



# **Progress of the GHGs monitoring programme by CMA and cooperative projects**

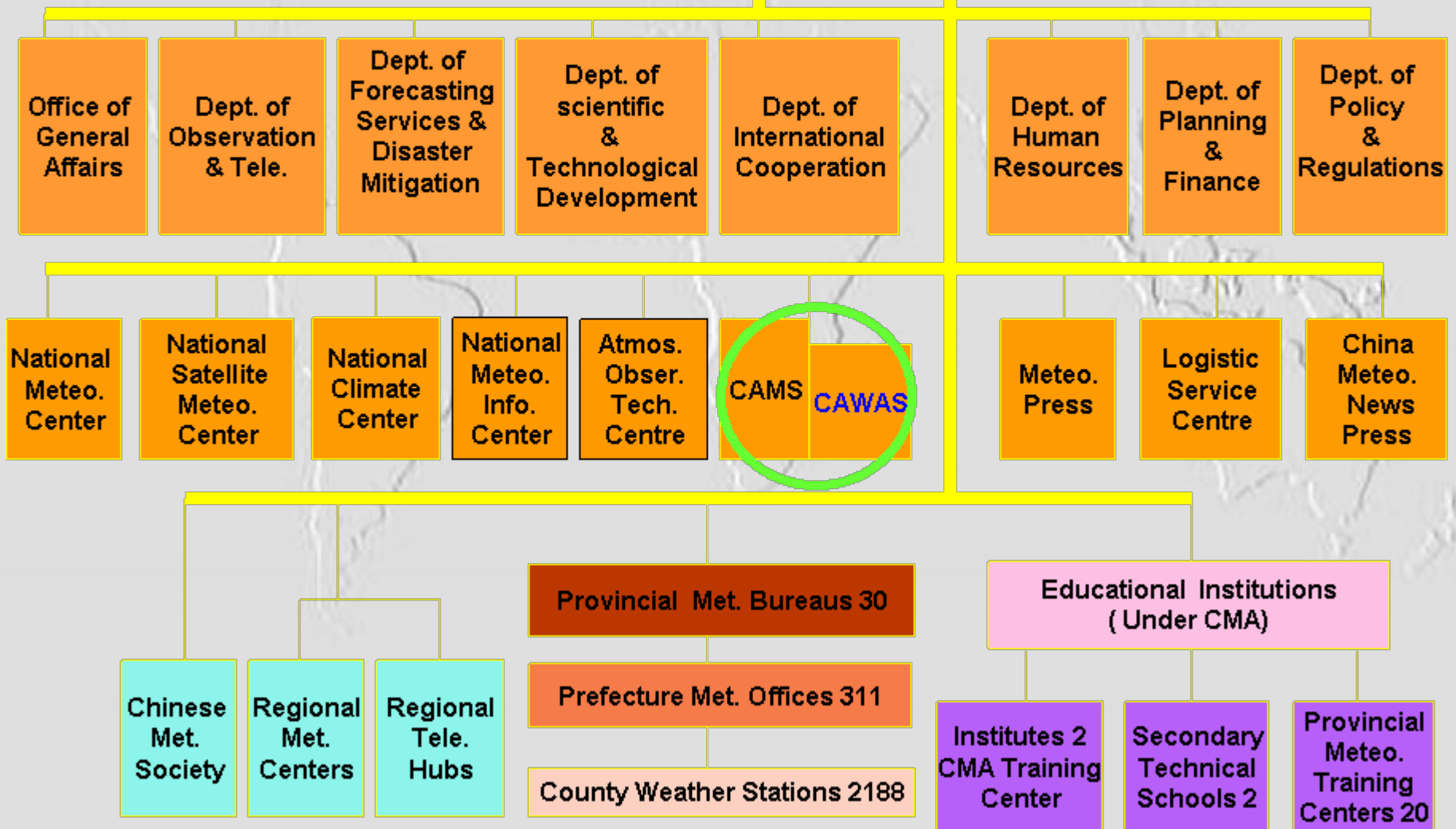
**Lingxi ZHOU, and colleagues/collaborators**

**CAMS, CAWAS/CMA**

**14-15 May 2008  
NOAA ESRL GMD Annual Meeting, Boulder, Colorado, USA**

# State Council

## CMA



# CAWAS, CMA mission

Personnel 90 (currently 60)

Atmospheric chemistry observations  
(including GAW stations), research,  
forecasting & services

An essential part of GAW & IGACO



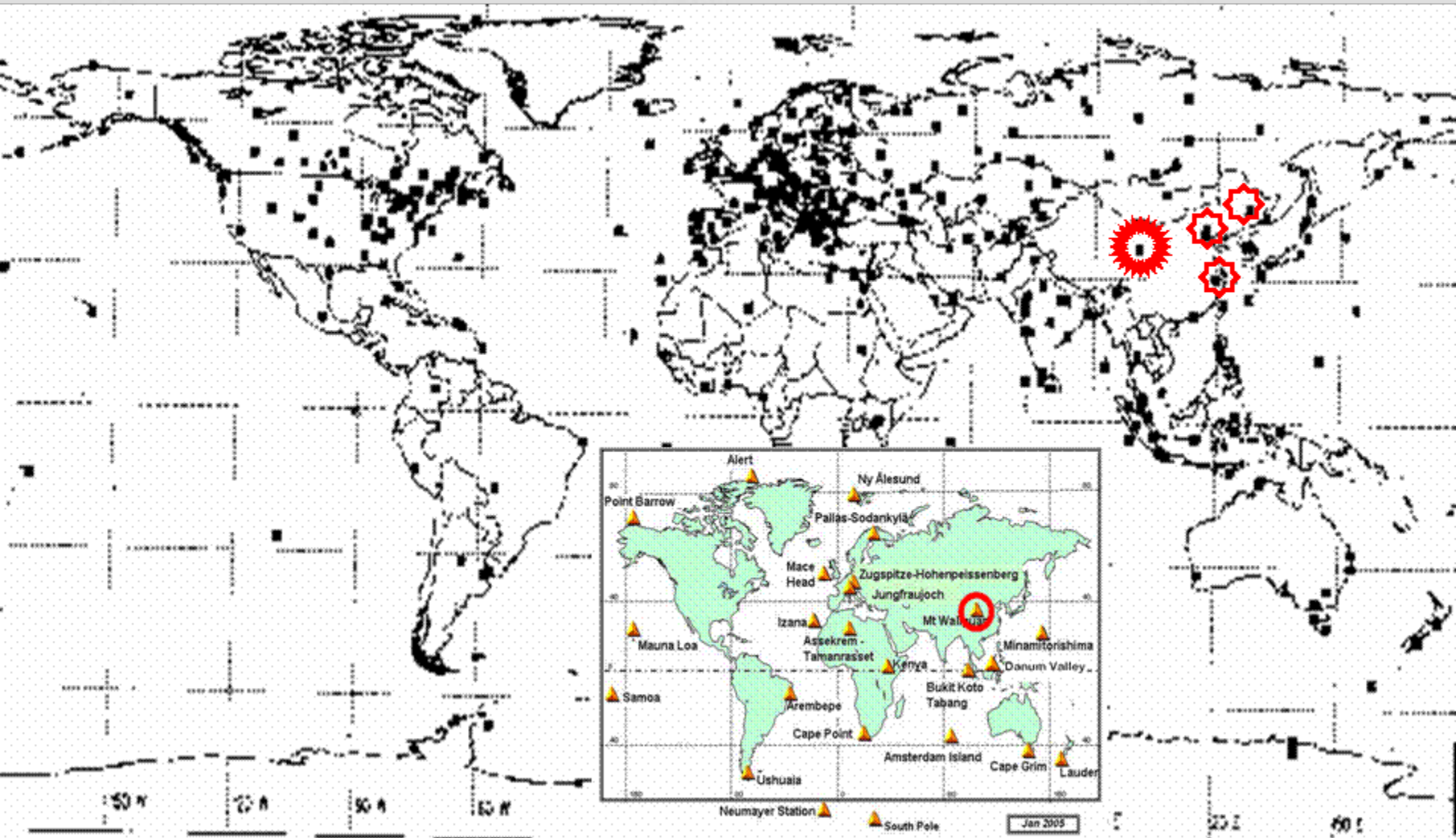
# CAWAS Research Groups

## Observation- -Modeling

- Aerosol
  - **Greenhouse Gases & Related Tracers**
  - Reactive Gases & Atmospheric Photochemistry
  - Total Ozone and Radiation
  - Atmospheric Deposition
  - Boundary Layer
  - Data Assimilation
- Atmospheric Composition Modeling
  - Chemical Transport Modeling
  - Climate Effect of Atmospheric Compositions
  - Inverse Modeling
  - Forecasting Analysis

# WMO/GAW Global & Regional Stations

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



# WMO Global Atmosphere Watch (GAW) Strategic Plan: 2008 – 2015

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**Table 4. List of comprehensive aerosol measurements with a subset of core variables (in bold) that are recommended for long-term measurements in the global network [WMO, 2003b].**

Type	Parameter
Continuous	<b>Multiwavelength aerosol optical depth</b>
	<b>Mass concentration in two size fractions (fine, coarse)</b>
	<b>Mass concentration of major chemical components in two size fractions</b>
	<b>Light absorption coefficient</b>
	<b>Light scattering coefficient at various wavelengths</b>
	Hemispheric backscattering coefficient at various wavelengths
	Aerosol number concentration
	Cloud condensation nuclei at 0.5% supersaturation
	Vertical distribution of light extinction coefficient
Intermittent	Aerosol size distribution
	Detailed size fractionated chemical composition
	Dependence of aerosol variables on relative humidity
	Cloud condensation nuclei spectra (various supersaturations)
	Vertical distribution of aerosol properties

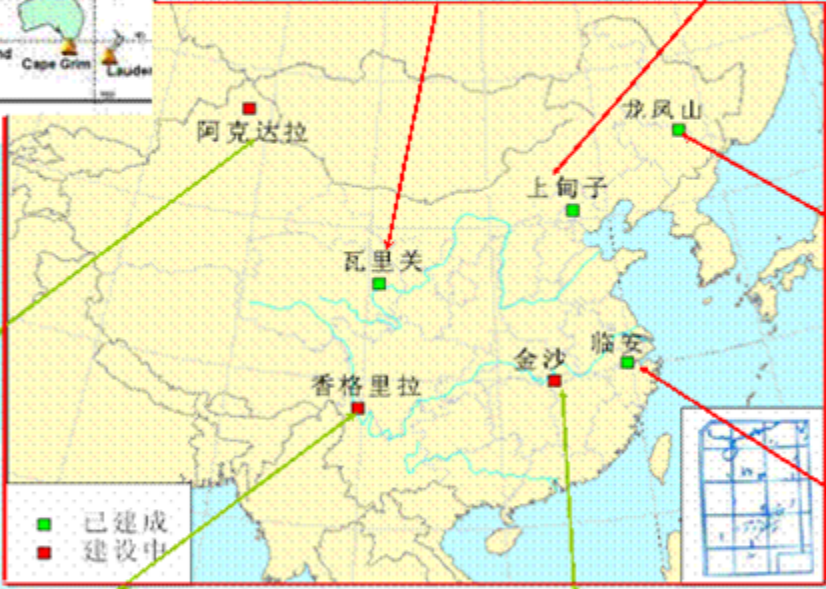
# GAW Global & Regional Stations in China



**瓦里关**  
(36.3° N, 100.9° E, 3810 m)



**上甸子**  
(40.39° N, 117.07° E, 293.9 m)



**龙凤山**  
(44.73° N, 127.6° E, 310 m)



**临安**  
(30.3° N, 119.73° E, 138 m)



**阿克达拉**  
(47° 06' N, 87° 58' E, 562 m)

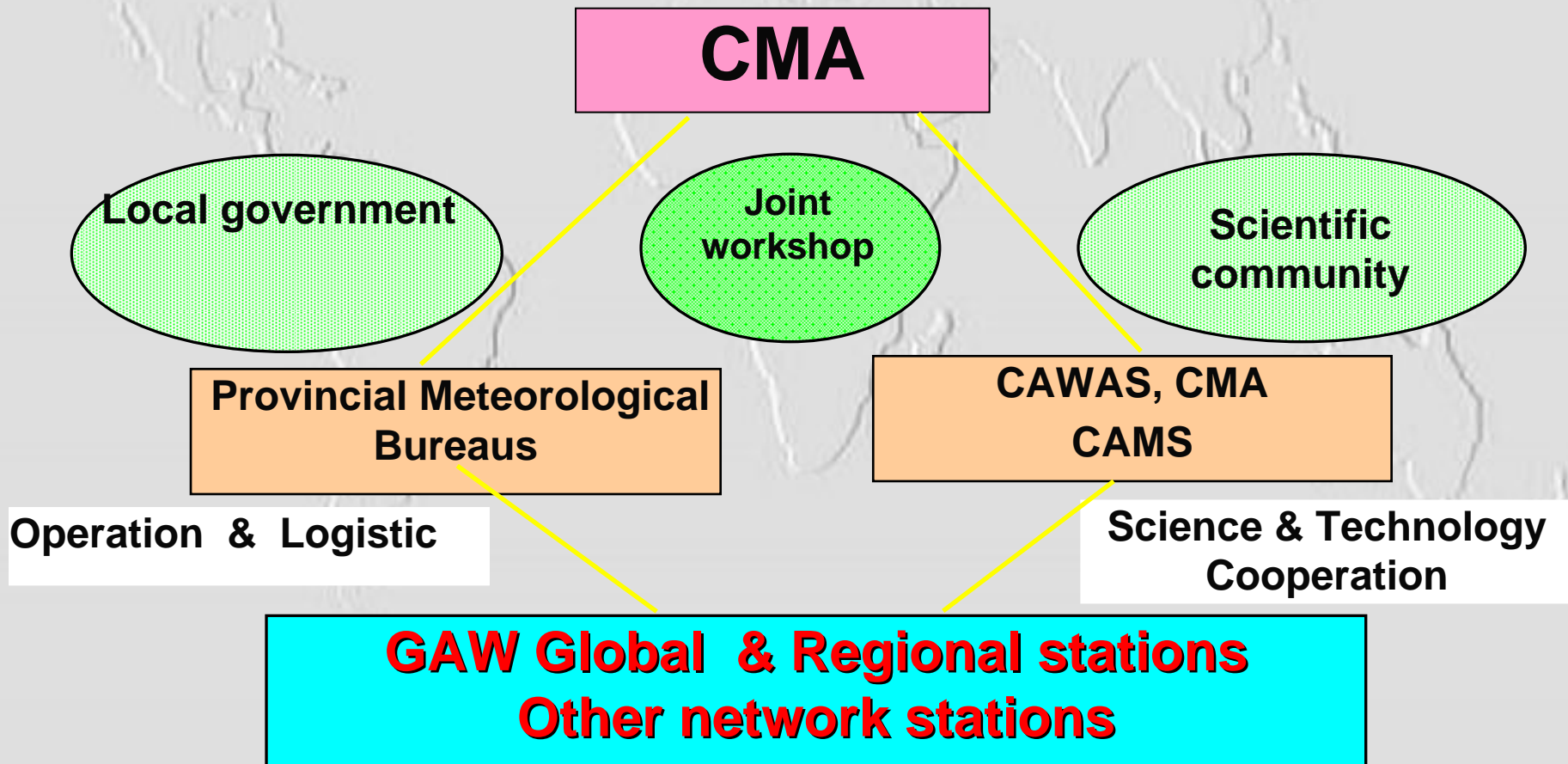


**香格里拉** (27° 30' N, 99° 0.5' E, 3580 m)



**金沙** (31° 24.5' N, 112° 59.5' E, 862 m)

# Management GAW stations in China

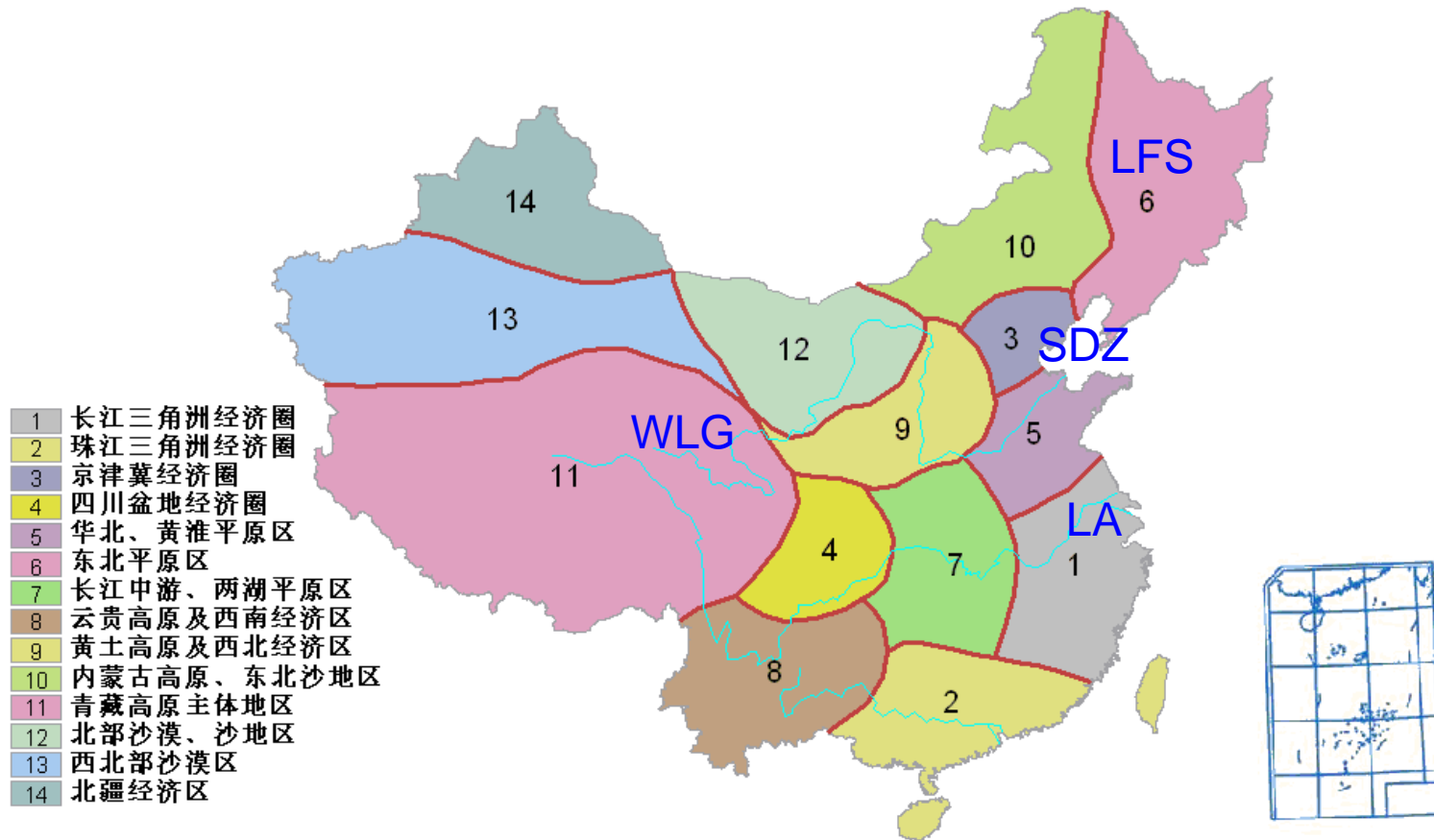




# China Atmosphere Watch ( 14 Key regions )

## National Centre for Network Observation

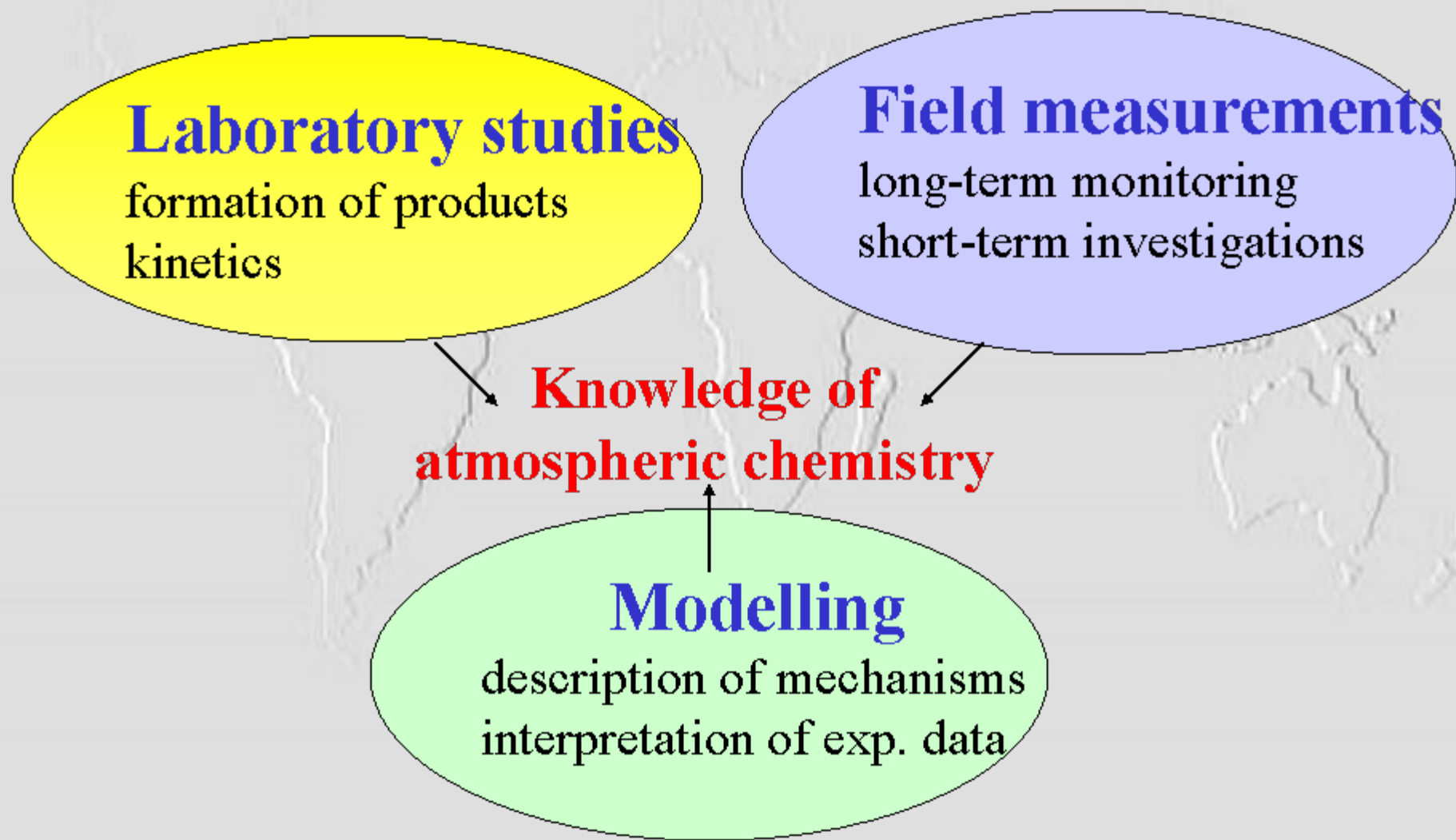
### Funded by MOST Project (2005.12-2008.12)



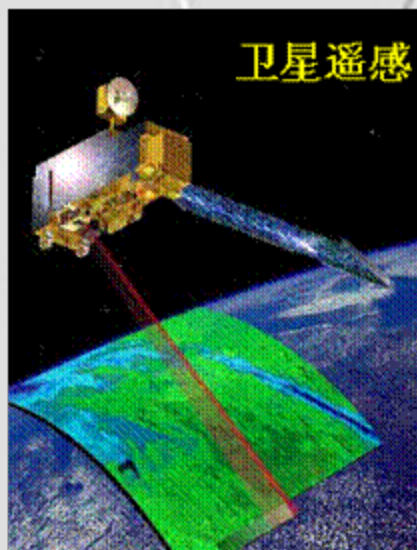
# Why do we measure GHGs ?

- **Long term global/regional trends by network observation**
  - **Global compliance with the Kyoto and Montreal Protocols**
- **Assessment of global & regional emission/absorption**
  - **Bottom-up method (conventional)**
    - Databases on production and consumption
    - Transfer functions (production-banks-emissions)
  - **Top-down method (alternative)**
    - Atmospheric observations
    - Tracer-ratio method
    - Meteorological inverse modelling

# Approaches



# Various measurement platform



观测手段多样

WMO/GAW  
China Global Atmosphere Watch  
Baseline Observatory

## Waliguan Observatory

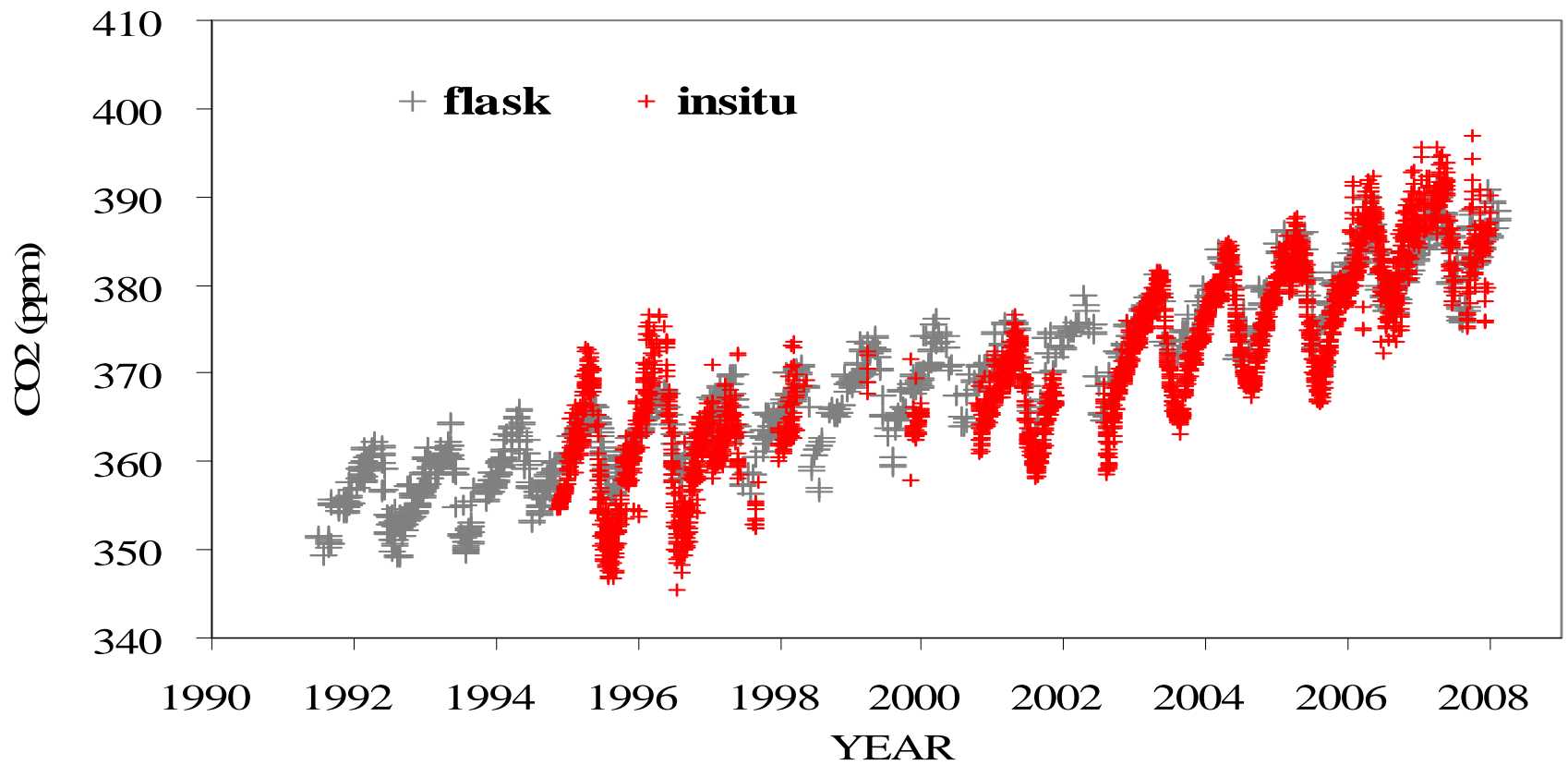
36°17' N, 100°54' E, 3816m



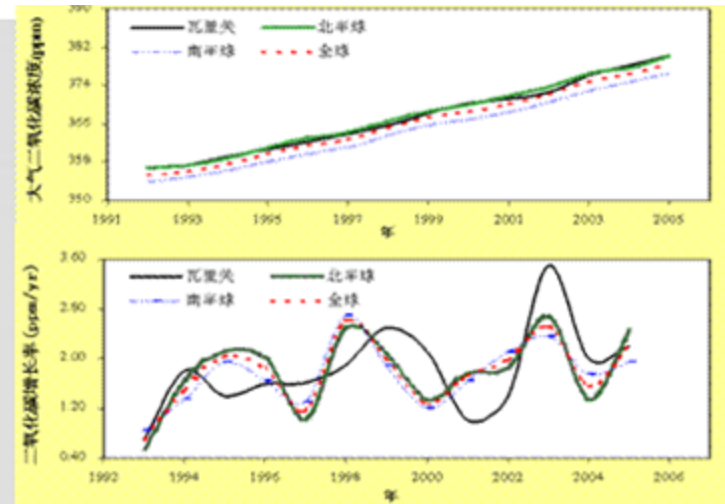
**In-situ CO<sub>2</sub>, CH<sub>4</sub>, CO**  
monitoring systems  
on 2<sup>nd</sup> floor of the main  
building.

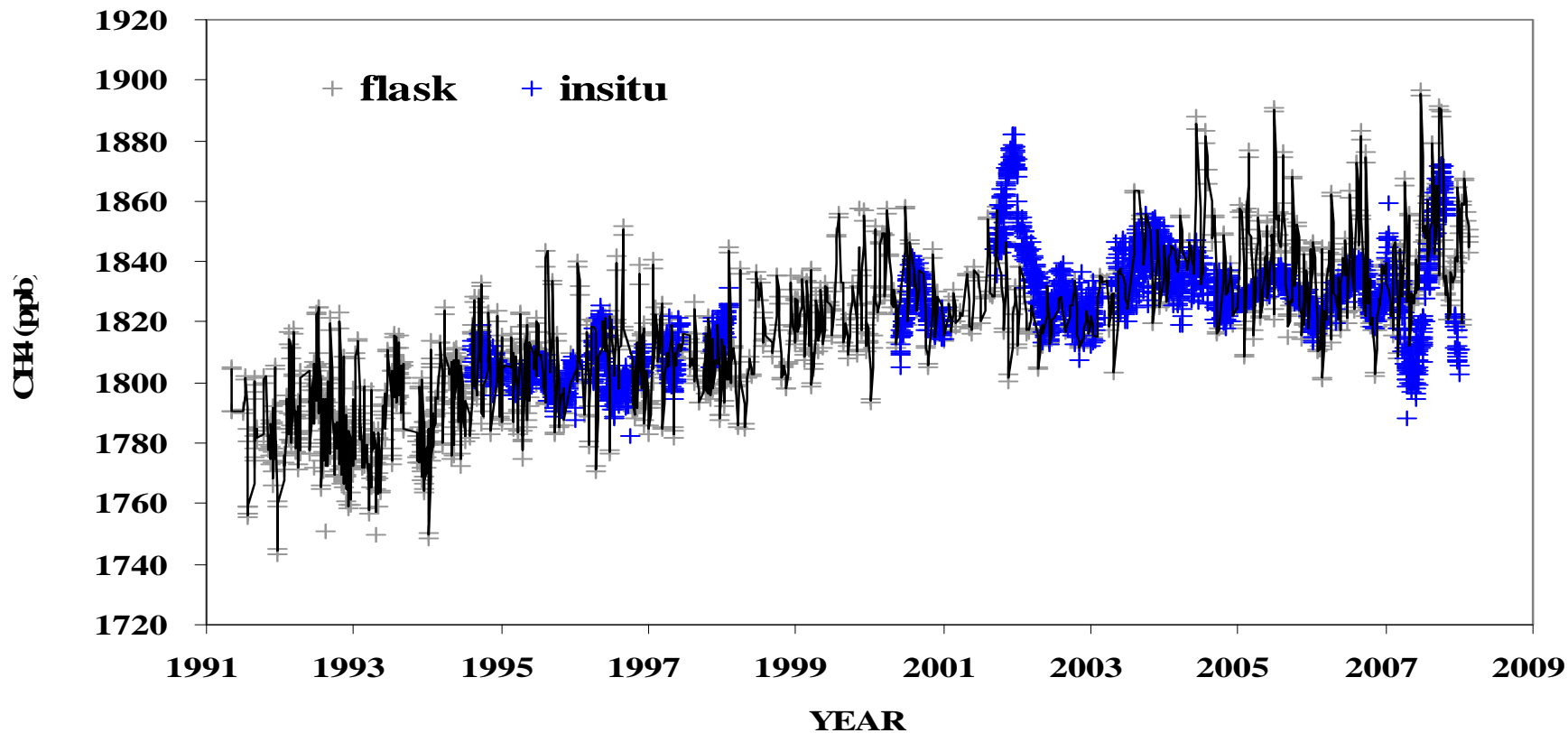


An **89m tower** (20m east of the main building), to measure meteorological parameters at different levels and to obtain air samples for the in-situ CO<sub>2</sub>, CH<sub>4</sub> and CO measurements.

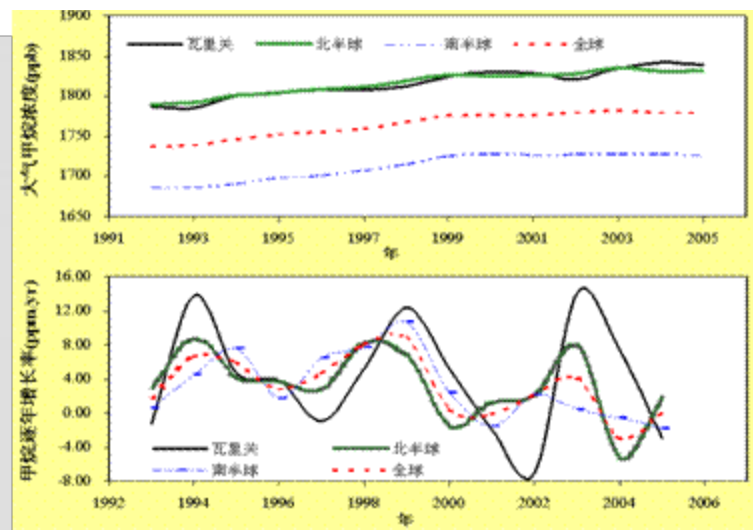


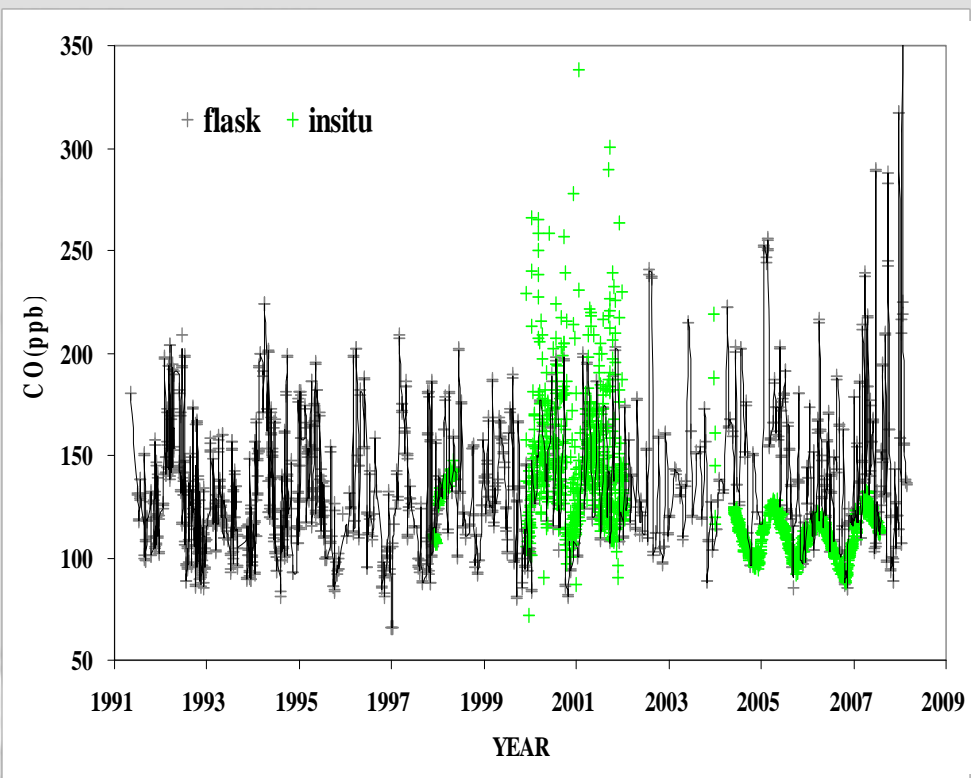
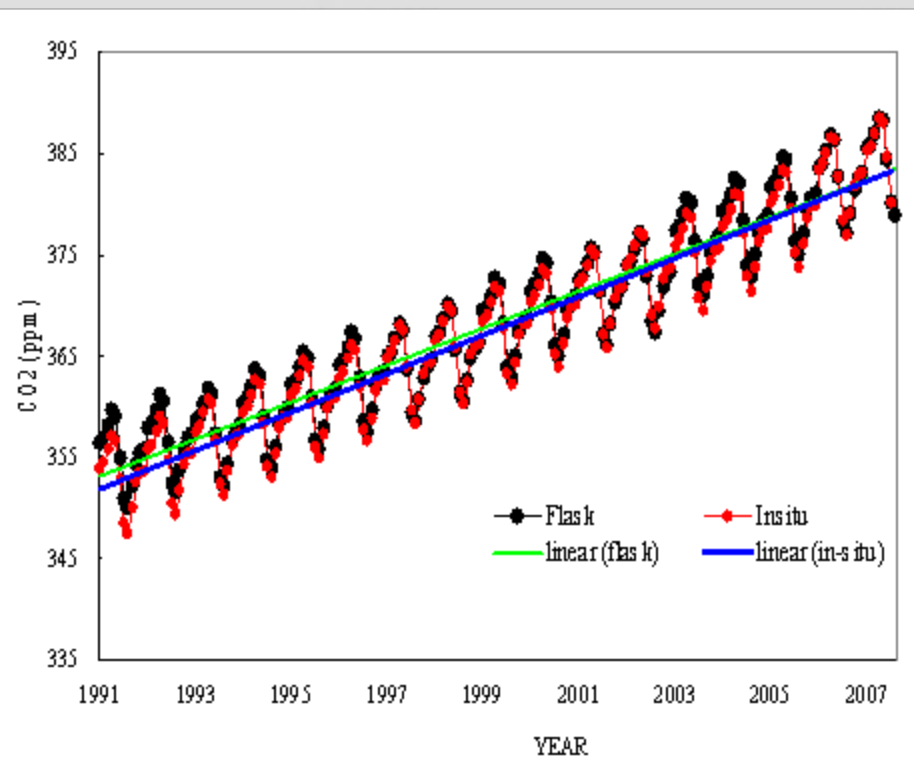
# Atmospheric CO<sub>2</sub> at Waliguan



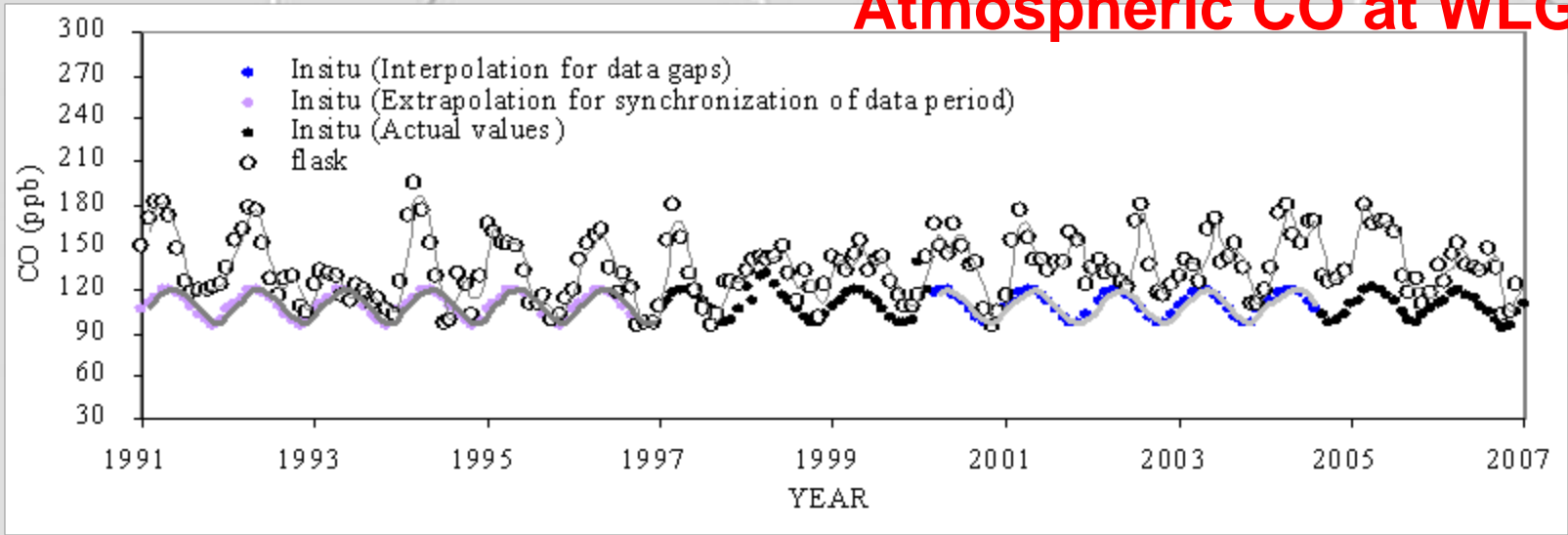


# Atmospheric CH<sub>4</sub> at Waliguan

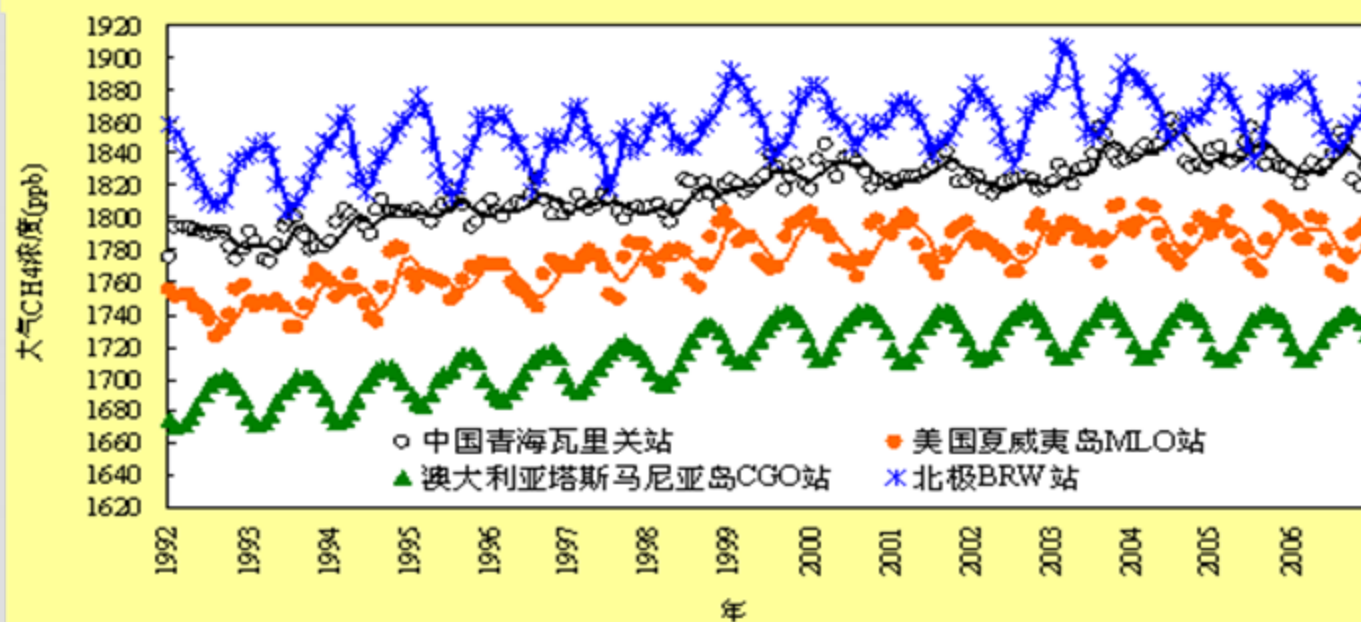
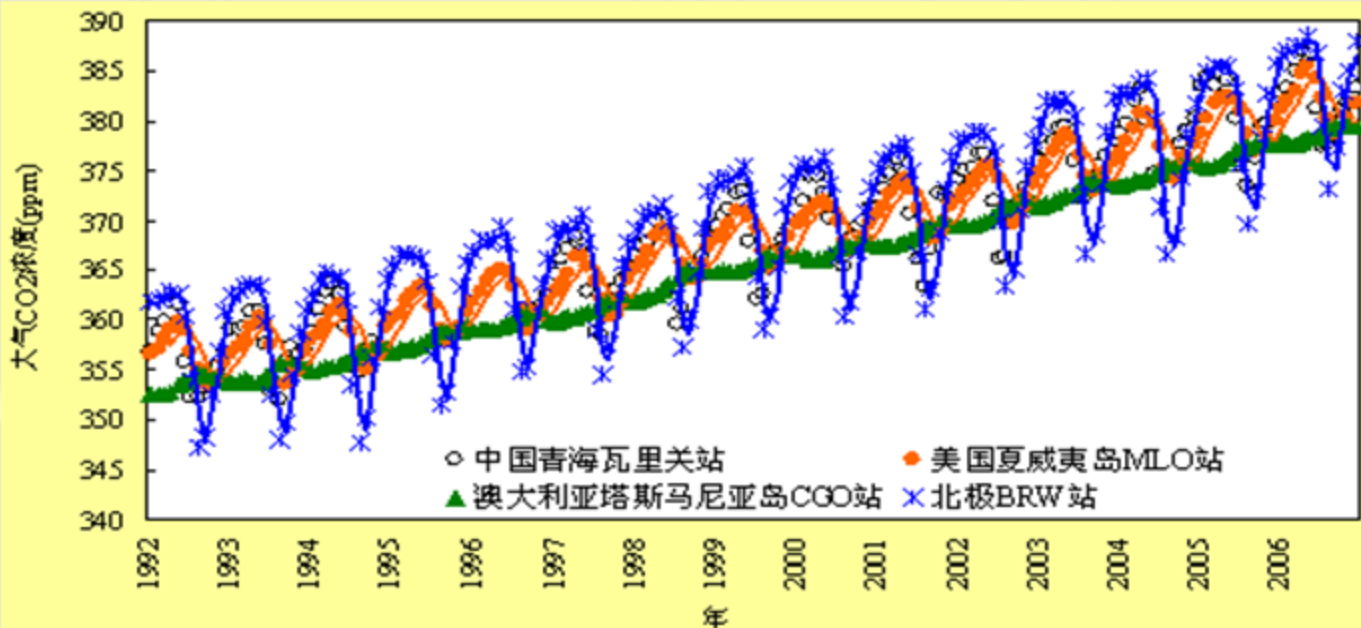


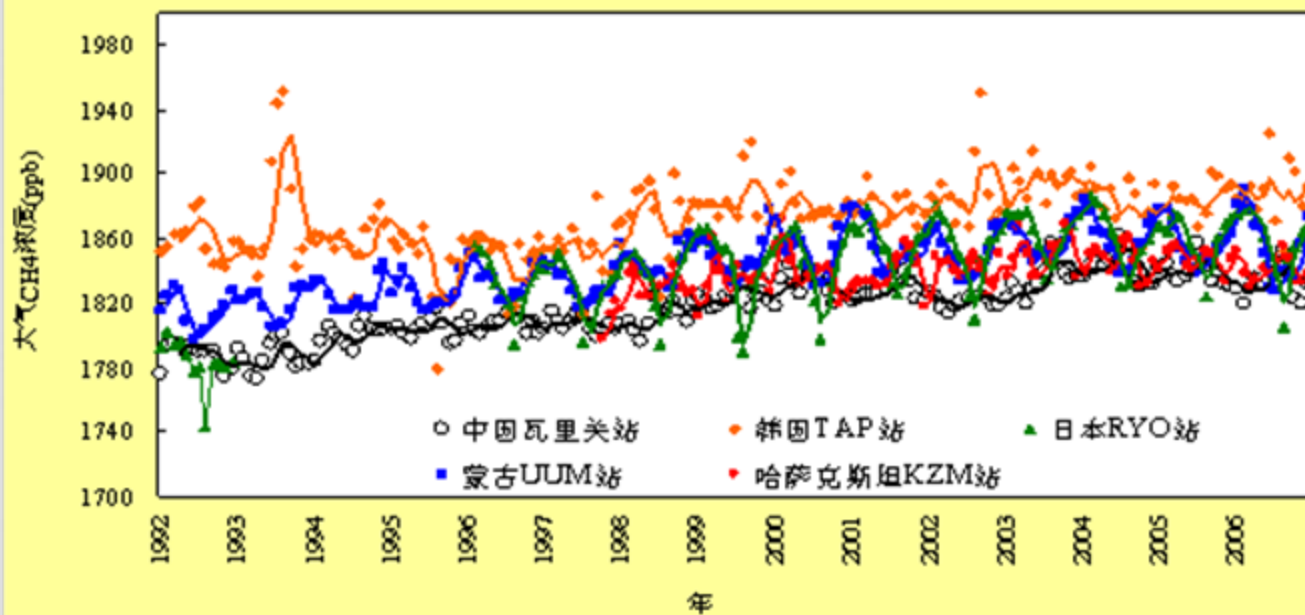
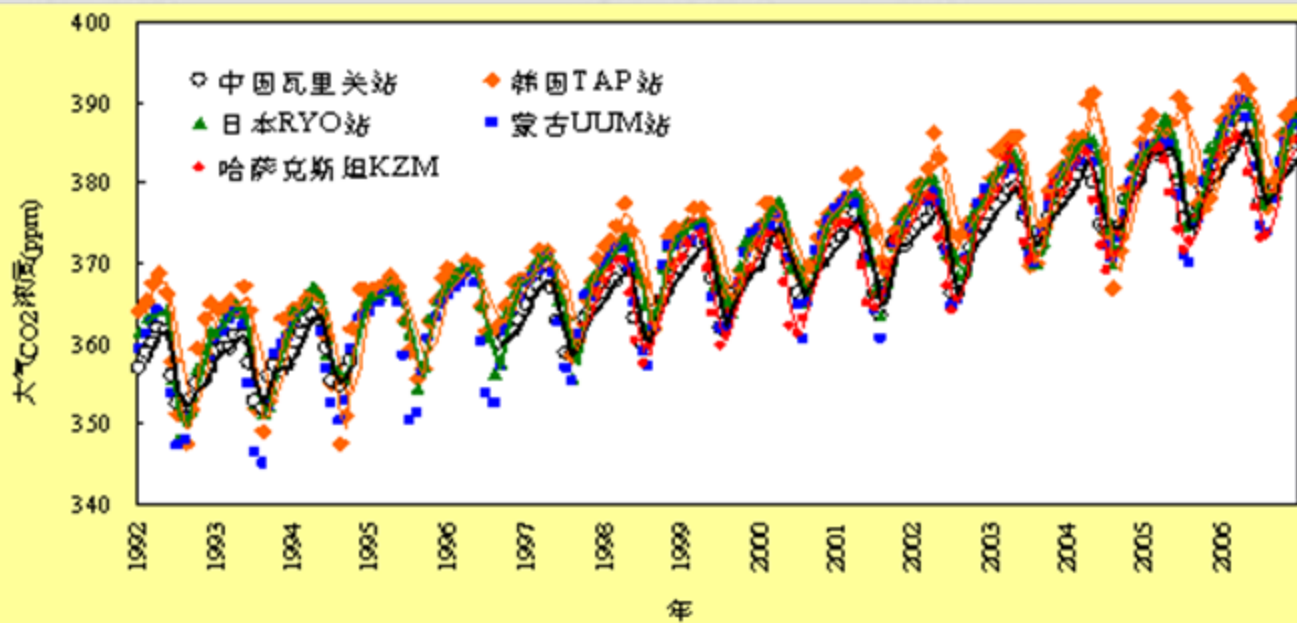


## Atmospheric CO at WLG









# Flask air sampling at Mt. Waliguan

**Carbon Cycle** Interactive Atmospheric Data Visualization

CC Home IADV Home Data Tables FAQ Support Help

Basic Display Options  
[\[View Advanced Display Options\]](#)

1. Move cursor over map to view available data sets
2. Select a single site from map, list, or word search

Current Selection ...

**Mt. Waliguan, Peoples Republic of China**

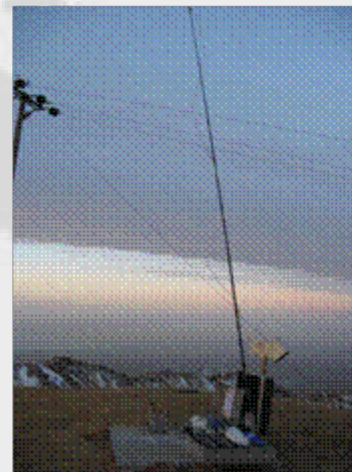
3. Option:
4. Gas:
5. Data Type:
6. Press "Submit"

**GMD Carbon Cycle Sampling Network**  
[\[De-activate Popup Detail\]](#)

Gas	Strategy	First	Last	Status
ch4	Network Flask	1991-05-07	2006-05-10	Ongoing
ch4c13	Network Flask	2001-07-23	2006-03-16	Ongoing
co	Network Flask	1990-08-05	2006-05-10	Ongoing
co2	Network Flask	1990-08-05	2006-05-10	Ongoing
co2c13	Network Flask	1990-08-05	2006-05-10	Ongoing
co2o18	Network Flask	1990-08-05	2006-05-10	Ongoing
h2	Network Flask	1990-08-05	2006-05-10	Ongoing
n2o	Network Flask	1997-04-16	2006-05-10	Ongoing
sf6	Network Flask	1997-04-16	2006-05-10	Ongoing

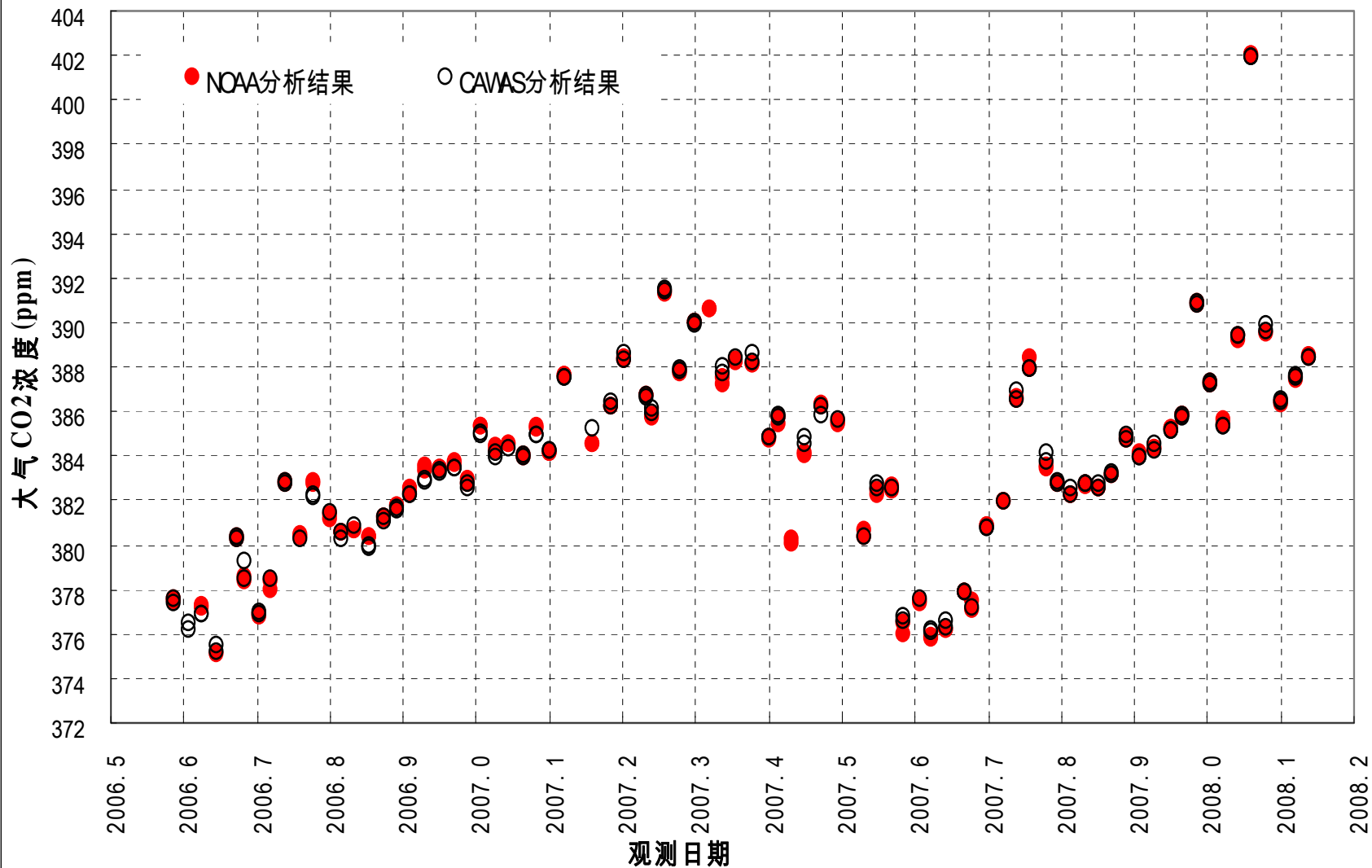
Peoples Republic of China, Mt. Waliguan [WLG]

javascript:BasicSiteSelection('WLG', '134|WLG|Mt.+Waliguan|Peoples+Republic+of+China|36.29|100.90|3810,00|50') Internet

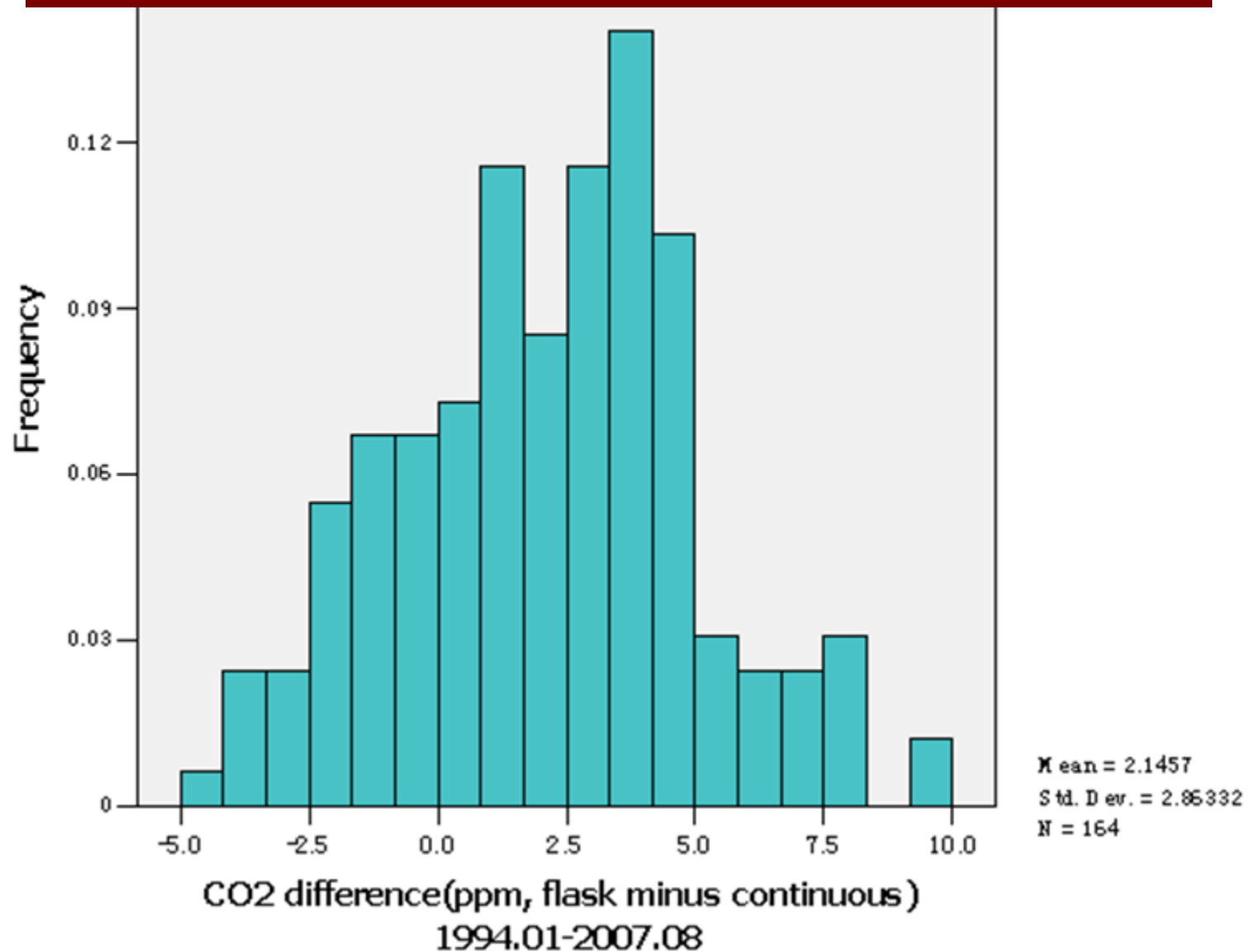


# WLG flask samples

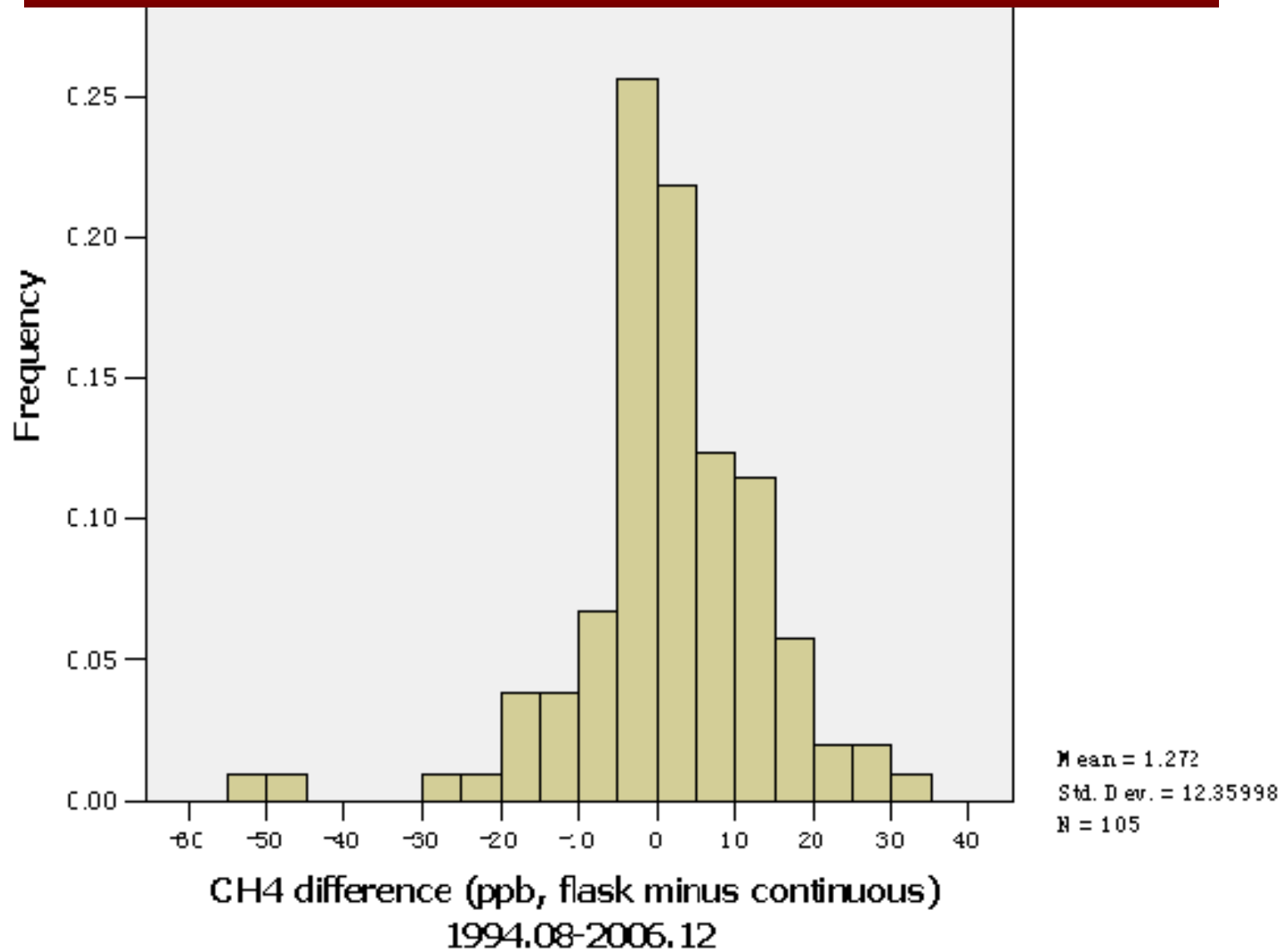
WLG大气CO<sub>2</sub>浓度NOAA和CAWAS比对结果



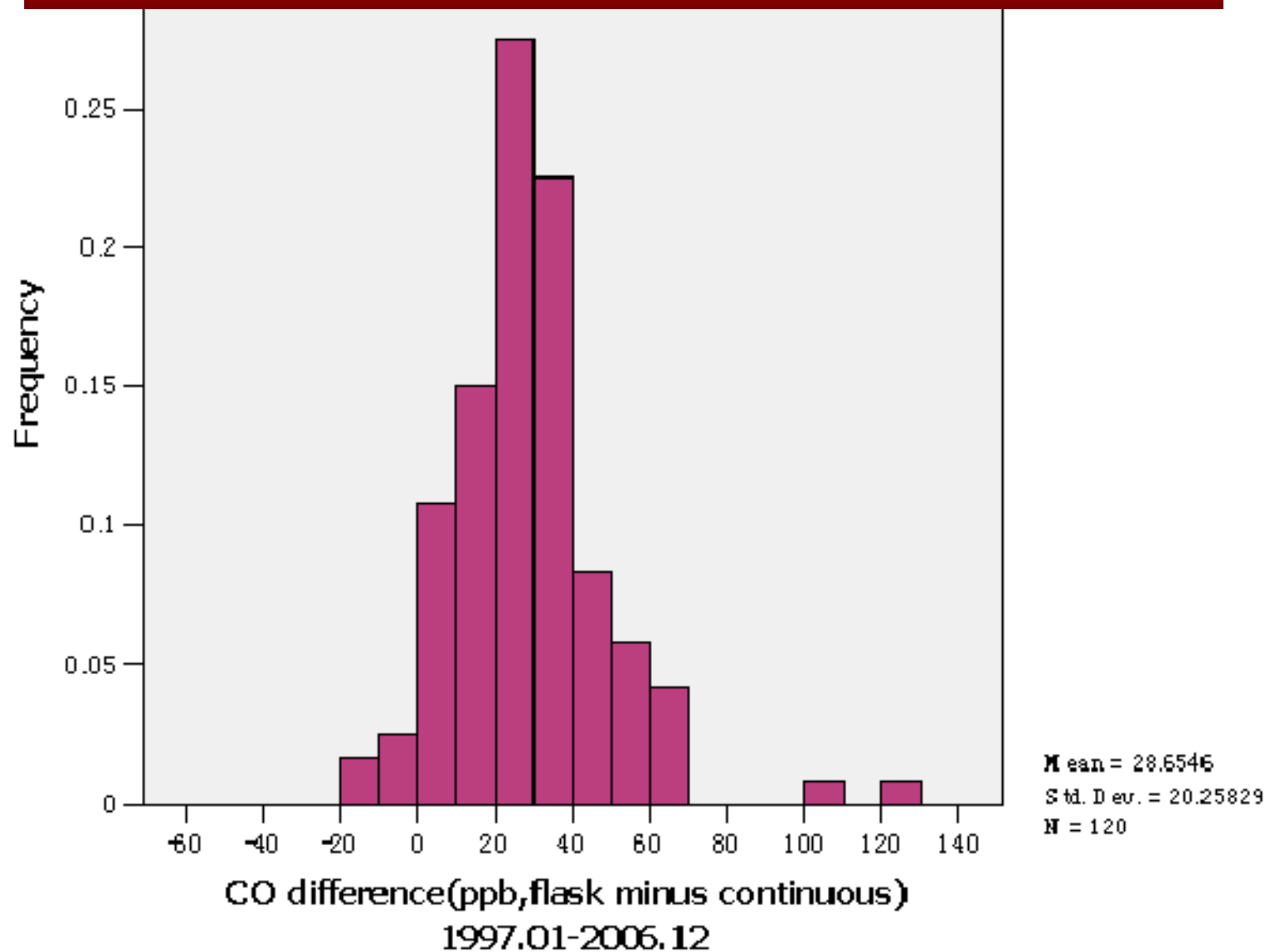
# WLG flask vs in-situ CO2



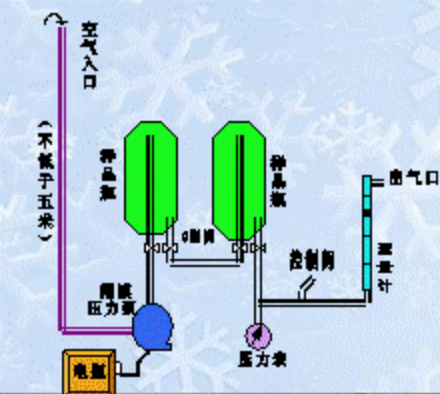
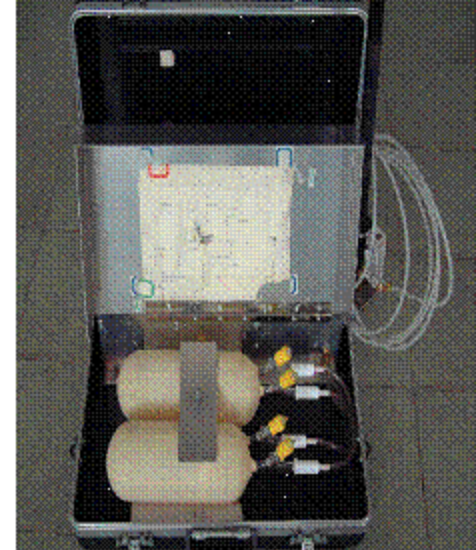
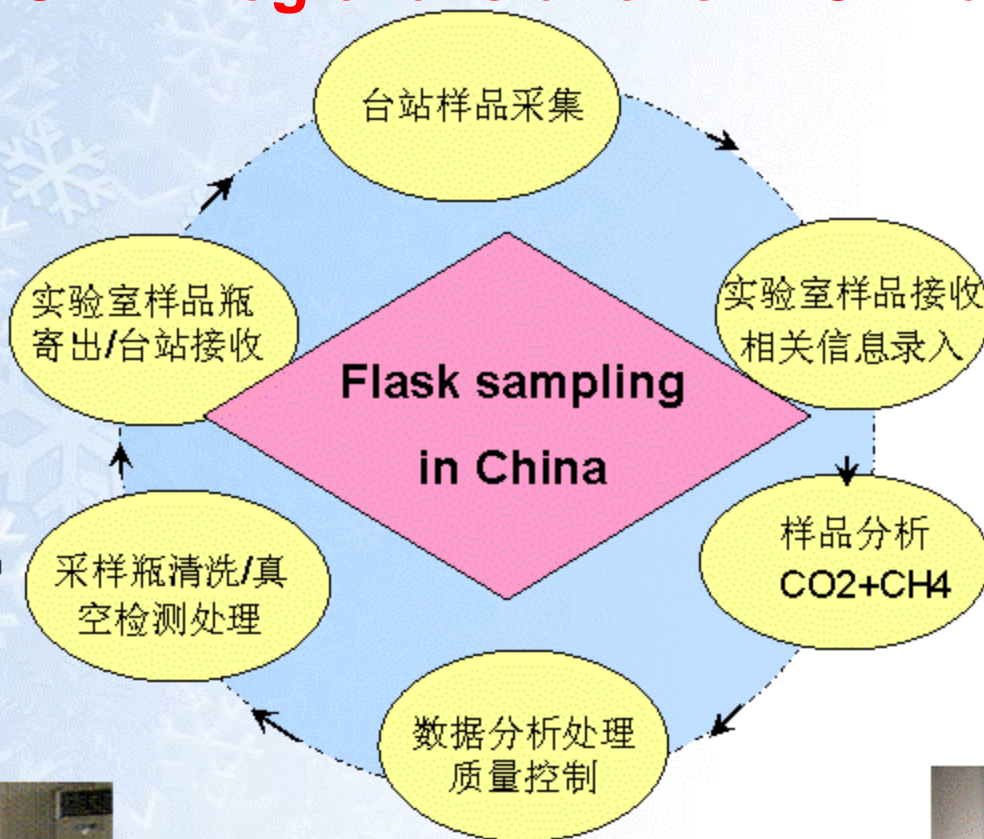
# WLG flask vs in-situ CH4



# WLG flask vs in-situ CO

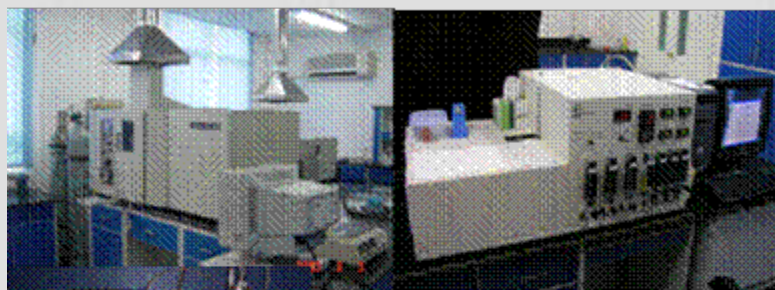


# GAW Regional stations in China





# Key Lab for Atmospheric Chemistry in Beijing



**Aerosol**



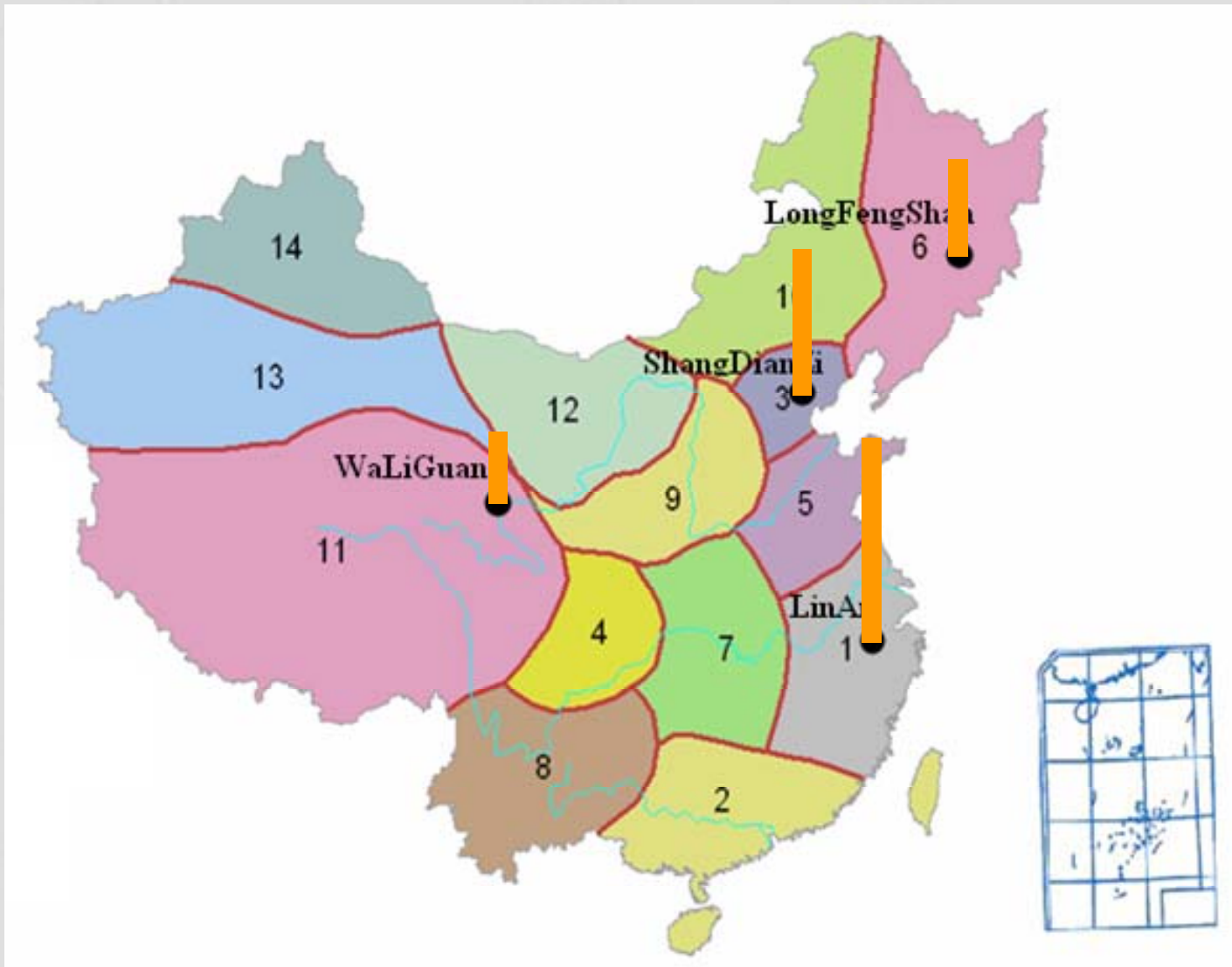
**GHGs & tracers**



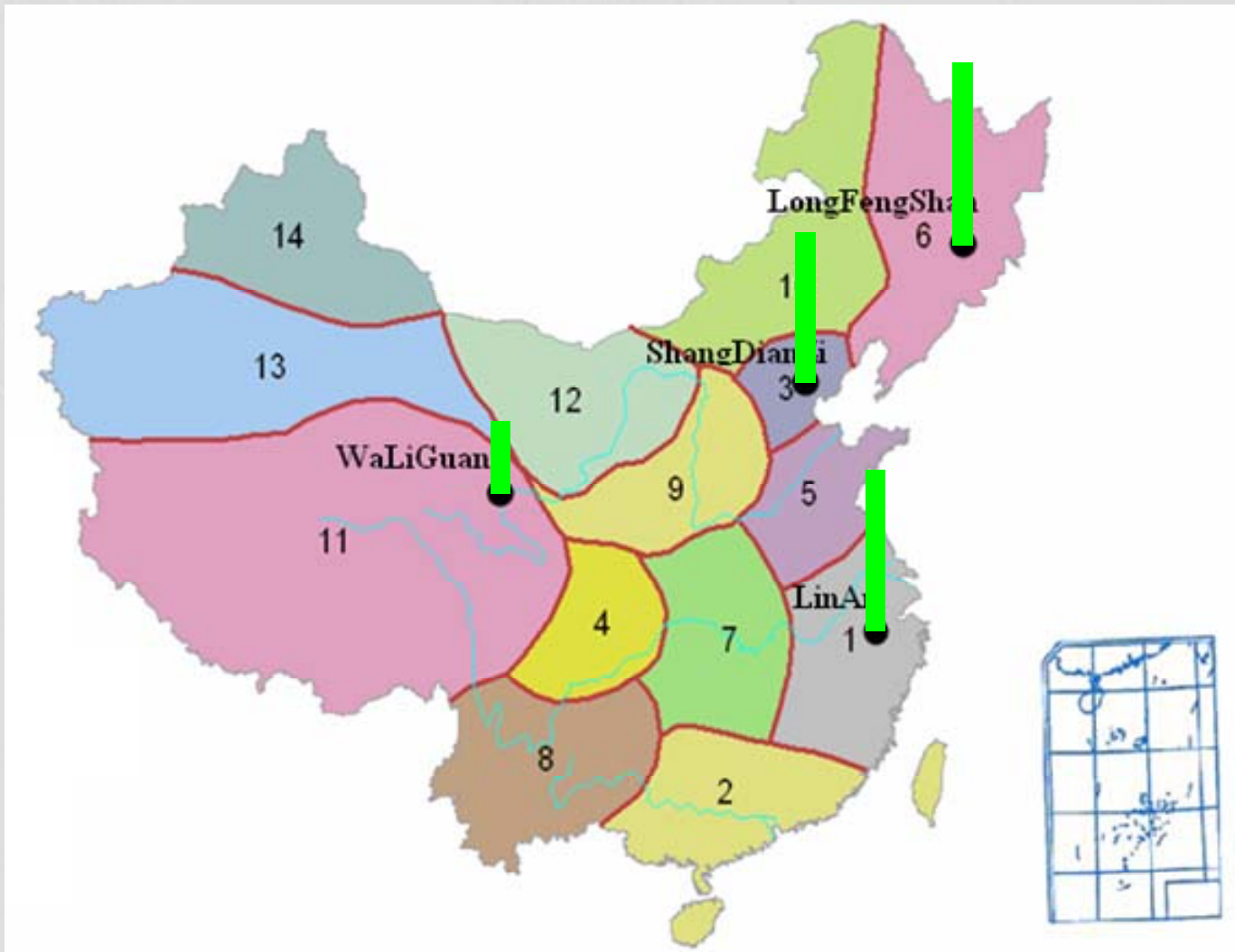
**Reactive gases**



**Precipitation Chemistry**

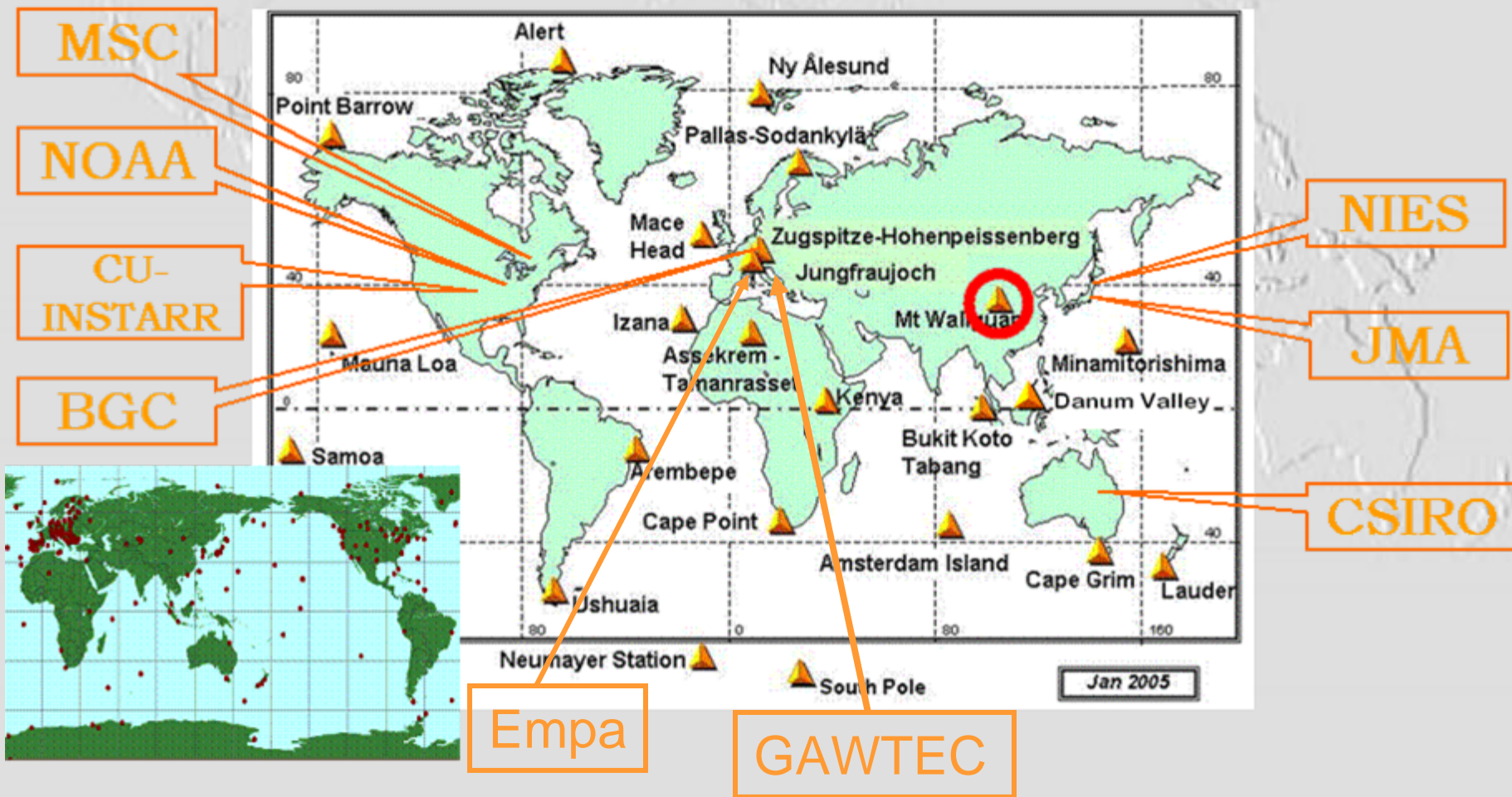


**Atmospheric CO<sub>2</sub> mixing ratio (2006-2007)**

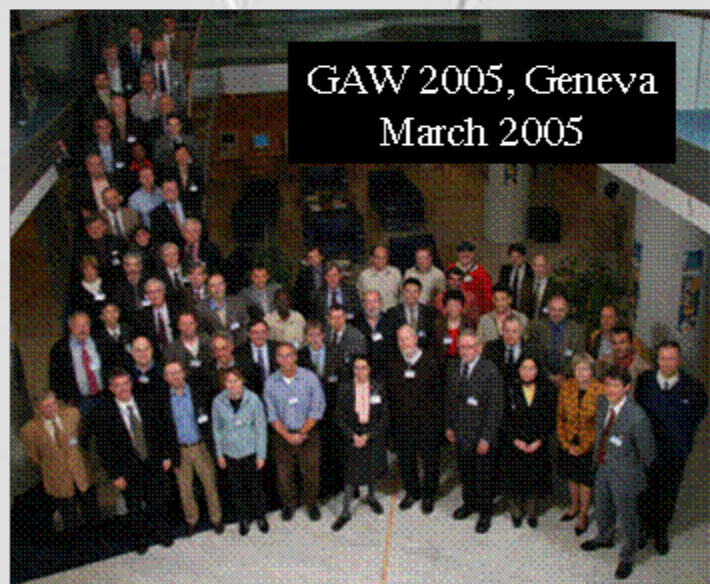


**Atmospheric CH<sub>4</sub> mixing ratio (2006-2007)**

# International Cooperation



# WMO/IAEA Meetings of Experts on CO<sub>2</sub> Concentration & Related Tracer Measurement Techniques



# 14<sup>th</sup> WMO/IAEA Meeting of Experts on Carbon Dioxide, Other Greenhouse Gases, and Related Tracers Measurement Techniques

10-13 September 2007, Helsinki, Finland



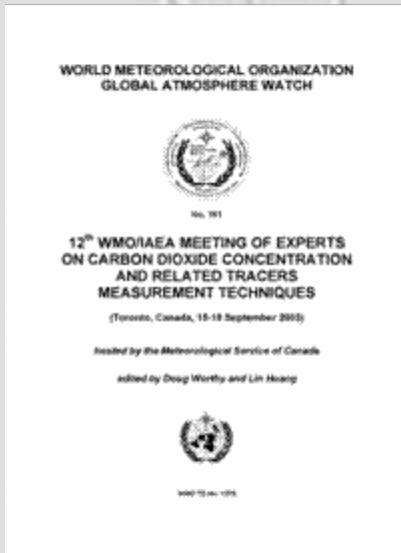
# WMO TD Report

**L. Zhou, X. Zhang, Y. Wen and D. Zhang (2006).** China National Report. 13th WMO/IAEA Meeting of Experts on Carbon dioxide Concentration and Related Tracer Measurement Techniques. 19-22 September 2005, Boulder, Colorado, USA. GAW No.168:151-154. [\(WMO TD No.1359\)](#)

**Lingxi Zhou and Xiaoye Zhang (2005).** Highlights of China GAW activities. Report of the CAS Working Group on Environmental Pollution and Atmospheric Chemistry and the GAW 2005 Workshop. 14-18 March 2005, Geneva, Switzerland. WMO/GAW, No.165:117-119. [\(WMO TD No.1302\)](#)

**Zhou Lingxi, Wen Yupu and Zhang Xiaochun (2005).** China National Report. 12th WMO/IAEA Meeting of Experts on Carbon dioxide Concentration and Related Tracer Measurement Techniques. 15-19 September 2003, Toronto, Canada. WMO/GAW, No.161:231-237. [\(WMO TD No.1275\)](#)

**Zhou Lingxi, Wen Yupu and Zhang Xiaochun (2003).** China National Report. 11th WMO/IAEA Meeting of Experts on Carbon dioxide Concentration and Related Tracer Measurement Techniques. 25-28 September 2001, Tokyo, Japan. WMO/GAW, No.148:129-131. [\(WMO TD No.1138\)](#)



# 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 s( Lab - NOAA) CO2 (ppm)
<b>GROUP ONE (Tank #4532, #4495, #4584)</b>					
US- NO AA	Feb-Mar 2001		4532	4495	4584
US- NO AA	Apr 2002		354.91	368.14	384.81
US- NO AA	Feb 2005				
JP - Tohoku U.	Jan 2003	Mar 2004			
JP - NIES	Apr 2003	Mar 2004		CH4, N2O, SF6, CO, H2, d13C, d18O	
JP - MRI	July 2003	Mar 2004			
JP - AIST	Sept/Dec 2003	Mar 2004		CH4	
JP - JMA	Jan 2004	Mar 2004			
Korea - KMA (KGAVD)	Mar/Jun 2004	July 2004			
CH - CMA (WLG)	July 2004	Nov 2004			
CH - CMA (BJ)	Aug 2004	Nov 2004			
US- SCRIPPS	June 2005	June 2005		(CMM) d13C, d18O	
FR - LSC E	Oct/Nov 2005	Dec 2005		(ECM II)	
<b>GROUP TWO (Tank #4542, #4505, #4535)</b>					
US- NO AA	Feb-Mar 2001		4542	4505	4535
US- NO AA	Apr-May 2002		355.85	368.35	384.68
US- NO AA	Dec 2004				
IT - Monte Cimone	Oct 2002	Oct 2002			
IT - ENEC Lampedusa	Nov 2002	Mar 2003			
IT - Plateau Rosa, C.ESL/CNR	Dec 2002	Dec 2002			
HU - HMS	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 - WEST	not attend				
US - Harvard U.	not attend				
<b>GROUP THREE (Tank #17511, #4425, #4146)</b>					
US- NO AA	Mar-July 2000		17511	4425	4146
US- NO AA	July 2001		353.68	366.25	383.31
US- NO AA	Apr 2002				
US- NO AA	Dec 2004/Jan 2005				
DE - U. Heidelberg	Sep 2002	Sep 2005		CH4, N2O, d13C, d18O	
DE - UBA	Oct 2002	Mar 2003		CH4	
FR - LSC E	Nov/Dec 2002	Dec 2005		CH4, N2O, SF6	
DE - FZK, Bodeby IFU	not attend				
FMI	Jan 2003	Mar 2004			
BMPA	July 2003	July 2003		CH4, CO (CO2 not measured)	
DE - MPI BGC	Nov/Dec 2003	Oct 2004		CH4, N2O, SF6, CO, d13C, d18O	
HU - HMS	Mar 2004	Dec 2005			
NL - U. Groningen	Nov 2004	Sep 2005		CH4, CO, d13C, d18O	
NZ - NIWA	Mar 2005	Apr 2005			
AN - CSIRO	Sep 2005	Apr 2006		CH4, CO	
SA - CAP EPT.	Dec 2005	Mar 2006		CH4, CO	
US - NCAR	May-June 2005	June 2005		CO, N2	

### 4<sup>th</sup> WMO Round-robin (15 countries)

25+1 Labs reported CO<sub>2</sub>

11+1 Labs reported CH<sub>4</sub>

7+1 Labs reported CO

5+1 Labs reported N<sub>2</sub>O/SF<sub>6</sub>

6+1 Labs reported d<sup>13</sup>C and d<sup>18</sup>O

1 Lab for O<sub>2</sub>/N<sub>2</sub> and 1 Lab for H<sub>2</sub>

Lingxi ZHOU, Referee since 2002

CAMS/CMA joined 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> WMO Round-robin inter-comparison organized by **WMO/CCL** hosted by **NOAA ESRL** for the periods of 1995-1997, 1999-2000 and 2002-2006.



# 1<sup>st</sup>, 2<sup>nd</sup> Inter-comparison (CH<sub>4</sub>)

## Asia and South-West Pacific

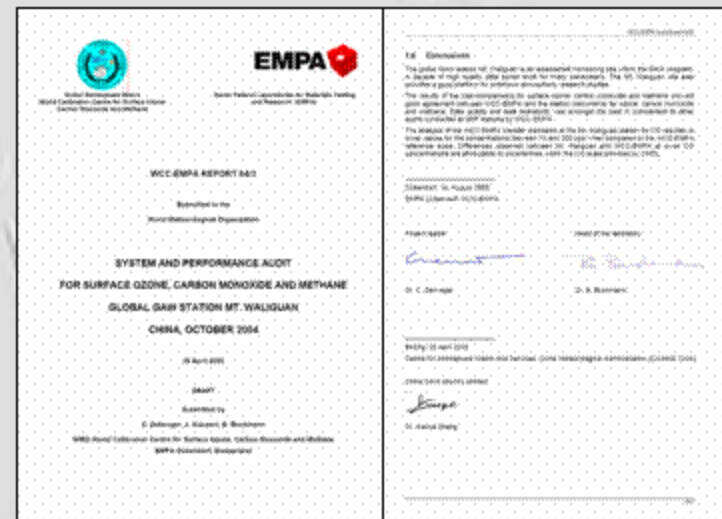
2001-2003 / 2004-2005 and 2005-2006

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

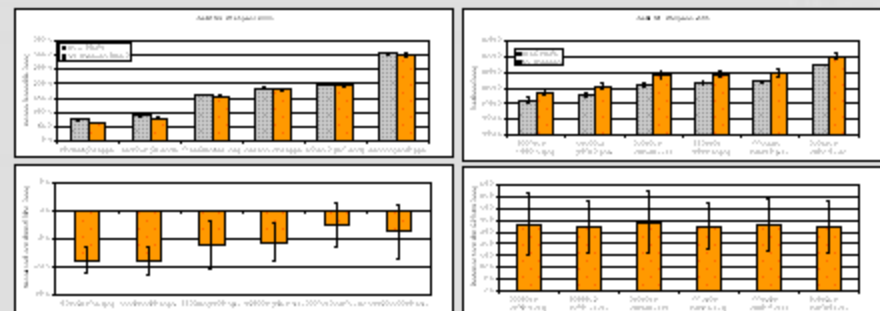
<http://gaw.kishou.go.jp/wcc/ch4/comparison.html>

<b>Laboratory</b>	<b>Country</b>	<b>Information</b>	
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

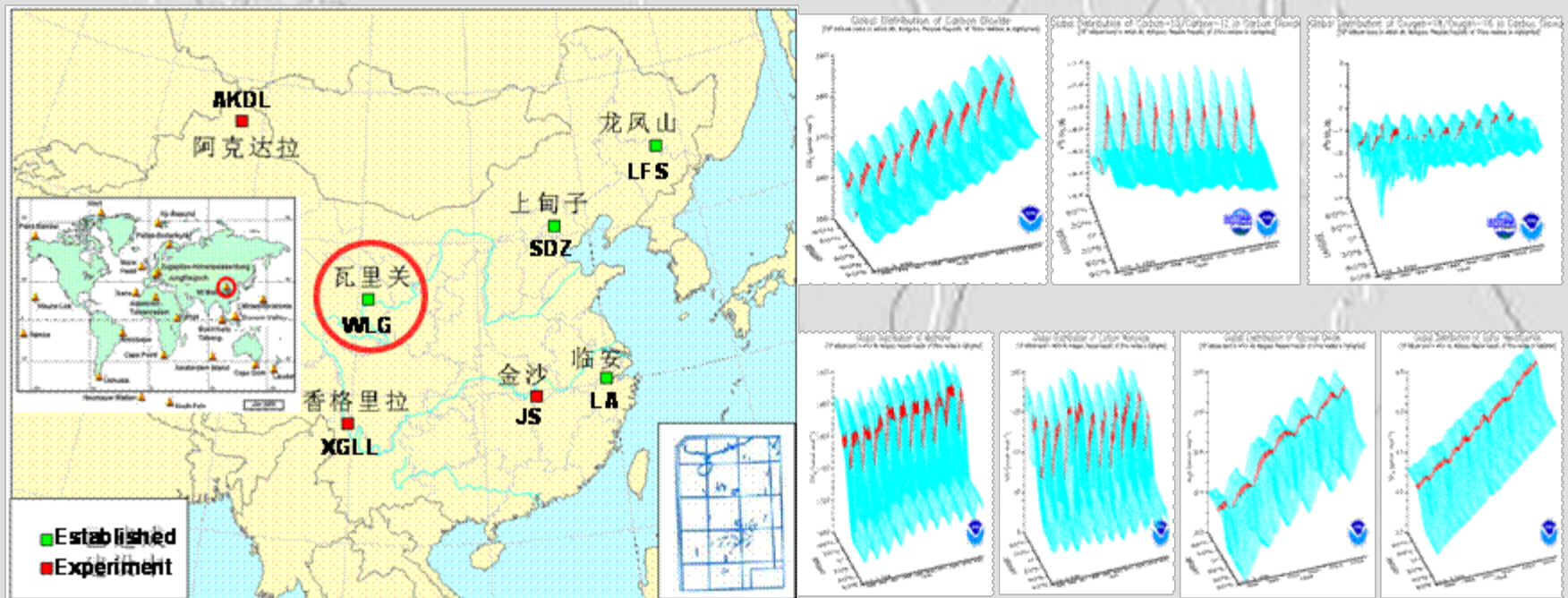


System + performance audits for **surface O<sub>3</sub>, CO, CH<sub>4</sub>** were performed at **WLG** by the **WMO/WCC** hosted by **EMPA**, Switzerland in **Sept. 2000** and **Oct. 2004**, respectively.



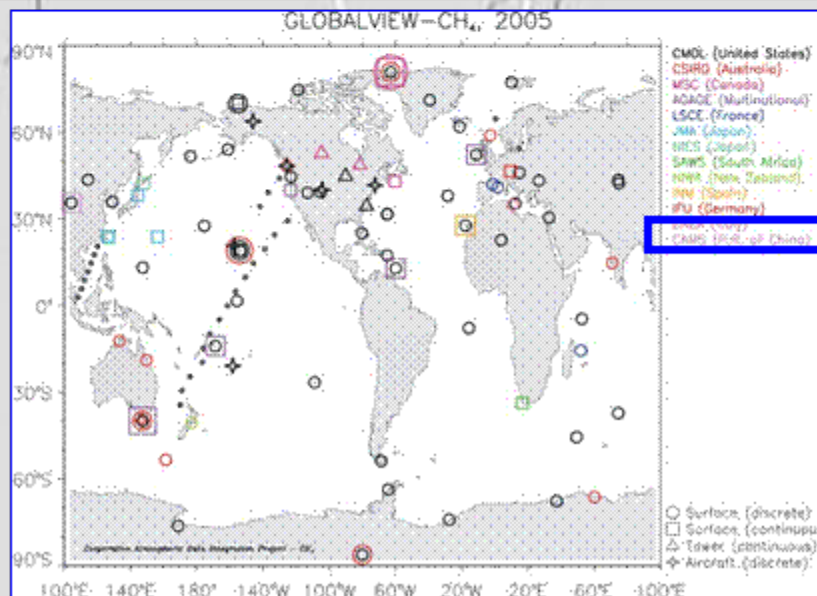
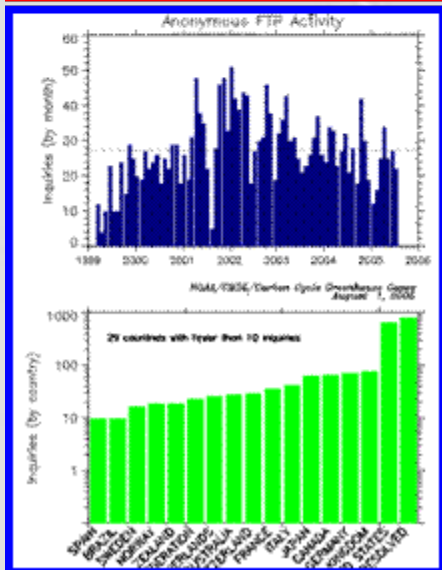
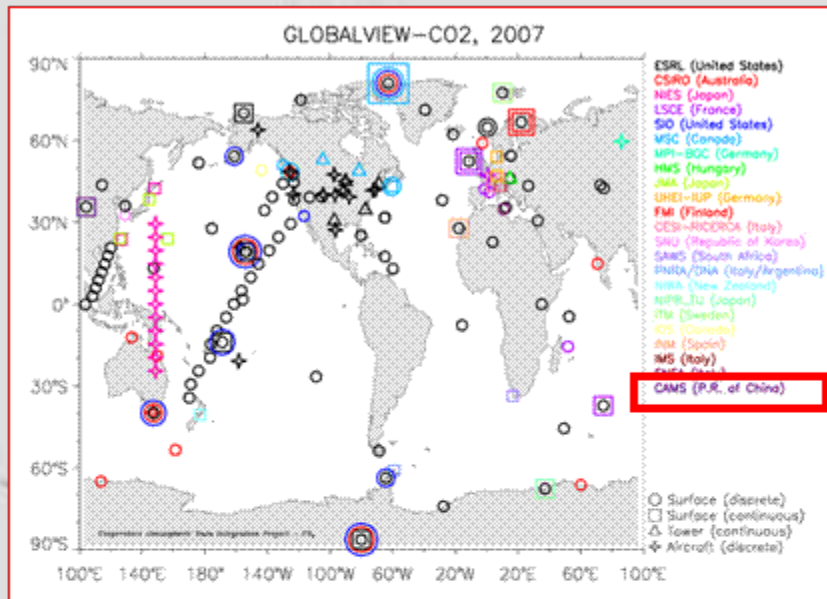
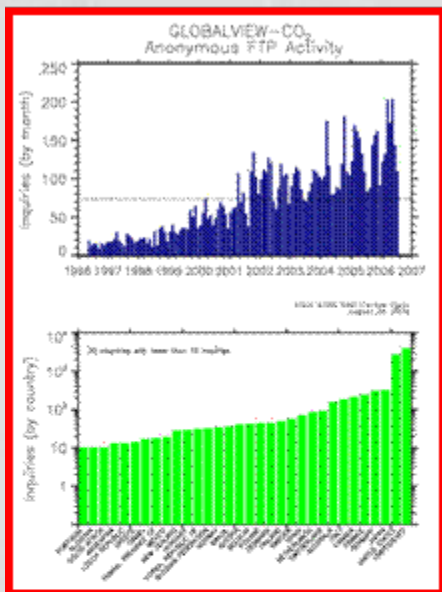
# Cooperative China-U.S. Greenhouse Gases and Related Tracers Measurements Program

L.X. Zhou, X.C. Zhang, L.X. Liu, B. Yao, F. Zhang, M. Wen, Y.P. Wen, P. Zhao, J.L. Jin, X.Y. Zhang, X.J. Zhou  
 P.P. Tans, R.C. Schnell, E. Dlugokencky, J.W.C. White, T. Conway, A. Crotnell, S.A. Montzka, C.L. Zhao, K. Masarie, A. Andrews, and C. Sweeney

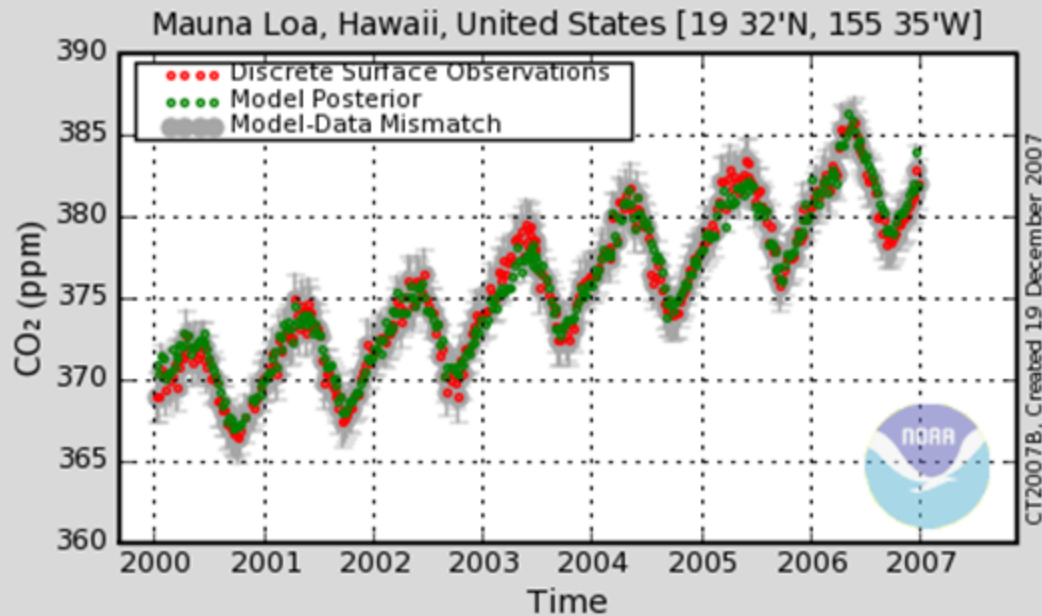
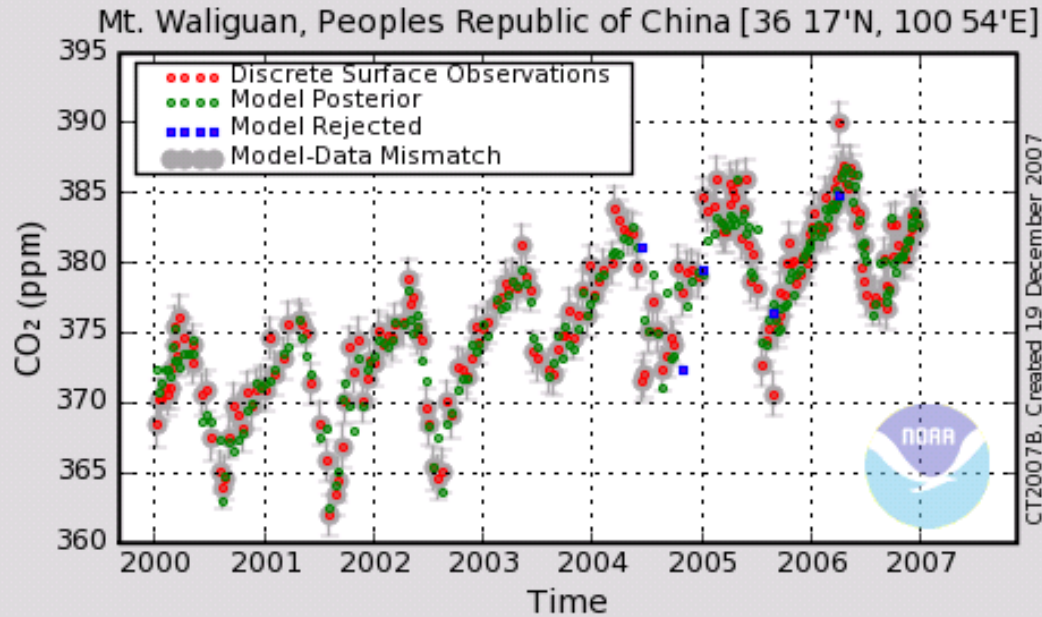


The 7 GAW stations in China and the 3D annual global carbon cycle greenhouse gases pictures showing atmospheric CO<sub>2</sub>, δ<sup>13</sup>C & δ<sup>18</sup>O in CO<sub>2</sub>, CH<sub>4</sub>, CO, N<sub>2</sub>O, SF<sub>6</sub>.  
 Red lines indicate measurement data from Mt. Waliguan (36°17'N, 100°54'E, 3816m asl), China.

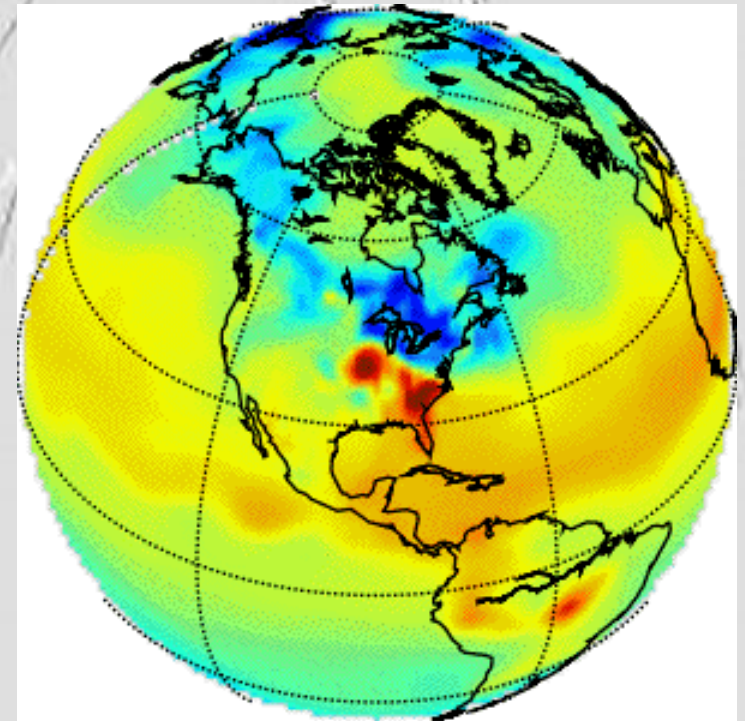
# GlobalView-CO<sub>2</sub>, CH<sub>4</sub>



Atmospheric CO<sub>2</sub> & CH<sub>4</sub> Data obtained at **WLG** by in-situ & discrete measurements have been used in the **NOAA ESRL Cooperative Atmospheric Data Integration Project (CADIP)**.



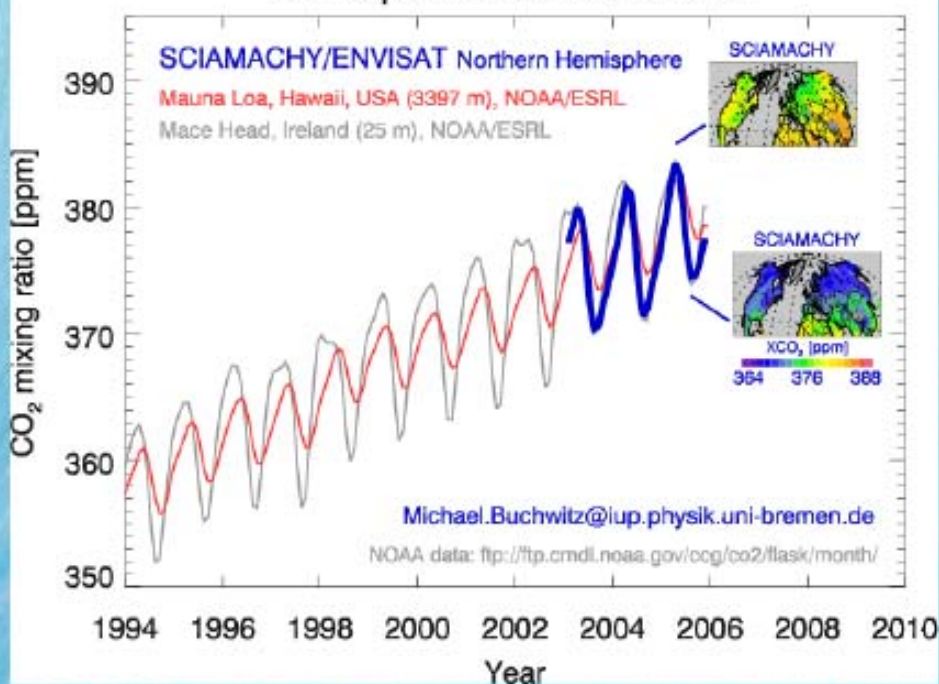
Time series of  
CO<sub>2</sub> mole  
fractions used in  
**CarbonTracker**



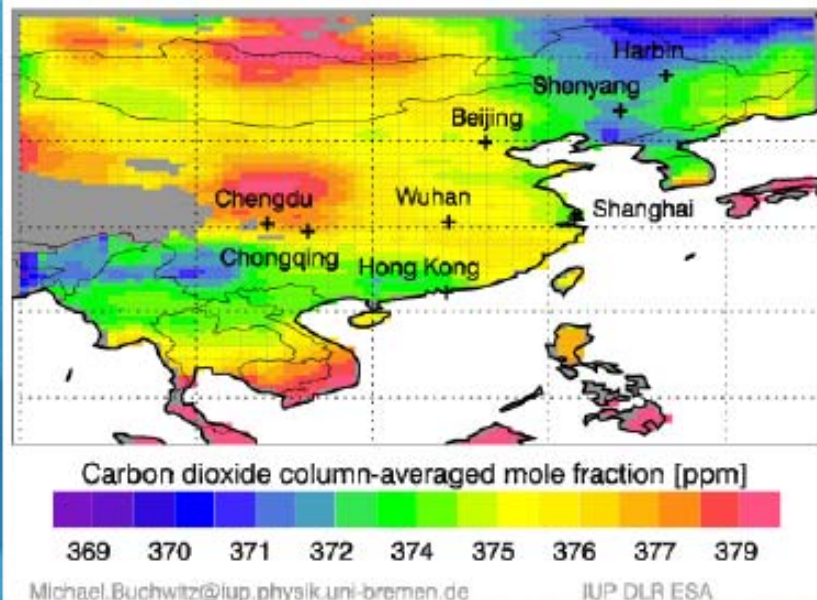
# Carbon dioxide from SCIAMACHY

## CO<sub>2</sub>

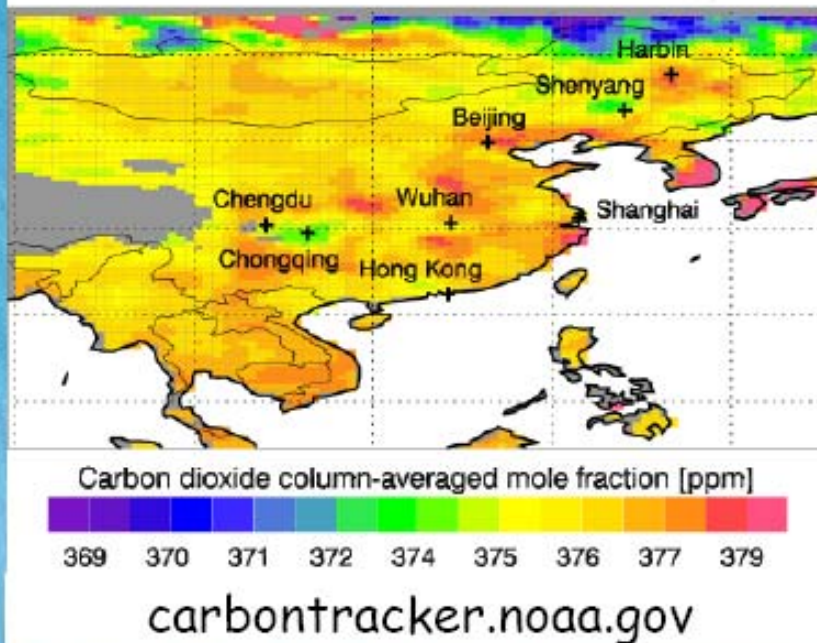
### Atmospheric Carbon Dioxide



### Carbon dioxide 2004 SCIAMACHY/ENVISAT



### Carbon dioxide 2004 CarbonTracker/NOAA

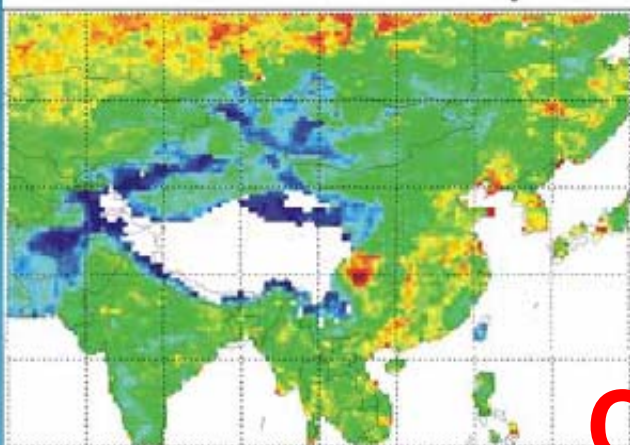




# CH<sub>4</sub> Observations vs Model

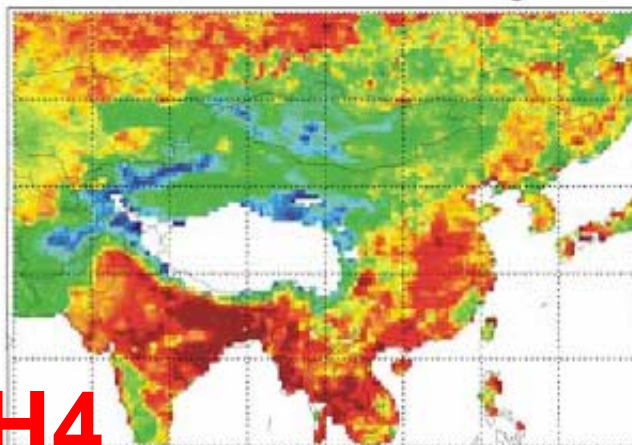


XCH<sub>4</sub> SCIA/WFMD 2003 May-Jul



Michael Buchwitz@iop.physik.uni-bremen.de (WFMDV0.5/SZACORRv1.02, QUAL-OK)

XCH<sub>4</sub> SCIA/WFMD 2003 Aug-Oct



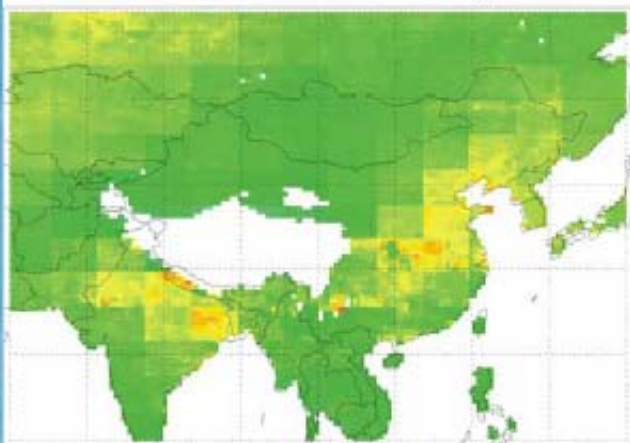
Michael Buchwitz@iop.physik.uni-bremen.de (WFMDV0.5/SZACORRv1.02, QUAL-OK)

XCH<sub>4</sub> [ppbv]



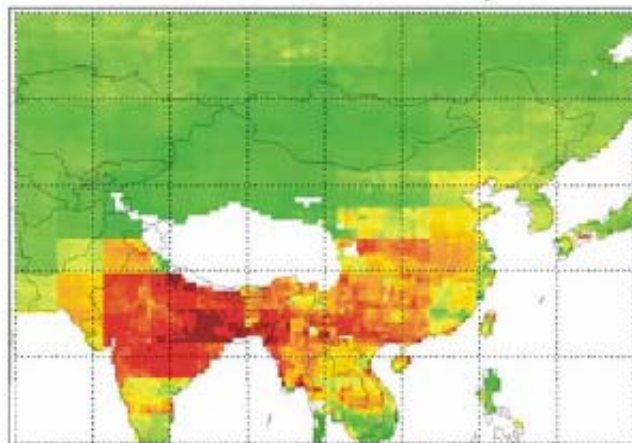
CH<sub>4</sub>

XCH<sub>4</sub> JRC/TM5 2003 May-Jul



Dmitry Begumeev@JRC-Ispn Figure Michael Buchwitz@iop.physik.uni-bremen.de

XCH<sub>4</sub> JRC/TM5 2003 Aug-Oct



Dmitry Begumeev@JRC-Ispn Figure Michael Buchwitz@iop.physik.uni-bremen.de

SCIA

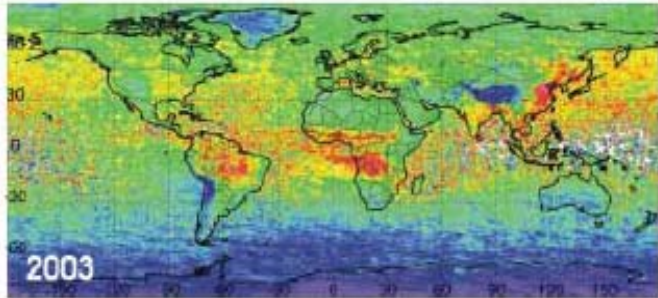
TM5



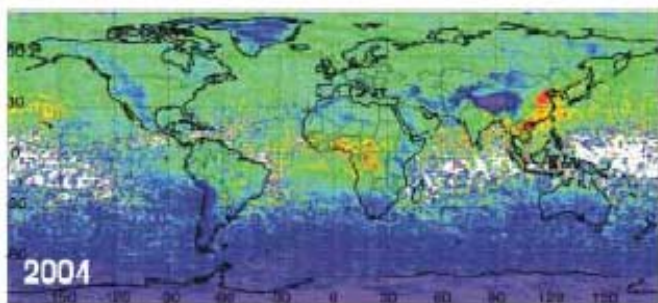


# Carbon monoxide from SCIAMACHY

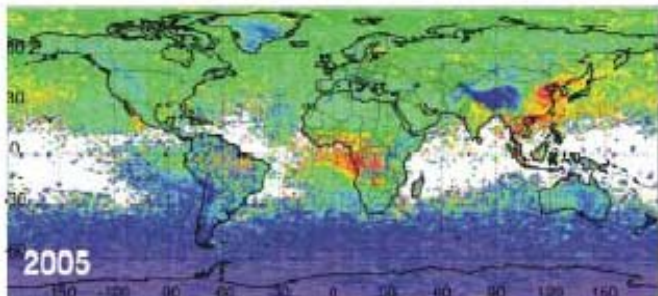
CO columns SCIAMACHY (WFMDv0.6)



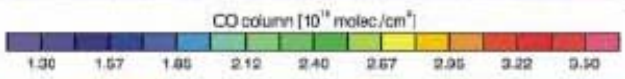
2003



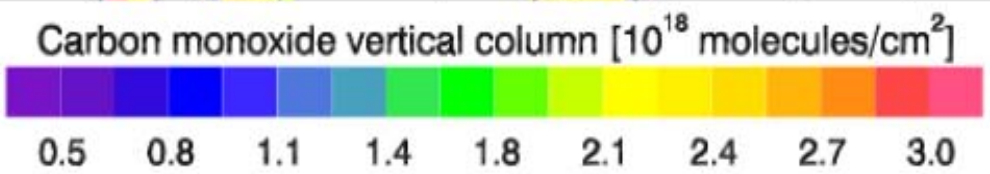
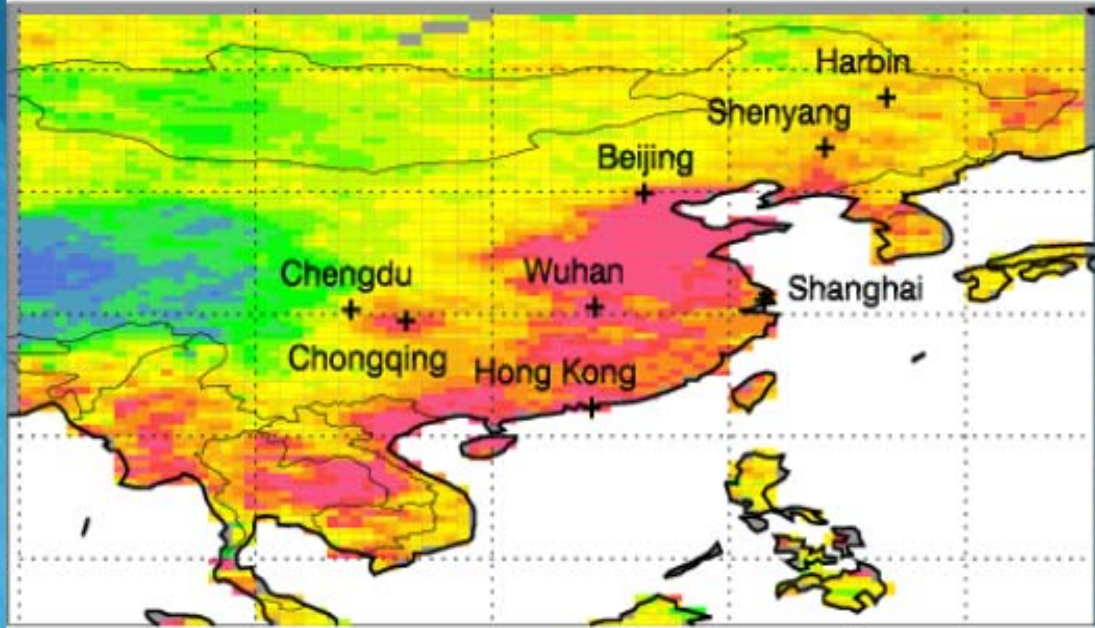
2004



2005



Carbon monoxide 2004 SCIAMACHY/ENVISAT



Michael.Buchwitz@iup.physik.uni-bremen.de

IUP DLR ESA

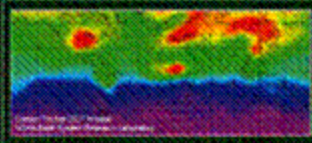
# CO



WMO

# Greenhouse Gas Bulletin

The State of Greenhouse Gases in the Atmosphere Using Global Observations through 2005



Global average CO2 rising one part in 10,000 per year... The WMO Global Greenhouse Gas Bulletin... The WMO Global Greenhouse Gas Bulletin... The WMO Global Greenhouse Gas Bulletin...

**Selected greenhouse gas observations**

**Distribution of the bulletins**

The WMO World Data Centre for Greenhouse Gases... The WMO World Data Centre for Greenhouse Gases... The WMO World Data Centre for Greenhouse Gases...

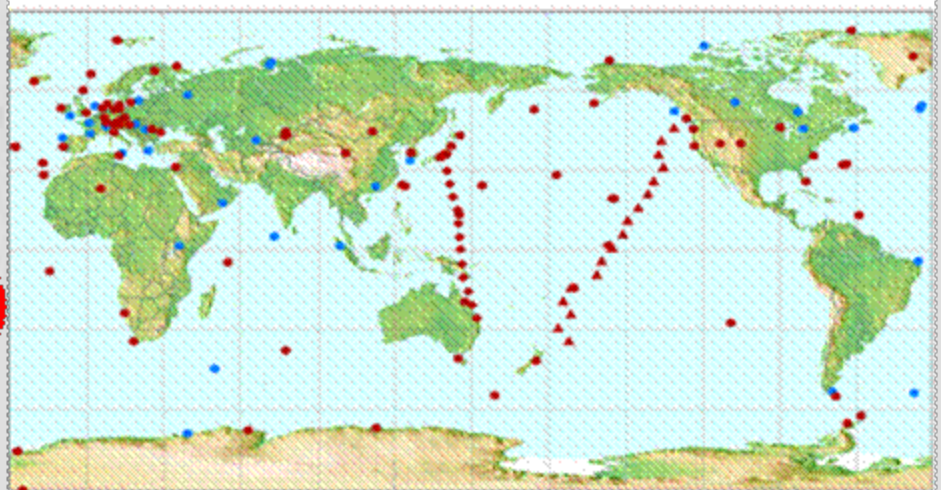
**Autocorrelations and links**

Participating countries are requested to continue to... The WMO World Data Centre for Greenhouse Gases... The WMO World Data Centre for Greenhouse Gases...

**Contents**

1. WMO World Data Centre for Greenhouse Gases, Japan and... [www.wmo.int/greenhouse](#)
2. WMO World Data Centre for Greenhouse Gases, Japan and... [www.wmo.int/greenhouse](#)

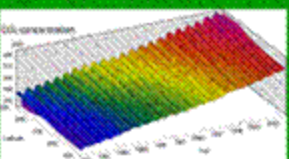
# Monitoring Stations for Carbon Dioxide (CO2)



WMO World Data Centre for Greenhouse Gases As of 30 September 2004

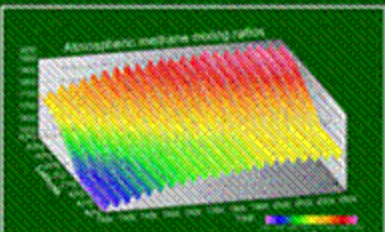
# WMO Greenhouse Gas Bulletin

The State of Greenhouse Gases in the Atmosphere Using Global Observations up to December 2004



# WMO Greenhouse Gas Bulletin

The State of Greenhouse Gases in the Atmosphere Using Global Observations through 2005



Three-dimensional representation of the globally averaged distribution of atmospheric methane (CH4) mixing ratios for the period 1983-2005...

# WMO GHGs Bulletin

# Various application

Global Air system V8.01



Global Air system V8.01



EMPA

EMPA logo and contact information.

WMO logo and contact information.

WMO logo and contact information.



# Earth System Research Laboratory

## Global Monitoring Division

### Information

- Home
- Project Goals
- Documentation
- Collaborators
- Version History
- Overview
- FAQ

### Results

- Executive Summary
- View
  - Flux Maps**
  - Flux Time Series
  - Carbon Weather
  - CO<sub>2</sub> Time Series
  - Product Evaluation
- Download
  - 3-D Model
  - Fractions
  - Weekly Fluxes
  - Source Code
  - Observations

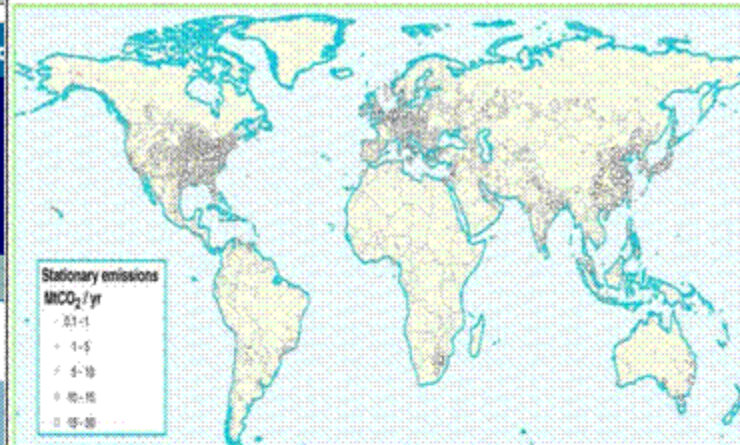
### Get Involved

- Your

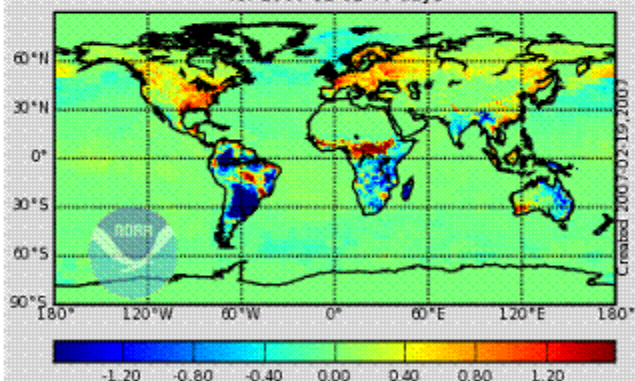
## Flux Maps

# Various application

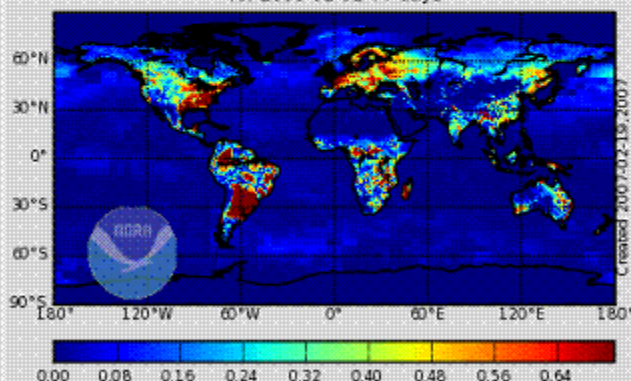
### Global distribution of large stationary sources of CO<sub>2</sub>



### weekly mean flux [ $\mu\text{mol}/\text{m}^2/\text{s}$ ] for 2000-01-01 +7 days



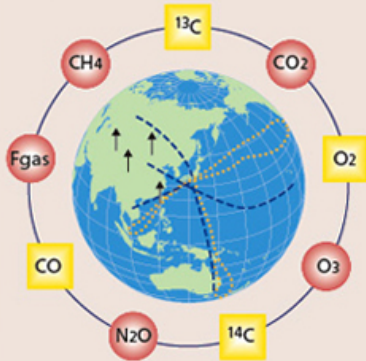
### Weekly mean StDev [ $\mu\text{mol}/\text{m}^2/\text{s}$ ] for 2000-01-01 +7 days



### Results Summary (all units PgC/yr)

Region Name	Estimated Mean	Fossil Emissions	Fire Emissions	Total Flux
Total Flux	$-2.15 \pm 2.11$	6.78	2.71	$7.34 \pm 2.11$
Land Flux	$-0.81 \pm 2.06$	6.28	2.71	$8.17 \pm 2.06$
Ocean Flux	$-2.35 \pm 0.56$	0.56	0.00	$-1.78 \pm 0.56$

## Highly Precise Large-Scale Three-Dimensional Observation of Atmospheric Components



Observation of vertical and horizontal distribution, chronological change  
 Observation of greenhouse gas state tracers  
 CO<sub>2</sub> - oxygen, isotopes (<sup>13</sup>C, <sup>14</sup>C, <sup>18</sup>O), CO<sub>2</sub> distribution  
 CH<sub>4</sub>, N<sub>2</sub>O - isotopes, latitudinal distribution, chronological change  
 Fgas - composition ratios, regional distribution

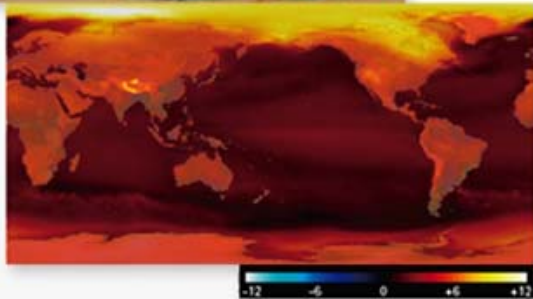


Obtaining the cooperation of commercial airlines and ocean shipping companies to perform exhaustive observation of the global environment

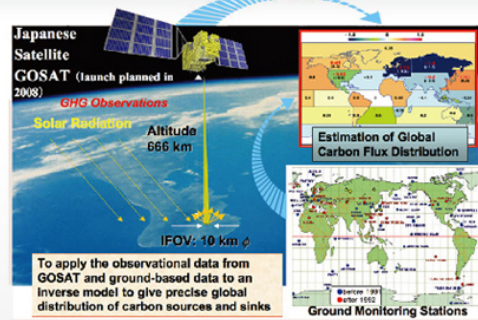


Unstaffed monitoring station

Extracting the regional characteristics of the Asia-Oceania area



Examples of changes in surface air temperature from the beginning of the 20th century as predicted by a climate model. Above: Average from 2001 to 2010; Below: Average from 2051 to 2060. Dramatic increases are predicted for the high latitudes such as the north



Measurement scheme of Greenhouse Gases Observing Satellite (GOSAT) and estimating the distribution of the global carbon flux from inverse models



United Nations Climate Change Conference: Meeting of the Parties to the Protocol (MOP) and Conference of the Parties to the Convention (COP) (Nairobi, November 2006)

## Long-term Variations in GHGs

Long-term Variation Mechanisms of Greenhouse Gas Concentrations and their Regional Characteristics



Observation Sites and Routes for Monitoring GHG Concentrations in the Asia-Pacific Region

This project focuses on atmospheric observation of various GHGs in the Asia-Pacific region by airplane, ship, and at monitoring sites. Monitoring sites in Hateruma (Okinawa) and Ochi-no-Iwa (Hokkaido) are being used for high quality measurement of many GHGs. Some influences from Asia can be detected at both stations.

Observations by cargo ships in the Pacific provide latitudinal GHG distributions, which reflect the distribution of their global source areas. We use four cargo ships and conduct long-term monitoring of a variety of atmospheric constituents.

We have recently started measuring the vertical distribution of CO<sub>2</sub> over large airports around the world and concentrations at higher altitudes using the JAL aircraft.

**Contact** Dr. Hiroyuki Maki  
 Chief, Global Carbon Cycle Research Section  
 Center for Global Environmental Research  
 National Institute for Environmental Studies  
 1-2-2 Ogasawara, Tsurumi, Tokyo, 260-8508 Japan  
 e-mail: h.maki@nies.go.jp

For more information, <http://www.cesr.nies.go.jp>

# Various application

# System for Observation of Halogenated Greenhouse Gases in Europe and Asia (SOGE-A): **Achievement and Perspective**

L.X. Zhou<sup>1</sup>, F. Stordal<sup>2</sup>, M.K. Vollmer<sup>3</sup>, B. Grealley<sup>4</sup>, S. Reimann<sup>3</sup>,  
P.G. Simmonds<sup>4</sup>, X.C. Zhang<sup>1</sup>, M. Maione<sup>5</sup>

<sup>1</sup> *Chinese Academy of Meteorological Sciences (CAMS), China*

<sup>2</sup> *Norwegian Institute for Air Research (NILU), Norway*

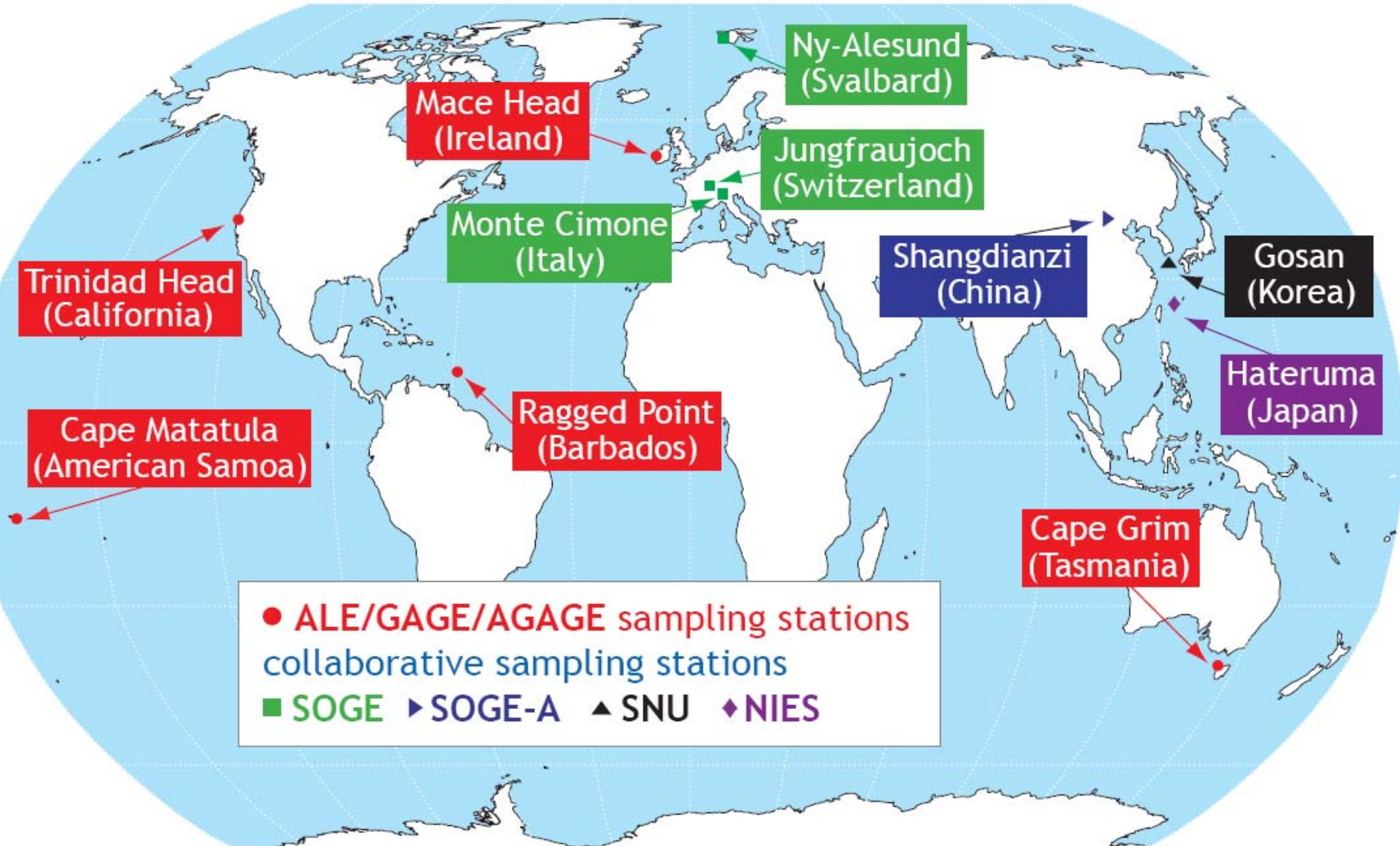
<sup>3</sup> *Swiss Federal Laboratories for Materials Testing and Research (EMPA), Switzerland*

<sup>4</sup> *University of Bristol, UK*

<sup>5</sup> *University of Urbino, Italy*

**Launch of EU-China Year of Science and Technology Policy Forum, Brussels, 11 October 2006**

# Join AGAGE/SOGE and affiliated Networks



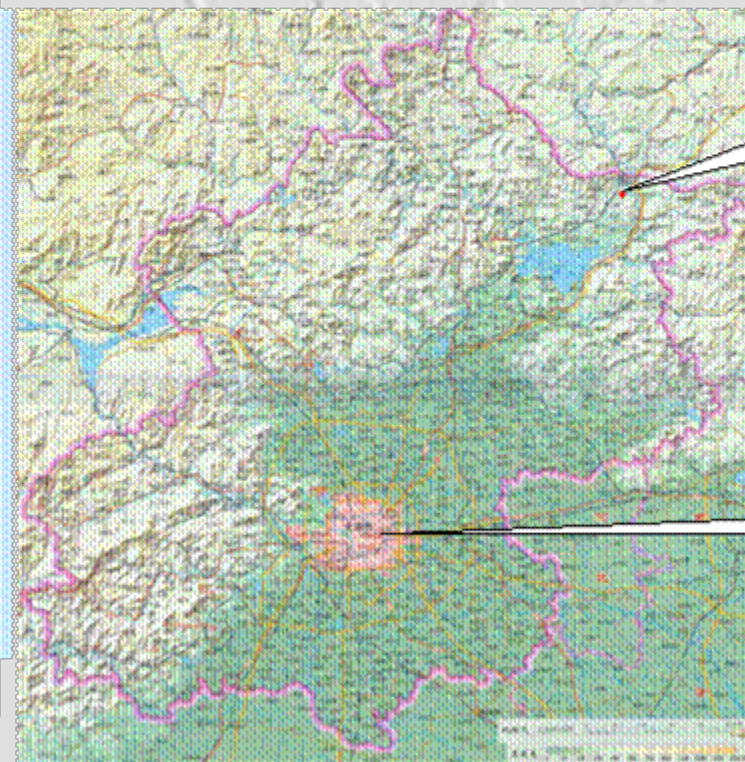
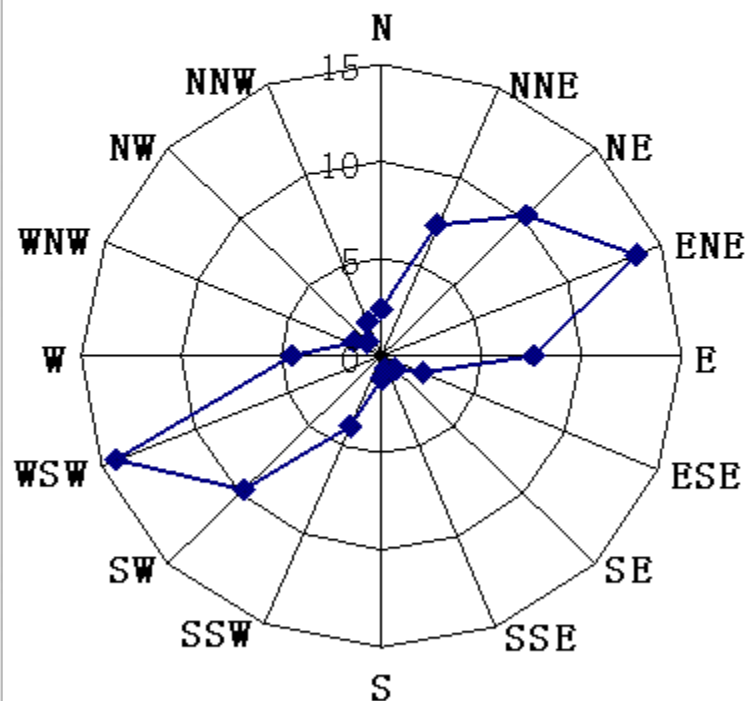
# Shangdianzi GAW Regional Station

This system is implemented for the first time in China.



# Wind Rose (1971-2004) Shangdianzi GAW Regional Station

1971-2004年风向频率玫瑰图



SDZ

Urban  
Beijing

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

# Greenhouse Gases measured at SDZ

## Included in the Kyoto Protocols.

- **CO<sub>2</sub>**, **CH<sub>4</sub>**, **N<sub>2</sub>O**
- 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<sub>4</sub> C<sub>2</sub>F<sub>6</sub> C<sub>4</sub>F<sub>8</sub>*
- **SF<sub>6</sub>**

*Species in **red (GC)** and **blue (Flask)** are measured at ShangDianZi*

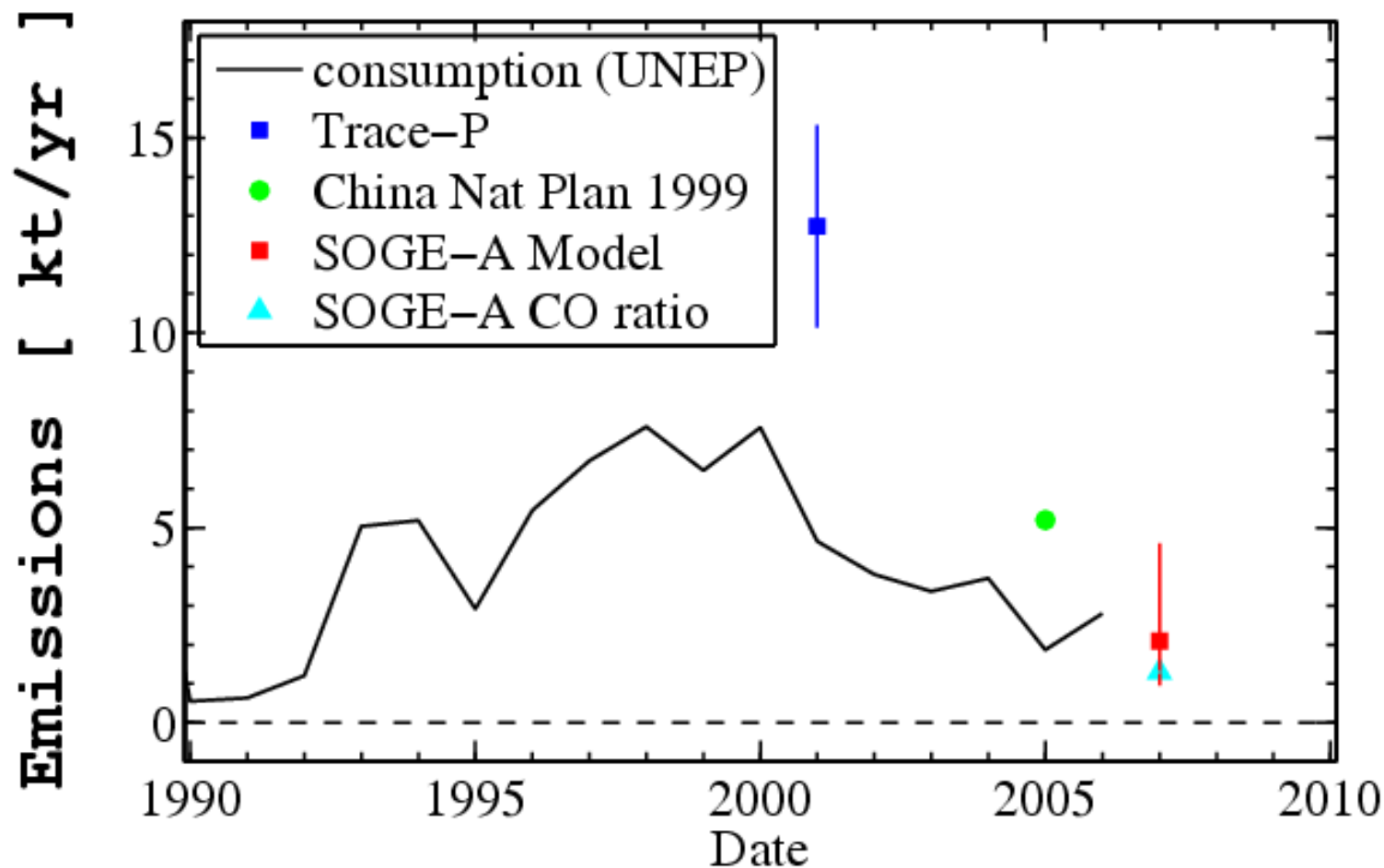
## Included in the Montreal protocols.

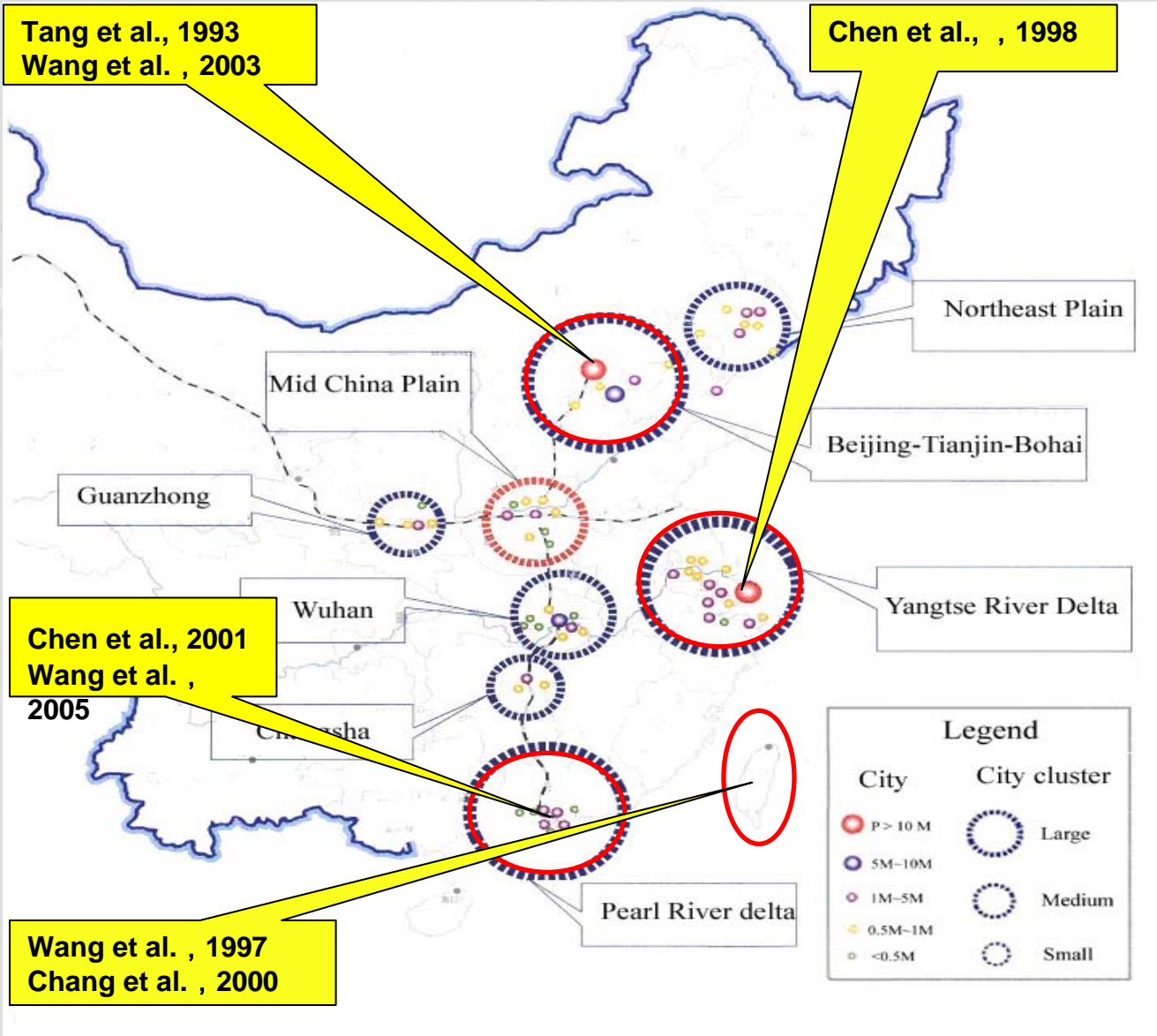
- CFCs: chlorofluorocarbons  
(C, Cl, F):  
*CFC-12, CFC-11, CFC-113, CFC-115, CFC-114*
- HCFCs: hydrochlorofluorocarbons  
(C, Cl, F, H):  
*HCFC-22, HCFC-141b, HCFC-142b, HCFC-124*
- Halons: (C, Br, Cl, F):  
*H-1301, H-1211*
- Trichloroethane = methyl chloroform = **CH<sub>3</sub>CCl<sub>3</sub>**
- Carbon tetrachloride (**CCl<sub>4</sub>**)
- Chloroform (**CHCl<sub>3</sub>**)
- TCE (**C<sub>2</sub>HCl<sub>3</sub>**) and PCE (**C<sub>2</sub>Cl<sub>3</sub>**)
- Methyl bromide (**CH<sub>3</sub>Br**)



# Compare with other results

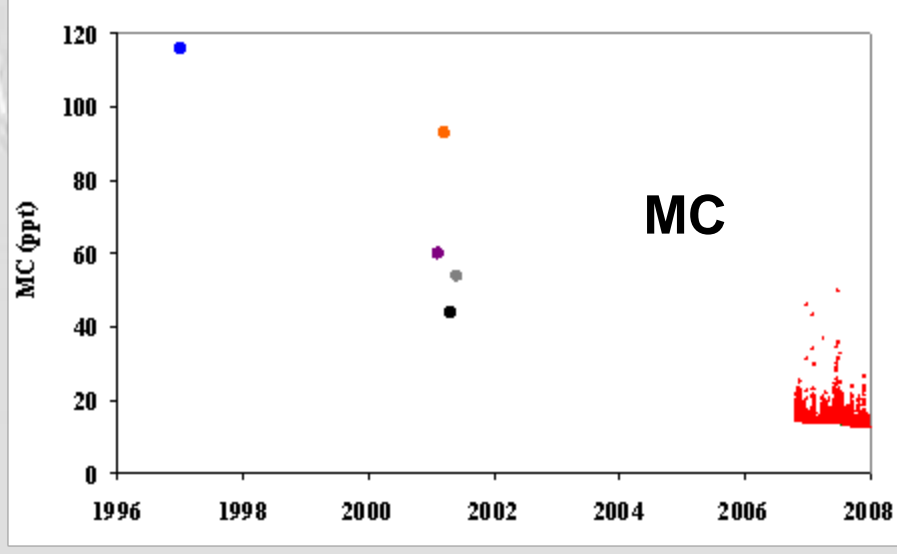
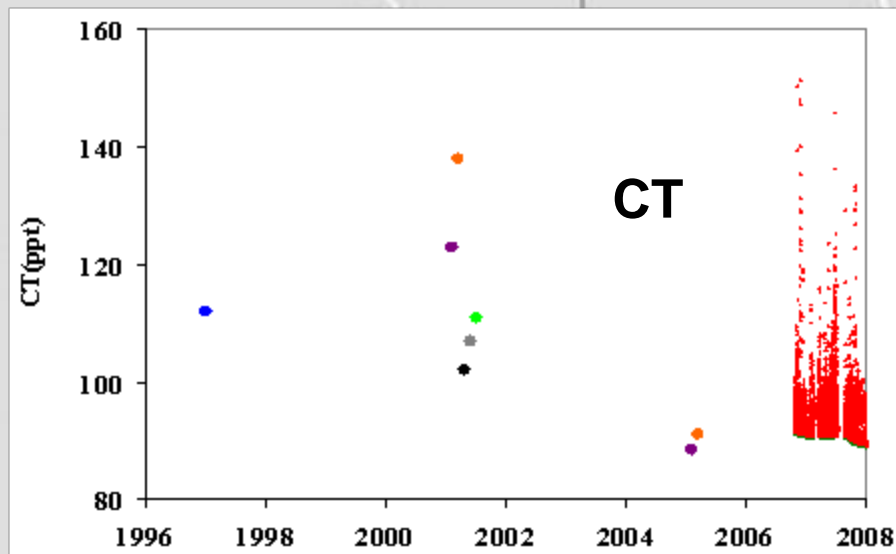
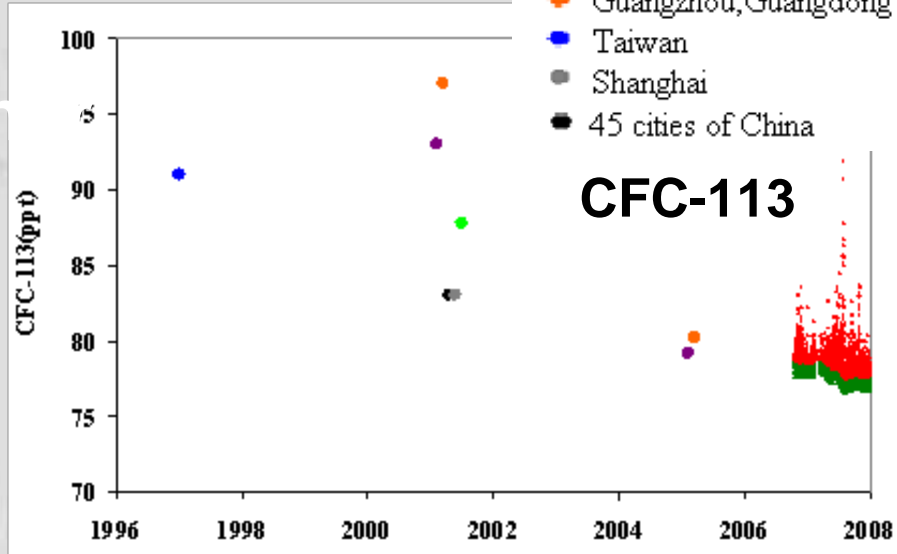
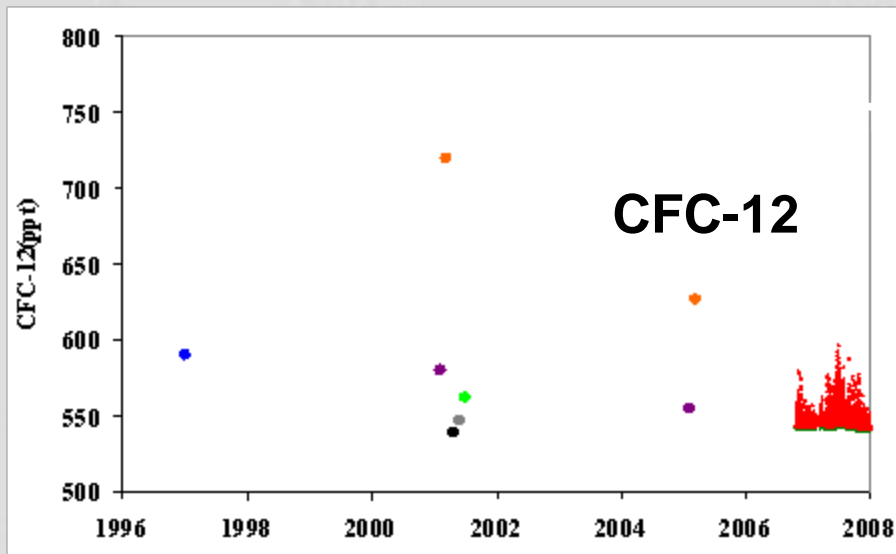
$\text{CH}_3\text{CCl}_3$  (methyl chloroform)



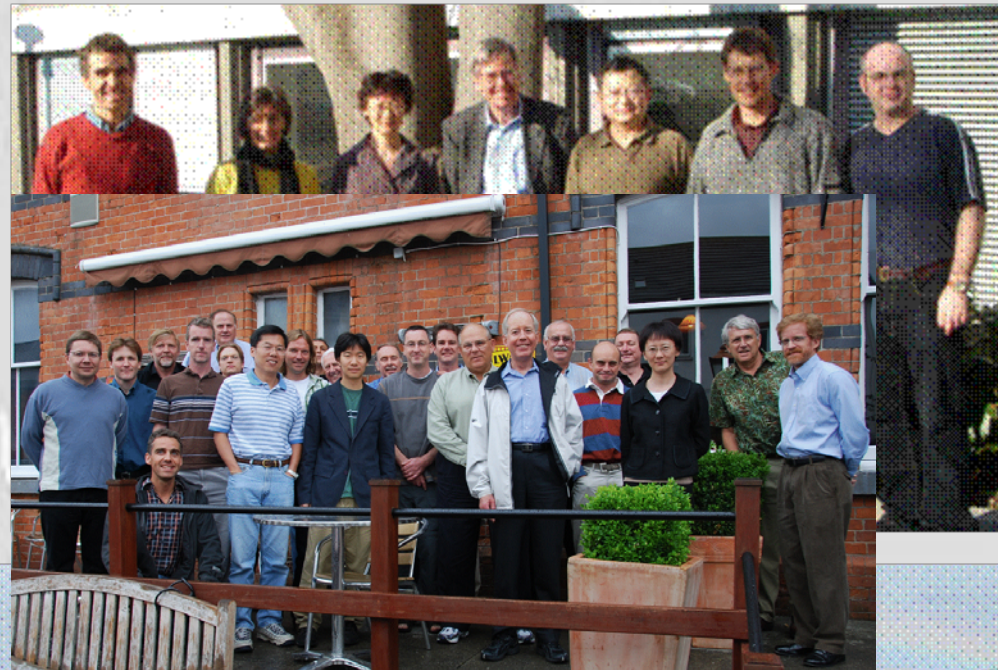


# Compare with other sites in China

- SDZ Background
- SDZ pollution
- Dinghushan, Guangdong
- Sanya, Hainan
- Guangzhou, Guangdong
- Taiwan
- Shanghai
- 45 cities of China



# SOGE-A, SOGE, AGAGE, ESRL collaborators



# Shangdianzi GAW Regional Station



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**中国气象局**  
中文 / English

中国气象局网站 - 气象新闻 | 2007年6月29日 星期六

### 欧亚地区卤代温室气体系统观测工作会议召开

来源：中国气象局 发布时间：2007-06-29

中国气象局  
研究员召开，  
由研究员分  
并邀请相关  
专家、上海子站  
主任、于2006  
在俄罗斯国际北  
极地区、保护  
院。



# Ongoing work & funding

## 中国气象局新闻发布会



## Ongoing work

- Climate gas observations
- International networks
- Monitoring of long term trends
- Estimation of regional emissions to complement regular inventories

## Future directions

- Extend to all major greenhouse gases: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O
- Extend to other background stations to cover other regions
- Common efforts in impacts modelling: climate and ozone
- Integrate with air pollution and aerosol studies

# 2006-2007 CMA funding

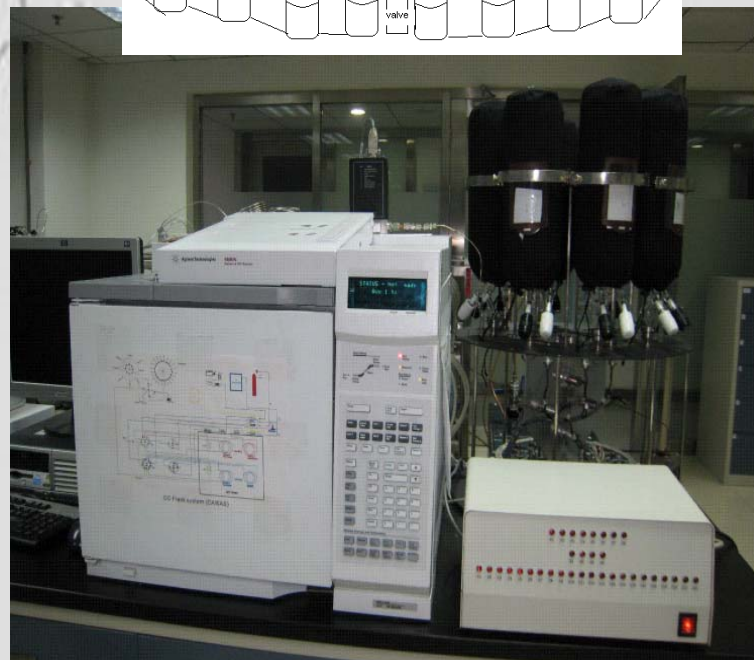
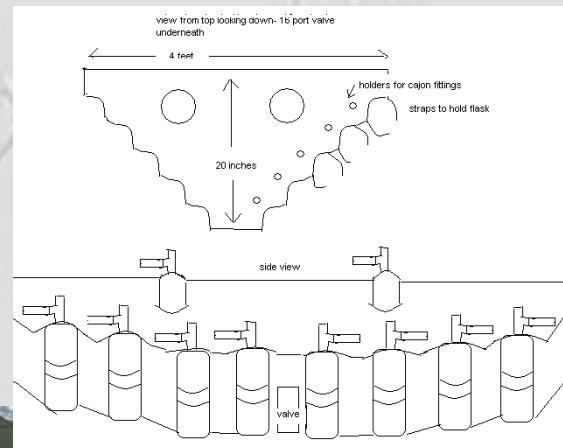
- GC-FID+ECD

MSC Canada

NOAA/ESRL/GMD

In-situ, CH<sub>4</sub>/CO/N<sub>2</sub>O/SF<sub>6</sub>

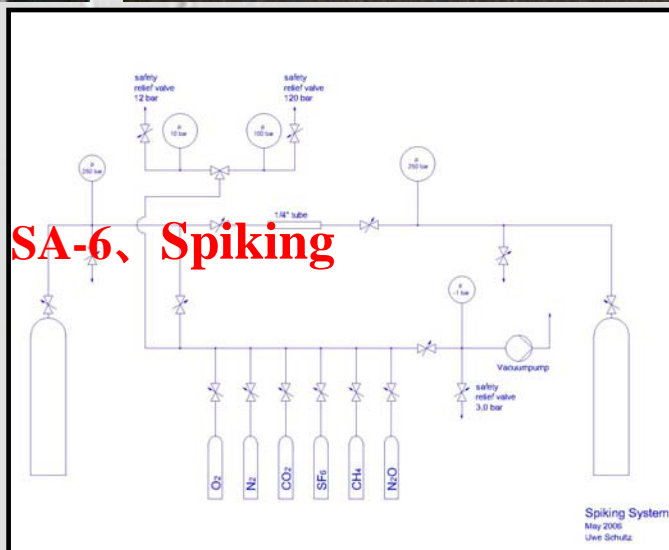
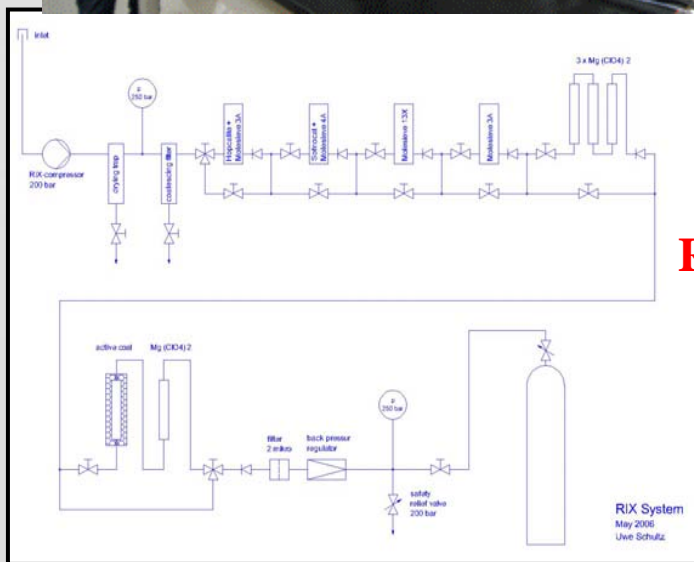
Flask, CO<sub>2</sub>/CH<sub>4</sub>/N<sub>2</sub>O/SF<sub>6</sub>/CO/H<sub>2</sub>





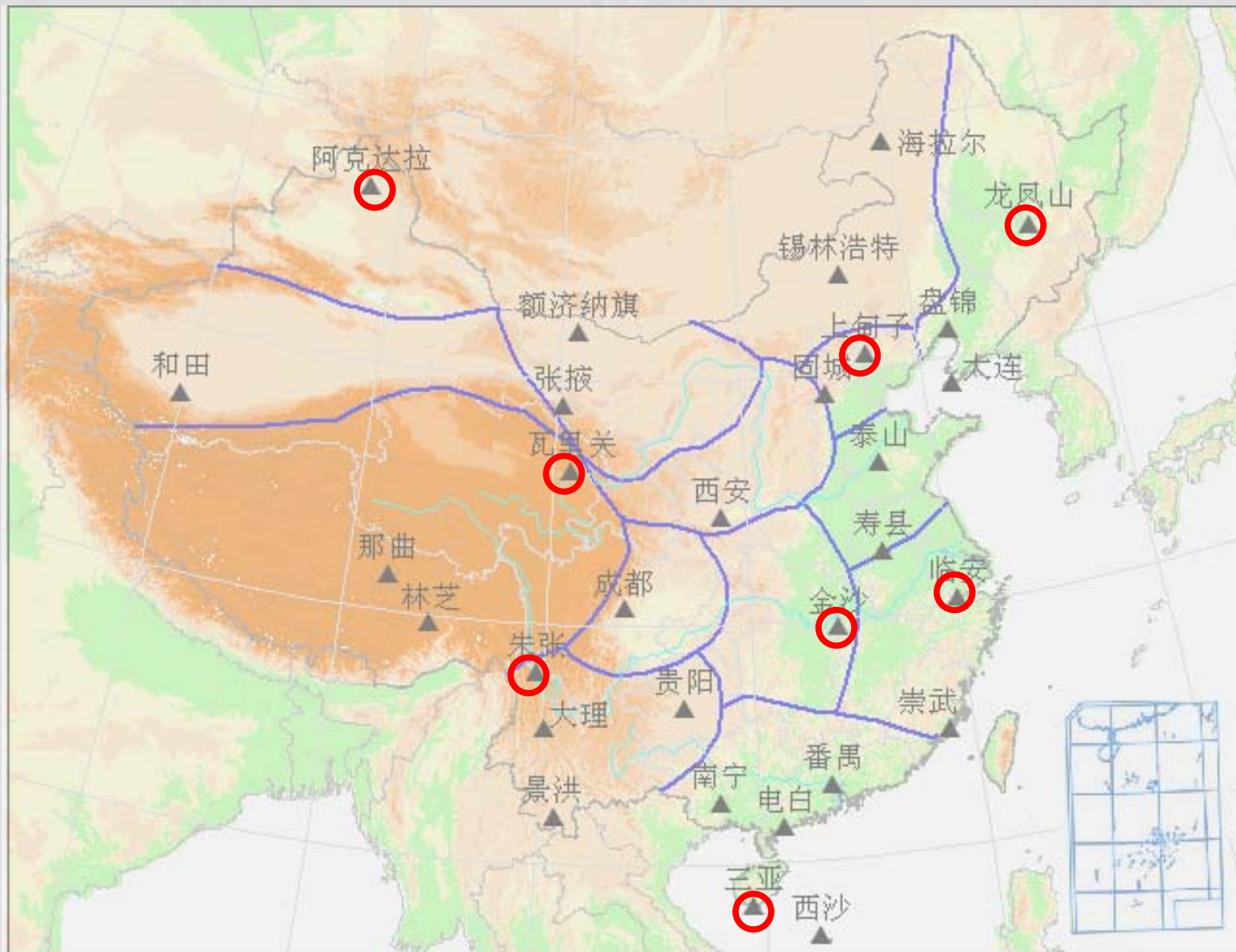
# 2006-2007 CMA funding

## NOAA/ESRL/GMD



Rix SA-6, Spiking

# CMA proposed air sampling sites in China





## GHGs measurement CAWAS, CMA

GC-FID+ECD ( $\text{CH}_4$ ,  $\text{CO}$ ,  $\text{N}_2\text{O}$ ,  $\text{SF}_6$ )  
GC-RGD ( $\text{CO}$ ,  $\text{H}_2$ )



ca07322 CO2 337.26 ppm  
ca07362 CO2 351.87 ppm  
ca07301 CO2 373.52 ppm  
ca07395 CO2 396.88 ppm

ca07372 CH4 1795.5 ppb

CA07481 CO 154.4 (1.0)  
CA07479 CO 63.2 (0.4)  
CA07487 CO 91.0 (0.6)  
CA07470 CO 138.5 (0.9)  
CA07403 CO 159.2 (1.1)  
CA07411 CO 203.8 (1.4)  
CA07493 CO 273.9 (1.9)

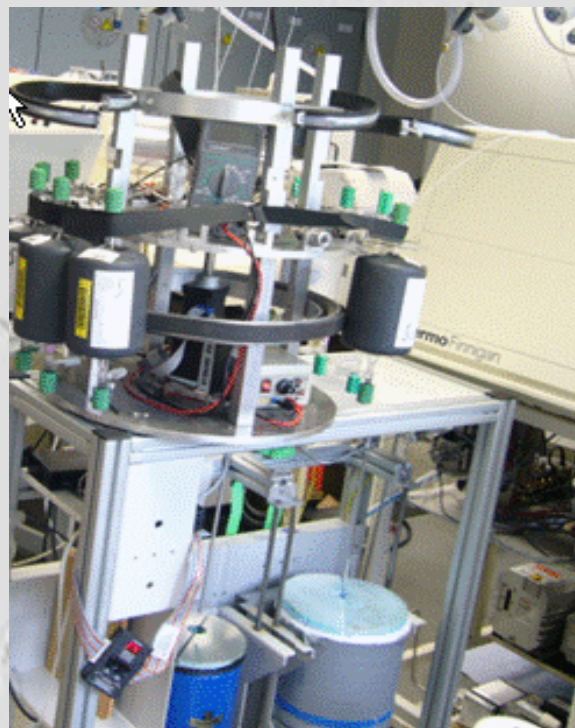
CA07473 N2O 278.11 (0.13), SF6 5.12 (0.02)  
CA07495 N2O 298.27 (0.15), SF6 7.07 (0.03)  
CA07477 N2O 315.13 (0.10) , SF6 8.96 (0.03)  
ca07389 N2O 320.41 [0.17] ppb, SF6 6.14 [0.02] ppt  
CA07407 N2O 324.31 (0.14) , SF6 6.13 (0.03)  
CA07476 N2O 334.90 (0.12) , SF6 8.13 (0.02)  
CA07483 N2O 389.45 (0.15) , SF6 10.01 (0.04)

## CAMS GHGs Lab Primary standards (newly purchased from WMO CCL)



# 2007-2008 CMA funding

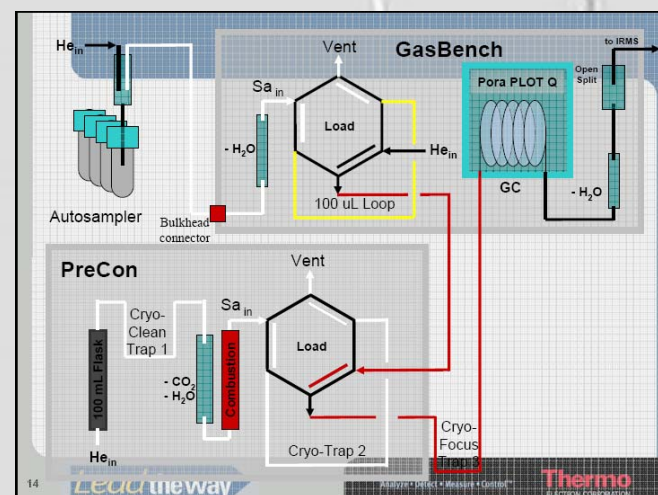
## MPI-BGC, CU-INSTAAR, MSC, NIES



**MAT253**

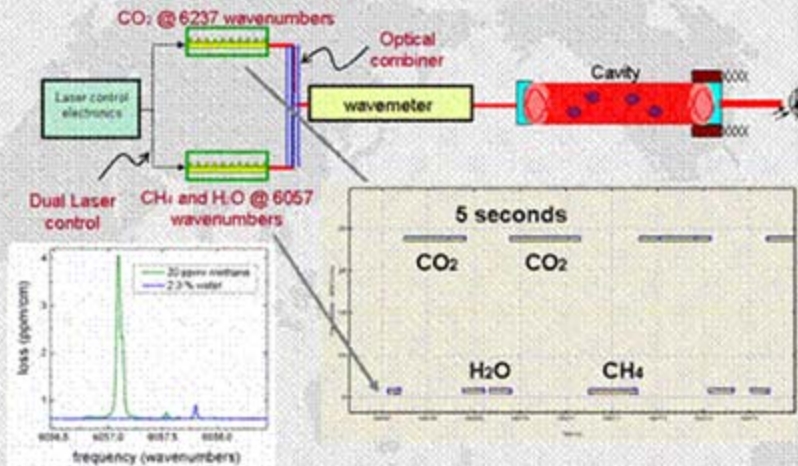
**Airtrap**

**GasBenchII**

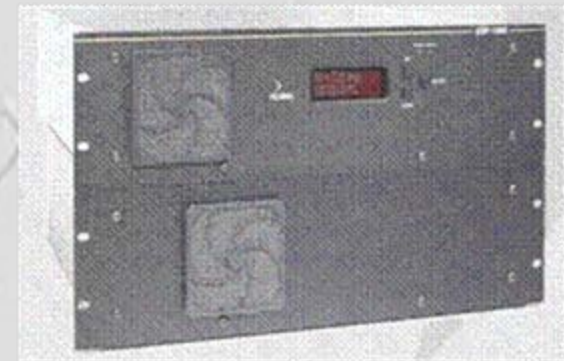


# 2007-2008 CMA funding

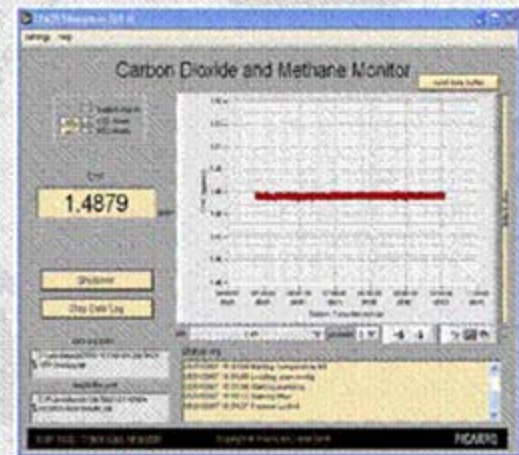
Picarro ESP-3000i 大气CO<sub>2</sub>和CH<sub>4</sub>甚高分辨率在线监测系统



One laser for CO<sub>2</sub>, and one laser for CH<sub>4</sub> and H<sub>2</sub>O  
Concentration measurements for each species interleaved every five seconds



Picarro EnviroSense 3000i  
图形用户界面



In-situ measurement  
at 4 sites approved

- CO<sub>2</sub>: <200 ppbv in 5 seconds
- CH<sub>4</sub>: <1 ppbv in 5 seconds
- H<sub>2</sub>O: < 100 ppmv in 5 seconds

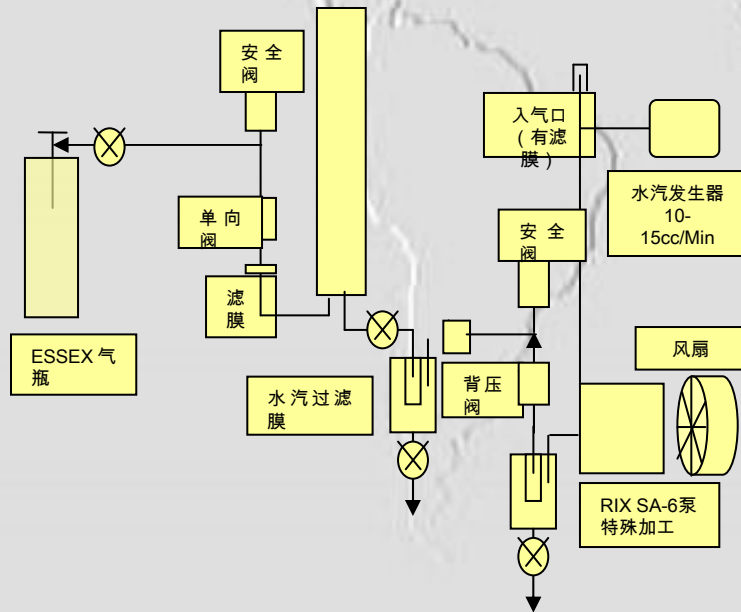
最大飘移

- CO<sub>2</sub>: 500 ppbv / month
- CH<sub>4</sub>: 3 ppbv / month



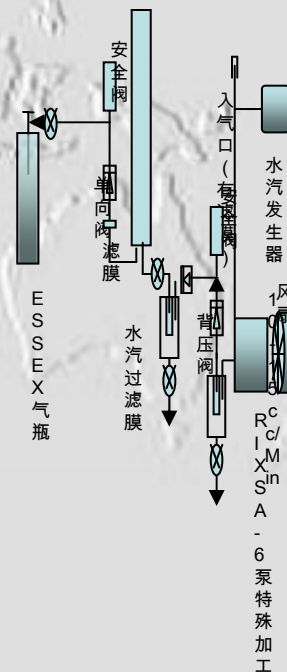
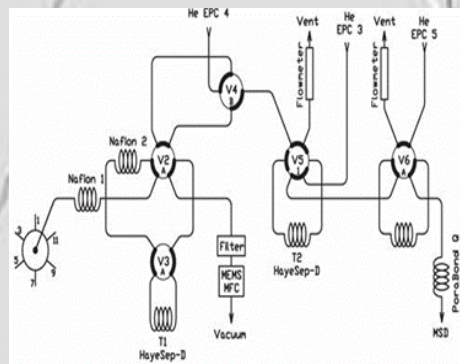
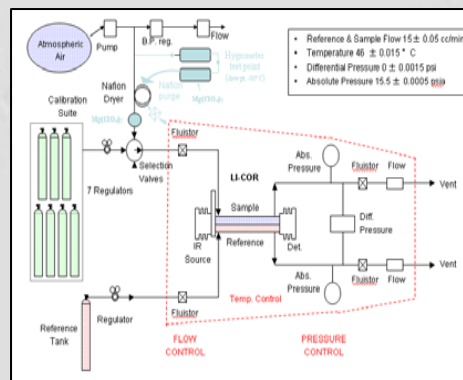
# 2007-2008 CMA funding

## LoFlo-CO2 ( CSIRO-MAR )



# 2007-2008 CMA funding

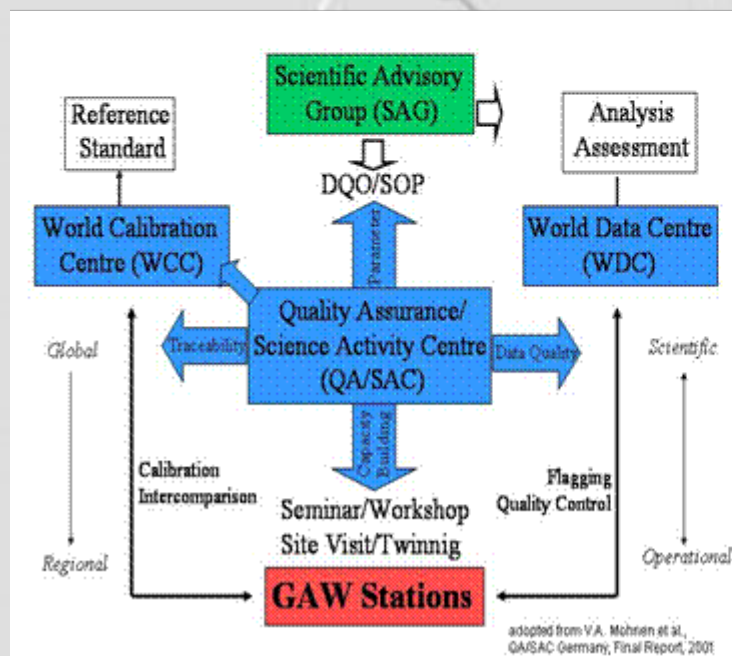
## Medusa ( Empa/SOGE-A/AGAGE )





# QA/SAC China

Play a major role in training, quality assurance system, establishing SOPs for **GAW** measurements, overseeing quality of the data produced and promoting the use of GAW data.



**Announce intention of  
CMA to establish  
GAW QA/SAC China**



**Prof. Guoguang ZHENG**

**Deputy Administrator of CMA**

**& Executive Vice Chairman of the China GCOS Committee**



**Discuss with other QA/SACs**

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- **GAWTEC, Germany**
- **FMI, Finland**
- **GAW SAG, QA/SAC, CCL, WCC, WDC, .....**



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