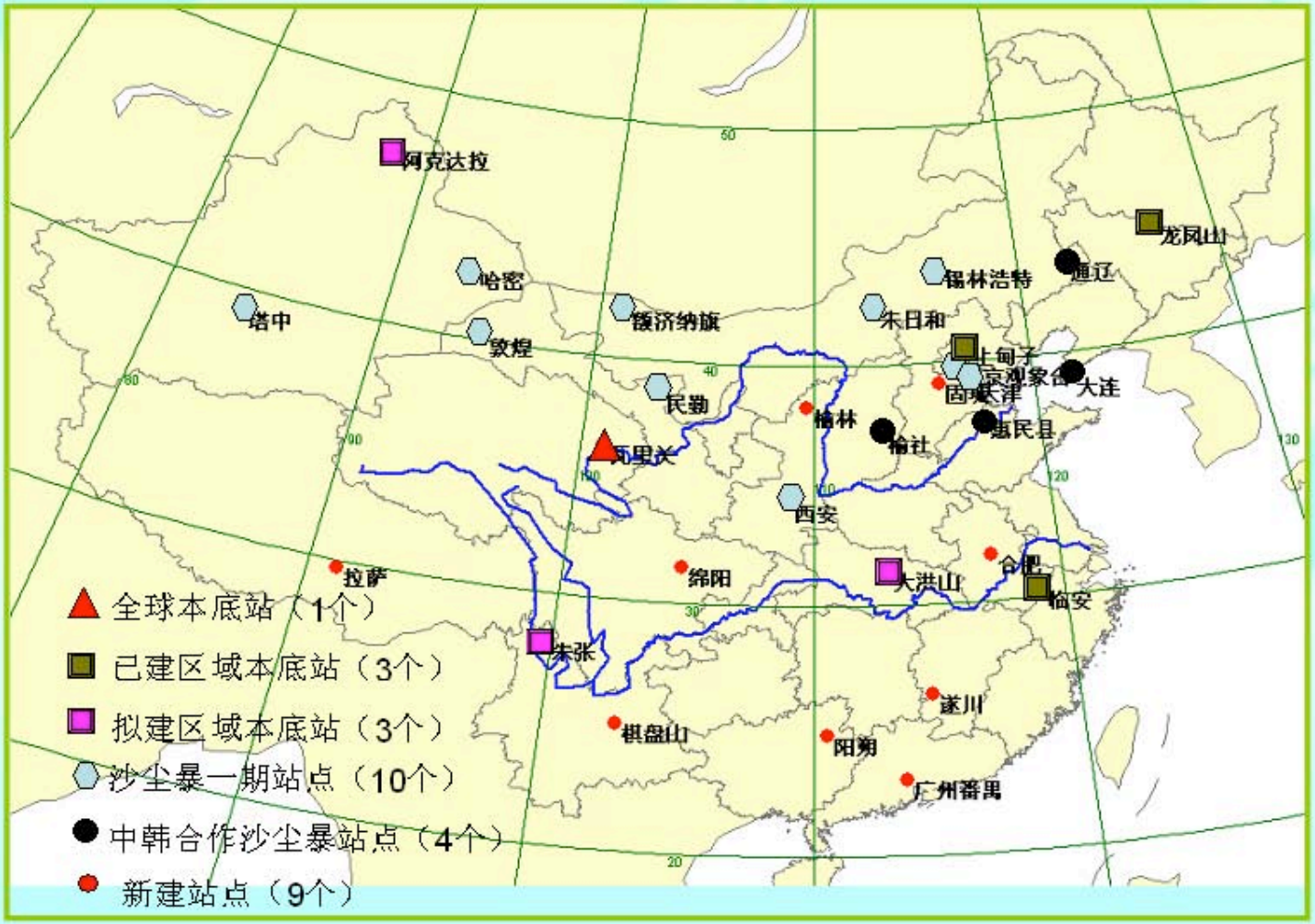
SDS Network Observation (1st Stage) +

Nephelometer Network

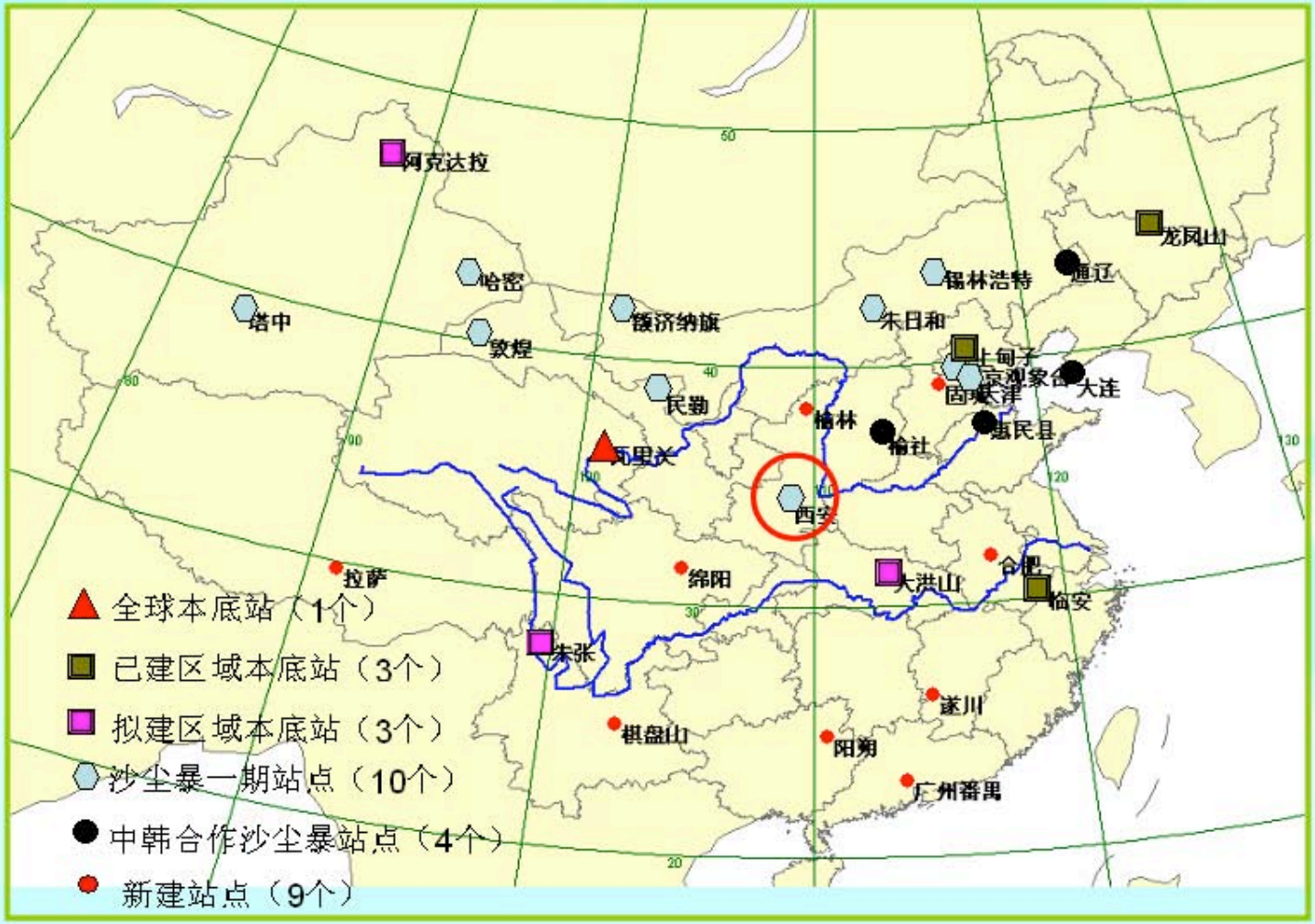
浊度计站点(Nephelometer Stations)

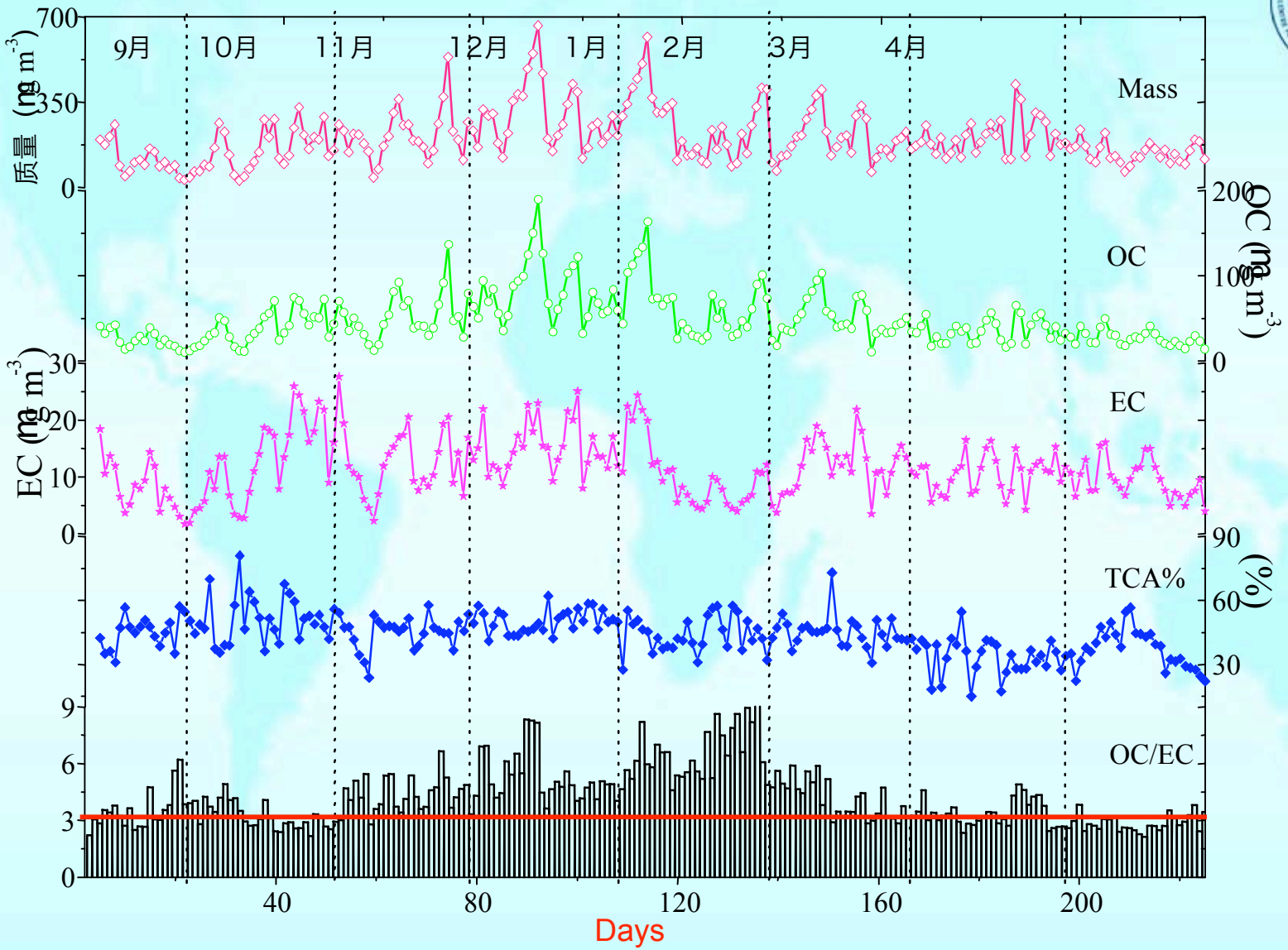
CMA PM10 (Some with PM2.5, PM1) Network (2005)

中国气象局颗粒物网



Some BC (EC) & OC Results


阿克达拉
哈密
塔中
敦煌
锡济纳旗
民勤
瓦里关
拉萨
绵阳
朱张
棋盘山
西安
榆林
榆社
朱日和
锡林浩特
上甸子
京观象台
固城
大津
大连
惠民县
龙凤山
通辽
大洪山
合肥
临安
遂川
阳朔
广州番禺
全球本底站（1个）
已建区域本底站（3个）
拟建区域本底站（3个）
沙尘暴一期站点（10个）
中韩合作沙尘暴站点（4个）
新建站点（9个）



2003年9月13日至2004年4月30日西安（总观测日223天）

13 Sept. 2003 – 30 April 2004 XiAn (Total observation days: 223)

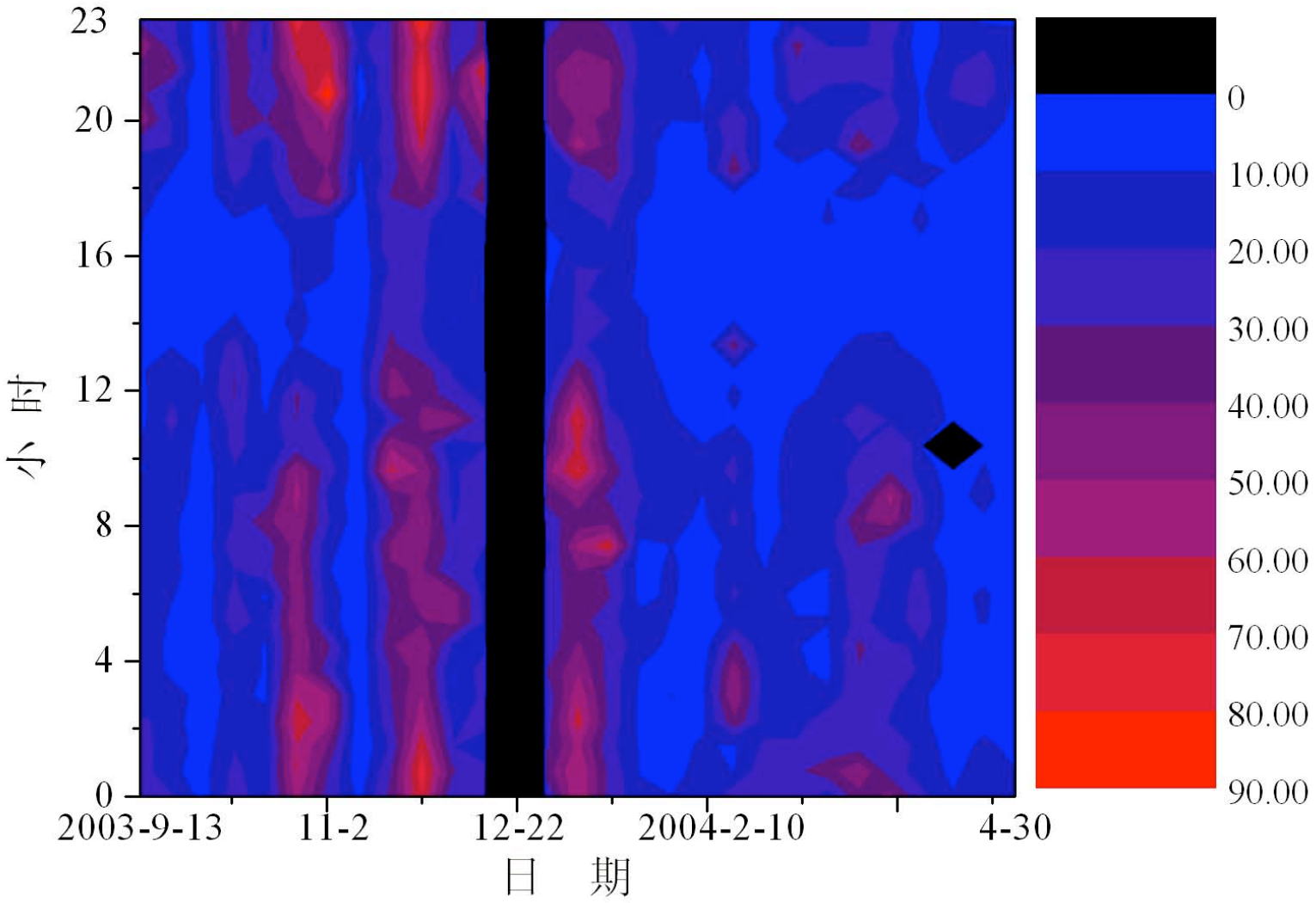


图3-1 2003年9月13日-2004年4月30日每5分钟的BC浓度变化序列图（BC浓度单位μg m^{-3}）

(5 min-averaged BC variations at XiAn (13 Sept., 2003) – 30 April, 2004)

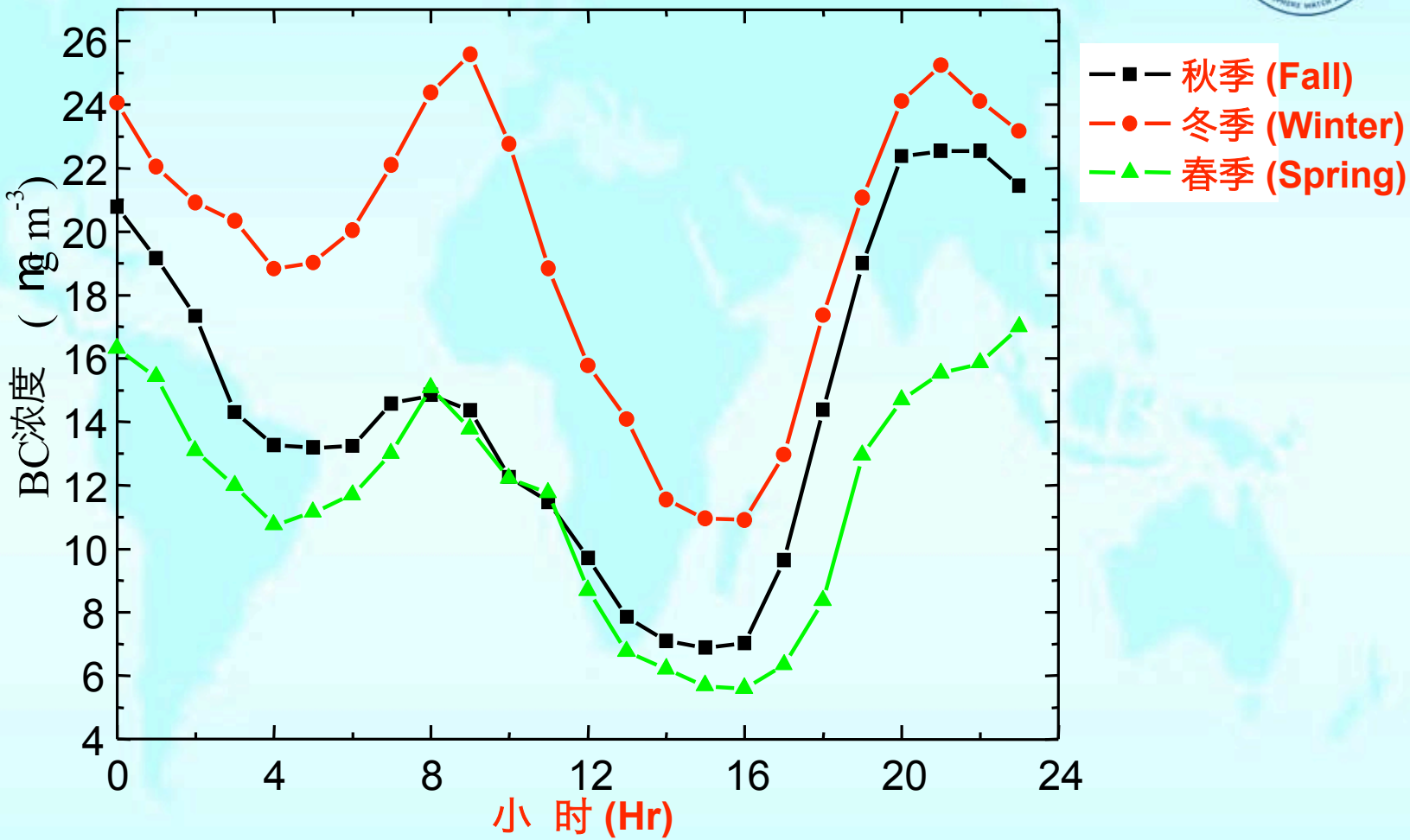
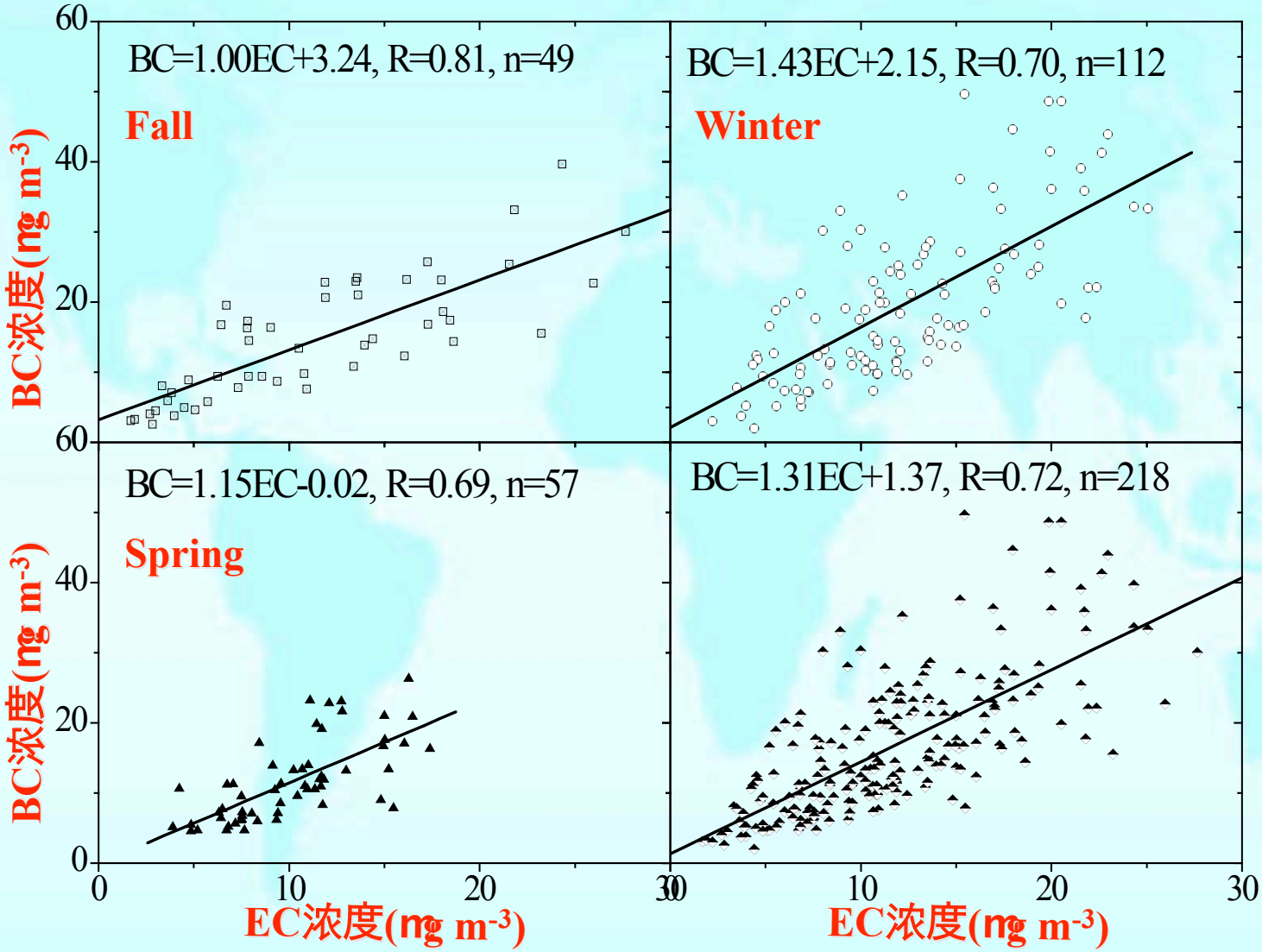


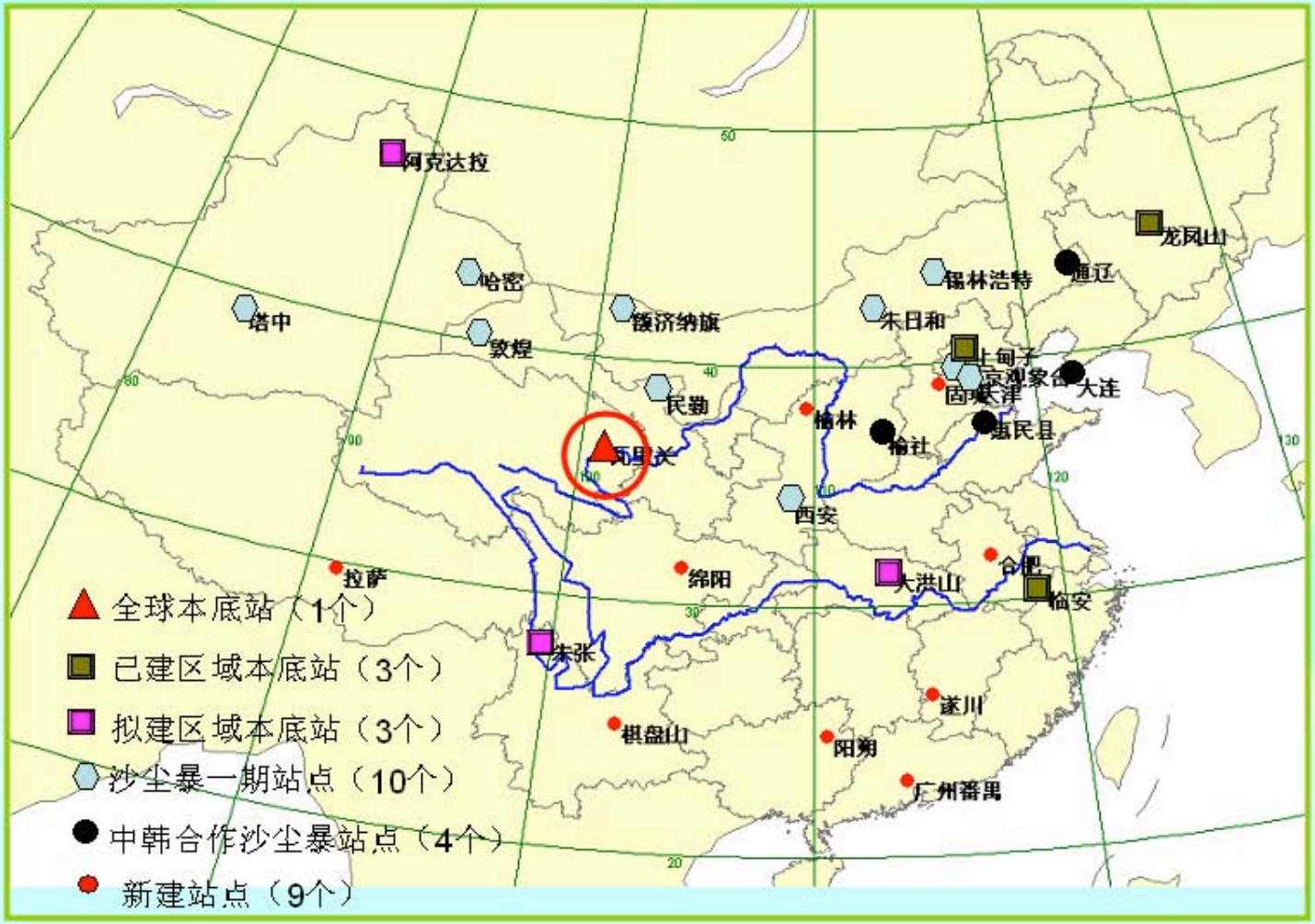
图3-3　秋、冬、春季 BC日平均浓度变化

(Seasonal-averaged hr. BC conc. during Fall of 2003 to Spring 2004)

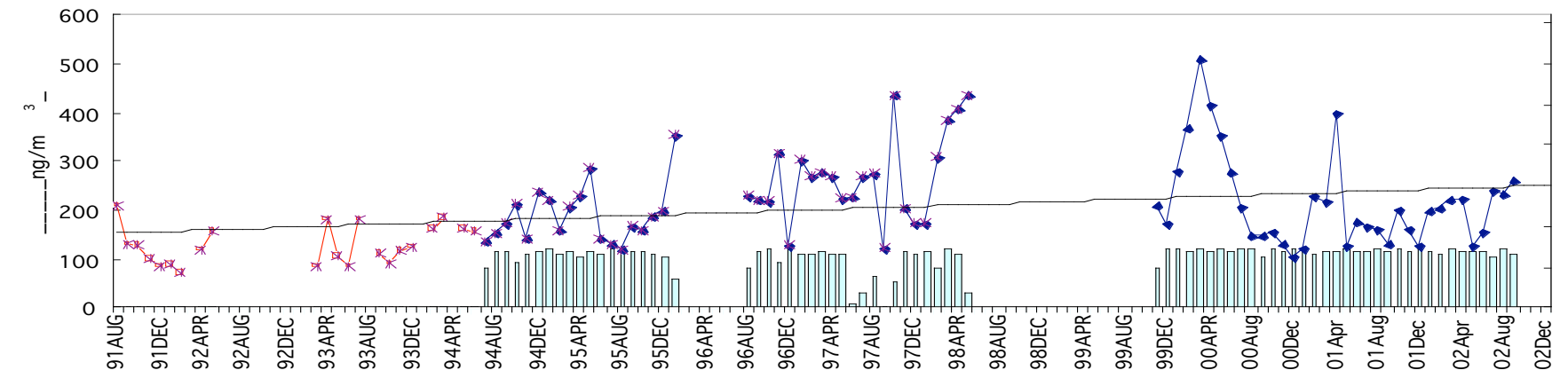


EC vs BC

(XiAn, Fall of 2003 to Spring of 2004)


阿克达拉
哈密
塔中
敦煌
额济纳旗
民勤
瓦里关
拉萨
绵阳
朱张
棋盘山
西安
榆林
榆社
朱日和
锡林浩特
通辽
龙凤山
上甸子
京观象台
大连
固城
大津
惠民县
大洪山
合肥
临安
遂川
阳朔
广州番禺
全球本底站（1个）
已建区域本底站（3个）
拟建区域本底站（3个）
沙尘暴一期站点（10个）
中韩合作沙尘暴站点（4个）
新建站点（9个）

BC (Waliguan)


600
500
400
300
200
100
0
ng/m3
91AUG
91DEC
92APR
92AUG
92DEC
93APR
93AUG
93DEC
94APR
94AUG
94DEC
95APR
95AUG
95DEC
96APR
96AUG
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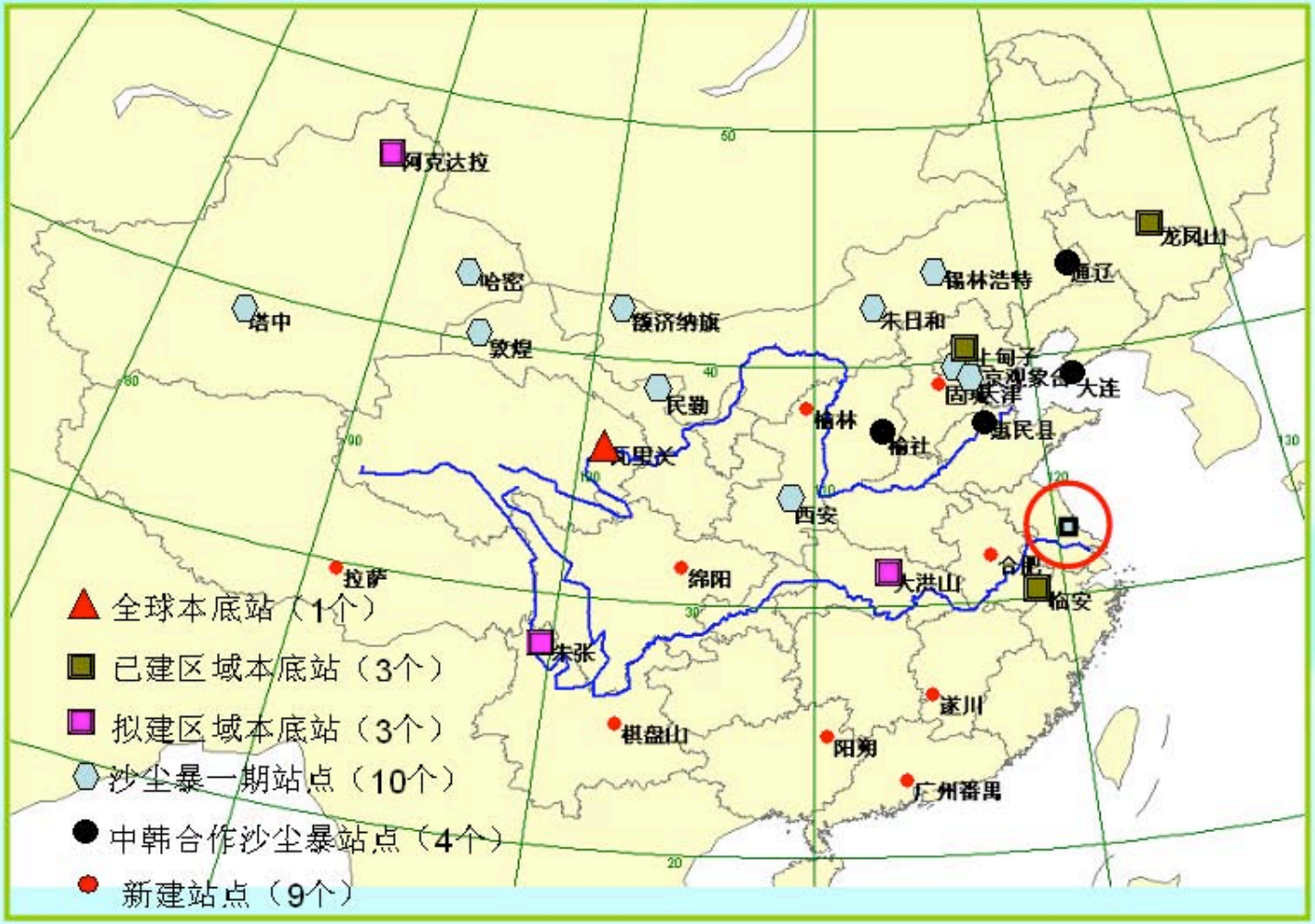
02Aug
02Dec


阿克达拉
哈密
塔中
敦煌
额济纳旗
民勤
瓦里关
拉萨
绵阳
朱张
棋盘山
西安
榆林
榆社
朱日和
锡林浩特
通辽
龙凤山
上甸子
京观象台
大连
固城
大津
惠民县
合肥
大洪山
临安
遂川
阳朔
广州番禺
全球本底站（1个）
已建区域本底站（3个）
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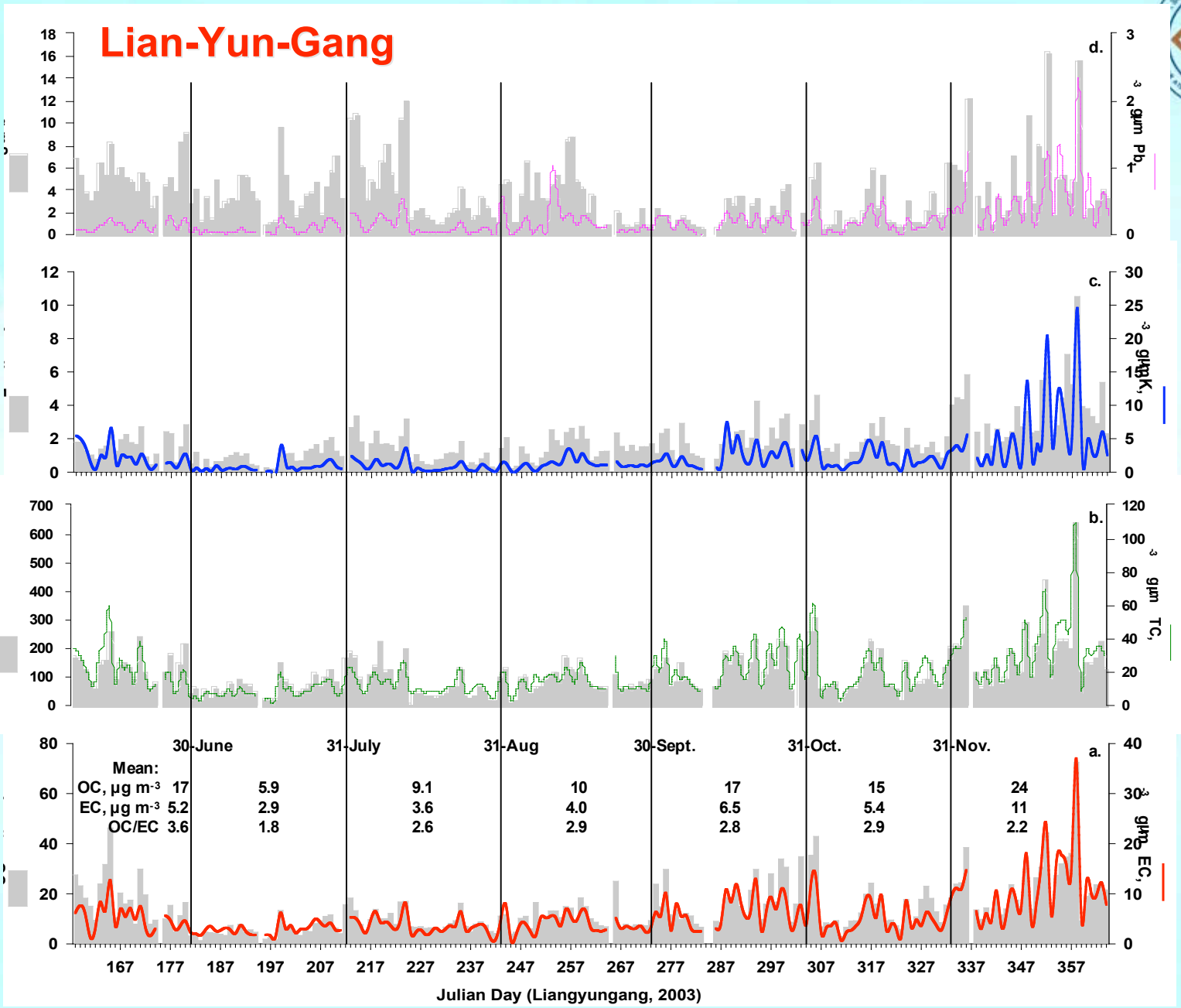
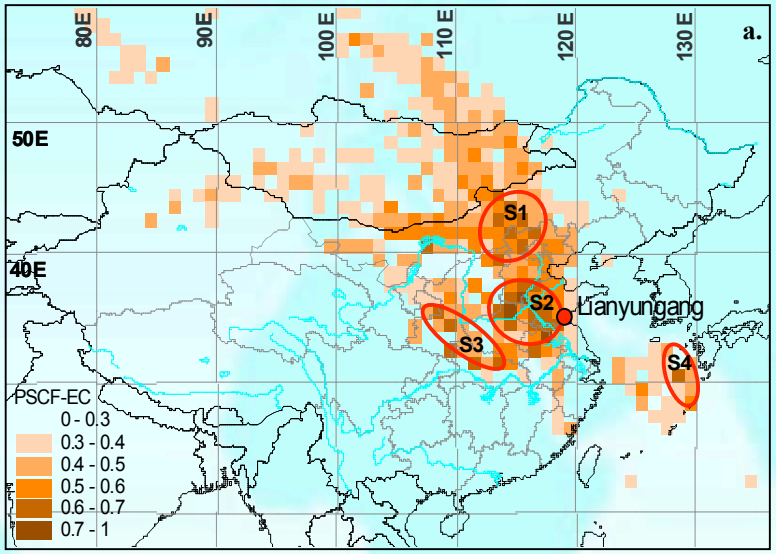
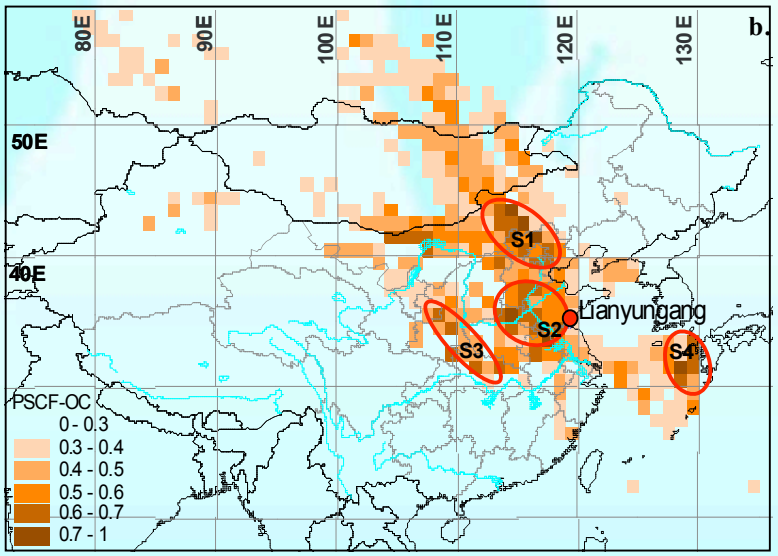
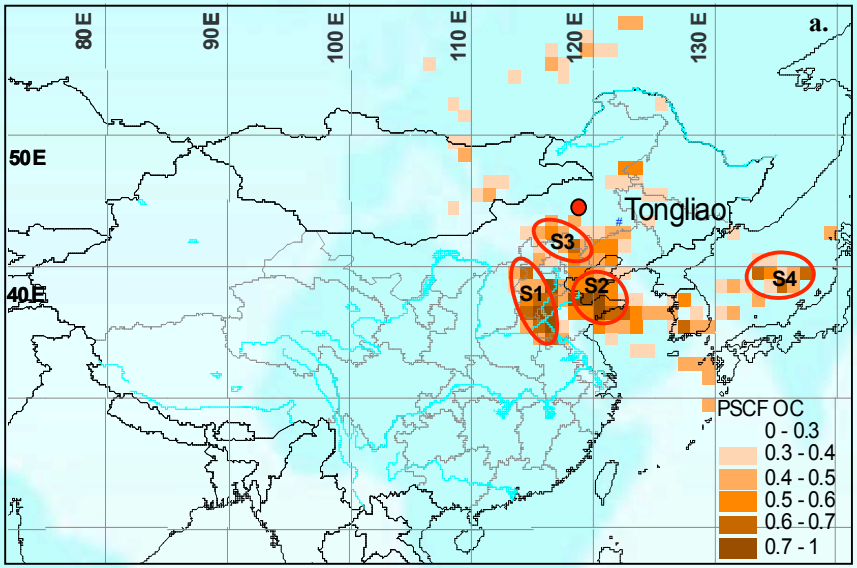
沙尘暴一期站点（10个）
中韩合作沙尘暴站点（4个）
新建站点（9个）

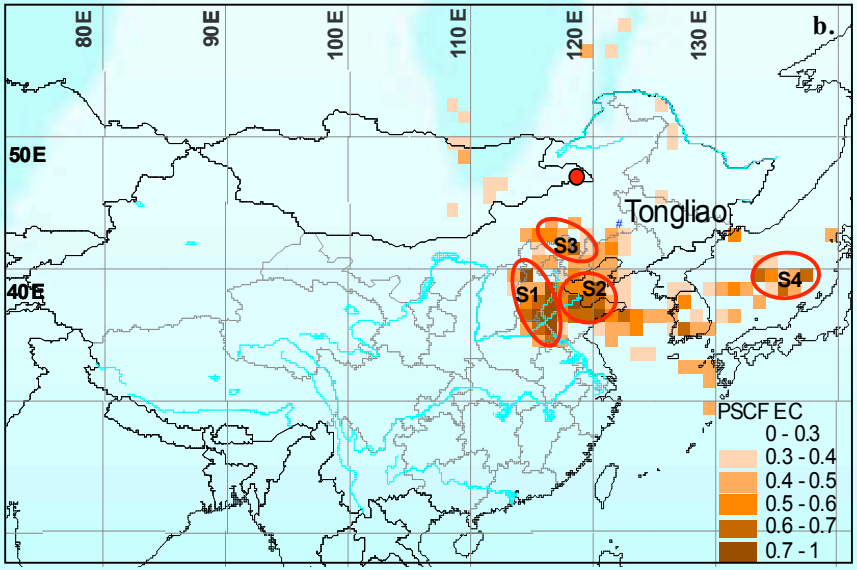
Lian-Yun-Gang




a.
80E
90E
100 E
110 E
120 E
130 E
50E
40E
S1
S2
S3
S4
Lianyungang
PSCF-EC
0 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 1


b.
80E
90E
100 E
110 E
120 E
130 E
50E
40E
S1
S2
S3
S4
Lianyungang
PSCF-OC
0 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 1


a.
80 E
90 E
100 E
110 E
120 E
130 E
50 E
40 E
Tongliao
S1
S2
S3
S4
PSCF OC
0 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 1


b.
80 E
90 E
100 E
110 E
120 E
130 E
50 E
40 E
Tongliao
S1
S2
S3
S4
PSCF EC
0 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 1

Thank you!