

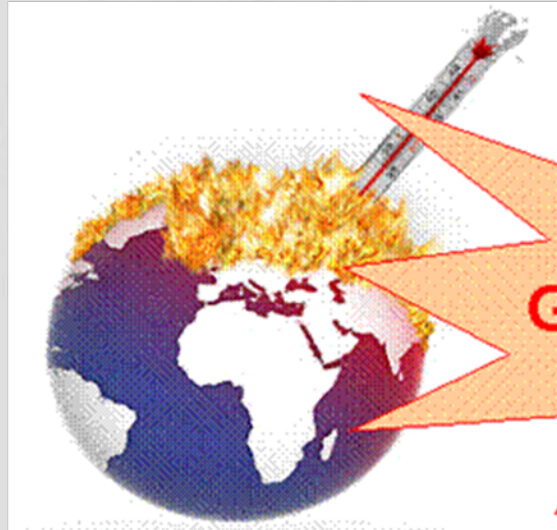
Updated outcomes for greenhouse gases from China GAW stations and near future implementation

Lingxi ZHOU, and colleagues/collaborators

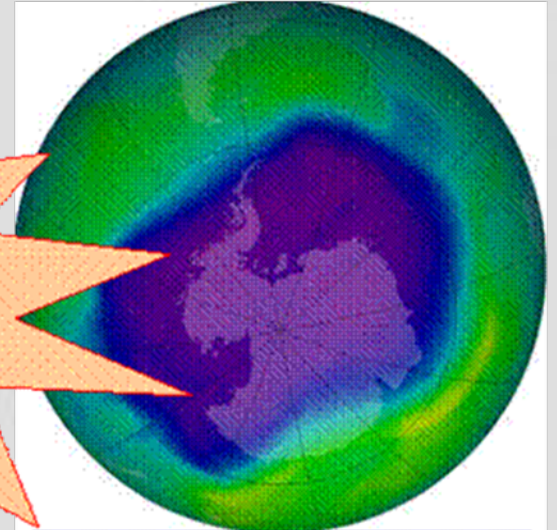
zhoulx@cma.cma.gov.cn, zhoulx2007@gmail.com

CAMS, CAWAS/CMA

**ESRL Global Monitoring Annual Conference
May 13th - 14th, 2009, Boulder, Colorado, USA**



Greenhouse Gases



the Kyoto protocol

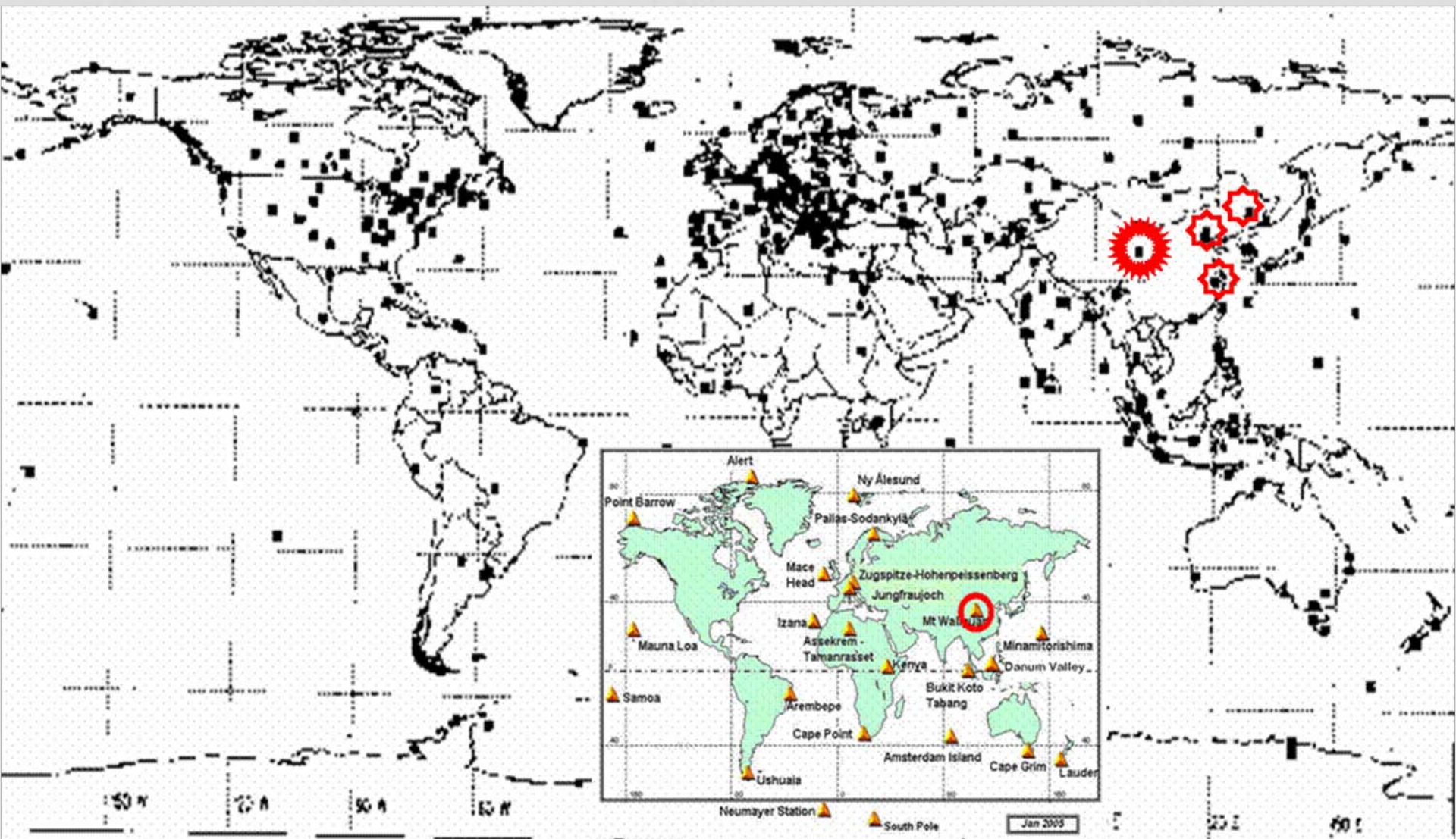
- CO_2
- CH_4
- N_2O
- SF_6
- **HFCs: hydrofluorocarbons**
(C, H, F):
- **PFCs: Perfluorated Hydrocarbons** (C, F)

the Montreal protocols

- **CFCs: chlorofluorocarbons**
(C, Cl, F)
- **HCFCs: hydrochlorofluorocarbons**
(C, Cl, F, H)
- **Halons: (C, Br, Cl, F)**
- **Trichloroethane**
- **Carbon tetrachloride (CCl_4)**
- **Chloroform (CHCl_3)**
- **Methyl bromide (CH_3Br)**

WMO/GAW Global & Regional Stations

More than 200 sites (<http://www.wmo.ch>)



WMO/GAW
China Global Atmosphere Watch
Baseline Observatory

Waliguan Observatory

36°17' N, 100°54' E, 3816m

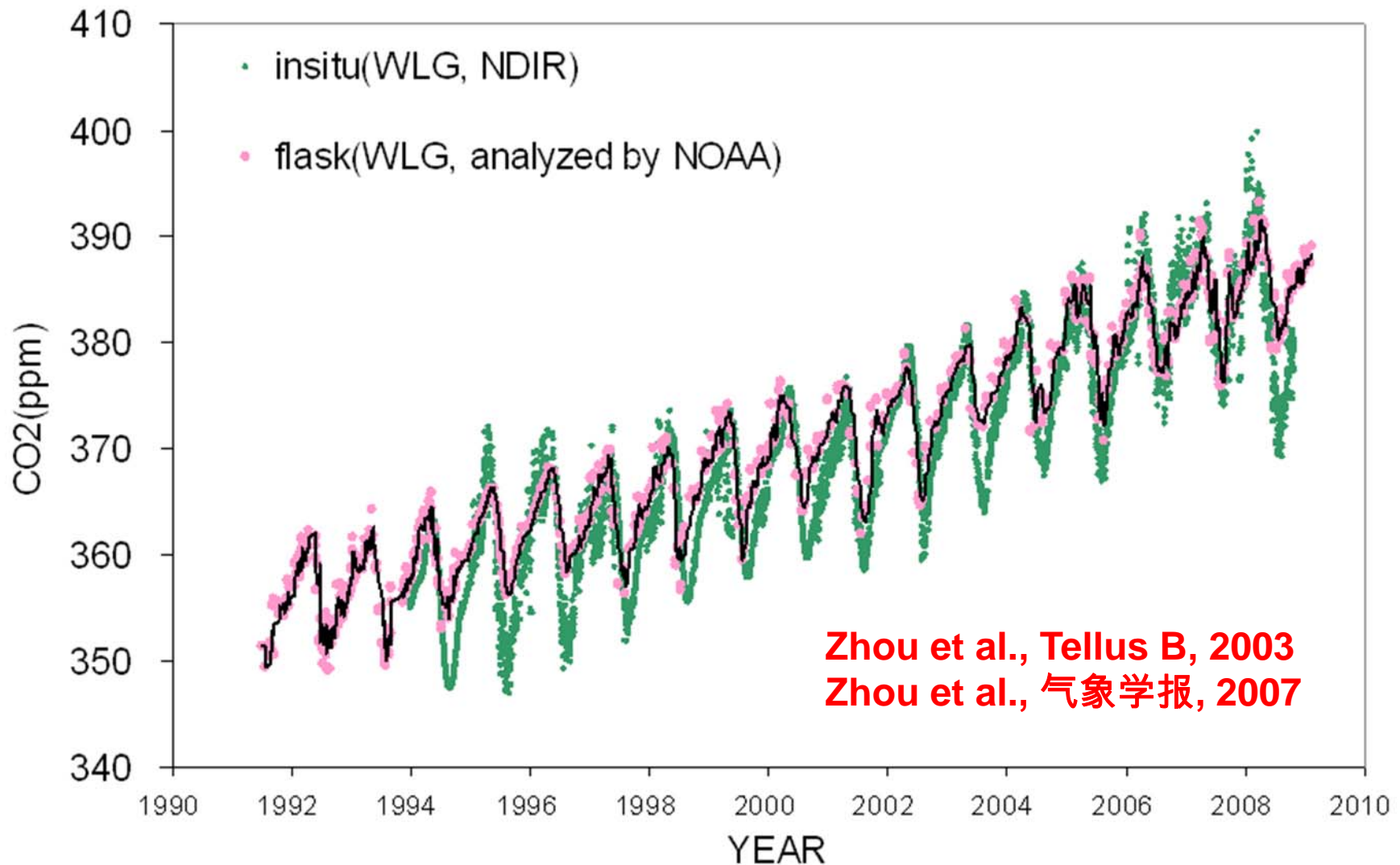


In-situ CO₂, CH₄, CO
monitoring systems
on 2nd floor of the main
building.

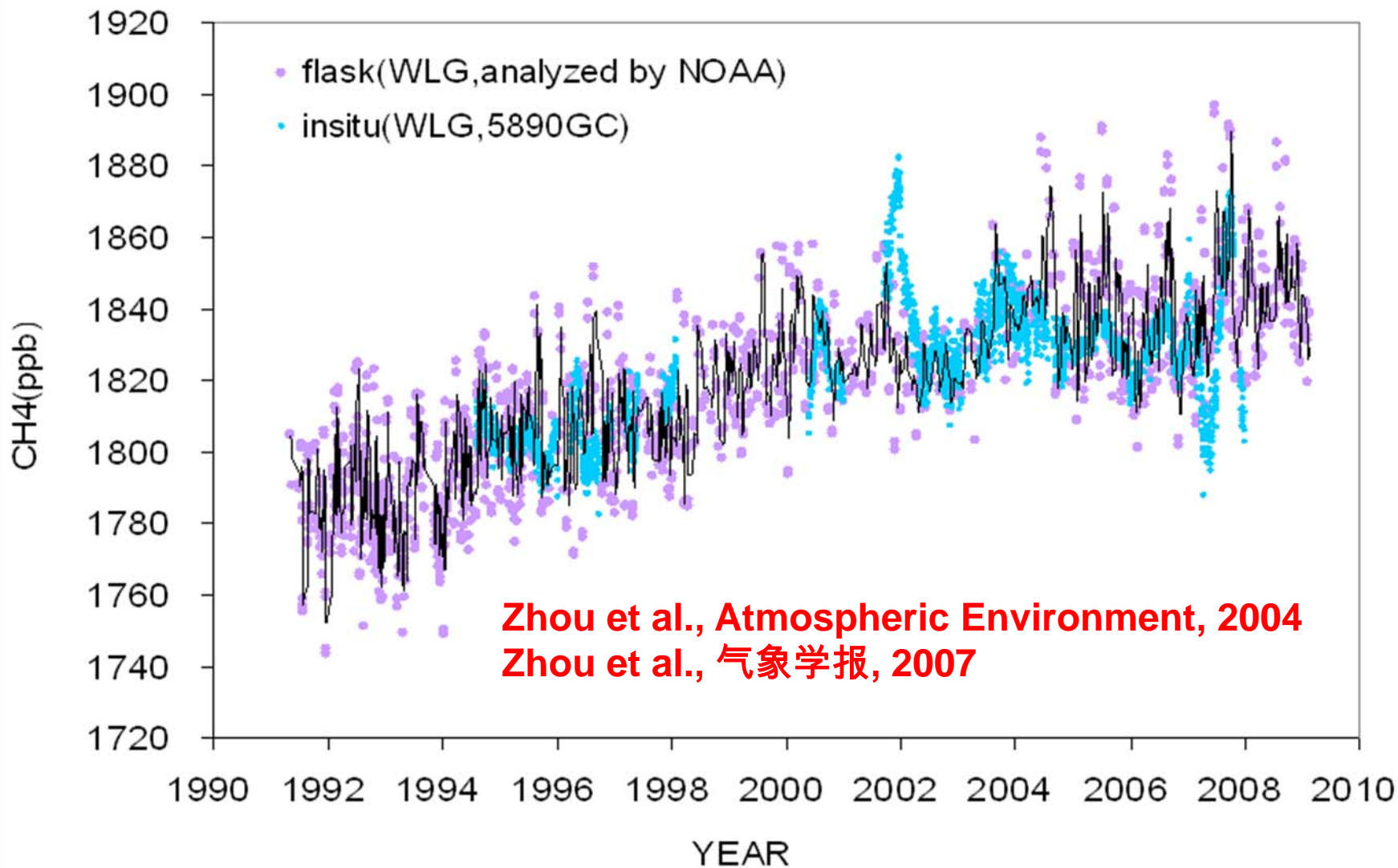


An **89m tower** (20m east of the main building), to measure meteorological parameters at different levels and to obtain air samples for the in-situ CO₂, CH₄ and CO measurements.

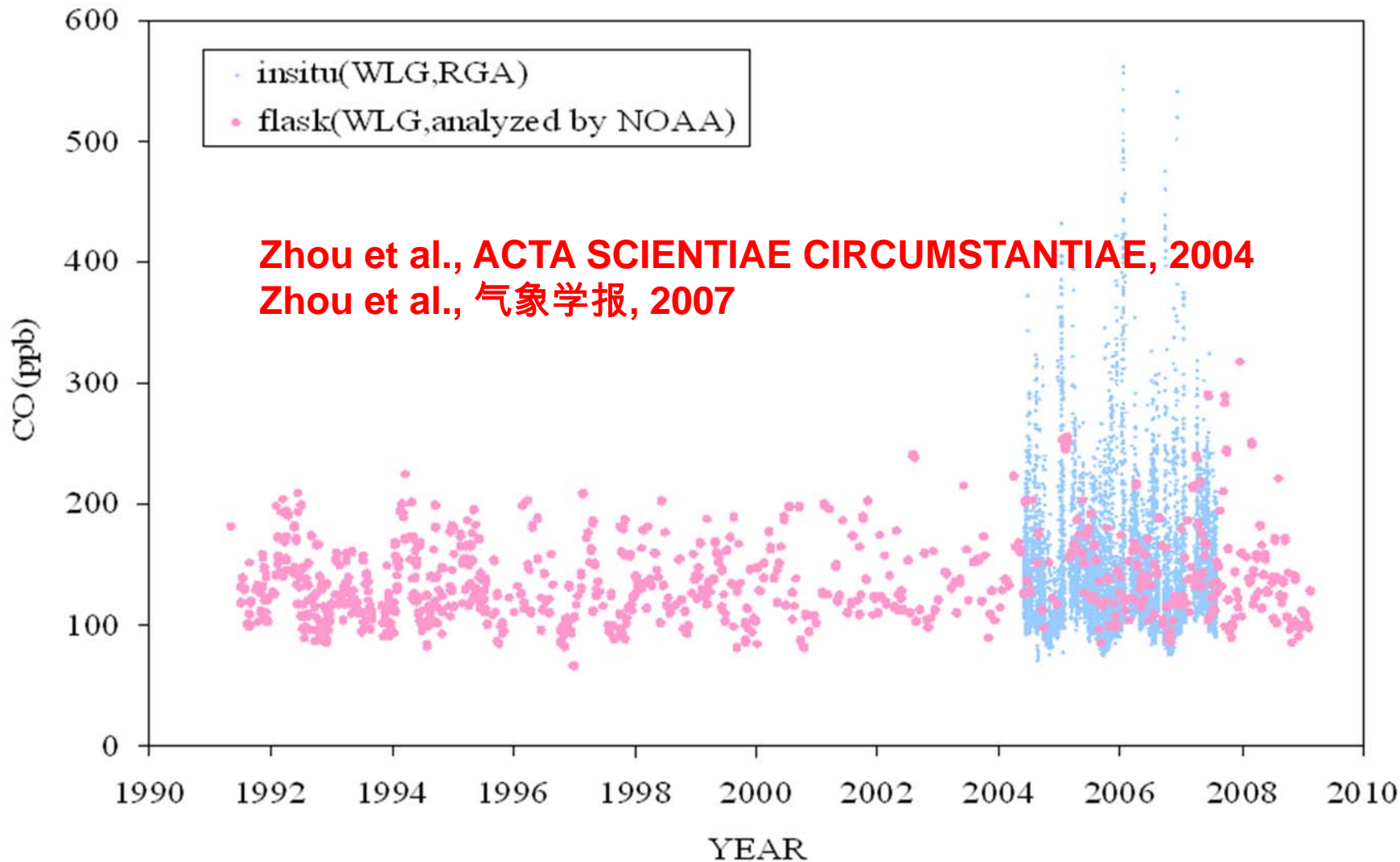
Historical data at Mt. Waliguan (CO₂)

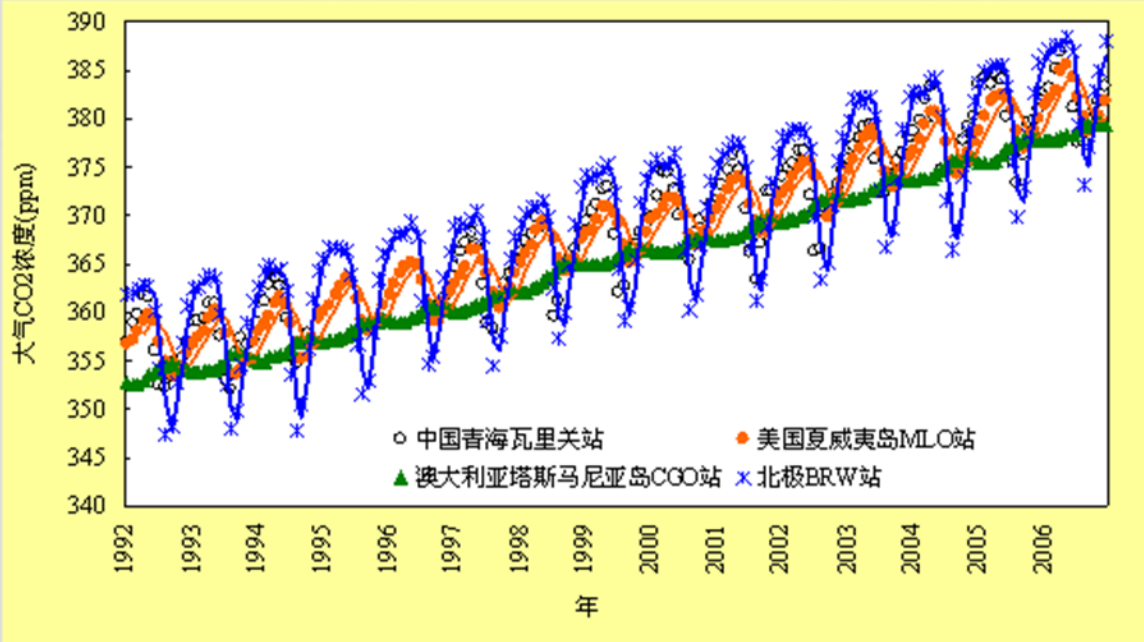


Historical data at Mt. Waliguan (CH₄)



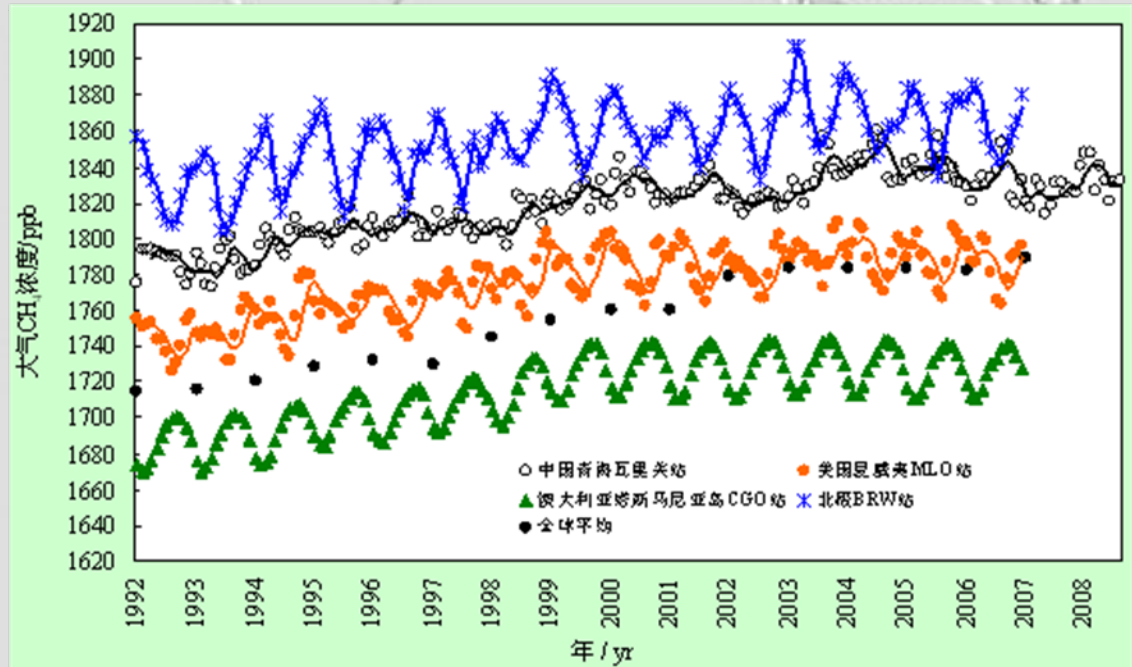
Historical data at Mt. Waliguan (CO)



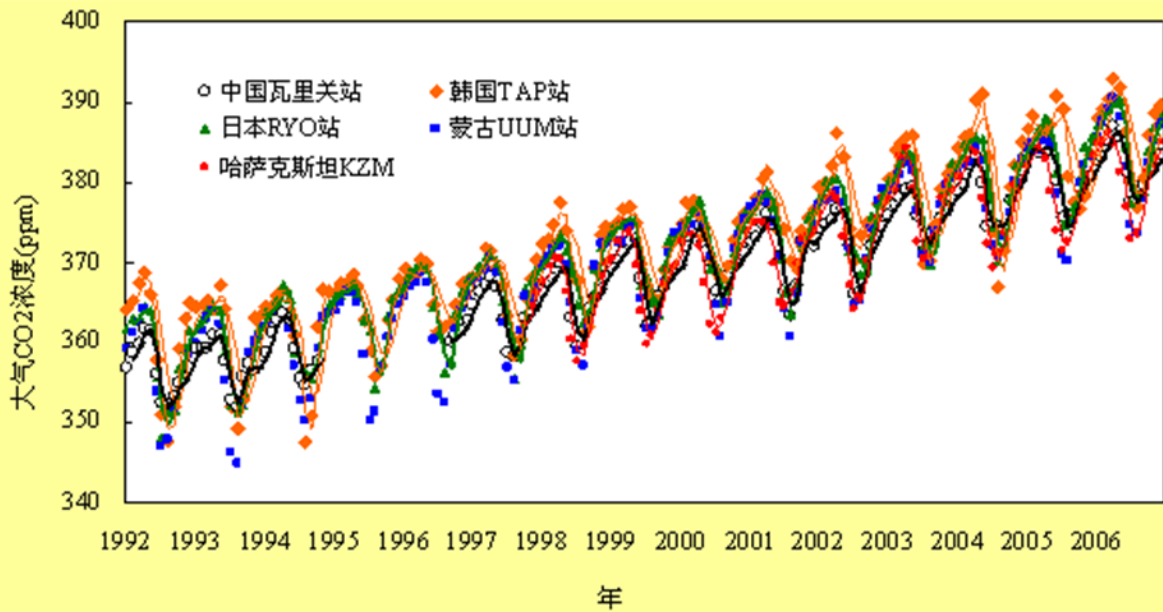


Atmospheric CO₂ and CH₄

**Waliguan
compare to some
other GAW
global stations**

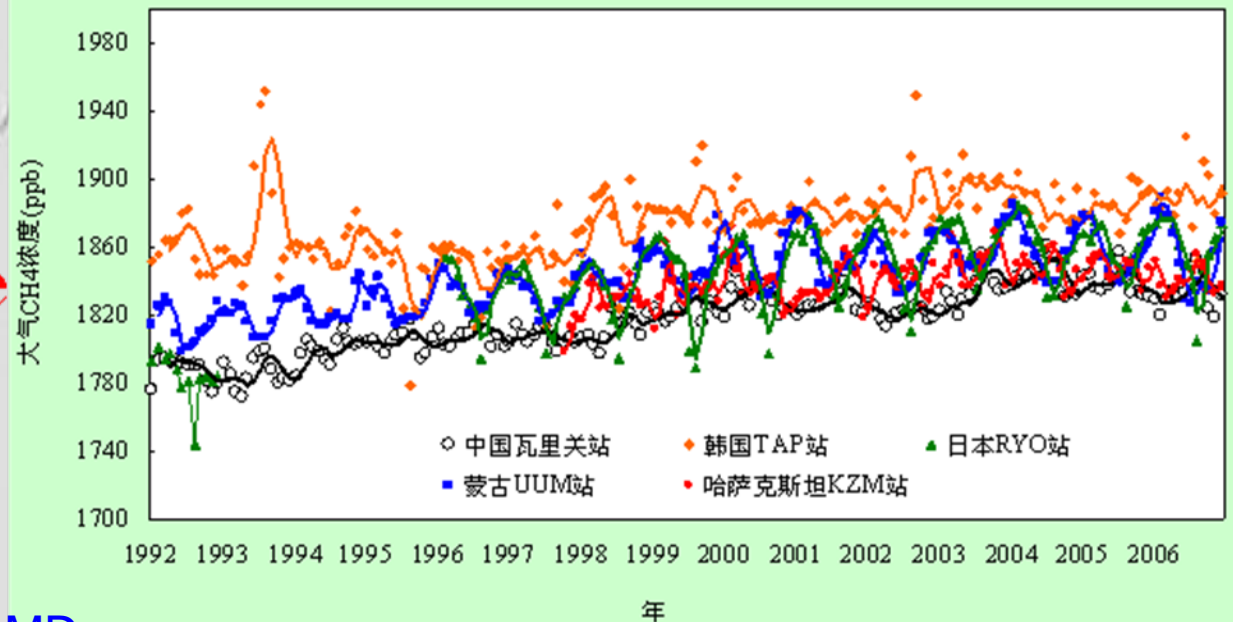


Data source:
WDCGG, NOAA/ESRL/GMD



Atmospheric CO₂ and CH₄

**Waliguan
compare to some
adjacent GAW
regional stations**

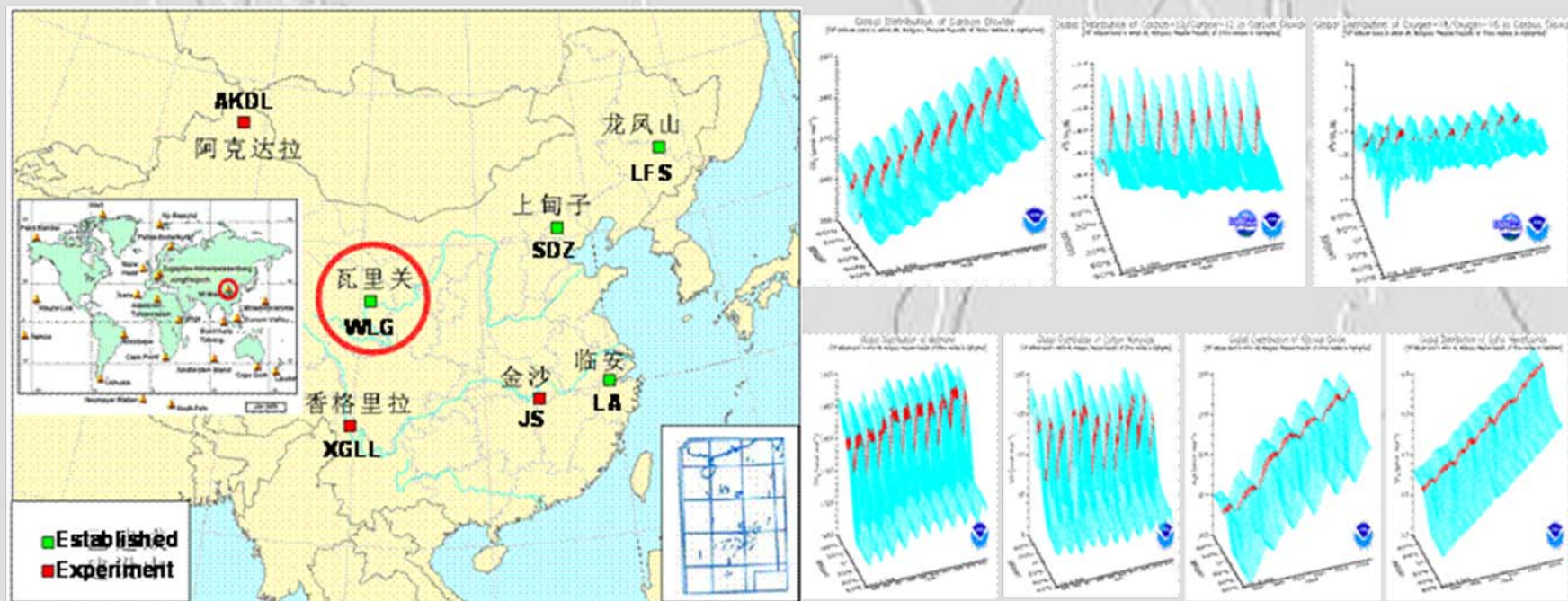


Data source:
WDCGG, NOAA/ESRL/GMD

Cooperative China-U.S. Greenhouse Gases and Related Tracers Measurements Program

L.X. Zhou, L.X. Liu, S.X. Fang, F. Zhang, B. Yao, M. Wen, L. Xu, S. Gu, K.P. Zang, L.J. Xia, X.C. Zhang, Y.L. Chen, P. Zhao, Y.P. Wen, X.J. Zhou, and Waliguan staff

P.P. Tans, R.C. Schnell, E. Dlugokencky, J.W.C. White, T. Conway, A. Crotwell, S.A. Montzka, C.L. Zhao, K. Masarie, A. Andrews, and C. Sweeney



The 7 GAW stations in China and the 3D annual global carbon cycle greenhouse gases pictures showing atmospheric CO₂, δ¹³C & δ¹⁸O in CO₂, CH₄, CO, N₂O, SF₆.

Red lines indicate measurement data from Mt. Waliguan (36°17'N, 100°54'E, 3816m asl), China.

GAW Global & Regional Stations in China



Waliguan

(36.3° N, 100.9° E, 3810 m)

Shangdianzi



上甸子

(40.39° N, 117.07° E, 293.9 m)

LFS



龙凤山

(44.73° N, 127.6° E, 310 m)

AKDL



阿克达拉

(47° 06' N, 87° 58' E, 562 m)

JS



金沙 (31° 24.5' N, 112° 59.5' E, 862 m)

XGLL



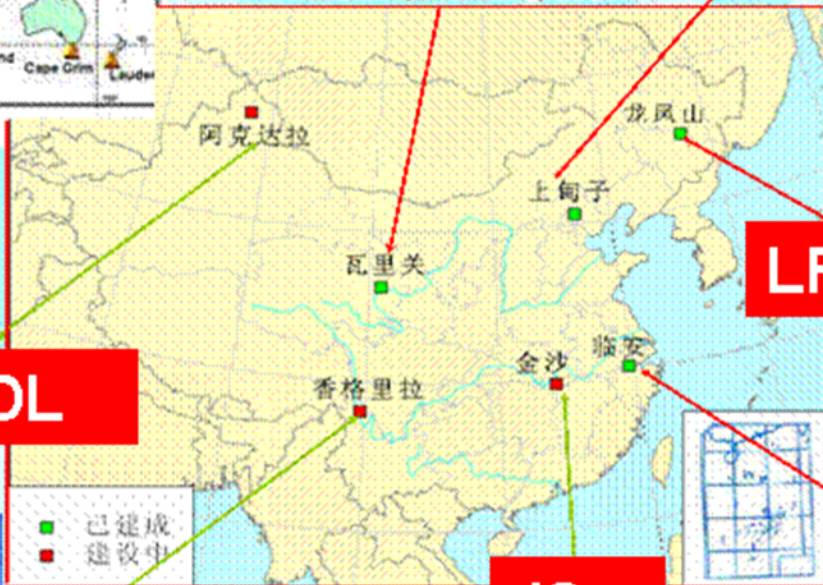
香格里拉 (27° 30' N, 99° 0.5' E, 3580 m)

LAN



临安

(30.3° N, 119.73° E, 138 m)





Beijing Lab and GAW stations

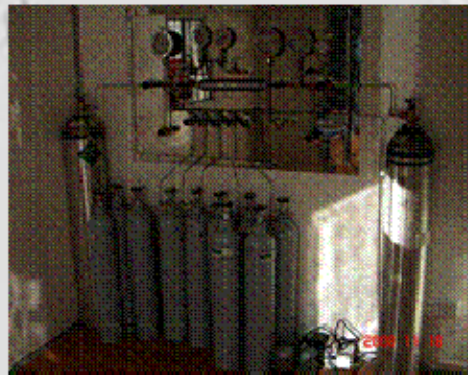


**GHGs measurement
CAWAS, CMA**

**GC-FID+ECD (CH₄, CO, N₂O, SF₆)
GC-RGD (CO, H₂)**

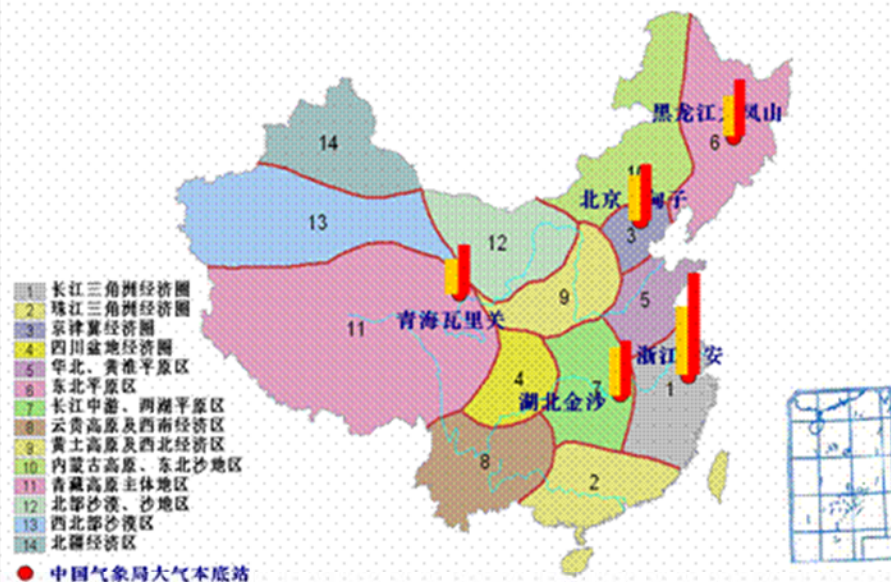


**Picarro-CH₄/CO₂甚高分辨率在线
监测系统**

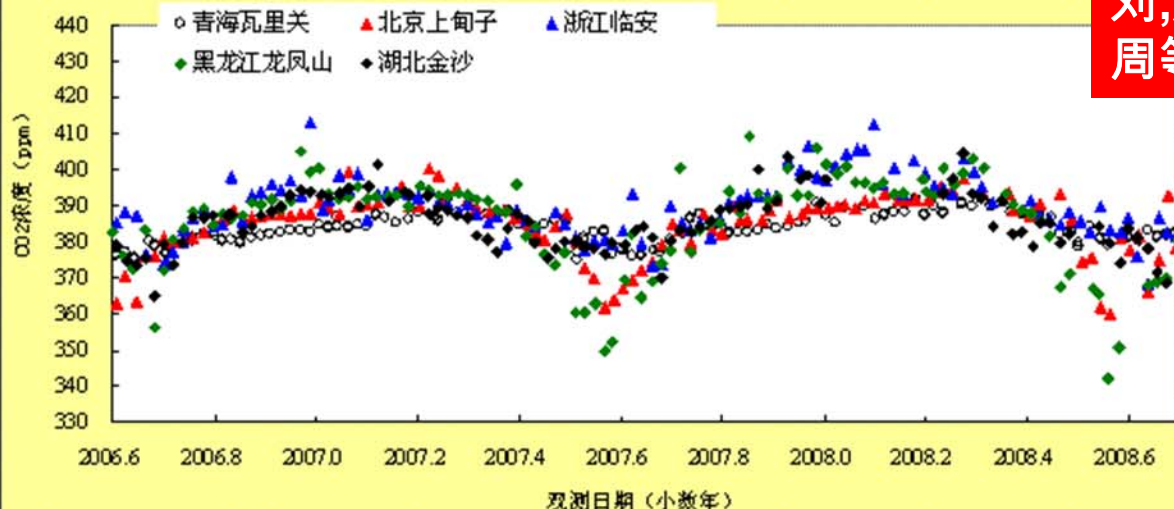


Atmospheric CO₂ from China GAW stations (flask data, 2006-)

国家大气成分本底野外研究站网络布局分区图



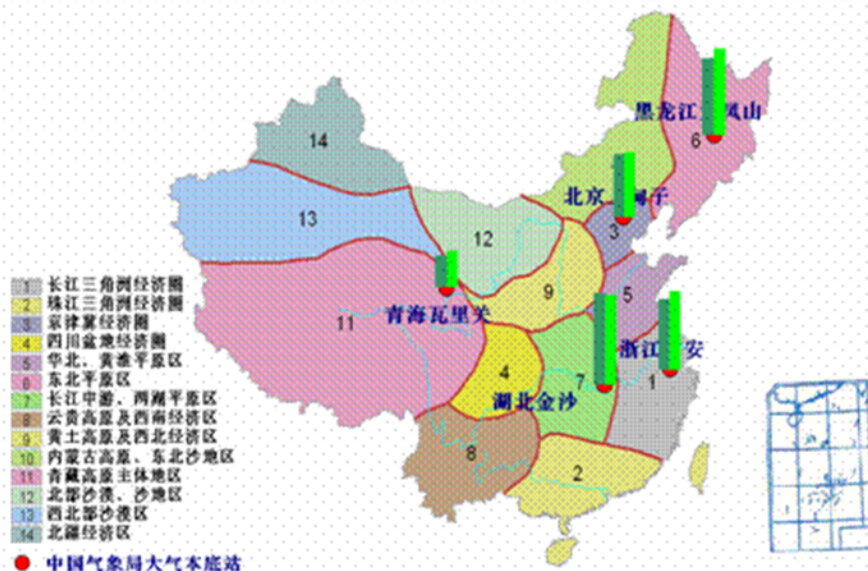
2006年9月-2008年8月 五个本底站2个完整年度大气CO₂浓度对比



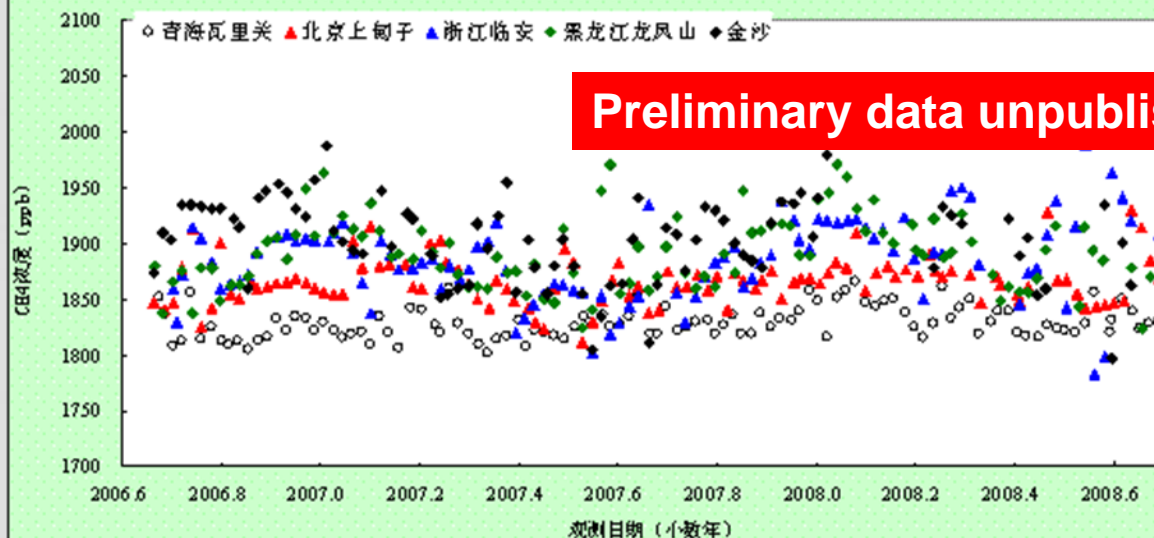
刘,周等, 中国科学, 2009
周等, 应用气象学报, 2008

Atmospheric CH₄ from China GAW stations (flask data, 2006 -)

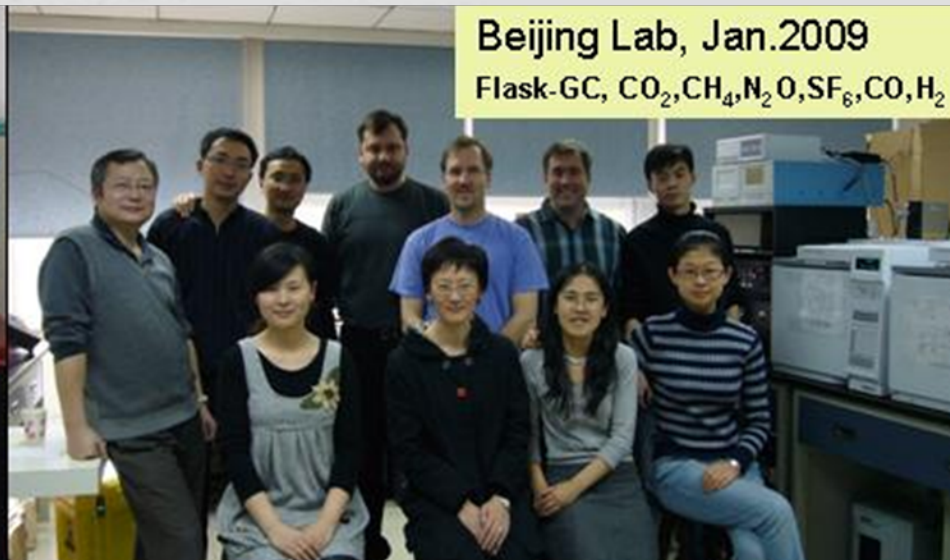
国家大气成分本底野外研究站网络布局分区图



2006.9月-2008.8月五本底站2个完整年度大气CH₄浓度对比



Preliminary data unpublished, please do not cite.



Beijing Lab, Jan.2009
Flask-GC, CO₂,CH₄,N₂O,SF₆,CO,H₂

Beijing Lab and GAW stations

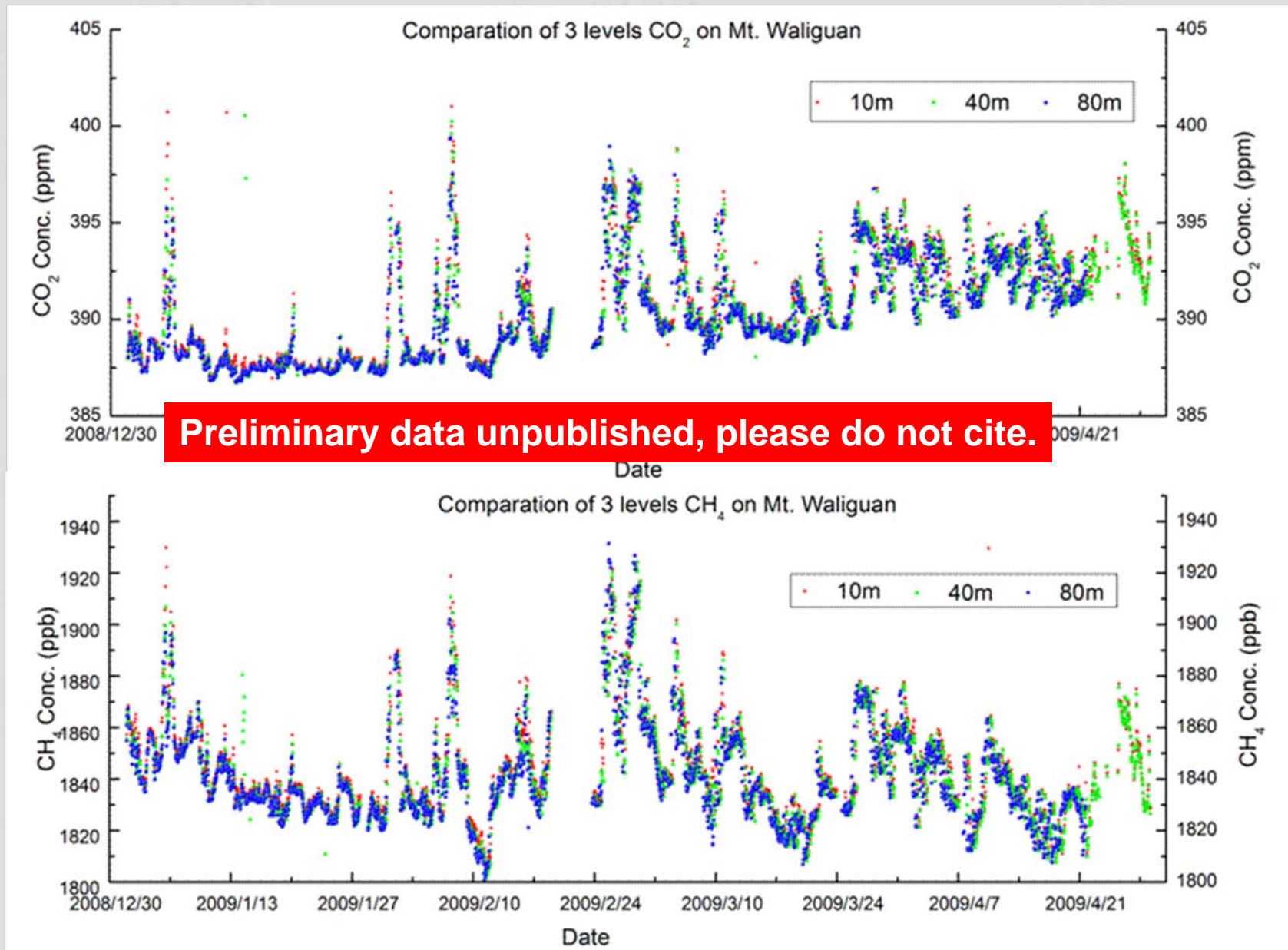


WLG,SDZ,LA,LFS stations
In-situ CRDS, CO₂,CH₄

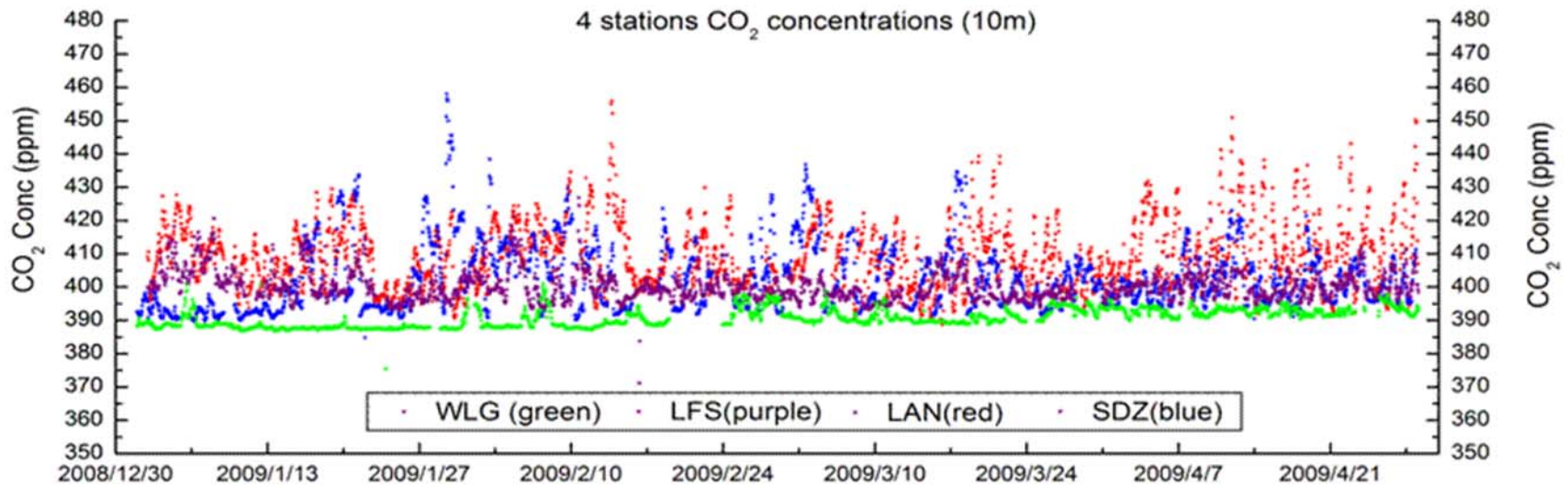


WLG station, Jan.2009
In-situ GC, CH₄,CO,N₂O,SF₆

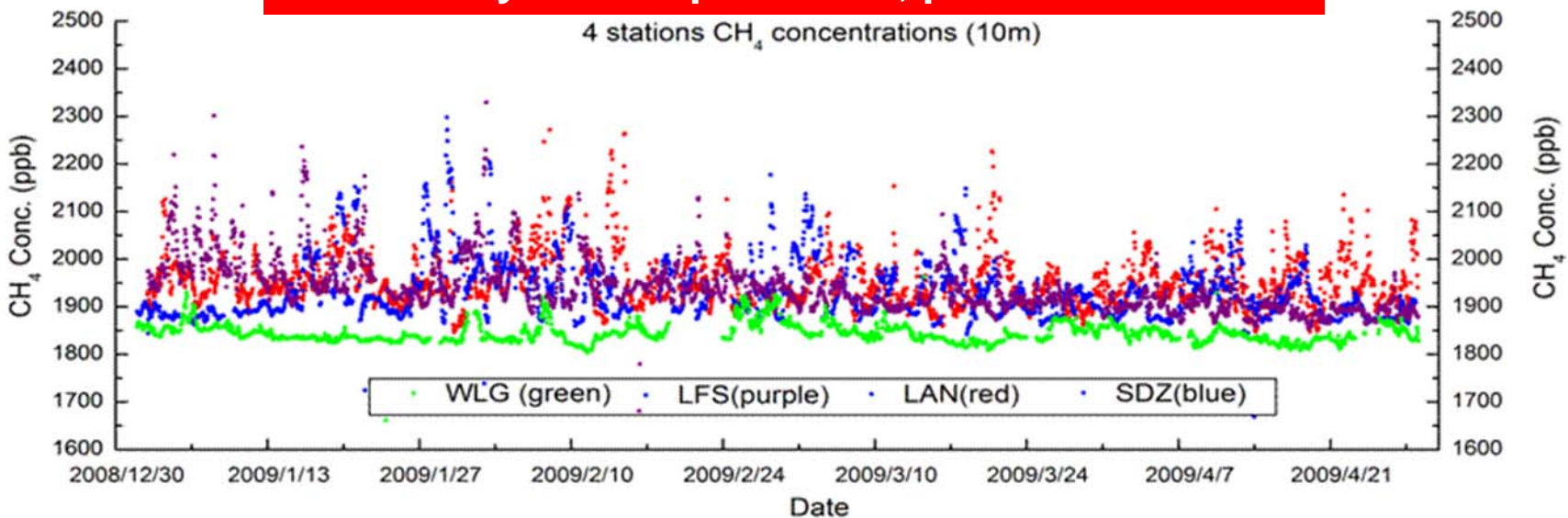
Picarro CH₄ & CO₂ data, Mt. Waliguan (10m, 40m, 80m agl)



Picarro CH₄ & CO₂ data from Jan. 1st, 2009 to present (4 GAW stations in China)



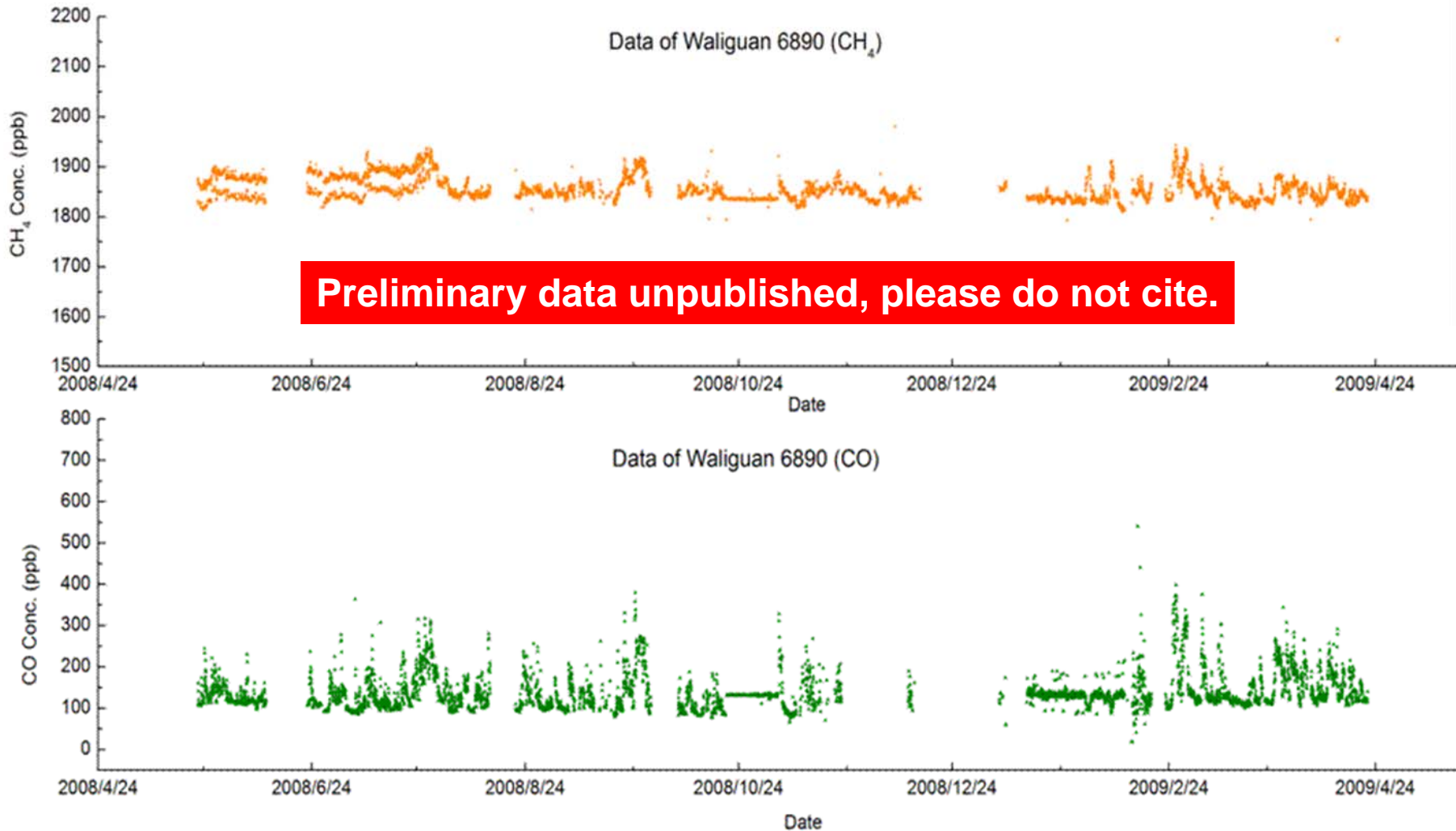
Preliminary data unpublished, please do not cite.



**6890N GC (CH₄, CO, N₂O, SF₆)
since May 2008 (Mt. Waliguan)**

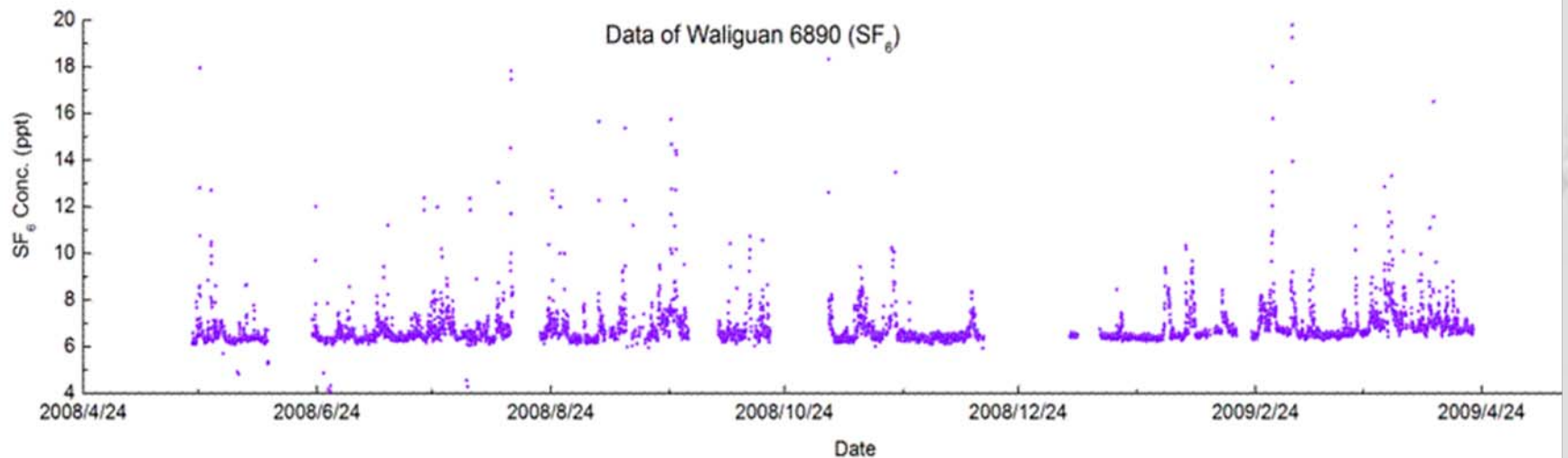
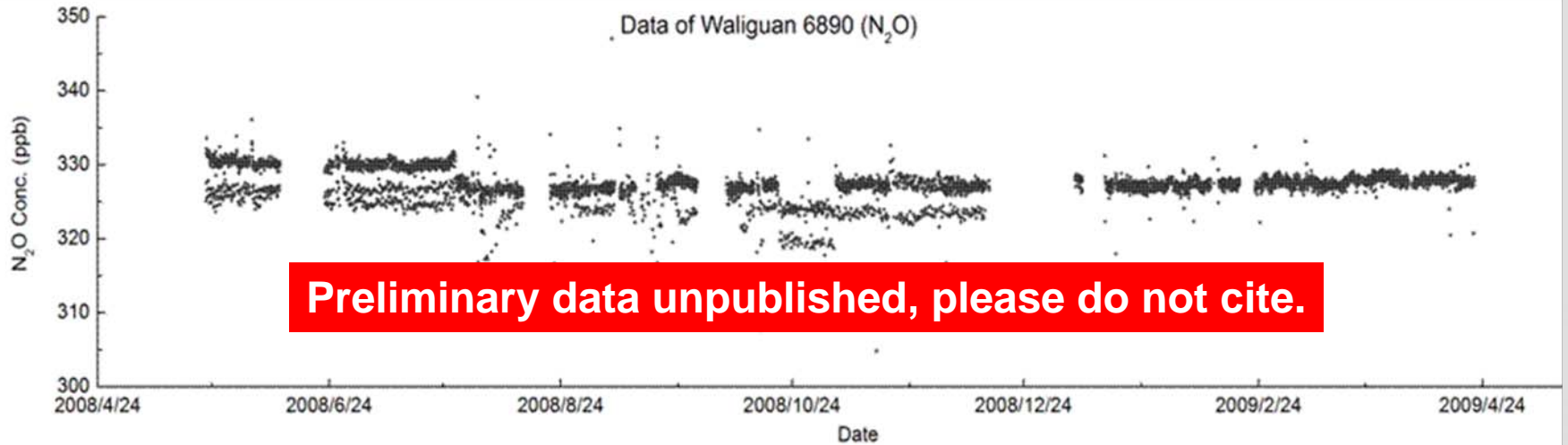


CH₄ and CO data from May 2008 to present (in-situ GC-FID, Mt. Waliguan)



N_2O and SF_6 data from May 2008 to present

(in-situ GC-ECD, Mt. Waliguan)



Joint AGAGE, SOGE and affiliated Networks



Advanced Global Atmospheric Gases Experiment

Sponsored by NASA's Atmospheric Composition Focus Area in Earth Science

- Home
- Brochure
- Mission
- Research Highlights
- Stations
- Instruments
- Data
- Publications
- Related Links
- PI and Co-PIs
- Science Team Only

AGAGE Stations

Mace Head Trinidad Head Barbados Samoa Cape Grim

Affiliated Stations

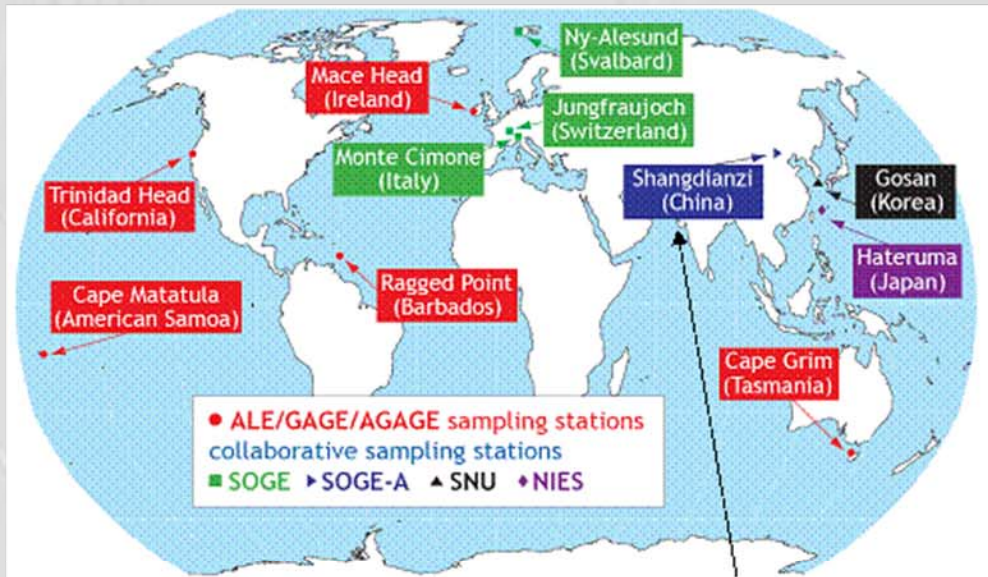
Ny Alesund Jungfraujoch Mt. Cimone ShangDianZi Gosan Hateruma



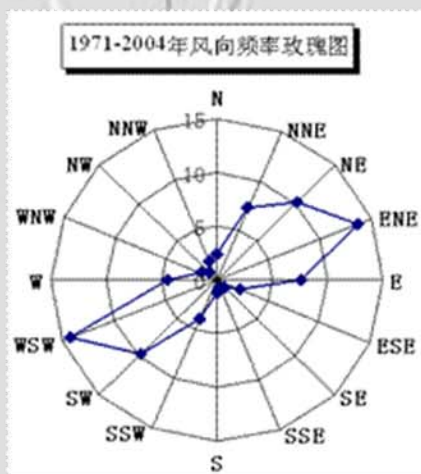
The Shangdianzi GAW Regional Station (Global Atmosphere Watch programme of the World Meteorological Organization) 150km northeast of urban Beijing is part of the domain of the China Meteorological Administration (CMA). It is jointly operated by the Beijing Meteorological Bureau (BMB) and the Chinese Academy of Meteorological Sciences (CAMS). The first in-situ measurement of ODSs and solvents in China has been performed by GC-ECDs at the Shangdianzi since 2006. As one of the partners of SOGE-A, Shangdianzi measurement is attached to the SOGE and linked to the AGAGE network. Furthermore, in-situ atmospheric CO₂/CH₄ measurements by Picarro CRDS and in-situ CH₄/CO/N₂O/SF₆ by GC-FID+ECD and enhanced in-situ measurements of halocarbon by the Medusa GC-MS will be implemented at the Shangdianzi in 2009.

Station Information (Shangdianzi, China)

Latitude:	40° 39' N
Longitude:	117° 7' E
Time Zone:	GMT+8
air sample Intake:	301.3 m (station is 293.3 m above sea level)
Station PIs:	Lingxi Zhou, zhoulx@cams.cma.gov.cn
Station manager:	



Wind Rose (1971-2004) Shangdianzi GAW Regional Station



>30% from clean sector
Ca 22% from Urban Beijing sector

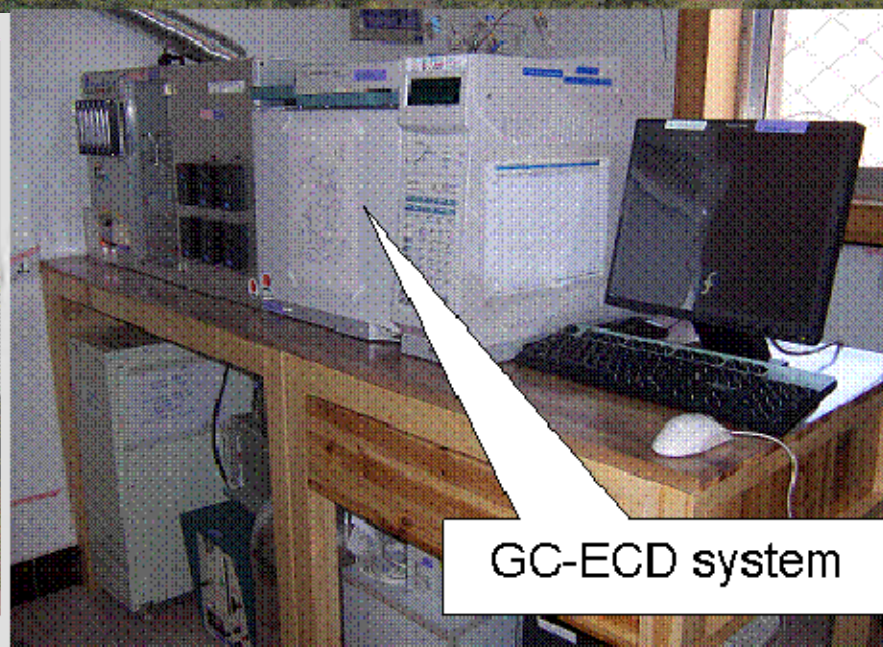
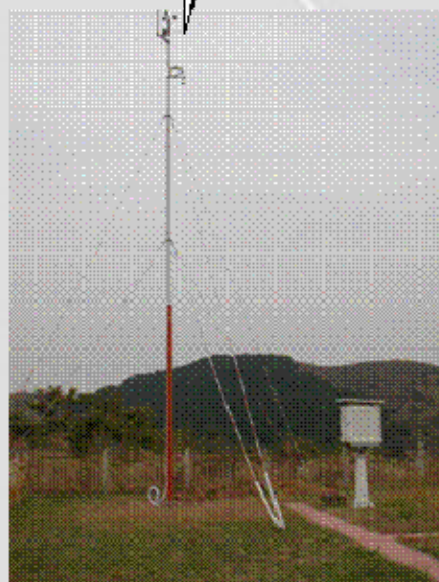
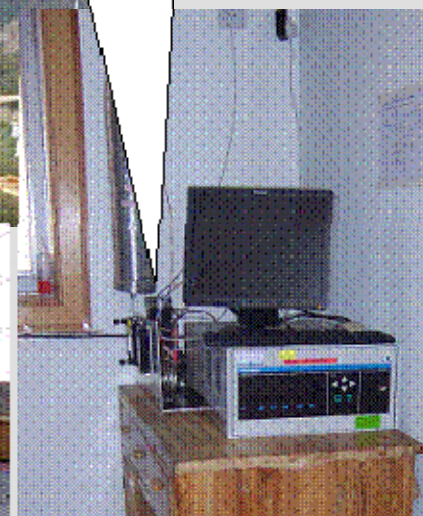
Shangdianzi GAW Regional Station

Since October 2006

Sample inlet



CO monitor



GC-ECD system



Compounds currently measured at Shangdianzi

Ozone-depleting Gases

- CFCs: chlorofluorocarbons (C, Cl, F):
CFC-12, CFC-11, CFC-113, CFC-115, CFC-114
- HCFCs: hydrochlorofluorocarbons (C, Cl, F, H):
HCFC-22, HCFC-141b, HCFC-142b, HCFC-124
- Halons: (C, Br, Cl, F):
H-1301, H-1211
- Trichloroethane = methyl chloroform = CH_3CCl_3
- Carbon tetrachloride (CCl_4)
- Chloroform (CHCl_3)
- TCE (C_2HCl_3) and PCE (C_2Cl_3)
- Methyl bromide (CH_3Br)

Greenhouse Gases

- CO_2 , CH_4 , N_2O
- HFCs: hydrofluorocarbons (C, H, F):
HFC-134, HFC-152a, HFC-125, HFC-23, HFC-143, HFC-227ea, HFC-161, HFC-365mfc, HFC-245fa, HFC-236fa, and many more
- PFCs: Perfluorated Hydrocarbons (C, F):
 CF_4 C_2F_6 C_4F_8
- SF_6

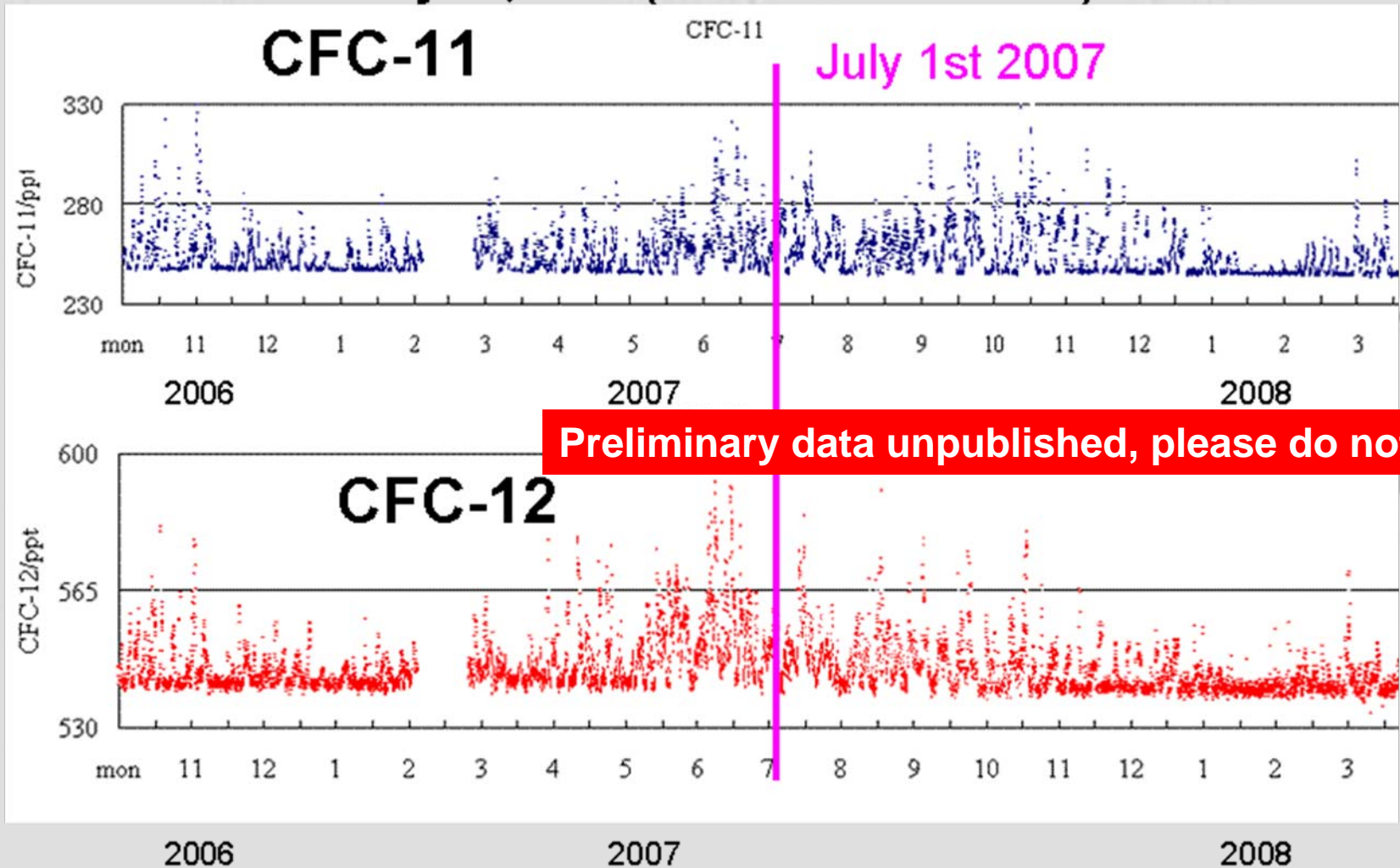
• CO

Species in red: in-situ

Species in blue: flasks

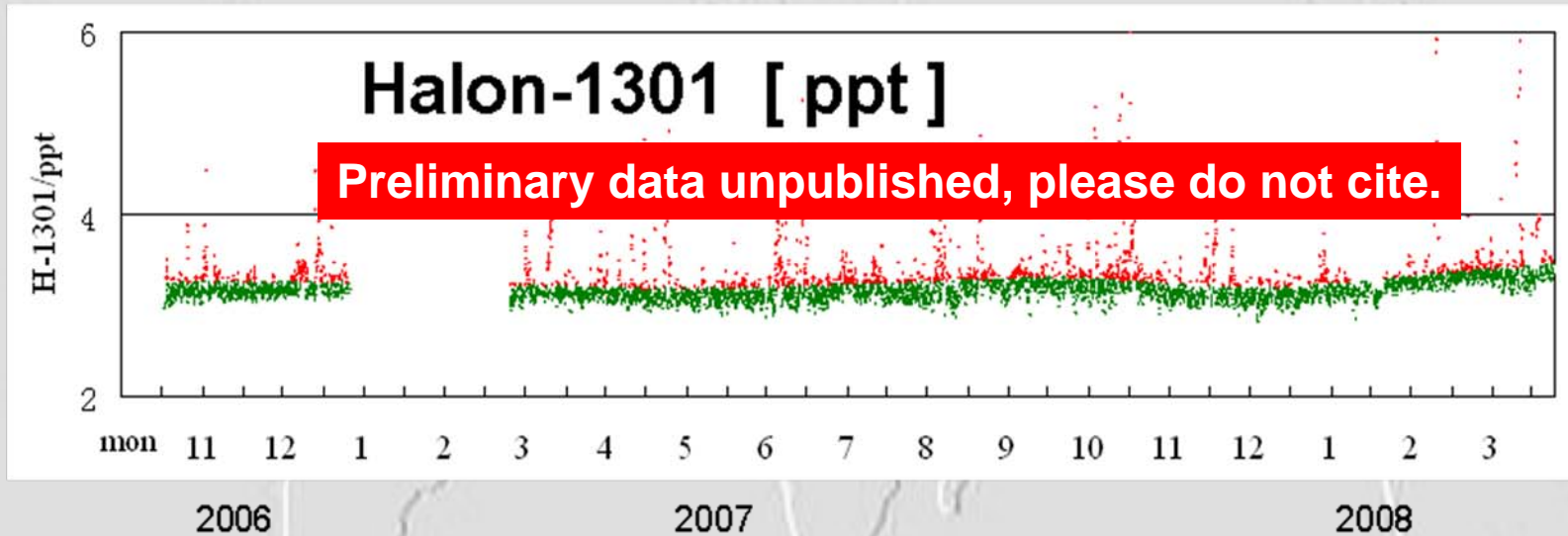
Preliminary results from SDZ, China

Production and consumption of **CFCs** was banned on July 1st, 2007 (China National Plan)

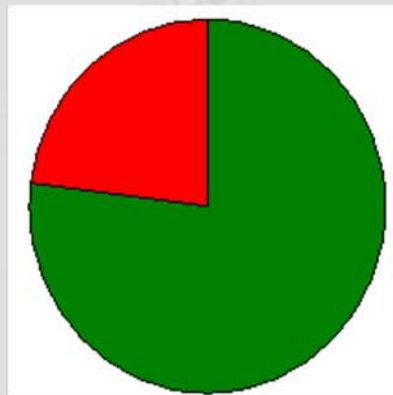


Preliminary results from SDZ, China

Production and consumption of **Halons** will be banned in 2010



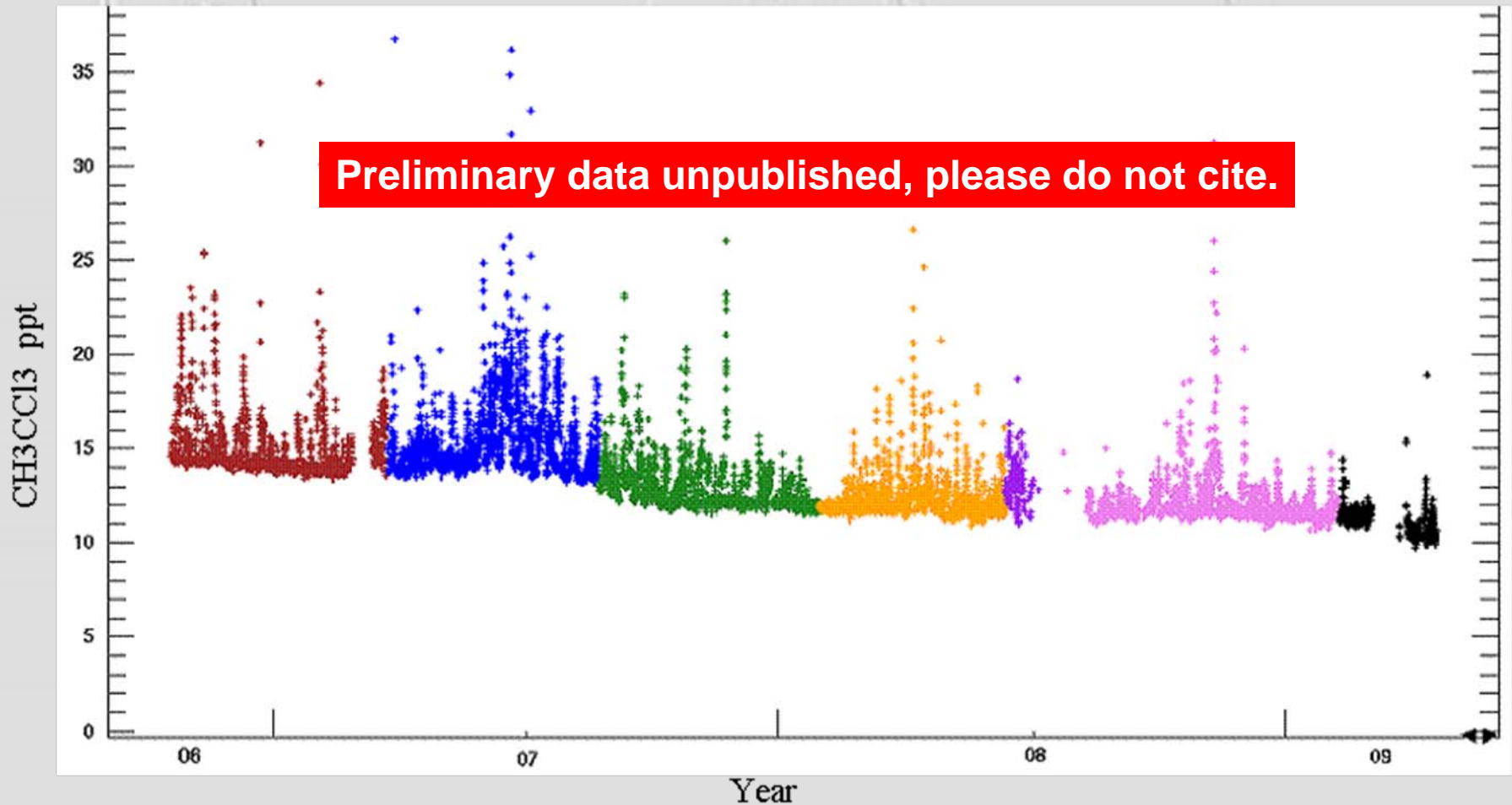
Polluted



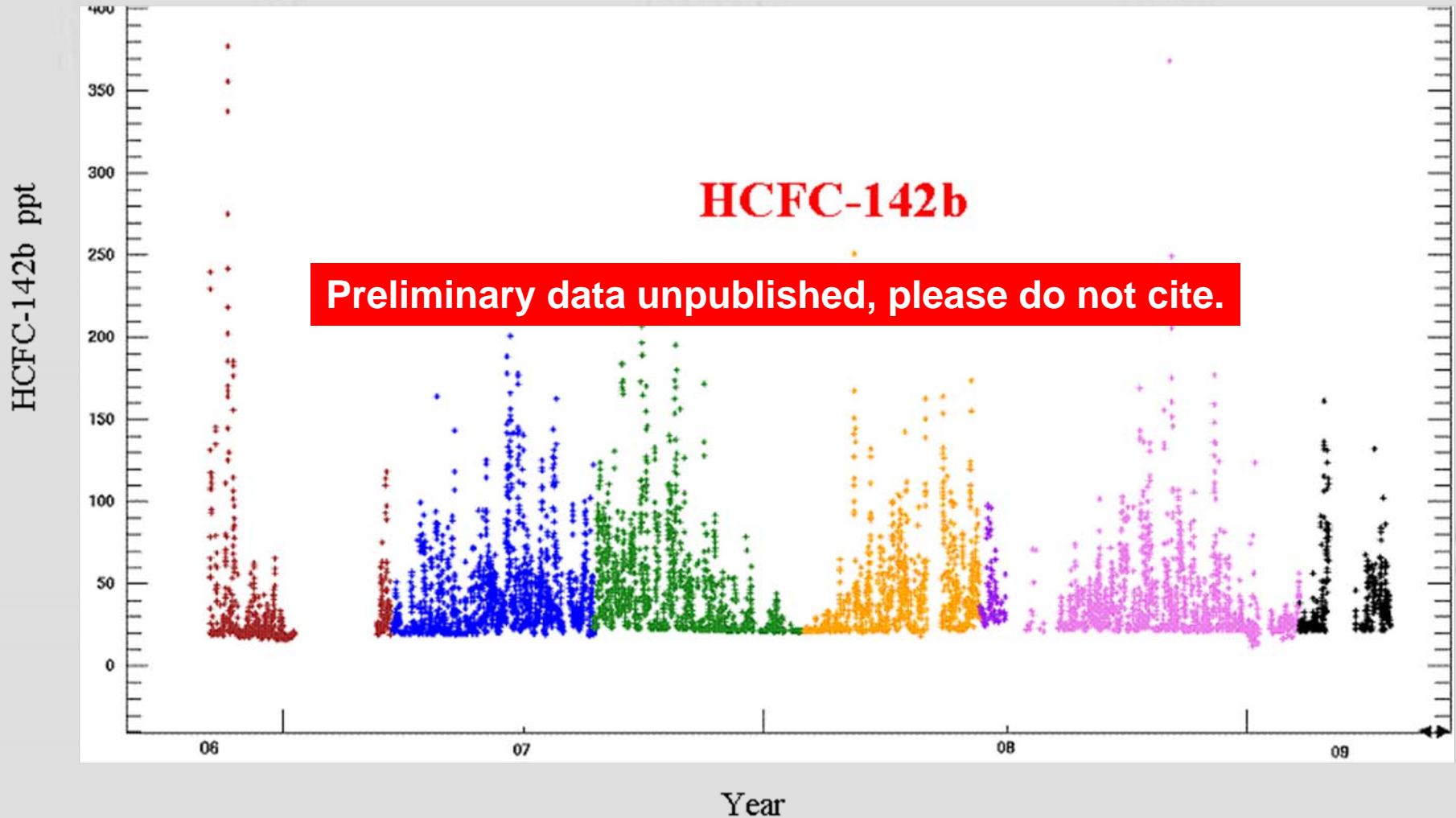
Background

Preliminary results from SDZ, China

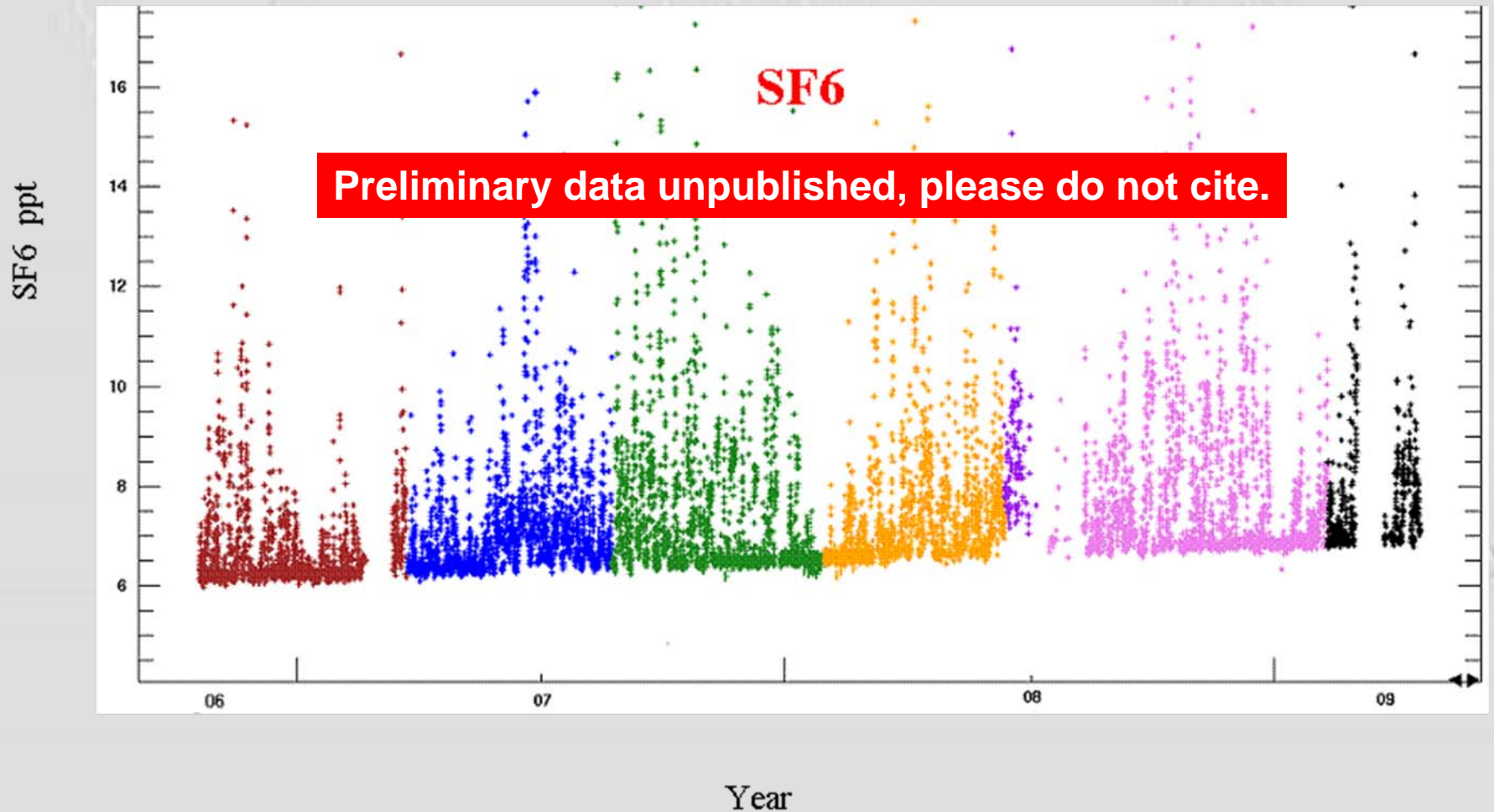
Production and consumption of
methyl chloroform (CH_3CCl_3)
will be banned in 2015



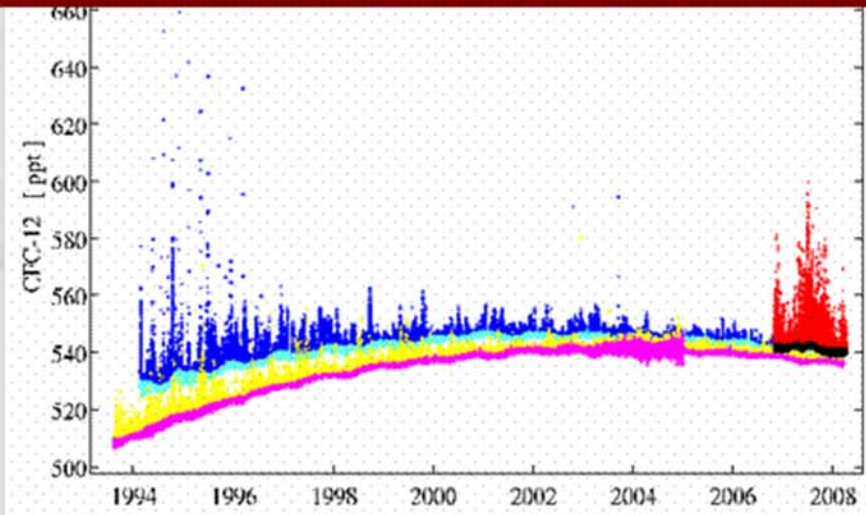
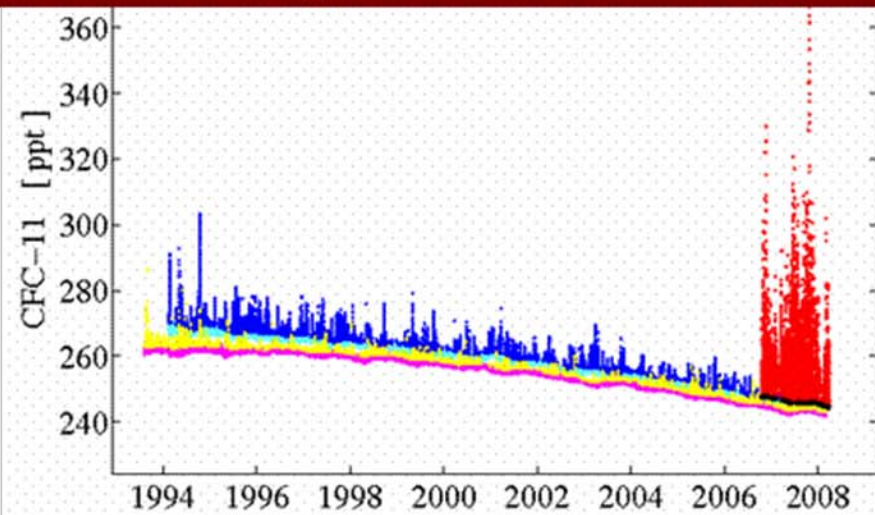
Preliminary results from SDZ, China



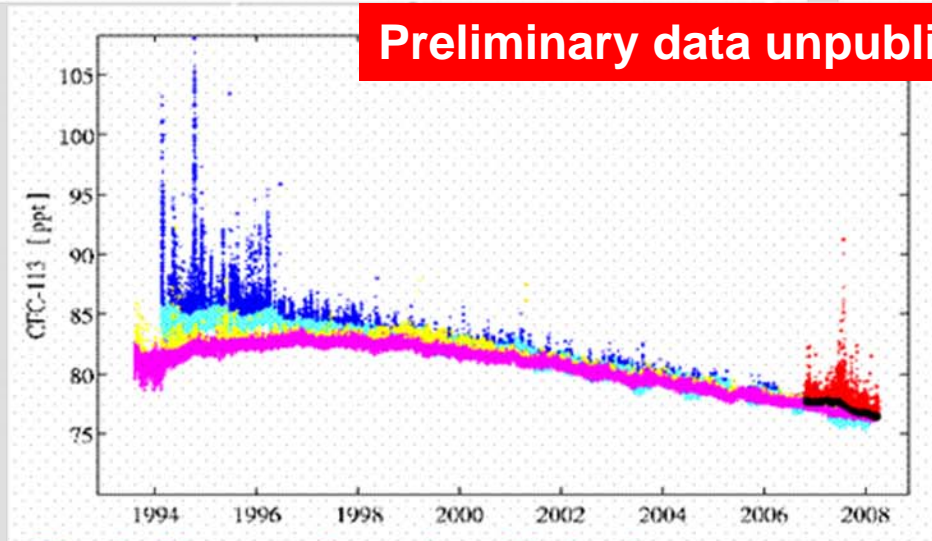
Preliminary results from SDZ, China



Compare with some AGAGE global sites



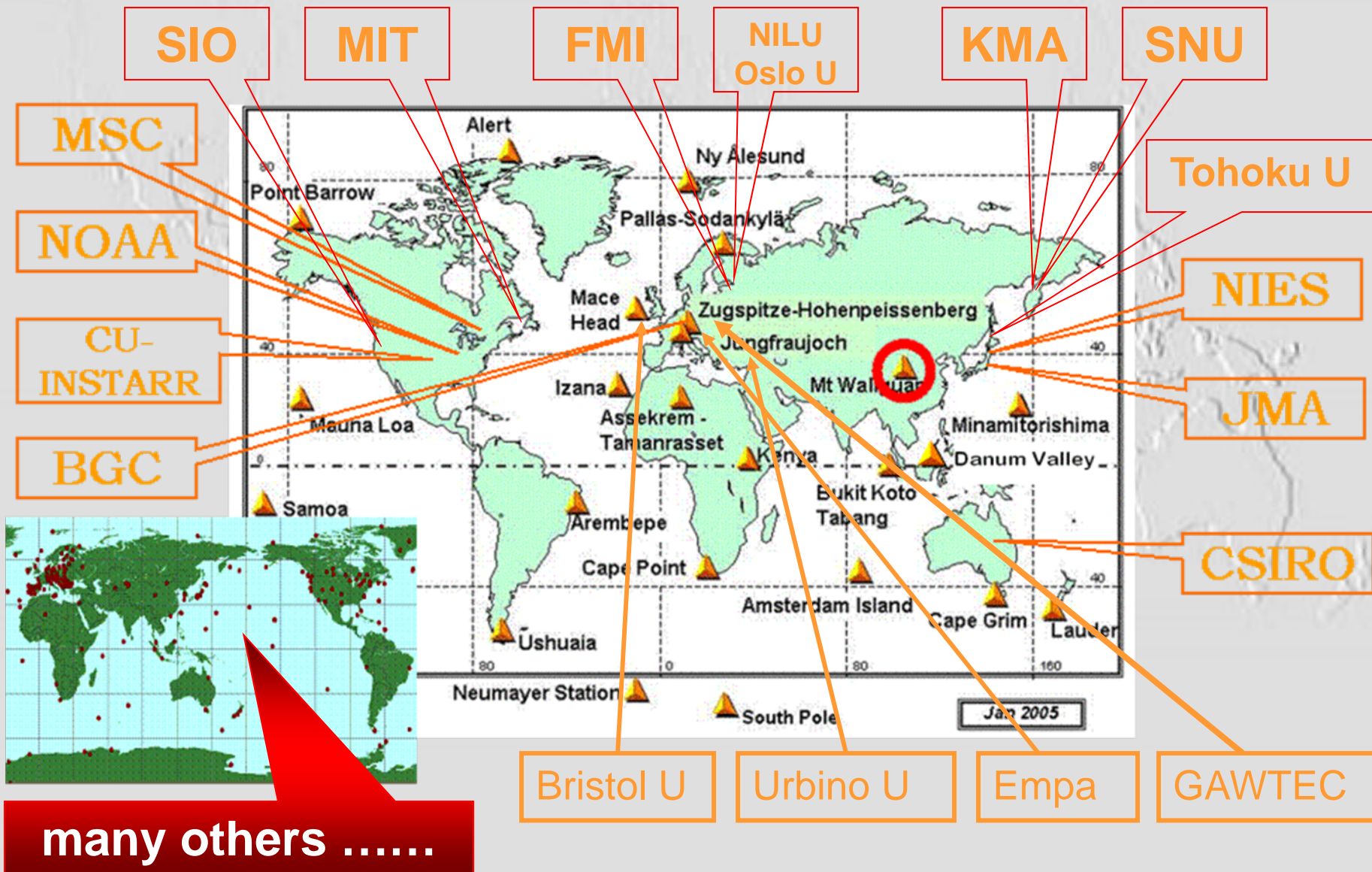
Preliminary data unpublished, please do not cite.



Courtesy AGAGE:
Mace Head / Cape Grim
Observational data

Red-Shangdianzi polluted、Black-Shangdianzi background
Blue-Mace Head polluted、Light blue -Mace Head background
Yellow-Cape Grim polluted、Pink-Cape Grim background

International Cooperation



WMO Round-robin Inter-comparison (GHGs)

2002 - 2006 WMO ROUND-ROBIN INTERCALIBRATION RESULTS CARBON DIOXIDE CONCENTRATIONS [Preliminary]

Laboratories	Analysis Date	Report Date	TANK # CO2 (ppm)			Other species measured (Reported in red)	Difference (Lab - NOAA) CO2 (ppm)		
			4532	4495	4564		4532	4495	4564
GROUP ONE (Tank #4532, #4495, #4564)									
US-NOAA	Feb-Mar 2001								
US-NOAA	Apr 2002		354.91	368.14	384.81				
US-NOAA	Feb 2005								
JP - Tohoku U.	Jan 2003	Mar 2004							
JP - NIES	Apr 2003	Mar 2004				CH4, N2O, SF6, CO, N2, d13C, d18O			
JP - MPI	July 2003	Mar 2004							
JP - AIST	Sept/Dec 2003	Mar 2004				CH4			
JP - JMA	Jan 2004	Mar 2004							
Korea - MMA (K-GAMP)	Mar-Jun 2004	July 2004							
CH - CMA (WUG)	July 2004	Nov 2004							
CH - CMA (BJ)	Aug 2004	Nov 2004							
US - SCRIPPS	June 2005	June 2005				(CMM) d13C, d18O			
FR - LDC E	Oct/Nov 2005	Dec 2005				(ECM II)			
GROUP TWO (Tank #4542, #4595, #4535)									
US-NOAA	Feb-Mar 2001								
US-NOAA	Apr-May 2002		355.85	368.55	384.68				
US-NOAA	Dec 2004								
IT - Monte Cimone	Oct 2002	Oct 2002							
IT - ENEC Lampedusa	Nov 2002	Mar 2003							
IT - Plateau Rosa (ES/CNR)	Dec 2002	Dec 2002							
HU - HME	Feb 2003	Sep 2003							
CA - MSC	May 2005	July 2005				CH4, N2O, SF6, CO, d13C, d18O			
CA - O SAP	not attend								
US - Perm State U.	Sep 2005	Sep 2005							
US - NIST	not attend								
US - Navard U.	not attend								
GROUP THREE (Tank #117511, #4425, #4146)									
US-NOAA	Mar-July 2000								
US-NOAA	July 2001		353.68	366.25	383.31				
US-NOAA	Apr 2002								
US-NOAA	Dec 2004/Jan 2005								
DE - U. Heiseberg	Sep 1/Oct 2002	Sep 2005				CH4, N2O, d13C, d18O			
DE - UBA	Oct 2002	Mar 2003				CH4			
FR - LDC E	Nov/Dec 2002	Dec 2005				CH4, N2O, SF6			
DE - FZK, Komedy IFU	not attend								
FMI	Jan 2003	Mar 2004							
EMPA	July 2003	July 2003				CH4, CO (CO2 not measured)			
DE - MPI/BGC	Nov/Dec 2003	Oct 2004				CH4, N2O, SF6, CO, d13C, d18O			
HU - HME	Mar 2004	Dec 2005							
NL - U. Groningen	Nov 2004	Sep 2005				CH4, CO, d13C, d18O			
NZ - NIWA	May 2005	Apr 2006							
AD - CSIRO	Sep 1/Oct 2005	Apr 2006				CH4, CO			
SA - CAEPT	Dec 2005	Mar 2006				CH4, CO			
US - NCAR	May-June 2005	June 2005				CO, N2			

4th WMO Round-robin (15 countries)

25+1 Labs reported CO₂

11+1 Labs reported CH₄

7+1 Labs reported CO

5+1 Labs reported N₂O/SF₆

6+1 Labs reported d¹³C and d¹⁸O

1 Lab for O₂/N₂ and 1 Lab for H₂

Lingxi ZHOU, Referee since 2002

5th WMO Round-robin started in 2009

CAMS/CMA joined 2nd, 3rd, 4th WMO

Round-robin inter-comparison organized

by **WMO/CCL** hosted by **NOAA ESRL** for

the periods of 1995-1997, 1999-2000 and 2002-2006.

1st, 2nd Inter-comparison (CH₄)

Asia and South-West Pacific

2001-2003 / 2004-2005 and 2005-2006

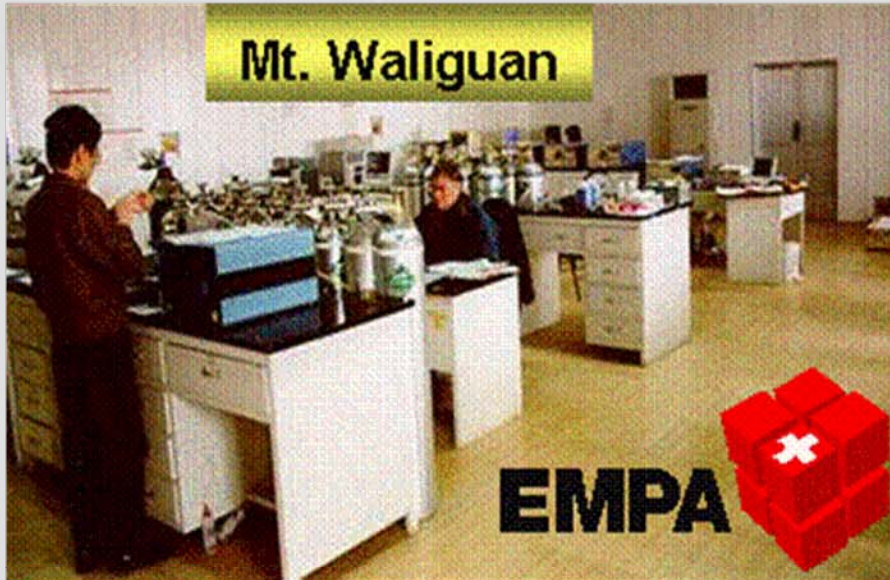
organized by the WMO/WCC hosted by JMA, Japan.

<http://gaw.kishou.go.jp/wcc/ch4/comparison.html>

3rd Inter-comparison (CH₄) started in 2008

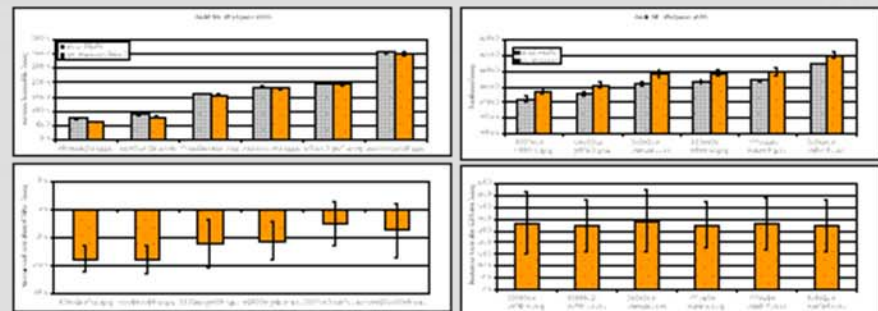
Laboratory	Country	Information	
Headquarters of JMA	Japan	Measurement	Contact
CGAWBO, CMA	China	Measurement	Contact
KGAWO, KMA	Korea	Measurement	Contact
Headquarters of KRISS	Korea	Measurement	Contact
Headquarters of CSIRO	Australia	Measurement	Contact
Headquarters of NIWA	New Zealand	Measurement	Contact
Tohoku University	Japan	Measurement	Contact
NIES	Japan	Measurement	Contact

WCC Audit

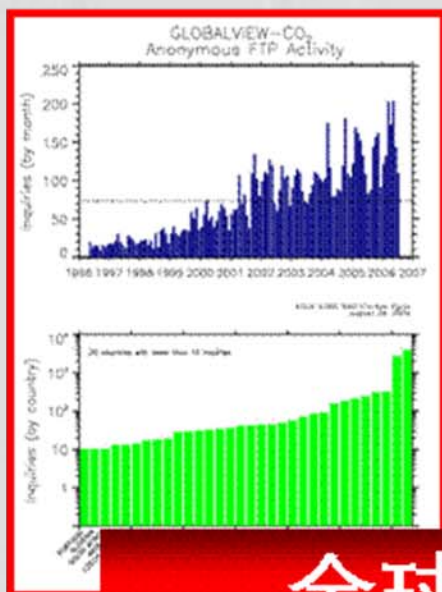


3rd Audit planned in 2009

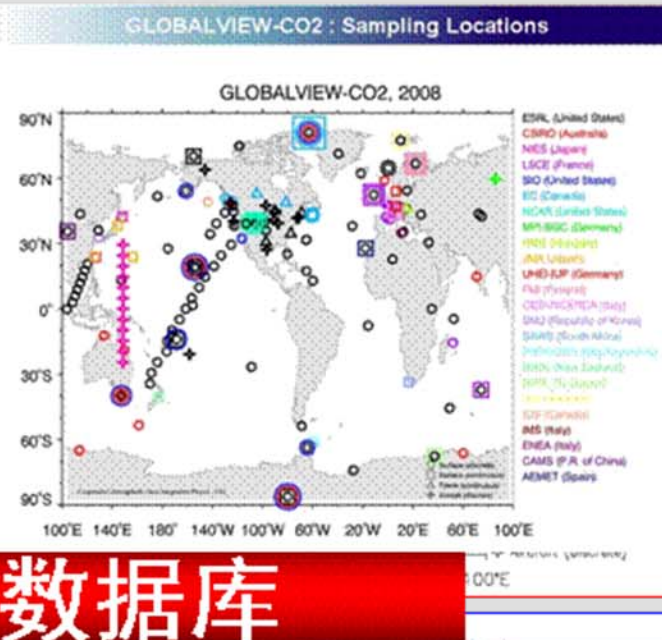
System + performance audits for **surface O₃, CO, CH₄** were performed at **WLG** by the **WMO/WCC** hosted by **EMPA**, Switzerland in **Sept. 2000** and **Oct. 2004**, respectively.



GlobalView-CO₂, CH₄



- General Information
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 - Project Goals
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 - Data Integration
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- Products
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 - Description
 - How To Use
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 - Capabilities
 - Version History
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 - Sampling
 - Locations
 - Methodology
 - Download
 - References
 - GLOBALVIEW-OH
 - GLOBALVIEW-CO
 - GLOBALVIEW-CO2CTI
- Get Involved
 - Join



全球同化数据库

GLOBALVIEW-CO₂: Collaborators

We thank our colleagues at the following laboratories for their participation in our collaborative CO₂, CH₄, and CO₂CTI. Your laboratory has been assigned a Lab ID. Number that is used to associate GLOBALVIEW records with the contributing lab.

AUSTRALIA

- Commonwealth Scientific and Industrial Research Organization (CSIRO) Marine and Atmospheric Research (MARC) 3-404 2)
- J.P. Stiller
- Eq. Laboratory
- P. Augustin
- R. J. Plummer

CANADA

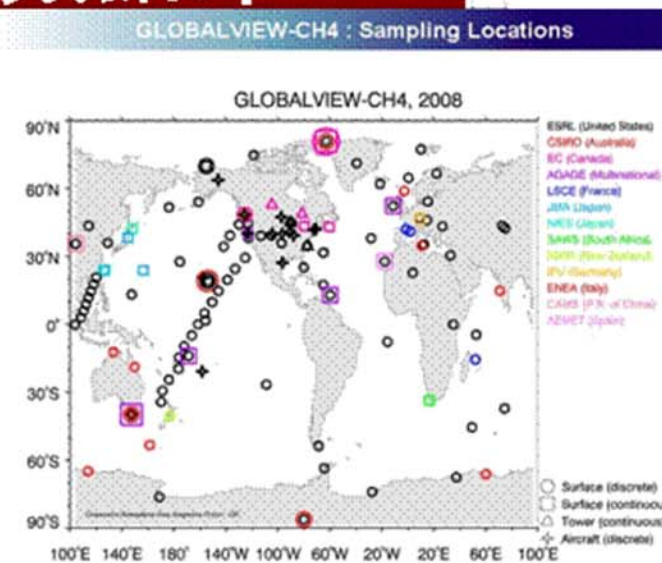
- Environment Canada (EC) 3-808 0)
- G. Audy
- M. Enli
- A. Barr
- C.S. Wong (Canadian Ocean Sciences)
- Institute of Ocean Sciences (IOS) 3-404 1 2)
- C. S. Wong
- J. Page

CHINA

- Chinese Academy of Meteorological Sciences (CMA) and Centre for Meteorology and Services (CMS), China Meteorological Administration (CMA) 3-808 3 3)

Logos for CSIRO, Environment Canada, and MPI-MGC are shown.

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 - Home
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 - Data Extension
 - Data Integration
 - Lab IDs
 - File Names
- Products
 - GLOBALVIEW-CO₂
 - Introduction
 - Description
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 - GLOBALVIEW-CO
 - GLOBALVIEW-CO2CTI
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Atmospheric CO₂ & CH₄ Data obtained at **WLG** by in-situ & discrete measurements have been used in the **NOAA ESRL Cooperative Atmospheric Data Integration Project (CADIP)**.

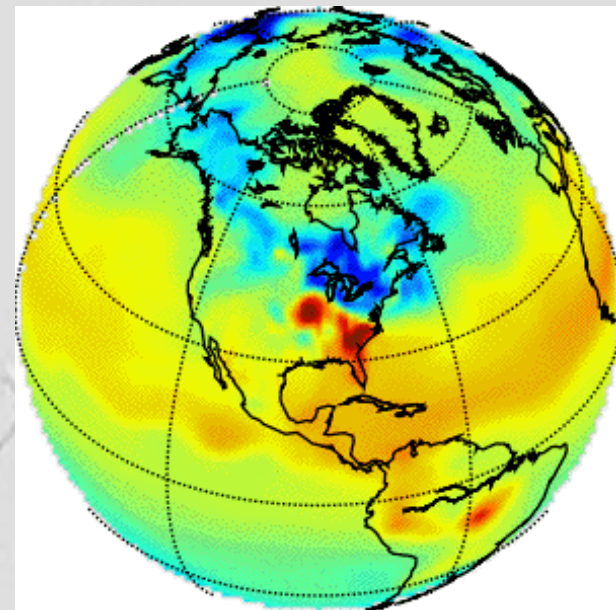
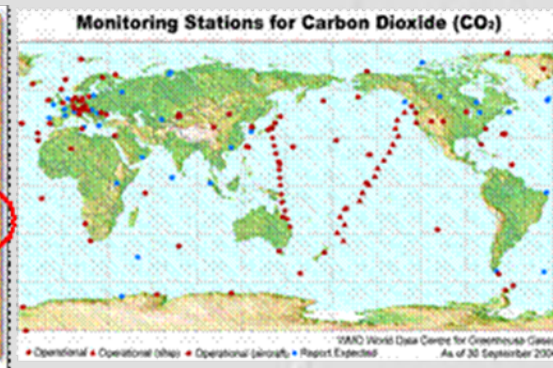
WMO Greenhouse Gas Bulletin
The State of Greenhouse Gases in the Atmosphere
Global Observations through 2009

WMO Greenhouse Gas Bulletin
The State of Greenhouse Gases in the Atmosphere
Global Observations through 2009

Monitoring Stations for Carbon Dioxide (CO₂)

Legend: Operational (red dot), Operational (blue dot), Operational (black dot), Report Expected (red dot)

WMO World Data Centre for Greenhouse Gases
As of 30 September 2009



WMO Greenhouse Gas Bulletin
The State of Greenhouse Gases in the Atmosphere
Global Observations through 2009

WMO Greenhouse Gas Bulletin
The State of Greenhouse Gases in the Atmosphere
Global Observations through 2009

WMO GHGs Bulletin

U.S. Department of Commerce | National Oceanic & Atmospheric Administration | NOAA Research

Earth System Research Laboratory
Global Monitoring Division

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Flux Maps

Region: Averaging: and Data:

Results Summary (All units Pg/yr)

Region Name	Estimated Mean Fossil Emissions	Fire Emissions	Total Flux
Total Flux	-2.15 ± 2.11	6.78	7.34 ± 2.11
Land Flux	-0.91 ± 2.06	6.20	5.17 ± 2.06
Ocean Flux	-2.35 ± 0.55	0.58	-1.78 ± 0.56

Various application



About IPCC

- Home
- About IPCC
- How the IPCC is organized
- IPCC Bureau and TFB
- IPCC Secretariat
- Working Group I
- Working Group II
- Working Group III
- Task Force on National Greenhouse Gas Inventories
- Other IPCC activities

THE IPCC BUREAU AND THE TASK FORCE BUREAU

Members of the IPCC Bureau are normally elected for the duration of the preparation of an IPCC Assessment Report (5-6 years). They should be experts in the field of climate change and all regions should be represented in the IPCC Bureau. The Bureau is chaired by the Chair of the IPCC and is composed of the Co-Chairs of the three IPCC Working Groups and the Task Force Bureau on National Greenhouse Gas Inventories, IPCC Vice-Chairs and Vice-Chairs of the Working Groups. Presently the IPCC Bureau is composed of 30 members.

The Bureau of the Task Force on National Greenhouse Gas Inventories (TFB) oversees the National Greenhouse Gas Inventories Programme. It is composed of two Co-chairs, which are also members of the IPCC Bureau, and 12 members.

The current composition of the IPCC Bureau and the TFB is shown below:

THE IPCC BUREAU (SEPT. 2008)

Chairman



Rajendra K. Pachauri

IPCC Vice - Chairs

		
<u>Ogunlade Davidson</u> (Sierra Leone)	<u>Jean-Pascal van Ypersele</u> (Belgium)	Hoesung Lee (Republic of Korea)

Working Group I The physical science basis	Working Group II Impacts, adaptation, vulnerability	Working Group III Mitigation	Task Force Bureau National Greenhouse Gas Inventories
Co-chairs	Co-chairs	Co-chairs	Co-chairs
 <u>Thomas Stocker</u> (Switzerland)	 Christopher Field (USA)	 <u>Ottmar Edenhofer</u> (Germany)	 <u>Taka Hiraishi</u> (Japan)
 <u>Dahe Qin</u> (China)	 <u>Vicente Barros</u> (Argentina)	 <u>Ramon Pichs-Madruga</u> (Cuba)	 Thelma Krug (Brazil)
		 <u>Youba Sokona</u> (Mali)	

**Dahe QIN
China**

IPCC, Bureau of the Task Force on National Greenhouse Gas Inventories (Sept. 2008 - 2014), together with IPCC AR5



Co-Chairs (2)

Taka Hiraishi (Japan)

Thelma Krug (Brazil)

Members (12)

Washington Zhakata (Zimbabwe)

Zhou Lingxi (China)

Leonidas O. Girardin (Argentina)

Art Jaques (Canada)

Robert Sturgiss (Australia)/

Leonard J. Brown (New Zealand) *

Detelina Petrova (Bulgaria)/

Sadeddin Kherfan (Syrian Arab Republic) **

Enmanuel Mpeta (United Republic of Tanzania)

Sirintornthep Towprayoon (Thailand)

Sergio Gonzalez Martineaux (Chile)

William N. Irving (USA)

Rizaldi Boer (Indonesia)

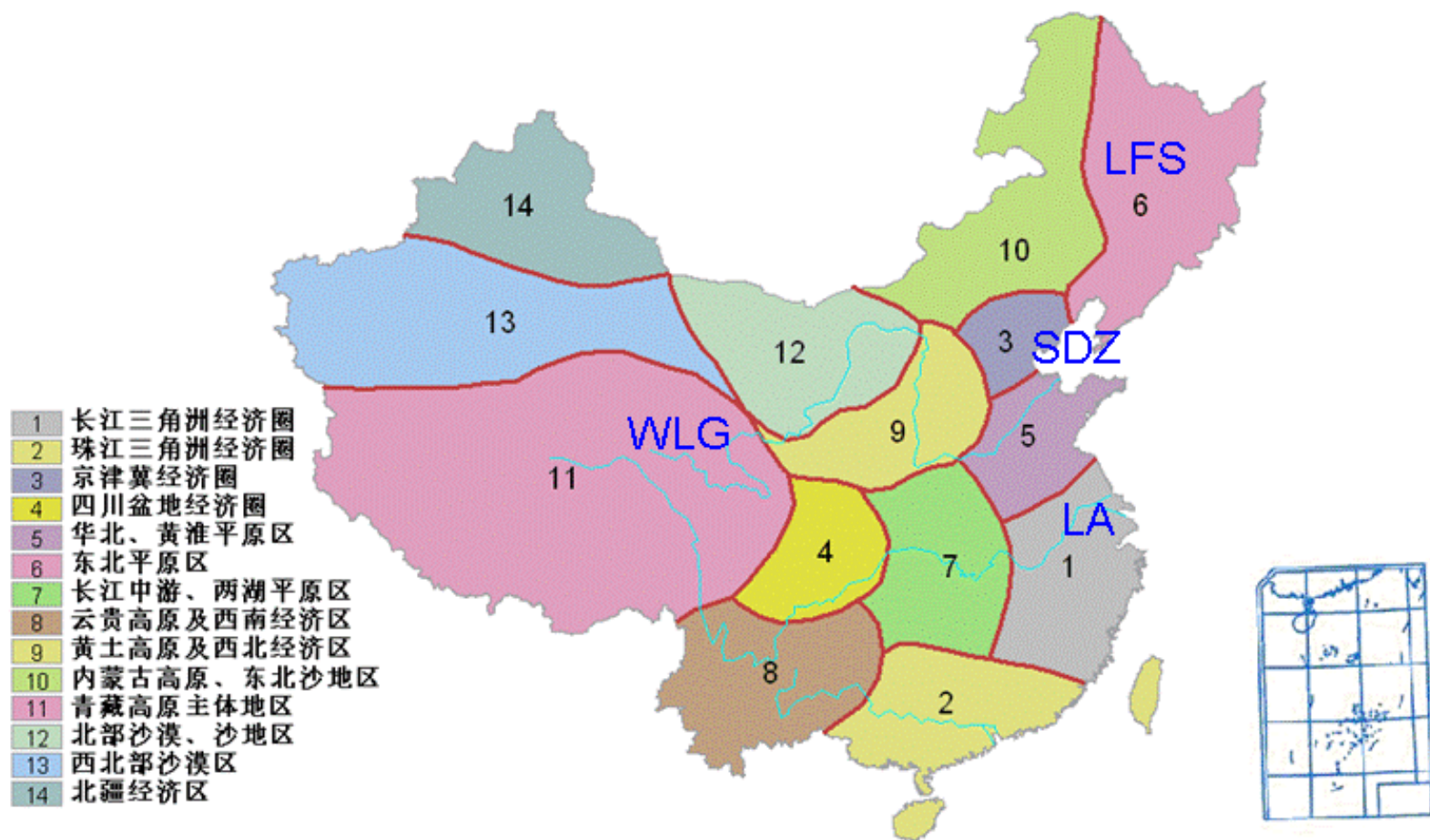
Jim Penman (UK)

Ongoing work & funding

China Atmosphere Watch (14 Key regions)

National Centre for Network Observation

Funded by MOST Project (2005.12-2008.12)

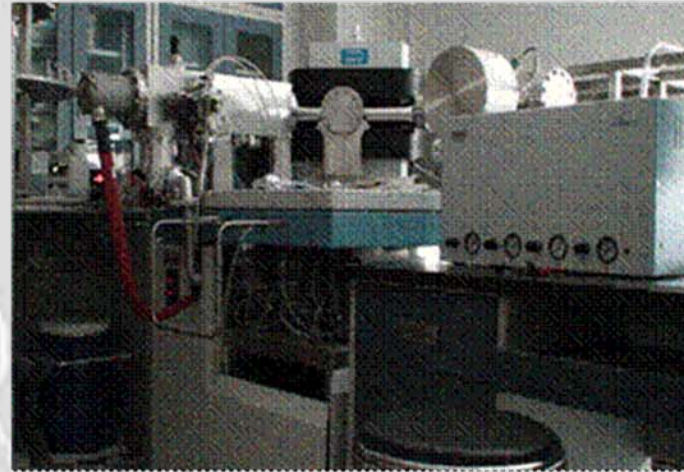
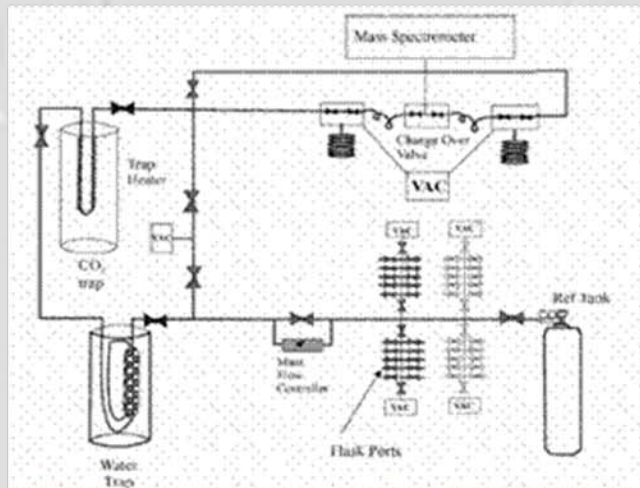


Beijing Lab LoFlo (CSIRO made)



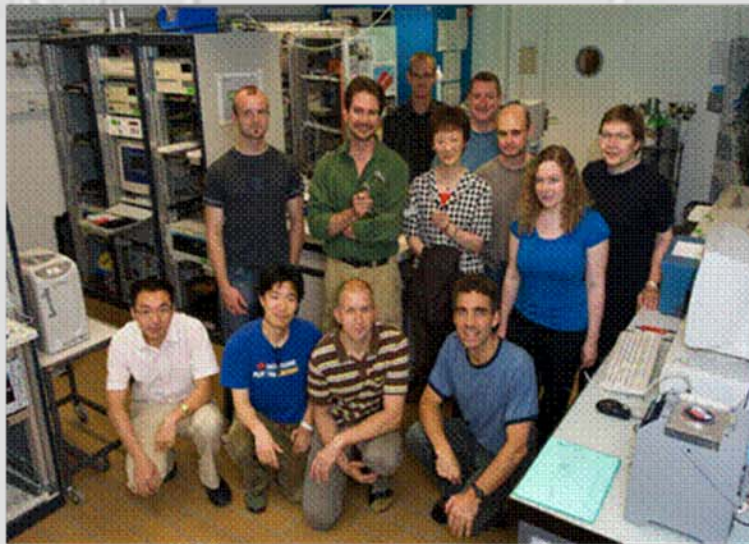
Beijing Lab (CO₂ stable isotopes)

MAT253, Airtrap, GasBenchII



Medusa (Empa=>SOGE-A=>AGAGE) measure > 40 compounds

Beijing Lab and SDZ station



Medusa Trap making workshop
June 2008, Zurich, Switzerland



Picarro-CH₄/CO₂基高分辨率在线观测系统



2009 funding
Picarro
GC-FID+ECD
more sites

MSC Canada
NOAA/ESRL/GMD
In-situ, CH₄/CO/N₂O/SF₆



QC Concentration Plots

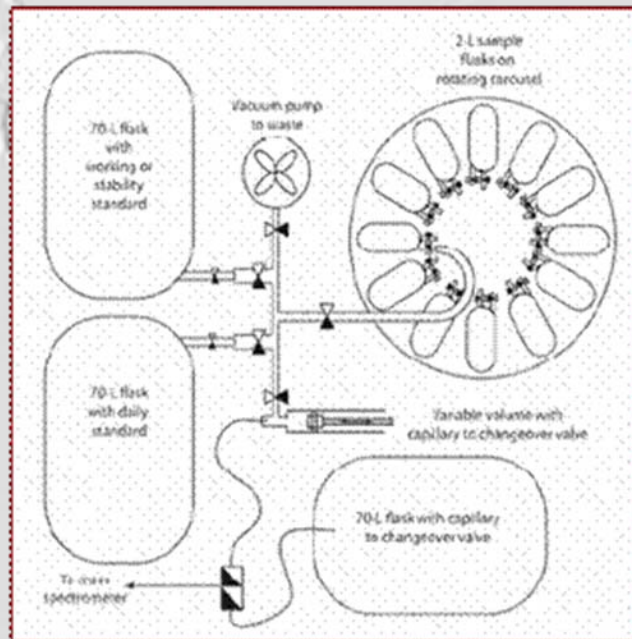
- CO
- CH4
- N2O
- SF6
- Picarro-CH4
- Picarro-CO2

Status:

- Beijing - January 20, 2009 @ 12:11:45 PM GMT
- Linan - January 20, 2009 @ 12:31:37 PM GMT
- Longfengshan - January 20, 2009 @ 12:51:38 PM GMT
- Shangdianzi - January 20, 2009 @ 01:11:40 PM GMT
- Waliguan - January 20, 2009 @ 07:32:03 AM GMT

Atmospheric O₂/N₂

2009 funding



准确、高精度测量大气O₂/N₂比，将弥补目前我国在该领域的空白，为准确评估我国典型区域CO₂浓度的动态变化提供依据。

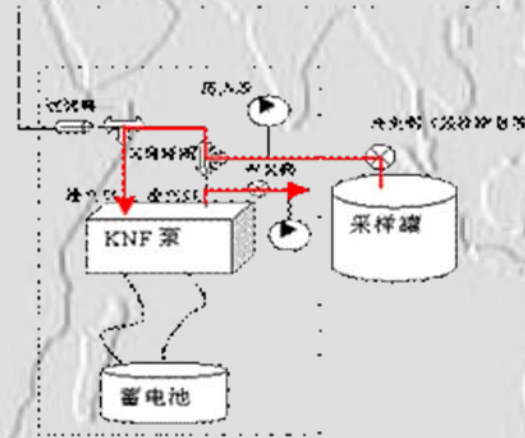
Flask, PFP, Canister

2009 funding



LED MESSAGES and INSTRUCTIONS

- 1. Turn on the power switch and check the battery level.
- 2. Perform the calibration procedure as described in the manual. Use the calibration gas provided.
- 3. The instrument will display the current concentration of the gas being measured.
- 4. The instrument will display the current concentration of the gas being measured.
- 5. The instrument will display the current concentration of the gas being measured.
- 6. The instrument will display the current concentration of the gas being measured.
- 7. The instrument will display the current concentration of the gas being measured.
- 8. The instrument will display the current concentration of the gas being measured.



Acknowledgement

- **WLG, SDZ, LA, LFS, and CAMS colleagues**
- **CMA, MOST, NSFC, MOP..... of China**
- **Environment Division, AREP, WMO**
- **NOAA ESRL GMD & CU-INSTAAR, USA**
- **MSC Canada**
- **BoM & CSIRO-MAR, Australia**
- **Empa, Switzerland and SOGE-A members**
- **NIES & JMA, Japan**
- **MPI-BGC & GAWTEC, Germany**
- **FMI, Finland**
- **GAW SAG, QA/SAC, CCL, WCC, WDC,**

**and many
others**



**And all the people who give concern &
support to China GAW**